INFORMATION TO USERS

This was produced from a copy of a document sent to us for microfilming. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the material submitted.

The following explanation of techniques is provided to help you understand markings or notations which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting through an image and duplicating adjacent pages to assure you of complete continuity.

2. When an image on the film is obliterated with a round black mark it is an indication that the film inspector noticed either blurred copy because of movement during exposure, or duplicate copy. Unless we meant to delete copyrighted materials that should not have been filmed, you will find a good image of the page in the adjacent frame. If copyrighted materials were deleted you will find a target note listing the pages in the adjacent frame.

3. When a map, drawing or chart, etc., is part of the material being photographed the photographer has followed a definite method in "sectioning" the material. It is customary to begin filming at the upper left hand corner of a large sheet and to continue from left to right in equal sections with small overlaps. If necessary, sectioning is continued again—beginning below the first row and continuing on until complete.

4. For any illustrations that cannot be reproduced satisfactorily by xerography, photographic prints can be purchased at additional cost and tipped into your xerographic copy. Requests can be made to our Dissertations Customer Services Department.

5. Some pages in any document may have indistinct print. In all cases we have filmed the best available copy.

University Microfilms International

300 N. ZEEB RD., ANN ARBOR, MI 48106

8212473

Whitfield, Gary Hugh

SPATIAL AND TEMPORAL POPULATION ANALYSIS OF THE ONION MAGGOT (HYLEMYA ANTIQUA (MEIGEN)), IN MICHIGAN

Michigan State University PH.D. 1981

University
Microfilms
International 300 N. Zeeb Road, Ann Arbor, MI 48106

PLEASE NOTE:

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark __√__.

1. Glossy photographs or pages __✓__
2. Colored illustrations, paper or print _____
3. Photographs with dark background __✓__
4. Illustrations are poor copy _____
5. Pages with black marks, not original copy _____
6. Print shows through as there is text on both sides of page _____
7. Indistinct, broken or small print on several pages __✓__
8. Print exceeds margin requirements _____
9. Tightly bound copy with print lost in spine _____
10. Computer printout pages with indistinct print _____
11. Page(s) __________ lacking when material received, and not available from school or author.
12. Page(s) __________ seem to be missing in numbering only as text follows.
13. Two pages numbered __________. Text follows.
14. Curling and wrinkled pages _____
15. Other ____

University
Microfilms
International

SPATIAL AND TEMPORAL POPULATION ANALYSIS OF THE ONION MAGGOT (*Hylemya antiqua* (Meigen)), IN MICHIGAN

by

Gary Hugh Whitfield

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Entomology

1981

ABSTRACT

SPATIAL AND TEMPORAL POPULATION ANALYSIS OF THE ONION MAGGOT (Hylemya antiqua (Meigen)), IN MICHIGAN

by

Gary Hugh Whitfield

The onion maggot, Hylemya antiqua (Meigen), is the major pest of onions in Michigan. This study investigated the spatial and temporal characteristics of the various life-stages of the onion maggot and their impact on the crop. Emergence, flight behavior, phenology and mortality of immature stages, onion plant damage, and the seed-corn maggot, Hylemya platura (Rond.) were investigated. A population model for the onion maggot is presented and simulation runs are compared to field data.

Emergence results suggested that more information than just soil or air degree days is needed for predicting adult emergence. Adult flight curves were obtained by using a temperature adjustment technique which accounted for within day temperature changes and natural diurnal rhythm. Foliar pesticides applied to control adult populations were shown to be ineffective.

Only two generations of larval activity were found to normally occur on the onion crop. The third larval generation occurred in cull onions or onions not harvested until late in the year. High pupal mortality due to superparasitism by Aleochara bilineata (Gyll.) was evident where onion fields had not received a granular insecticide application. Overwintering mortality was found to be

constant for all test conditions, and frequency of diapause was low during the first and second generation of pupae.

Onion plant damage was found to occur in a random pattern early in the season and in a contagious pattern later in the season. Presence of volunteer onions in the spring affected probability of onion plant damage. First and second generation damage was not reduced by foliar insecticide sprays applied to control adult populations. Within- and between-field plant damage surveys provided information on amount of onion plant damage by the onion maggot throughout the season in Michigan.

Seed-corn maggots may be primary invaders of onions early in the spring. Adult populations were found to be highly correlated with adult onion maggot densities.

A population model accurately tracked onion maggot adult emergence after incorporation of adult mortality by *Entomophthora muscae* (Cohn). Adult flight curves and phenology of immature stages were compared to field results; general agreement was evident.

DEDICATION

To my wife Terri, whose constant support and encouragement helped make it all possible, and to my parents, who placed their children's education before all personal goals.

ACKNOWLEDGMENTS

For his willingness to take me on as one of his students and for his constant help, encouragement and advice during this study, I thank Dr. Dean L. Haynes, my major advisor. I also thank the members of my committee, Dr. Stuart Gage, Dr. Edward Grafius, Dr. Gary Simmons and Dr. Lal Tummala, for their guidance and review of my work. Dr. James Bath is appreciated as a committee member and as a department chairman, for providing an excellent atmosphere for scientific pursuit and personal expression. I thank Mr. Tom Ellis for all his help during this study and for his flexibility and immeasurable patience with new, struggling graduate students.

During this study, I was fortunate to have many excellent student employees, who added considerably to the integrity and scope of this study. Most notably I thank Ms. Lisa Johnson, Mr. Mark Silliman, Mr. John Putnam, Ms. Loretta Brenner, Ms. Joanne Davidhizer, Mr. Vince Fritz, Mr. Jack Shirer and Ms. Kellie Dorin.

I thank my fellow graduate students for their interest, help and friendship during the past years. I particularly valued my association with Dr. Ray Carruthers, Dr. Emmett Lampert, Dr. William Ravlin, Mr. Michael Mispagel, and Mr. Frank Drummond.

Appreciation is also extended to Ms. Marie Pane and Ms. Cathy Stewart who prepared the typed copy, and Ms. Susan Battenfield who edited the original draft.

I also gratefully acknowledge the financial assistance I received from the Department of Entomology, Michigan State University, and from the National Research Council of Canada.

TABLE OF CONTENTS

TABLE OF CONTENTS, continued

LIST OF TABLES

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF FIGURES

LIST OF FIGURES, continued

LIST OF FIGURES, continued

LIST OF FIGURES, continued

LIST OF FIGURES, continued

LIST OF FIGURES, continued

LIST OF FIGURES, continued

I. INTRODUCTION

For the past two decades, there has been a lot of controversy surrounding the use, and sole reliance on, pesticides to control insect populations in agriculture. Shortly after World War II, problems associated with the excessive use of chemical pesticides, such as resistance, resurgence, biomagnification, and environmental contamination, occurred, and the general public as well as the scientific community began questioning the wholesale use of pesticides. In the 1960's, the questions became the catalyst for a new philosophy of "integrated control"--"integrated pest management."

Integrated pest management (IPM) was, and still is, widely recognized as a necessary alternative to the pesticide dilemma (Pimentel et al. 1965, Rabb and Guthrie 1970, Geier 1966, Tummala and Haynes 1977). This approach for suppression of insect populations makes use of the many recent advances in various techniques of insect control. Over the past twenty years, there has been an increase in research, development and use of biological control methods, genetic control techniques, cultural control methods, use of attractants and host plant resistance. Progress and success in these areas of insect control allowed for development of alternative insect control programs and led to more judicious use of chemical insecticides.

Many previous control programs involving widespread use of non-selective chemical insecticides have been replaced by integrated control programs. Success of some of these programs, however, has been limited due to a variety of reasons: 1) they focused only on using the pesticide less, 2) more often than not, no biological information on the insects affected by the pesticide was collected or used in implementing the programs, 3) a single method of control was used instead of selection and integration of several control techniques, and 4) they failed to use a multi-disciplinary approach that would examine and consider all biotic and abiotic parameters when designing the control programs. In some cases, control programs were designed by researchers from several disciplines who worked on the same crop or set of problems. Each tactic, however, was researched as if it was the only answer to the problem. The result was often a multidisciplinary approach with no provision for integrating the many control techniques (see Haynes et al. 1980).

Recently, a transdisciplinary approach to insect control has been suggested which enables researchers to integrate different insect suppression methods when developing a control program. A "wide-area" view of the whole ecosystem and analysis of how the different methods of control affect the dynamics of pest populations are used to determine which controls are best suited and how they should be integrated or sequenced for use. This approach channels the various control techniques into more comprehensive strategies based on the ecological characteristics of the total ecosystem. This view, ecosystem analysis, has been put forth by several authors over the past decade and is now replacing most conventional pest-crop studies (Rabb 1978, Price 1975, Haynes et al. 1980, Jantsch 1970, Rabb et al.).

Ecosystem analysis in agricultural systems encompasses the same basic ecological principles used for any ecosystem. The major difference is the great impact that man himself can exert. To produce maximum crop yield, man usually alters the agroecosystem with tremendous energy inputs of fertilizers, irrigation, resistant plant varieties, pesticides, etc. Often these inputs are used to direct ecological processes so a desired result occurs (Rabb et al. 1974).

Haynes et al. (1980) described inputs of pesticides or fertilizers as direct controls and those of parasitism and predation as indirect controls. They suggested that direct controls can cause major disruptions in the ecosystem; whereas, indirect controls, while being very sensitive to ecological processes, usually do not. The changes caused by and the effects of such direct controls, therefore, need to be determined and examined in addition to the natural processes occurring in the ecosystem.

The onion agroecosystem is an example of where direct controls have been used for the past 50 years. Haynes et al. (1980) chronicled the evolution of pesticides used as controls on this crop in the United States. In the onion agroecosystem, insects and weeds are the two major organisms for direct controls. Crop loss due to pestilence is estimated to range from 10 to 40%. The onion maggot, Hylemya antiqua (Meig.), herein referred to as OM, has been described as the major pest in the production of onions in many areas of North America (Harris and Svec 1976, Eckenrode et al. 1975, Guyer and Wells 1954, Ellington 1963, Carruthers 1979). Chemical insecticides were and are the primary direct control. The OM developed resistance to chemical insecticides which led to increased applications, higher dosages and new compounds.

Insecticide resistance by the OM has been documented by several authors over the last ten years. Brown (1971) listed eight species of soil insects that had developed resistance to DDT, including the OM. Guyer and Wells (1959) reported poor control of OM in Michigan by DDT and resistance to DDT by OM was documented by Harris and Svec (1976). Cyclodienne insecticide resistance by OM also developed. Howitt (1958) first reported cyclodienne resistance in OM in Washington State, and cross-resistance over the whole cyclodienne group of insecticides has now occurred, including resistance to dieldrin, aldrin, heptachlor, chlordane, endrin, and lindane. Harris and Svec (1976) noted that field studies conducted in all onion growing areas of the United States revealed poor onion maggot control by cyclodienne compounds between 1954-1960. Related species of root maggots also were shown to be resistant to the cyclodienne's, including the cabbage maggot (Hylemya brassicae (Bouche')), turnip maggot (Hylemya floralis (Fallen)), and seed-corn maggot (Hylemya platura (Rond.)) (Harris 1977).

In the 1960's, the chlorinated hydrocarbons and cyclodienne insecticides were replaced by organophosphates and carbamates. Ethion, diazinon, phorate, and parathion were the first to be used. Harris (1977) reported resistance to organophosphate compounds in three soil insects, including the OM. He reported that selection for OM resistance to the organophosphate and carbamate compounds occurred because the insect is confined to a single host, has several generations per year, and each generation is constantly subjected to intense insecticide pressure.

Harris and Svec (1976) reported increased resistance by the OM to both the organophosphate and carbamate insecticides. The thiophosphate, Dyfonate® (fonophos) is presently being used (1977-81) in most onion production areas for chemical control of the onion maggot (Michigan, New York, Ontario), and although adequate control is still demonstrated by use of this compound, it may follow the course of the previous recommended material, Dasanit® (fensulfothion), which, through repeated use and resultant resistance, became ineffective.

In addition to insecticide resistance, other biotic components of the onion agroecosystem, including weeds, diseases, and nematodes, are exhibiting similar control problems (Haynes et al. 1980). Herbicides and fungicides are applied at three to seven day intervals from planting date to harvest and often nematicides are used to fumigate the soil following onion harvest in preparation of rotation with carrots (two to four year rotation with onions). Weed resistance to 2,4-D has been reported (Hopen 1972) and resistance to Dithan M-45, used to control onion leaf blight (Botrytis squamosa) has also been noted (Lorbeer, 1977, pers. comm., Dept. of Plant Path., Cornell Univ.). Past and present onion crop production has been and is dependent on high energy inputs of fertilizers, resistant varieties, pesticides, and high level mechanization. These production practices directly depend on dwindling fossil fuel energy and new chemical compounds. The economics of developing new pesticides, combined with resistance to existing chemicals and an awareness of the detrimental effects on the environment, are forcing researchers to re-examine current control systems in commercial onion culture.

The future of pest control in the onion agroecosystem lies primarily in how controls are used. Single strategy pest control exerts tremendous selection pressure for adaptation to the exposed organism and provides little to no flexibility to account for stochastic and regional variation in weather and field conditions (Tummala et al. 1975). Often, little to no information is collected on pest density, distribution (spatial and temporal), rate, timing and spread of damage to the crop, and how this affects the success of the control measures. One of the requirements for developing sound pest management programs is having accurate estimates of pests or natural enemy population densities, as well as reliable assessments of plant damage and resultant effects of control programs. Biological monitoring, described as one of the weakest elements in large-scale research programs, is essential for successful on-line pest management for on-line research in populations and communities (Rabb 1978).

In 1976, a project was initiated at Michigan State University to study the onion agroecosystem. The overall objective was to conduct an ecosystem analysis to define and investigate the biotic and abiotic components of the onion system. This included a study of the ecological processes occurring, and factors determining or affecting the processes and their outcomes. Several investigators were involved in the study, and each investigator was responsible for a specific area, but information flow and cooperation between investigators was mandatory.

This thesis primarily addresses the population dynamics of the OM, particularly the spatial and temporal dynamics of the OM population in Michigan. The major objectives of this study were: 1) to investigate and explore the within and between generation dynamics of OM life stages (first two generations), 2) to determine factors affecting survival, 3) to examine the spatial and temporal distributions of the OM and resultant onion plant damage and, 4) to document the many biotic and abiotic factors and their interactions that are involved in the onion agroecosystem. Interactions of the study organism (OM) with the host plant and other crops and species were investigated whenever possible.

In addition to these objectives, a biological monitoring program on a regional scale was conducted. This effort provided information on onion maggot densities both within and between fields and also provided information on the extent and distribution of OM plant damage in Michigan.

It was felt that studies on the population dynamics of the OM and a regional biological monitoring program would provide some answers to the many questions regarding OM population management. Accurate estimates of population density and the temporal distribution of the various age classes are necessary in all insect population studies. An understanding of the spatial distribution of host plant damage and factors determining or affecting this distribution are also needed. The distribution or disposition of an organism in space can affect sampling programs, methods of data analysis and can be used as measures of population size and condition of the population (Southwood 1978). In the past, little work has been done on quantifying the temporal distribution of the biotic components of the onion system. Information on the distribution of the life-stages in time and space is needed for formulation of management programs.

The onion agroecosystem project encompassed several departments and researchers in the university who worked together to understand ecosystem interactions. Information from this study has gone into a common pool of information from which new management tactics may be developed. A systems point of view has been employed to integrate the various control techniques into a comprehensive understanding based on the ecological characteristics of the ecosystem and dynamics that exist between the pest and their environment. This thesis also provides some of the biological parameters necessary for inclusion in this management program.

II. BACKGROUND

A. Onion Maggot

The biology of the OM and control measures used in the past have been well reviewed by many authors, notably Loosjes (1976), Doane (1953), Tozloski

(1954), Perron and LaFrance (1961), Perron (1972) and Ellington (1963), and Scott (1969) published an extensive bibliography for Hylemya antiqua (Meig.)

Although Hennig (1974) placed the OM in the genus Delia, recent literature suggests that it is still considered to be in the Hylemya genus. At least forty-nine species of this genus have been recorded in Michigan (Appendix A) of which several are considered to be important pests on agricultural crops. A detailed description and key to the genus is given by Huckett (1971).

1. Adults

The OM overwinters as a diapaused pupae and emerges in the spring. The first emergence is referred to as the first generation flight in this report. The eggs and resultant larvae from this generation have been described as the first larval brood (Eckenrode et al. 1975). Further flights and larval generations are named accordingly. There are typically three generations of flight and three larval broods each year in Michigan.

Very little quantitative work has been done on the behavior of OM adults in the field. The most extensive research was conducted by Loosjes (1976), who presented results of dispersal experiments using mark-recapture techniques. He reported that dispersal rate was temperature-dependent, but independent of wind direction. Thirty-seven percent of the females and 50% of the males were found to emigrate after emergence. Female migration decreased during oviposition and mating. Loosjes (1976) also reported that adult dispersal was 2.5 times greater outside onion fields than within the field. In any one onion field the average diffusion coefficient was 2000 m^2/day; however, in an area encompassing more than one field and with an average onion fly density, the diffusion coefficient was 3600 m^2/day (Loosjes 1976).

Several authors have observed that OM adults feed actively on flowers or weed pollen following initial emergence (Baker 1928, Maan 1945, Rygg 1960, Carruthers 1979). Female OM have been described as being an anatogenous, requiring a protein source before egg laying can occur (Missonnier and Stengel 1966, Missonnier 1967). Maan (1945) reported that adult OM in the field live from three to four weeks. Loosjes (1976) presented survivorship curves for adult OM and reported that 50% of the adults of the first generation died in ten days and 50% of the adults of the second generation died in seven days. He suggested that the greater morality in the second generation was due to higher infection by Entomophthora muscae (Cohn). He also stated that the field survivorship results agreed reasonably well with those of laboratory experiments and the literature on related species (Rockstein and Miquel 1973).

2. Immature Stages

Eggs of the OM are laid in the soil around the base of the onion plant or on the leaves of the plant itself. Eggs are normally laid in groups of three to six, and oviposition occurs repeatedly during the life of the female fly (Karuma et al. 1972). Required degree-day accumulation for eclosion was reported by Carruthers (1979) to be 50 degree-days with base temperature of 3.88°C. Oviposition on previously damaged onions was often observed (Workman 1958, Armstrong 1924, Loosjes 1976, Carruthers 1979). Perron (1972) reported that healthy, mature onions are usually not attacked by larvae during the second generation, and Gray (1924) reported that OM often oviposit on flaccid onion leaves or where dense onion foliage occurs. Perron (1972) also reported that greater densities of eggs were found on onions planted at higher densities, but noted that the number of eggs per plant remained the same regardless of planting density. Several authors have suggested that onion volatiles attract adult female OM for feeding or oviposition (Matsumoto 1970, Dindonis and Miller 1980).

Ellis et al. (1979) investigated the influence of onion cultivars and their microbial colonizers on resistance to the OM. They reported that plant density, age, and degree of microbial activity regulated OM oviposition, and they suggested that OM populations may be managed in the future by manipulating the micro-organisms responsible for the interactions that affect oviposition.

Survival for the immature stages has been investigated in the laboratory and under field conditions. Humidity and soil moisture can affect egg development or survival (Eyer 1922, Baker and Stewart 1927, Ellington 1963, Workman 1958). Workman (1958) reported that 10% soil moisture in muck soil was required for optimum eclosion. He also reported, however, that although low soil moisture delayed eclosion, when soil moisture was increased after a period of dryness, eclosion occurred within 20 to 30 minutes. Maan (1945) questioned whether a dew in the morning could provide the required moisture for eclosion to occur. Ellington (1963) presented results of egg development under different temperatures and reported that at a zero vapor pressure deficit, eclosion increased with a decrease in temperature from 90° to 50°F.

The survival rate of OM larvae also appears to depend on soil moisture and temperature. Workman (1958) reported that 23% soil moisture in muck soil was needed for survival of one day-old first instar OM larvae and that when soil moisture was below this minimum, larvae were only able to travel a short distance before dessication led to death.

OM larvae feed directly on the tissue of the onion bulb. Depending on the larval stage of development, they may migrate to other onions especially when onion bulb volume is small. Degree-day requirements for completion of the three larval instars were reported by Carruthers (1976) to be 37, 89 and 161 degree-days (4.4° C).

Third instar larvae pupate in the soil at a depth of five to fifteen cm. Diapause in the pupal stage has been reported to be induced by low temperatures and short day length (MacLeod 1965). Various observations on the frequency of diapause or aestivation within the onion growing season have been reported (Miles 1955, Rygg 1960). Perron and LaFrance (1961) reported diapause percentages of 0-19, 43.5-91 and 99-100 for the three generations of the OM in Quebec. Loosjes (1976) reported diapause percentages of 21.9 and 84.6 for the two generations of OM in the Netherlands; however, his results were highly variable, and he suggested further experiments were necessary before any definite conclusions could be made. Degree-day requirements for pupal stage completion were reported by Carruthers (1979) to be 306 degree-days at a base temperature of 3.88° C (39° F). These results agreed with Eckenrode et al. (1975) who reported a base temperature of 4.4° C (40° F) for OM pupae.

Abiotic factors also have been shown to affect OM pupal emergence, adult survival and activity. According to Ellington (1963), maximum survival of pupae (50% or more) occurred between 60-90° F. He also reported that no adults emerged at 90° F under all moisture conditions, but that the survival rate decreased under low temperatures and higher moisture stresses. Baker and Stewart (1927) reported that maximum emergence from OM pupae occurred at 4-16% soil moisture. Little to no emergence occurred in soil that had been oven dried. Workman (1958) found that laboratory-reared, adult flies lived between 77 and 101 days for males and females, respectively. Miles (1955) concluded that

70° F was necessary for oviposition to occur, and Maan (1945) observed that cold temperatures decrease fly activity and oviposition between 50-70° F. Ellington (1963) reported that males tended to emerge approximately one day before females, but male longevity was less than females. Adult longevity ranged from one day at 90° F to 84 days at 60° F. He also stated that the maximum number of eggs were oviposited at 70° F and 10 mm vapor pressure deficit. A lower vapor pressure deficit (5 mm) resulted in the most eggs being laid at 60-70° F. Ellington (1963) also found that the preovipositional period decreased from 22 days at 50° F to 2 days at 90° F.

Perron and LaFrance (1961) examined the survival of the OM immature stages in the field under caged conditions. They developed life-table information on population increase, longevity and densities of age-specific stages. Three generations per year were reported as occurring in Quebec; the highest population increase occurred during the second generation, whereas the lowest occurred during the third. They suggested the second generation was the most important in terms of species survival since it had the highest population increase and contributed the greatest number of overwintering pupae. Loosjes (1976) felt such results could not be related directly to field situations and further questioned Perron's subsequent field-oriented studies by saying they lacked a precise sampling method and contained conflicting evidence. Perron (1972) reported field mortalities of 45-78% for the egg stage, 74-96% for the larval stages and 56-84% for the pupae stage.

Loosjes (1976) described two full larval generations and a partial third for the onion maggot in the Netherlands. He conducted preliminary experiments on larval population density and mortality, but his results of 89.4% mortality in the larval stages were questionable due to the experimental procedures used and the lack of a sufficient sample size. His survival rates for larvae were also complicated by poor handling and transport of eggs and unexpected spraying of insecticides during the course of the experiment.

Ellington (1963) conducted field and cage studies in New York on population phenology and dormancy of OM pupae. He concluded that there were only two generations of adults per year and that the second generation failed to develop to any appreciable degree. Reporting an 11% dormancy of first generation pupae and less than 19% of the second generation, he suggested that diapaused pupae from the first generation accounted for the overwintering population. It appears that he failed to observe a third generation, which probably occurred late in the fall and which contributed most of the overwintering pupae.

McEwen et al. (1973) conducted life-table studies of the OM in Ontario on untreated plots of onions. Egg, larval and pupal stages were sampled throughout the season from which percentage OM survival was determined. They reported a high percentage of eggs led to adult fly emergence with 14% (first generation) to 79% (third generation) mortality occurring between the egg and the first larval instar. Little information on sampling methods was given, however, and the experimental procedures were inadequate where survivorship was calculated by returning all life-stages to the laboratory for advance to the next stadium. The total number of life-stages sampled per 180 feet of row were presented for three generations, but little information and no significance was attached.

Abiotic factors appear to have little effect on overwintering pupal mortality. Ellington (1963) reported an overwintering mortality of only 0-4%

from field cage studies in New York. Loosjes (1976) observed that pupae put in the field in December had a percentage emergence in the spring similar to that in the laboratory (85-95%). The overwintering mortality of OM pupae has not been fully quantified. Mortality can occur due to the action of natural enemies or abiotic factors. Perron (1972), conducting studies in Quebec on untreated onion plots, found that up to 20% of overwintering pupae had been parasitized by the Staphylinid parasitoid, Aleochara bilineata (Gyll.), and as much as 12% parasitism could occur by the braconid parasitoid, Aphaereta pallipes (Say). Loosjes (1976) reported an average of only 5% parasitism of OM pupae from samples collected on commercial fields in the Netherlands.

3. Natural Enemies

Several parasitoids and predators of the OM have been reported in the literature (Wishart and Monteith 1954, Salkeld 1959, Read 1962, Perron 1972, Loosjes 1976). Of these, only two appear to occur repeatedly in most studies: Aleochara bilineata (Gyll.) and Aphaereta pallipes (Say).

Perron (1972) reported that the Staphylinid parasitoid, A. bilineata, was the most important natural enemy of the OM, acting as a predator in the adult stage and as a parasitoid in the larval stage. A. bilineata has been reported as being a very important natural enemy of many species of root maggots, most notably the cabbage maggot (Wishart 1957, Calhoun 1953, Moore and Legner 1971, Nair and McEwen 1975, Finlayson and Campbell 1976). A number of articles have been published on its biology in general (Wadsworth 1915, Wishart et al. 1956, Read 1962), but little information is available in relation to it as a natural enemy of the OM. A. bilineata normally has two generations a year, but a third generation may also occur. Adults emerge from root maggot pupal cases in the spring.

Eggs are laid in the soil, with each female laying an average of 700 eggs (Bromand 1980). First instar larvae are parasitic and actively search out root maggot pupae in which to complete their development (Wadsworth 1915). Larvae enter the pupal cell by eating a hole in the puparium; they then consume the contents of the puparium and pupate within the root maggot pupal case.

Loosjes (1976) reported 3-10% parasitism of OM pupae by A. bilineata, but warned that the percent parasitism recorded could have been low due to extensive insecticide sprays applied for root maggot control. Carruthers (1977, pers. comm., Dept. of Entomology, Cornell Univ.) and Ritcey (1976, pers. comm., Dept. of Entomology, Univ. of Guelph) observed that percent parasitism on OM pupae was extremely low in Michigan and Ontario, respectively. Both researchers, however, made these observations from pupae collected within insecticide-treated areas.

Studies on the cabbage maggot have revealed that when chemical controls are used, parasitism by A. bilineata can decrease rapidly (Coaker 1966). Kirknel (1978) reported on relative toxicities of four soil insecticides to A. bilineata. He found that soil type, exposure time in the field, and the depth at which the insecticide was placed all affect the toxicity of the insecticide to A. bilineata.

Finlayson et al. (1980) conducted bioassays in the laboratory with A. bilineata and four granular soil insecticides (20 ppm). Chlorfenvinphos was found to be the least toxic with no mortality occurring after a seven-day exposure. One hundred percent mortality occurred with terbufos after a five-day period, and 60% and 85% mortality occurred with carbofuran and isofenphos, respectively, after seven days of exposure. Field experiments were also conducted to determine the effect of these insecticides on field populations of

A. bilineata and the cabbage maggot, Hylemya brassicae (Weideman). Parasitism of H. brassicae pupae by A. bilineata increased from 17.7% to 39.8% within a year and from 17.7% to 76.3% in a three-year period on untreated plots. Parasitism in treated plots was significantly less (0-33.3%).

Perron (1972) reported that the most important hymenopterous parasitoid and the second most important natural enemy of the OM was the braconid, A. pallipes (Say), that was capable of parasitizing up to 12% of overwintering pupae for any year. Salkeld (1959) reported 29% parasitism of OM pupae by A. pallipes. This braconid has also been reported as parasitizing the cabbage maggot (Wishart 1957). Studies by Carruthers (1981) have shown the adult to be highly susceptible to pesticides, including most of the herbicides used on onions.

B. Seed Corn Maggot

The onion plant can be infested by several other species of Diptera, one of which is the seed-corn maggot, Hylemya platura (Rond.), herein referred to as SCM. The SCM is considered to be a major pest of several field crops and a minor pest on vegetables. H. platura has been recorded on onions by several authors who described it as an important dipterous pest of the onion bulb (Mathewman et al. 1950, Ritisch and Schwardt 1949, Hudon and Perron 1954, Miller and McClanahan 1960). In Michigan, Merrill and Hutson (1953) found that nearly one fifth of the root maggots attacking onions in May and June were SCM. They suggested applying control treatments soon after planting, because damage to onions was mainly observed in the spring, when germinating onions were attacked before initial plant emergence. Miller and McClanahan (1960) noted that adults were attracted to moist soils and, for many crops, an infestation of maggots may be present before planting.

Information on the number and phenology of generations of the SCM is conflicting. Dustan (1948) reported only one generation a year while most other authors reported between three and five generations in North America (Ritisch 1950, Caesar 1931, Strong and Apple 1958, Miller and McClanahan 1960). Reports of damage to cultivated crops are limited to the first or second generation; the size of other generations described are so small that in most cases they are not even detected in the field (Miller and McClanahan 1960). The flies emerge very early in the spring approximately two to three weeks before the OM. Adults oviposit on cole crops, radishes and onions; the second, and largest, generation usually is observed on field beans.

Little quantitative information is available on SCM damage to onions. Hudon and Perron (1954) reported on root maggot species and densities in seeded onions in Quebec over a fifteen week period. Published results, however, were reduced to monthly totals, where 19% of all larvae collected in June were determined to be SCM. Mathewman et al. (1950) also recorded root maggot species and densities from samples of damaged onions collected from early June to July in Ontario. They reported that 97% of the root maggots were _H. antiqua_ and only 1.3% were _H. platura_, the majority of the latter being found in the first two weeks of July. Loosjes (1976) reported that during the first flight of the OM in the Netherlands, onions with only SCM larvae were found on several occasions. He suggested, however, that the SCM should be considered only a secondary pest of onions because they could only build up in density when a high density of OM was present as well. His conclusions were based on observations of low populations of the SCM when OM populations were also low in number.

Brooks (1951) reported that in a sample of dipterous larvae, species and their numerical proportions were likely to vary both seasonally and geographically and that as many as 14 species of Diptera had been found in onion plants. As a result, Mathewman et al. (1950) felt that the value of observations made on root maggot studies were in doubt unless a careful identification and analysis of field populations of maggots was made.

C. Spatial Distribution and Sampling

Many different types of traps have been described and used for trapping adult root-maggot flies to determine phenology, relative estimates of adult abundance, and activity (Southwood 1978, Eckenrode et al. 1975, McEwen et al. 1973, Ellington 1963, Carruthers 1979, Loosjes 1976).

Activity traps, sticky traps and flight interception traps have been used in more recent studies into OM flight activity (Eckenrode et al. 1975, McEwen et al. 1973, Loosjes 1976). Baited traps have also been used, with baits ranging from blood and bone meal (Eckenrode, 1979, Ag. Exp. Stn., Geneva, NY, pers. comm.) to fermented yeast mixtures (Peterson 1924) and onion volatile mixtures (Eckenrode et al. 1975, Loosjes 1976).

Results of adult trapping have been used in New York and Michigan to describe the phenology of the adult OM and to identify times of peak flight activity (Eckenrode et al. 1975, Carruthers 1979). Eckenrode et al. (1975) suggested this information could be used to help time adult control activities during the season and to provide information on success of the controls used.

Degree-day requirements for peak adult flight activity determined from adult trapping were found to be very similar in New York and Michigan

(Carruthers 1979). Carruthers (1979) suggested caution, however, if degree-day requirements were used for prediction purposes. He stated that large deviations can occur in predicting second and third generation flight activity due to unaccounted for environmental mortality of the larvae. His results, however, were based on adult trapping for only one year.

Loosjes (1976) used flight interception traps to monitor adult activity and relative abundance in the Netherlands. Trapping results tracked population decreases from successive sterile male releases and the effect of different applied chemical controls. He also used release-recapture experiments to estimate OM adult density. A total of 8,550 marked flies were released over three fields during the first generation flight. Population levels of 1.7-3.6 flies per square meter were calculated for fields where onion plant damage was high.

Most of the information on sampling for root maggot larvae is conducted on a small plot perspective where a set number of plants, selected randomly, are examined for various insect life-stages. Loosjes (1976) suggested that stratified-random sampling would be more appropriate for sampling the OM since a large variance was often associated with sample results when simple random sampling was used. Stratified sampling is recommended where obvious differences are notable in population parameters for different classes, strata or habitat of the sample space (Jessen 1978). This type of sampling was shown by Carruthers (1979) to increase sampling precision and to reduce the number of samples required when sampling OM immature stages. He identified two classes of onions (visually healthy and visually damaged) which he divided into five sub-strata. He showed that sampling visually healthy onions accounted for most of the variance in sample results and suggested that total immature density estimates could be made by using the sample results of the other strata of onions. Carruthers (1979) analyzed all immature life-stages, including the pupal stage. In an actual biological monitoring program, however, determination of all the life-stages is impractical. Loosjes (1976) noted that up to 50% of the eggs of the OM may be overlooked in sampling and that sampling for first instar larvae requires extremely careful dissection of all plant material, ruling out the use of a search-type program.

Southwood (1978) provides an excellent review of dispersion and points out the importance of knowing the pattern of distribution or disposition of animals in space. The OM population has been described as being distributed in an aggregated pattern within and between fields (Perron et al. 1955, Workman 1958, Rawlins et al. 1960, Carruthers 1979). Carruthers (1979) fit observed frequency distributions of onion maggot larvae per onion to a negative binomial frequency distribution and reported that a common "K," or factor of aggregation, existed for the different sampling periods. He also examined the spatial distribution of OM pupae around an onion source and showed that 90% of the pupae were located within a six inch radius from an onion and that all pupae lie above six inches in the soil. Loosjes (1976) reported that the occurrence of pupae in a field conformed to the negative binomial distribution with K dependent on the mean.

Little information has been published on sampling methods used to assess OM plant damage in the field. Most reports of onion loss have been qualitative, describing huge losses during certain years for large onion growing areas, but no information is given on how the estimates were made (Perron et al. 1958, Mathewman et al. 1950, Hudon and Perron 1954). To estimate damage loss, Loosjes (1976) suggested that random samples of .5 meter to 1 meter of onion row be examined (depending on damage intensity). The number of such samples is calculated by analyzing the mean and variance of a prior sample estimate. Carruthers (1979) also reported on a design for sampling mean plant damage at both a field level and a regional level. His technique provides optimum determination of a sample unit, size, and number for different levels of precision.

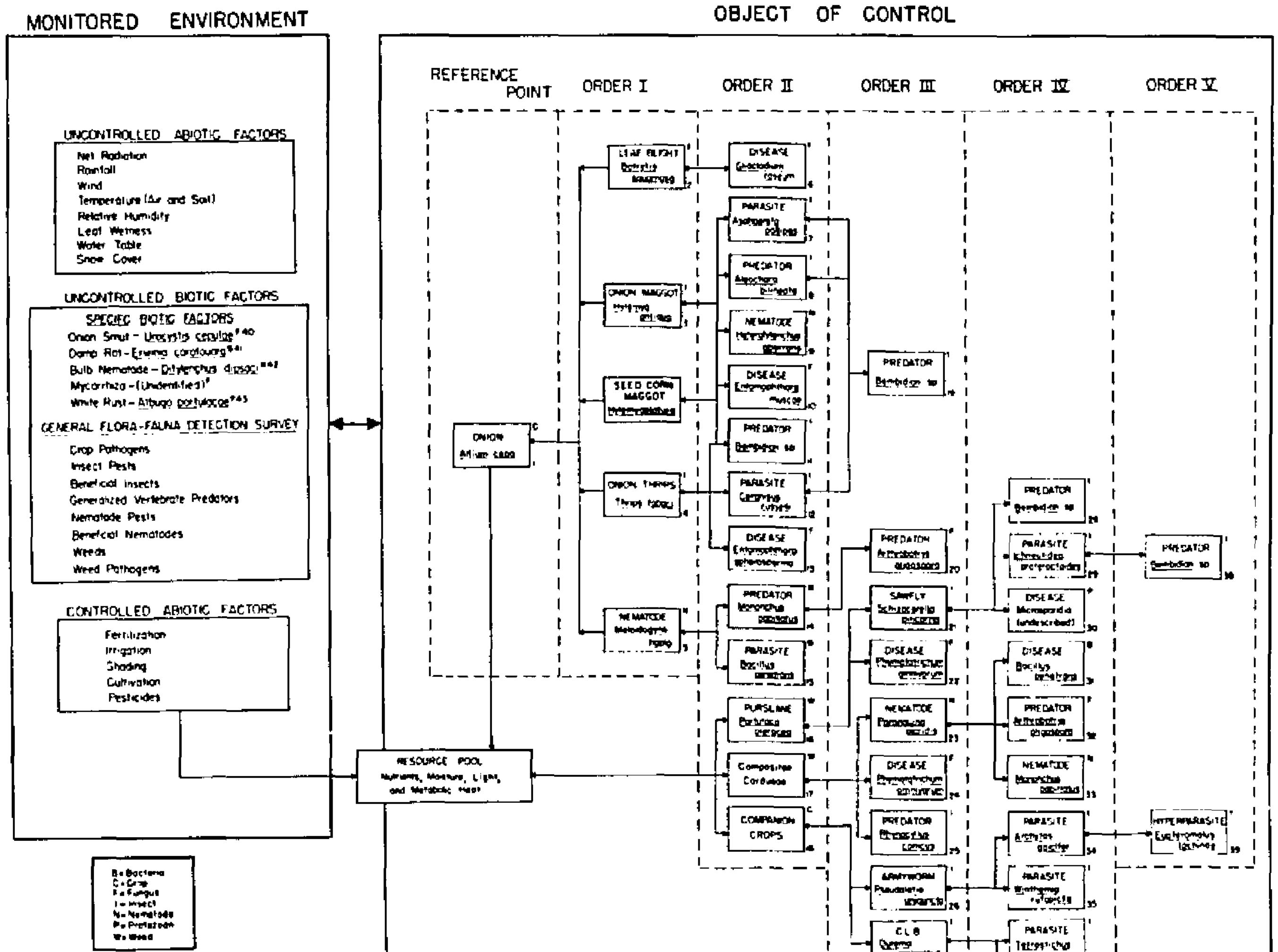
The distribution of onion maggot plant damage has been described as contagious (Perron et al. 1955, Workman 1958, Rawlins et al. 1960). Through a quantitative study, Loosjes (1976) reported a negative binomial distribution of onion plant damage with "K" dependent on the mean. Carruthers (1979) also reported a negative binomial distribution of OM plant damage both within and between onion fields. Several reasons for the aggregated pattern of damage were given by Loosjes (1976) and Carruthers (1979). Although no common aggregation coefficient was found, a combination of interacting factors was suspected. These included: 1) clustered egg deposition, 2) ovipositional preference for certain sizes or densities of onions, 3) strong ovipositional preference for previously damaged onions, 4) possible density dependent survival, and 5) effect of the spatial distribution of the granular insecticide placed in the row at time of planting. Carruthers (1979) believed that initial plant damage fitted a random distribution and acted as a center for further damage. He suggested that successful initial damage was in part due to oviposition on unprotected areas of onions where the soil insecticide was not present. Analysis of damage samples from a limited number of Dyfonate-treated fields supported this hypothesis.

III. ECOSYSTEM STRUCTURE, IDENTIFICATION AND CONCEPTUAL MODEL.

The onion agroecosystem is an excellent system to study in a wide-area approach for ecosystem analysis. Onions in Michigan are presently grown on muck soil which occurs in discrete pockets in various areas of the state. As a result, its boundaries are well defined, and system environment dichotomy is easily performed. This dichotomy is a first step towards developing an ecosystem approach (Haynes et al. 1980). For many crops, the first step of a conceptual separation is difficult due to the many agricultural and natural ecological systems within the space of study. These systems compound the interactions and can lead to a greater list of controllable and uncontrollable factors that become difficult to ascertain in multiple system-environment interactions. This implies that a system with a more defined geographical region (object of concern) may lend itself better to the conceptual framework of system environment dichotomy.

The structural features of interaction levels within the onion agroecosystem and the identification of the monitored environment and object of control are described by Haynes et al (1980) (Figure 1). These features of the onion agroecosystem design can be reorganized so that when studying the population dynamics of the OM, the OM becomes the reference point (Figure 2). This system-environment dichotomy, and subsequent re-organization, provide a framework for a quantitative analysis of the system and their interactions. Identification of the controlled and uncontrolled biotic and abiotic factors in the monitored environment are necessary to insure that management or production options are determined and that other parameters are at least identified and monitored.

Figure 1. Conceptualization of the onion agroecosystem showing levels of interaction within the object of control and the monitored environment. Numbers refer to footnotes in Appendix B (after Haynes et al., 1980).


MONITORED ENVIRONMENT
UNCONTROLLED ABIOTIC FACTORS
Net Radiation
Rainfall
Wind
Temperature (Air and Soil)
Relative Humidity
Leaf Wetness
Water Table
Snow Cover
UNCONTROLLED BIOTIC FACTORS
SPECIFIC BIOTIC FACTORS
GENERAL FLORA-FAUNA DETECTION SURVEY
Crop Pathogens
Insect Pests
Beneficial Insects
Generalized Vertebrate Predators
Nematode Pests
Beneficial Nematodes
Weeds
Weed Pathogens
CONTROLLED ABIOTIC FACTORS
Fertilization
Irrigation
Shading
Cultivation
Pesticides
OBJECT OF CONTROL
REFERENCE POINT
ORDER I
ORDER II
ORDER III
ORDER IV
ORDER V
ONION
LEAF BLIGHT
ONION MAGGOT
SEED CORN MAGGOT
ONION THRIPS
NEMATODE
DISEASE
PARASITE
PREDATOR
PURSLANE
Composites
COMPANION CROPS
SAWFLY
ARMYWORM
C.L.B
HYPERPARASITE
RESOURCE POOL
B = Bacteria
C = Crop
F = Fungus
I = Insect
N = Nematode
P = Protozoan
W = Weed

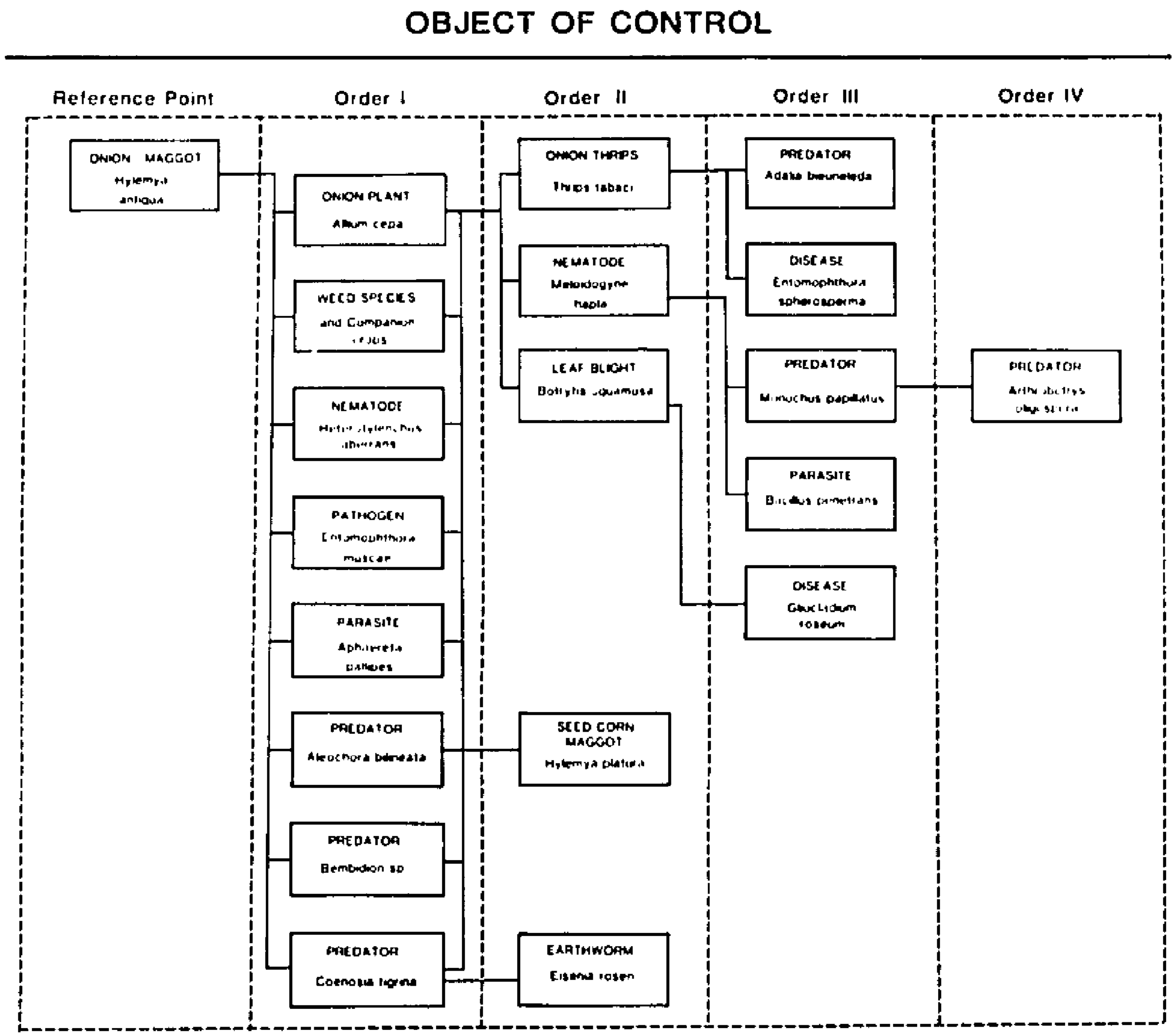


Figure 2. Conceptualization of the object of control for the onion agroecosystem with the onion maggot, Hylemya antiqua, as the reference point.

A conceptual submodel of the onion system was developed early during the onion agro-ecosystem project (Whitfield et al. 1981). The initial model conceptualization and structure resulted from a team effort by Mr. Frank Drummond, Mr. J. Valenti and this author. The model consisted of several submodels including the OM, the onion plant, and a braconid parasitoid. Abiotic variables of the model were soil and foliar pesticides, weather and time. These variables were used to construct a model that would show the distribution of maturity for the organisms at any point in time. This model was primarily a research tool for identifying areas where more information was needed. It also served as a comprehensive review of the literature and as a catalyst which forced us to examine the types and effects of a variety of control strategies. Designing the model and identifying the various parts of the system involved a process of breakdown, reiteration, and testing that enabled us to view and work with the complex onion system. Validation of model runs were not made during this phase of the modeling project since little to no quantitative information was available at the time about field densities of the life-stages of the OM, its parasitoid, and results of applying chemical controls. Simulation runs for this conceptual model were compared only to available information from the literature.

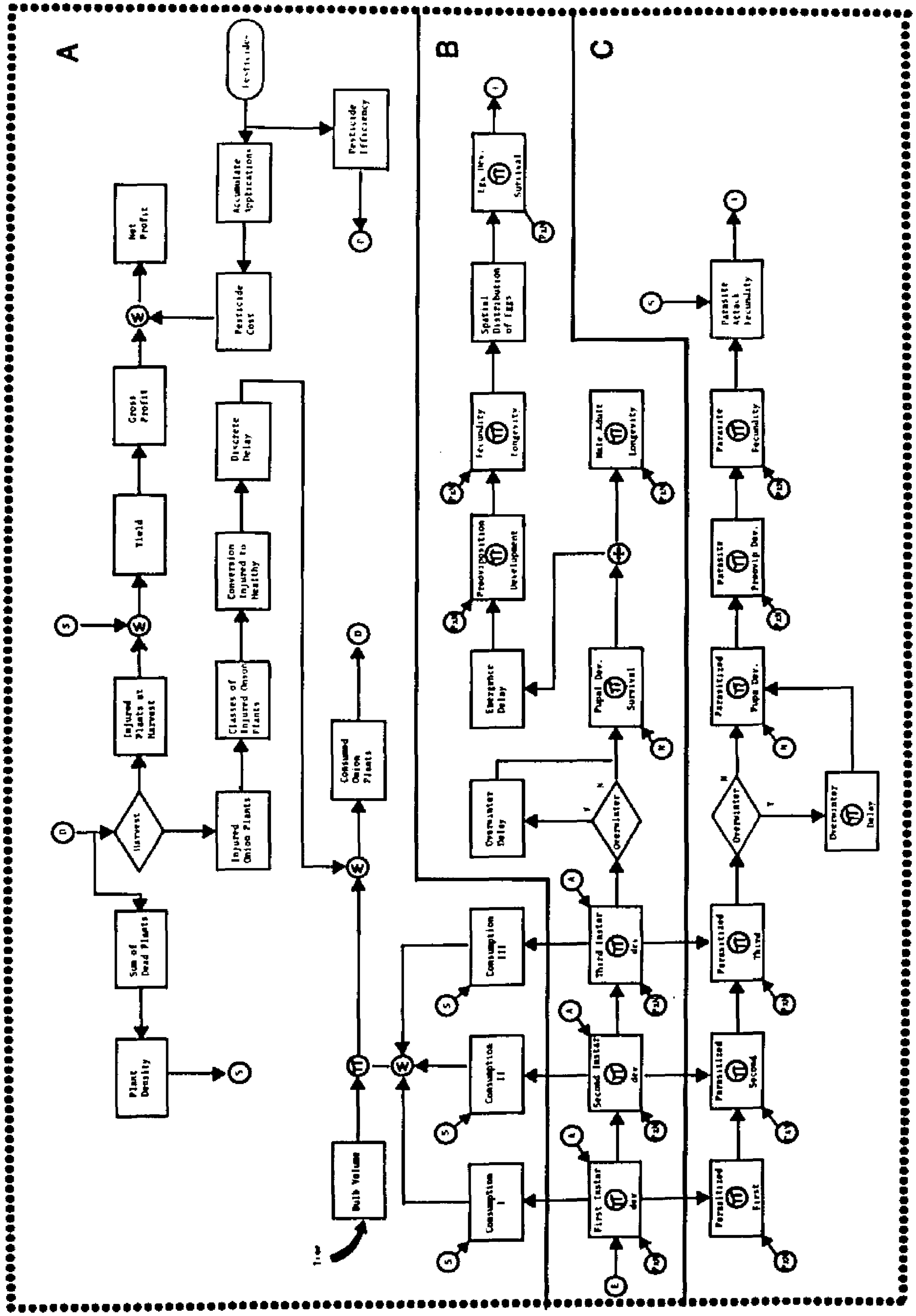
A. Conceptualized Model

The conceptualized model (Fig. 3) had controllable inputs: weather (three different weather sets from Lansing, Ludington, and Houghton, MI), parasitism (Aphaereta pallipes Say), planting density, type of pesticide, frequency of pesticide use, initial date of application of pesticide, and spring density of onion maggot pupae. The outputs of the model are yield (amount per acre), net profit, and the number of individuals in each age class (for each organism). The model was judged a success if there was good correlation between output and information in the literature.

In formulating the model, a one-acre field of onions was considered. It was thought that the size of the field would have no bearing on the dynamic interactions that were taken into account by the model. With minor modification, any size field could be implemented into the model structure. This assumption was based on two restraints that were built into the model. First, no immigration or emigration would take place with the OM or the parasitoid component (closed system). Second, onion bulb growth would be based on a static regression model that would result in uniform growth for all onions. These restraints enabled the model to elucidate the interactions independent of the size of fields. The economic section of the model was a static submodel in that the cost of labor and materials, as well as marketability of the crop, remained constant through time. This was not detrimental to the workings of the model since it provided a standard measure where comparisons between simulation runs could be made quickly.

The construction of a model detailing the relationships between abiotic parameters and pesticide effectiveness and breakdown was not undertaken due to the complexity of such a system. Instead, it was assumed that data on average, half-life tendencies of certain pesticides approximated most pesticide behavior over a wide range of weather conditions (F. Matsumura, 1978, and A. Wells, 1977, pers. comm., Dept. of Entomology, Mich. St. Univ.). A number of restrictions or assumptions were incorporated into the model components concerning the population dynamics of the OM and parasitoid. Assumptions that applied to all the organisms were: (a) mortality was not age-specific in each age

Figure 3. Functional diagram of the life system of the onion maggot (S=spacing of onions, D=dead onion plants, P=mortality due to pesticides, E=eggs, A=parasitism, N=natural mortality). A, submodel of the onion, pesticide, and economics components; B, submodel of the dynamics of the onion maggot population; C, submodel of the dynamics of the parasitoid population.


A
B
C
Net Profit
Gross Profit
Yield
Injured Plants at Harvest
Harvest
Sum of Dead Plants
Plant Density
Accumulate Applications
Pesticide Efficiency
Pesticide Cost
Discrete Delay
Conversion Injured to Healthy
Classes of Injured Onion Plants
Injured Onion Plants
Consumed Onion Plants
Bulb Volume
Consumption I
Consumption II
Consumption III
Spatial Distribution of Eggs
Fecundity
Longevity
Preoviposition
Development
Emergence Delay
Overwinter Delay
Overwinter
Pupal Dev.
Survival
Male Adult
Longevity
First Instar
Second Instar
Third Instar
Parasitized First
Parasitized Second
Parasitized Third
Parasitized Pupa Dev.
Parasite Preovip Dev.
Parasite Fecundity
Parasite Attack Fecundity

class, but was distributed uniformly; (b) the reaction of all life stages to temperature was instantaneous; and (c) development was temperature dependent. No age-specific mortality was assumed because no pertinent information on this topic was found in the literature. It was felt that the best approach was to treat mortality uniformly across the life stages until research dictated otherwise.

Presently, assumptions b and c form the basis for most insect population dynamics models (R. Rabinge, 1978, pers. comm., Agric. Inst., Wageningen, Netherlands) (Fulton 1978). More specifically, the data of Ellington (1963) and Salkeld (1959) tend to suggest that these temperature relationships hold true for the OM and A. pallipes.

Temperature had the most widely distributed effects in this model. It was input to a number of functions that affected adult emergence, oviposition, survival and length of stay in a life stage. Temperature data from the National Weather Service was supplied in the form of daily maximums and minimums. The time sequence of the model was in tenths of days, each tenth or 2.4 hours representing a DT (i.e., Δt). In order to calculate an average temperature for each DT, temperature changes within a day were assumed to be sinusoidal with the maximum and minimum twelve hours apart (Fulton 1978).

$$\text{Average air temperature} = \text{Min} + [(\text{Max}-\text{Min})/2] + [(\text{Max}-\text{Min})/2] * [\cos(2.4\ \text{DT})]$$

These calculated temperature values, when used to determine degree-day accumulations, produced errors that were insignificant when looked at over an entire season (Baskerville and Emin 1969). Heat units or degree-days were used to synchronize emergence, to place gravid OM females in the correct fecundity class, to regulate the numbers of OM pupae going into diapause, and to evaluate the model's performance (by comparing observed simulation results with information from the literature).

$$\text{Degree days} = F(t) = \mathrm{Max}[0, T(t) - T_0] * DT$$

where $T(t)$ = temperature at time t

T_0 = threshold temperature

and heat accumulation in degree-days required for mean development of a life stage, TDD, is

$$TDD = \int_0^x F(t)\,dt$$

where x represents the mean number of calendar days required to complete development in a life stage.

Regression analysis between degree-day accumulations for air and soil have been shown to give coefficients of determination, r^2, from .86 to .96 in mineral soils (Lampert 1976). Bath (1975) developed a soil-air temperature model for muck soil of uniform particle size, with a slope of less than 2% and for a depth of four inches.

$$ST = 16.41966 + .750848 * \text{average air temperature}$$

$$(r^2 = .69)$$

This regression equation was used to predict soil temperatures (ST) from air temperatures when needed for egg, larval, and pupal development.

The main structure of the model could be viewed as a union of three main biological components. These represented the submodel of the onion, pesticide, and economics components (Fig. 3A), the submodel of the dynamics of the onion maggot population (Fig. 3B), and the submodel of the dynamics of the parasitoid population (Fig. 3C). Using components was felt to be the ideal method for constructing a model of a smaller subsystem so that the model could be expanded by interfacing components without drastic model restructuring. Table look-up functions (Llewellyn 1965) were used in all three components for linear interpolations between data points in each entry and linear extrapolation below and above the minimum and maximum values for each data set.

The density of onions per acre available for consumption by the OM was a function of within-row spacing, specified by the user.

NO = 22366 * 12/SPC

where NO = number of onions per acre,

SPC = spacing of onions (in inches) within a double row bed.

Onion consumption by each larval stage was determined at the end of every ten DT's (one day). Consumption rates were based on data by Workman (1958) and scaled according to the larval instars involved. Given the size of the onion bulb at that time, consumption by all instars was then summed and subtracted from the number of onions left in the field.

The relationship between larval consumption (volume of onion consumed) and bulb diameter is as follows:

First instar consumption = $.196\ e^{-.95} * BD$

Second instar consumption = $.4\ e^{-.85} * BD$

Third instar consumption = $6.75\ e^{-1.} * BD$

where BD = bulb diameter (G. Bird, 1976, unpublished data).

It was assumed that all available onions in the field were the same size at any one point in time and bulb volume was obtained from using the table look-up function for any specific date.

bulb volume = $.002\ e^{(.09 * \text{days after seeding})}$

The number of onions consumed (NK) was determined by subtracting the total volume of onion consumed by all instars from available onion volume (bulb volume * number of onions per acre). From this, the number of damaged onions was determined (Loosjes 1976):

ND = 1.9 x NK

where ND = number of damaged onions per day,

NK = number of killed onions per day.

Damaged onions were assigned a percent damage according to a negative exponential equation where 50% of the damaged onions (ND) were assumed to be 90% consumed.

NO = NO + (ND x .5) x CX

where CX was equal to .1, .2, .3, .4, .5, .6, .7, .8, or .9.

This gave a damage distribution of nine classes for the partial consumption of onions. The remaining onion volume within these classes was available for consumption the next day. The percent of volume not consumed was converted back to healthy onions, based on the assumption that the OM larva usually migrates only when the onion has been consumed. Calculation of the number of damaged onions was necessary as an input for the economic sub-component.

Furrow and foliar insecticide applications were available management options. An in-furrow application that inflicts 98% mortality on all larval stages (A. Wells, 1977, pers. comm., Dept. of Entomology, Mich. St. Univ.) can be made at planting time. A foliar spray directed at the adult OM may also be applied at various times during the season. Depending on the particular spray chosen, the mortality factor of adult OMs and A. pallipes follows an exponential decay curve with a half-life of one, two or four days (F. Matsumura, 1978, pers. comm., Dept. of Entomology, Mich. St. Univ.).

PMORT = 1.0 - .96 * EXP ((-CPDAY) * (.69314/FREQ)) where PMORT = mortality due to insecticide spray,

CPDAY = number of days between sprays,

FREQ = residual effectiveness of spray applied

(Malathion - 1 day, Parathion - 2 days, Diazinon - 3 days).

At harvest the total number of onions remaining in the field (NO) was converted to 100 pound quantities (440 onions per cwt) and multiplied by the market price ($6.00) to give a gross profit for the end of the growing season. The net profit was obtained by deducting the costs of any pesticides used and the fixed costs of production, estimated to be $1200.00 (C. Cooper, 1976, pers. comm., Coop. Ext. Ser., Mich. St. Univ.), from the gross profit.

NETP = ((NO/440) * 6.0) - (CF + CS)) - 1200.

where NETP = net profit,

NO = number of healthy onions remaining in field,

CF = cost of a furrow insecticide,

CS = cost of foliar insecticide.

It was found that the developmental period of a population of organisms was distributed over time. That is, for the aggregate flows, individuals have different lag times; therefore, while individuals may enter the process at the same point in time, the output flow will be distributed over time. This was usually due to genetic differences among individuals and variable conditions in the microclimate. A method of modeling this type of aggregative behavior can be performed by using time-varying, distributed delays (Manetsch and Park 1977).

The basic assumption in using time-varying, distributed delays to simulate insect development was that the time required for development of a specific stage had an associated mean and variance for a temperature regime. Depending on the shape of the probability density function of the particular process, the parameters D and K were chosen, such that D was the mean lag time, D = D(t), and K described the shape of the distributed variable.

When modeling a continuous process as opposed to a discrete one, the assumption is made that mortalities, dependent on temperature, operated continuously. This implies that:

$$P(t) = P(o)\ e^{at}$$

where t = time,

a = instantaneous survival

P(o) = initial population,

P(t) = population at time t.

Fulton (1978) developed the idea of instantaneous survival being an exponential relationship with temperature. This idea enabled mortalities to be implemented in the delay technique.

In trying to apply a survival function over the entire life stage, a complication arose since the time spent within the stage was also a function of temperature. The interaction was eliminated by using the instantaneous survival rate as the proportional loss rate:

$$P(t) + DT = P(t)\ e^{PLR}$$

where PLR = a + b * temperature

The instantaneous survival rate was used to compute half-lives of the individuals under the existing temperature regime. By setting $P(t)/P(o) = e^{at} = 1/2$, the half-life became $t = -(\ln 2/a)$. This half-life represents a median survival time.

The following relationships between instantaneous survival and temperature were used in the model:

egg survival = .16 - .03 temperature

first instar survival = 1. - .02 temperature

second instar survival = .5 - .01 temperature

third instar survival = .11 - .002 temperature

The OM component was responsible (a) for simulating the passage of individuals through the various age classes, (b) for simulating the effects of different mortality factors, and (c) for supplying the other components with numbers of OMs in various age classes. Two important assumptions were made: (a) density-dependent relationships did not operate in the OM system; and (b) all female adults were mated and fertilized. These assumptions were made because of lack of data to specify otherwise.

The time-varying, distributed delays, for aggregates moving through the age classes, were dependent on the mean developmental times. The onion maggot component for the most part was executed on a per DT basis. The mortality acting within the developmental stages was a product of the "natural" temperature dependent mortality and the mortality due to pesticides. These were assumed to be independent events. The pupal mortality depended solely on soil temperature. The overwintering delay represented the number that entered diapause. The subroutine "diapause" converted pupae to diapausing pupae, depending on degree-day accumulations. The three generations were tracked by accumulating degree-days. Ten, 67 and 100% of the pupae were put into diapause from each generation, respectively (Perron 1972).

Degree-days were also used to place mature females into fecundity classes. The number of eggs oviposited by a gravid female was tied to the temperature regime that the individual was exposed to during preoviposition (Loosjes 1976). The approximate length of the preovipositional period for OM is 120 degree-days. This was calculated by:

TOTAL = TOTAL + [2.0 * MAXTEMP (I) + MINTEMP (I)] + [MINTEMP (I+1)]/4.0

where TOTAL = sum of average daily temperatures of preovipositional period (120 degree-days)

Five fecundity delays were used at 50°, 60°, 70°, 80° and 90°F. If a group of females underwent preovipositional development between 45° and 55°F, they were put into delay 50°F. Similarly, if an aggregate of females were exposed to an average temperature of 74°F during preovipositional development, they were put into delay 70°F, etc.

BIN = (.5 + TOTAL/S/10.0) - 4

where BIN = developmental class (1,2,3,4 or 5, corresponding to classes of 50°, 60°, 70°, 80° and 90° developmental delays)

S = number of days for preovipositional period.

Each day the total number of females remaining in each delay would oviposit an average number of eggs for their fecundity class.

$$\text{NUMEGG} = \sum_{i=1}^{5} \text{NROLEF(I)} * \text{NT}$$

where I = developmental class 1 through 5,

NT = .75, 2.5, 4.0, .5 or 0, corresponding to developmental class,

NROLEF(I) = number of ovipositing OM females in each developmental class (I),

NUMEGG = total number of eggs oviposited per day.

Many factors will affect the placement and spatial distribution of the eggs. A static distribution (Perron 1972), where 65% of the eggs are oviposited in the soil and 35% are oviposited on the onion plant, was used because more comprehensive data were unavailable. This did not detract from the model since no migration time was assumed.

The parasitoid component involved a structure (use of delays for the various life stages) similar to the OM component. The parasite attack model was a modified version of Griffith and Holling (1969).

ANHA = ANO * [[1-(1+A*TAG*P)]/(ANO*AK)] - AK

where ANHA = total number of hosts attacked during DT,

ANO = prey density,

A = number of attacks per unit time,

TAG = total time available for generating attacks,

P = parasitoid density,

AK = dispersion coefficient, "k" of negative binomial (parasite).

The model used the number of available hosts, along with the number of adult parasitoids, to generate a percent parasitism.

PATT = ANHA/(ANO*2.0/SPC) * .1

where PATT = percent attack by parasites,

SPC = onion plant spacing,

IPPO = 7.1 * PP

where PP = number of parasitized pupae,

IPPO = number of female parasitoids emerging from parasitized pupae.

In the model, provisions were made for discovering individuals that were previously parasitized. The data of Salkeld (1959) suggest that *A. pallipes* can discriminate between parasitized and nonparasitized hosts. This was simulated in the OM model by removing the parasitized larvae from the normal flow through the larval delays. The parasitized larvae (each DT) were placed into a parallel delay. To generate parasitized larvae, the attack model used larvae only from the unparasitized, OM component. Thus, larvae are never parasitized more than once. The attack rates were applied to the intermediate rates of the larval delays. This acted as an attrition to the delay and added to the parasitized larval intermediate rates. The parasitized larval flow proceeded at a rate 20% faster (Salkeld 1959).

Results and Discussion

No independent set of data was available for validation of the model; however, the model met known features of OM biology. These features included:

1) The OM has three overlapping generations per season in Michigan.
2) The development of the life stages are temperature controlled and peaks of adult emergence may be predicted through degree-day accumulations.
3) The maximum damage to onions usually occurs early in the season when bulbs are small.

Figure (4A) shows how the model adequately simulated the first two of these conditions. Given an initial population of 1000 pupae per acre, three, non-overlapping, generations were simulated due to the relatively short time spent in preoviposition. The peaks of these curves represent maximum adult emergence and occur at degree-day accumulations of 280, 1200 and 1950 (4.4°C) for East Lansing, Michigan, weather data of 1977. These values agree with those of Eckenrode _et_ _al_. (1975) who reported a thermal unit accumulation for the first, second and third broods, respectively.

The third condition was also simulated, as illustrated by plotting the

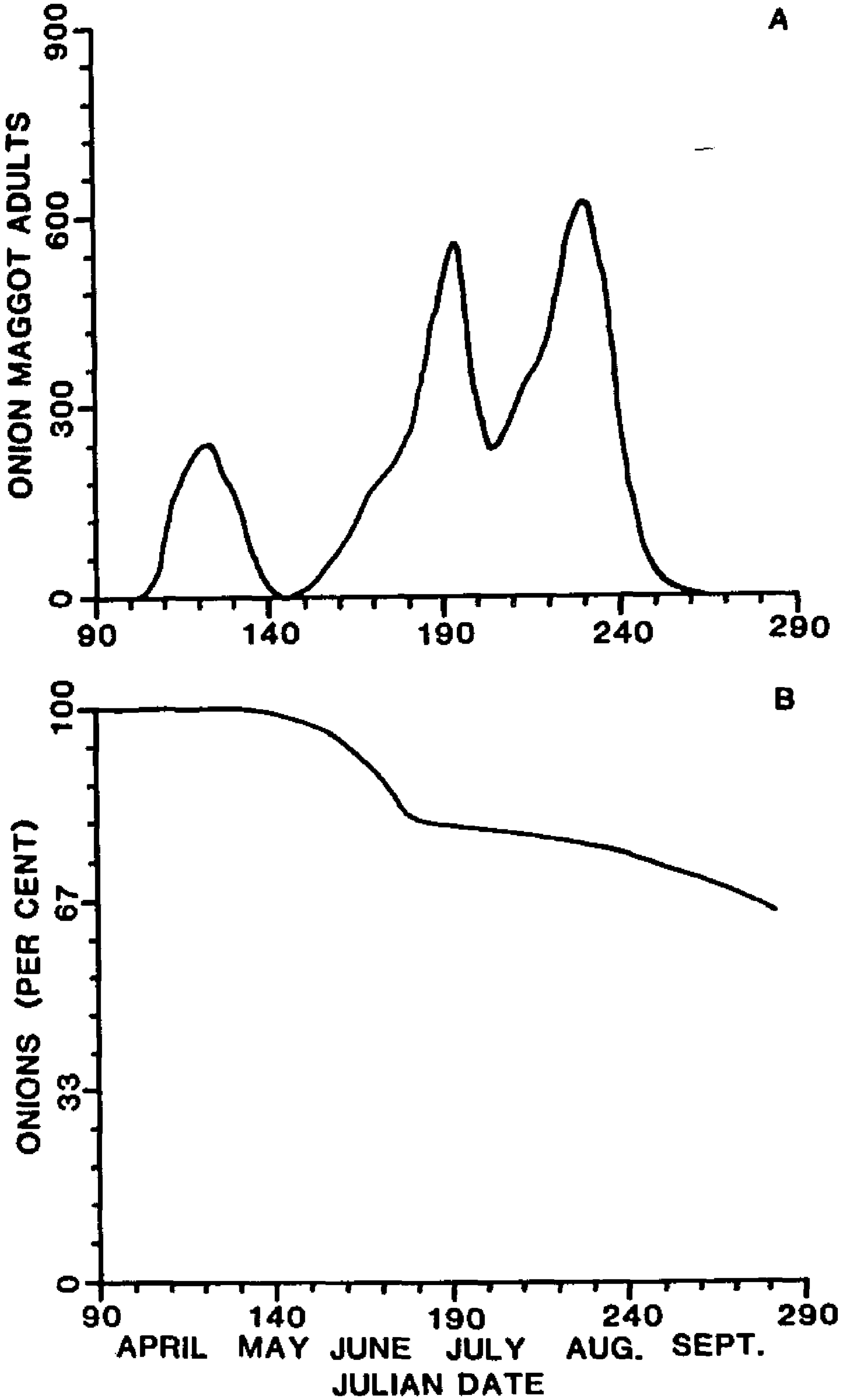


Figure 4. Simulation with an initial overwintering population of 1000 OM pupae per acre. A, number of adults in preovipositionary classes; B, percent of onions not damaged by maggots over time.

percent of onions left in the field versus the number of days in the growing season (Fig. 4B). Early in the season, damage increased as total larvae increased. Damage then tended to level off even though the larval population continued to increase. The response was due to larger bulbs, which had a greater tolerance to larval feeding.

Given that the model simulated OM development and consumption correctly, three simulations were made to analyze:

1) the effect of a parasitoid on OM densities and onion yield
2) the effect of foliar sprays on OM, parasitoid densities and onion yield, and
3) the importance of the timing of the first foliar spray.

For the first run, an initial population of 1000 pupae and 500 parasitized pupae per acre were used. There were three distinct peaks of reproducing parasite populations (Fig. 5A) that were closely synchronized with the preoviposition peaks of the previous run (Fig. 4).

The parasitoid population decreased the second and third generation of preoviposition OMs, from peaks of 515 to 220 and from 610 to 200 over the previous run (Fig. 5B). The first generation was not affected. As a result of the decrease in the OM population later in the season, late damage to onions was less. This simulation resulted in a net profit of $298.00 per acre, as opposed to $9.00 without parasitoids.

In the second analysis, a spray of malathion was applied on day 50, and every 40 days thereafter, to an initial population of 10,000 pupae and 2000 parasitized pupae per acre. Day 50 was picked for the first spray date to coincide with the end of the first preoviposition peak of the OM, so that the

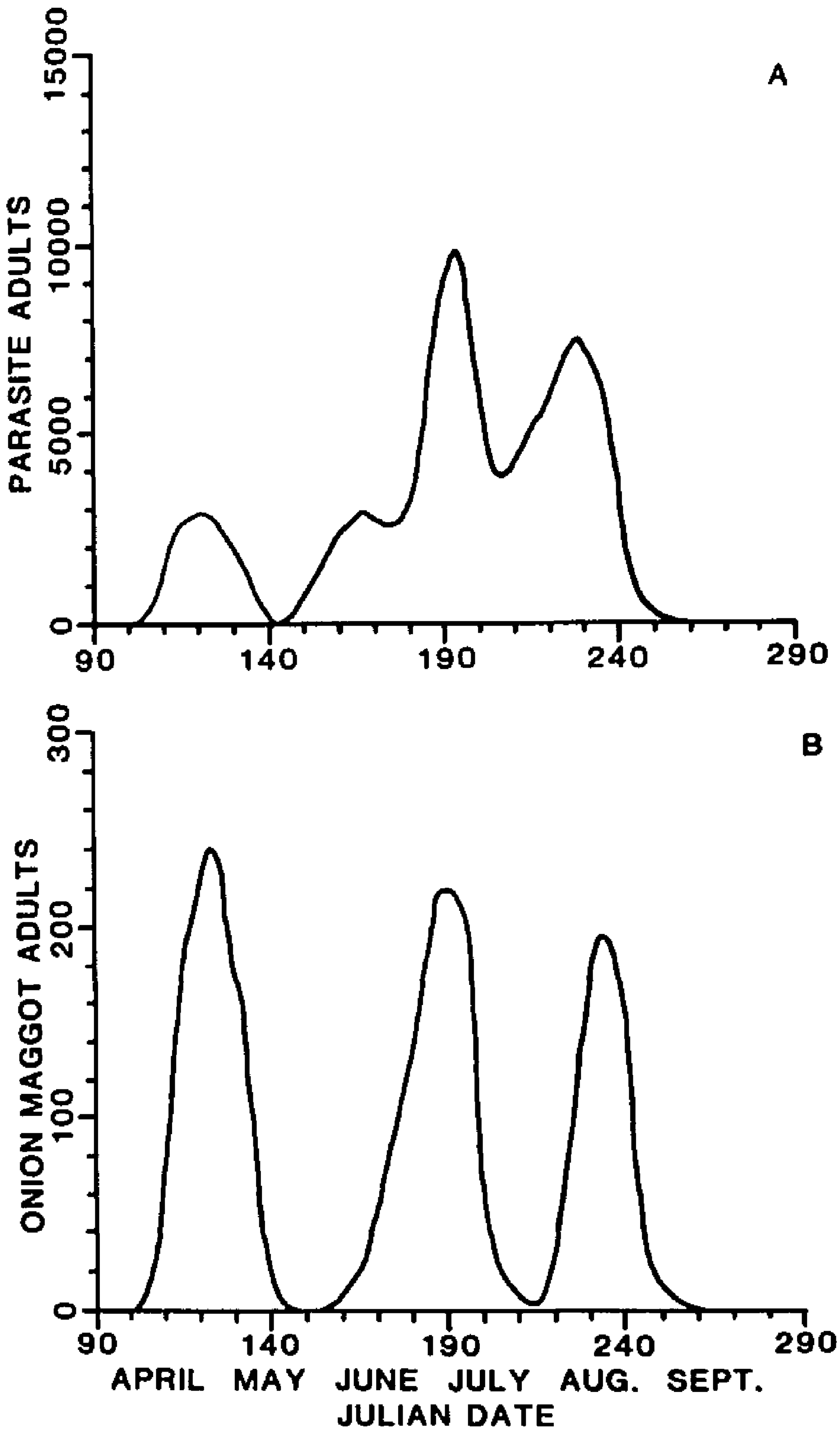


Figure 5. Simulation with an initial overwintering population of 1500 pupae of which 500 are parasitized. A, number of adult parasitoids; B, number of OM adults in preovipositionary classes.

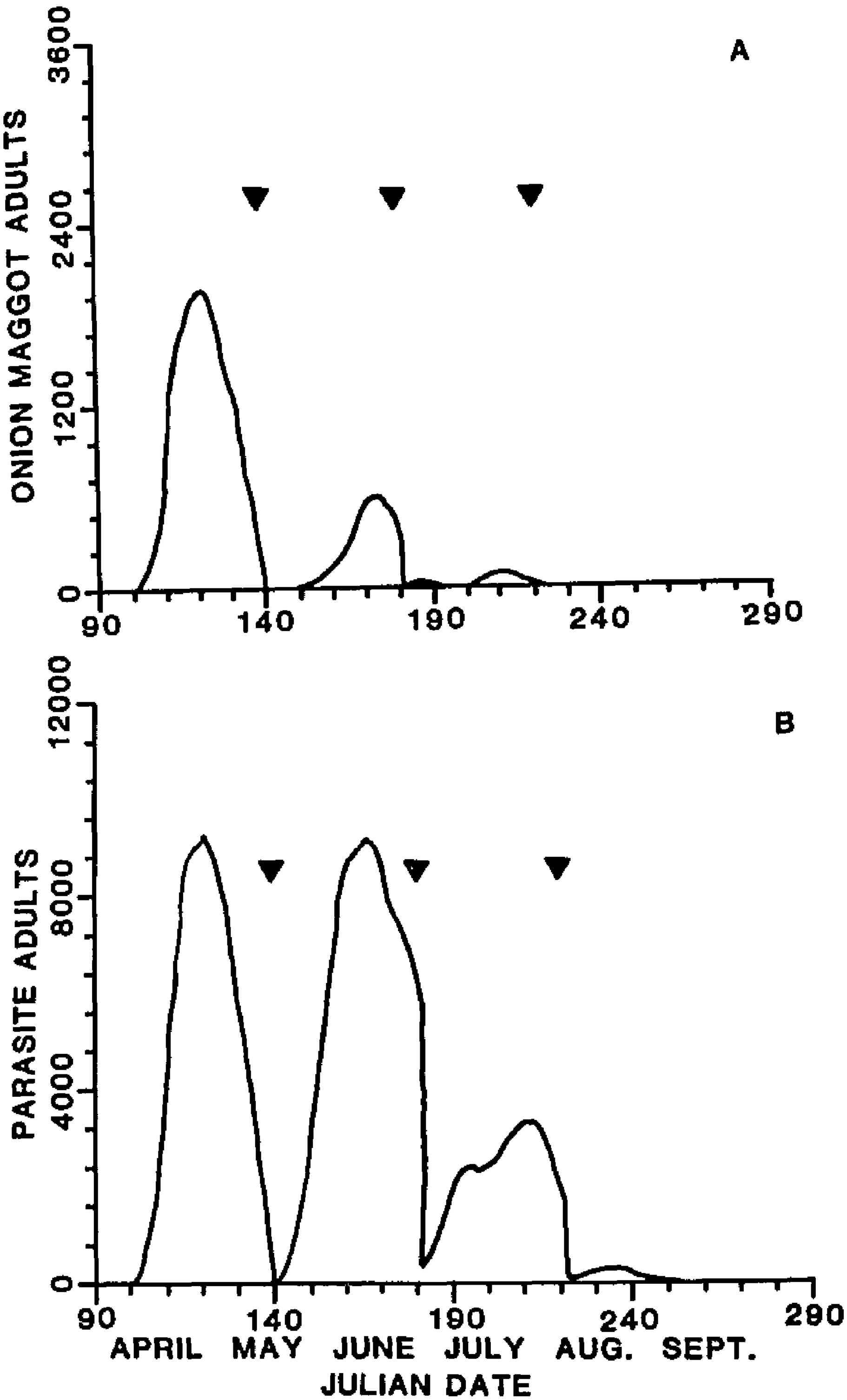


Figure 6. Simulation with an initial overwintering population of 12,000 OM pupae of which 2000 were parasitized. A foliar spray of malathion was applied at day 140, and every 40 days thereafter (▼=spray date). A, number of OM adults in preovipositionary classes; B, number of adult parasitoids.

adult population, now at its reproducing peak, would be sprayed at an optimum time. By spraying every 40 days thereafter, each successive generation of reproducing adults would also be sprayed at an optimum time. OM densities decreased considerably (Fig. 6A). The first generation of reproducing parasitoids, however, had already reached a peak at day 50 and the malathion spray had little effect on the first generation adults (Fig. 6B). The second generation of parasitoids was reduced a little by the residual effect of the day 50 spray, but again was not greatly reduced by the next spray at day 90, since the population had already peaked. The $172.18 net profit was low due to larval feeding early in the season. The number of parasitized, diapausing pupae, however, was high at the end of the season compared to OM densities and could be expected to have an important effect the following year.

The third analysis investigated whether the timing of the first spray was critical to OM and parasitoid populations. A spray of malathion was applied on day 80, and every 40 days thereafter, to an initial population of 10,000 OM pupae and 2000 parasitized pupae per acre. The first spray was applied after the build-up of reproducing OMs. As a result, the second generation of OMs was not decreased as much as it was in the previous run, and OM densities remained higher late in the season (Fig. 7A).

The reproducing population of parasitoids, however, was not reduced by the first spray until halfway through their second generation (Fig. 7B). The population remained high to the end of the season. Although this high population would reduce numbers of OMs the next year, the outcome for the current year was a net loss of $1100.00 per acre.

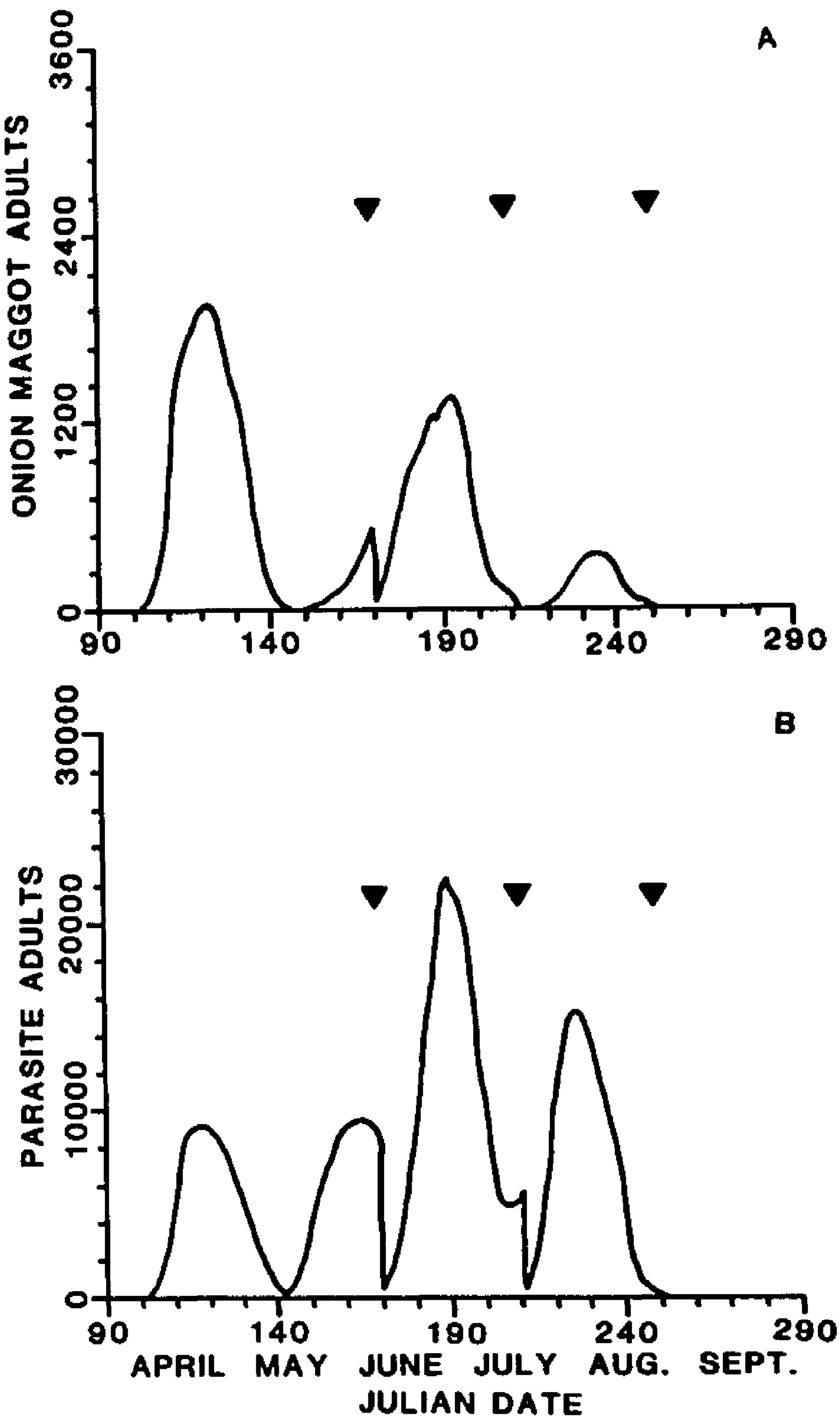


Figure 7. Simulation with an initial overwintering population of 12,000 OM pupae of which 2000 were parasitized. A foliar spray of malathion was applied at day 170, and every 40 days thereafter (▼=spray date). A, number of adults in preovipositionary classes; B, number of adult parasitoids.

B. Conclusion

The model adequately simulated the development of the life stages of the OM and was sensitive to changes in biotic and abiotic parameters. It revealed interesting information and relationships about the population dynamics of the OM, the effects of carefully-timed, insecticide sprays to avoid parasitoid mortality, and the effects of onion size on damage estimates early in the season. At the same time, it presented areas where more information is needed, such as migration, damage distributions, density-dependent effects and pesticide efficiency.

The damage distribution assumed in the model was random, although some data pointed to a clumped distribution, especially later in the season. Damage distribution was found to affect consumption rates, survivorship and parasitism. As a result, a damage-distribution component is essential to perfecting the model.

It was assumed that there were no density-dependent effects. No information is available on density-dependent features. However, such effects, if present, would undoubtedly influence all areas of the model.

IV. STUDY AREA

The study area was considered to be the onion-production area in the vicinity of Grant, Newaygo County, Michigan. This area was selected because it consists of an isolated pocket of approximately 16 sq mi of organic muck soil where mainly onions and carrots are grown. The fields are usually 10-40 hectares in size, and a two to four year crop rotation (onions, carrots, celery and mint) is practiced. The area is farmed by approximately 20 growers and has a history of OM problems dating back to the 1940s. Onions are the primary crop of the region, and despite multiple insecticide inputs, the OM remains an annual problem.

In 1978 and 1979 a field of 1.5 hectares was available to the onion agroecosystem project. This area, hereafter referred to as the research field, or field 7, was to be maintained under commercial conditions with the exception that control of the OM by chemical means was an option. Due to the nature of this arrangement, the population dynamics of the OM could be investigated under commercial conditions and differing chemical treatments within an area where the density of the OM was high. In 1978 the field was treated with a granular insecticide (Dyfonate—1 lb AI per acre) at planting; only the north half received the same granular treatment in 1979 (Figure 8). During both years, no foliar insecticide sprays were applied.

In 1979 and 1980 up to seven commercial onion fields were selected for regional analysis of population density and onion plant damage. All these fields had been treated with Dyfonate at planting. In addition, all but one of the fields was sprayed at various dates with foliar sprays of parathion, diazinon, or Sevin®. In 1980, one commercial field (field 13), approximately 10 hectares in size, was not sprayed, so that it could be compared to an adjacent area (field 14) which received weekly sprays of parathion from planting date to harvest. Figure 9 is an aerial map of the region showing the location and numbering system for the specific commercial study fields.

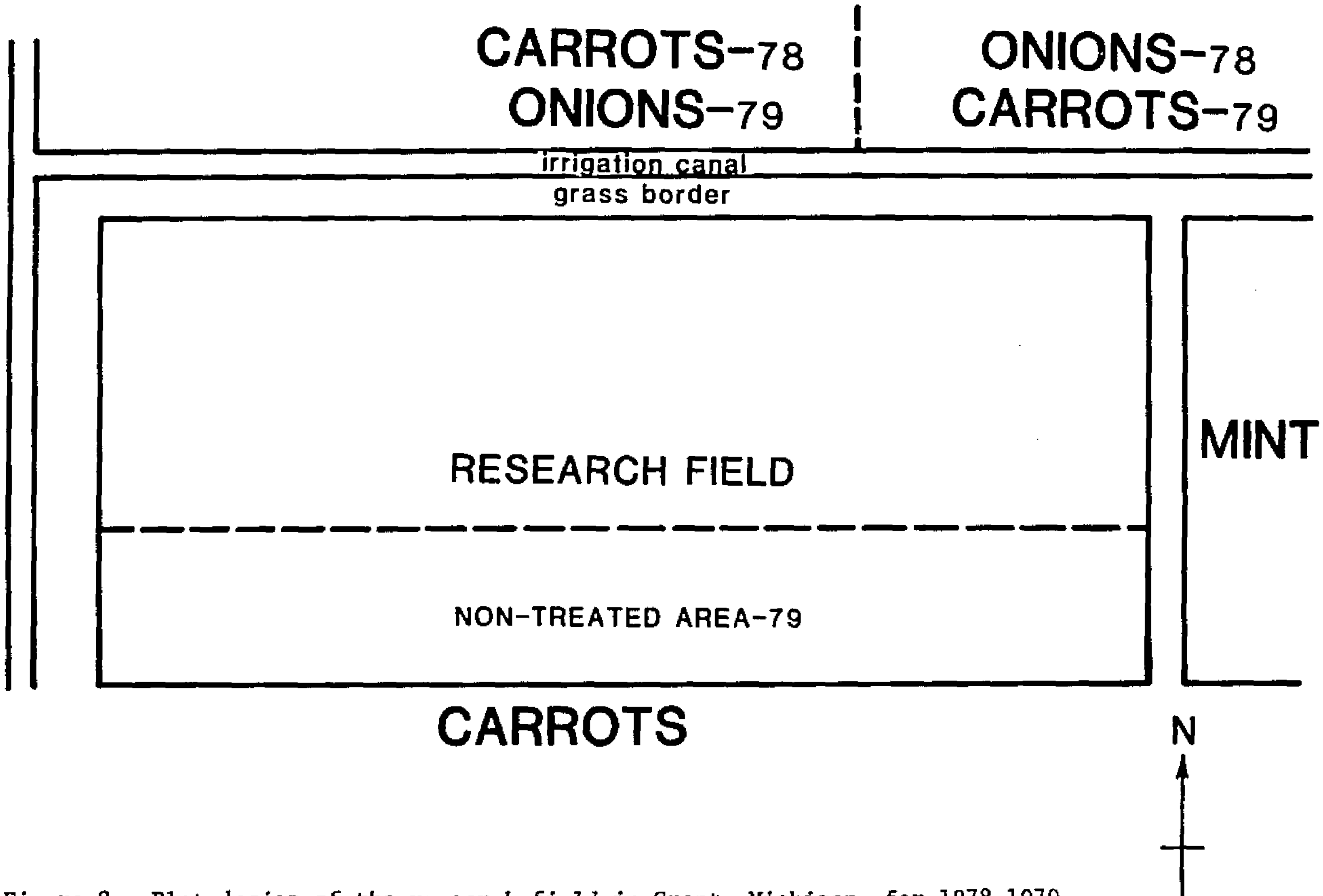
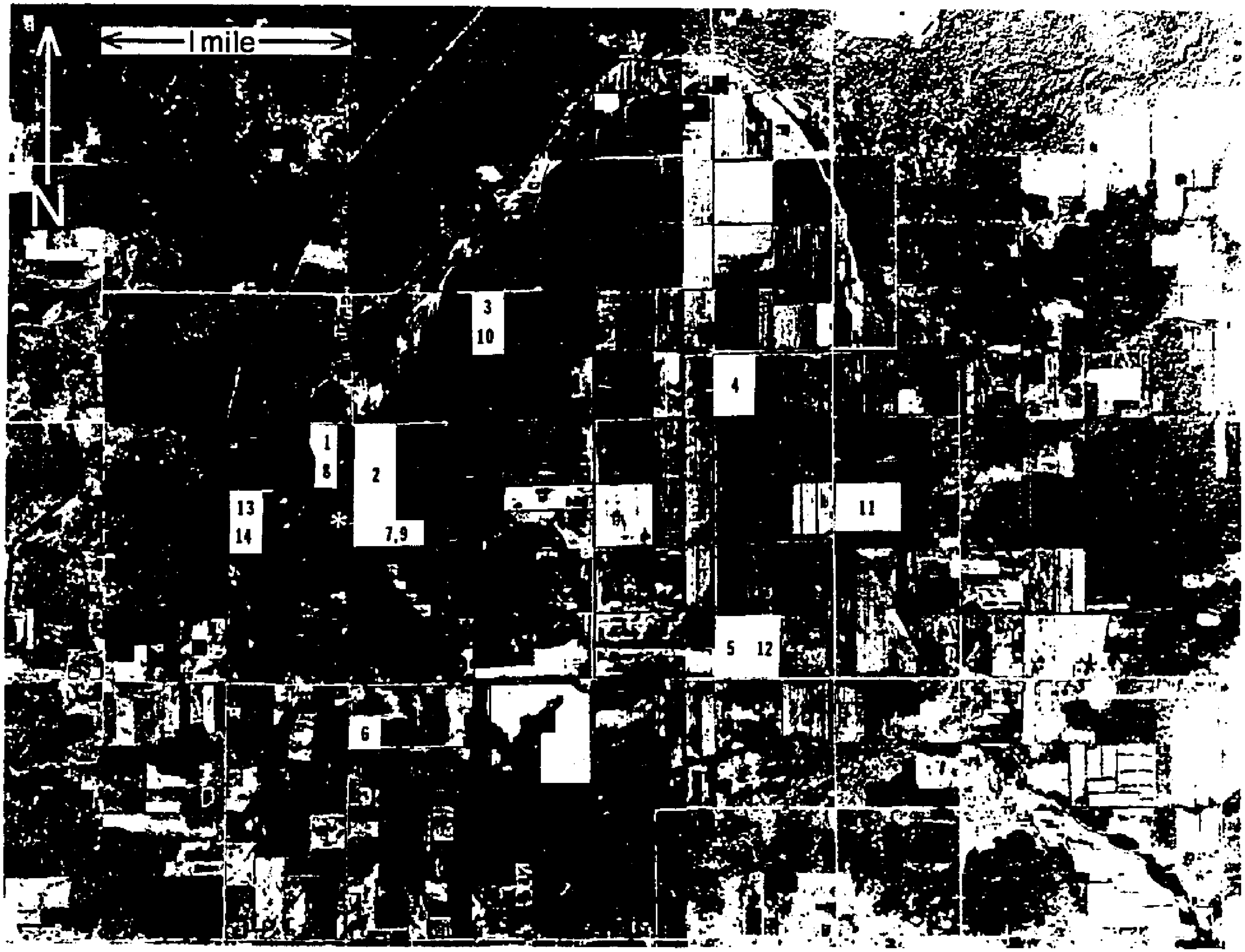


Figure 8. Plot design of the research field in Grant, Michigan, for 1978-1979.

Figure 9. Aerial photograph of the Grant onion growing area of Newaygo County in Michigan. Location of study fields 1-14 and the field laboratory station (*) are indicated.



1 mile
N
3
10
4
1
8
2
13
14
7,9
11
5
12
6

V. MATERIALS AND METHODS

A. Population Sampling

Various sampling procedures for different life stages of the OM were used to determine OM population density and phenology. Many of the procedures were extremely time-consuming and as a result sample interval, replication, or sample precision had to be continually weighted against available resources. Methods for adult, larval, and pupal population studies are discussed separately below.

1. Adults

Several different types of traps were employed to study the adult onion maggot population. The type, number, placement, and purpose of the traps are presented in Table 1. All flies collected were returned to the laboratory for identification, sex determination, and recording purposes. Except for emergence traps and rotary flight traps, all adult traps were monitored between 8 a.m. and 10 a.m. at three to four day intervals. Emergence traps were monitored daily when possible, so fly mortality would not occur. Rotary flight traps were monitored hourly during the day.

The possibility of predicting emergence of OM adults from soil and/or air temperature was investigated through the emergence traps. To measure adult OM emergence for each generation, emergence traps were set out over areas of damaged onions within the research field. These traps were originally designed to measure emergence rates of cereal leaf beetle adults, *Oulema melanopus* (L.) (Gage 1974). The traps consisted of a Lumite® screen supported by an aluminum tripod structure such that emerging adult flies would enter a collection device at the top. A rubberized canvas material was sewn to the bottom of the screen and

Table 1. Trapping devices, number, placement and purpose for monitoring OM adult populations in Grant, Michigan, for 1977-1980.

Trap Type	Year	No. of Traps	Placement	Monitoring Purpose
Stickyboards	1977-79	50	onion field and borders (grid pattern)	to determine relative abundance, activity, phenology and height distribution
Activity traps	1978-79	25	onion field (random)	to determine relative abundance, activity and phenology
Rotary flight traps	1977-78	3-Hi	onion field (random)	to determine within day activity and height distribution over time
Sweep net	1978	5 of 50 sweeps	onion field, carrots and borders (random)	to determine spatial distribution within a day
Emergence traps	1978-80	90	onion field (over areas of damaged onions)	to determine emergence and rate of emergence
Flight interception traps	1979-80	50	onion field and borders (equally spaced)	to determine relative abundance, activity, phenology, within day activity and spatial distribution

the trap covered an area of 1 sq yd (.84 m^2). The canvas was buried to insure that no emerging adults would escape entrapment. The collection device was modified so that adult flies could be trapped alive—a necessary requirement for another study in the project (see Carruthers 1981). Two, 2-litre plastic containers were used for this purpose. The container was fitted with a section of cheesecloth on top and a funnel in the bottom. This container rested inside the second which was connected directly to the trap by a 10 cm radius entrance hole (Figure 10). The top container could be easily removed and replaced.

The time of emergence-trap placement was determined from results of regular larval sampling. Traps were placed over areas of damaged onions only when most OM were in the pupal stage. This method covered the onions for the least amount of time so effects to the onions by the traps would be minimized.

To examine adult activity, relative abundance, and phenology, several types of activity traps were used. Stickyboards were set up in a grid pattern (1 trap per 232 sq m) within the research field and along the borders (weeds and carrots). The boards were 1.22 m by 15 cm constructed of sheets of pegboard bolted to each side of a stake and painted "crescent yellow." All boards were coated with a thin layer of Tanglefoot® on both surfaces.

"Activity" traps were used to monitor adult abundance and activity. These traps are similar to the cone traps used by Eckenrode et al. (1975) to monitor OM populations in New York and cabbage maggot populations in Wisconsin (Eckenrode and Chapman 1971). The traps are constructed of a nylon screen and are supported by aluminum tripod poles. The sides of the screen are pulled up and tied so flies may enter from underneath. The collection device was constructed from a plastic covered jello mold into which glycerol was added to

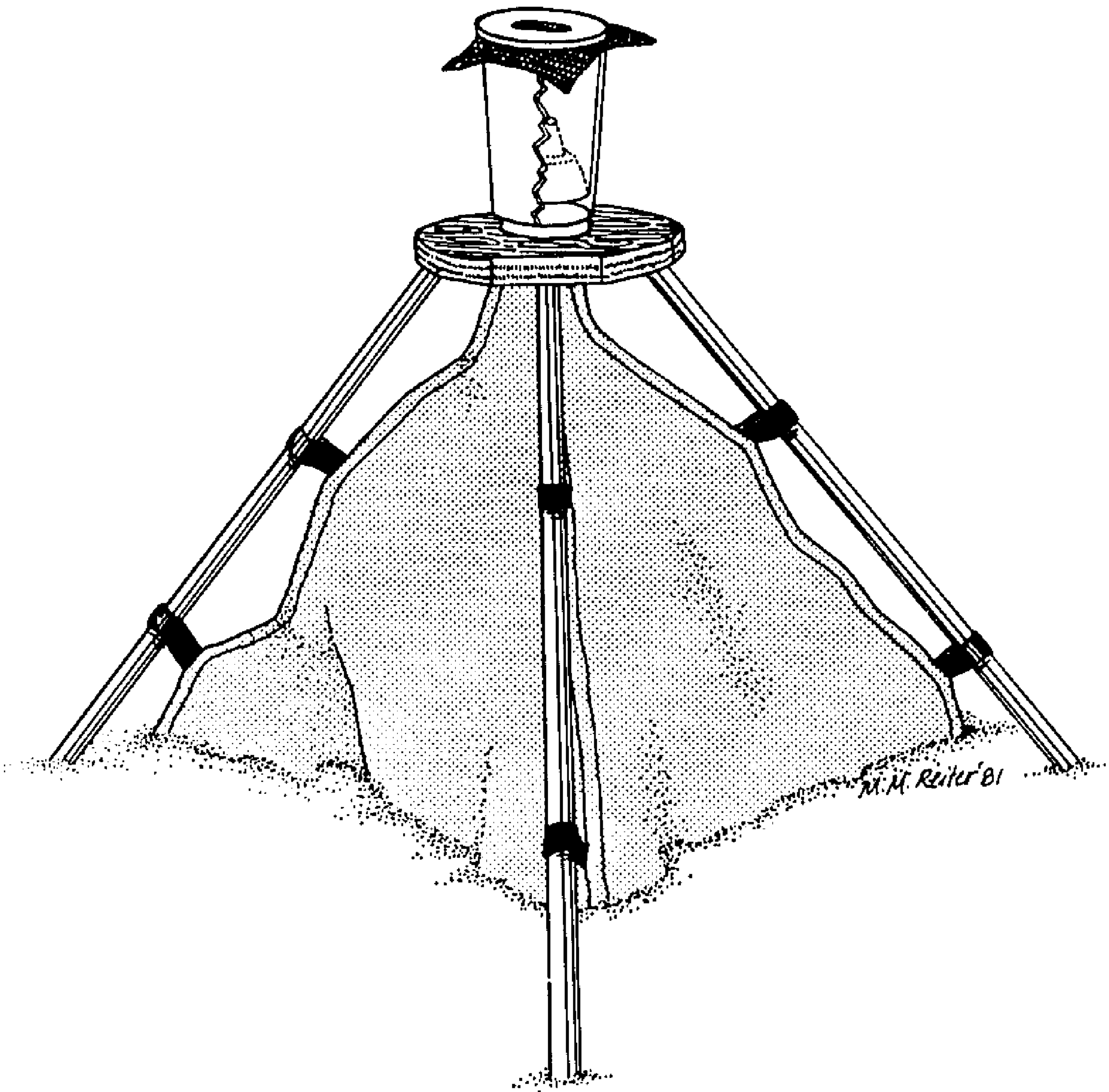


Figure 10. Schematic of emergence trap used to catch adult male and female OM during the first, second and third generation emergence in 1978-1980.

preserve the trapped insects. These traps were placed randomly over sections of onion rows to trap ovipositing and feeding adults. The trap covered an area of approximately .84 sq. m.

Because the maintenance and monitoring of sticky boards was extremely time-consuming, flight-interception traps were built to monitor adult activity. This trap resembles a malaise trap, consisting of a metal frame and nylon net of which the roof slopes upwards to the innermost corners at which collecting devices are attached (Loosjes 1976) (Figure 11). The collecting devices consisted of a covered 2-litre plastic bucket containing two sheets of plastic treated with Tanglefoot. These sheets (20 cm by 12 cm) could be easily removed and returned to the laboratory for fly identification and recording. Twelve of these traps were set up along the borders of the research field in 1979 and were alternated between facing into and out of the field. In 1979 and 1980, four to eight traps were placed along the north-south border of the commercial study fields, all facing into the field.

To examine adult activity in relation to abiotic factors and also to study diurnal flight rhythms, and flight height distribution, additional trapping was conducted. In 1978, rotary-flight traps (Helgesen and Haynes 1972) were used to sample adults at two different heights. These traps consisted of two sweepnets attached to a crossbeam that rotated at approximately 16 km/hr. A portable generator was required to provide power to the electric motors. Up to three traps could be run at any one time. Net height was set to 30 cm and 100 cm so the height of adult flight could also be determined. Traps were monitored hourly from 5 a.m. to 10 p.m. several days during the growing season. In 1979, ten additional flight-interception traps were set up in the research field between the

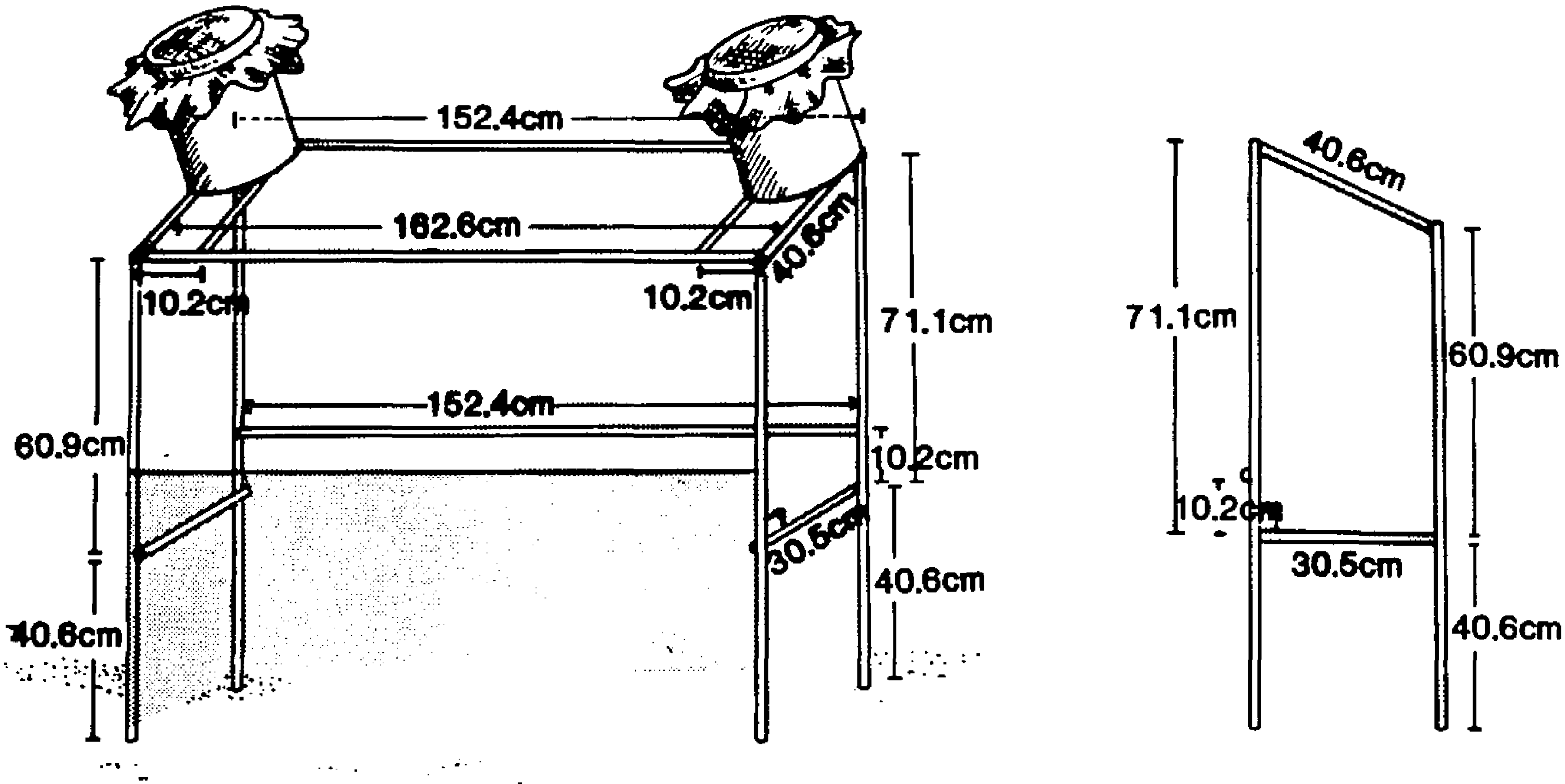


Figure 11. Dimensions of flight interception trap used to trap adult male and female OM and SC in study fields during 1979-1980.

Dyfonate-treated and non-treated areas for similar purposes.

In 1978, sweepnet samples in onions, weeds, and carrots were taken to investigate the spatial distribution of adults during the night hours. Five sets of 50 sweeps of foliage with a standard 38 cm sweepnet were taken between the hours of 11 p.m. and 1 a.m. several nights during the season. Individual sweepnet samples were placed in glass canning jars containing 50 ml of 70% ETOH. All samples were processed the following day.

2. Larvae

In the field it is very difficult to follow a uniformly-sized cohort through time. Even if a single input of eggs was initiated, age classes would soon overlap due to natural variability. As yet, techniques for removal, transportation and successful placement of OM eggs have not been developed. Analytical techniques do exist, however, for examining sampling results of overlapping age classes recorded under normal field conditions (Dempster 1961, Kiritani and Nakasuji 1967, Richards and Waloff 1954, Richards et al. 1960, Manly 1975, Birley 1977, Southwood 1978).

Root maggot larval populations were sampled to examine the phenology of larval feeding on the onion crop under differing chemical regimes. In 1978, ten sections of 60 cm of onion row were sampled twice a week from May to September. In 1979, five sections of 60 cm of onion row were sampled twice a week on the non-Dyfonate side of the research field. These sections were randomly selected within areas of onions where root maggot damage was evident. The spatial location (x,y coordinate) of each individual onion and the total number of damaged onions present was recorded. Each onion was then removed and dissected in the field when possible, so all root maggot larvae could be collected and returned to the laboratory. Later in the season, when onions were large and dissection in the field became difficult, onions were placed in plastic bags, tied, labelled, and returned to the laboratory for dissection. Once an onion had been removed and the larvae were retrieved, the soil beneath the row up to a 20 cm depth was sifted to collect any root maggot larvae in the soil. All larvaei were returned to the laboratory for identification and recording.

3. Pupae

Four studies were conducted of root maggot pupal populations. These included: a) relative population estimates, b) mortality within the growing season (including parasitism), c) incidence of pupal diapause, and d) overwintering mortality.

Relative population estimates for root maggot pupae were obtained during the regular larval sampling periods. All soil beneath the 60 cm sections of onion row was removed (60 cm x 20 cm x 20 cm) and sifted for presence of root maggot pupae. The pupae were returned to the laboratory to be identified and recorded.

In order to estimate within and between-generation mortality during the growing season, all pupae were placed in 250 ml styrofoam containers containing a 1:1 ratio of moist sand and vermiculite. A covered lantern globe was placed over the container. Pupae were monitored at one to two day intervals for adult root maggot and parasitoid emergence. In 1979 all pupae were closely examined with a dissecting microscope before being placed in the sand-vermiculite containers. This was done to determine if parasitism was evident and to obtain records of pupal abnormalities (parasitoid entrance holes).

In 1979, additional pupal sampling was conducted specifically to obtain percent parasitism. Pupae were sampled from both the Dyfonate and non-treated areas of the research field during peak periods of pupal occurrence. Soil was sifted from samples of 30 cm sections of onion row several times during the season. The six commercial study fields were sampled by taking an average of 100 pupae per field per sample period. All pupae were set up in sand-vermiculite containers and were monitored daily for root maggot and parasitoid emergence.

Areas where emergence traps were used for first and second generation of root maggot adults, offered an opportunity to investigate the incidence of pupal diapause. Since these traps effectively collected all emerged adults, and at the same time prevented further infestation by root maggot larvae, all remaining pupae in the soil had to be present for an extended period of time. Even if all root maggot larvae present during the time of initial placement of the trap were in the third instar larval or pupal stage, adult emergence would have been expected following six weeks of trapping. All soil (80 cm x 80 cm x 20 cm) beneath five emergence traps for second and third generation emergence in 1978 and first, second and third generation emergence in 1979 was sifted for root maggot pupae. All recovered pupae were returned to the laboratory and placed in sand-vermiculite containers.

In 1979, three replicates of approximately 500 second and third instar OM larvae were collected from the field and placed on OM-damaged onions. Emergence traps were placed over these areas during the first generation larval brood. Adult OM emergence was recorded, and, after eight weeks of root maggot emergence, the soil beneath the traps was sifted for presence of pupae in diapause.

Overwintering mortality of OM pupal populations was investigated at the University Muck Farm, Eaton County, in 1978. OM pupae collected from the field in November were buried at various depths ranging from 3 to 36 cm in a field previously planted to onions. Seven replicates at four depths (3 cm, 8 cm, 13 cm, 18 cm) and three replicates at three depths (23 cm, 28 cm, 36 cm), each of ten OM pupae were set out. Pupae buried at the 18 cm depth or less were buried in 20 cm x 15 cm plastic buckets filled with muck soil and perforated with 1 cm holes to facilitate water drainage. The buckets allowed for easy location and removal of pupae during the winter months. Data from Workman (1958) indicated that the number of adult OM emerging from diapaused pupae increased with an increasing period of cold temperatures up to the sixth week. To insure that a sufficiently cold period had lapsed, the first replicate was not removed until January 10. A replicate was removed February 6, March 1, and April 4. They were returned to the laboratory, and pupae were held at 20°C to obtain adult emergence records. Pupae buried at a depth of greater than 18 cm were put in 6 x 8 cm envelopes made of nylon mesh screening. These envelopes were recovered in late May of 1979 and pupae were held at 20°C to obtain adult emergence records. Three remaining replicates of pupae in buckets were allowed to emerge under natural field conditions.

In November 1979, the bucket experiment was repeated at the University Muck Farm as previously described. No buckets were removed during the winter months, but all pupae were recovered in late April 1980 and then held at 20°C to determine emergence. Pupae were also buried in four fields in Grant, MI (study fields 1, 5, 6, and non-Dyfonate area of the research field). Five replicates of 20 OM pupae were buried at a 13-15 cm depth both within the field and along the field border. To facilitate location and removal, all pupae were placed in a 6 cm diameter petri plate before being buried. Pupae were recovered and returned to the laboratory in April 1980, along with a sample of 30 pupae collected from the soil surface in field 5. The pupae were examined for presence of parasitism and were held for adult amergence at 20°C.

B. Within-Field Plant Damage Studies

Previous studies of the spatial distribution of damage to onions by the OM have been difficult to assess due to the fact that the onions had been treated with insecticides at various points in time. Descriptions of the distribution of onion plant damage were also primarily limited to specific sample periods. In order to evaluate the distribution, rate, timing, and extent of damage on insecticide-treated and non-treated plots of onions, experiments were performed to assess damage over time so that the dynamic characteristics of the distribution could be described. A spatial and temporal record of individual onions and their condition over time enabled the use of a number of analytical techniques to assess the distributions.

In 1978, four plots of onions, each plot 5 rows wide and 3.65 m long, were established at the research field which had received a treatment of granular insecticide (Dyfonate) at planting. In 1979, two plots of the same size used in 1978 were established on both the treated (Dyfonate) and non-treated areas of the field. For both years, the exact x and y coordinate of each individual onion within the plots were recorded. For within-row location (y-coordinate), this required placing a tape measure along the row and recording, to the nearest centimeter, each onion's location. For between-row location (x-coordinate), the row spacing was multiplied by the row distance being measured (86 cm row spacing). At the same time, the condition of each onion was recorded: 1) visibly healthy onions, 2) onions showing symptoms of OM damage, 3) dead or dried up onion plants, 4) missing onion plants. This "mapping" of individual onions was carried out at weekly intervals during the spring when onions were in the seedling stage and every other week when onions began to mature.

One of the main advantages of this procedure was the permanent record of each individual onion from emergence; therefore, missing onions (fourth class) could easily be determined by comparing previous record results.

In 1979, field observations led to the hypothesis that presence or absence of volunteer onions in the spring affects the ovipositional preference of the OM and the spatial distribution of damage. Volunteer onions are onion bulbs left in the field from the previous year and that sprout and grow the next spring. These onions usually remain undisturbed in commercial fields until onion seedlings can tolerate cultivation—at or about the end of the first generation attack by the OM.

A series of experiments was set up to examine the effect of volunteer onions on OM oviposition and onion plant damage. In 1979, the "mapping" plots were established over areas of different densities of volunteer onions. The density of volunteers ranged from 0-30 on both the Dyfonate-treated area and non-treated area. The exact location (x,y coordinate) of each volunteer in these plots was recorded. The location of volunteer onions and their effect on OM damage during the first generation of root maggot attack could therefore be evaluated.

In 1980, 15 plots of onions (.9 m of onion row x 3 rows) were set up in a commercial field in Grant to study the effects of different densities of volunteers on onion plant damage. Within these plots, densities of single and aggregate volunteers were established. The x,y coordinate of each onion and volunteer and/or group of volunteers were recorded following onion plant emergence in the spring using the mapping procedure previously described. Onion plant damage within each plot was recorded at the end of June.

Nearest-neighbor sampling techniques were used to examine the location of volunteer onions in a field and the probability of plant damage occurring in their vicinity. In 1979, the sampling began by tossing a ball repeatedly into the research field. From this the following five measurements were recorded: 1) distance from random point (position of ball) to nearest volunteer onion, 2) distance from the volunteer onion to nearest damaged onion seedling, 3) distance from damaged seedling in (2) to random point, 4) distance from random point to any nearest damaged onion seedling, and 5) distance from volunteer onion in (1) to damaged plant in (4). One hundred and twenty sets of these measurements were made on the non-treated side of the research field (sixty sets for each of two densities of volunteer onions) and sixty sets of measurements were taken on the Dyfonate side where only one density of volunteers was evident.

C. Between-Field Plant Damage Surveys

To obtain information on the extent and distribution of onion plant damage on a regional basis, commercial study fields in Grant were surveyed for onion plant damage. First generation onion plant damage is easily recognized in the field. The onion leaves become flaccid then the tips yellow. Complete foliage dehydration and rot usually occurs.

Carruthers (1979) examined the within and between-field sampling for plant damage. He presented within and between-field sampling programs for root maggot damage by which plant damage density could be determined with acceptable precision and cost. A 30 m sample unit of 10 to 20 samples gave maximum efficiency over the largest range of densities and levels of precision and was the preferred sample unit for estimating regional OM plant damage. The study fields and research field were surveyed weekly from the first of May to the first week of August in 1979 and 1980. Twenty sections of 30 m of onion row were randomly selected in each field by tossing a 30 cm garden stake into the field and selecting the section from the nearest row where it landed. After visually examining each onion plant, the total number of onions exhibiting damage symptoms were recorded.

Second generation OM plant damage can be more difficult to assess late in the season due to increased onion bulb size and natural plant sinescence. With a larger bulb the onion plant can withstand more physical damage before showing characteristic damage symptoms. Natural plant senescence causes the onion leaves to fall over; therefore, it becomes difficult late in the season to assess damage only by visual examination while walking along the onion row. To overcome this problem, two commercial study fields (13 and 14) were surveyed intensively on a weekly basis from mid-July to the end of August. Twenty sections of 1.54 m of row were randomly selected by throwing a 30 cm garden stake into the field and moving 1 m down-row from this point. Each onion within the section was then removed, and bulbs were examined for signs of root maggot damage. Both damaged and healthy onion plants were recorded. Damaged onions were also classified according to two conditions: 1) recently damaged (larvae present and initial damage symptoms evident) and 2) old damage (no root maggot larvae present but evidence of feeding injury, advanced bulb rot, or dehydration).

At the end of the season, just before onion harvest, each commercial study field was surveyed to obtain a final estimate of root maggot damage. Between 10 and 15, 30 m sections of onion row in each field were selected by tossing a 30 cm garden stake into the field. All onions within each section were removed, examined, and recorded according to two classes: 1) damaged onions (larvae, bulb rot, dehydration, or feeding injury easily identifiable), and 2) non-damaged onions (no larvae or feeding injury easily visible).

In 1977, Carruthers (1979) initiated an onion plant damage survey of the major onion production regions in Michigan. Pest management field assistants (PMFAs), employed by county extension offices, surveyed all onion fields in their respective areas twice during the growing season. These sample periods coincided with degree-day estimates of peak larval damage of the first and second OM generations (Carruthers 1979). PMFAs were alerted as to when a damage survey should be initiated in their area by PMEX (Pest Management EXecutive System) (Croft et al. 1976). To determine the extent of onion plant damage in onion production areas of the state, and to provide a long term data base of estimates of OM damage and onion production practices in Michigan, this survey was continued from 1978-1980.

Onion plant damage surveys were conducted by PMFAs in four major onion growing areas of Michigan: 1) Grant (Newaygo County), 2) Bravo (Allegan County), 3) Jackson County, and 4) Lapeer County. The boundaries of these areas were defined according to the area for which pest management cooperators were responsible. Ten (1978) or twenty (1979-80) replicates of a 30 m section of onion row within each field were selected randomly. For each section the total number of damaged onions was recorded. A record of production practices, post harvest activities, history of each field, description of field, and where samples were taken was obtained at each sampling period.

There were two sampling periods for each season at approximate degree-day accumulations of 1) 600 and 2) 1270 (base 4.4°C). These values had been shown to coincide with the time of maximum noticeable damage for each of the first and second generations (Carruthers 1979). Exact dates of the surveys were determined from results of larval sampling at the research field in Grant. The PMEX system was used to initiate each damage survey and to give any additional instructions, data forms, and description of OM damage. A visit was also made to each PMFA involved to answer any questions about the survey and to demonstrate how the sampling should be performed.

D. Abiotic Monitoring

Information on production practices including: use, application method and type of pesticides used; planting and harvest dates; irrigation; and weeding practices were obtained on a continuous basis from grower spray records and production reports. The Grant weather station provided records of daily maximum and minimum air temperatures and daily precipitation. In addition, a weather station was set up at the research field from April to October each year. Instruments used at this station included: 1) a hygrothermograph to record temperature and relative humidity, 2) a three point soil thermograph to monitor soil temperature at three depths (3, 8 and 15 cm), and 3) a pyrheliometer to record solar radiation (gm-cal/cm^2). These instruments took continuous readings through the use of a moving strip chart. Charts were changed once a week and weekly values were entered onto computer files for 1/2-1 hour intervals through use of the Tektronix® template option (Appendix C).

VI. RESULTS AND DISCUSSION

A. Adult Emergence

Daily emergence of OM adults was monitored to predict emergence from soil or air degree-day accumulation. Emergence results were also used to examine the phenology of the adults and to determine adult survivorship (see Carruthers 1981).

Carruthers (1979) had determined that OM pupae were distributed in the soil at a depth of 2 to 15 cm and that 50% of the population was found between 5 and 8 cm. He also reported a developmental temperature of 4.4°C for OM pupae.

Since the OM pupates in the soil, it was felt that soil degree-day accumulation would be the most accurate prediction parameter. In 1979 and 1980, a least-squares regression analysis of air degree-days (4.4°C base) versus soil degree-days (4.4°C base) was performed for soil temperatures at the 8 cm depth (Figure 12). No significant difference was found between the slopes or intercepts for the two years. The data were also examined on a month to month comparison for the 3, 8 and 15 cm soil depth (Table 2). The regressions indicated that a lag period exists between degree-day accumulation for soil when compared to air early in the season, but this lag period is reduced due to greater warming of the soil as the season progresses. More years of soil temperature data, however, are needed before drawing any specific conclusions about the

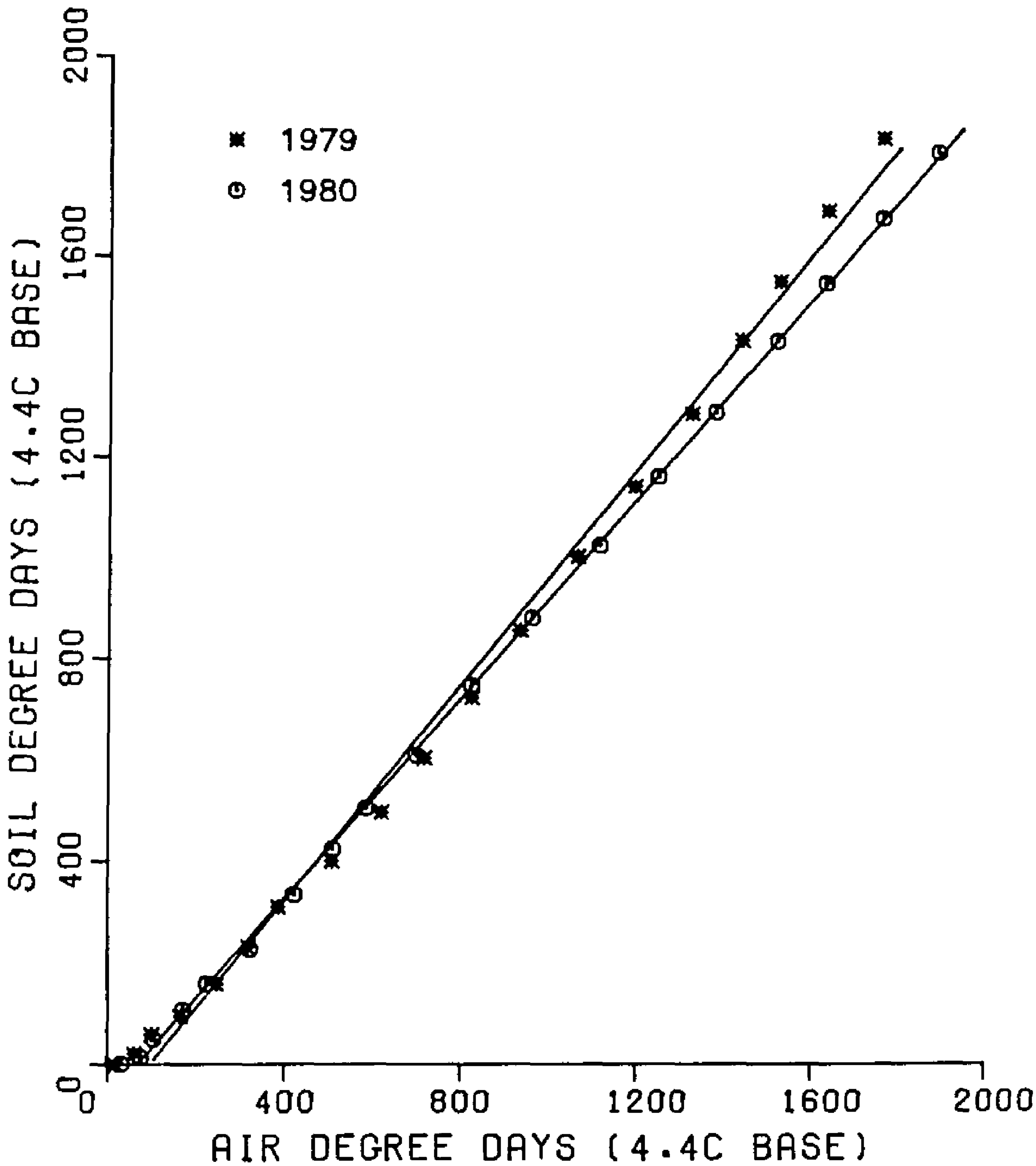


Figure 12. Relationship between soil degree days (4.4°C base at 8 cm depth) and air degree days (4.4°C base) in Grant, Michigan, for 1979 and 1980.

Table 2 . Regression equations for estimation of soil degree day accumulation for 1979 and 1980 from air degree day accumulation in Grant, Michigan, for 3 soil depths (-3, -8, and -15 cm).

a) 1979

Month	-3	r^2	-8	r^2	-15	r^2
April	ST = - 6.83 + .699*DD°	.93	ST = - 5.03 + .514*DD°	.93	ST = - 3.99 + .396*DD°	.91
May	ST = - 23.83 + .949*DD°	.97	ST = - 39.81 + .850*DD°	.96	ST = - 37.21 + .708*DD°	.96
June	ST = - 23.30 + 1.011*DD°	.99	ST = - 50.36 + .899*DD°	.99	ST = -100.30 + .877*DD°	.99
July	ST = - 84.50 + 1.111*DD°	.99	ST = -189.00 + 1.110*DD°	.99	ST = -195.80 + 1.039*DD°	.99
August	ST = -228.40 + 1.216*DD°	.99	ST = -410.20 + 1.274*DD°	.99	ST = -421.00 + 1.205*DD°	.99
September	ST = -268.20 + 1.233*DD°	.99	ST = -481.40 + 1.307*DD°	.99	ST = -569.30 + 1.282*DD°	.99
Year	ST = - 49.10 + 1.091*DD°	.99	ST = - 80.08 + 1.040*DD°	.99	ST = - 90.46 + .969*DD°	.99

b) 1980

Month	-3	r^2	-8	r^2	-15	r^2
April	ST = - 11.52 + .599*DD°	.90	ST = - 10.81 + .493*DD°	.86	ST = - 5.69 + .252*DD°	.77
May	ST = - 64.30 + 1.064*DD°	.99	ST = - 42.47 + .864*DD°	.99	ST = - 56.41 + .784*DD°	.99
June	ST = -104.60 + 1.181*DD°	.99	ST = - 91.78 + .101*DD°	.99	ST = -121.11 + .973*DD°	.99
July	ST = - 32.58 + 1.106*DD°	.99	ST = - 46.78 + .960*DD°	.99	ST = -197.00 + 1.033*DD°	.99
August	ST = - 29.73 + 1.107*DD°	.99	ST = -106.80 + 1.008*DD°	.99	ST = -103.00 + .959*DD°	.99
September	ST = - 75.32 + 1.129*DD°	.99	ST = -200.80 + 1.056*DD°	.99	ST = -298.80 + 1.085*DD°	.99
Year	ST = - 58.72 + 1.123*DD°	.99	ST = - 65.43 + .980*DD°	.99	ST = - 79.98 + .9522*DD°	.99

relationship of air to soil degree-day accumulation, although it may be suggested that muck soil accumulates degree-days each year at the same rate, according to degree-day air accumulation. This may be due to onion production practices, whereby the soil is usually kept bare of ground cover before planting and after harvest. Muck soil is also very homogenous in structure and composition. As a result, degree-day estimates from air temperature records and use of air-soil degree-day regression equations may be satisfactory for predicting soil degree-day accumulation.

Emergence data for each generation and year were analyzed according to the following description:

1) Emergence counts (Y) were accumulated over the X axis (where X is time or degree-days (4.4^{o}C base)).

2) All cumulative counts were transformed to obtain a cumulative proportion of total emergence.

3) Proportional cumulative counts were transformed by use of the probit (Finney, 1971) in order to linearize the data.

4) Least-squares regression analysis was performed to obtain the probit regression equation (E_p=a+bx; where E_p is the predicted emergence in probits, a is the intercept, and b is the slope).

5) Emergence data were fit to a normal curve and the mean and variance obtained for use in determining curvilinear cumulative proportion emergence lines according to the normal distribution.

6) Cumulative emergence data were compared to curvilinear cumulative proportion emergence lines.

Three parameters were examined for possible use in predicting OM adult

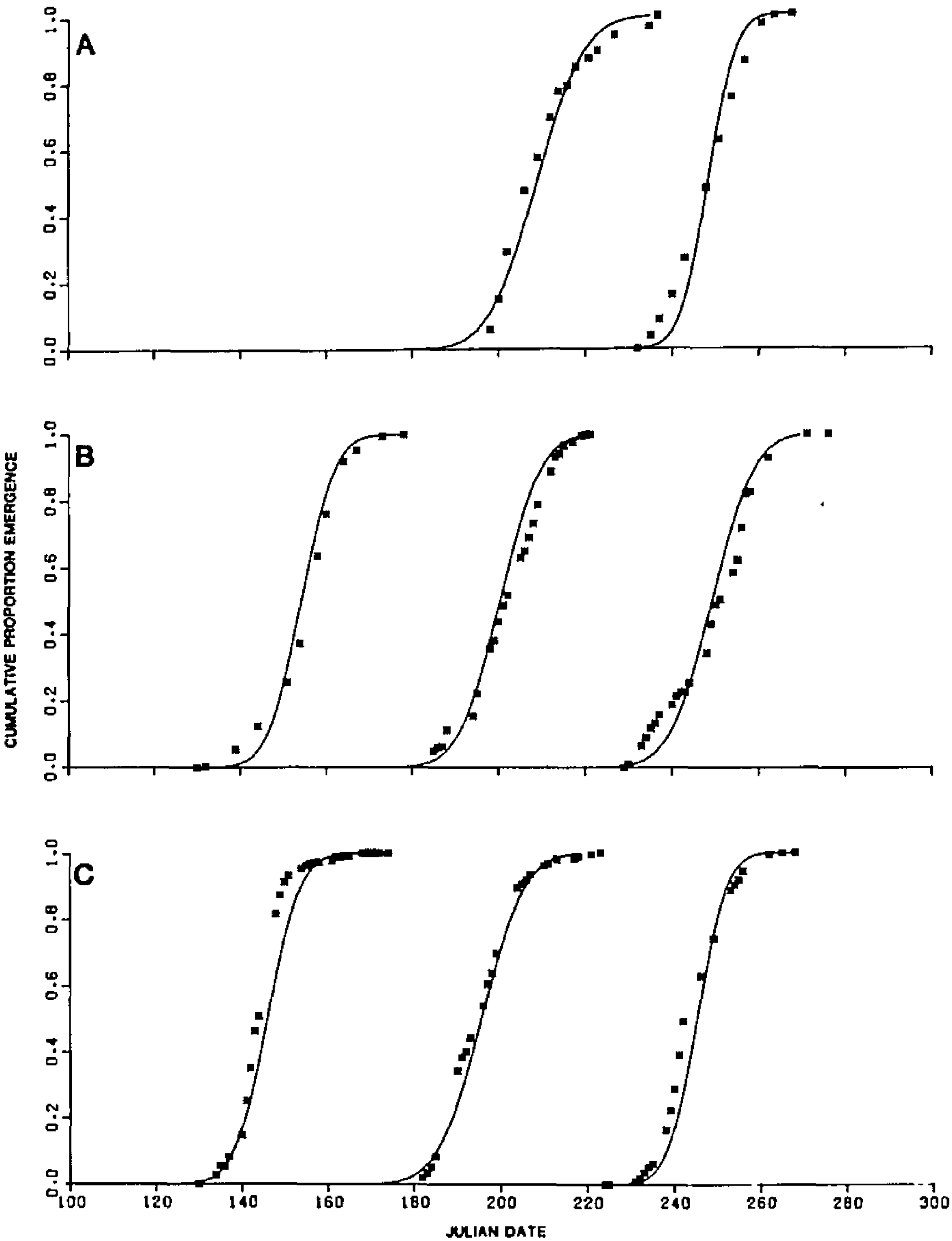


Figure 13. Cumulative proportion emergence of three generations of OM adults compared to Julian date in 1978 (A), 1979 (B), and 1980 (C).

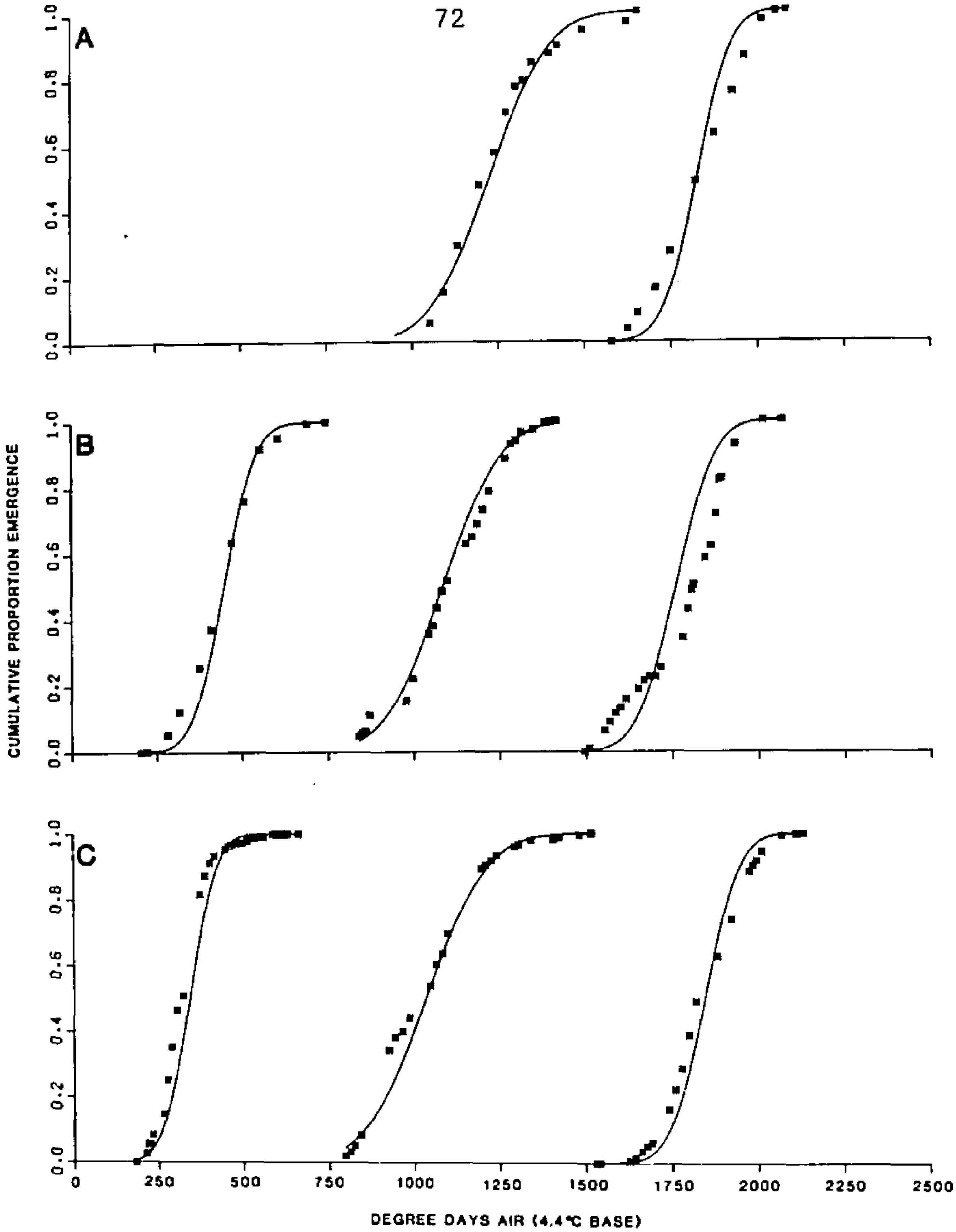


Figure 14. Cumulative proportion emergence of three generations of OM adults compared to air degree day accumulation (4.4°C base) in 1978 (A), 1979 (B), and 1980 (C).

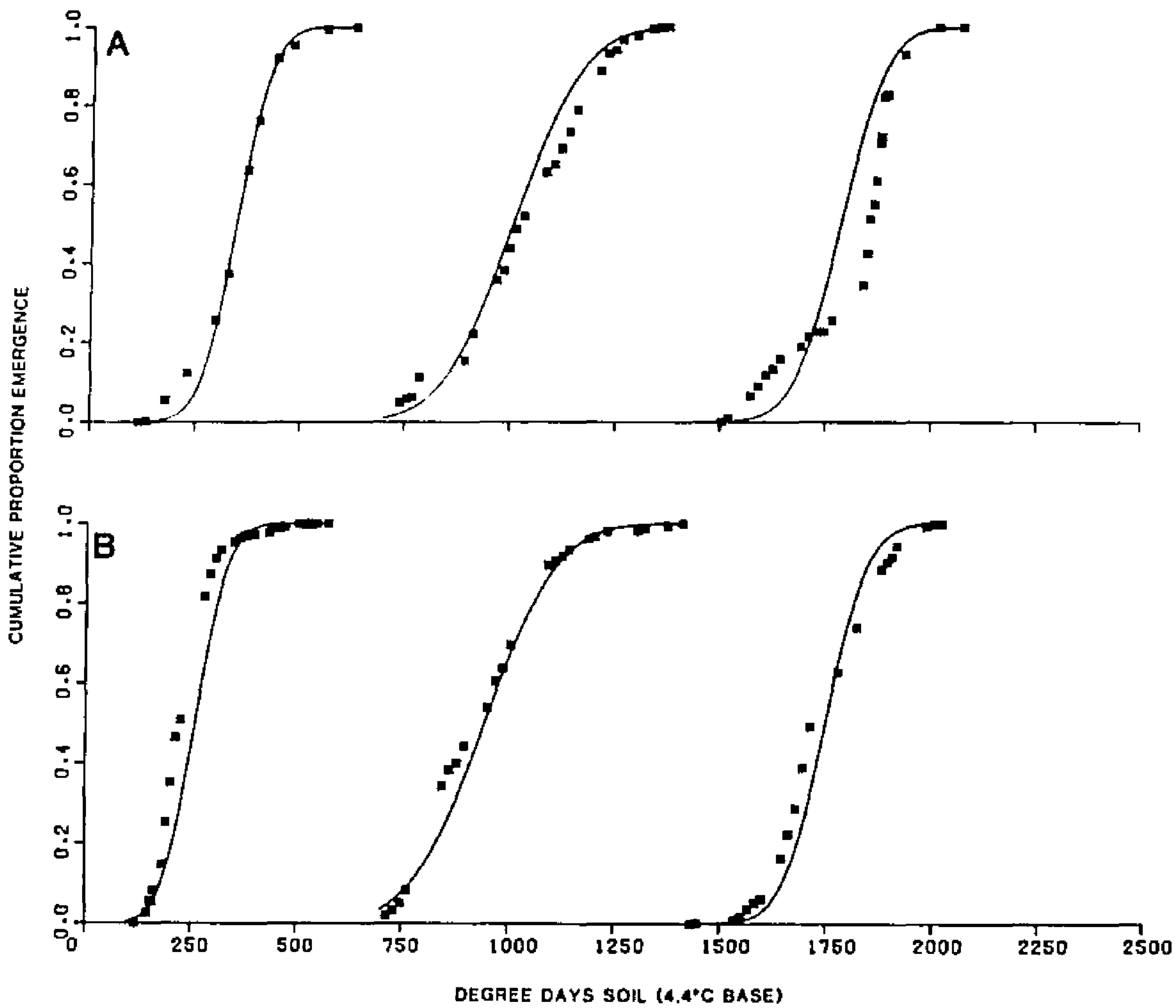


Figure 15. Cumulative proportion emergence of three generations of OM adults compared to soil degree-day accumulation (4.4°C base at 8 cm depth) in 1979 (A) and 1980 (B).

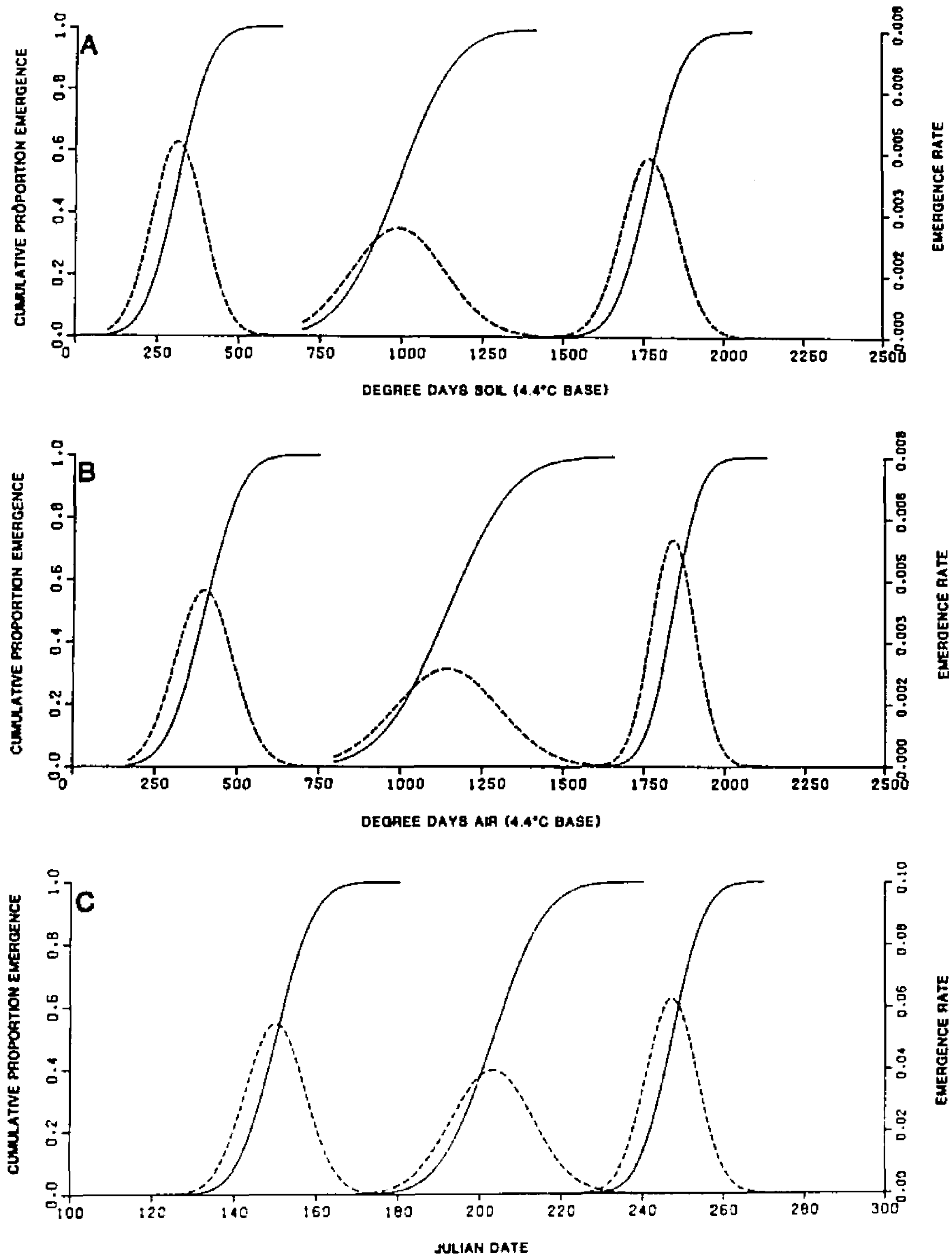


Figure 16. Average cumulative proportion emergence and rate of emergence of three generations of OM adults from 1979-80 compared to: A) soil degree-days (4.4°C base at 8 cm depth), B) air degree-days (4.4°C base), and C) julian date.

Table 3 . Probit regression equations for adult OM emergence and degree day period for 50 percent emergence (.5Ep). DD^{o} is accumulated degree days above 4.4^{o}C.

a) Julian date

Year	Generation	Regression Equation	r^2	.5 Ep	Variance
1979	first	Ep = −19.22 + .162 *Day	.94	154	38.10
1980	first	Ep = −19.53 + .168 *Day	.92	145	38.10
Avg	first	Ep = −15.74 + .137 *Day	.91	150	52.89
1978	second	Ep = −18.87 + .114 *Day	.85	208	76.54
1979	second	Ep = −21.84 + .134 *Day	.90	200	55.69
1980	second	Ep = −19.56 + .126 *Day	.94	195	63.39
Avg	second	Ep = −15.34 + .099 *Day	.96	203	100.16
1978	third	Ep = −42.34 + .191 *Day	.90	248	27.53
1979	third	Ep = −27.42 + .130 *Day	.87	249	59.08
1980	third	Ep = −39.24 + .180 *Day	.96	245	30.72
Avg	third	Ep = −33.83 + .157 *Day	.94	247	40.46

b) Degree day air (4.4C^{o} base)

Year	Generation	Regression Equation	r^2	.5 Ep	Variance
1979	first	Ep = − 1.11 + .0136*DDo	.94	448	5,375
1980	first	Ep = − .38 + .016 *DDo	.93	342	4,036
Avg	first	Ep = .46 + .011 *DDo	.88	399	7,776
1978	second	Ep = − 3.98 + .007 *DDo	.89	1,226	18,673
1979	second	Ep = − 3.10 + .007 *DDo	.97	1,085	17,949
1980	second	Ep = − 2.35 + .007 *DDo	.94	1,033	19,731
Avg	second	Ep = − 2.18 + .006 *DDo	.96	1,142	25,299
1978	third	Ep = −18.33 + .013 *DDo	.88	1,826	6,132
1979	third	Ep = −14.70 + .011 *DDo	.82	1,760	7,986
1980	third	Ep = −18.12 + .012 *DDo	.95	1,843	6,359
Avg	third	Ep = −14.27 + .010 *DDo	.97	1,840	4,628

Table 3. (continued)

c) Degree day soil-8cm (4.4°C base)

Year	Generation	Regression Equation	r^2	.5 Ep	Variance
1979	first	Ep = - .16 + .015*DD°	.95	348	4,553
1980	first	Ep = .82 + .016*DD°	.92	260	3,872
Avg	first	Ep = 1.06 + .012*DD°	.89	313	6,339
1979	second	Ep = - 2.61 + .007*DD°	.91	1,009	17,613
1980	second	Ep = - 1.94 + .007*DD°	.94	946	18,607
Avg	second	Ep = - 1.95 + .007*DD°	.96	990	20,315
1979	third	Ep = -14.93 + .011*DD°	.81	1,790	8,072
1980	third	Ep = -16.59 + .012*DD°	.95	1,752	6,588
Avg	third	Ep = -15.67 + .012*DD°	.93	1,769	7,330

Variance - variance of data about a normal curve.

.5 Ep - 50% emergence of OM adults (degree days) emergence: Julian date, air degree-days (4.4^{o}C base), and soil degree-days (4.4^{o}C base). The cumulative emergence data and fitted curvilinear cumulative proportion lines for each generation were plotted against these parameters for each year (Figures 13-15). For each parameter and generation, data were pooled and cumulative proportion emergence and rate of emergence for the pooled data were determined (Figure 16). Table 3 gives the probit regression equations for each generation, year, and parameter of prediction.

The slopes of the regression equations were found to be not significantly different between years in each generation when soil or air degree-days where used to predict emergence. Significant differences in the slopes between years for each generation were obtained where the Julian date was used in the prediction equation. For all three parameters (air soil degree-days and Julian date), there were significant differences (comparisons of .95 CI) between the intercepts for each year and generation.

The lack of significant differences in the slope of the regression equation often indicates that development is responding equally to an environmental parameter such as temperature. The fact that significant differences occurred when Julian date was used may be expected, since temperature accumulation between days can vary considerably. Large differences in the intercepts between years, however, would not be expected for air or soil degree-days if pupae were responding only to temperature. Maximum differences of 106, 193, and 183 air degree-days between years for the first, second, and third generation, were obtained for 50 percent emergence. Similarly, maximum soil degree-day differences between years of 88, 63, and 38 were obtained at 50 percent emergence for the first, second, and third generation.

Variability in degree-day accumulation for emergence can caused by differences between years in 1) pupal distribution in the soil, 2) radiant energy, 3) soil moisture, 4) surface reflection of radiant energy, 5) ground cover, 6) fall production practices, 7) snow cover, and 8) rainfall. Eckenrode et al. (1975) reported degree-day differences of up to 165 degree-days (298 degree-days °F) between years for 50% emergence of the first generation of OM in New York State. He also reported maximum differences of 121 and 244 degree-days between years for 50 percent emergence of the second and third generation. Loosjes (1976) reported considerable differences when using accumulated degree-days to predict OM emergence in the Netherlands. An examination of his data revealed differences of up to 100 degree-days between years for 50 percent emergence in the first generation.

Simple prediction of OM emergence may not be possible through degree-day accumulation alone. Ticheler et al. (1975) found that a slight temperature shock to OM pupae in diapause caused a complicated reaction pattern such that predicting development was not possible. Mukerji and Gage (1978) found that soil type and soil moisture affected grasshopper egg development and that hatching would not occur unless moisture stress was relieved (> 13.5%).

To investigate if abiotic factors in addition to temperature affected OM pupal development in the spring, the probit regression equations of emergence for soil degree-days were examined. The probit regression equation can be rearranged to include a constant such that the cumulative degree-day difference for emergence between two years would be at a minimum. By introducing a constant into the equation, we obtain:

$$EP = a + b(x-c)$$

where:

EP = predicted emergence in probits

a = intercept (desired)

b = slope

x = cumulative soil degree-day value

c = unknown constant

or: $a_s = a_1 + cb_1$

such that for a given EP, we select a_s as a standard intercept and a_1, b_1 as the slope and intercept that is adjusted to minimize the cumulative degree-day difference where:

$$c = \frac{a_s - a_1}{b_1}$$

Substituting in the values for the first generation emergence from Table 3 where 1980 is considered as a standard year:

$$c = \frac{-.1614 - .8206}{.01607}$$

=66.2 degree-days soil (4.4° C base)

This constant implies that degree-day accumulation by OM pupae in 1979 did not start until 66 degree-days after it should have when compared to 1980. All possible factors that would delay an accumulation of degree-days in 1979 can now be examined in relation to the length of the required delay. For example, one possible factor may be soil moisture or rainfall. In 1979 there were 69 accumulated degree-days at the 8 cm soil depth on April 24. An examination of accumulated rainfall (Appendix C) revealed that in 1979 rainfall accumulation was atypical in April when compared over a four-year period: 1977-1980. An accumulation of only 1.24 inches of rain had occurred by April 24, 1979, as compared to 4.59, 3.13 and 3.73 inches in 1977, 1978 and 1980, respectively. Also there had been no substantial rain (> 1 cm/day) up to this date in 1979. During the other years, a substantial rain of at least 3 cm/day had occurred early in April before any soil degree-day accumulation at the 8 cm depth. By removing 69 soil degree-days from the accumulated degree-day totals, new probit regression equations for emergence were determined for the three generations in 1979 (Table 4). This adjustment improved the use of soil degree-days for predicting emergence for the two years and all three generations. Maximum differences between years of only 19, 5, and 31 degree-days occurred for 50 percent emergence.

Not enough information was available to confirm whether in fact lack of rainfall or insufficient soil moisture delayed the 1979 emergence. It was observed, however, that soil moisture in Grant for the spring of that year was much lower than other years, and little snow cover had occurred during the previous winter months. Also, a spring rain can warm soil surface layers and increase soil moisture which improves heat conduction through the soil by replacing the poorer conductor, air.

Summary tables for OM emergence for 1978-80 are presented in Appendix D. There was no significant difference between time of emergence for males and females, although males tended to emerge one to two days earlier. Air degree-days and soil degree-days are the most useful for emergence prediction, since this information can be used for other onion growing areas. (Degree-day values (4.4° C base) for air and soil for five percentages of cumulative emergence for each year and generation are presented, along with yearly averages in Table

Table 4. Probit regression equations for adult OM emergence and degree day period for 50 percent emergence (.5 Ep). DD° is accumulated degree days above 4.4°C for the 8 cm soil depth after one day of 1 cm of precipitation in the Spring.

Year	Generation	Regression Equation	r^2	.5 Ep	Variance
1979	first	Ep = .861 + .015*DD	.94	279	5,375
1980	first	Ep = .821 + .016*DD	.93	260	4,036
1979	second	Ep = - 2.090 + .008*DD	.97	941	17,949
1980	second	Ep = - 1.940 + .007*DD	.94	946	19,731
1979	third	Ep = -14.160 + .011*DD	.82	1,721	8,072
1980	third	Ep = -16.590 + .012*DD	.95	1,752	6,588

Variance - variance of data about a normal curve.

.5 Ep - 50% emergence of OM adults (degree days).

Table 5. Air and soil degree day estimates for different percentages of emergence of OM adults for 1978-1980 in Grant, Michigan.

	Degree Day AIR (4.4C base)				Degree Day SOIL (4.4C base)		
Percent Emergence	1978	1979	1980	Average	1979	1980	Average
			FIRST GENERATION				
5	--	328	238	255	238	158	183
25	--	398	299	340	303	218	260
50	--	448	342	399	348	260	313
75	--	497	384	458	393	301	367
95	--	568	446	544	458	362	444
			SECOND GENERATION				
5	1,002	865	802	881±102	791	722	724
25	1,135	996	939	1,035±100	920	854	894
50	1,226	1,085	1,033	1,142±99	1,009	946	990
75	1,318	1,175	1,127	1,248±99	1,098	1,037	1,085
95	1,450	1,305	1,263	1,402±98	1,227	1,170	1,223
			THIRD GENERATION				
5	1,698	1,614	1,713	1,683±53	1,643	1,619	1,629
25	1,774	1,700	1,790	1,776±48	1,730	1,698	1,712
50	1,826	1,760	1,843	1,840±44	1,790	1,752	1,769
75	1,879	1,820	1,897	1,882±40	1,850	1,806	1,827
95	1,955	1,907	1,974	1,957±35	1,938	1,885	1,910

5. Intermediate values can be obtained through the probit regression equations and appropriate probit transformations (Fischer and Yates 1963).) Eckenrode et al. (1975) reported average cumulative degree-day values (4.4°C base) for 50 percent emergence of the three generations of OM as 395, 1054, and 1752, which agrees closely with air degree-day values of 399, 1142 and 1840 reported here.

B. Adult Activity and Relative Abundance

Before adult trapping results could be analyzed, it was necessary to examine the flight behavior of the adult OM. Several sets of data from adult trapping were used for this purpose, in addition to data on adult flight behavior given in the literature.

1. Height Distribution of Adult Flight

The distribution of flight height was investigated in order to assure that the heights of the various traps used were adequate for the passive trapping methods employed. Carruthers (1977, unpublished) set out sticky traps at various heights in an onion field and within a grass border of the onion field to measure the height at which OM adults fly. Results indicate that adults fly at a greater height in the border areas than within the onion crop itself (Figure 17). For traps placed between onion rows, no adults were trapped at a height greater than 120 cm. Up to 27% of the adults were trapped at a height greater than 120 cm in the grass border adjacent to the onions. The reverse was true at the lowest height of 0 to 20 cm. Up to 21% of the total flies trapped were caught at this height in the onion crop, as opposed to none in the grass border. No significant differences of male to female ratio were found between the various trap heights for either location. All trapping was conducted early in the season when onion

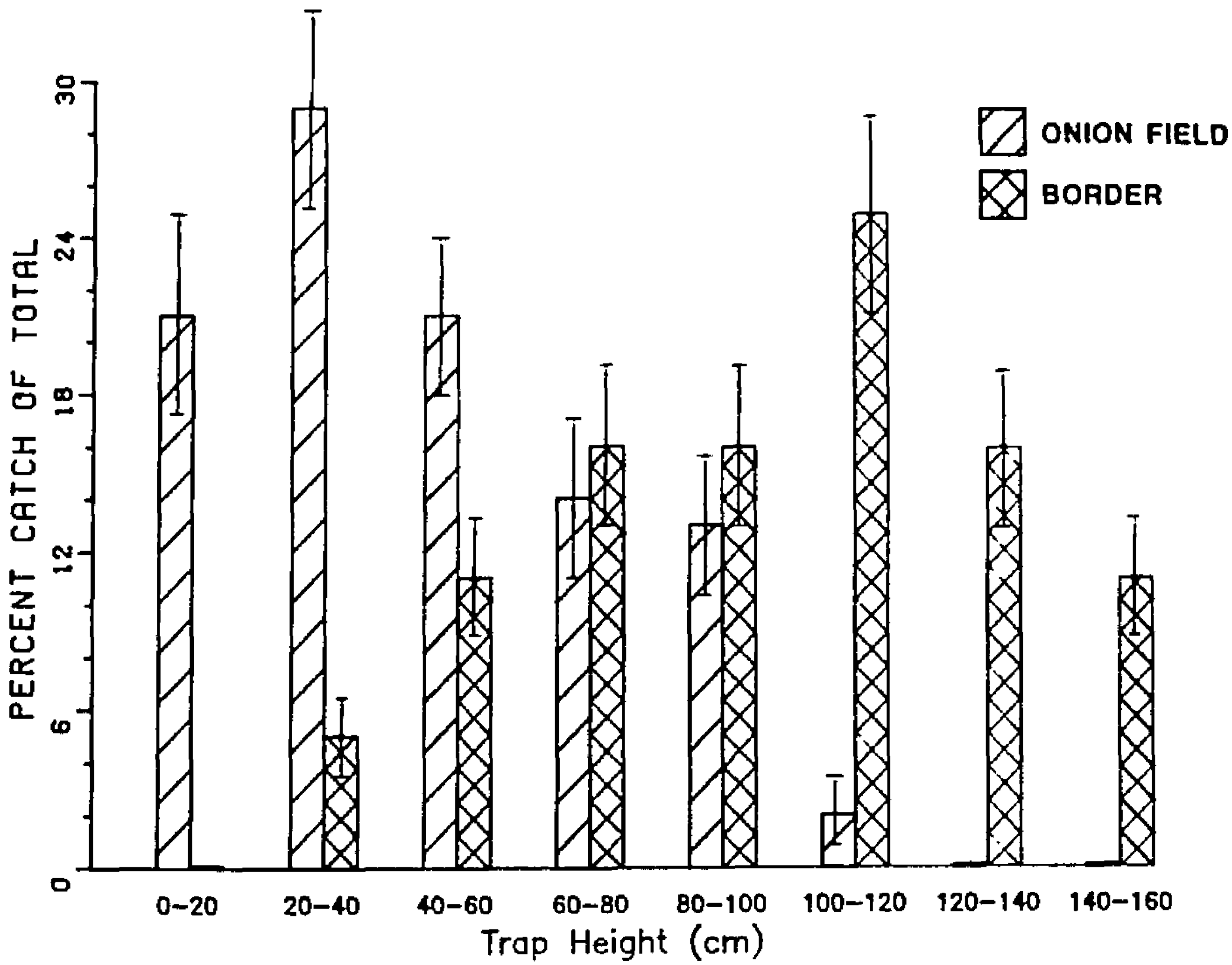


Figure 17. Comparison of percent catch of OM adults for different trap heights in two habitats: a) within the onion field; and b) grass border area (.95 CI indicated).

plants were small (June 7).

Loosjes (1976) reported that adult OM were seldom observed flying much above local vegetation, with an average flight height of 10 to 30 cm along ditch banks, to a maximum of 50 cm depending upon mowing intensity and border height. In the Grant area early in the spring, most foliage bordering the onion fields is taller than the onion crop. Although grass borders are normally mowed or sprayed with herbicides, these areas can attain heights of up to 120 cm between mowing or spray intervals. The ratio of foliage height of the borders to onion crop height, however, is not static. The onion plant normally reaches a height of 60–70 cm at maturity.

In order to investigate whether onion crop height can influence OM flight behavior, trapping was conducted within the onion field at several dates during the growing season. Rotary flight trap data from nets set at two different heights (30 and 100 cm) revealed that the height at which adults fly varies during the season. Early in the season the 30 cm net caught between 90–100% of the total adults trapped at both heights. As the season progressed, however, a greater percentage of flies were trapped by the net set at 100 cm (Figure 18A). Lampert (1978, unpublished) measured onion leaf length at various dates during the 1978 season in the Grant research field. Least-squares regression analysis was performed on this data and the slope of the regression of date versus leaf length of the onion plant was not significantly different from the slope of the regression equation for date versus proportion of OM caught at the trap height of 100 cm (Figure 18B). These results suggest that OM adults may fly at or above the height of the crop and that flight height increases over time due to onion crop growth. A trap height of up to 100 cm should be adequate for trapping OM

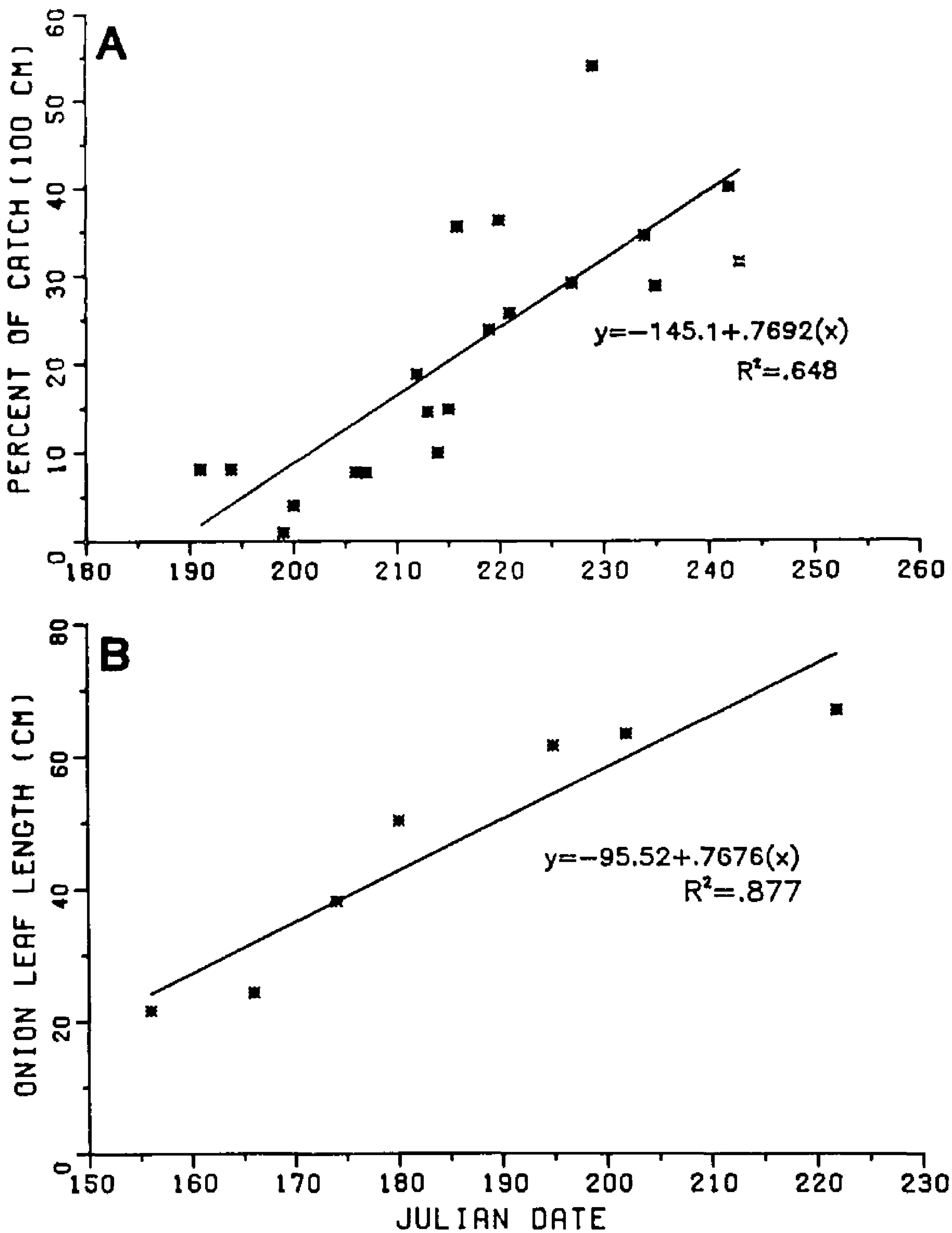


Figure 18A. Percent of total OM adult catch at the 100 cm net height in 1978.

Figure 18B. Onion leaf length during the onion growing season in 1978.

adults throughout the onion growing season. Traps of a greater height may provide higher relative estimates of adult abundance but logistical problems involving construction and collection of trapped adults may occur.

2. Spatial Aspects

The influence of trap location on trapping results was investigated. Because trapping equipment can interfere with normal production practices, it was necessary to determine if traps could be placed along the edges of the onion field to obtain representative data on flight activity.

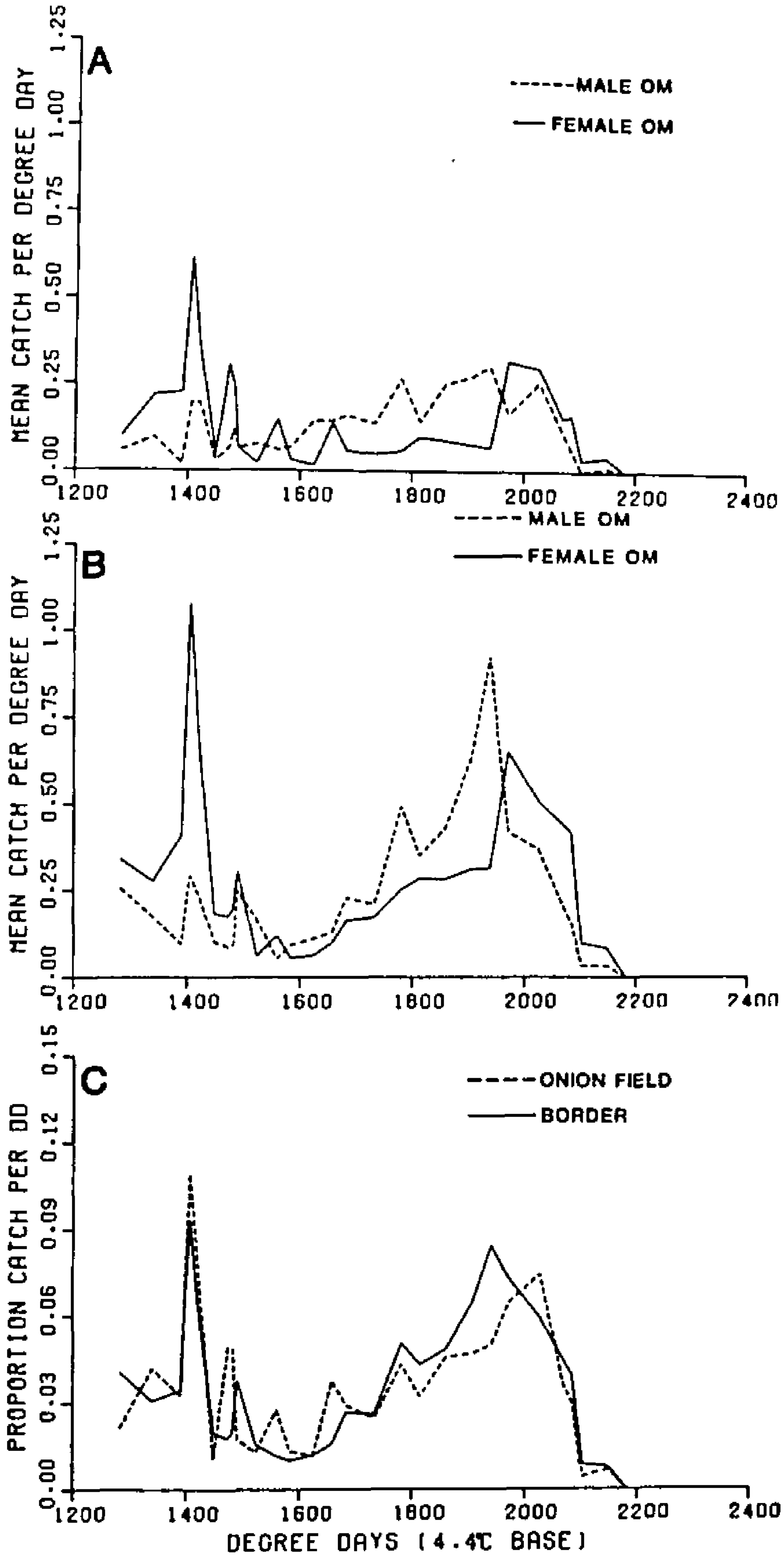
Flight-interception traps were placed both within the field and along the field edges in 1979. Adult flight curves for the second and third generation revealed differences in the density of adults trapped between the two locations (Figure 19A-B). Up to twice the density of males and females were caught by traps placed along the border compared to the traps in the center of the onion field. In order to examine trapping results independent of density differences, trap counts of adults were transformed to proportional counts for each location. The resultant curves of adult activity were observed to be quite similar for the two trapping locations throughout the two generations examined (Figure 19C). Since there were no differences in the phenology of activity between trapping areas and since higher relative density estimates are desirable for analysis of trapping results (often necessary for use in parametric statistics), interception traps may be placed along field borders for monitoring adult fly activity. These results agreed with those of Loosjes (1976) who found that flight interception traps worked best along field borders.

Because flight interception traps face one direction, it was necessary to determine if the direction and trap placement would influence trapping results.

Figure 19A. Mean catch of OM adults during the second and third generation flight by flight interception traps placed within the onion research field in 1979.

Figure 19B. Mean catch of OM adults during the second and third generation flight by flight interception traps placed along the borders of the onion research field in 1979.

Figure 19C. Proportion of total adult OM catch during the second and third generation flight by flight interception traps placed within and along the borders of the onion research field in 1979.


A
MALE OM
FEMALE OM
MEAN CATCH PER DEGREE DAY
B
MALE OM
FEMALE OM
MEAN CATCH PER DEGREE DAY
C
ONION FIELD
BORDER
PROPORTION CATCH PER DD
DEGREE DAYS (4.4C BASE)

In 1979, flight-interception traps were placed along all four borders of the research field and were alternated between facing into or out of the field. Traps facing into the field were expected to trap flies returning to the borders while traps facing the borders were expected to trap flies migrating to the onion field. Two-way analysis of variance for sample date and trap location revealed no significant differences in trapping results for the two directions for all sample dates examined. There were also no significant differences in the ratio of male to female catch between the two directions (Appendix E).

To examine trap placement, a paired T-test was used. Trapping results from paired traps (one facing in and one facing out of the field) along the four field borders were analyzed to determine if different border habitats gave different results. There were no significant differences in trap results between these habitats (carrots, grass borders, and mint) for all trapping dates examined. These results agree with Loosjes (1976) who found no correlation of trap location on catch size with respect to direction of adult dispersal. He concluded that flight direction had a low correlation with dispersal direction due to predominantly random flight behavior in the field and along the borders. Within-day differences in trap catch could not be determined since traps were only monitored daily. Differences in trapping results during the day, however, may have been expected, since the micro-habitats of the border areas differ considerably.

It was hypothesized that different micro-habitats between border and onion foliage during night hours might influence adult OM behavior. Therefore, sweepnet sampling was conducted between 11 p.m. and 1 a.m. to examine the spatial distribution of resting adults in carrot and grass borders and the onion crop.

Since the sweepnet actually made contact with the foliage, any adults recovered were considered to be resting on the sampled foliage. Analysis of variance and subsequent mean comparison test (Duncan's Multiple Range) revealed significant differences in the numbers of adults collected from the three habitats for all sample dates during the season (Table 6). The greatest number of adults (29.3 per 50 sweeps) were found resting in carrot crop borders. Results from onion foliage were very low—only 3.7 adults caught per 50 sweeps.

Carruthers (1981) sampled OM adults within the onion field and along carrot borders during daylight hours and reported significant differences between these two habitats throughout the season. He suggested that aggregation in the carrot borders occurs due to increased shelter from effects of solar radiation and high temperatures. Although these conditions would not be present at night, other micro-climatic differences may influence the spatial distribution during the night hours. Carruthers (1981) for example, has shown that relative humidity is considerably higher in grass and carrot border areas than in the onion field at night.

3. Within-Day Flight Activity

Within-day flight activity, or the daily rhythm of adult flight, was examined. This information was necessary to evaluate the abiotic effects on flight activity and to establish when traps should be emptied for daily counts. Rotary flight traps were run continuously from 4:30 a.m. to 10:30 p.m. for several days during the growing season in 1978. The traps were placed between onion rows in the research field and were emptied hourly. Nets were set to 30 and 100 cm heights and the nets swept only the air above the onion crop, so

Table 6. One-way analysis of variance and Duncan's multiple range test of mean catch of OM adults per 50 sweeps for different foliage during night hours.

Variable	DF	Sum of Squares	Mean Square	F
Foliage Type	2	27,678.5	13,839.2	180.3***
Residuals	207	15,888.7	76.8	
Total	209	43,567.1		

***(p<.001)

Group	Foliage Type	Mean Catch/50 Sweeps*
1	Onions	3.7a
2	Grass Border	26.5b
3	Carrot Border	29.3c

*means folled by same letter are not significantly different (α=.05) records of adult activity could be obtained.

Results indicate that adult activity varies with time of day (Figure 20). The times of greatest activity occur between the hours of 5:30-9:30 a.m. and 5:30-8:30 p.m. An analysis of variance revealed significant differences between hours of the day for percent of total catch (Table 7). The hour of greatest activity was from 6:30-7:30 p.m. and no flight occurred after 9:30 p.m. This information partially agrees with Loosjes (1976) who reported that most flight activity occurs at dusk. His results, however, did not indicate a second period of increased activity during the early morning hours.

To determine when traps should be checked, observations were made on the behavior of OM adults caught by the flight interception traps. One to three hours normally elapsed between the time a fly entered an interception trap until it worked its way up and into the collection device on top. As a result, traps were checked every morning between 7 and 8 a.m. and only the flies within the collection device were removed. Collected flies were recorded as having been trapped during the previous day such that any flies remaining in the net but not in the collection device were recorded the following day after entrapment.

4. Weather Effects

All of the traps used to monitor adult activity during the season were relative trapping designs, with the exception of rotary flight traps which sample a constant volume of air. To biologically interpret the results, changes in activity due to changing environmental conditions must be examined. The natural diurnal cycle of the adult OM has already been discussed, but the effect of prevailing climatic conditions during times of flight also need to be accounted for.

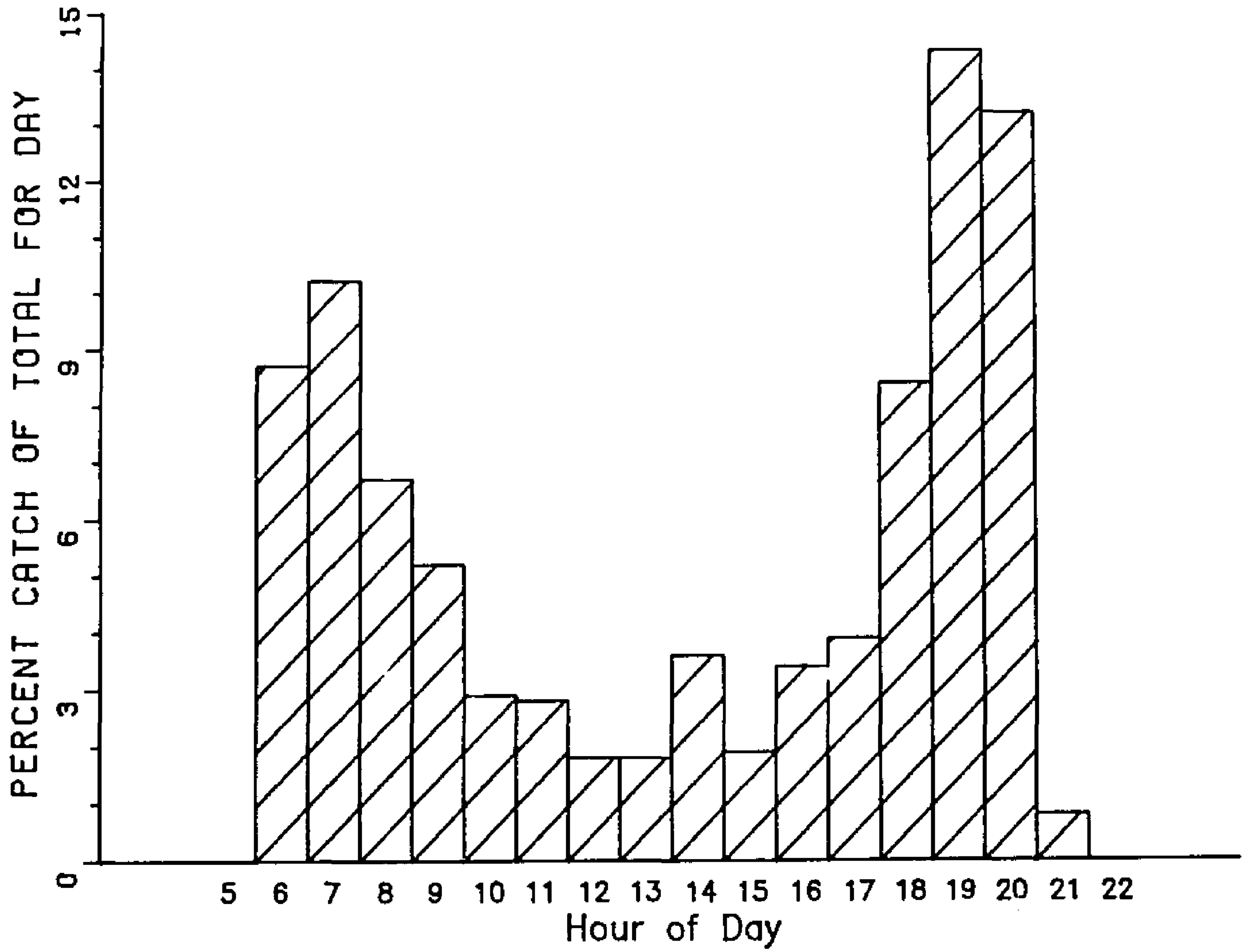


Figure 20. Mean percent catch of total OM adults for the hours of 4:30 to 22:30, several dates during the season in 1979.

Table 7. One-way analysis of variance and Duncan's multiple range test for different times of percent catch of total OM adults. All percentages were transformed by arcsin square root before analysis.

Variable	DF	Sum of Squares	Mean Square	F
Time of Day	16	280.6	17.5	2.8**
Residuals	100	627.1	6.3	
Total	116	907.7		

**($p<.01$)

Group	Time of Day	Percent Catch of Total**
1	5:30- 6:30	8.7abc
2	6:30- 7:30	10.2abc
3	7:30- 8:30	6.7d
4	8:30- 9:30	5.2d
5	9:30-10:30	2.9d
6	10:30-11:30	2.8d
7	11:30-12:30	1.8d
8	12:30-13:30	3.6d
9	13:30-14:30	1.9d
10	14:30-15:30	3.4d
11	15:30-16:30	3.9d
12	16:30-17:30	8.4abc
13	17:30-18:30	12.3ab
14	18:30-19:30	14.3a
15	19:30-20:30	13.2ab
16	20:30-21:30	0.8d
17	21:30-22:30	0.0e

**means followed by the same letter are not significantly different (α=.05)

Loosjes (1976) reported that daily catch of OM adults by flight-interception traps was strongly correlated with maximum temperature. He determined daily differences in trap catch given incremental differences in maximum daily temperature. This technique requires a series of daily catches, such that catches in consecutive days may be compared to corresponding maximum temperatures, and the density of the adults between any two days can be assumed to be a constant. Any differences in measured activity can be attributed to differences in the maximum daily temperature. This technique has been used by other authors for examining temperature influence on insect activity (Williams 1961, Johnson 1969).

The data from Loosjes (1976) was examined for use in adjusting activity-trap data for temperature changes through the season. Cumulative catch size was transformed by use of the probit so a linear relationship between catch size and temperature was obtained (Finney 1971). Least-squares regression analysis was then performed to obtain the prediction equation for relative catch size given maximum temperature values (Figure 21). Before the trap catch could be adjusted, it was necessary to determine a "standard day" or temperature with which all other temperatures would be compared. Based on laboratory observations, Loosjes (1976) described a standard day of activity as occurring at 20°C. At this temperature, 100% relative catch size would be assumed. Any deviations from this temperature required appropriate adjustment whereby catch records from days with lower temperatures would be increased and those from days of higher temperatures would be decreased according to the temperature factor determined.

Loosjes (1976) adjusted the total trap count for a day based on the

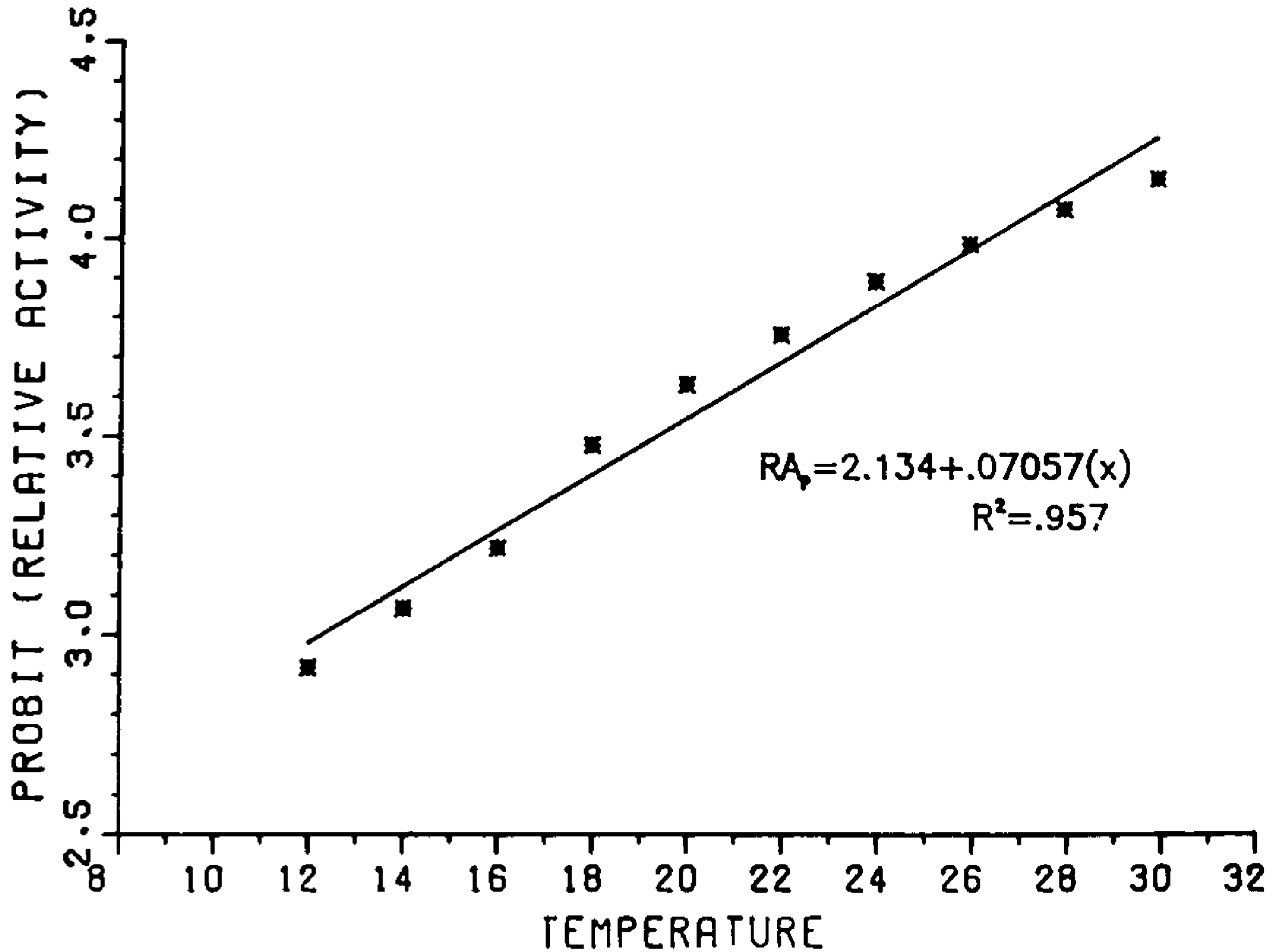


Figure 21. Relationship between probit of percent relative activity (RA) of OM adults and daily temperature (°C). Standard day (100% relative activity) equals 20°C (data of Loosjes, 1976).

maximum temperature for that day. The procedure, however, failed to account for the within-day activity or natural daily rhythm of the adult. Given that temperature can influence flight activity, it is also necessary to determine if flight normally takes place at the time the temperature occurs. Any adjustment for temperature must be the product of these two factors. The interaction of temperature and the time of day during which activity takes place is a three-dimensional relationship when relative catch size is to be predicted (Figure 22).

One would expect that several other weather parameters, such as solar radiation, relative humidity, wind and rainfall, could affect activity and resultant trap-catch. An attempt was made to analyze these affects by comparing daily trap catches to measured abiotic conditions. Flight-interception traps in the research field in 1979 were checked at hourly intervals for several sample dates throughout the season. Multivariable-regression techniques were used to evaluate the effect of relative humidity, temperature, and solar radiation on trap catch. Although the analysis failed to show any significant relationships, it should not be interpreted as indicating that these parameters have no influence on trap catch. The assumptions of this type of analysis require that compounding interactions be identified and measured. Overall dependence of one variable on another or the relationship between any particular pair of variables can then be determined. The natural within-day activity of the adult OM may be the most dominant factor for determining adult activity. Because only a limited number of days under natural varying conditions were assessed, it was felt that more trapping information, both within a day and between days of varying conditions, was necessary before a complete structural model could be formulated to explain adult activity.

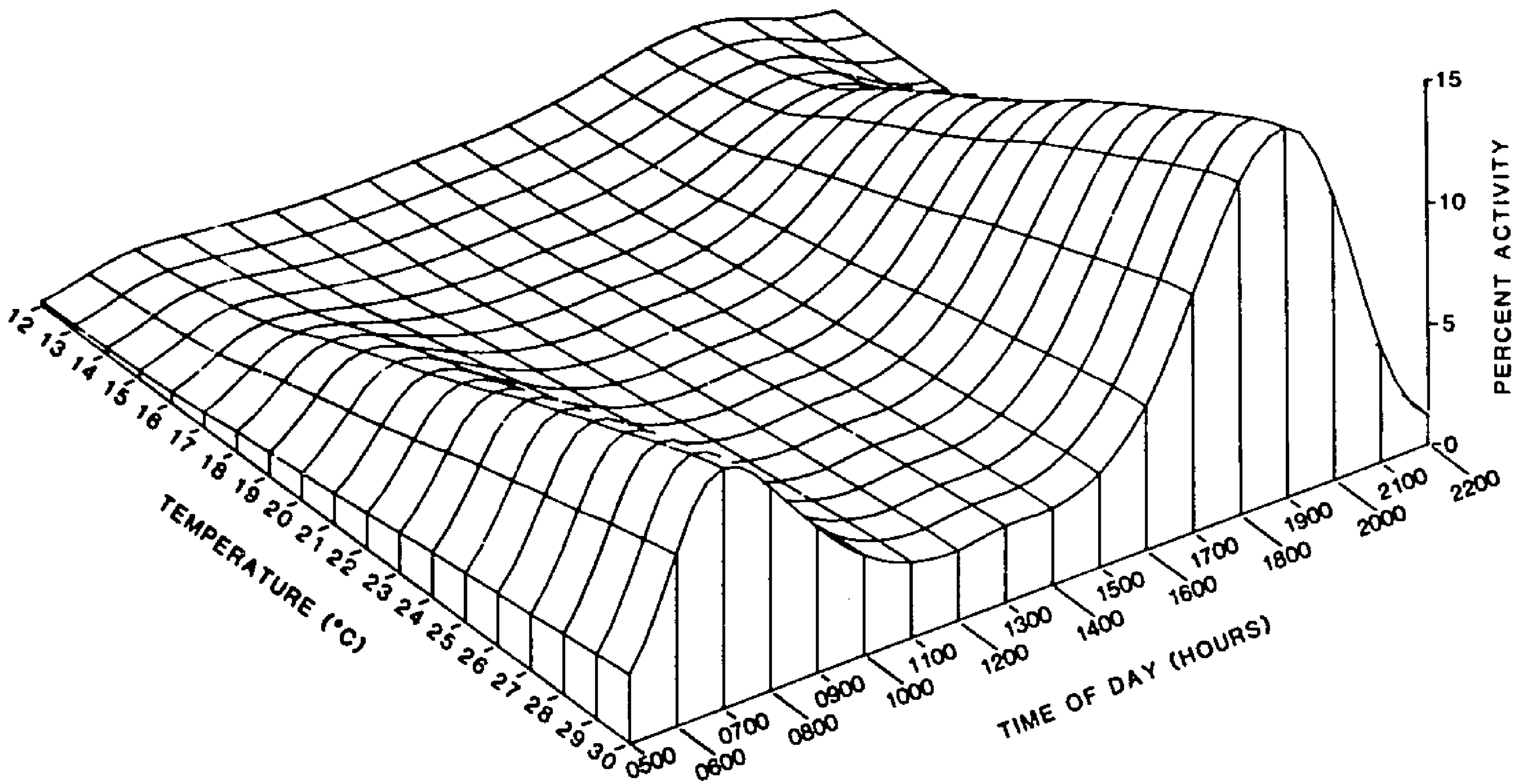


Figure 22. Graphical representation of temperature adjusted technique, where adult trap catch is adjusted according to the activity level observed for the temperature and hour during the day.

Heavy rain and strong winds are correlated with lower temperatures and diminished trap catch (Loosjes 1976). Therefore temperature adjustment may be adequate for these situations. A light rain, however, may reverse the situation. During a period of light rain or following major precipitation, OM adults were often active in the field. Carruthers (1977, unpublished) monitored adult OM activity in the field with sticky boards before and following a light rain. His data revealed an increase in flight activity immediately following precipitation (Figure 23), but because only one data set was available for examination, no attempt was made to correct trap catch for periods of rainfall. Records of intensity of precipitation, as well as accumulated amount, may be necessary before adjustments are to be made.

Solar radiation or light intensity has been shown to influence the flight behavior of cabbage maggot adults in the laboratory. Hawkes (1969), measuring walking activity of the cabbage maggot under different light intensities, reported that cabbage maggot adults responded to decreasing light intensity and that within-day activity depended on environmental conditions. Therefore, correction of trap data for within-day activity may compensate for radiation effects during the day.

It has already been shown that OM adults fly at or about the height of the surrounding vegetation. At heights of 30-120 cm, wind direction may be expected to influence adult flight activity. Loosjes (1976) examined the influence of wind direction on adult flight activity by comparing trap catches between traps facing in different directions. He reported that traps placed along the borders of a field were least affected by differences in wind direction when compared to traps placed within the onion field. More flies were caught in traps

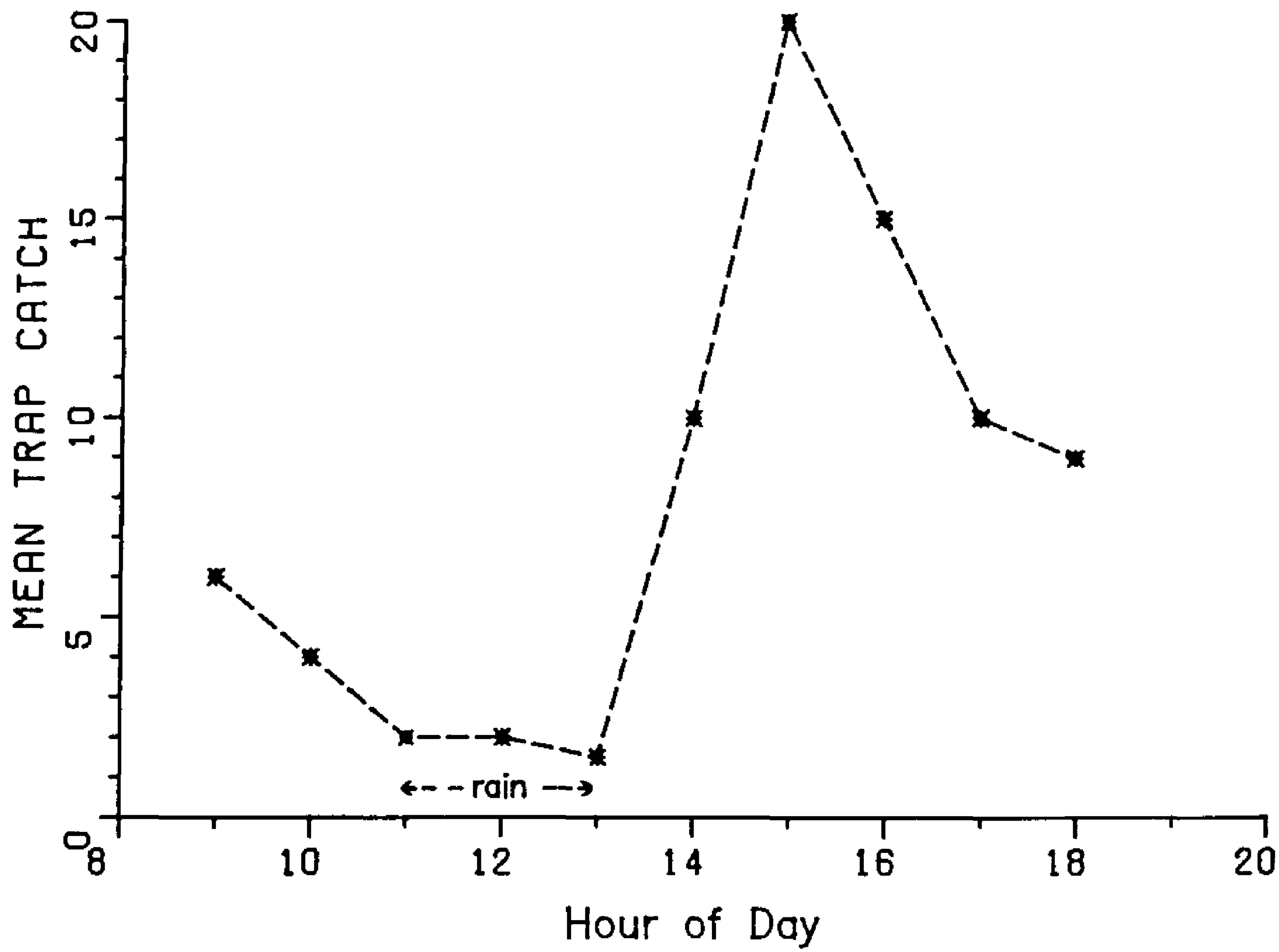


Figure 23. Mean hourly trap catch of OM adults with sticky boards before and after a period of precipitation (after Carruthers, 1977).

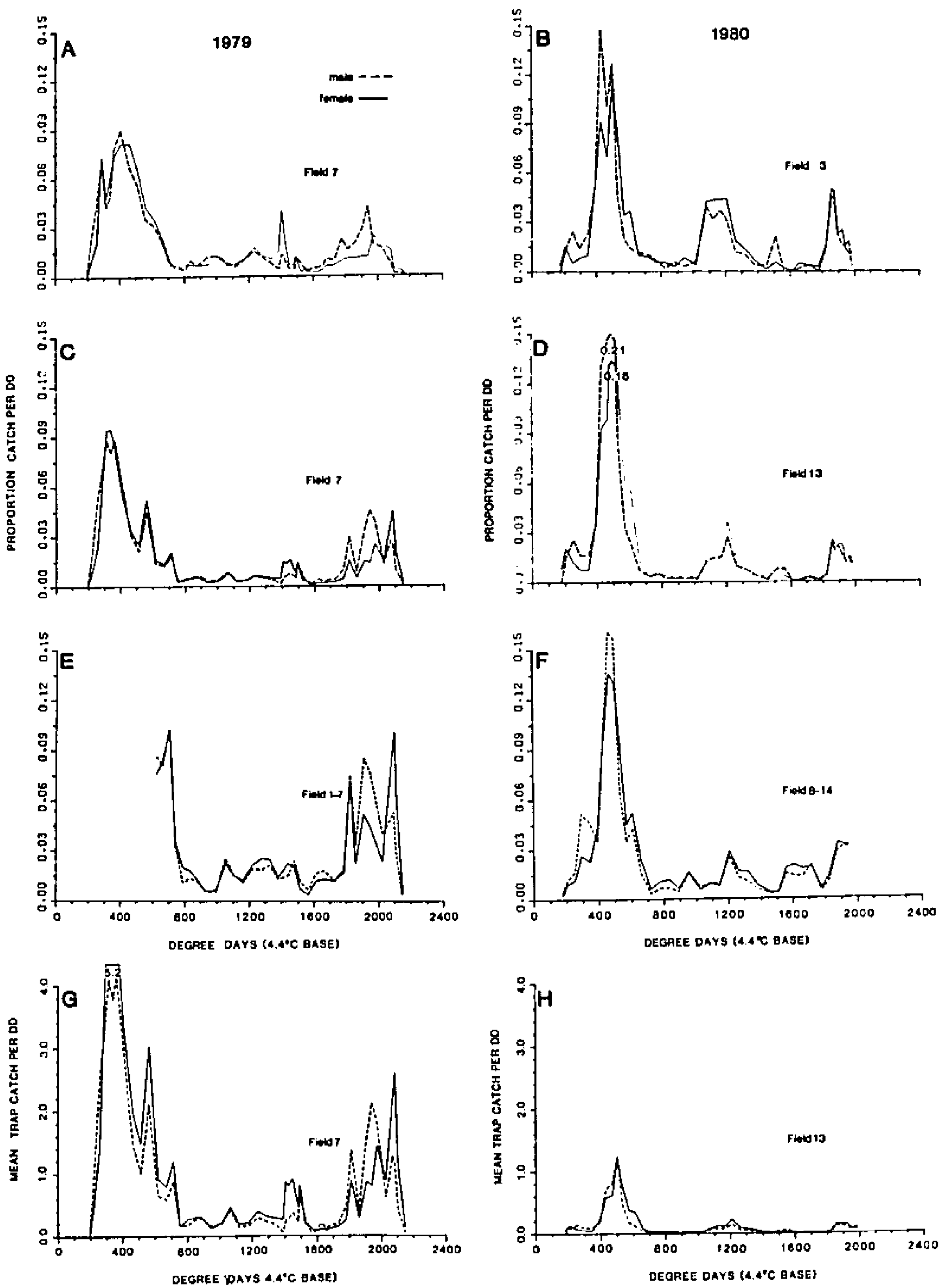
facing downwind, but local differences in vegetation between traps were reported to obscure possible influence by wind direction, and definite conclusions could not be reached.

5. Adult Flight Curves

A temperature-adjustment computer program was written to adjust the trap catch of flight-interception traps, activity traps, and sticky boards (Appendix E). The program was designed to adjust hourly trap catch for effects of weather and within-day flight activity. Daily catch records were obtained by linear interpolation of counts from three-day sample periods. Maximum and minimum temperature records from the Grant weather station were fitted with a sine curve to obtain hourly temperature values for each day (Fulton 1978). Daily trap counts were distributed hourly (hours 05-22) according to the within-day distribution of activity already determined. Relative catch size was then adjusted hourly by the relative-catch prediction equation according to the temperature at that hour. Hourly counts were summed for one day and three-day counts were aggregated to obtain an estimate for the date the trap was checked.

This procedure eliminated the large influence of daily weather factors. In 1979, rain, strong winds, and low temperatures occurred in the Grant area between May 12-16 (Appendix C). The effect of these adverse weather conditions was directly reflected in trap counts by flight-interception traps (Figure 24A). Adult activity dropped considerably during this period. At the same time, emergence of the first adult generation was occurring; therefore, a sharp drop in population density would not have been expected. The temperature adjustment program, however, adjusted the trap catch accordingly and the

Figure 24. Proportion of total OM adult catch before (A-B) and after (C-F) temperature adjustment for flight interception traps in 1979 and 1980. Mean trap catch for field 7 (G) and field 13 (H).


A
1979
male
female
Field 7
B
1980
Field 3
C
PROPORTION CATCH PER DD
Field 7
D
0.21
0.18
PROPORTION CATCH PER DD
Field 13
E
Field 1-7
F
Field 8-14
DEGREE DAYS (4.4°C BASE)
G
5.2
MEAN TRAP CATCH PER DD
Field 7
H
MEAN TRAP CATCH PER DD
Field 13
DEGREE DAYS (4.4°C BASE)

resultant curve revealed an increase in trap catch during this period (Figure 24C). (Flight curves have first been presented as a proportion of total catch so the effect of the temperature adjustment may be compared to the original data (research field in 1979 and field 13 in 1980).) For each year, data from the remaining study fields (1-5, 8-12, and 14) was pooled; the proportion of total catch over degree-days after temperature adjustment is presented in Figure 24E-F. By plotting the proportion of total trap catch over degree-days the phenology of adult activity can be examined and compared independent of density. It can be seen that three generations of flight took place during the season. The flight curves for all fields described a similar phenology of adult flight for each year.

The adjusted flight interception trap data may now be accepted as relative estimates of abundance, whereby major environmental factors affecting activity have been adjusted.

The relative abundance of OM adults plotted against degree-days for the research field in 1979 and for field 13 in 1980 revealed considerable differences in density (Figure 24G-H). Adjusted adult flight curves for all study fields where flight interception traps were used are presented in Figures 25-26. Differences in density between fields may be partly attributed to differences in control measures, soil type, field location, and production practices. Carruthers (1979) reported lower onion plant damage by OM in areas where the marl content of the soil was high. For example, Field 1 (1979) and 8 (1980) had the lowest fly density for both years; it also had a very high marl content in comparison to the other study fields. Presence or absence of grass borders or shelter could also influence adult density and spatial distribution. Planting and harvest dates for onions were normally consistant between fields; however, some differences occurred, and this

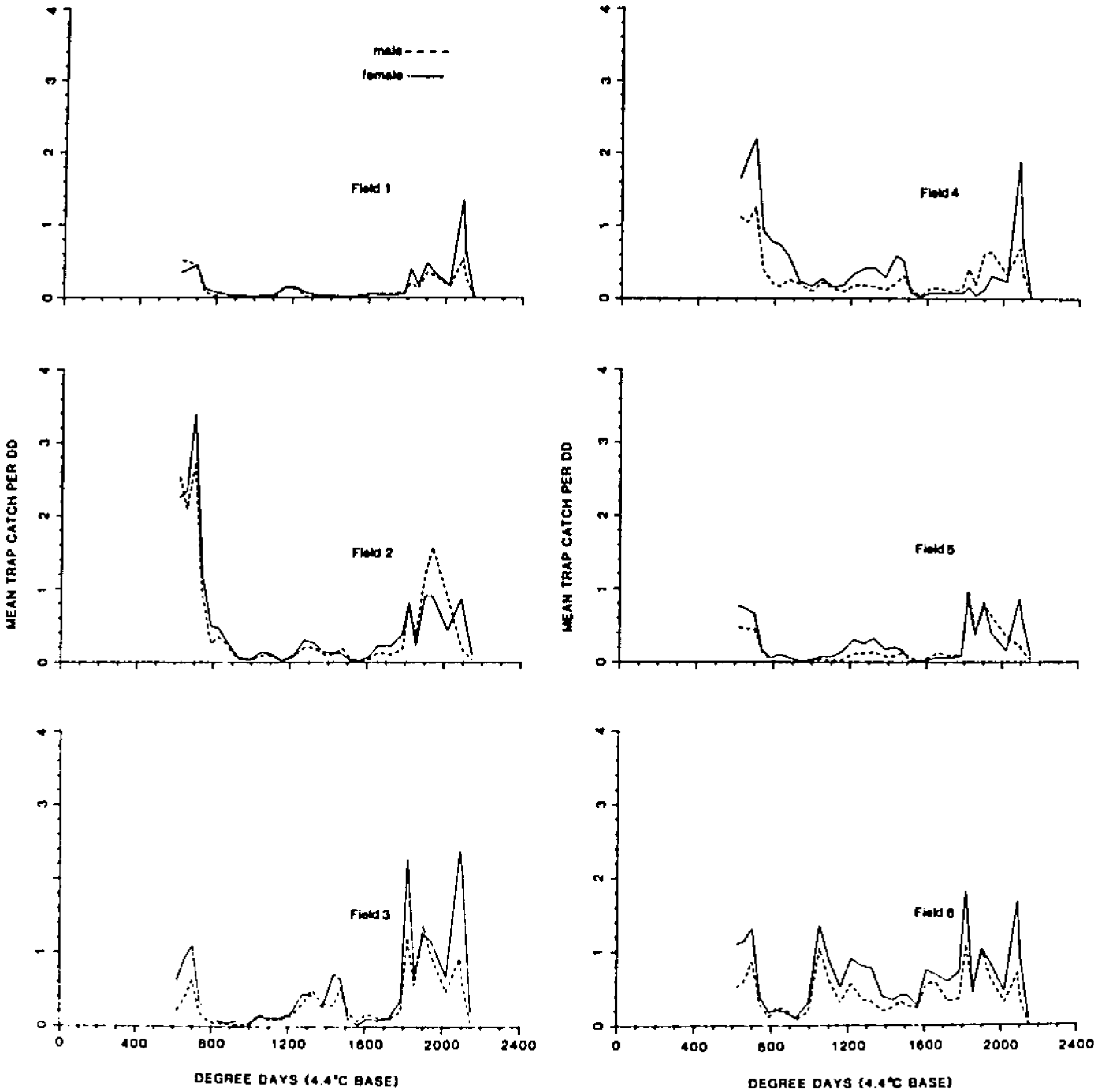


Figure 25. Flight curves of male adult OM from flight interception traps in commercial study fields in 1979.

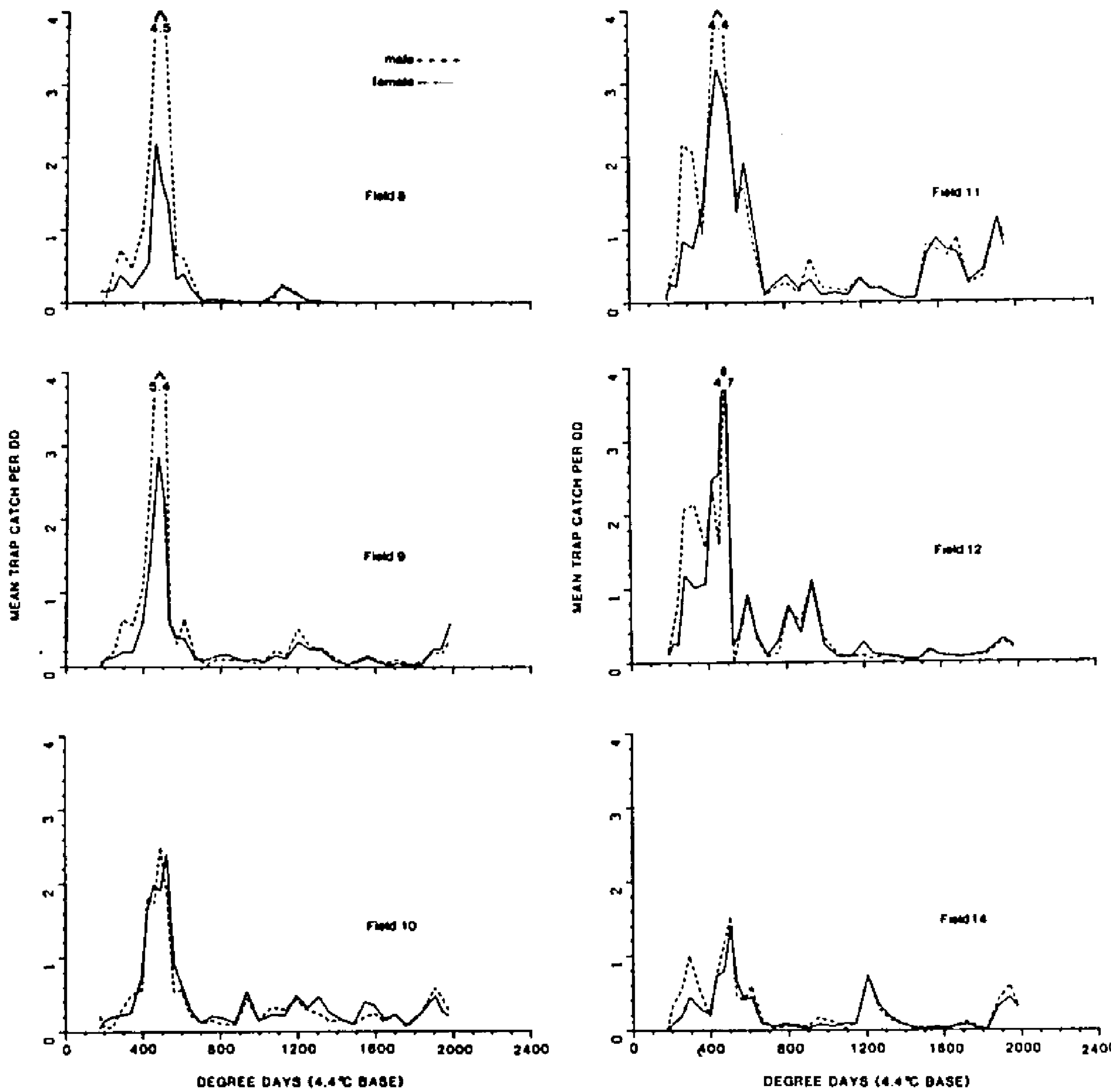


Figure 26. Flight curves of male and female adult OM from flight interception traps in commercial study fields in 1980.

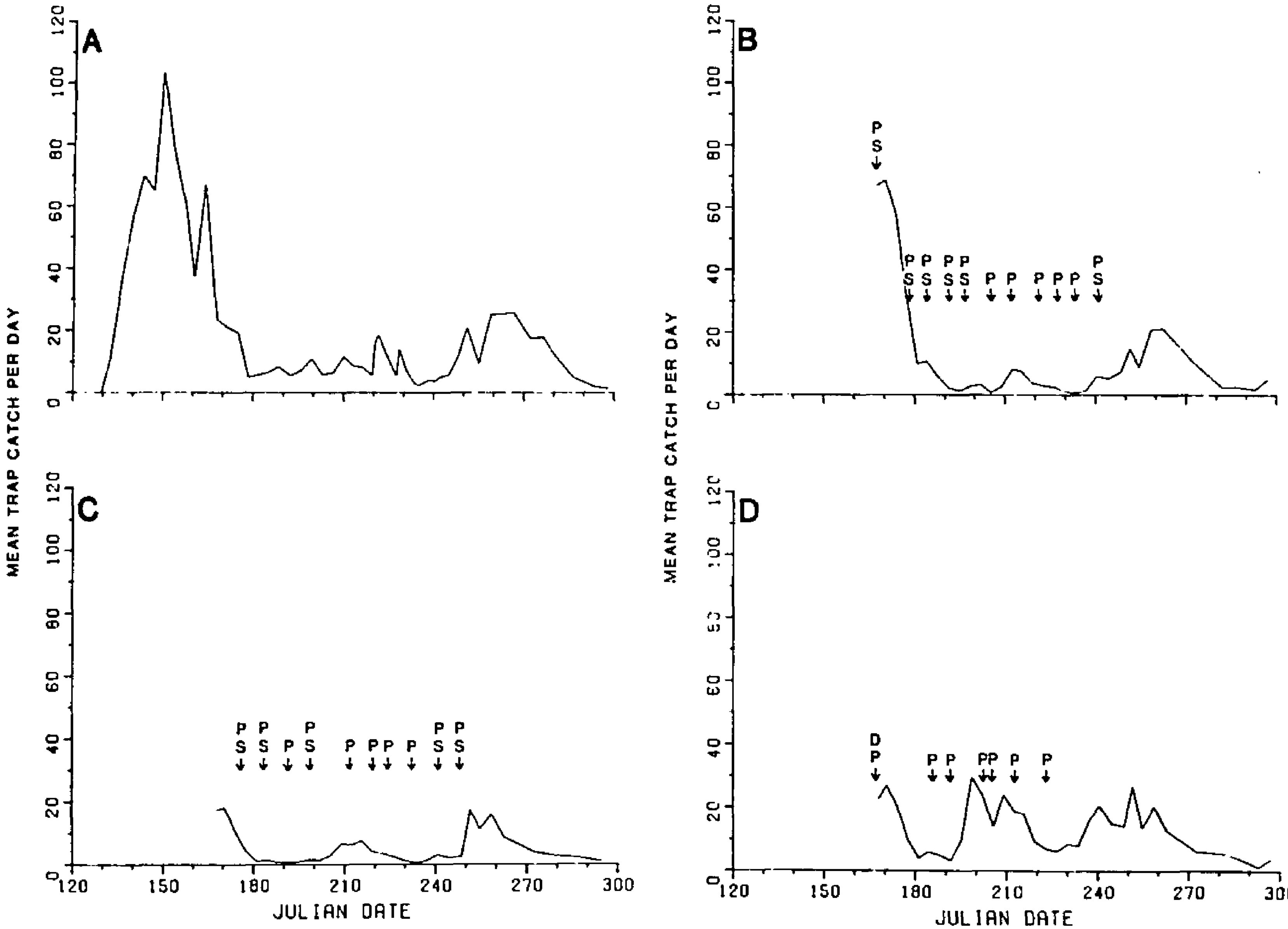
could also have influenced adult density.

All the commercial study fields in 1979 (1-6) and 1980 (7-12 and 14) were sprayed with foliar insecticides (parathion (.227 kg AI per hectare), diazinon (.227 kg AI per hectare), and Sevin® (.227 kg AI per hectare)) to control OM adults. Sprays were normally applied weekly from the first week in June to the first week in September. In order to examine what effect foliar insecticide sprays had on OM adult abundance, spray records of several growers were compared to adult trap catch through the season for the respective fields. The research field of 1979 and Field 13 in 1980 were used for comparative purposes, since no foliar insecticide sprays were applied to these fields. Figures 27-28 show that there were no major discernable affects on OM adult density following a spray. For both years, the non-sprayed fields reflected similar flight curves and changes in density levels for the dates that spraying took place on other fields. Major changes in density through time resulted from natural changes in the phenology of the adults--not to large "kills" by the insecticides. In some instances, after a spray was applied, a small change in adult density was reflected in the flight curve, but the population returned to its original trajectory a few days later.

To determine if the non-sprayed areas during 1979 and 1980 had significantly greater fly populations because spraying did not take place, adult totals for all fields were calculated. The method of obtaining the total seasonal production (TSP) of a life-stage has been presented by several authors (Southwood 1978, Helgesen and Haynes 1972, Kiritani and Nakasuji 1967, Manly 1976, Lampert 1980). A computer program by Lampert (1980) was used for this purpose by which:

Figure 27A. Mean trap catch of adult OM by flight interception traps in field 7 in 1979 (no foliar insecticide sprays applied).

Figure 27B-D. Mean trap catch of adult OM by flight interception traps in field 2 (B), field 5 (C), and field 6 (D) in 1979. Periods of foliar insecticide application are indicated (P-parathion, S-Sevin, D-diazinon).


A
B
C
D
MEAN TRAP CATCH PER DAY
JULIAN DATE
0
20
40
60
80
100
120
150
180
210
240
270
300
P S
P
D P

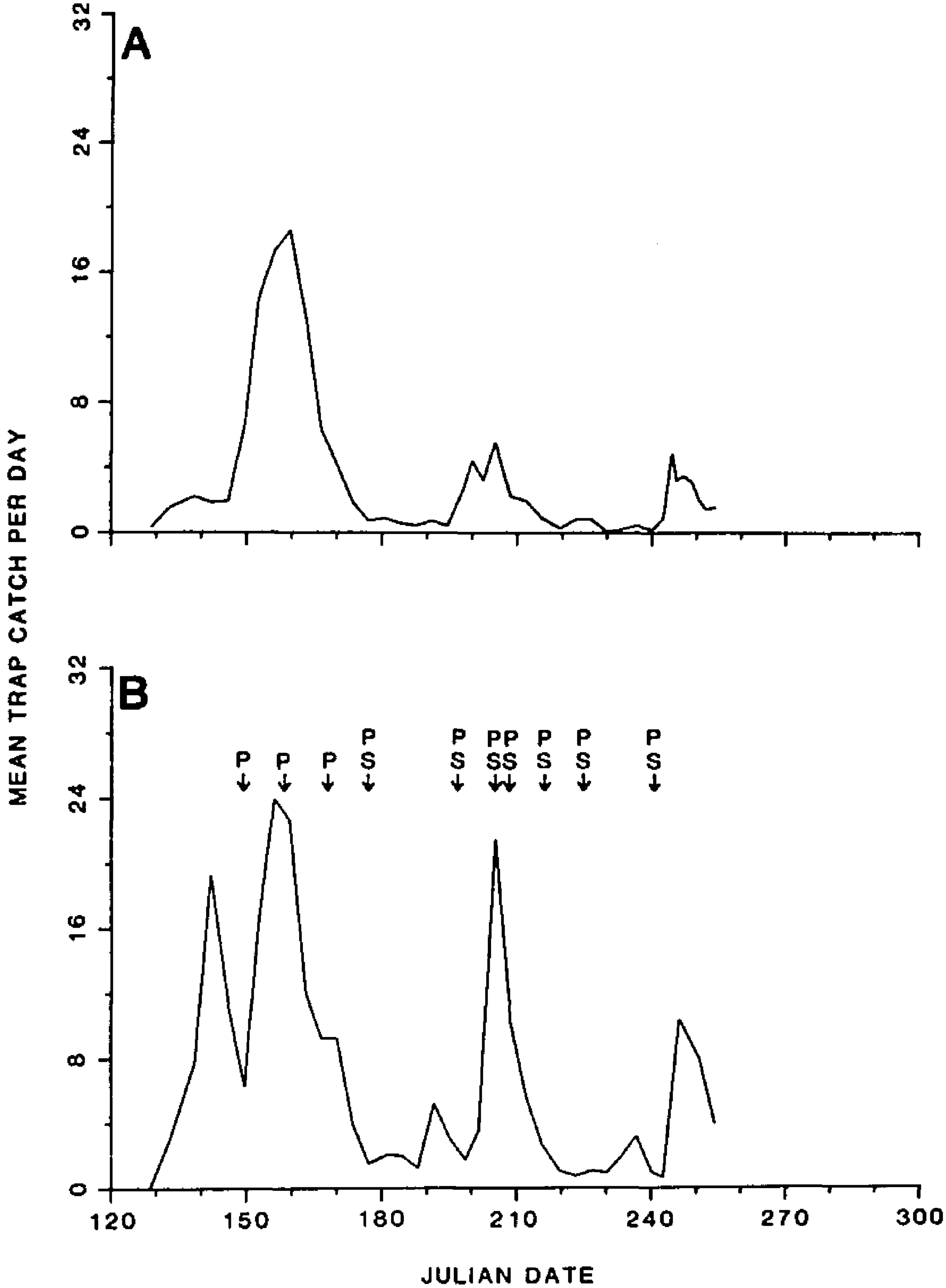


Figure 28A. Mean trap catch of adult OM by flight interception traps in field 13 in 1980 (no foliar insecticide sprays applied).

Figure 28B. Mean trap catch of adult OM by flight interception traps in field 14 in 1980. Periods of foliar insecticide application are indicated (P-parathion; S-Sevin).

$$TI_i = \sum_{j=1}^{n-1} \left[\left(\frac{D_{ij}+D_{i,j+1}}{2} \right) (DD_{j+1} - DD_j) \right]$$

where TI = total incidence

DD_j = accumulated degree-days on j^{th} date

D_{ij} = density of the i^{th} stage on the j^{th} sample date.

To correct for redundant observations, the total incidence was then divided by the developmental time of the OM adult (167 degree-days; 4.4°C base) to obtain the TSP.

For 1979, TSP was calculated only for the second and third generation flights since trap records were not available for the first generation. For 1980 TSP for all three flights was calculated (Table 8). This information was used to determine if the TSP of the non-sprayed field in each year differed significantly from the mean of the TSPs of the other fields. The null hypothesis (H_o: $U_1 = U_2$) was accepted for both years at the 95% confidence interval, indicating that the TSP of the non-sprayed fields was not significantly different from the other fields for each year.

Trap data from sticky board and activity traps placed in the research field in 1978 and 1979 were also adjusted using the temperature adjustment program. Figures 29-30 present proportional trap data for the original counts of both traps along with proportional temperature adjustment curves and mean catch per degree-day. Temperature adjustment of trap data had little effect on the phenology of adult activity.

The sticky boards described three flights of OM adults during 1978. In 1979, however, only a partial third generation flight was recorded because traps had to be removed from the field at harvest (flight interception traps along the

Table 8. Total production of OM adults for study fields in Grant, Michigan, in 1979-1980.

a) 1979

FIELD:	7*	1	2	3	4	5	6
2nd gen.	441.7	61.9	213.4	308.1	396.9	148.4	683.7
3rd gen.	787.9	237.9	534.8	712.9	315.2	343.6	699.2

b) 1980

FIELD:	13*	8	9	10	11	12	14
1st gen.	315.0	944.3	960.8	321.9	1,634.7	1,276.6	522.2
2nd gen.	77.1	65.1	233.2	402.9	371.4	372.1	221.3
3rd gen.	34.6	1.9	31.9	120.8	302.5	58.6	38.9

*not sprayed

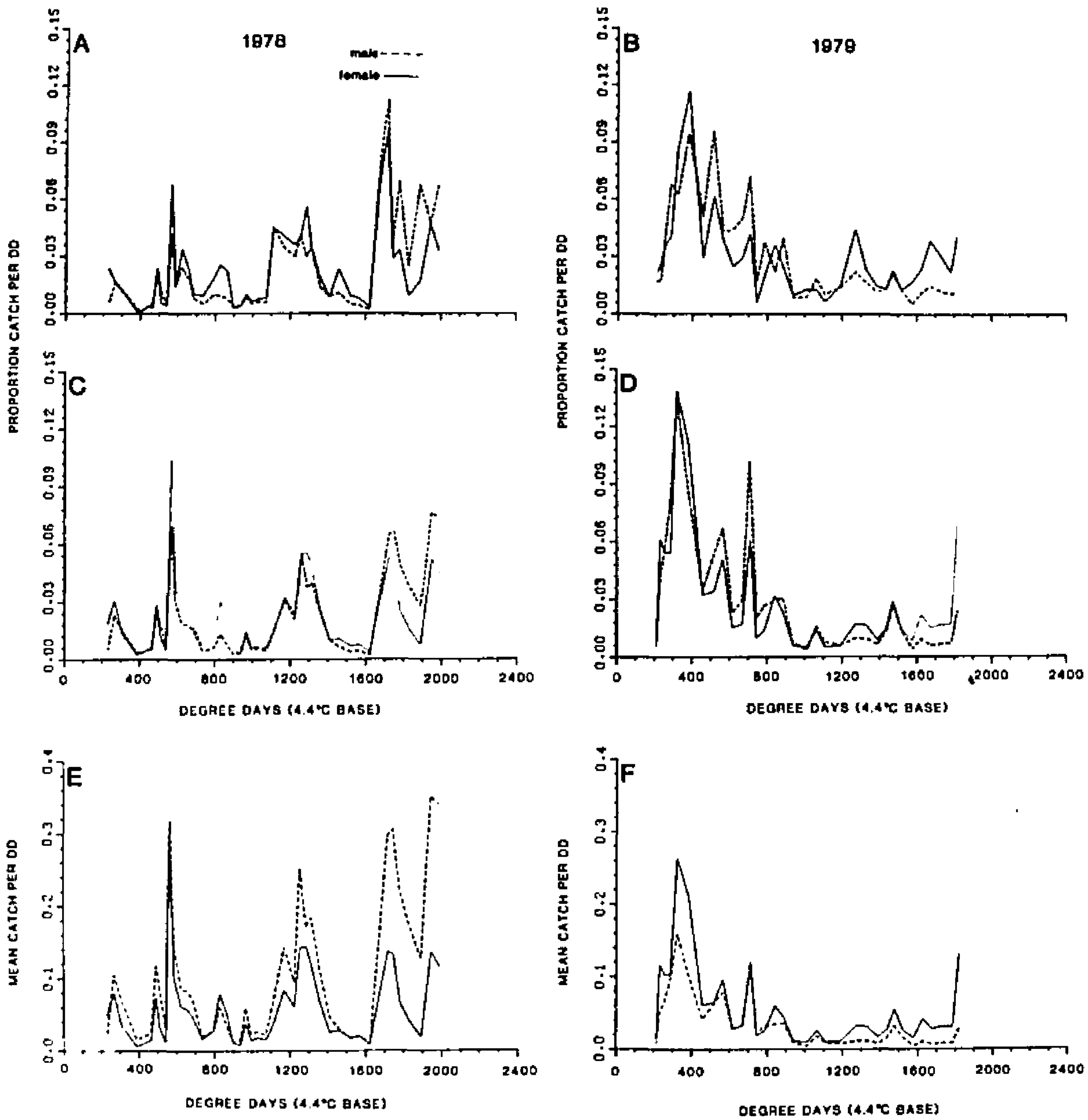


Figure 29. Proportion of total OM adult catch before (A-B) and after (C-D) temperature adjustment for stickyboard traps in 1978 and 1979. Mean trap catch for the research field in 1978 (E) and 1979 (F).

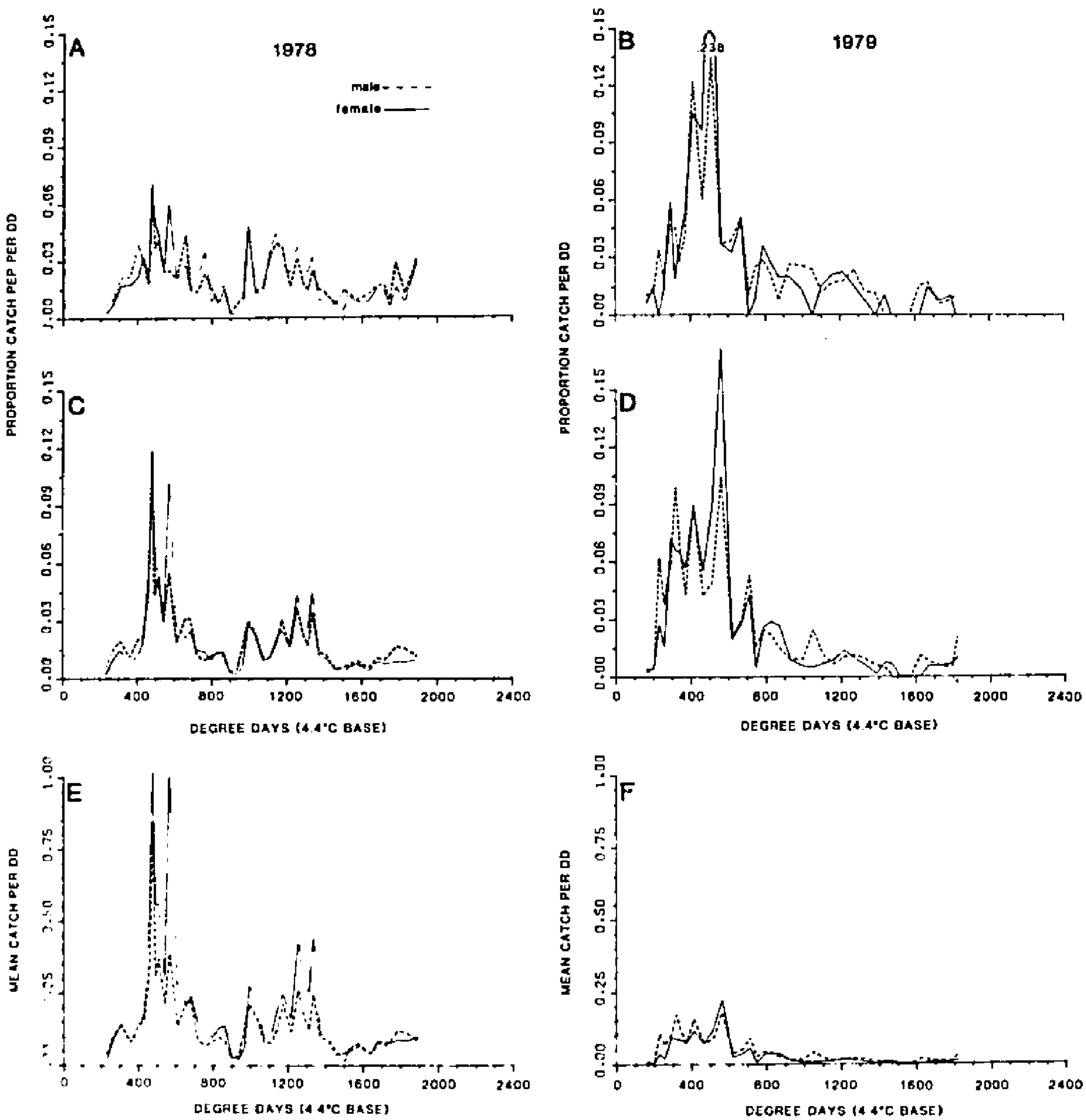


Figure 30. Proportion of total OM adult catch before (A-B) and after (C-D) temperature adjustment for activity traps in 1978 and 1979. Mean trap catch for the research field in 1978 (E) and 1979 (F).

borders of the field remained and revealed a full third generation flight). The proportional flight curves of 1979 described a similar phenology of OM flight when compared to the data of the flight interception traps used in the same year and area. The relative density of second generation adults in 1979 was considerably lower than 1978. The second generation counts in 1979 were also low in comparison to the first generation of that year. This data were unexpected since in 1979, only half the field was treated with Dyfonate and considerable onion plant damage by OM occurred. The relationship between onion plant damage and relative fly density will be discussed in a later section.

The activity traps of 1978 also described three flights of OM adults; however, because activity traps had to be removed at harvest in 1979, only two flights were observed. The proportional curves for both years described a similar generation phenology of OM flight when compared to stickyboards (1978-79) and flight-interception traps (1979). Major differences between male and female catch were originally expected since activity traps were placed over onion plants to trap ovipositing females. No differences in the male to female ratio were readily apparent; therefore, it was assumed that male OM visited onion plants as often as females for mating or feeding.

C. Onion Maggot Larval and Pupal Population Trends

The study of population trends and densities is useful in determining population synchrony with degree-day values and in examining the influence of insecticide use on immature stages. OM larvae and pupae were sampled continually during 1978 and 1979 to determine the synchrony of the population trends for each generation. Sampling was conducted in the Dyfonate-treated research field in 1978. In 1979 sampling was conducted on the non-treated area of the research field (no Dyfonate present).

OM immature stages typically occur in an aggregated pattern within the field (Loosjes 1976). In the past, there has been very little attempt to quantify OM larval populations because of the necessary large sample size. Even after a sample size has been decided on, removing larvae from the onions and sifting the soil for OM pupae requires a great amount of time and effort. Therefore, most population studies in the past have been limited to assessing OM adult densities and resultant onion plant damage (Loosjes 1976, Eckenrode et al. 1975, Perron et al. 1958, Ellington 1963).

Carruthers (1979) reported that stratification was advisable when sampling immature OM stages. He first divided the habitat into visibly-healthy and visibly-damaged onions. He further subdivided this into two strata of healthy onions and three strata of damaged onions. Comparative analysis of the stratified sampling procedure and simple random sampling revealed that a considerably decreased sample size was adequate when using stratification.

For this study only two strata were identified: visible damage and no apparent damage. Further stratification was not necessary and would have required more time than was feasible with three-day sample estimates.

The data from larval and pupal sampling were summarized and are presented, along with the respective variance and standard error, in Appendix H. An average standard error of 30% of the mean was obtained for each year for 5 to 10 biweekly samples of 60 cm of damaged onion row. It was evident there were only two generations of larval activity during the onion growing season. Sampling for immatures was continued in 1979 after the date when onions were

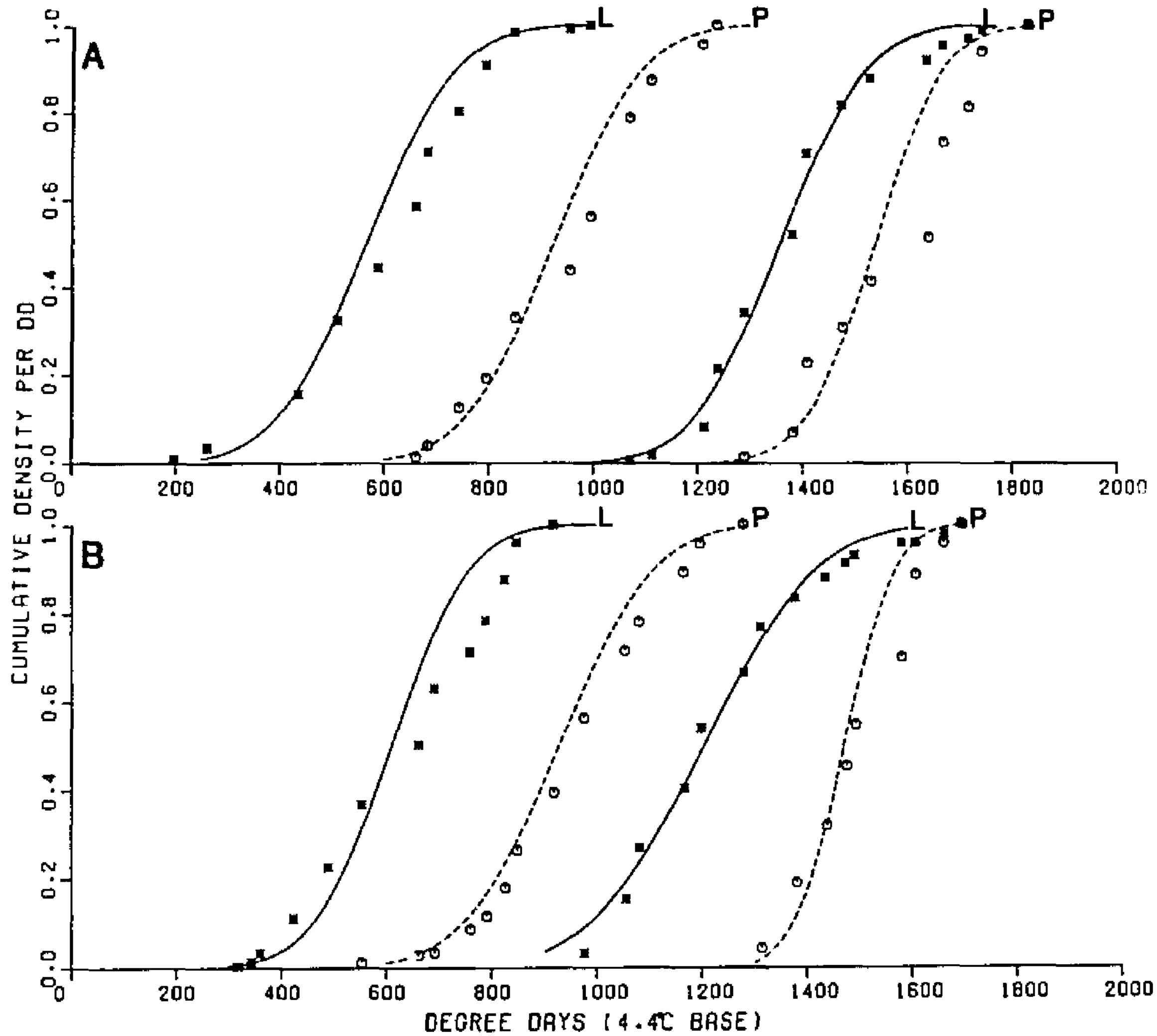


Figure 31. Cumulative proportion of second and third instar OM larvae (L) and OM pupae (P) for two generations from samples of 60 cm of onion row in 1978 (A) and 1979 (B).

mature and ready for harvest (Julian date 233). A third generation of larval activity occurred after this time, as evidenced from a buildup of second instar density after Julian day 237 (August 25) (Appendix H). In 1978 onions were physically removed from the soil (lifted) on Julian day 240 (August 29). Immature stage sampling was continued until Julian day 249 (September 7), but no third larval generation occurred on these onions. The physical act of removing the onions from the soil probably deterred oviposition and increased the mortality of the third generation of first instar larvae. Observations following onion harvest revealed a third larvae generation on cull onions (onions and sections of onions left in the field following harvest). Drummond (1979, unpublished) reported that the third generation of OM larvae principally occurs on cull and mature onions awaiting harvest in the fall. In the Grant area, since most onion acreage is harvested one to two weeks before and following day 244, a third generation of OM larvae does not ordinarily occur on onions unless harvest date is delayed.

Second and third instar larvae for each year were pooled and the cumulative proportion density for the first and second generation were plotted with cumulative pupal density against degree-days (Figure 31). Curvilinear cumulative proportion lines were obtained by probit transformation of the data and least-squares regression analysis (Finney 1971). It was evident from these graphs that the phenology of the first generation immature stages agreed between years. For the second generation, however, there was a large degree day difference between the two years for both larvae and pupae occurrence. Probit regression equations and values for 50% cumulative density revealed degree-day differences between the two years of 232, 147 and 65 degree-days for the second and third instar and pupae respectively (Table 9).

The phenology of the OM immature stages primarily depends on time of adult emergence and subsequent oviposition. Any significant differences between years in time of adult emergence should be reflected by similar differences in the subsequent immature generation. In 1978 no records of first generation emergence were available. Examination of adult flight data, however, revealed that peak first generation adult flight occurred at approximately the same degree-day interval in 1978 and 1979. Similar degree-day estimates for 50% cumulative larval density, therefore, would be expected for the first generation for both years. Comparison of second generation emergence data revealed a difference of 141 degree-days between the two years for 50% adult emergence. This disparity was also evident in the larval populations. A variation of 154 degree-days for 50% cumulative larval density resulted between 1978 and 1979. Any general prediction for immature stages of the OM is therefore contigent on availability of accurate adult emergence records.

D. Survivorship and Parasitism

In order to quantify population densities of larvae and pupae, total seasonal production of these life stages was determined. The method used was identical to that already given for calculating total adult incidence. The total seasonal incidence for the immature stages was divided by the appropriate developmental time of the life stage to obtain an estimate of total seasonal production (TSP). Total seasonal production for each generation of OM adults was obtained directly from emergence trap results. The emergence traps effectively trapped adults emerging from 100 cm of row. The data was converted to estimates of adult

Table 9. Probit regression equations for percent occurrence of immature stages of the OM and degree day period for 50 percent occurrence (.5P). DD° is accumulated air degree days above 4.4°C.

Year	Generation	Life-stage	Regression Equation	r^2	.5 P	Variance
1978	1	2^{nd} larvae	P = 1.16 + .008*DD°	.91	501	17,007
		3^{rd} larvae	P = - 0.18 + .008*DD°	.90	599	13.392
		Pupae	P = - 1.82 + .007*DD°	.93	925	18,420
		2^{nd} and 3^{rd}	P = 0.84 + .007*DD°	.91	566	18,591
	2	2^{nd} larvae	P = - 5.56 + .008*DD°	.97	1,348	16,290
		3^{rd} larvae	P = - 5.46 + .008*DD°	.90	1,398	17,863
		Pupae	P = - 9.82 + .009*DD°	.81	1,541	10,828
		2^{nd} and 3^{rd}	P = - 5.42 + .008*DD°	.95	1,360	17,051
1979	1	2^{nd} larvae	P = - 0.67 + .011*DD°	.87	518	8,355
		3^{rd} larvae	P = - 1.74 + .010*DD°	.86	655	9,462
		Pupae	P = - 1.47 + .007*DD°	.93	930	20,690
		2^{nd} and 3^{rd}	P = - 0.19 + .008*DD°	.85	611	13,863
	2	2^{nd} larvae	P = - 0.58 + .005*DD°	.89	1,117	40,096
		3^{rd} larvae	P = - 3.29 + .007*DD°	.88	1,251	22,818
		Pupae	P = -14.10 + .013*DD°	.81	1,476	5,972
		2^{nd} and 3^{rd}	P = - 2.10 + .006*DD°	.87	1,206	28,834

Variance - variance of data about a normal curve.

.5 Ep - 50% occurrence of OM immature stages (degree days) emergence from 60 cm of row so comparisons of TSP could be made between larvae, pupae, and adults. Survival from one life stage to the next was calculated by dividing the TSP of the previous life stage by that of the present lifestage (Kiritani and Nakasuji 1967, Helgesen 1969).

In 1978, total larval mortality of 52% and 43% occurred for the first and second generations, respectively (Table 10); mortality was evenly distributed between the second and third instar stages. In 1979 similar values of total larval mortality occurred; however, most mortality occurred during the second instar stage. The presence of Dyfonate in 1978 may have led to greater third instar mortality during both generations.

A major disparity was evident between the two years when pupal mortality was examined. In 1978, mortality of less than zero was obtained for pupae of the first and second generation (second and third generation pupae). (For cases where the mortality is less than zero, error is often attributed to sample error and inaccurate calculation of developmental times (Helgesen and Haynes 1972). Such values often indicate that mortality of the previous class was overestimated and that natural mortality is at some minumum value above zero.) In 1979, 35 and 71% pupal mortality occurred for the first and second generations respectively. This high pupal mortality was unexpected, since observations of OM pupae under laboratory conditions indicated a high survivorship.

All pupae collected during regular field sampling for immature stages were returned to the laboratory for purposes of obtaining parasitoid and adult emergence records. A staphylinid beetle, Aleochara bilineata (Gyll.) was observed in 1978 as having parasitized OM pupae late in the season (Table 11). Maximum parasitism observed for any one sample period was 2.9% (Figure 32A).

Table 10. Total production (TP) and survival (S_i) of various life-stages of the OM from samples of 60 cm of onion row in the research field during 1978-1979.

Year	Stage	First Generation		Second Generation	
		TP/60cm	Si	TP/60cm	Si
1978	Second	44	.61	39	.79
	Third	27	.78	31	.70
	Pupae	21	1.04	22	1.27
	Adult	22		28	
1979	Second	35	.57	57	.43
	Third	20	1.00	25	.96
	Pupae	20	.65	24	.29
	Adult	13		7	

Table 11. Proportional mortality of OM pupae from samples of 60 cm of onion row in 1978.

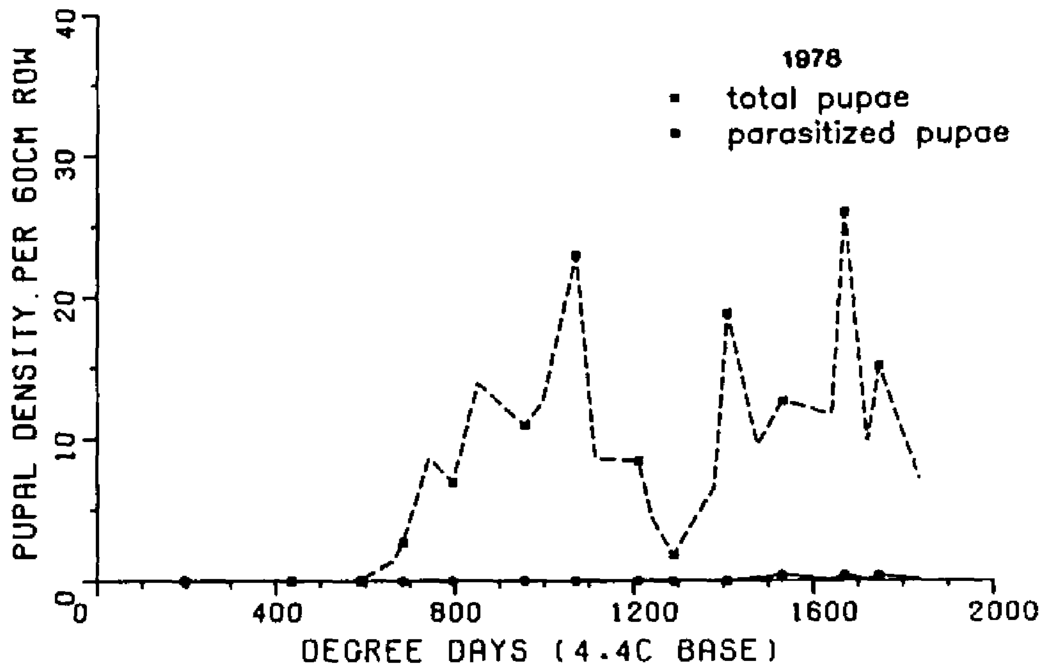
DATE	NUMBER PUPAE	EMERG. FLIES	EMERG. PARAS.	TOTAL MORT	VAR	PARASITE MORT	VAR	UNKNOWN MORT	VAR
171	14	12	0	.1420	.0087	0.0000	.0000	.1420	.0087
173	27	24	0	.1111	.0037	0.0000	.0000	.1111	.0037
177	86	77	0	.1047	.0011	0.0000	.0000	.1074	.0011
180	69	58	0	.1594	.0019	0.0000	.0000	.1594	.0019
184	139	123	0	.1151	.0007	0.0000	.0000	.1151	.0007
191	109	101	0	.0734	.0006	0.0000	.0000	.0734	.0006
194	125	114	0	.0880	.0006	0.0000	.0000	.0880	.0006
199	229	108	0	.0917	.0004	0.0000	.0000	.0917	.0004
201	86	78	0	.0930	.0010	0.0000	.0000	.0930	.0010
207	84	76	0	.1071	.0011	0.0000	.0000	.1071	.0011
209	46	43	0	.1304	.0025	0.0000	.0000	.1304	.0025
213	18	14	0	.2222	.0096	0.0000	.0000	.2222	.0096
220	59	47	0	.2033	.0027	0.0000	.0000	.2033	.0027
222	188	153	0	.1862	.0008	0.0000	.0000	.1862	.0008
226	95	82	2	.1368	.0012	.0211	.0002	.1158	.0011
229	139	126	4	.0935	.0006	.0287	.0002	.0648	.0004
236	117	105	1	.1025	.0008	.0085	.0001	.0940	.0007
238	259	214	4	.1583	.0005	.0154	.0001	.1429	.0005
241	98	81	1	.1735	.0015	.0102	.0001	.1633	.0014
243	151	126	4	.1655	.0009	.0264	.0002	.1391	.0008
249	72	62	1	.1250	.0015	.0139	.0002	.1111	.0014

Total pupal mortality ranged from 7.3 to 22.2% during the season with an average mortality of 11% for the second generation pupae and 15.4% for the third. In 1979, higher OM pupal parasitism by A. bilineata was recorded (Table 12). Up to 20.8% of the OM pupae were parasitized for any one sample date, and parasitism was observed during most of the second and third pupal generation (Figure 32B). Total pupal mortality ranged from 7.7% to 54.1% during the season, with an average mortality of 29.8% for second generation pupae and 42.1% for the third. Higher pupal parasitism in 1979, however, did not completely account for the large difference in total pupal mortality between the two years. Unknown mortality of 25 and 28% occurred in 1979 for the second and third generation pupal populations. Only 11 and 14% unknown mortality occurred in 1978.

Calhoun (1953) reported that 12-36 hours were necessary for the first instar A. bilineata larvae to make an entrance hole in the root maggot pupal case. He reported that the cuticle of the host pupae is always punctured during this process, and the hemolymph flows out, coagulates, and seals the entrance hole. Wadsworth (1915) described entrance holes as .08 to .13 mm in diameter and circular in outline. The sealed hole initially appears opaque white and later turns dark brown in color. Bromand (1980) examined cabbage maggot pupae and reported superparasitism by A. bilineata was common where 46 to 53% of the pupae contained more than one A. bilineata larvae. He counted the number of entrance holes present on the pupae and reported that as the number of holes per pupae increased from 1 to 5, percent emergence of A. bilineata decreased from 57.3% to 4.5%. No information was given about entrance hole density and host pupae survivorship. Wadsworth (1915) reported that the entrance holes can allow

Table 12. Proportional mortality of OM pupae from samples of 60 cm of onion row in 1979.

DATE	NUMBER PUPAE	EMERG. FLIES	EMERG. PARAS.	TOTAL MORT	VAR	PARASITE MORT	VAR	UNKNOWN MORT	VAR
164	26	24	0	.0769	.0027	0.0000	.0000	.0769	.0027
171	18	15	0	.1667	.0077	0.0000	.0000	.1667	.0077
173	6	5	0	.1667	.0232	0.0000	.0000	.1667	.0232
179	57	45	0	.2105	.0029	0.0000	.0000	.2105	.0029
181	32	21	1	.3438	.0071	.0313	.0009	.3125	.0067
184	70	47	2	.3286	.0032	.0286	.0004	.3000	.0030
186	93	49	3	.4731	.0027	.0323	.0003	.4408	.0027
191	141	69	5	.5106	.0018	.0355	.0002	.4751	.0018
194	184	111	7	.3967	.0013	.0380	.0002	.3587	.0013
199	167	114	11	.3174	.0013	.0659	.0004	.2515	.0011
201	71	49	11	.3099	.0030	.1549	.0018	.1550	.0018
206	122	88	12	.2705	.0016	.0984	.0007	.1721	.0012
208	70	40	12	.4286	.0035	.1714	.0020	.2572	.0027
213	48	28	8	.4167	.0051	.1667	.0029	.2500	.0039
215	24	13	5	.4583	.0103	.2083	.0069	.2500	.0078
219	83	51	8	.3855	.0029	.0964	.0010	.2891	.0025
223	72	33	9	.5417	.0034	.1250	.0015	.4167	.0034
227	75	40	4	.4667	.0033	.0533	.0007	.4134	.0032
229	52	34	4	.3462	.0044	.0769	.0014	.2693	.0038
235	86	45	11	.4767	.0029	.1279	.0013	.3488	.0026
237	105	62	16	.4095	.0023	.1524	.0012	.3571	.0018
241	40	27	7	.3250	.0055	.1750	.0036	.1500	.0032
243	24	15	4	.3750	.0098	.1667	.0058	.2083	.0069



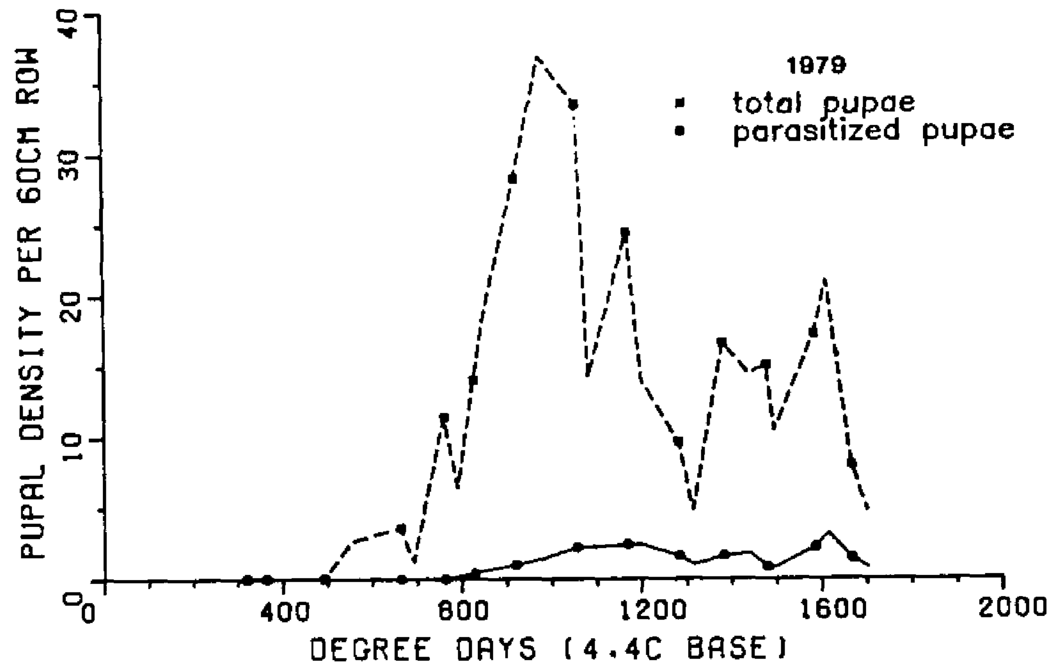


Figure 32. Comparison of total OM pupae and number of pupae parasitized by A. bilineata from samples of 60 cm of onion row in 1978 and 1979.

nematodes or fungi to enter the pupae; therefore, host mortality can result.

All pupae collected in 1979 from the commercial study fields and Dyfonate-treated and non-treated area of the research field, were examined for presence of entrance holes made by A. bilineata. Some pupae were found with unsealed entrance holes; others were found with entrance holes in various stages of the sealing process (Figure 33). Most pupae were superparasitized (multiple entrance holes present). Superparasitism in the non-treated area of the research field was particularly evident and up to 20 entrance holes were observed for a single OM pupae. Pupal mortality and percent parasitism in this field were similar to what had been reported during the regular immature stage sampling (Table 13). Average pupal mortality over all dates in the Dyfonate-treated area of the research field was 20.9%. Pupal mortality in commercial study fields where Dyfonate and foliar sprays had been applied ranged from 12.8% to 13.9%.

Analysis of variance and Duncan's multiple range test were performed on the pooled data for all fields except field 3 (only two sample dates were available for field 3). Between-field differences were examined for percent parasitism by A. bilineata, percent of pupae with entrance holes, and percent total pupal mortality. Although significant differences in percent parasitism between two groups of fields was evident, no specific biological explanation could account for the groupings (Table 14a). When numbers of pupae with entrance holes were examined, more significant differences were found (Table 14b). Pupae from the treated and non-treated areas of the research field had significantly more entrance holes than pupae from the commercial fields. Percent total mortality of pupae was significantly higher in the non-treated area of the research field when compared to all other fields examined (Table 14c).

Figure 33A. Photograph of an OM pupa showing the entrance hole made by A. bilineata, only a few hours after the cuticle was penetrated.

Figure 33B. Photograph of entrance hole of A. bilineata in OM pupa, showing the contents of the pupa protruding from the hole.

Figure 33C. Photograph of the entrance hole of A. bilineata partly sealed over.

Figure 33D. Photograph of the sealed entrance hole of A. bilineata on an OM pupa.

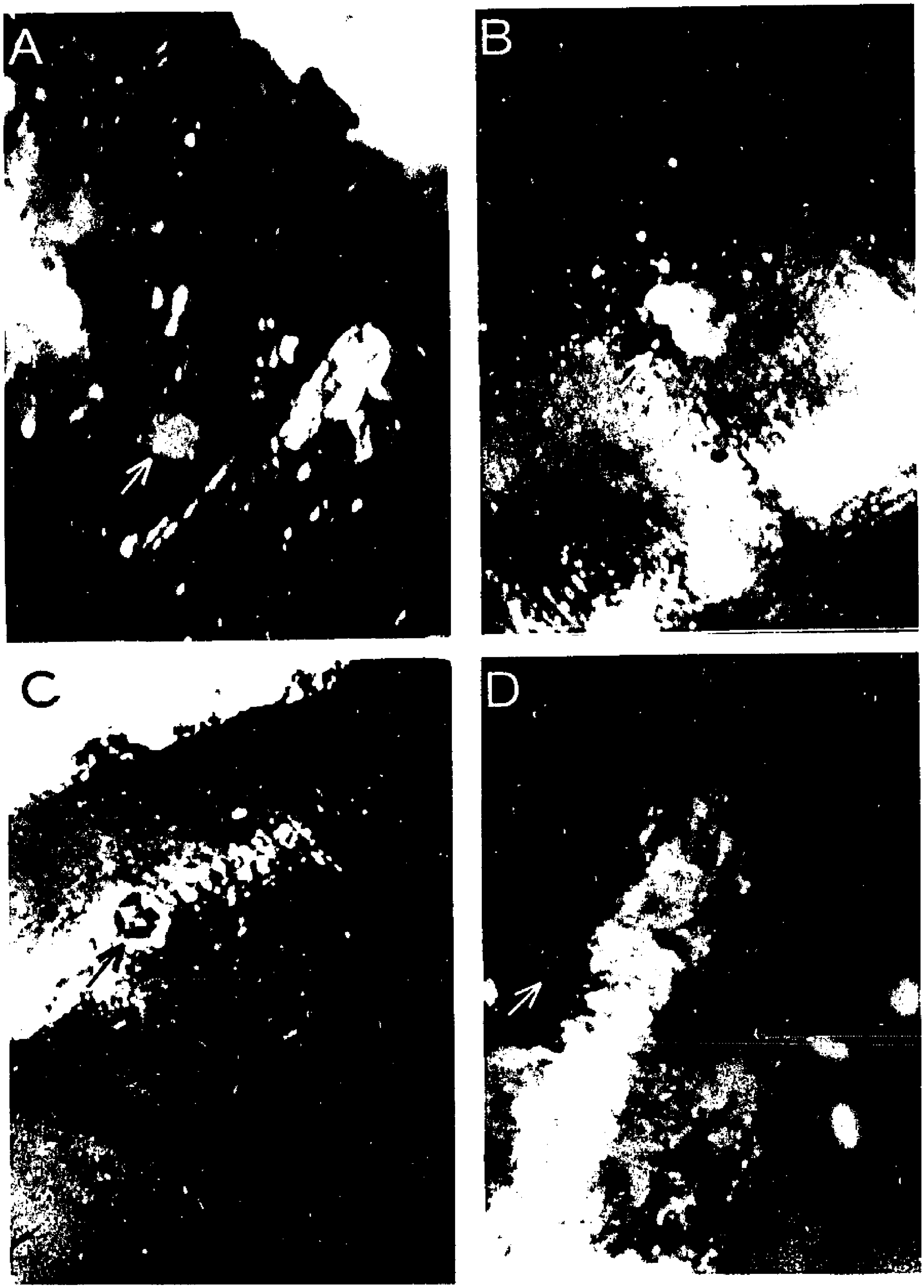

A
B
C
D

Table 13. Proportion OM pupal mortality and proportion of OM pupae with entrance holes made by A. bilineata from samples of 30 cm of onion row in commercial study fields of Grant, Michigan, in 1979.

DATE	FIELD	N	PROP. PARAS.	VAR	PROP. ENT. HOLES	VAR	PROP. TOTAL MORT	VAR	PROP. UNKNOWN MORT	VAR
186	5	106	0.0000	.0000	.0909	.0008	.1724	.0013	.0815	.0007
186	6	81	0.0000	.0000	.1320	.0014	.1618	.0017	.0298	.0004
186	7	396	.0152	.0000	.2800	.0005	.3150	.0005	.0350	.0001
186	7D	303	.0412	.0001	.6700	.0007	.4900	.0008	.1800	.0004
191	1	73	.0060	.0001	.1180	.0014	.1918	.0021	.0738	.0009
191	2	55	0.0000	.0000	.0820	.0014	.1623	.0025	.0803	.0013
191	3	56	.0020	.0000	.1310	.0020	.2000	.0029	.0690	.0011
191	4	122	.0060	.0000	.1630	.0011	.2540	.0016	.0910	.0007
191	7	46	.0210	.0004	.3180	.0047	.2390	.0040	.0790	.0002
191	7D	235	.0520	.0002	.4820	.0011	.5021	.0011	.0201	.0001
200	1	41	0.0000	.0000	.0900	.0020	.1463	.0030	.0563	.0013
200	2	80	.0040	.0000	.0880	.0010	.1250	.0014	.0370	.0004
200	6	24	.0080	.0003	.1140	.0042	.1820	.0062	.0680	.0026
200	7	60	.0310	.0005	.1489	.0021	.1200	.0018	.0289	.0004
200	7D	169	.1090	.0006	.3880	.0014	.4000	.0014	.0120	.0001
206	7	39	.0480	.0012	.0890	.0021	.1438	.0032	.0548	.0013
206	7D	168	.1160	.0006	.1600	.0008	.2619	.0012	.1019	.0005
222	1	65	0.0000	.0000	.0910	.0013	.0923	.0013	.0013	.0000
222	2	100	.0010	.0000	.0760	.0007	.1200	.0011	.0440	.0004
222	4	113	0.0000	.0000	.0410	.0003	.2000	.0014	.1590	.0012

Table 13. (continued)

DATE	FIELD	N	PROP. PARAS.	VAR	PROP. ENT HOLES	VAR	PROP. TOTAL MORT	VAR	PROP. UNKNOWN MORT	VAR
222	5	54	.0040	.0001	.0910	.0015	.1290	.0021	.0380	.0007
222	6	84	.0010	.0000	.0390	.0004	.0714	.0008	.0324	.0004
222	7	221	.0220	.0001	.0820	.0003	.1409	.0005	.0589	.0003
222	7D	170	.0890	.0005	.2730	.0012	.3200	.0013	.0470	.0003
229	1	100	0.0000	.0000	.0460	.0004	.0870	.0008	.0410	.0004
229	2	97	.0060	.0001	.0710	.0007	.1180	.0011	.0470	.0005
229	3	118	.0080	.0001	.0730	.0006	.1410	.0010	.0680	.0005
229	4	66	0.0000	.0000	.0420	.0006	.0700	.0010	.0280	.0004
229	5	135	.0060	.0000	.0690	.0005	.1320	.0008	.0621	.0004
229	6	92	.0080	.0001	.0640	.0007	.0980	.0010	.0340	.0004
229	7	108	.0360	.0003	.1630	.0013	.2100	.0015	.0470	.0004
229	7D	181	.1420	.0007	.4260	.0014	.4760	.0014	.0500	.0003

Table 14. One-way analysis of variance and Duncan's multiple range test for three observations on OM pupae collected from study fields in 1979. All percentages were transformed by arcsin square root before analysis.

a) Comparison of percent of OM pupae parasitized by A. bilineata.

Variable	DF	Sum of Squares	Mean Square	F
Percent parasitism	6	22,563.4	3,760.5	3.3*
Residuals	23	25,955.6	1,128.5	
Total	29	48,518.9		

*(p<.05)

Group	Field	% Parasitism[A]
1	7N	9.15a
2	7	2.8ab
3	1	.2b
4	2	.3ab
5	4	.2b
6	5	.3ab
7	6	.4ab

b) Comparison of percent of OM pupae with entrance holes of A. bilineata.

Variable	DF	Sum of Squares	Mean Square	F
Percent with Entrance Holes	6	18.5	3.10	5.74***
Residuals	23	12.4	.54	
Total	29	30.9		

***(p<.001)

Group	Field	% with Entrance Holes[A]
1	7N	39.9a
2	7	18.0ab
3	1	8.6bc
4	2	7.9bc
5	4	8.2bc
6	5	8.4bc
7	6	11.7c

[A]means followed by the same letter are not significantly different (α=.05)

Table 14. (continued)

c) Comparison of total percent pupal mortality.

Variable	DF	Sum of Squares	Mean Square	F
% Total mortality	6	6.2	1.1	4.7**
Residuals	23	5.1	.2	
Total	29	11.4		

**(p<.01)

Group	Field	% Total Mortality[A]
1	7N	49.0a
2	7	20.9b
3	1	13.1b
4	2	13.1b
5	4	17.5b
6	5	14.4b
7	6	12.8b

[A] means followed by the same letter are not significantly different (α=.05)

To determine if parasitism or percent of pupae with entrance holes explained the variability in total pupal mortality over these dates, least-squares regression analysis was performed. Analysis of percent pupal parasitism versus percent total mortality gave an r^2 of .48. Regression of the number of pupae with entrance holes versus total pupal mortality for all fields gave an r^2 of .87 (Figure 34). From these results several conclusions were made. Although successful parasitism by A. bilineata was low, considerable OM pupal mortality still occurred. Superparasitism often occurred and was expected to be more prevalent when host densities were low compared to parasitoid population density. The impact of A. bilineata on OM pupal populations needed to be examined in terms of effective pupal mortality rather than being limited to successful parasitoid emergence. A granular application of Dyfonate insecticide significantly decreased potential OM pupal mortality by reducing parasitism by A. bilineata. Foliar applications of insecticides could also have reduced total pupal mortality by decreasing parasitoid densities.

E. Diapause and Overwintering Mortality

To estimate the incidence of diapause, the soil beneath emergence traps was removed and sifted following a six week period from time of trap placement. All recovered pupae were returned to the laboratory for observation. A dissecting microscope was used to examine pupal cases. A light beam directed from underneath allowed for easy examination of the contents of each pupae. Most dead pupae were found to contain dried remnants of tissue which had tended to aggregate in one area of the pupal case. For some pupae no dried remnants were visible, but viable pupae could easily be identified due to the

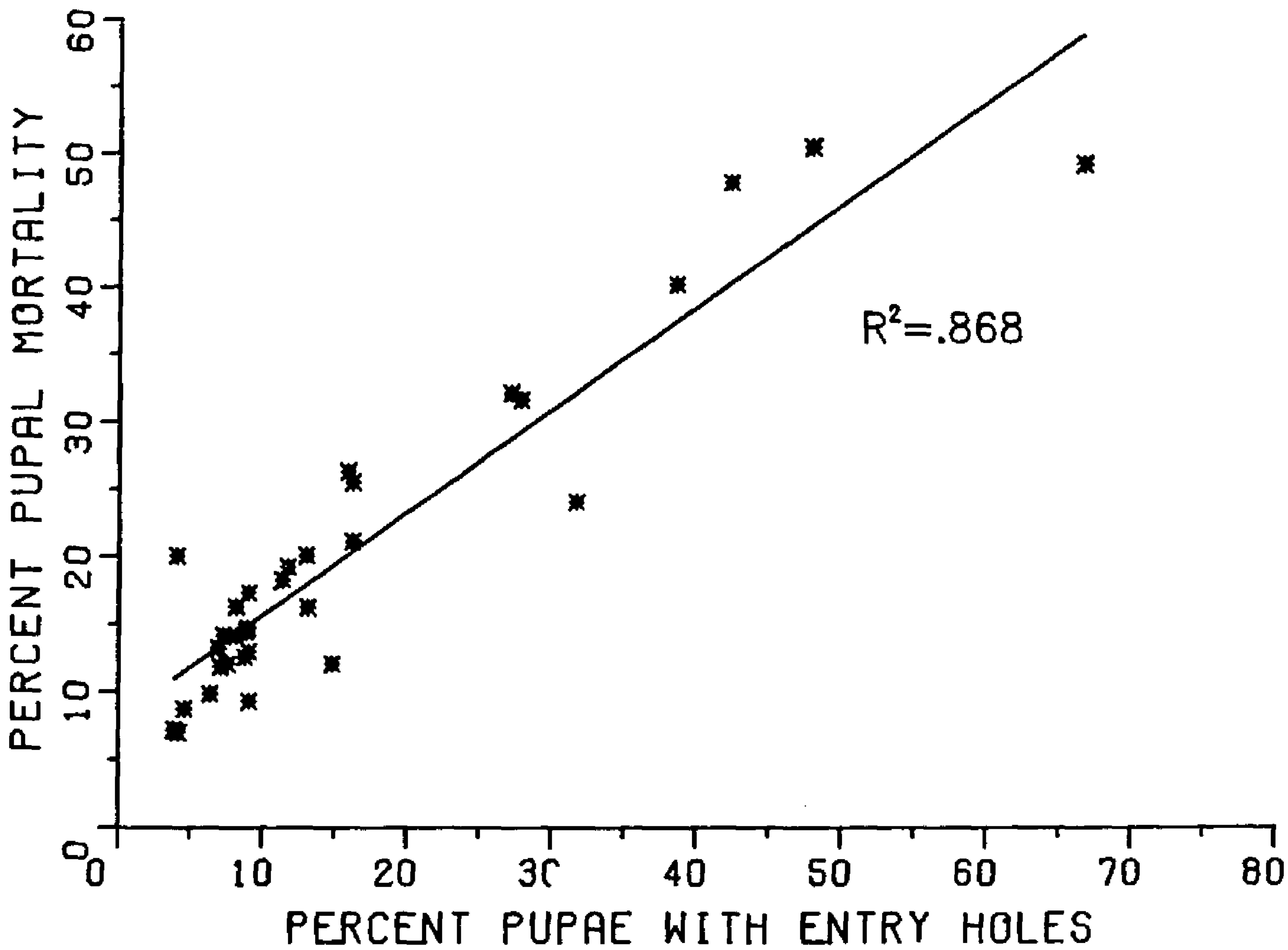


Figure 34. Relationship between percent of OM pupae with entrance holes of A. bilineata and percent OM pupal mortality for study fields in 1979.

presence of a partly-formed adult OM. The number of viable pupae recovered were divided by the number of emerged adults to obtain a percent of viable pupae that did not emerge (Table 15). Following first generation adult emergence, no viable pupae were observed to remain in the soil in 1979. An average of 3% viable pupae remained following second and third generation adult emergence in both 1978 and 1979. All pupae recovered were kept in the laboratory at 20^{o}C under conditions of 100% relative humidity for records of emergence. No emergence during the summer occurred. By late November 1979, only two adult OM had emerged from pupae originally described as viable.

The viable pupae recovered from underneath emergence traps were assumed to have been in diapause or in quiescence. A high percentage of emergence from diapausing pupae would not have been expected later in the year since a period of low temperatures is necessary for optimum emergence to occur (Workman 1958). Pupae in a state of quiescence, however, would have been expected to emerge after a delayed period of time. Diapause in the OM can be described as a facultative process whereby arrested development is due to environmental conditions (Ellington 1963). Many authors have reported diapause frequencies for the OM in different areas of the world. An excellent review of these data was given by Ellington (1963) and Loosjes (1976). Diapause frequencies reported for the OM in onion growing areas of New York State may be the best set of data to compare Michigan records to, since climatic conditions are similar. Ellington (1963) reported diapause frequencies of 0-4%, and 11% for New York State following first and second generation OM emergence respectively. The data for Michigan and New York contrast considerably with that of Quebec (Canada). Perron and LaFrance (1961) reported diapause frequencies of

Table 15. Percent of viable OM pupae retrieved from underneath emergence traps and buried OM larvae following eight weeks of adult.

Year	Emergence Period	Collection Site	Emerged Adults	Total Pupae	Viable Pupae Remaining	% Viable Pupae Remaining
1978	Second	Emergence Traps	166	180	6	3.6 ± 1.4
	Third	Emergence Traps	151	162	3	1.9 ± 1.1
1979	First	Emergence Traps	108	114	0	0
	Second	Emergence Traps	69	76	4	5.8 ± 2.8
		Buried Larvae	421	443	9	2.1 ± 0.6
	Third	Emergence Traps	68	74	3	4.4 ± 2.4

8, 67, and 99%, respectively, for the first, second and third generation for the southern area of the province.

Results of studies on survival of overwintering pupae revealed an average survival of 87.8% for all collection dates, depths, field locations and years. Analysis of variance revealed no significant differences in pupal survival between any of the conditions that were tested for. All data for the different collection dates in 1978 were pooled for each depth, and the data for 1978 and 1979 were summarized to obtain an average overwintering survival estimate (Table 16). This information agrees with Loosjes (1976) who reported that pupae buried in the field in December had a percentage emergence similar to that in the laboratory. Abiotic parameters during the winter appear to have little effect on pupal survival.

In 1978, a braconid parasitoid, *Aphaereta pallipes* (Say), emerged from an average of 10% of the overwintering pupae. Between 4 and 12 adult male and female parasitoids emerged from each parasitized pupal case. All pupae for the 1978 overwintering study were obtained from field samples of third instar larvae and pupae. Samples consisted of larval infested cull onions from the research field. The number of overwintering pupae parasitized was probably underestimated, because field samples were conducted in October, and additional parasitism may have occurred after this date. Recent studies by Groden (1980, unpublished) revealed a high percentage parasitism of OM larval populations in the fall by *A. pallipes* in areas where insecticides had not been applied. Parasitism of OM larvae by *A. pallipes*, however, have only been reported as occurring during the last larval generation (Salkeld 1959, Perron 1972, Loosjes 1976).

Table 16. Overwintering survival of OM pupae placed at different soil depths and in various locations in 1978-1979.

Depth/location	Overwintering Pupal Survival	
	1978	1979
Depth		
Soil Surface	--	93.5 ± 5.4
3 cm	89.1 ± 4.5	85.7 ± 5.8
8 cm	93.6 ± 3.2	86.5 ± 5.6
13 cm	91.7 ± 3.7	86.1 ± 5.7
18 cm	90.9 ± 4.0	92.1 ± 4.4
23 cm	82.2 ± 7.2	--
28 cm	84.3 ± 6.6	--
33 cm	89.6 ± 5.7	--
Location		
Commercial fields	--	87.8 ± 2.1
Research Field-Treated	--	88.0 ± 3.4
Research Field-Non-treated	--	89.3 ± 3.4
Border Areas	--	85.1 ± 2.9
Avg:	89.2 ± 1.8	86.8 ± 1.25
Overall Avg:	87.8 ± .98	

In 1980, all pupae used in the overwintering study were obtained from a laboratory culture. No records of pupal parasitism or predation were observed for any of the conditions examined. Significant predation or parasitism of field populations may have occurred early in the fall, however, before study pupae were buried. Perron (1972) reported an average of 16.4% parasitism of overwintering OM pupae by A. pallipes and A. bilineata during 1966-1970 in southern Quebec. Recent laboratory studies by Carruthers (1981), however, have shown that current pesticides cause high mortality of natural enemies of the OM. Ritcey (1976, pers. comm., Univ. of Guelph) stated that less than 10 parasitized pupae were observed from the thousands of field collected pupae recovered in commercial fields of Ontario. Parasitism and predation of overwintering pupae may therefore be severely limited by present onion production practices.

F. Distribution of Onion Plant Damage

Onion plots that were "mapped" on a regular basis for onion plant damage were analyzed for 1) distribution of damage through time and 2) the average time that a damaged onion remained in the field.

From the accurate recording of the fate of each onion through the season, it was possible to calculate the distribution of damage over time. Records of onion damage for 1978 were summed for each date and each plot to obtain the rate of percent onion plant damage for all damage that occurred during the season (Figure 35). Two distinct periods of damage were found. These damage periods were found to coincide with the first and second generation larval broods. Some third generation damage was also evident after day 240. Up to 65% of the total damage that occurred during the season was caused by the first

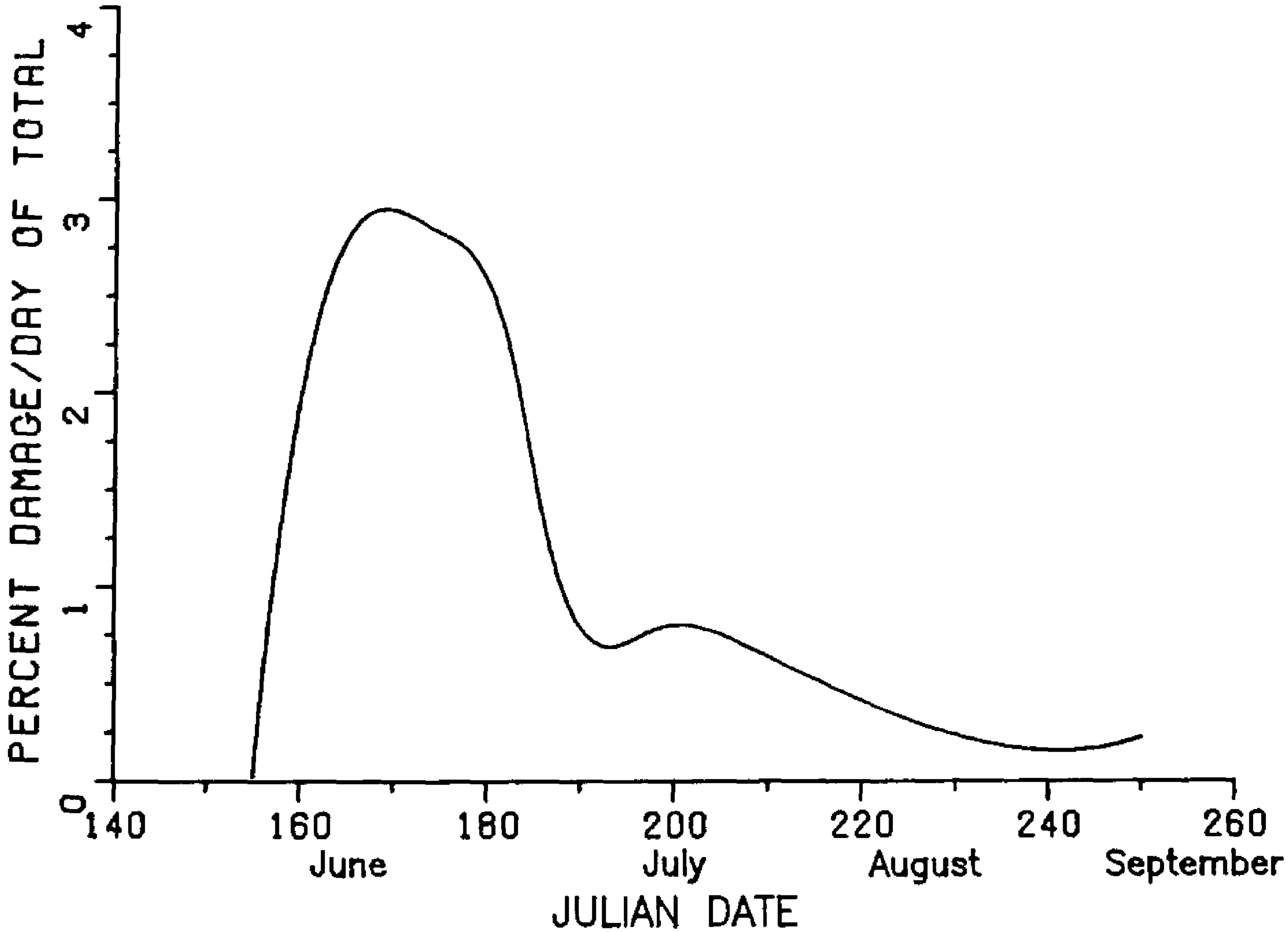


Figure 35. Onion maggot plant damage per day as a percent of total damage during the 1978 growing season.

generation brood. This information agrees with Loosjes (1976) who reported that most damage to onion plants occurred during first generation larval attack. High first generation damage is probably a result of frequent migration by OM larvae in the spring when onion plant volume is less. Later in the season, when onion bulb volume is greater, OM larval migration is less frequent and as a result less onion plant damage occurs.

Thirty onions from each plot during both years were randomly selected for the purpose of determining the average length of time an onion remained in the field following initial damage. Since the condition of each onion was recorded at each monitoring date, and because missing onions could be determined, the average residency time of a damaged onion could be calculated by comparing subsequent recording periods. For most onions that were attacked, the condition changed from healthy to damaged to dead and, finally, to missing. Early in the season, onions recorded as healthy one week were found to be missing the next, this indicated that the residency time of the damaged onion was less than or equal to a week. Least-squares regression analysis of the logarithm (base 10) of degree-day period of initial damage versus the length of time a damaged onion was still present revealed a linear relationship (Figure 36). Onions damaged later in the season remained in the field as damaged onions much longer than seedling onions damaged early in the season. This would be expected, since the volume of a seedling onion is less and dehydration and soft rot would be expected to destroy the onion quickly. An onion damaged during the second generation (greater than 900 degree-days) would therefore be expected to remain in the field longer than 300 degree-days or two weeks. In most cases, onions damaged during the second generation would remain in the field up to harvest.

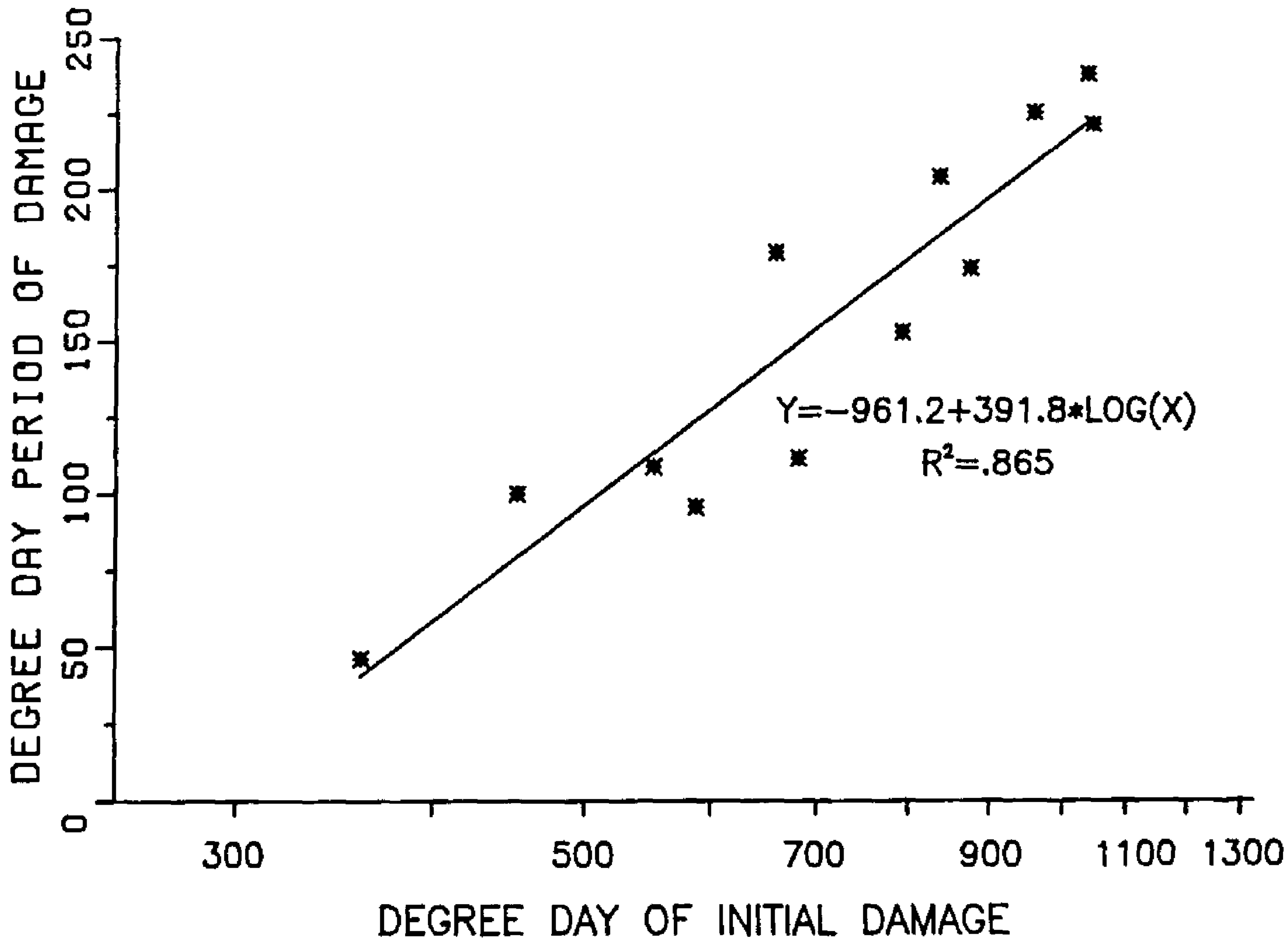


Figure 36. Relationship between degree day of initial OM damage and the degree day period that a damaged onion remains visible in the field.

To investigate the spatial distribution of damage to onions by the OM, the plots of onions that were mapped in 1978 and 1979 were analyzed. A computer program was used to analyze the distribution of respective classes of onions using quadrat sampling techniques. The "sample" computer program (Dimoff 1979) allows the user to select any number or size of quadrats. Sample density and descriptive statistics are provided for samples taken from an x, y coordinate file of the study organism. Statistics provided by the program include the variance to mean ratio and Morisita's index. These indices were selected for use in spatial pattern analysis because they are well known and commonly used by biologists. Variance to mean ratio $^{(I)}$ is equal to:

$$I = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{\bar{x}\ (n-1)} = \frac{S^2}{\bar{x}}$$

(after Elliott 1977). This index of dispersion can be tested for significant departures from unity by reference to a table of X^2 (chi-squared) values where:

if the X^2 value is less than expected, a regular distribution is suspected; if greater than expected, a contagious distribution is suspected. Morisita's index (Morisita 1959) was calculated by:

$$I_\delta = \frac{\sum_{i=1}^{n} (x_i)^2 - \sum_{i=1}^{n} x_i}{(\sum_{i=1}^{n} x_i)^2 - \sum_{i=1}^{n} x_i}$$

Departures from randomness are judged significant ($P < .05$) when:

$$X^2_{\alpha,n-1} = I_\delta(\sum_{i=1}^{n} x_i - 1) + n - \sum_{i=1}^{n} x_i$$

are outside 5% significance levels for X^2 (Elliott 1977).

Each plot of x,y onion plant coordinates was sampled by fixing the x sample coordinate for a particular row and randomly selecting the y coordinate. In this way, sampling was conducted randomly down each onion row (Figure 37A). Coordinates of different strata of damaged onions for sampling purposes were selected by specifying the onion condition desired. The width of the quadrat selected was fixed at 8 inches (20 cm) and quadrat lengths of 6, 12, 24, and 48 inches (15, 30.5, 61 and 122 cm) were selected for each sample run. Five, ten and fifteen quadrats of each size were sampled from each plot for both years.

A summary of the spatial pattern analysis is presented for plot 1 in 1978 and 1979 (Table 17). For both plots significant departure from randomness (tending towards contagious) was revealed by I and I_s (Morisita's index) for dates later in the season. Early in the 1978 season (June 15), only the 24" (61 cm) and 18" (122 cm) sample size could be evaluated; a random spatial distribution for plant damage for this date was indicated. In 1979, plot 1 was not treated with a granular insecticide and damage occurred much earlier in this plot over the previous year. A random distribution of plant damage was revealed for most quadrat sizes for the first two dates during this year. In most instances, the variance to mean ratio and Morisita's index indicated the same spatial distribution for all plots, dates, and sample sizes. There were little to no differences between quadrat size and number for determining significant departure from a random spatial distribution of damaged plants. In some cases, a quadrat length of 6" (15 cm) failed to sample any individuals, and indices could not be calculated.

Several authors have discussed the problems of using quadrats for

Figure 37A. Use of the Sample program for selection of quadrats of OM plant damage in onion mapping plots.

Figure 37B. Graphical representation of method used to obtain nearest neighbor measurements NORP and NN for calculation of Batcheler's Ratio B.

Figure 37C. Graphical representation of method used to obtain nearest neighbor measurements r_A for calculation of Clark and Evans' dispersion statistic.

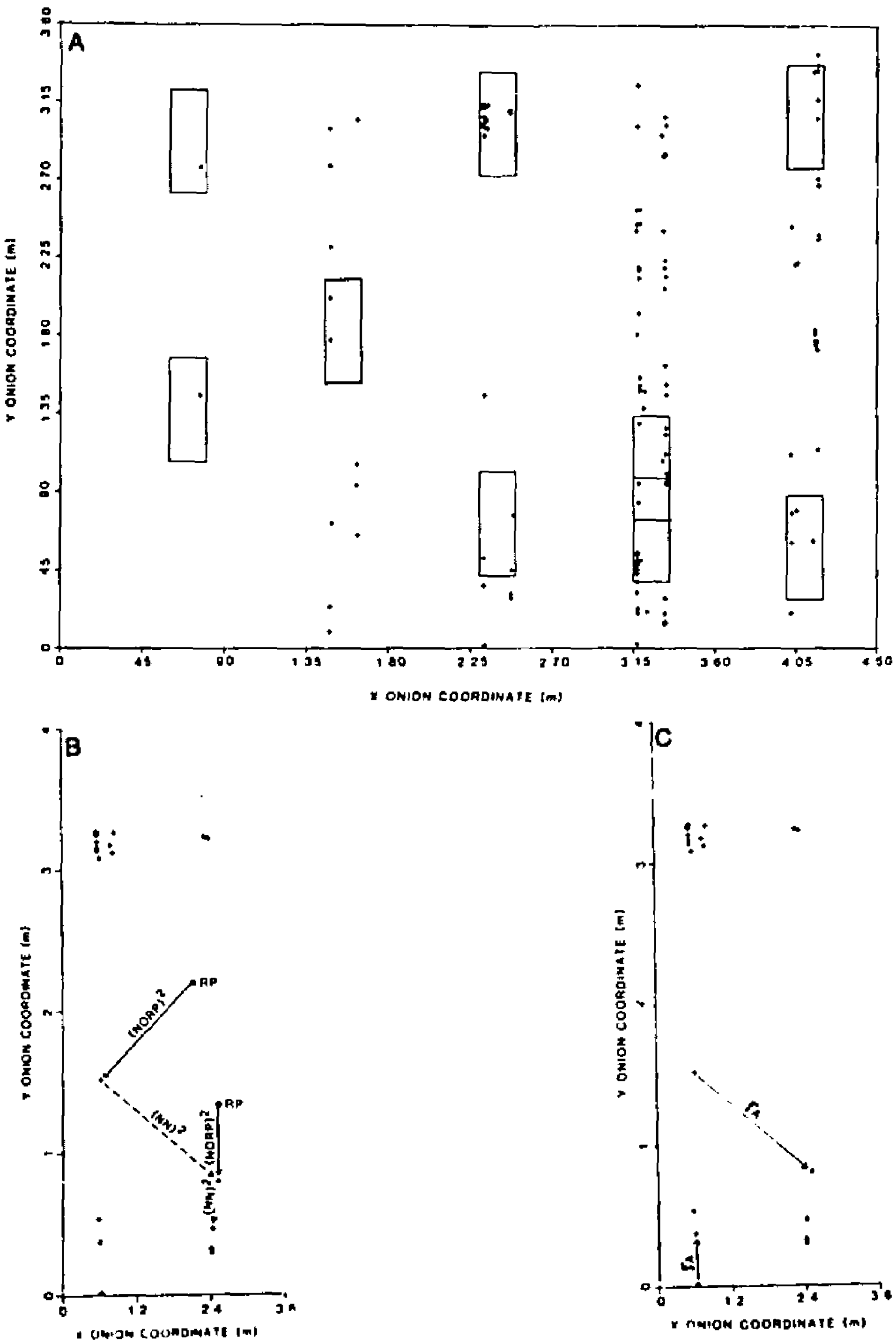

A
Y ONION COORDINATE (m)
X ONION COORDINATE (m)
B
(NORP)²
(NN)²
RP
C
f_A

Table 17. Spatial distribution of OM plant damage determined from use of variance mean ratio (I) and Morisita's index (I_s) for various quadrant dimensions, sample size and dates in 1978-1979.

Plot	Date	No. of Onions	I				I_s			
			8x6	8x12	8x24	8x48	8x6	8x12	8x24	8x48
1-Dyfonate	06/15/78	4	-	-	c	r	-	-	c	r
	06/22/78	181	c	c	c	c	c	c	c	c
	06/29/78	218	c	r	c	c	c	r	c	c
	07/05/78	260	c	c	c	c	c	c	c	c
	07/11/78	301	r	c	c	c	r	c	c	c
	07/17/78	403	c	r	c	c	c	c	c	c
1-no Dyfonate	05/30/79	34	-	r	r	r	-	r	r	r
	06/06/79	83	c	r	r	c	c	c	r	c
	06/13/79	235	c	c	c	c	c	c	c	c
	06/20/79	516	c	c	c	c	c	c	c	c
	07/04/79	722	c	c	c	c	c	c	c	c
	07/17/79	767	r	r	c	c	c	r	r	c

r-random

c-contagious

evaluation of spatial patterns of organisms (Elliott 1977, Pielou 1977, Lampert 1980). If the quadrat size is too large or too small in relation to the size of the clumps of individuals, the spatial pattern may be incorrectly determined. As quadrat size increases, the mean and variance will also usually increase, and indices of dispersion are, to some extent, always affected. To overcome these problems, nearest-neighbor techniques have been developed to test for departure from randomness for spatial patterns of stationary organisms. These techniques have been used extensively for measuring the spatial distribution of plants (Greig-Smith, 1957).

Two computer programs were used to take nearest-neighbor measurements of onion plant damage in individual rows of each mapping plot (Appendix G). One method (Clark and Evans 1954) finds the nearest neighbor (onion plant) to a point previously selected. The distance from a nearest neighbor to the organism is then measured such that:

$$R = r_A / r_E$$

where: r_A = mean distance of the nearest neighbor

to a randomly selected individual, and

r_E = onion distance from random individuals to their nearest neighbor

if the population were distributed at random

[$1/(2\sqrt{p})$, p=population density].

This index is judged significantly different from random when:

$$C = (r_A - r_E) / sr_E$$

is greater than 1.96 ($P < .05$)

where:

N = number of distances measured

sr_E = standard error of r_E calculated by .26136/[N_p

(p = population density)

The second method involved the use of Batchelor's B index (Batchelor 1971) as modified by Lampert (1980). This method also first requires a random point to be selected; the distance from this random point to a nearest-neighbor is recorded. This value is squared and divided by the square distance from a random individual to the nearest individual such that:

$$B = \frac{NORP}{NN}$$

where: NORP = the mean squared nearest-neighbor distance

to a random point, and

NN = the mean squared nearest neighbor distance to a random individual.

Significant departure from randomness is indicated when B' is greater than F with $2_{n_{NORP}}$ and $2_{n_{NN}}$ degrees of freedom (Moore 1954).

Individual rows within each plot were sampled by these two methods rather than a composite plot of five rows (Figure 37B-C). This procedure insured that row effects were minimized. Damaged onions within the row were selected for sample runs by first specifying the onion condition desired. Thirty, fifty, and one hundred measurements were taken for selected rows.

Pearson's bivariate correlation analysis (SPSS-Nie et al. 1975) was used to test for significant correlation between onion plant density and the index being measured. No significant correlations were indicated for either index (Table 18). Lack of correlation between population density and index of dispersion for all sample sizes is desirable since an index of dispersion should not be influenced by variation in sample size, number of samples, sample mean, and total numbers in

Table 18. Pearson's correlation coefficient of Batcheler's ratio (B') and Clark and Evans statistic (R) with density for different sample sizes.

	B'			R		
sample size	30	50	100	30	50	100
coefficient r	.009	.264	.257	.112	.310	.213
α	.487	.111	.115	.312	.194	.185

the sample (Elliott 1977). A summary of the spatial pattern described by these indices is given for two representative rows in 1978 and 1979 in Table 19. In 1978, no onion plant damage had occurred within the row by the first sample date and the spatial pattern could not be described. In 1979, however, no significant departure from a random distribution was indicated early in the season by both indices. For both years, significant departure from randomness (towards contagious) was indicated later in the season.

Carruthers (1979) reported that variability in his results on spatial patterns of onion plant damage may have been due to pesticide-induced mortality. He suggested that initial oviposition and resultant damage quickly evolved from a random distribution to an aggregated distribution in pesticide-treated fields because of higher survival rates in areas where the pesticide was ineffective. To test this hypothesis, quadrat and nearest-neighbor samples were taken on onion rows in a Dyfonate- and non-Dyfonate-treated plot in 1979. Morisita's index of dispersion was calculated for samples of damaged plants by taking ten quadrats of 8" (20 cm) by 24" (61 cm) for each date. Batchelor's ratio, B', was calculated for distance measurements of damaged onion plants by taking 100 samples from each row of each plot. Index values for each sample method were plotted against sample date for both areas (Figure 38). For both indices, a value of greater than one indicated significant departure from randomness. The spatial pattern of damaged onion plants in the Dyfonate-treated areas tended towards a contagious distribution a week earlier than damaged plants in the non-Dyfonate area. For both areas, indices decreased later in the season, approaching a random distribution.

Changes in the density of a population often lead to changes in the spatial

Table 19. Spatial distribution of OM plant damage determined from use of Batcheler's ratio (B') and Clark and Evans Statistic (R) for various sample sizes and dates in 1978-1979.

Row	Date	No. of Onions	B'			R		
			30	50	100	30	50	100
Plot 1-Row 2	06/15/78	0	--	--	---	--	--	---
	06/22/78	39	c	c	c	c	c	c
	06/29/78	76	c	c	c	c	c	c
	07/05/78	95	c	c	c	c	c	c
	07/11/78	101	c	c	c	c	c	c
	07/17/78	120	c	c	c	c	c	c
Plot 1-Row 2	05/30/79	5	r	r	r	r	r	r
	06/06/79	9	r	r	r	r	c	r
	06/13/79	41	c	c	c	c	c	c
	06/20/79	114	c	c	c	c	c	c
	07/04/79	155	c	c	c	c	c	c
	07/17/79	166	c	c	c	c	c	c

r-random

c-contagious

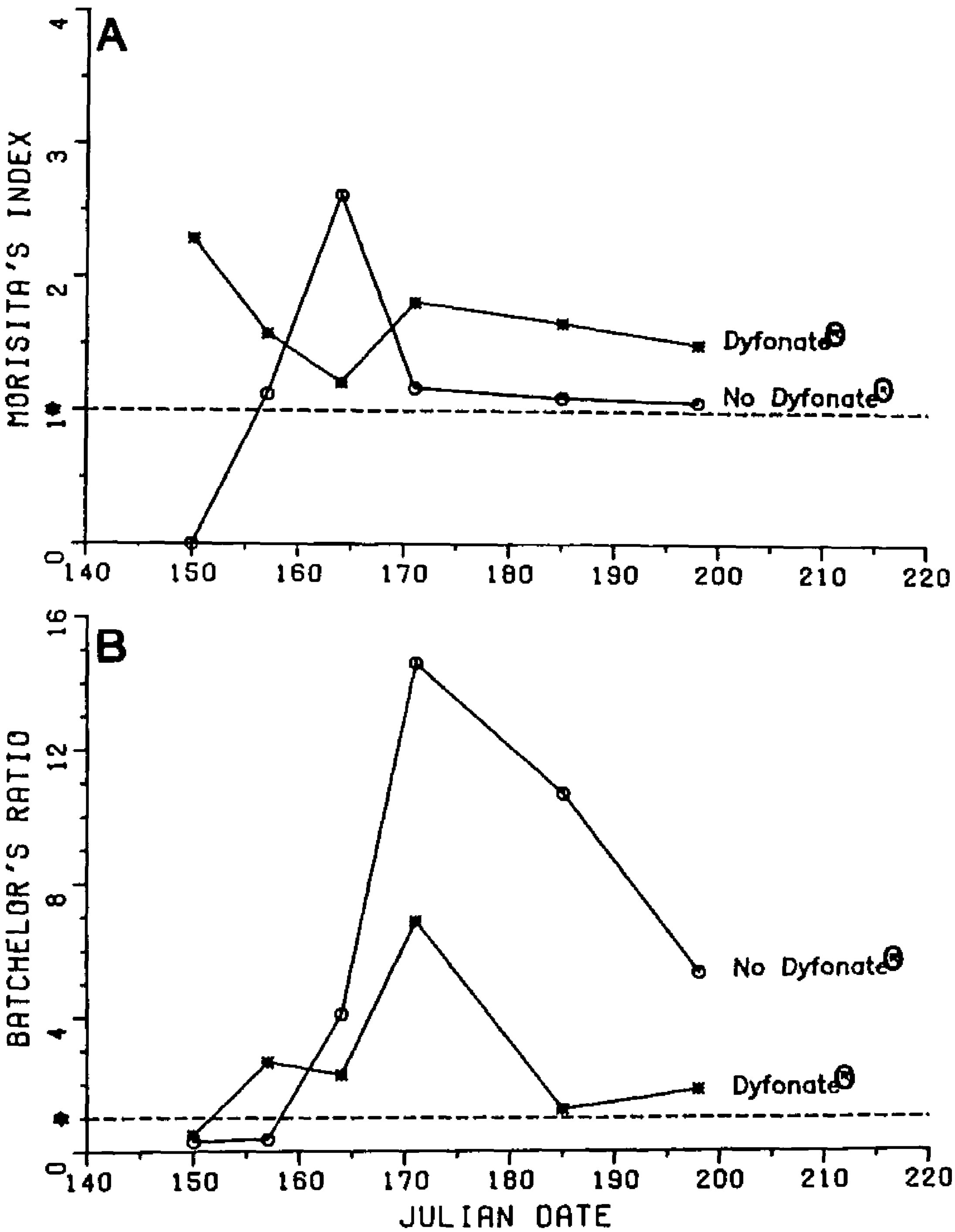


Figure 38A. Morisita's index of dispersion for quadrat samples of OM plant damage in a Dyfonate and no-Dyfonate plot during the 1979 growing season (*--- distribution is contagious above this line).

Figure 38B. Batcheler's ratio of dispersion for nearest neighbor sampling of OM plant damage in a Dyfonate and no-Dyfonate plot during the 1979 growing season (*---distribution is contagious above this line).

distribution. When a population is sparse, the distribution often fits a random pattern, since few individuals occur in a sample unit (Southwood 1978). The spatial distribution of populations of organisms have often been reported to initially appear random when low densities are present and later to depart from randomness as the density increases (Finney 1941, Davis and Wadley 1949, Iwao 1956, Harcourt 1961). This situation may also be true for onion plant damage. A random distribution was described early in the season when initial plant damage was low; the spatial pattern significantly departed from random later in the season as damage increased.

Carruthers (1979) reported similar results when comparing the spatial distribution of initial centers of onion plant damage to the spatial distribution of damaged onion plants later in the season. He reported that initial plant damage fit a random distribution, but as time progressed more highly-aggregated patterns of damage became apparent. The highly aggregated pattern later in the season is due to adults preferring to oviposit on previously-damaged onions, such that centers of damage gradually increase with time. As the density of damaged plants increases, the distribution may tend toward Poisson again. This may be due to clumps of damage increasing late in the season such that the areas of these clumps begin to approach each other.

G. Effect of Volunteer Onions on the Spatial Distribution of Onion Plant Damage

Since two of the "mapping" plots of onions were situated over areas of volunteer onions, the effect of these volunteer onions on the spatial distribution of onion plant damage could be evaluated. The x,y coordinate of each volunteer onion was plotted along with the coordinates of each damaged onion in the plot. This procedure was performed for each sample date and plot in 1979. A representative plot (plot 3) is an example of where the location of each volunteer onion and all damaged or missing onions are plotted for each monitoring date (Figure 39). It is obvious from visual examination that onion plant damage occurred more often where volunteer onions were present. This was also the case for plots 1 and 2 which were located in the non-Dyfonate-treated area of the research field. Initial plant damage primarily occurred in the vicinity of the volunteer onions, and continued monitoring indicated that these areas of damage increased in size through the season. Plot 4 on the Dyfonate-treated side of the research field had no volunteers present. Up to 25% less OM damage occurred in this plot when compared to the damage on the same side of the field in plot 3.

In 1979, by randomly selecting points in the field and measuring the distances from these points to volunteer or damaged onions, several sets of distance measurements were taken in the research field. All measurements were analyzed for possible use in determining a test statistic for quantifying the relationship of the presence of volunteer onions and OM plant damage (Dimoff 1980, unpublished). A test statistic, "P" was arrived at where:

$$P = \frac{D-A}{D+A}$$

where D = distance from a random point to the nearest damaged onion, and

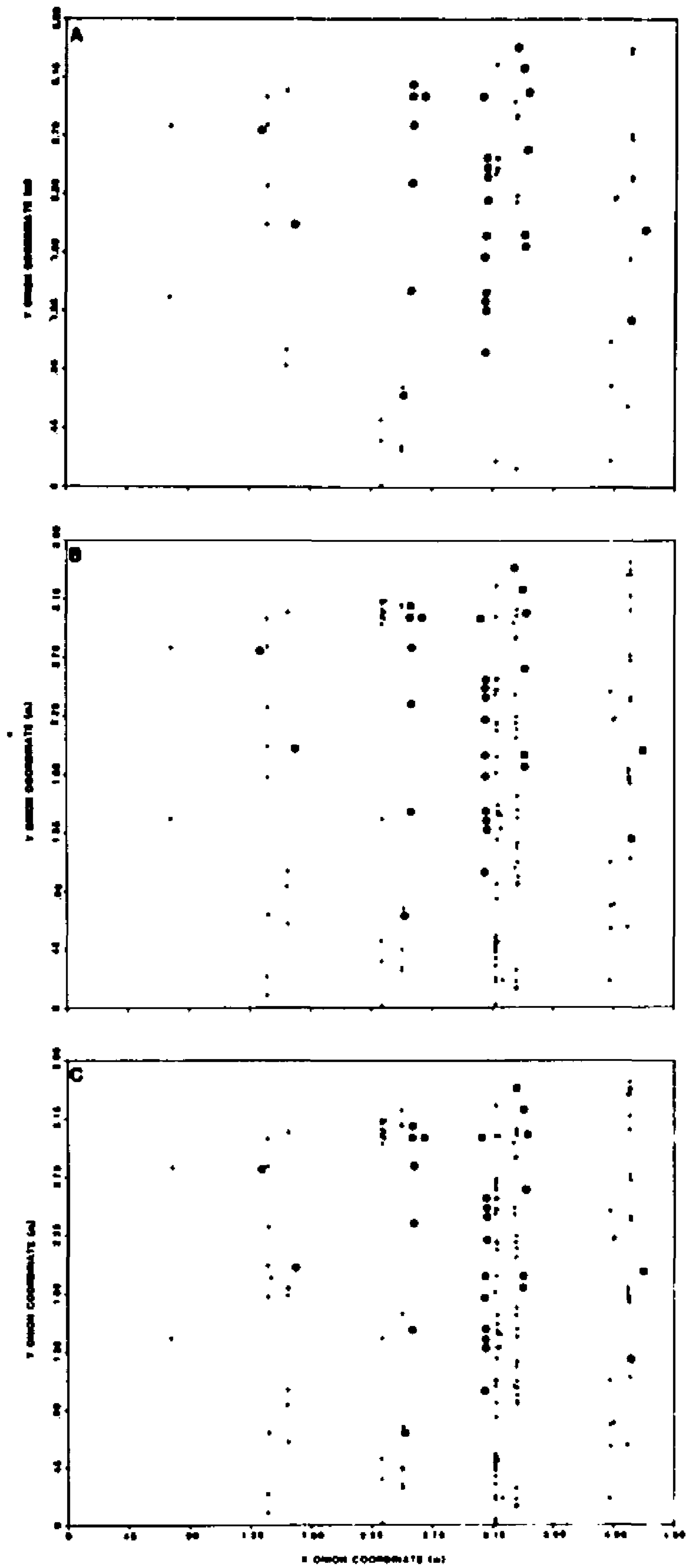
A = distance from nearest volunteer (to the random point)

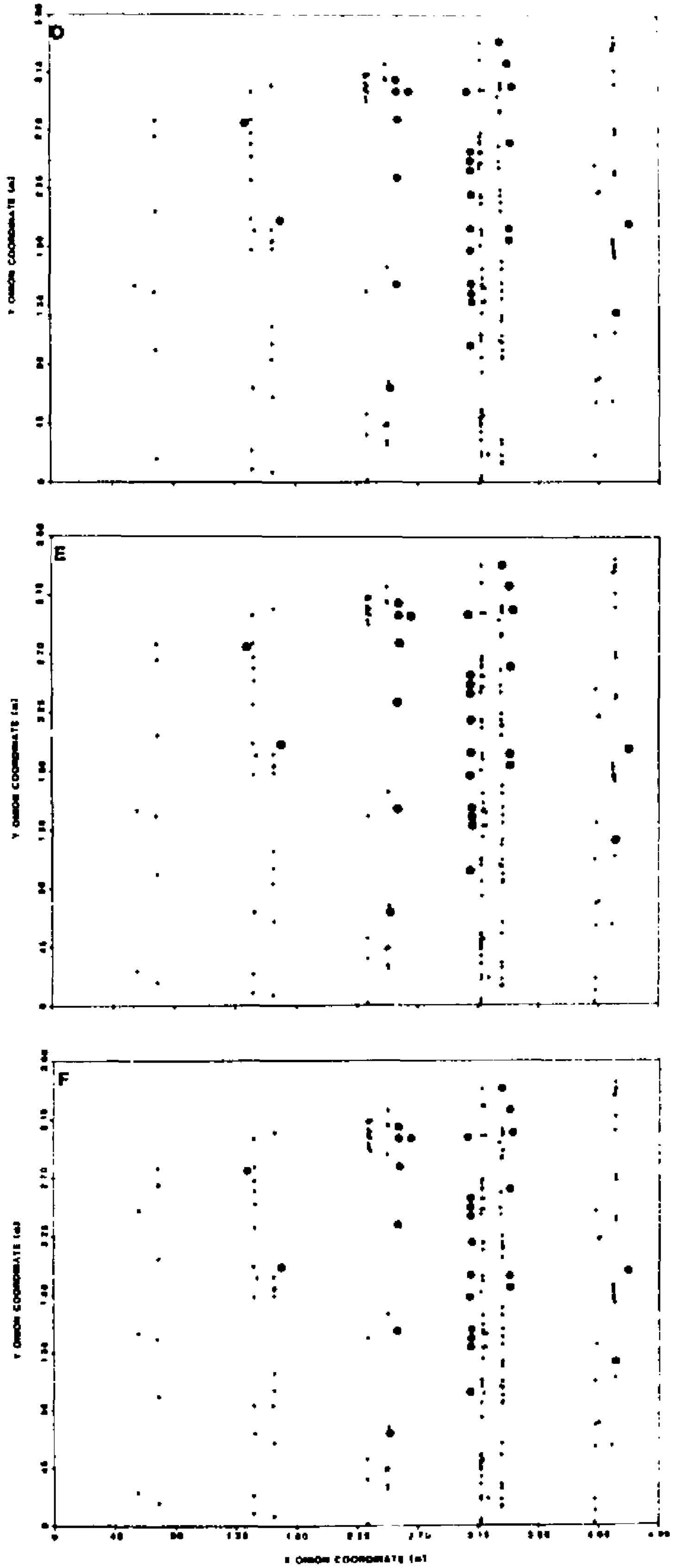
to nearest damaged onion.

The value of P must lie between -1 and 1, where:

$P < 0$ indicates that the A distance is greater than that of the D distance,

Figure 39. Graphical representation of progression of OM plant damage in plot 3 in 1979. Location of individual damaged onions (+) and volunteer onion plants (•) are presented. (A-June 6, B-June 13, C-June 20, D-July 17, E-August 1, F-August 16).


A
B
C


D
E
F

and there is less probability of onions close to volunteers being damaged.

$P = 0$ A Distance is equal to D distance and no effect by volunteers may be assumed.

$P > 0$ A distance is less than D distance, and there is a greater probability of an onion close to a volunteer being damaged.

Traditional methods of handling distance measurements require that the distribution of the variates be determined (Pielou 1977). Any correlation or interdependence between the variates also must be measured and accounted for if standard parametric statistics are to be used.

To test for independence between distances A and D, several tests are available. Each test has different assumptions and techniques for determination of independence. Pearson's product-moment correlation test (Steele and Torrie 1960), Kendall's rank-order correlation test (Hollander and Wolfe 1973), and Spearman's rank-order correlation test (Hajek 1969) were used to determine correlation coefficients for the three sets of measurements taken in the research field in 1979 (Table 20). A and D were shown to be independent distance variates by all three independence tests.

Both A and D distances for three sets of measurements were plotted as a cumulative density and resembled a negative binomial distribution, whereas the P statistic was found to be close to a normal distribution (Figure 40). A Kolmogorov-Smirnov test revealed no significant departure from the negative binomial distribution for both A and D variates or from the normal distribution for the P statistic (Table 21).

The usefulness of P, for testing against some predetermined value of P or for testing between plots of different densities of volunteer onions, requires that

Table 20. Independence test statistics of distance measurements A and D for two densities of volunteer onions in a Dyfonate-treated field and for one density of volunteer onions in a non-dyfonate field.

Plot (No. Volunteers)	Pearson's Corr. Coefficient	Kendall's Tau	Spearman's Rho
Dyfonate (low density)	-.117 α=.327	.076 α=.179	.119
Non-dyfonate (low density)	-.155 α=.193	-.001 α=.983	-.048
Non-dyfonate (high density)	-.079 α=.548	-.058 α=.35	-.062

Figure 40. Cumulative density of the distance measurements A and D and test statistic P for 60 samples in a Dyfonate-treated area.

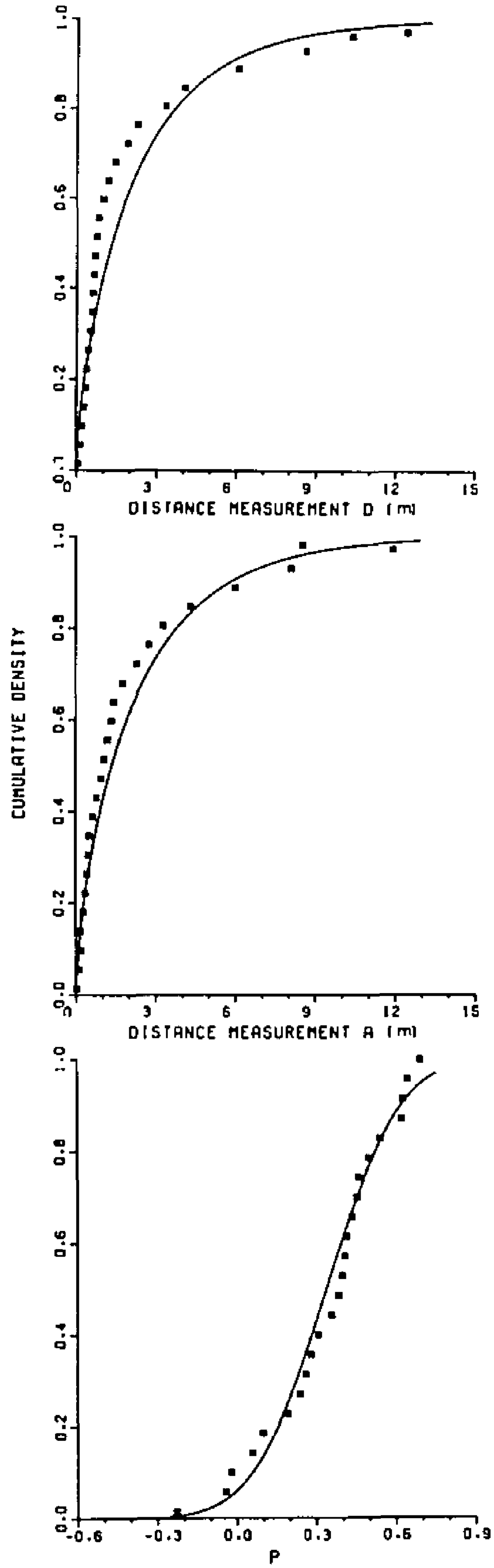

CUMULATIVE DENSITY
DISTANCE MEASUREMENT D (m)
DISTANCE MEASUREMENT A (m)
P

Table 21. Kolmogorov-Smirnoff test statistic and distribution of distance measurements A and D and the test statistic P for three volunteer onion conditions.

		Kolmogorov-Smirnoff Statistic			
Variate	N	Dyfonate (low)	No Dyfonate (low)	No Dyfonate (high)	Distribution
A[1]	60	.115	.054	.034	Negative binomial
D[1]	60	.128	.086	.064	Negative binomial
P[2]	60	.104	.145	.107	Normal

[1]Ho: fits negative binomial

[2]Ho: fits normal

robustness, accuracy, and precision be determined and evaluated. Confidence limits and significance tests for this statistic are presently being developed (Dimoff 1980, unpublished).

In 1980, a computer program was developed for determining values of P for onion plots that contained different numbers of volunteers (Appendix G). The program selects a random point within an onion row and measures the distance A and D (previously described) to determine a value of P for the sample. Any number of samples may be chosen, and a mean value of P is returned, along with the number of onions present and volunteer onion density.

Sample runs were made for three different sample sizes (20, 60, and 100 distance measurements). Values of P were determined for five volunteer conditions which included differing numbers of single volunteers (2,5) and aggregates of volunteers (1 of 3 and 2 of 3) per plot. Check plots were sampled by randomly determining a volunteer location for the distance measurement A. Values of P and the variance (three replications) associated with it are presented (Table 22).

A value of P close to zero was returned for all check plots examined. This would be expected, where the volunteer onion location is picked at random and essentially acts as another random point. Values of P close to zero were also returned for all plot conditions and sample sizes when the closest (first) damaged onion to the random point and volunteers were selected. On first examination, a value of P close to zero for the nearest selected damaged onion may not have been expected, if presence of volunteer onions was assumed to affect the spatial distribution of OM damage. Onion plant damage in these plots, however, was monitored late during the first generation of OM larval attack and considerable

Table 22. Summary of P values for 20, 60 and 100 samples of the Nth nearest onion in plots of single and aggregates of volunteer onions. (1st line = value of P; 2nd line = CI (.95))

	Number of Samples																				
	20							60							100						
	Nth Onion							Nth Onion							Nth Onion						
No. Volunteers	1	5	10	20	25	35	50	1	1	10	20	25	35	50	1	5	10	20	25	35	50
Check	-.11	.01	.02	.01	.04	.01	.02	-.03	-.01	.01	.09	-.04	-.02	.01	-.27	-.14	.02	.10	.05	-.05	.04
	.026	.02	.02	.02	.02	.02	.02	.02	..02	.02	.02	.02	.02	.02	.08	.08	.02	.04	.02	.02	.02
2-Single	.04	.14	.40	.34	.19	.14	.05	-.06	.29	.41	.31	.20	.13	.03	-.08	.30	.40	.31	.18	.12	.03
	.02	.08	.04	.08	.06	.10	.02	.02	.02	.02	.08	.10	.12	.02	.02	.02	.02	.08	.06	.02	.02
5-Single	-.117	.18	.29	.16	.12	.06	.09	-.14	.21	.27	.20	.10	.05	.03	-.12	.20	.29	.18	.11	.05	.04
	.02	.06	.02	.04	.04	.02	.02	.02	.02	.02	.10	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
1-Aggregate	.02	.37	.49	.57	.52	.37	.12	-.09	.36	.50	.53	.45	.36	.12	-.03	.31	.49	.54	.46	.36	.12
	.02	.08	.10	.10	.10	.12	.02	.02	.06	.08	.10	.12	.08	.02	.02	.02	.06	.08	.10	.08	.02
2-Aggregate	-.09	.30	.43	.42	.29	.14	.05	-.059	.32	.42	.39	.30	.16	.05	-.07	.32	.42	.40	.31	.15	.05
	.02	.02	.04	.02	.06	.02	.02	.02	.02	.04	.02	.04	.04	.02	.02	.02	.02	.02	.02	.02	.02

damage had occurred in all plots. Aggregates of onion plant damage around areas of volunteer onions were found to be present, but damage was also evident in areas where volunteers were not present. By selecting only the closest damaged onion to a random point or volunteer, it is now understandable that the two distances would be similar due to the high density of damaged onions present throughout the plot. To overcome this problem, a value of P was determined for measurements of the n^{th} nearest onion where:

$$P_n = \frac{D_n - A_n}{D_n + A_n}$$

for the n^{th} nearest neighbor. The computer program was adjusted to allow the user to select the n^{th} nearest onion for all sample runs. Values of P_n were determined for n being equal to 5, 10, 20, 25, 35, and 50 (Table 22). By increasing the value of the n^{th} damaged onion selected, we effectively selected for only aggregates of damage. The higher value of P obtained as the n^{th} onion was increased from 1 to 20 (single volunteers) or from 1 to 25 (aggregates) confirms that aggregates of OM plant damage occurred in the vicinity of volunteer onion plants.

The value of P increased and then decreased as the nearest onion distance was increased for all sample runs and plots. For plots of single volunteers the value of P reached a maximum when the 20^{th} nearest onion distance was selected. For aggregate plots, maximum value of P was reached at the 20^{th} or 25^{th} nearest onion distance. A higher maximum value of P was obtained for the aggregate plots, and the value decreased slightly as the number of aggregates was increased from one to two per plot. Similarly, the maximum value of P decreased as single volunteers were increased from two to five volunteers per plot.

To test for significant differences between plot conditions and the n^{th} nearest onion selected, a two way analysis of variance was performed. For all plot conditions, sample size had little effect on the value of P, so all sample sizes were pooled before analysis. Analysis of variance results were examined as a two way analysis of multiple observations per plot to account for multiple samples from each plot examined (Steel and Torrie 1960). Hypothesis testing revealed significant differences among plots and the n^{th} nearest onion selected (Table 23). To test for where differences occurred, a one-way analysis of variance was performed for the n^{th} nearest onion selection for each plot condition. Duncan's multiple range test results revealed no significant differences between n^{th} nearest onion selection for check plots of no volunteers, but significant differences were determined for all other plots examined (Table 24). A significant maximum value of P was obtained for the 10^{th} or 20^{th} nearest onion selected for all plots examined. From this information, it appears that distance measurements of the 10^{th} to 20^{th} onion may be best for determining a maximum P value for plots of different volunteer densities.

The 10^{th} and 20^{th} nearest onion distances were selected to determine significant differences between plots for values of P. One-way analysis of variance and subsequent multiple range testing for the 10^{th} nearest onion revealed that plots of a single aggregate of volunteer onions had a significantly greater maximum P value over all other plots (Table 25). The maximum P value for two single-volunteers was the next highest and was equal to that of the two aggregate-volunteer plots. A significant group was revealed for the five single-volunteer plots which was less than the two single volunteer plots. Plots of no

Table 23. Two-way analysis of variance for values of P for plots of different densities of volunteer onions and different Nth onion selected.

Source of Variation	DF	Sum of Squares	Mean Square	F
Main effect	10	3.48	0.35	175***
Plot	4	2.00	0.50	250***
Nth Onion	6	1.48	0.25	125***
2-way Interaction	24	0.95	0.04	20***
Explained	34	4.43	0.13	65***
Residual	280	0.76	0.002	
Total	314	5.19	0.02	

***($p < .001$)

Table 24 a. One-way analysis of variance and Duncan's multiple range test for values of P for the Nth nearest onion in plots containing one single volunteer onion.

Variable	DF	Sum of Squares	Mean Square	F
Nth Onion	6	1.43	.24	27.6***
Residual	56	0.48	.008	
Total	62	1.91		

***(p<.001)

Group	Nth Onion	P*
1	1	-.05a
2	5	.28cd
3	10	.41e
4	20	.32d
5	25	.20bc
6	35	.14b
7	50	.02a

*means followed by the same letter are not significantly different (α=.05)

Table 24b. One-way analysis of variance and Duncan's multiple range test for values of P for the Nth nearest onion in plots containing two single volunteer onions.

Variable	DF	Sum of Squares	Mean Square	F
Nth Onion	6	.99	.16	104.9***
Residual	56	.09		
Total	62	1.08	.002	

***(p<.001)

Group	Nth Onion	P*
1	1	-.13a
2	5	.19d
3	10	.28e
4	20	.18d
5	25	.12c
6	35	.05b
7	50	.03b

*means followed by the same letter are not significantly different (α=.05)

Table 24c. One-way analysis of variance and Duncan's multiple range test for values of P for the Nth nearest onion in plots containing one aggregate of three volunteer onions.

Variable	DF	Sum of Squares	Mean Square	F
Nth Onion	6	2.73		35.9***
Residual	56	0.71		
Total	62	3.44		

***($p<.001$)

Group	Nth Onion	P*
1	1	-.02a
2	5	.35c
3	10	.50d
4	20	.57d
5	25	.50d
6	35	.36c
7	50	.12b

*means followed by the same letter are not significantly different ($\alpha=.05$)

Table 24d. One-way analysis of variance and Duncan's multiple range test for values of P for the Nth nearest onion in plots containing two aggregates of three volunteer onions.

Variable	DF	Sum of Squares	Mean Square	F
Nth Onion	6	1.95	.33	118.3***
Residual	56	0.15	.003	
Total	62	2.11		

***(p<.001)

Group	Nth Onion	P*
1	1	-.07a
2	5	.31d
3	10	.42e
4	20	.40e
5	25	.31d
6	35	.15c
7	50	.05b

*means followed by the same letter are not significantly different (α=.05)

Table 25. One-way analysis of variance and Duncan's multiple range test for values of P for the 10th nearest onion selected in plots of different densities of volunteer onions.

Variable	DF	Sum of Squares	Mean Square	F
Plots	4	2.49	.62	69.4***
Residual	40	0.36	.009	
Total	44	2.85		

***($p<.001$)

Group	Plot	P*
1	0	.02a
2	2-single	.40c
3	5-single	.28b
4	1-aggregate	.50d
5	2-aggregate	.42c

*means followed by the same letter are not significantly different ($\alpha=.05$)

volunteers had a significantly lower P than all other plots examined. Analysis of variance and multiple range testing for the 20^{th} onion selected revealed similar results, except for identification of a separate group for two single-volunteers and two aggregate-volunteer plots (Table 26). From this information it appears that a single aggregate of volunteers can lead to the greatest number of onions being damaged by OM in the vicinity of the volunteers, when compared to plots of single volunteer onions. Further comparisons reveal the following order of magnitude for number of damaged onions occurring in the vicinity of a volunteer source: 1 aggregate > 2 aggregates > 2 single volunteers > 5 single volunteers (Figure 41).

A decrease in the value of P as the number of aggregate or number of single volunteers per plot is increased may be due to the limited size of the plot. The OM adult may be using both visual and olfactory cues when responding to the presence of a volunteer onion. The effective ground area or air space around each volunteer or aggregate of volunteers that the OM responds to is not known. It is hypothesized that as the density or location of volunteers for a fixed area increases, disruption of these signals or confusion by the OM adults takes place, and oviposition does not occur only in the immediate vicinity of volunteer onions. A similar situation has been observed and reported in insect pheromone research where, in areas where high concentrations of a sex pheromone were released, mating disruption occurred.

For all plots where volunteers were present, the value of P decreased from a maximum value as the n^{th} nearest onion selected was further increased. For most plots, the value of P decreased to a value close to zero when the 35^{th} nearest onion distance was selected. This information may be useful for

Table 26. One-way analysis of variance and Duncan's multiple range test for values of P for the 20th nearest onion selected in plots of different densities of volunteer onions.

Variable	DF	Sum of Squares	Mean Square	F
Plots	4	2.34	.58	49.9***
Residual	40	0.47	.011	
Total	44	2.81		

***(p<.001)

Group	Plot	P*
1	0	.04a
2	2-single	.32b
3	5-single	.18c
4	1-aggregate	.55d
5	2-aggregate	.39e

*means followed by the same letter are not significantly different (α=.05)

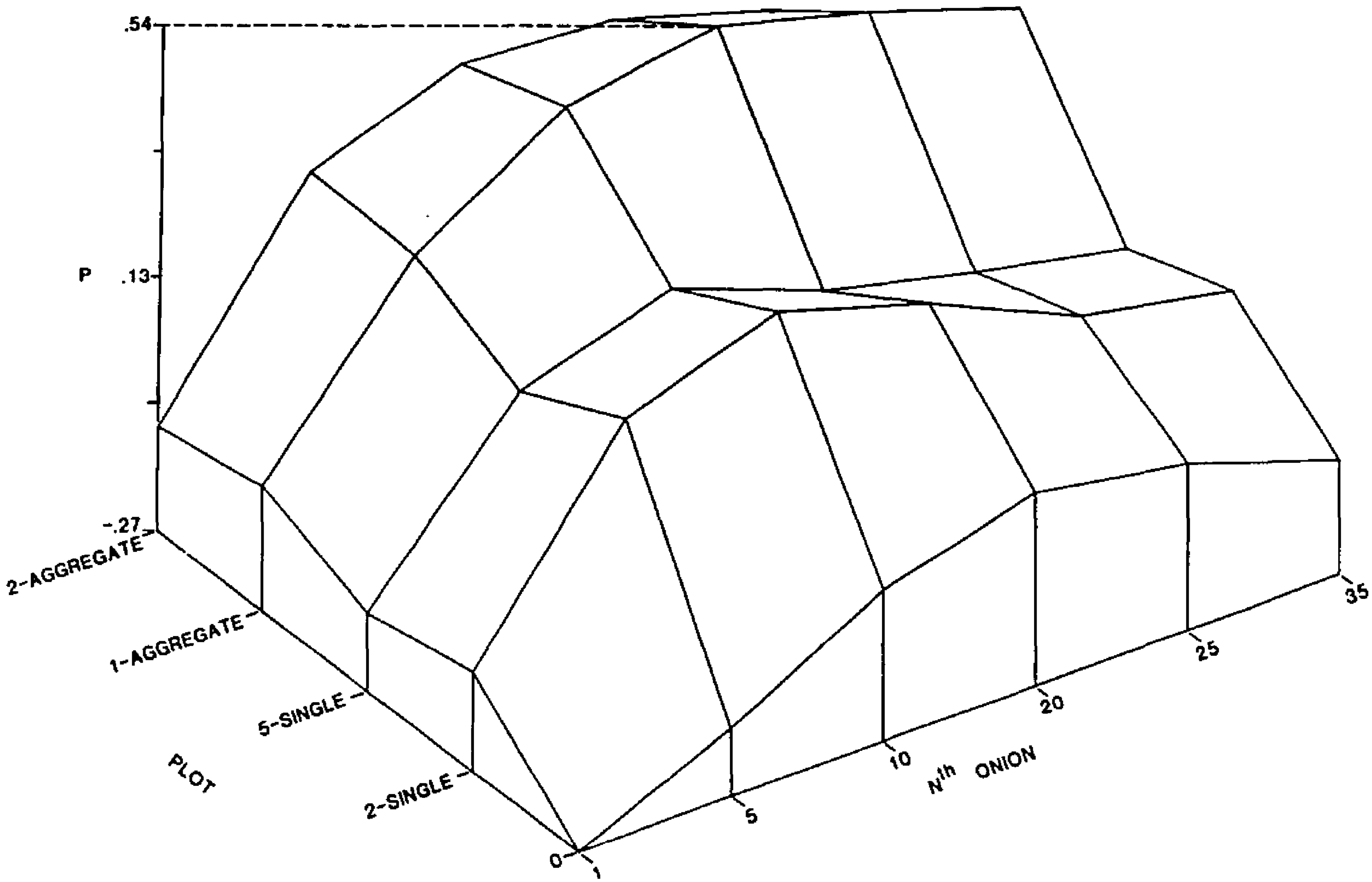


Figure 41. Graphical representation of the value of P obtained for different densities of volunteer onions and the Nth nearest onion selected.

determining the size of the aggregates of OM plant damage around volunteer onion plants. The size of these aggregates may in turn provide information about the effective area of influence by volunteer onions.

For this purpose, two volunteer conditions (aggregate volunteers and single volunteers) were selected for further sampling to obtain values of P. The n^{th} nearest onion was incrementally increased by one for a single sample size of 60. Plots of the value of P and n^{th} nearest onion selected for measurement, revealed two significant values of P for the two volunteer conditions (Figure 42). It may be assumed that each of these peaks are due to the occurrence of an aggregate of damaged plants as we move out from the location of the volunteer onion. If this is true, the n^{th} nearest onion value for the first peak would describe the mean clump size for an aggregate of OM damaged plants around the volunteer onion. Further peaks would describe the mean clump size for other aggregates of OM-damaged plants and their distance from the site of the volunteer onion. From these results, it appears that damaged onion plants consist of aggregate areas (which agrees with the information already presented on the spatial distribution of OM plant damage). Mean clump size for the first aggregate around a single volunteer onion is approximately 34 onions, or a radius of 32 cm (15 plants per 30 cm). The mean clump size for the first aggregate of OM plant damage around an aggregate of volunteers is approximately 37 onions, or a radius of 35 cm. From this information, it appears that the area of damage around an aggregate of volunteers is only slightly greater than the area around a single volunteer.

The area that a volunteer onion affects, in terms of OM plant damage, may be greater than this information reveals. As we move away from the site of the

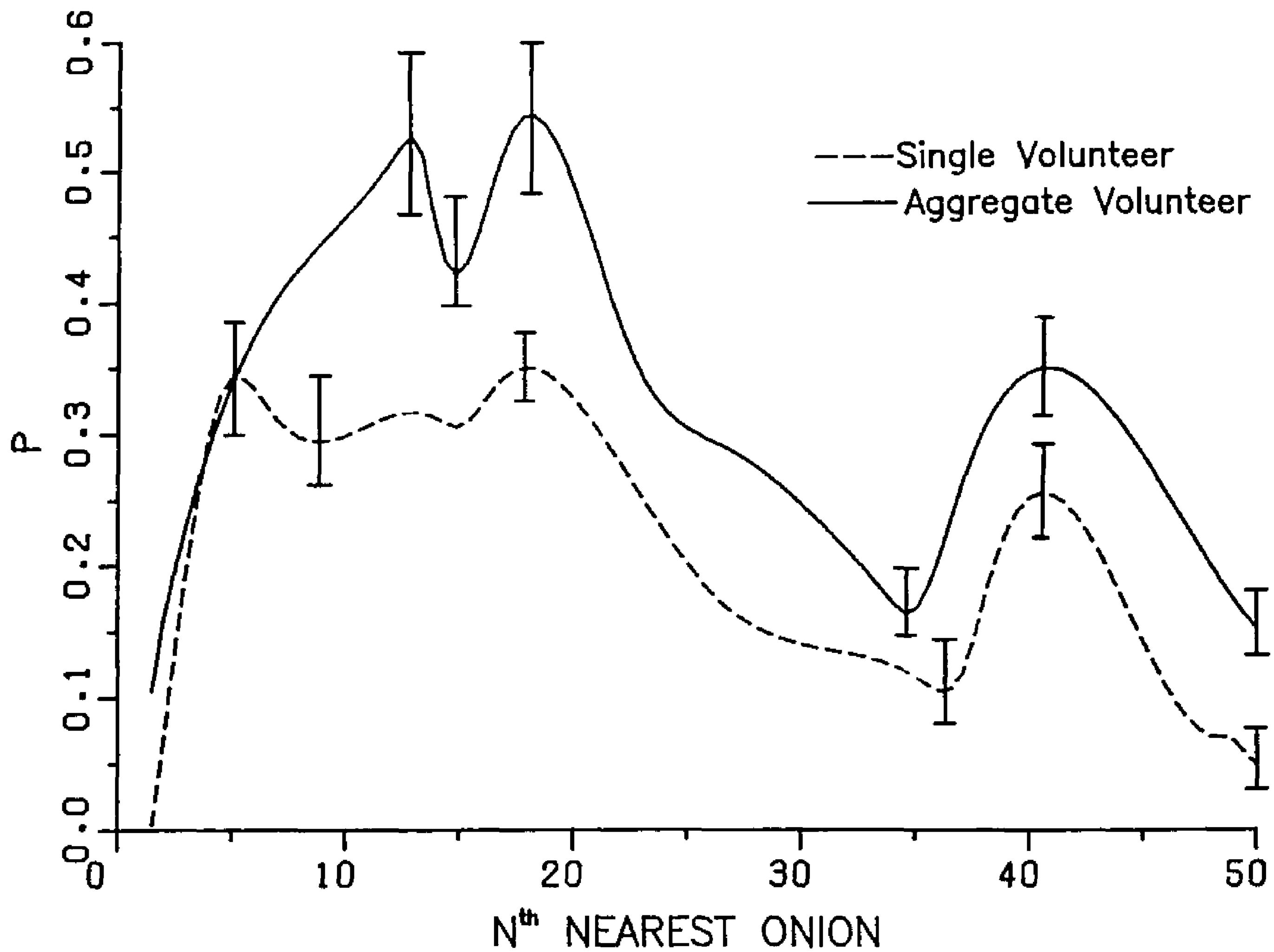


Figure 42. Values of P for the Nth nearest onion selected in plots containing single and aggregates of volunteer onions.

volunteer onion, the distance between aggregates of damage may increase; therefore, the population of OM-damaged plants near sites of volunteer onions may consist of several aggregates, where a large aggregation of these aggregates occur in the vicinity of volunteer onion plants.

Further evaluation and interpretation of this technique is needed before its use can be fully justified in spatial pattern analysis. Similar techniques have been developed for analysis of spatial patterns in plant ecology through quadrat sampling (Greig-Smith 1957). Morisita (1959) developed a technique for measuring clump size by using different quadrat sizes and his index of dispersion (I_s). The index is determined for a number of quadrats where the quadrat size is doubled each time. The ratio of I_s for one quadrat size and I_s for a quadrat twice that size is plotted against quadrat size and, where peaks occur, mean clump size is assumed.

H. OM Plant Damage Surveys

1. Regional Surveys

First generation OM plant damage was measured weekly in the study fields and research field in 1979 and 1980 (Appendix F). Percent damage in each field for each sample date during the first generation OM attack was determined by dividing the mean number of damaged plants per 30 m sample of onion row by onion plant density (1500 plants per 30 m).

Onion plants are often infected by soft rot bacteria and therefore decompose rapidly after being damaged by OM larvae. After complete decomposition, the plant is often no longer visible and will not be recorded during regular OM plant damage sampling. To insure that all OM damage is recorded, it is necessary to sample damage at time increments not more than that required for onion decomposition. Sample intervals greater than this time may underestimate the total plant damage that has occurred.

The degree-day period for onion plant decomposition has been shown to depend upon the degree-day period of initial attack. The average length of time for total onion decomposition in the spring was found to be 155 degree-days. Therefore, sample intervals of approximately one week (average of 20 degree-days per day) during the Spring were adequate for recording OM plant damage. To obtain the amount of total damage that occurred for the first generation of OM attack, weekly estimates of plant damage were simply accumulated.

Total OM plant damage during the first generation was determined for the commercial study fields and research field for 1979 and 1980 (Table 27). The extent of damage differed considerably between fields for each year. Production practices, soil type, and field location were probably more important than fly density in determining the amount of damage each field received. All fields had been treated with a granular insecticide (Dyfonate) at planting, and foliar insecticide sprays were applied at various times to some fields during the first generation attack by the OM.

Up to 85% damage occurred in the area of the research field in 1979 where no granular insecticide was applied. In commercial fields considerable damage was sometimes observed at the ends of onion rows or along a whole field length. It was learned that in these cases, the granular insecticide had not been placed in the row due to machinery limitations or malfunction.

For several fields in 1979 and 1980, foliar sprays of insecticides were applied to control first generation adults. It has already been shown that where

Table 27. Total first generation OM damage and number of foliar sprays applied for study fields in Grant, Michigan, 1979-1980.

1979

Field	Number of Foliar Sprays	N	% Damage	VAR	SE	CI (.95)
1	4	20	.33	.25	.11	± .22
2	6	20	1.68	.71	.18	± .37
3	5	20	1.80	1.28	.25	± .50
4	4	20	1.55	.53	.16	± .32
5	4	20	1.69	1.06	.23	± .46
6	5	20	3.95	2.83	.38	± .75
7	0	20	2.73	1.91	.31	± .62

1980

Field	Number of Foliar Sprays	N	% Damage	VAR	SE	CI (.95)
8	4	20	1.73	1.17	.24	± .48
9	4	20	2.91	1.62	.28	± .57
10	3	20	11.10	11.43	.75	±1.51
11	4	20	5.48	2.09	.32	± .64
12	4	20	3.75	5.50	.52	±1.04
13	0	20	6.99	8.21	.64	±1.28
14	7	20	7.33	9.77	.69	±1.39

sprays were applied, adult populations did not decrease significantly. To determine if foliar sprays applied in the spring significantly decreased OM plant damage, percent total damage for sprayed and non-sprayed fields were compared at the end of the first generation. Students T-test was used to compare the means of field 7 (non-sprayed) and fields 1-6 (sprayed) in 1979. For 1980, field 13 (non-sprayed) was compared to fields 8-12 and 14 (sprayed). For both years, percent total damage in non-sprayed fields were found to be not significantly different from sprayed fields ($\alpha = .05$).

Field 13 and 14 in 1980 were selected specifically to determine if OM plant damage was decreased by using foliar sprays. These fields were adjacent to each other and only field 14 was sprayed with foliar insecticides of either Sevin or parathion during the first generation of OM activity. Percent OM plant damage for each field was compared over the season by plotting bi-weekly sample results (Figure 43). Very few differences in percent damage occurred.

Second generation OM plant damage was determined by recording all damage (recent and old) at harvest. Since damaged onions remained in the field greater than 270 degree-days or two to three weeks, it was expected that total OM damage occurring late in the season could be determined by recording all damage present at the end of second generation OM attack. To determine if this procedure was adequate, second generation damage was recorded each week in fields 13 and 14. Since only recently damaged onions were recorded during sampling, the sum of these estimates should be equal to the percent total damage (recent and old) recorded at harvest. Comparison of the two sampling procedures revealed that percent total damage recorded at harvest was not significantly different from cumulative estimates of damage obtained by

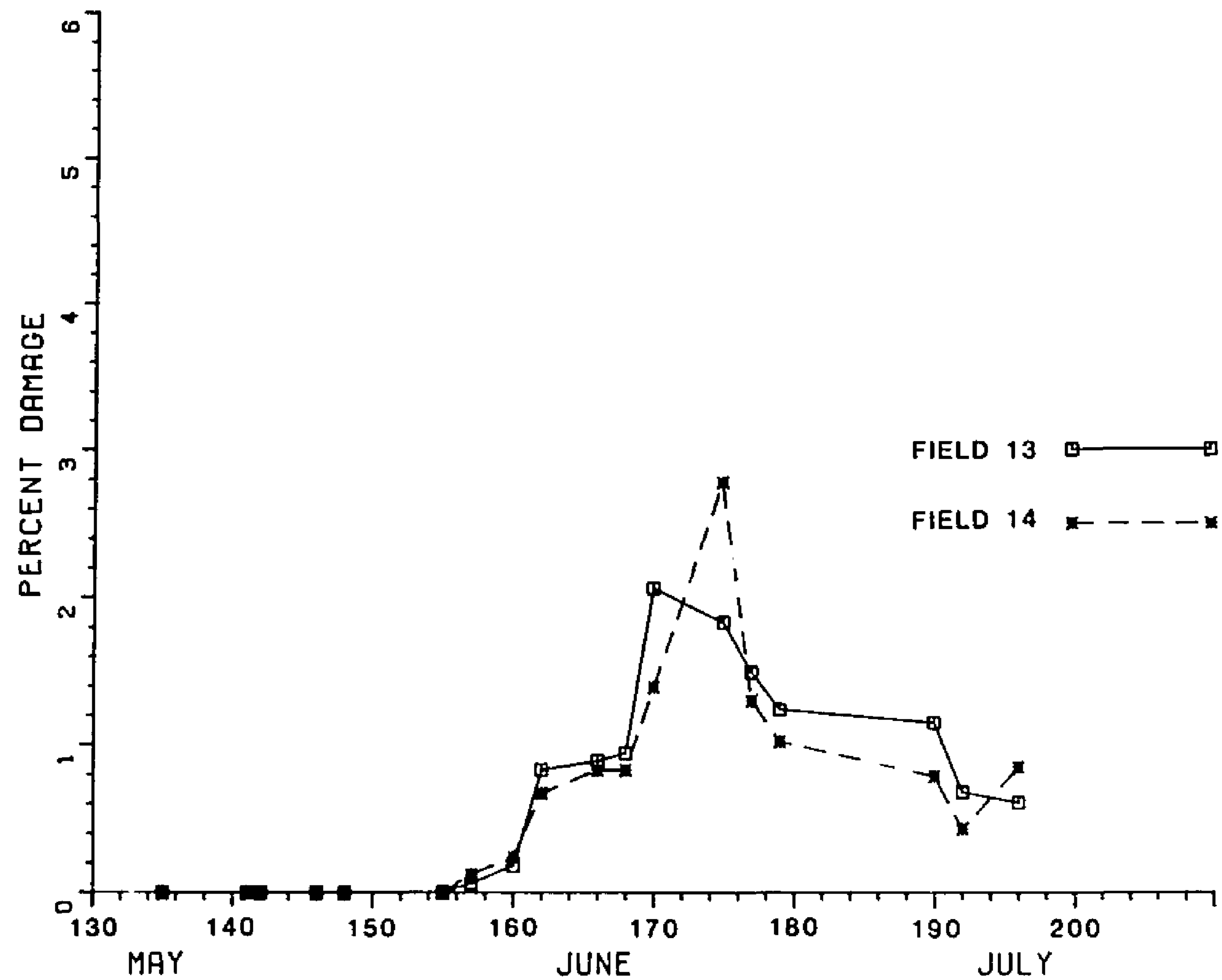


Figure 43. Percent OM plant damage during the first generation in fields 13 and 14 (1980).

recording new damage each week (Table 28). Based on these results, onion plant damage recorded at harvest was felt to be appropriate for determining total second generation damage.

One-way analysis of variance and a Duncan's multiple range test revealed significant differences in total second generation damage between fields for each year (Tables 29-30). For both years, non-sprayed fields were shown to have no more significant damage than several sprayed fields. Field 1 (1979) and 8 (1980) (same field) had the lowest percent onion plant damage for both the first and second generation; whereas, field 5 (1979) and field 10 (1980) had the highest. Each of these fields was sprayed with foliar insecticides three to five times during the second generation.

Pearson's Bivariate Correlation test was used to determine if percent damage during the first generation was correlated to percent damage during the second generation. For 1979 no significant correlation was evident, but for 1980 correlation between first and second generation damage was significant (Table 31).

To determine if percent OM damage was correlated with OM population density, total adult incidence and total seasonal production was determined for each field and year by integrating the area under adult flight curves and dividing by adult developmental time. Pearson's bivariate correlation analysis was used to test for significant correlation for the following pairs of values: a) first generation adults/first generation damage, b) second generation adults/second generation damage, c) first generation damage/second generation adults, d) second generation damage/third generation adults, e) second generation

Table 28. Total second generation OM plant damage for fields 13 and 14 determined by summation of weekly damage estimates and final harvest assessment.

Field	Date	% Damage (per week)	CI (.95)	Σ	% Damage (harvest)	CI (.95)
13	211	1.28	± .66	1.28		
	216	2.61	±1.56	3.89		
	225	1.69	± .93	5.58		
	232	.30	± .20	5.88		
	238	0.00	±0.00	5.88	5.00	±2.01
14	211	1.95	± .96	1.95		
	216	3.61	±2.60	5.56		
	225	1.48	± .50	7.04		
	232	1.40	± .42	8.44		
	238	0.00	±0.00	8.44	6.57	±2.68

Table 29. One-way analysis of variance and Duncan's multiple range test for percent total OM plant damage during the second generation for study fields in Grant Michigan, in 1979. All percentages were transformed by square root before analysis.

Variable	DF	Sum of Squares	Mean Square	F
Field	6	23.80	3.97	11.7***
Residuals	83	28.06	.34	
Total	89	51.86		

***(P<.001)

Field	N	Number of Foliar Sprays	% OM* Damage	SE	CI (.95)
1	5	3	.62a	.39	±1.11
2	15	5	2.73cd	.36	± .73
3	15	4	1.13ab	.17	± .35
4	15	5	3.26cd	.39	± .84
5	15	5	6.26e	1.16	±2.49
6	15	2	4.33de	.54	±1.16
7	10	0	2.01bc	.57	± .73

*Means followed by the same letter are not significantly different. (α=.05)

Table 30. One-way analysis of variance and Duncan's multiple range test for percent total OM plant damage during the second generation for study fields in Grant, Michigan, in 1980. All percentages were transformed by square root before analysis.

Variable	DF	Sum of Squares	Mean Square	F
Field	6	57.03	9.50	20.7***
Residuals	83	37.98	.46	
Total	89	95.02		

***(P<.001)

Field	N	Number of Foliar Sprays	% OM* Damage	SE	CI (.95)
8	10	3	1.11a	.24	± .55
9	10	4	5.49c	.87	±1.99
10	10	4	17.53d	1.06	±2.43
11	10	3	4.89bc	.76	±1.74
12	10	2	2.86b	.56	±1.28
13	20	0	5.00c	.88	±2.01
14	20	3	6.57c	1.17	±2.68

*Means followed by the same letter are not significantly different. (α=.05).

Table 31. Pearson's correlation coefficient between first and second generation OM onion plant damage in 1979 and 1980.

Year	N	Pearson's Coefficient	α
1979	7	.39	.191
1980	7	.88	.004

damage/third generation adults up to harvest, f) first and second generation damage/first and second generation adults, and g) first and second generation damage/second and third generation adults. For both years, there was significant correlation between first generation damage and second generation adults (Table 32). No other significant correlations were revealed ($\alpha > .05$).

The lack of significant correlation between adult fly populations and damage for the same generation may be due to emigration of flies following initial emergence or preoviposition. Loosjes (1976) reported that up to 50% of OM adults migrate to other fields following emergence. Correlation of first generation damage and the following generation of adults may be expected, however, if presence of damage indicates successful larval attack and development. The lack of correlation between second generation damage and third generation adults may have been due to field production practices. During third generation adult activity, onion fields are harvested and, in some cases, a cover crop is planted. These practices could cause considerable migration or immigration depending on individual field conditions. Onion fields where large numbers of cull onions are left behind after harvest may also, for example, be much more attractive to ovipositing adults than fields with low numbers of cull onions. Fields planted to cover crops (rye grass), have also been shown to have significantly fewer OM infested cull onions following harvest (Drummond 1979, unpublished).

2. State Surveys

The sampling scheme of Carruthers (1979) was used to estimate regional and field level onion plant damage in the major onion growing areas of the state. Both sampling components (field and regional level) were designed so each could

Table 32. Pearson's correlation coefficient for various comparisons of total adult production and OM plant damage in study fields of Grant, Michigan, during 1979-1980.

A with B	N	Pearson's Coefficient	∝
1979			
2nd adults-2nd damage	7	.26	.28
1st damage-2nd adults	7	.92	.001***
2nd damage-3rd adults	7	-.24	.30
2nd damage-3rd adults (H)	7	-.06	.45
1st and 2nd damage-2nd and 3rd adults	7	.34	.23
1980			
1st adults-1st damage	7	-.09	.42
2nd adults-2nd damage	7	.32	.31
1st damage-2nd adults	7	.74	.03*
2nd damage-3rd adults	7	.24	.31
2nd damage-3rd adults (H)	7	-.27	.27
1st and 2nd damage-1st and 2nd flies	7	.11	.41
1st and 2nd damage-2nd and 3rd flies	7	.47	.14

***(P<.001)
*(P<.05)
H-up to harvest
∝ - alpha level

be used independent of one another or in conjunction if desired. Similar methods of data collection, implementation, and analysis for field and regional estimates allow for two sampling levels that may be linked for an overall monitoring system. The damage estimates provide a historical record for different fields, regions, and years. This information can be used to evaluate effects of changing management decisions, specific grower production practices, or chemical control methods. It also provides information for crop loss assessment.

Sampling procedures for determining damage estimates are usually criticized as either being too general for adequate decision-making or too intensive for economic constraints. Intensive field-level sampling of all onion fields in an area may be prohibitive. However, more specific information may be necessary for some fields where management decisions are to be made. Intensified regional sampling can be used initially to identify fields above or below a specified damage level. By using a less comprehensive sampling method first, the total area can be divided into portions of variable interest: areas needing immediate action (extremely high damage), areas where more intensive field level sampling is needed, or areas requiring no further action (extremely low damage). The regional program was conducted successfully in most major onion growing areas of Michigan from 1977-1980 (Table 33). In some cases, it was not possible to obtain complete data sets (all fields) for an area, but the sample program was robust enough to tolerate a significant amount of missing data. Pest management personnel and county agents found the program to be workable and useful. Records of production practices, collected at the same time, have been used to help explain some anomalies or trends in the results.

Percent damage estimates provide a relative estimate of damage at one point in time. To determine how this estimate was related to total damage,

Table 33. Regional estimates of first and second generation OM plant damage for the major onion growing areas of Michigan from 1977-1980.

		FIRST GENERATION ONION MAGGOT DAMAGE			SECOND GENERATION ONION MAGGOT DAMAGE		
Region and Year	NF[1]	n[2]	Regional Mean	Standard Error	n[2]	Regional Mean	Standard Error
1977[3]							
Bravo	21	6	3.30	1.34	4	3.51	2.48
Grant	20	6	1.48	.91	7	.36	.23
Jackson	23	10	2.60	.60	10	3.14	.44
Lapeer	15	13	.45	.23	15	.07	.03
1978[3]							
Bravo	20	12	.04	.02	12	3.90	.78
Grant	23	16	17.70	2.48	16	5.16	.58
Jackson	24	19	2.23	.38	19	2.24	.42
Lapeer	7	7	7.56	.98	7	.36	.07
1979[4]							
Bravo	20	2	5.70	4.18	--	---	--
Grant	21	13	3.47	.67	10	.51	.13
Jackson	20	9	.32	.17	--	---	--
Lapeer	8	7	4.02	.47	7	.46	.09
1980[4]							
Bravo	20	8	11.20	2.83	8	16.40	5.18
Grant	24	24	20.44	1.01	24	5.40	.24
Jackson	20	4	30.10	14.01	--	---	--
Lapeer	8	8	7.15	.31	8	.30	.055

[1]Approximate number of fields per region (NF).

[2]Number of fields sampled per region (n).

[3]Ten samples taken per field.

[4]Twenty samples taken per field.

point estimates of damage from commercial study fields were compared to the calculated total, first-generation damage for 1979 and 1980. Point estimates were taken on or about July 1 for both years. A second-order polynomial curve was found to give a good fit to the data (Figure 44). The reliability of this equation cannot be determined without further field experimentation; however, this relationship may be expected to change from year to year.

Damage estimates from weekly samples of commercial study fields and the research field in 1979 and 1980 were transformed to proportional estimates by dividing each sample count of damaged onions by the total damage that occurred in each field. Although each field had a different density of damaged onions present at each sample date, proportional estimates for each date allowed comparison of damage between fields independent of density. The cumulative proportional estimates describe the rate of change of OM damage during the first generation of OM larval activity. For the Grant area, this rate of damage during the first generation appeared to be the same for all fields in a year, regardless of the amount of damage.

Two-way analysis of variance was performed for each year to test for significant difference in proportion damage estimates for dates and fields (Tables 34-35). Differences between dates were expected but differences between fields indicate that although the rate of damage appeared similar for all fields, significant differences were present.

To determine which fields were contributing the most variance, two-way analysis of variance was performed on six fields where for each analysis a different field was deleted. No significant differences between the six fields were observed when field 1 in 1979 and field 10 in 1980 were deleted from the

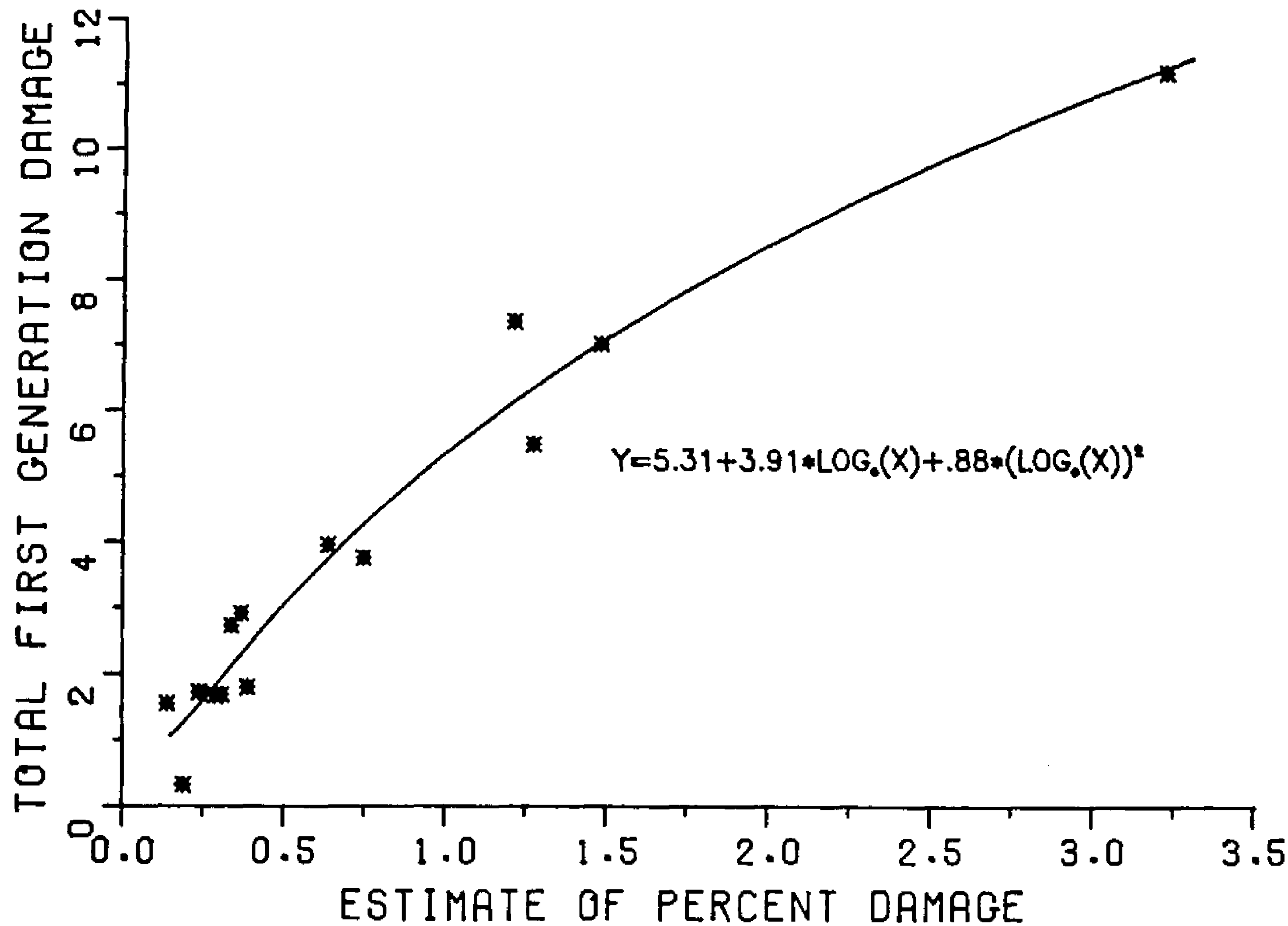


Figure 44. Relationship between point estimates of percent OM damage and total first generation damage for the study fields in 1979 and 1980.

Table 34. Two-way analysis of variance for proportion of total first generation damage for date and field in 1979. All proportions were transformed by square root before analysis.

Source of Variation	Sum of Squares	DF	Mean Square	F
Main effects	2.01	18	.112	76.7***
Date	1.97	12	.164	112.7***
Field	.04	6	.007	4.9***
2-way interactions	.72	67	.011	7.4***
Explained	2.74	85	.032	22.1***
Residual	2.39	1632	.001	
Total	5.16	1717	.003	

***(P<.001)

Table 35. Two-way analysis of variance for proportion of total first generation damage for date and field in 1980. All proportions were transformed by square root before analysis.

Source of Variation	Sum of Squares	DF	Mean Square	F
Main effects	1.62	15	.108	71.8***
Date	1.57	9	.175	116.5***
Field	.02	6	.004	2.7**
2-way interactions	.30	53	.006	3.8***
Explained	1.92	68	.028	18.8***
Residual	1.97	1309	.002	
Total	3.89	1377	.003	

***(P<.001)
**(P<.01)

analysis (Tables 36-37). Field 1 had the lowest OM plant damage and field 10 had the highest compared to the 12 other fields examined. These results indicate that the rate of OM damage in a region may be the same for all fields only over a limited range of different damage densities. Damage in some fields may occur at a different rate, depending upon damage intensity. Fields with high amounts of damage, for example, may be more attractive to ovipositing adults than fields where little damage has occurred. Placing fields into different strata of damage density may be advisable to obtain a regional rate of OM damage for the season.

Proportional damage estimates of fields 2-7 (1979) and fields 8-9 and 11-14 (1980) were accumulated and plotted against degree-days (4.4C^{o} base) (Figure 45). For both years, the distribution of these estimates was found to not depart significantly from that of a negative binomial (Kolmogorov-Smirnoff test). A curvlinear line of the negative binomial distribution was fit to the data based on the mean and k value for each year (mu = 698 degree-days, k = 22 for 1979; mu = 741 degree-days, k = 20 for 1980). Because a two-way Kolmogorov-Smirnoff test revealed significant differences between the mean and k values for each year, results were not pooled. Curvilinear lines or the negative binomial expression:

$$P(x) = (1 + \frac{u}{K}) \quad \text{(after Elliott 1977)}$$

can be used to determine the proportion of damage (P) that has occurred at any degree-day interval (X). The use of this relationship was limited to fields where .5 to 8 percent total first generation damage occurred. Its use must also be limited to the onion growing area of Grant until subsequent studies reveal a general agreement between regions.

To demonstrate the use of a cumulative proportion damage curve, point estimates of OM damage for 19 fields in 1980 were examined. The regional

Table 36. Two-way analysis of variance for proportion of total first generation damage for date and field in 1979 after omission of field 1. All proportions were transformed by square root before analysis.

Source of Variation	Sum of Squares	DF	Mean Square	F
Main effects	2.08	17	.122	99.9***
Date	2.07	12	.172	141.0***
Field	.006	5	.001	1.0 ns
2-way interactions	.42	55	.008	6.2***
Explained	2.49	72	.035	28.3***
Residual	1.69	1385	.001	
Total	4.18	1457	.003	

***(P<.001)

Table 37. Two-way analysis of variance for proportion of total first generation damage for date and field in 1980 after omission of field 10. All proportions were transformed by square root before analysis.

Source of Variation	Sum of Squares	DF	Mean Square	F
Main effects	1.30	14	.093	57.1***
Date	1.29	9	.143	88.1***
Field	.02	5	.004	2.2 ns
2-way interactions	.29	44	.007	4.1***
Explained	1.59	58	.027	16.9***
Residual	1.82	1119	.002	
Total	3.41	1117	.003	

***(P<.001)

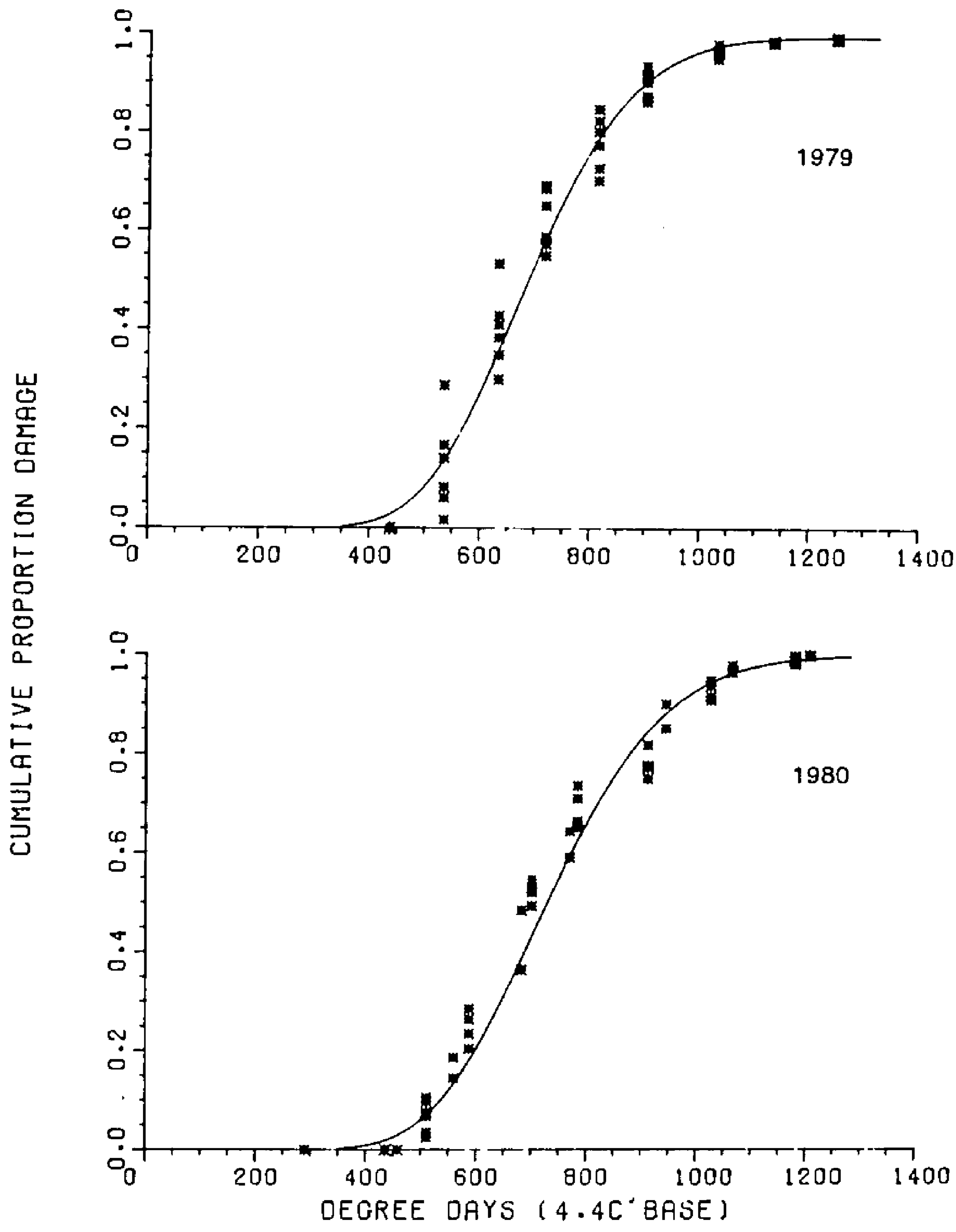


Figure 45. Cumulative proportion curve of first generation OM plant damage in 1979 (A) and 1980 (B) over degree-days (4.4° base).

sampling program of Carruthers (1979) was used to obtain individual field estimates. All field estimates of OM damage were converted to percent damage where each estimate was a measure of the amount of damage that occurred the week preceding the sample date. To obtain the proportion of total damage (WY), measured by the damage estimate, the cumulative proportion curve can be used, where X is equal to the degree-day interval (1 week) that the sample represented. Total damage is obtained by multiplying the percent damage estimate by one over the proportion measured (1/W Y) (Table 38).

Only 4 (23%) of the 19 fields had estimates of total damage greater than that allowed for use of the cumulative proportion curve (.5-8%). One or two fields in the area, sampled weekly, may therefore be adequate for determining the rate of OM damage which can be used with percent estimates of damage for total damage estimation.

I. Seed Corn Maggot Component

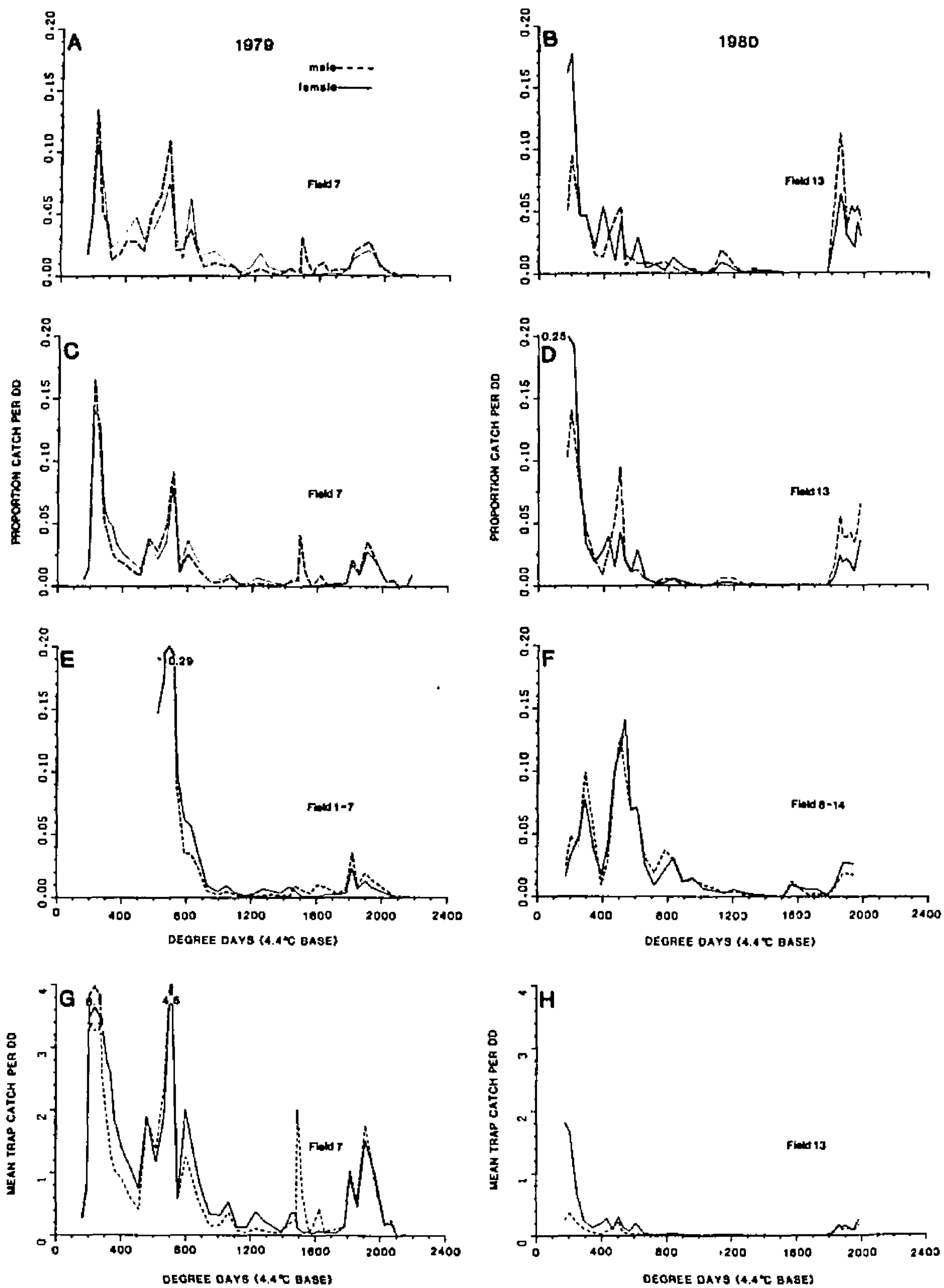
Seed corn maggot (SCM) populations were monitored in Grant to examine the phenology of the lifestages and their impact on onion production. The flight behavior of the adults was examined during OM flight studies and was found to be very similar to the OM. The temperature adjustment procedure was used to adjust trap data for abiotic effects on flight activity. Trap counts for the research field and Field 13 are presented before temperature adjustment as a proportion of total flies trapped in flight-interception traps (Figure 46). After temperature adjustment, the counts were again transformed to proportion of total catch to show the effect of the temperature adjustment. The pooled, temperature-adjusted, trap counts of the other six commercial study fields for

Table 38. Predicted total percent first generation damage for fields in Grant, Michigan, by use of point estimates of damage and the cumulative proportional damage curve for 1980.

Field Number	Point Estimate of % Damage	SE	Predicted Total % Damage
1*	1.84	.27	8.62
2	1.07	.35	7.42
3	.49	.10	2.18
4	.92	.29	4.09
5	.69	.34	3.07
6*	6.68	.88	29.69
7*	4.43	.82	19.69
8	1.18	.28	5.25
9	.17	.06	.76
10	.26	.09	1.16
11	.61	.10	2.71
12	1.09	.23	4.84
13	.59	.14	2.62
14	1.43	.37	6.36
15	.24	.08	1.07
16	.65	.14	2.89
17	1.63	.32	7.24
18	.74	.25	3.29
19*	2.79	.47	12.40

*% damage estimate outside equation bounds.

Figure 46. Proportion of total SC adult catch before (A-B) and after (C-F) temperature adjustment for flight interception traps in 1979 and 1980. Mean trap catch for field 7 (G) and field 13 (H).


A
1979
male
female
Field 7
B
1980
Field 13
C
PROPORTION CATCH PER DD
Field 7
D
0.25
PROPORTION CATCH PER DD
Field 13
E
0.29
Field 1-7
DEGREE DAYS (4.4°C BASE)
F
Field 8-14
DEGREE DAYS (4.4°C BASE)
G
4.5
MEAN TRAP CATCH PER DD
Field 7
DEGREE DAYS (4.4°C BASE)
H
MEAN TRAP CATCH PER DD
Field 13
DEGREE DAYS (4.4°C BASE)

each year are presented as proportion of total catch for comparison. Temperature-adjusted trap data from flight-interception traps for all fields and both years are presented in Figures 47-48. Identical procedures and presentations were done for stickyboard trap counts in 1978-79 for the research field (Figure 49).

For all traps, fields, and years few differences were observed between male and female catch. Due to the number of overlapping generations, specific times of generation activity were difficult to determine. All three years revealed high densities of adults early in the spring at 100 to 200 degree-days. This was followed by another peak of activity at degree-day periods of 750 to 850. A third peak, usually lower than the preceding peaks, occurred at degree-day periods of 1150 to 1250. In most cases, a large fourth peak was recorded for degree-day intervals of 1900 to 2000. These times of peak density estimates may only reflect the number generations of activity on onions and not the total number of generations of the SCM. Seed corn maggots are known to feed on over 100 plant species, and it may be expected that at certain times during the season, crops other than onions may support other generations not recorded on the onion crop.

When OM larvae and pupae were laboratory-identified, third instar SCM larvae and pupae were recorded when present (Appendix H). Plots of these immature stages described three generations of larval activity on onions during 1978 and 1979 (Figure 50). The phenology of these stages was found to closely resemble the adult SCM flight curves for the sresearch field where second to fourth generation adults lagged the first to third larval broods. An examination of adult flight curves for the research field and commercial study fields revealed

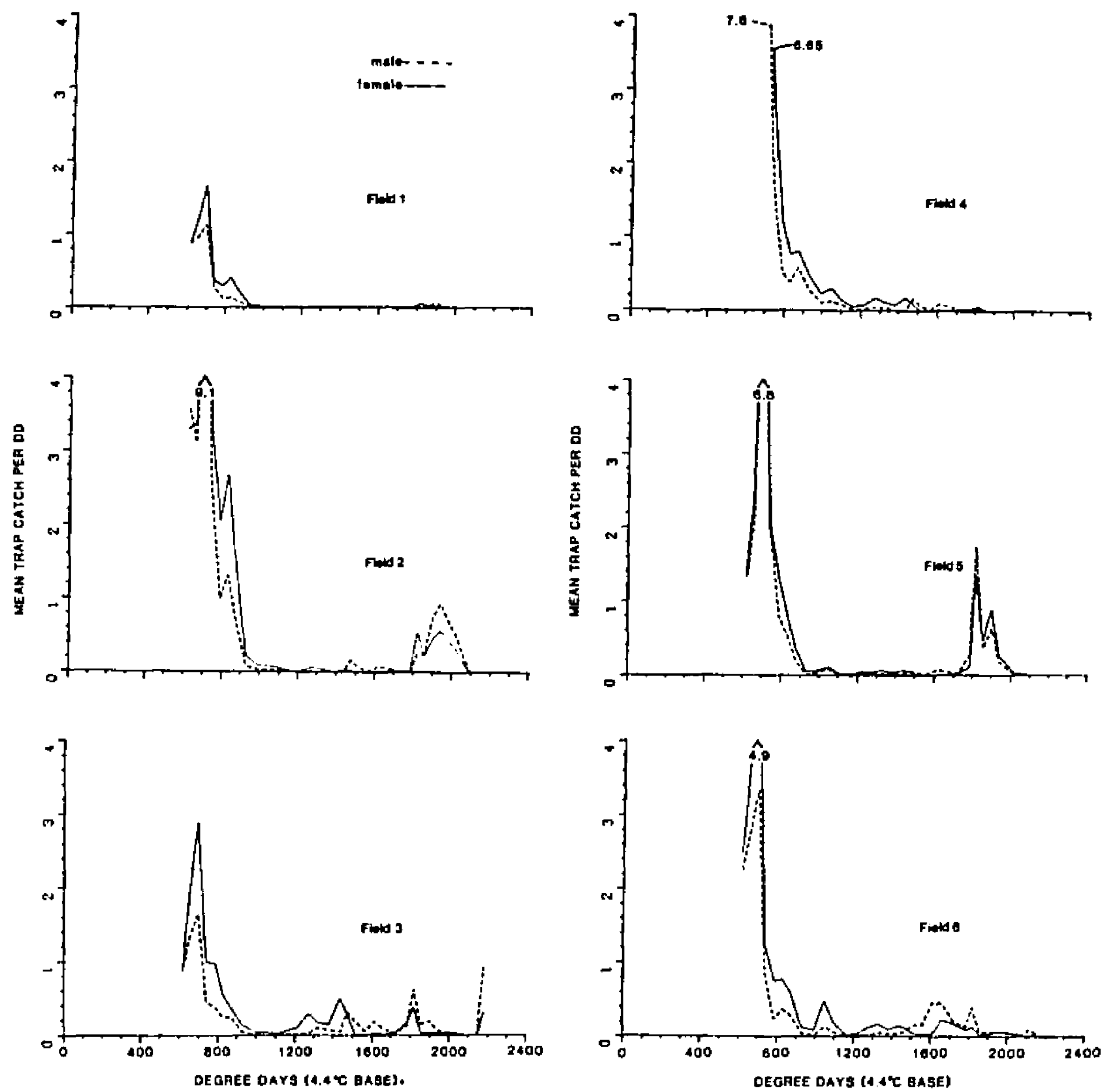


Figure 47. Flight curves of male and female adult SC from flight interception traps in commercial study fields in 1979.

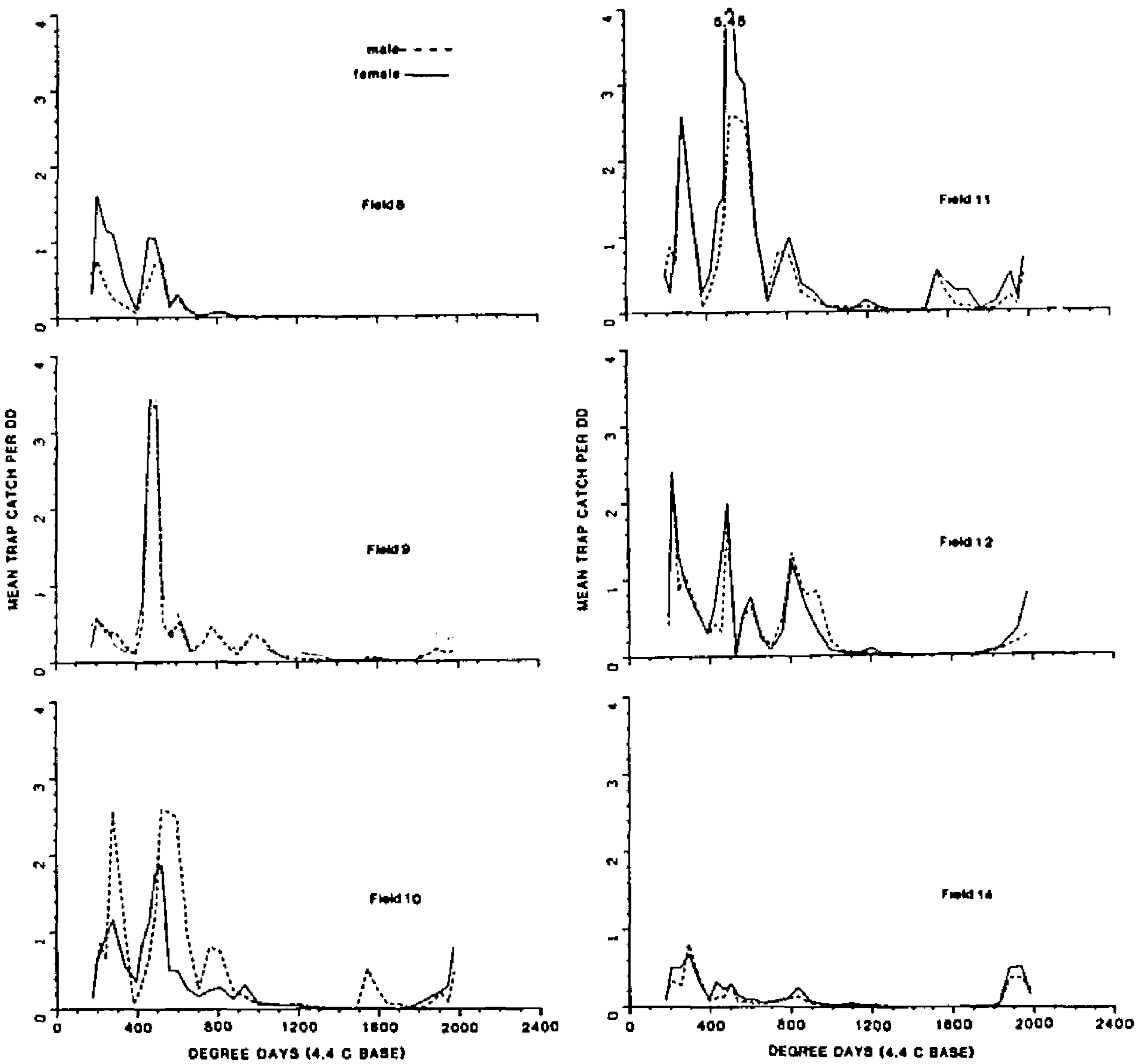


Figure 48. Flight curves of male and female adult SC from flight interception traps in commercial study fields in 1980.

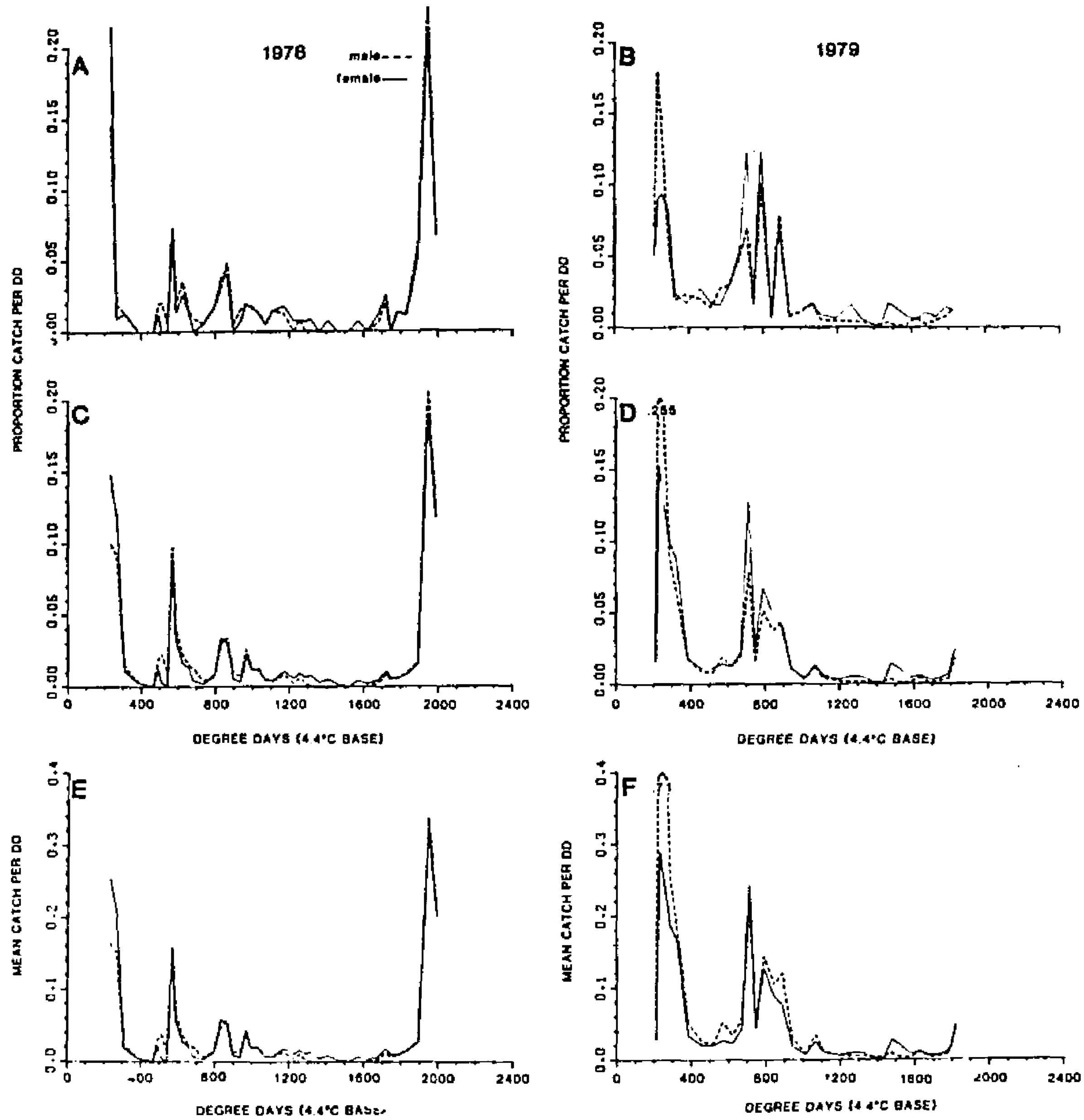


Figure 49. Proportion of total SC adult catch before (A-B) and after (C-D) temperature adjustment for sticky board traps in 1978 and 1979. Mean trap catch for the research field in 1978 (E) and 1979 (F).

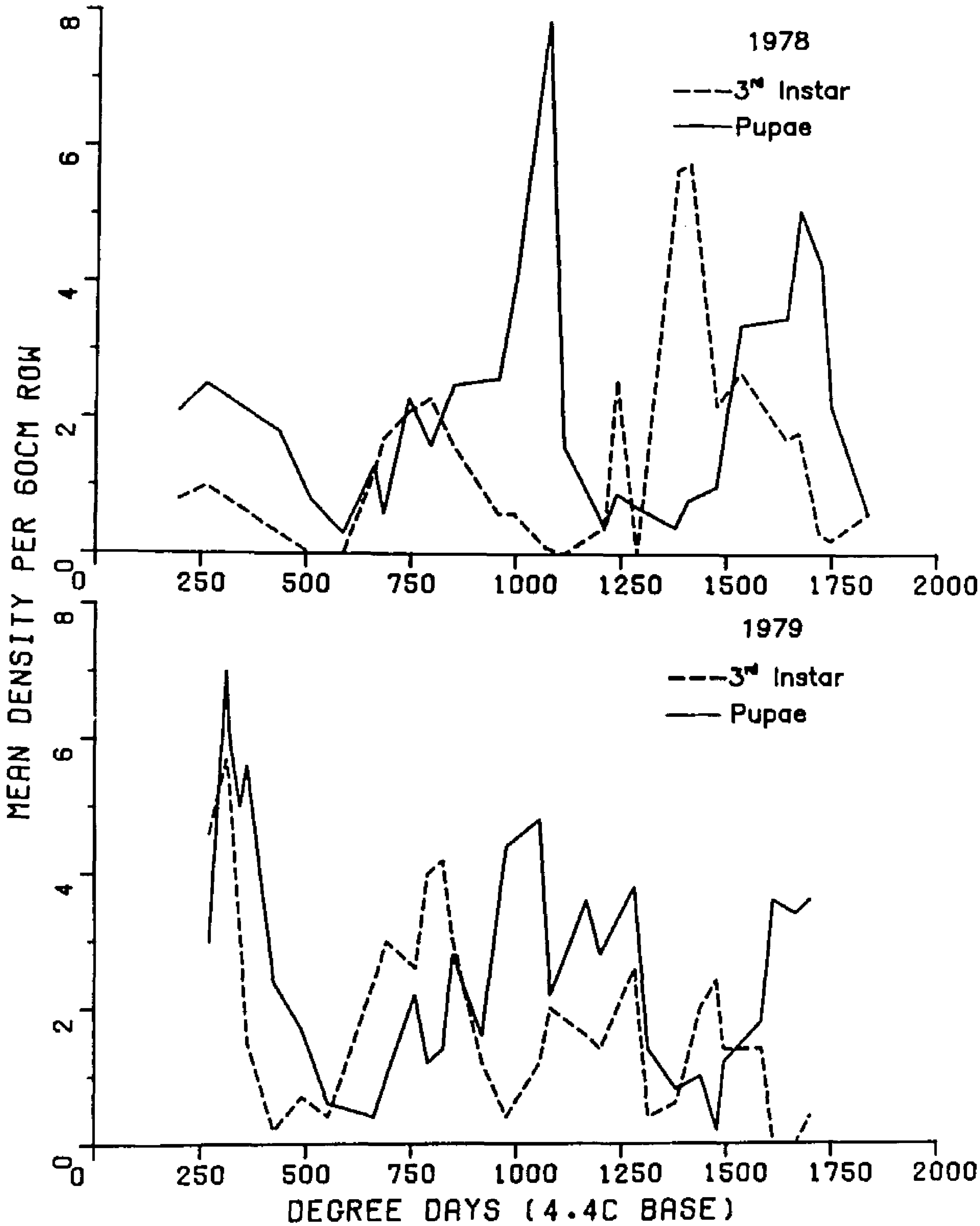


Figure 50. Mean density of third instar larvae and pupae of the SC from samples of 60 cm of onion row in 1978 and 1979.

that the third generation of adults was very low. This factor was not reflected by the larval or pupal density of the second generation brood in the research field; therefore, high mortality of adults during this generation or migration of adults to other crops may have occurred.

Loosjes (1976) observed that SCM population densities were highly dependent on OM population density. He suggested that SCM populations do not reach high densities where OM density is low. To examine this relationship, the total seasonal production of OM adults determined from adult flight curves were compared to the total seasonal production of SCM adults for the commercial study fields in 1979 and 1980. Pearson's Rank Correlation analysis was used to test for significant correlations for each year and the pooled data for both years. Significant correlation between total seasonal production of OM and SCM adults for each year was evident (Table 39). For each field, total seasonal adult production of the two species were similar.

Seed corn maggot populations may depend on OM density or there may be common factors affecting both species' survival, development, and habitat preference. Seed corn maggots in the past have been primarily described as secondary pests of onions and as only feeding on onion plants previously inhabited by the OM. To determine if presence of SCM larvae was dependent on OM larval populations, the ratio of third instar larvae for the two species was compared for each sample date (Figure 51). For both years, first samples taken early in the season revealed that SCM larvae were the primary species present on damaged onions. In 1979 damage to onions was widespread and SCM larvae were the primary invaders up to day 150 (May 30). OM larvae were observed to be the primary inhabitants of damaged onions from June 1 through the rest of the onion

Table 39. Pearson's Correlation Coefficient for total OM and SC adult seasonal production for study fields in Grant, Michigan, in 1979-1980.

Year	N	Pearson's Coefficient	α
1979	7	.87	.006
1980	7	.97	.001
1979 and 1980	14	.87	.001

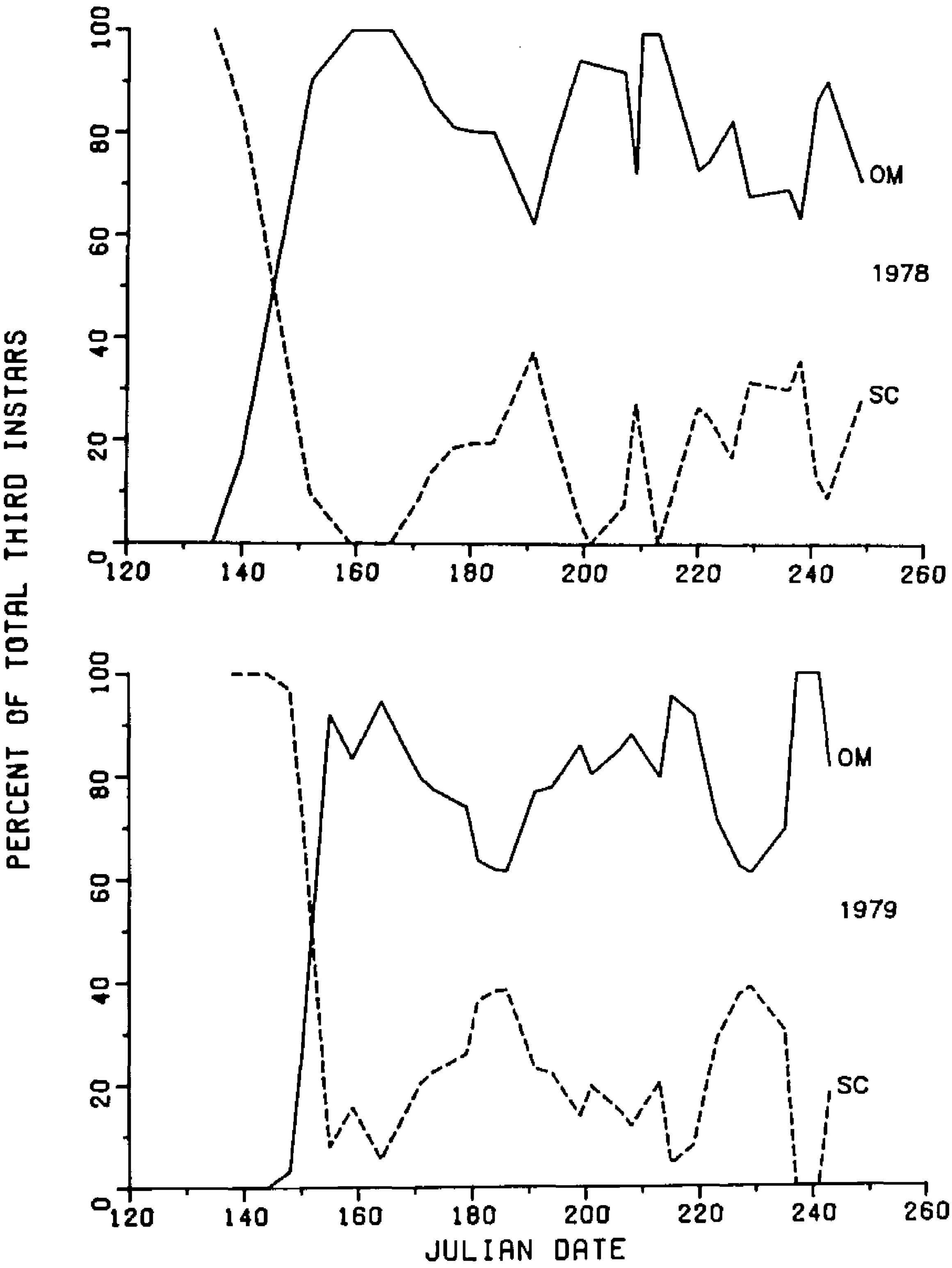


Figure 51. Comparison of the percentage ratios of SC and OM third instar larvae, from samples of 60 cm onion row in 1978 and 1979.

growing season. The ratio of SCM to OM larvae was higher for this period in 1979 than in 1978. It appears that early in the spring, SCM larvae can be considered primary pests of onions and that initial onion damage may be the result of SCM activity rather than the OM. Loosjes (1976) reported that damaged onions containing only SCM larvae were often found especially during the first generation of damage in the Netherlands.

Seed corn maggot larvae may be very susceptible to the granular insecticide Dyfonate; therefore, this chemical could control SCM larval populations early in the spring. When a granular treatment is not applied, successful SCM larval attack may accur. Because the OM prefers to oviposit on previously damaged onions, the initial areas of damage caused by the SCM may act as centers of OM attraction. This relationship would explain the presence of damage observed earlier in the non-Dyfonate treated area of the research field in 1979. All larval sampling in 1979 was conducted in the non-Dyfonate section of the research field; whereas, in 1978 onions were sampled in a Dyfonate-treated area. In 1978, SCM density per 60 cm sample of onion row was very low and initial onion damage in the field was very sparse. In 1979, initial damage was widespread and SCM larval densities per sample were high in comparison to 1978.

J. Validation of the OM Submodel

Model performance for the conceptual model was regarded as acceptable for the abiotic information that was used (see Section III). After this first phase of model conceptualization and structure, validation testing of results were possible. Validation of a model usually requires an independent set of data that has not been used in model formulation. The agro-ecosystem project provided a set of field data that could be used to validate the submodel of the population dynamics of the OM. Because the model was made up of several free body models, the submodel of the OM could be run independently of the other submodels so results could be compared to field data.

The submodel of the OM provided estimates of the various life stages of the OM through the season. A computer subroutine was added so soil and air temperature data for the onion growing area of Grant, Michigan, could be used in the developmental delays. Oviposition was set to zero when the cumulated degree-day value in the model was equal to the required degree-day estimate for onion plant maturity in the field (1550, base $4.4^{o}C$). This procedure allowed oviposition and OM larval development only during the regular onion growing season. Oviposition or larval development on cull onions after onion harvest was not accounted for. Listing and documentation of the model are provided (Appendix G).

Cumulative OM emergence for the 1980 simulation run was compared to field emergence rates for that year (Figure 52). The predicted first generation emergence of OM adults by the model accurately tracked field estimates. Second and third generation emergence results revealed a lag period of several days between field results and model prediction. Deviation of model prediction for the third generation emergence was greater than that of the second generation. Carruthers (1981) described similar results when he compared the same field emergence data to that of predicted emergence from computer simulation.

After adding a submodel of *E. muscae* infection, he found that model results accurately tracked the second and third generation OM emergence. He

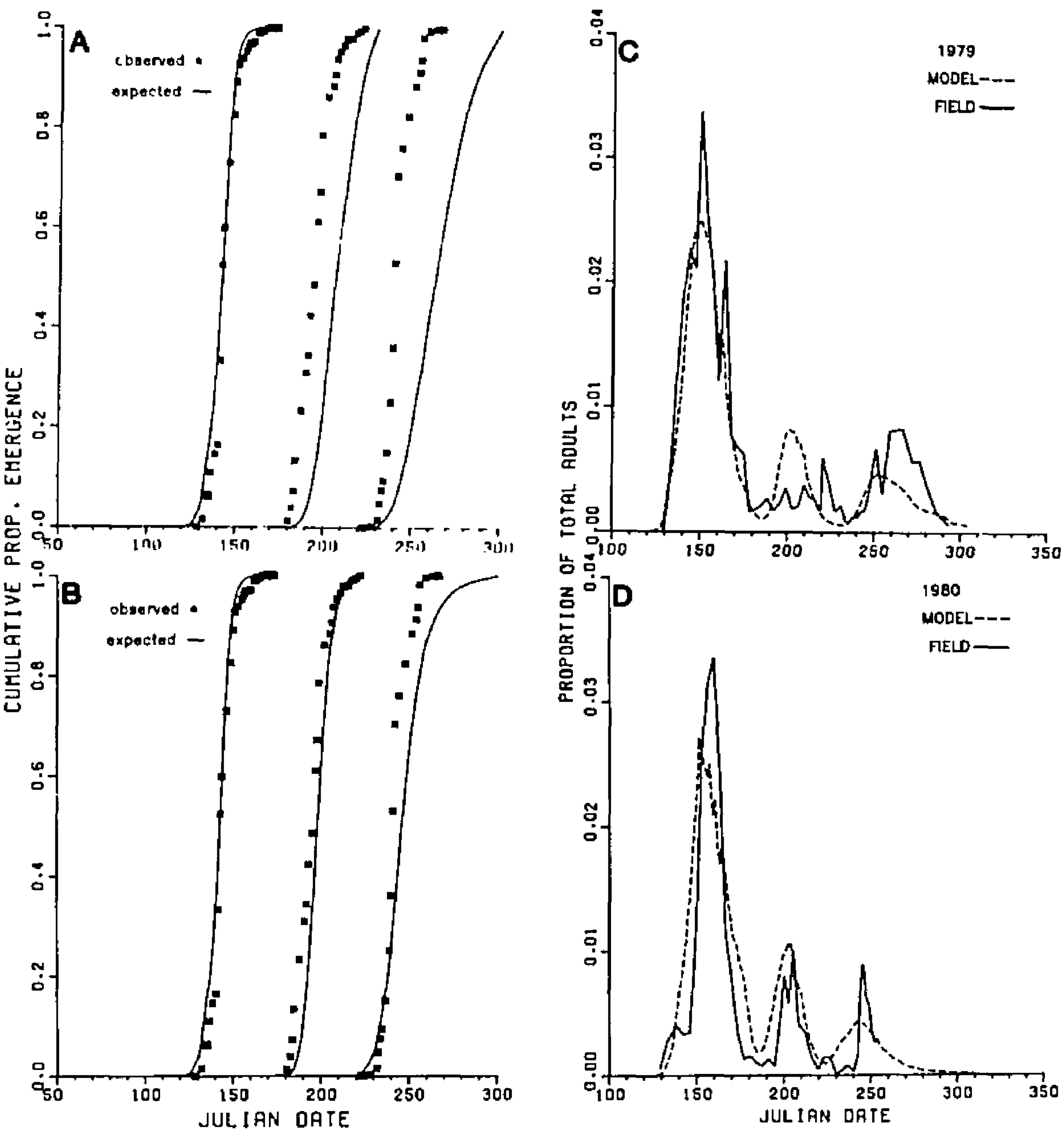


Figure 52A. Cumulative proportion OM emergence for model (expected) and field (observed) data for Grant, 1980. (*E. muscae* not included.)

Figure 52B. Cumulative proportion OM emergence for model (expected) and field (observed) data for Grant, 1980, after inclusion of *E. muscae*.

Figure 52C. Proportion of total OM adults for model and field data in Grant, MI, 1979.

Figure 52D. Proportion of total OM adults for model and field data in Grant, MI, 1980.

suggested that a shift of the predicted second and third generation emergence by the model occurred due to additional adult mortality caused by E. muscae.

Adult mortality was adjusted in the model according to field data on infection levels of E. muscae (Carruthers 1981). Model prediction of second and third generation emergence of OM adults for 1980 was found to track the field emergence results accurately (Figure 52). Based on these results, adult OM mortality by E. muscae was included in all proceeding model runs.

Temperature-adjusted trap catch of flight-interception traps for 1979 and 1980 (field 7, 13) were compared to model results for the same years. Counts were transformed to a proportion of total catch so results could be examined independent of density (Figure 52). Model results were similar to field results for both years. In 1979 the model predicted a higher peak proportion of adults for the second generation when compared to the field data. The total adult incidence for the second generation, however, was the same for the model and the field. For both years, model and field results described a similar phenology of adult activity.

Model runs were made for 1979 to examine the phenology of the immature stages of the OM (Figure 53). Field sampling results and model predictions are presented as a proportion of the total so comparisons can be made independent of density. Only two generations of larval activity on immature onions were revealed. These results agree with information presented earlier from immature stage sampling in the field. The phenology of immature stages predicted by the model, do not agree completely with population estimates from field sampling. Such deviations in the phenology may be partly due to the use of only one developmental base temperature (4.4°C) in the model. Different base tempera-

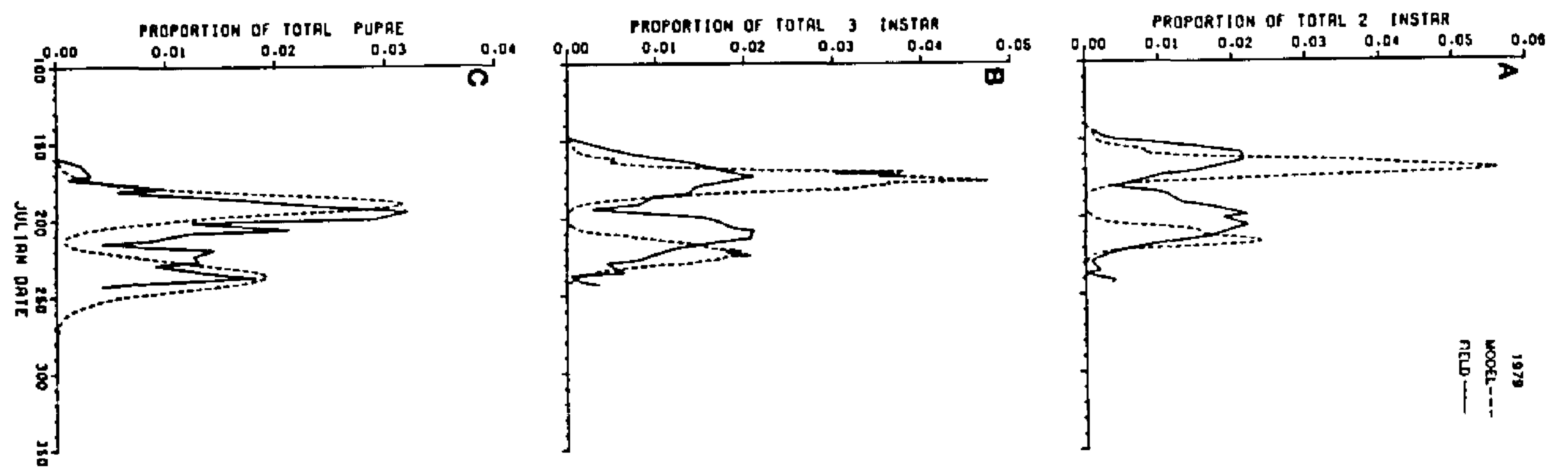


Figure 53. Comparison of field and model results for proportions of immature stages of the OM during the onion growing season in Grant, Michigan, in 1979. A) Proportion of second instar, B) Proportion of third instar, and C) Proportion of pupae.

tures for the various life-stages may exist, which, if incorporated into the model, would affect predicted phenology considerably. Deviations between the model and field results for proportional size of the second and third generation are also evident. This is probably due to sample location and procedures used for obtaining estimates of immature stages in the field. Field samples consisted of damaged areas of 60 cm of onion row. To more accurately compare field and model results, the number of damaged areas in the field for each generation would need to be included. From the previous section on OM plant damage, it is evident that more damage occurs early in the season and thus higher densities or a higher proportion of first generation larvae would be expected.

Model validation with field data will be greatly enhanced when an onion plant component is available. This component is presently being investigated for inclusion in an OM-*E. muscae* population model (Pet 1982, Michigan State University, projected date of MS thesis completion). Inclusion of a dynamic plant model will provide an opportunity to examine immature and adult survival, effects of a limited food resource on survival and effects of onion plant spatial distribution on both the adult and immature stages.

V. Summary and Conclusions

This research has sought to provide information on the spatial and temporal distribution of the OM in Michigan and the distribution and extent of OM plant damage. The phenology of the SCM was also investigated and its importance as a pest of onions is evaluated. A submodel of the OM population dynamics is provided and model output was compared to field research results on adult and larval phenology. A conceptual model of the onion agroecosystem was designed to illustrate the interactions of the OM in the system and to show how the various subcomponents are linked and integrated.

Results of adult emergence studies indicate that OM emergence each year may be predicted by accumulation of either soil or air degree-days. Degree day values of emergence updated for Grant, MI, may be used in prediction of OM emergence for different areas of the state. These values have been shown to closely agree with degree-day values reported for OM emergence in New York. Biotic and abiotic parameters other than temperature can also influence OM emergence. If greater accuracy in prediction of OM emergence is needed, more study is necessary to identify these other effects and how they may be monitored and used for predictive purposes. In this report, the effect of soil moisture on OM emergence was investigated by comparison of emergence and precipitation records. Although no definite conclusions can be made, it appears that soil moisture can affect adult OM emergence in the spring.

Several aspects of OM flight behavior were investigated. Adults were observed to fly at or about the height of the onion crop. Height of traps used for monitoring adult activity and abundance should therefore be adjusted during the season. A 100 cm trap height, however, should be adequate if one height of trap is desired for trapping adult root maggots during the whole of the season. It was also found that relative trapping devices worked best when placed along field borders, and that the direction of the trap or the foliage type of the border had little influence on relative catch size.

During night hours, the majority of OM adults were observed to rest in border habitats of grass or carrots. High moisture conditions and protection in these areas may account for this spatial distribution at night. Adult root maggots infected by E. muscae often attach to foliage in these border areas at night in order to sporulate (Carruthers 1981). Aggregates of adults in these areas at night is therefore desirable for spore attachment and infection by E. muscae.

Studies were conducted with flight interception traps to examine the within-day activity of OM adults. Greatest activity occurred between 5:30-9:30 a.m. and 5:30-8:30 p.m. Information from the literature on how abiotic factors influence OM flght were evaluated, and a temperature-adjustment program was written to adjust trap data for abiotic effects on OM flight activity and natural diurnal rhythm. The program appropriately adjusted trap data for effects of major weather disturbances on adult activity. A similar technique was used to adjust activity trap data of root maggot adults in the Netherlands (Loosjes 1976). Inclusion of within-day activity in trap catch adjustment enhanced the technique by providing a realistic transformation of activity data such that negative values were avoided.

Adult flight curves of temperature-adjusted data were presented for several study fields each year. Three generations of adult OM flight were observed, with the third flight occurring very late in the season, often after onion harvest. Adult flight curves of all fields in the region revealed a similar phenology of adult flight during the season. Between-field differences in adult density were apparent, however, and this was attributed to several factors infludling different soil types and presence or absence of protective border areas. Applications of foliar insecticide sprays had little effect on adult densities and failed to significantly reduce populations of adult root maggots in fields where they were used. Foliar applications of the insecticides malathion, parathion and diazinon are therefore not recommended as a control for OM adults.

Phenology and occurrence of OM immature stages were investigated. Only two generations of larval activity were observed during the onion growing season. The third larval brood occurred primarily on mature onions at harvest or cull onions left in the field following harvest. Mature onions not harvested until late in the fall were observed to be damaged by the third larval brood. Onions ready for harvest that had been "lifted" and physically disturbed were not damaged by the third larval generation. The major proportion of the third larval brood occurs on cull onions which are missed during harvest or dumped back into the field following processing. Phenology of the immature stages was found to depend on time of OM adult emergence and activity. Total second and third instar larval mortalities of 52% for the first and 43% and for the second generations were observed. Pupal mortality differed significantly among areas with different control programs. Superparasitism by A. bilineata caused increased pupal mortality during the second and third generation. Because parasitism by A. bilineata was low where a granular or foliar insecticide was applied, it follows that percent parasitism and OM pupal mortality was probably lower in commercial fields during the onion growing season due to widespread use of the insecticide Dyfonate and weekly applications of foliar insecticides.

These compounds decreased potential OM pupal mortality by reducing first instar parasitism by *A. bilineata*. Recent studies have shown that some granular insecticides used for root maggot control are less toxic to *A. bilineata* than the compounds (Finlayson et al. 1980). Compounds such as chlorfenvinphos may provide adequate OM control and be less toxic to natural enemy populations. Foliar applications of insecticides may also reduce total pupal mortality and parasitism by decreasing parasitoid populations. Reduced use of these sprays in the future would allow natural enemy populations to increase.

Only 3% of OM pupae during the second generation were observed to be in diapause. This value is much lower than percentages reported for Quebec and New York. Overwintering mortality of OM pupae was investigated, and differing abiotic conditions were found to have little effect. Overall mortality of overwintering OM pupae was found to be 12.2% for both years of the study. Parasitism by *A. bilineata* and *A. pallipes* was observed in overwintering OM pupae. Actual percent parasitism was not determined, but recent studies indicate that significant parasitism of OM pupae by these species has been low due to present onion production practices. Studies by Carruthers (1981) have shown that many of the current recommended materials including some herbicides can cause high mortality of OM natural enemies.

The extent and distribution of onion plant damage by the OM was investigated by "mapping" the condition and location of individual onion plants throughout the season. Sixty-five percent of the total seasonal damage was found to occur during the first generation brood. At this time, onion plants are small and frequent migration of OM larvae to nearby onion plants occurs.

Onion plants damaged early in the season were observed to remain in the field an average of 155 degree-days. Plants damaged later in the season remained visible in the field over a greater length of time, since the size of the onion plant is greater and dehydration and soft rot do not lead to bulb decomposition as quickly. A sample interval of one week or less was necessary for determination of OM plant damage in the spring to ensure that most damaged onions were available for recording before total decomposition occurred. Total second generation damage can best be assessed at harvest, since damaged onins remain visible in the field longer than two weeks.

Onion plant damage in the spring was found to be distributed initially in a random pattern. Significant departure from randomness toward contagious was revealed later in the spring as damage progressed. The distribution of damaged onions in plots treated with Dyfonate insecticide tended toward a contagious pattern a week earlier than that observed for damaged plants in non-treated plots. For both plot conditions, the distribution of damaged plants approached a random pattern late in the season as the density of damaged plants increased.

Volunteer onions were shown to affect the spatial distribution of OM plant damage. A test statistic was developed for comparing onion plant damage in areas of different volunteer onion density. It was also used for estimation of average clump size of damaged plants around volunteer onions. Aggregates of volunteer onions affected OM plant damage more than single volunteer onion plants. The area of onion plants directly affected by volunteer onions was found to be approximately 35-37 cm (radius). Onions close to volunteer onion plants had a higher probability of being damaged by the OM in the spring. This information may be useful for detection-type sampling of OM plant damage early in the season, by selecting fields where volunteer onions are present for initial damage surveys. When onion seedling damage is first observed in these areas close to volunteer plants, damage surveys can be initiated in all fields of the region.

Plant damage during the first generation of the OM was determined by accumulating weekly damage estimates in the spring. Foliar insecticide sprays did not significantly reduce OM larval damage during the first or second generation. First generation OM plant damage was significantly correlated with second generation adult populations. Post-harvest production practices might affect the spatial distribution of the third generation of adults, since no correlation between second generation damage and third generation adults was evident.

Regional surveys of OM plant damage were conducted in Michigan for both the first and second generation over a four-year period. Most fields in four major onion-growing areas were surveyed, and regional estimates of damage were determined. These surveys provided information on extent of OM damage in the state and use and success of control programs.

Onion plant damage in all study fields in Grant was observed to progress at the same rate over a limited range of onion damage density. Proportional damage curves were determined for the Grant region for two years. Total first generation Om plant damage was determined for 19 fields in 1980 by use of a proportional damage curve. The rate of damage may be determined each year by sampling a limited number of fields in the area. Damage estimates from regional surveys (point estimates) can then be used to estimate total percent OM plant damage at the end of the first generation of damage.

Adult flight curves of the SCM were presented for several fields in the Grant area. Four generations of adult flight were observed and these data agreed with results of immature stage sampling. There was significant correlation between SCM and OM adult populations for all fields and years examined.

SCM in the past has been described as either a secondary pest of onions or as being present only when OM larval populations were also present. SCM larvae were observed to be the primary inhabitants of damaged onions early in the season, especially when no granular insecticide was used. Areas of SCM onion plant damage may, therefore, act as centers of attraction for OM oviposition later in the spring.

A conceptual model of the survival and development of the OM was presented. Behavior of the conceptual model was found to be acceptable for known features of OM biology. Validation of the OM population dynamics submodel was possible by comparison of model output and field research results. Simulation of adult emergence revealed a lag period of several days between field results and model prediction of second and third generation emergence. Incorporation of adult mortality by _E. muscae_ greatly improved model results. The model accurately tracked second and third instar and pupal phenology when results were compared to field data. Simulation results also predicted only two generations of larval activity on onions before harvest. A third adult emergence was predicted to occur following onion havest in early September. Several assumptions and limitations of the model were presented, including the need for an onion plant subcomponent.

LITERATURE CITED

Armstrong, T. 1924. Onion maggot studies in the district of Montreal, Quebec, 1924. Ann. Rpt. Entomol. Soc. Ont. 1923 54:42-45.

Baker, A.D. 1928. The habits of the onion maggot flies (Hylemya antiqua Meigen). Ann. Rpt. Entomol. Soc. Ont. 1923 54:42-45.

Baker, A.D. and K.E. Stewart. 1927. The onion root-maggot (Hylemya antiqua Meigen) on the island of Montreal. 20th Rpt. Quebec Soc. for Prot. Plants 92-130.

Baskerville, G.L. and P. Emin. 1969. Rapid estimation of heat accumulation from maximum and minimum temperatures. Ecology 50:514-17.

Batcheler, C.L. 1971. Estimation of density from a sample of joint point and nearest-neighbor distances. Ecology 52(4):703-9.

Bath, J.E. 1975. Vegetable subproject. In: Bionomics and Management of Soil Arthropod Pests, M.L. Fairchild (ed.). EPA Grant Res. No. R802547, Second Ann. Rpt. pp. 247-380.

Bird, G. 1976. Measurements on onion plant growth. Unpublished data. Mich. St. Univ., E. Lansing.

Birley, M.H. 1977. The estimation of insect density and instar survivorship functions from census data. J. Anim. Ecol. 46:497-510.

Bromand, B. 1980. Investigations on the biological control of the cabbage rootfly (Hylemya brassicae) with Aleochara bilineata. West Paleoarctic Regional Section Bulletin, Volume 3, No. 1.

Brooks, A.R. 1951. Identification of the root maggots (Diptera: Anthomycidae) attacking cruciferous garden crops in Canada, with notes on biology and control. Can. Entomol. V 83:109-20.

Brown, A.W.A. 1971. Pest resistance to pesticides. In: Pesticides in the Environment, Vol. 1, Part 2, R. White Stevens (ed.). Marcel Dekker, New York. pp. 457-552.

Caesar, L. 1931. Insects attacking vegetables. Ontario Dept. Agr. Bull. 359 pp.

Calhoun, E.H. 1953. Notes on the stages and the biology of Baryodma ontarionis Cosey (Coleoptera: Staphylinidae), a parasite of the cabbage maggot, Hylemya brassicae (Bauche') (Diptera: Anthomyiidae). Can. Entomol. V 85:1-8.

Carruthers, R.I. 1979. Population sampling and spatial distribution of the immature life stages of the onion maggot, Hylemya antiqua (Meigen). MS thesis, Mich. St. Univ., E. Lansing. 197 pp.

Carruthers, R.I. 1981. The biology and ecology of Entomophthora muscae (Cohn) in the onion agroecosystem. PhD thesis, Mich. St. Univ., E. Lansing. 238 pp.

Clark, P.J. and F.C. Evans. 1954. Distance to nearest neighbor as a measure of spatial elationships in populations. Ecology 35:445-53.

Coaker, T.H. 1966. The effect of soil insecticides on the predators and parasites of the cabbage root fly (Erioischia brassicae (Bauche')) and on the subsequent damage caused by the pest. Ann. Appl. Biol. 57:397-407.

Croft, B.A., J.L. Howes and S.M. Welch. 1976. A computer-based extension pest management delivery system. J. Environ. Entomol. 5:20-34.

Davis, E.G. and F.M. Wadley. 1949. Grasshopper egg-pod distribution in the northern Great Plains and its relation to egg-survey methods. USDA Circ. 816. 16 pp.

Dempster, J.P. 1961. The analysis of data obtained by regular sampling of an insect population. J. Anim. Ecol. 30:429-32.

Dimoff, K. 1979. Sample. Mich. St. Univ., Dept. of Entomology.

Dindonis, L.L. and J.R. Miller. 1980. Host-finding behavior of onion flies, Hylemya antiqua. Envir. Entomol. 9(6):769-72.

Doane, C.C. 1953. The onion maggot in Wisconsin and its relation to rot in onions. PhD thesis, Univ. of Wisc. 129 pp.

Dustan, A.G. 1948. Seed-corn maggot. Can. Dept. Agr. Pub. 80.

Eckenrode, C.J. and R.K. Chapman. 1971. Observations on cabbage maggot activity under field conditions. Ann. Entomol. Soc. Am. 64:1220-30.

Eckenrode, C.J., E.V. Vea and K.W. Stone. 1975. Population trends of onion maggots correlated with air thermal unit accumulations. Envir. Entomol. 4(5):785-89.

Ellington, J.J. 1963. Field and laboratory observations on the life history of the onion maggot, Hylemya antiqua (Meigen). PhD thesis, Cornell Univ. 124 pp.

Elliott, J.M. 1977. Some methods for the statistical analyses of samples of benthic invertebrates. Freshwater Biol. Assn. Scientific Publication N. 25. 160 pp.

Ellis, P.R., C.J. Eckenrode and G.E. Harman. 1979. Influence of onion cultivars and their microbial colonizers on resistance to onion maggot. J. Econ. Entomol. V 72:512-15.

Eyer, J.R. 1922. Bionomics and control of the onion maggot. Penn. Agr. Exp. Bull. 171:16.

Finlayson, D.G. and C.J. Campbell. 1976. Carabid and staphylinid beetles from agricultural land in the Lower Fraser Valley, British Columbia. J. Entomol. Soc. Brit. Columbia 73:10-19.

Finlayson, D.G., J.R. Mackenzie and C.J. Campbell. 1980. Interactions of insecticides, a carabid predator, a staphylinid parasite and cabbage maggots in cauliflower. Envir. Entomol. 9(6):789-97.

Finney, D.J. 1941. Wireworm populations and their effect on crops. Ann. Appl. Biol. 28:282-95.

Finney, D.J. 1971. Probit Analysis, 3rd ed. Cambridge Univ. Press. 333 pp.

Fischer, R.A. and F. Yates. 1963. Statistical tables for biological, agricultural and medical research. Table IX. Oliver and Boyd, Edinburgh.

Fulton, W.C. 1978. The development of a model for use in the on-line control of the cereal leaf beetle (Oulema melanopus) (L.)). PhD thesis, Mich. St. Univ., E. Lansing. 121 pp.

Gage, S.H. 1974. Ecological investigations on the cereal leaf beetle, Oulema melanopus (L.), and the principal larval parasite, Tetrastichus julis (Walker). PhD thesis, Mich. St. Univ., E. Lansing. 172 pp.

Geier, P.W. 1966. Management of insect pests. Ann. Rev. Entomol. 11:471-90.

Gray, H.E. 1924. The onion maggot in Alberta. Ann. Rpt. Entomol. Soc. Ont. 1923 54:36-38.

Greig-Smith, P. 1957. Quantitative Plant Ecology. Academic Press, Inc., New York. 198 pp.

Griffith, K.J. and C.S. Holling. 1969. A competition submodel for parasites and predators. Can. Entomol. 101:785-819.

Guyer, G.E. and A. Wells. 1959. Evaluation of insecticides for control of the chlorinated hydrocarbon-resistant onion maggot. Mich. Agric. Exp. Stn. Quart. Bull. 41:614-23.

Hajek, J. 1969. Nonparametric Statistics. Holden-Day, San Francisco. 184 pp.

Harcourt, D.G. 1961. Spatial pattern of the imported cabbageworm, Pieris rapae (L.) (Lepidoptera: Pieridae), on cultivated Cruciferae. Can. Entomol. 93:945-52.

Harris, C.R. 1977. Insecticide Resistance in Soil Insects Attacking Crops. In: Pesticide Management and Insecticide Resistance. Academic Press, Inc., New York.

Harris, C.R. and H.J. Svec. 1976. Onion maggot resistance to insecticides. J. Econ. Entomol. 69:617-20.

Hawkes, C. 1969. The behavior and ecology of the adult cabbage root fly, Erioischia brassicae (Bauche'). PhD thesis, Dept. of Zoology and Comparative Physiol., Univ. of Birmingham, Wellesbourne, Warwick. 151 pp.

Haynes, D.L., R.L. Tummala and T.L. Ellis. 1980. Ecosystem management for pest control. BioSci.30(10):690-96.

Helgeson, R.G. 1969. The within-generation population dynamics of the cereal leaf beetle, Oulema melanopus (L.). PhD thesis, Mich. St. Univ.

Helgeson, R.G. and D.L. Haynes. 1972. Population dynamics of the cereal leaf beetle, Oulema melanopus (Coleoptera: Chrysomelidae): model for age-specific mortality. Can. Entomol. 104:797-814.

Hennig, W. 1974. Anthomyiidae. In: Die Fliegen der Palaerkteschen Region, E. Lindner (ed.), 63a, 306:681-776 (cited in Loosjes 1976).

Hollander, M. and D.A. Wolfe. 1973. Nonparametric Statistical Methods. John Wiley and Sons, New York. 503 pp.

Hopen, H.J. 1972. Growth of common purslane as influencing control and importance as a weed. Weed Sci. 20:20-23.

Howitt, A.J. 1958. Chemical control of Hylemya antiqua (Meigen) in the Pacific Northwest. J. Econ. Entomol. 51:883-87.

Huckett, H.C. 1971. Anthomyiidae of California exclusive of the sub-family Scatophaginae. Bull. of the Calif. Insect Survey 12:121.

Hudon, M. and J.P. Perron. 1954. Dipterous species infesting onions in the muckland areas of southwestern Quebec. Rpt. Quebec Soc. Prot. Plants V 36:89-92.

Iwao, S. 1956. The relation between the distribution pattern and the population density of the large twenty-eight-spotted lady beetle, Epilachna 28-maculata Motoschulsky, in egg-plant field. Pattern of the spatial distribution of insect 6. Jap. J. Ecol. 5:130-5.

Jantsch, E. 1970. Inter- and transdisciplinary university: a systems approach to education and innovation. Policy Sciences, pp. 403-428.

Jessen, R.J. 1978. Statistical Survey Techniques. Wiley, New York. 520 pp.

Johnson, C.G. 1969. Migration and dispersal of insects by flight. Methuen, London. 763 pp.

Karuma, G.A., F.M. Khalil and A. El-Sebae. 1972. Preliminary studies on the biology of the onion fly. Bull. Soc. d'Egypte 56:429-35.

Kiritani, K. and F. Nakasuji. 1967. Estimation of the stage-specific survival rate in the insect population with overlapping stages. Res. Popul. Ecol. 9:143-52.

Kirknel, E. 1978. The influence of diazinon, trichloronate, carbofuran and chlorfenvinphos on parasitism capacity of the rove beetle, Aleochara bilineata (Gyll.). Tidsekr. Planteavl. 82:117-29.

Lampert, E.P. 1976. White cutworm (Euxoa scandens (Riley)): sampling and biology in asparagus in Michigan. MS thesis, Mich. St. Univ., E. Lansing. 136 pp.

Lampert, E.P. 1980. Endemic ecology of the cereal leaf beetle (Oulema melanopus (L.)). PhD thesis, Mich. St. Univ., E. Lansing. 526 pp.

Llewellyn, R.W. 1965. Fordyn, an industrial dynamics simulator. Copyright 1965 R.W. Llewellyn, Raleigh, North Carolina.

Loosjes, M. 1976. Ecology and genetic control of the onion fly, Delia antiqua (Meig.). Ag. Res. Rpt. 857 P, Wageningen. 179 pp.

Maan, W.J. 1945. Biology en phaenologie van de uienvliet, (Chortophila antiqua (Meigen) en de preimat, Acrolepia assedella (Zeller) de preimat, als grondslag voor de bestrijding. Meded. Teunvoorlickingsdienst 39, 92 pp. (cited in Ellington 1963 and Loosjes 1976).

Manetsch, T.J. and G.L. Park. 1977. System analysis and simulation with applications to economic and social systems. Dept. Elec. Engr. and Sys. Sci., Div. of Engr. Res., Mich. St. Univ., E. Lansing.

Manly, B.F.J. 1975. A comparison of methods for the analysis of insect stage-frequency data. Oecologia 17:335-48.

Manly, B.F.J. 1976. Extensions to Kiritani and Nakasuji's method for analyzing insect stage-frequency data. Res. Popul. Ecol. 17:191-199.

Mathewman, W.G., A.W. Rothwell and J.P. Lachaine. 1950. Notes on the species of root maggots damaging onions, cabbage and radish at Ottawa in 1948. Can. Entomol. 82:12-16.

Matsumoto, Y. 1970. Volatile organic sulfur compounds in insect as insect attractants with special reference to host selection. In: Control of Insect Behavior by Natural Products, D. Wood et al. (eds.). Academic Press, New York. pp. 133-58.

McEwen, F.L., G. Ritcey and R. McGraw. 1973. Control of the onion maggot, Hylemya antiqua (Meigen), by use of the sterile male technique. Summary Report to the Ontario Pesticide Advisory Committee. 22 pp.

McLeod, D.G.R. 1965. Some observations on the physiology and ecology of soil insects. Proc. N. Cent. Branch Entomol. Soc. Am. 20:158-59.

Merrill, L.G. and R. Hutson. 1953. Maggots attacking Michigan onions. J. Econ. Entomol. V 46:678-80.

Miles, M. 1955. Studies of Anthomyiid flies. VI. The annual cycle of generations in some Anthomyiid root flies. Bull. Entomol. Res. 46:11-19.

Muller, J. 1969. Untersuchungen zu dem in der ovipositionszeit von Hylemya antiqua (Meig.) wirksamen orientierungsmechanismus. Wiss. Z. Ernst-Moritz-Arndt-Univ. Greifswald 18, Math.-Nat.:73-78.

Miller, L.A. and R.J. McClanahan. 1960. Life history of the seed-corn maggot, Hylemya cilicrura (Rond.) and of H. liturata (Mg.) (Diptera: Anthomyiidae) in southwestern Ontario. Can. Entomol. V 92:210-21.

Missonnier, J. 1967. Influence de la nutrition sur la multiplication des Anthomyiides. Int. Symp. Fytoform. Fytiat. 19:338-56.

Missonnier, J. and M. Stengel. 1966. Etude des facteurs de fecondite des adultes de Chortophila brassicae B., Hylemya antiqua Meig. and Pegomyia betae Curt. Annls. Epiphyt. 17:5-41.

Moore, I. and E.F. Legner. 1971. Host records of parasitic staphylinids of the genus Aleochara in America (Coleoptera: Staphylinidae). 64(5):1184-85.

Moore, P.G. 1954. spacing in plant populations. Ecology 35:222-27.

Morisita, M. 1959. Measuring the dispersion of individuals and analyses of the distributional patterns. Mem. Fac. Sci. Kyusku U. Series E (Biol.) 2:215-35.

Mukerji, M.K. and S.H. Gage. 1978. A model for estimating hatch and mortality of grasshopper egg populations based on soil moisture and heat. Ann. Entomol. Soc. Am. 71:183-90.

Nair, K.S.S. and F.L. McEwen. 1975. Ecology of the cabbage maggot, Hylemya brassicae (Diptera: Anthomyiidae), in rutabaga in southwestern Ontario, with some observations on other root maggots. Can Entomol. 107:343-54.

Nie, N.H., D.H. Hull, J.C. Jenkins, K. Steinbrenner and D.H. Bent. 1975. Statistical Package for the Social Sciences, 2nd ed. McGraw-Hill, New York.

Perron, J.P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua, under field conditions in southwestern Quebec. Ann. Soc. Entomol. Quebec 17(1):20-47.

Perron, J.P., D.G. Finlayson and A.G. Dustan. 1955. The onion maggot. Can Dept. Agric. Pub. 935. 4 pp.

Perron, J.P., J.J. Jasmin and J. LaFrance. 1958. Varietal resistance of seeded onions to the onion maggot, Hylemya antiqua (Meig.) (Diptera: Anthomyiidae). Can Entomol. 90:653-56.

Perron, J.P. and J. Lafrance. 1961. Notes on the life history of the onion maggot, Hylemya antiqua (Meig.) (Diptera: Anthomyiidae), reared in field cages. Can. Entomol. 93:101-6.

Peterson, A. 1924. Some chemicals attractive to adults of the onion maggot (Hylemya antiqua Meig.) and the seed-corn maggot (Hylemya cilicrura Rond.). J. Econ. Entomol. 17:87-94.

Pielou, E.C. 1977. Mathematical Ecology. John Wiley and Sons, New York. 385 pp.

Pimentel, D., D. Chant, A. Kelman, R.L. Metcalf, L.D. Newson and C. Smith. 1965. Appendix Y11. Improved pest control practices in restoring the quality of an environment. Rpt. of Envir. Pollution Panel, President's Science Advisory Committee. pp. 227-91.

Price, P.W. and G.P. Waldbauer. 1975. Ecological aspects of pest management. In: Introduction to Insect Pest Management, R.L. Metcalf and W. Luckmann (eds.). John Wiley and Sons, New York. pp. 37-73.

Rabb, R.L. 1978. A sharp focus on insect populations and pest management from a wide-area view. ESA Bull. 24:55-61.

Rabb, R.L. and F.E. Guthrie. 1970. Concepts of pest management. Proc. Conf. held at North Carolina St. Univ., Raleigh, March 25-27, 1970.

Rabb, R.L., R.E. Stinner and G.A. Carlson. 1974. Ecological principles as a basis for pest management in the agroecosystem. In: Proc. Summer Institute on Biol. Control of Plants, Insects and Diseases, F. Maxwell and F.A. Harris (eds.). Mississippi Univ. Press, Jackson. pp. 19-45.

Rawlins, W.A., M.J. Sloan, R.G. Strong and J.J. Ellington. 1960. The onion maggot and its control. New York (Cornell) Ag. Exp. Stn. Bull. 947. 18 pp.

Read, D.C. 1962. Notes on the life history of Aleochara bilineata (Gyll.) (Coleoptera: Staphilinidae) and on its potential value as a control agent for the cabbage maggot, Hylemya brassicae (Bouche') (Diptera: Anthomyiidae). Can. Entomol. 94:417-24.

Richards, O.W. and N. Waloff. 1954. Studies on the biology and population dynamics of British grasshoppers. Anti-Locust Bull. 17. 182 pp.

Richards, O.W., N. Waloff and J.P. Spradberry. 1960. The measurement of mortality in an insect population in which recruitment and mortality widely overlap. Oikos 11:306-10.

Ritisch, S.S. 1950. Biology of the seed-corn maggot, Hylemya cilicrura (Rondani), and preliminary studies on its control. PhD thesis, Cornell Univ., Ithaca, New York.

Ritisch, S.S. and H.H. Schwardt. 1949. Biology and control of the seed-corn maggot on beans in New York. J. Econ. Entomol. 42:77-80.

Rockstein, M. and J. Miquel. 1973. Aging in insects. In: The Physiology of Insects, Vol. 1, 2nd ed., M. Rockstein (ed.). Academic Press, New York. pp. 371-478.

Rygg, T. 1960. The onion fly (Hylemya antiqua Meig.): investigations on its biology and control in Norway. Medd. St. Plantev. 18:1-56.

Salkeld, E.H. 1959. Notes on anatomy, life history and behavior of Aphaereta pallipes (Say) (Hymenoptera: Braconidae), a parasite of the onion maggot, Hylemya antiqua (Meig.). Can. Entomol. 91:93-97.

Scott, D.R. 1969. A selected bibliography of the onion maggot, Hylemya antiqua (Meigen). Bull. Entomol. Soc. Am. 15:345-54.

Southwood, T.R.E. 1978 Ecological Methods, 2nd ed. Chapman and Hall, Ltd., London. 524 pp.

Steele, R.G.D. and J.H. Torrie. 1960. Principles and Procedures of Statistics. McGraw-Hill, New York. 481 pp.

Strong, F.E. and J.W. Apple. 1958. Studies on the thermal constants and seasonal occurrence of the seed-corn maggot in Wisconsin. J. Econ. Entomol. 51:704-7.

Ticheler, J.H.G., J. Noorlander, J.A.B.M. Theunissen, M. Loosjes and J.P.W. Noordink. 1975. Bestrijding van de uievlieg, Hylemya antiqua (Meig.), door middel van de "sterile-male" techniek. Juarvesl. 1974 Inst. Plziektenk. Onderz, Wageningen. pp. 90-93.

Tozloski, A.H. 1954. Control of the onion maggot on seed sets in the Connecticut Valley. J. Econ. Entomol. 47:494-97.

Tummala, R.L. and D.L. Haynes. 1977. On-line pest management systems. Environ. Entomol. 6:339-49.

Tummala, R.L., W.G. Ruesink and D.L. Haynes. 1975. A discrete component approach to the management of the cereal leaf beetle ecosystem. Environ. Entomol. 4(2):175-86.

Wadsworth, J.T. 1915. On the life history of Aleochara bilineata Gyll., a staphylinid parasite of Chortophila brassicae Bouche'. J. Econ. Biol. 10:1-26.

Whitfield, G.H., F.A. Drummond and D.L. Haynes. 1981. A simulation model for the survival and development of the onion maggot. Proc. Entomol. Soc. of Ont. VIII:39-55.

Williams, C.D. 1961. Studies on the effect of weather conditions on the activity and abundance of insect populations. Phil. Trans. R. Soc. B244:331-78.

Wishart, G. 1957. Surveys of parasites of Hylemya spp. (Diptera: Anthomyiidae) that attack cruciferous crops in Canada. Can. Entomol. 89:450-54.

Wishart, G., J.F. Doane and G.E. Maybee. 1956. Notes on beetles vs. predators of eggs of Hylemya brassicae (Bouche') (Diptera: Anthomyiidae). Can. Entomol. 88:634-39.

Wishart, G. and E. Monteith. 1954. Trybliographa rapae (Westw.) (Hymenoptera: Cynipidae), a parasite of Hylemya spp. (Diptera: Anthomyiidae). Can. Entomol. 86:145-54.

Workman, R.H., Jr. 1958. The biology of the onion maggot, Hylemya antiqua (Meigen), under field and greenhouse conditions. PhD thesis, Oregon St. Coll. 82 pp.

Wyman, D. 1972. Wyman's Gardening Encyclopedia. MacMillan Col., New York. 1222 pp.

APPENDIX A

Appendix A. Distribution of *Hylemya* spp. in Michigan

Figure A1. Counties and standard county codes for the state of Michigan for use with table A1.

Table A1. Distribution of *Hylemya* spp. in Michigan (codes refer to county codes in figure A1.).

Figure A1. Counties and standard county codes for the state of Michigan (from U.S. General Services Administration).

TABLE A1.

Species of the Genus Hylemya	Record of distribution in Michigan (codes refer to counties in figure A1).
abitibiennsis	55, 65
aemena	17, 19, 65, 79, 81, 85, 87, 111, 159
aestiva	33
alaba	7, 9, 13, 41, 53, 61, 63, 83, 97, 103, 111, 113, 127, 131
alcathoe	9, 17, 33, 41, 53, 61, 71, 87, 97, 111, 133, 153
antiqua	45, 65, 159
arnolitra	113
atomaris	51, 73, 111, 145
betarum	111
bicaudata	35, 111
brassicae	65, 73, 77, 87, 101, 111
bucculenta	97, 111, 123
cinerella	5, 11, 17-21, 31, 37, 45, 51, 59, 63-7, 73, 83, 87, 93, 97, 111, 123, 127, 143, 145, 149
cinerosa	17, 47, 123, 157
coensiaeformis	1, 17, 103, 153
curipes	51, 57, 81, 111
depressa	1, 17, 19, 31, 81, 87, 93, 111, 125, 127
discreta	
filicis	53
flavipennis	9, 19, 21, 27, 33, 47, 51, 69, 83, 111, 113, 133, 143, 159, 165
florilega	3, 11, 21, 31, 35, 45, 51, 63, 65, 75-9, 83, 93, 101, 107, 111, 113, 117, 121, 123, 133, 141, 153-7
fugan	65, 67, 73, 77, 81, 107, 111, 133, 143, 155
hinei	35, 51, 97, 111, 143
inconspicua	51
inormata	131, 133
laevis	11, 21, 59, 79, 111, 121, 139
lasciva	29, 31, 45, 47, 51, 53, 61, 65, 79, 83, 93, 109, 111, 131, 153
latifrontalis	103
leariventris	33, 41, 69, 103
longipalpis	37, 137
muscaria	111, 143, 145

Table A1. (continued)

Species of the Genus Hylemya (continued)	Record of distribution in Michigan (codes refer to counties in figure A1).
octoguttata	79
parvaeformis	113, 123
pilifemus	21, 51, 73, 91, 111
platura	1, 3, 7-13, 17-21, 25-43, 51-63, 67, 71-85, 89, 91, 95, 97, 101-5, 109-23, 127, 131, 133, 137-45, 149, 153, 155, 159, 165
pluvialis	3, 13, 33, 37, 39, 41, 51, 53, 67, 81, 101, 103, 111, 113, 137, 165
Probpscidalis	49
profuga	5, 51, 81, 83, 95
pullula	69, 77, 111
radicum	45, 65, 111, 115, 133, 149
replicata	35, 43, 61, 143, 153
restorata	41, 53, 153
salicola	35
setigera	27, 81, 125
setitarsata	3, 29, 33, 41, 71, 73, 97, 111, 131, 153
spinosossima	111, 153
stratifrons	35, 69
trilinesta	85, 131
trivitata	25, 31, 37, 69, 81, 111, 113, 127, 149, 159
variata	15, 25, 35, 37, 41, 45, 49, 59, 65, 69, 71, 77, 111, 143

Appendix B

(footnotes for Figure 1)

Footnote 1:

Nye, P. H. et al. 1975. The possibility of predicting solute uptake and plant growth response from independently measured soil and plant characterisitcs. Plant and Soil 42:161-70.

Robinson, J. C. 1973. Studies on the performance and growth of various short-day onion varieties (Allium cepa L.) in the Rhodesian low veld in relation to date of sowing. Rhod. J. Agric. Res. 11:51-69.

Footnote 2:

Hancock, J. G. and J. W. Lorbeer. 1963. Pathogenesis of Botrytis cinerea, B. squamosa and B. allii on onion leaves. Phytopathology. 53:669-73.

Footnote 3:

Ellington, J. J. 1963. Field and laboratory observations on the life history of the onion maggot, Hylemya antiqua (Meigen). Ph.D. thesis, Cornell University. 124 pp.

Kendall, E. W. 1932. Notes on the onion maggot, Hylemya antiqua (Meigen). Entomol. Soc. Ontario Rep. 62:82-84.

Footnote 4:

Lewis, T. 1973. Thrips, their biology, ecology and economic importance. New York: Academic, 366 pp.

Footnote 5:

Martin, G. C. 1958. Root-knot nematodes (Meloidogyne spp.) in the federation of Rhodesia and Nyasaland. Nematologica 4:122-25.

USDA. 1960. Index of Plant Diseases in the United States, Agriculture Handbook, No. 165. Crops Research Division, Ag. Research Service, USDA. p. 365.

Footnote 6:

Sprague, R. 1950. Diseases of Cereals and Grasses of North America. Ronald Press, New York.

Footnote 7:

Perron, J. P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua, ufield conditions in southwestern Quebec. Ann. Soc. Entomol. Que. 17(1):29-47.

Footnote 8:

Perron, J. P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua, under field conditions in southwestern Quebec. Ann. Soc. Entomol. Que. 17(1):29-47.

Footnote 9:

Stoffolono, J. G. 1969. Nematode parasites of the face fly and the onion maggot in France and Denmark. J. Econ. Entomol. 62:792-95.

Footnote 10:

Perron, J. P. and R. Crete. 1960. Premieres observationes sur le champignon, Empusa muscae Cohn. (Phycomycetes: Entomophthora) parasitant la mouche de l'oignon, Hylemya antiqua (Meig.) (Dipteres: Anthomyiidae) dons le Quebec. Ann. Entomol. Soc. Quebec 5:52-56.

Footnote 11:

Perron, J. P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua, under field conditions in southwestern Quebec. Ann. Soc. Entomol. Que. 17(1):29-47.

Footnote 12:

Russell, H. M. 1912. An internal parasite of Thysanoptera. Tech. Ser. Bur. Ent. U.S. 23:25-52.

Footnote 13:

Charles, V. K. 1941. A preliminary check list of the entomogenous fungi of North America. Tech. Bull. U.S. Dep. Agric. 21:707-85.

Footnote 14:

Cobb. N. A. 1917. The Mononchs, a genus of free-living predatory nematodes. Soil Science 3:431-86.

Footnote 15:

Mankau, R. et al. 1975. The life cycle of an endoparasite in some tylenchid nematodes. Nematologica 21:89-94.

Footnote 16:

Connard, M. H. and P. W. Zimmerman. 1931. Origin of adventitious roots in cuttings of Portulaca oleracea. Contrib. Boyce Thompson Inst. Plant Res. 3:331-46.

Zimmerman, C. A. 1969. The causes and characteristics of weediness in Portulaca oleracea L. Ph.D. Thesis, University of Michigan. 248 pp.

Footnote 17:

Shorthouse, J. D. and A. K. Watson. Plant galls and the biological control of weeds. Insect World Digest pp. 8-11.

Footnote 18:

Sawyer, A. J. 1976. The effect on the cereal leaf beetle on planting oats with a companion crop. M.S. Thesis, Michigan State University. 145 pp.

Footnote 19:

Perron, J. P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua, under field conditions in southwestern Quebec. Ann. Soc. Entomol. Que. 17(1):29-47.

Footnote 20:

Webster, J. M. 1972. Nematodes and biological control, pp. 469-96. In: Webster (Ed.) Economic Nematology. Academic Press, N.Y.

Footnote 21:

Gorske, S. F. 1973. The bionomics of the purslane sawfly, Schizocerella pilicornis. M.S. Thesis, University of Illinois. 108 pp.

Footnote 22:

USDA. 1960. Index of plant diseases in the United States. Agriculture Handbook No. 165. Crops Res. Div., Agric. Res. Ser. 531 pp.

Footnote 23:

USDA. 1960. Index of plant diseases in the United States. Ag. Handbook No. 165. Crops Res. Div., Ag. Res. Ser. 531 pp.

Footnote 24:

USDA. 1960. Index of plant diseases in the United States. Agriculture Handbook No. 165. Crops Res. Div., Agric. Res. Ser. 531 pp.

Footnote 25:

Goeden, R. D. et al. 1974. Present states of projects on the biological control of weeds with insects and plant pathogens in the United States and Canada. Weed Science 22:490-95.

Footnote 26:

Breeland, S. G. 1958. Biological studies on the armyworm, Pseudaletia unipuncta (Haworth) in Tennessee. J. Tenn. Acad. Sci. 33:263-347.

Footnote 27:

Helgesen, R. G. and D. L. Haynes. 1972. Population dynamics of the cereal leaf beetle, Oulema melanopus (Coleoptera: Chrysomelidae): a model for age specific mortality. Can. Entomol. 104:797-814.

Tummala, R. L. et al. A discrete component approach to the management of the cereal leaf beetle ecosystem. Environ. Entomol. 4:175-86.

Footnote 28:

Perron, J. P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua, under field conditions in southwestern Quebec. Ann. Soc. Entomol. Que. 17(1):29-47.

Footnote 29:

Webster, F. M. and C. W. Mally. 1900. The purslane sawfly--Schizocerus zabreskei. Can. Entomol. 32:51-55.

Footnote 30:

Gorske, S. F. 1973. The bionomics of the purslane sawfly, Schizorella pilicornia (Meig.). M.S. Thesis, Univ. of Illinois. 108 pp.

Footnote 31:

Mankau, R., J. L. Imbiani. 1975. The life cycle of an endoparasite in some tylenchid nematodes. Nematologica 21:89-94.

Footnote 32:

Webster, J. M. 1972. Nematodes and biological control, pp. 469-496 In: J.M. Webster (ed.) Economic Nematology. Academic Press, N.Y.

Footnote 33:

Cobb, N. A. 1913. Notes on mononchus and tylenchulus. Washington Acad. Sci. 3:287-88.

Cobb, N. A. 1917. The mononchs, a genus of free-living predatory nematodes. Soil Science 3:431-486.

Footnote 34:

Ravlin, F. W. 1975. A revision of the genus Juennicke (Diptera: Tachindae) for America north of Mexico. M.S. Thesis. Michigan State University. 80 pp.

Footnote 35:

Danks, H. V. 1975. Factors determining levels of parasitism by Winthemia rufopicta (Diptera: Tachinidae), with particular reference to Heliothis spp. (Lepidoptera: Noctuidae) as hosts. Can. Entomol. 107:555-684.

Danks, H.V. 1975. Seasonal cycle and biology of Winthemia rufopicta (Diptera: Tachinidae) as a parasite of Heliothis spp. (Lepidoptera: Noctuidae) on tobacco in North Carolina. Can. Entomol. 107:639-54.

Footnote 36:

Gage, S. H. and D. L. Haynes. 1975. Emergence under natural and manipulated conditions of Tetrastichus julis, an introduced larval parasite of the cereal leaf beetle, with reference to regional population management. Environ. Entomol. 4(3):425-34.

Footnote 37:

Maltby, H. I., F. W. Stehr, R. C. Anderson, G. E. Moorehead, L. C. Barton and J. D. Paschke. 1971. Establishment in the United States of Anaphes flavipes (Foerster), an egg parasite of the cereal leaf beetle, Oulema melanopus (L.) J. Econ. Entomol. 64:693-97.

Footnote 38:

Perron, J. P. 1972. Effects of some ecological factors on populations of the onion maggot, Hylemya antiqua (Meig.), under field conditions in southwestern Quebec. Ann. Soc. Entomol. Que. 17(1):29-47.

Footnote 39:

Thompson, W. R. 1943. A catalogue of the parasites and predators of insect pests. Sect. I, Pt. 2. Belleville, Ontario, Canada. The Imperial Parasite Service. 99 pp.

Footnote 40:

USDA. 1960. Index of plant diseases in the United States. Agriculture Handbook No. 175. Crops Res. Div., Agric. Res. Ser., p. 280.

Footnote 41:

Gorlenko, M.V., I. V. Voronkevich and T. S. Maksimova. 1956. Mutual relations between the onion fly and onion syrphid and the bacteria that cause damp rots in plants. (in Russian) Zool. Zh. 35 pt. 1 pp. 16-20, 6 refs. Moscow, 1956. (with a summary in English, Suppl. p. 4).

Footnote 42:

Newhall, A. G. and B. G. Chitwood. 1940. Onion eelworm or bloat caused by the stem or bulb nematode, Ditylenchus dipsaci. Phytopathology 30:390-400.

Footnote 43:

USDA. 1960. Index of plant diseases in the United States. Agriculture Handbook No. 165. Crops Res. Div., Agric. Res. Ser. p. 365.

APPENDIX C

Appendix C.

Table C1. Air temperatures and Degree Day Accumulation in F^{o} (base 4.4^{o}C) for Grant, Michigan, in 1978-1980.

Table C2-3. Soil temperatures and Degree Day Accumulation in F^{o} (base 4.4^{o}C) for three depths (3, 8, and 15 cm) for Grant, Michigan, in 1979 (C2) and 1980 (C3).

Table C4. Daily precipitation and accumulated precipitation for Grant, Michigan, in 1978-1980.

All data files are located on UP2017 and UP2018 dump tapes at the Michigan State University Computer Center.

CDDA78GRANTTEMPMAXMIN
CDDA79GRANTTEMPMAXMIN
CDDA80GRANTTEMPMAXMIN
CDDA79CUMDDAY79SOIL
CDDA80CUMDDAY80SOIL
CDDA7879GRANTPRECIP
CDDA80GRANTTEMPPRECIP

TABLE C1

DATE	ACC. DEGDAY	MAX TEMP	MIN TEMP
4/ 1/78	4.5	45	44
4/ 2/78	4.5	34	25
4/ 3/78	5.2	43	31
4/ 4/78	8.9	51	31
4/ 5/78	14.2	56	27
4/ 6/78	17.7	49	36
4/ 7/78	25.0	57	36
4/ 8/78	27.0	47	31
4/ 9/78	27.2	41	29
4/10/78	33.5	59	24
4/11/78	36.5	48	36
4/12/78	43.2	59	27
4/13/78	44.6	44	37
4/14/78	46.6	47	30
4/15/78	47.7	45	26
4/16/78	52.5	56	21
4/17/78	57.4	56	21
4/18/78	59.3	45	38
4/19/78	69.8	60	41
4/20/78	71.8	45	38
4/21/78	77.7	56	31
4/22/78	83.3	57	25
4/23/78	87.4	50	37
4/24/78	99.4	63	41
4/25/78	109.6	65	32
4/26/78	122.7	69	36
4/27/78	134.4	69	30
4/28/78	145.3	68	28
4/29/78	158.9	71	34
4/30/78	163.0	53	27
5/ 1/78	168.2	56	25
5/ 2/78	176.3	60	33
5/ 3/78	187.6	66	35
5/ 4/78	195.1	55	40
5/ 5/78	199.0	49	38
5/ 6/78	208.0	62	33
5/ 7/78	220.0	61	43
5/ 8/78	235.5	64	47
5/ 9/78	246.0	55	46
5/10/78	261.0	56	44
5/11/78	278.0	68	46
5/12/78	298.0	64	56
5/13/78	319.5	66	57
5/14/78	335.0	59	52
5/15/78	354.0	64	54
5/16/78	373.0	65	53
5/17/78	393.0	77	43
5/18/78	419.0	81	51
5/19/78	442.5	81	46
5/20/78	470.0	74	61
5/21/78	482.1	65	39
5/22/78	496.5	71	37
5/23/78	516.5	76	44
5/24/78	541.0	83	46
5/25/78	565.0	83	45
5/26/78	595.5	86	55
5/27/78	629.0	98	57
5/28/78	661.5	90	57
5/29/78	697.5	90	62
5/30/78	726.0	80	57
5/31/78	753.5	79	56
6/ 1/78	784.0	82	59
6/ 2/78	803.0	68	50
6/ 3/78	815.6	68	36
6/ 4/78	834.1	75	42
6/ 5/78	851.1	73	41
6/ 6/78	874.1	91	45
6/ 7/78	902.1	79	57
6/ 8/78	919.6	71	44
6/ 9/78	936.6	72	42
6/10/78	958.1	78	45
6/11/78	991.6	85	62
6/12/78	1014.6	66	60
6/13/78	1026.1	64	39
6/14/78	1034.3	61	31
6/15/78	1059.8	79	52
6/16/78	1084.3	74	55
6/17/78	1110.3	72	61
6/18/78	1136.3	76	55
6/19/78	1161.3	79	51
6/20/78	1189.8	83	54
6/21/78	1212.8	70	56
6/22/78	1231.3	75	42
6/23/78	1250.8	74	45
6/24/78	1276.3	82	49
6/25/78	1305.8	74	55
6/26/78	1337.3	79	64
6/27/78	1371.8	83	66
6/28/78	1401.8	85	55
6/29/78	1432.3	86	55
6/30/78	1462.8	84	57
7/ 1/78	1482.3	62	57
7/ 2/78	1504.3	64	60
7/ 3/78	1530.3	74	58
7/ 4/78	1555.3	82	48
7/ 5/78	1582.8	82	53
7/ 6/78	1615.8	86	50
7/ 7/78	1649.8	83	65
7/ 8/78	1678.3	75	62
7/ 9/78	1702.8	80	49
7/10/78	1722.3	70	49
7/11/78	1739.3	73	41
7/12/78	1759.3	79	41
7/13/78	1792.3	91	65
7/14/78	1819.8	82	53
7/15/78	1848.3	84	53
7/16/78	1871.3	79	47
7/17/78	1895.3	82	46
7/18/78	1927.8	82	63
7/19/78	1965.3	85	70
7/20/78	2003.8	91	56
7/21/78	2037.8	82	56
7/22/78	2071.3	85	66
7/23/78	2100.3	75	59
7/24/78	2125.3	82	48
7/25/78	2152.3	81	53
7/26/78	2180.8	77	60
7/27/78	2211.8	78	64
7/28/78	2228.9	75	39
7/29/78	2252.9	74	54
7/30/78	2272.9	71	49
7/31/78	2293.4	77	44
8/ 1/78	2319.9	91	52
8/ 2/78	2344.9	78	52
8/ 3/78	2367.4	75	50
8/ 4/78	2383.9	73	40
8/ 5/78	2401.9	76	40
8/ 6/78	2427.4	85	46
8/ 7/78	2456.9	83	56
8/ 8/78	2484.4	83	52
8/ 9/78	2514.4	82	58
8/10/78	2536.4	79	45
8/11/78	2559.4	80	46
8/12/78	2590.4	84	58
8/13/78	2622.4	88	56
8/14/78	2656.4	90	58
8/15/78	2692.4	89	63
8/16/78	2723.9	78	55
8/17/78	2756.4	85	60
8/18/78	2786.4	79	61
8/19/78	2815.4	71	67
8/20/78	2835.9	75	46
8/21/78	2859.9	82	46
8/22/78	2888.4	85	52
8/23/78	2919.9	85	58
8/24/78	2953.9	85	63
8/25/78	2977.4	72	55
8/26/78	3007.4	78	52
8/27/78	3036.4	74	64
8/28/78	3068.4	78	66
8/29/78	3097.4	77	61
8/30/78	3122.4	78	52
8/31/78	3144.9	76	49
9/ 1/78	3168.9	80	48
9/ 2/78	3197.4	79	58
9/ 3/78	3225.4	74	62
9/ 4/78	3246.4	77	45
9/ 5/78	3275.4	86	52
9/ 6/78	3305.9	84	57
9/ 7/78	3338.9	88	58

TABLE C1. CONTINUED

DATE	ACC. DEGDAY	MAX TEMP	MIN TEMP
9/ 8/78	3373.9	89	51
9/ 9/78	3402.4	75	62
9/10/78	3437.9	90	61
9/11/78	3472.9	88	62
9/12/78	3495.4	63	62
9/13/78	3512.9	63	52
9/14/78	3534.4	72	51
9/15/78	3555.4	73	49
9/16/78	3577.4	75	49
9/17/78	3600.9	69	58
9/18/78	3626.4	75	56
9/19/78	3654.4	91	55
9/20/78	3683.9	82	57
9/21/78	3700.9	61	53
9/22/78	3713.4	64	41
9/23/78	3725.2	57	35
9/24/78	3743.2	74	42
9/25/78	3755.7	64	41
9/26/78	3769.1	69	37
9/27/78	3786.1	62	52
9/28/78	3796.0	65	30
9/29/78	3806.2	62	38
9/30/78	3825.2	65	53
10/ 1/78	3841.7	62	51
10/ 2/78	3855.9	70	38
10/ 3/78	3869.9	65	43
10/ 4/78	3880.4	61	40
10/ 5/78	3894.4	62	46
10/ 6/78	3902.4	50	46
10/ 7/78	3905.1	47	37
10/ 8/78	3908.3	49	34
10/ 9/78	3916.3	61	30
10/10/78	3928.0	68	32
10/11/78	3941.5	62	45
10/12/78	3955.5	60	48
10/13/78	3961.6	55	35
10/14/78	3962.8	44	35
10/15/78	3970.3	58	35
10/16/78	3975.4	54	32
10/17/78	3980.2	55	25
10/18/78	3988.8	58	39
10/19/78	3995.3	56	35
10/20/78	4000.1	54	29
10/21/78	4014.7	70	39
10/22/78	4029.2	68	41
10/23/78	4035.2	49	43
10/24/78	4038.5	52	22
10/25/78	4044.0	55	31
10/26/78	4048.0	48	40
10/27/78	4054.0	56	32
10/28/78	4056.6	49	28
10/29/78	4058.7	48	24
10/30/78	4070.3	56	36
10/31/78	4078.8	60	35
4/ 1/79	0.0	38	32
4/ 2/79	0.0	36	30
4/ 3/79	2.7	50	24
4/ 4/79	2.7	40	33
4/ 5/79	4.0	45	30
4/ 6/79	4.0	28	15
4/ 7/79	4.0	38	14
4/ 8/79	4.3	32	30
4/ 9/79	4.9	44	28
4/10/79	7.3	50	18
4/11/79	7.9	43	28
4/12/79	22.7	73	35
4/13/79	30.7	54	42
4/14/79	33.9	49	34
4/15/79	37.3	48	38
4/16/79	44.1	55	38
4/17/79	51.5	61	26
4/18/79	60.7	65	26
4/19/79	71.1	68	25
4/20/79	84.7	73	30
4/21/79	99.2	58	51
4/22/79	110.0	67	30
4/23/79	125.5	75	34
4/24/79	140.0	67	42
4/25/79	161.5	65	58
4/26/79	169.5	52	44

DATE	ACC. DEGDAY	MAX TEMP	MIN TEMP
4/27/79	175.4	56	31
4/28/79	175.8	42	34
4/29/79	179.3	52	24
4/30/79	180.5	44	35
5/ 1/79	186.1	56	29
5/ 2/79	201.6	69	42
5/ 3/79	210.6	53	45
5/ 4/79	215.2	53	31
5/ 5/79	219.1	53	24
5/ 6/79	238.1	70	48
5/ 7/79	263.1	80	50
5/ 8/79	296.6	86	61
5/ 9/79	331.1	83	66
5/10/79	364.6	84	63
5/11/79	392.6	71	65
5/12/79	398.4	53	38
5/13/79	407.8	64	30
5/14/79	423.8	67	45
5/15/79	433.9	63	36
5/16/79	444.8	68	29
5/17/79	459.0	70	38
5/18/79	486.5	82	53
5/19/79	508.5	70	54
5/20/79	522.1	70	36
5/21/79	534.1	62	42
5/22/79	544.7	67	29
5/23/79	560.7	65	47
5/24/79	571.7	59	43
5/25/79	583.9	66	38
5/26/79	596.4	63	42
5/27/79	607.9	60	43
5/28/79	619.4	59	44
5/29/79	634.2	74	33
5/30/79	649.2	64	46
5/31/79	675.2	79	53
6/ 1/79	696.7	66	57
6/ 2/79	713.4	75	38
6/ 3/79	737.9	81	48
6/ 4/79	762.9	80	50
6/ 5/79	787.9	77	53
6/ 6/79	816.4	83	54
6/ 7/79	848.9	90	65
6/ 8/79	882.9	84	64
6/ 9/79	914.4	75	68
6/10/79	945.4	74	68
6/11/79	963.9	73	44
6/12/79	979.2	71	37
6/13/79	996.4	75	38
6/14/79	1023.9	84	51
6/15/79	1057.4	85	62
6/16/79	1090.9	87	50
6/17/79	1117.9	68	56
6/18/79	1141.4	74	53
6/19/79	1164.9	81	46
6/20/79	1192.9	78	58
6/21/79	1224.9	79	65
6/22/79	1246.4	68	55
6/23/79	1259.4	64	42
6/24/79	1276.9	73	42
6/25/79	1292.5	74	36
6/26/79	1313.0	79	42
6/27/79	1342.0	81	57
6/28/79	1369.0	82	52
6/29/79	1397.0	76	60
6/30/79	1423.5	75	58
7/ 1/79	1441.5	62	34
7/ 2/79	1466.0	79	50
7/ 3/79	1488.0	76	48
7/ 4/79	1514.0	76	56
7/ 5/79	1530.2	74	35
7/ 6/79	1548.0	78	37
7/ 7/79	1569.5	81	42
7/ 8/79	1594.0	80	49
7/ 9/79	1624.0	84	56
7/10/79	1654.5	85	56
7/11/79	1687.5	85	61
7/12/79	1722.5	89	61
7/13/79	1758.5	89	63
7/14/79	1794.0	94	67

TABLE C1. CONTINUED

DATE	ACC. DEGDAY	MAX TEMP	MIN TEMP
7/15/79	1830.0	88	64
7/16/79	1857.5	82	53
7/17/79	1881.5	76	52
7/18/79	1901.5	80	40
7/19/79	1924.0	84	41
7/20/79	1948.5	86	43
7/21/79	1976.5	86	50
7/22/79	2007.0	86	55
7/23/79	2039.5	99	56
7/24/79	2071.0	79	64
7/25/79	2104.0	76	70
7/26/79	2132.0	79	57
7/27/79	2161.0	87	51
7/28/79	2193.0	83	61
7/29/79	2220.5	85	50
7/30/79	2249.5	82	56
7/31/79	2281.5	80	64
8/ 1/79	2309.0	74	61
8/ 2/79	2337.5	81	56
8/ 3/79	2366.5	81	57
8/ 4/79	2397.0	82	59
8/ 5/79	2426.0	82	56
8/ 6/79	2452.0	79	53
8/ 7/79	2486.5	88	61
8/ 8/79	2516.5	78	62
8/ 9/79	2543.0	80	53
8/10/79	2573.5	76	65
8/11/79	2591.0	71	44
8/12/79	2606.8	73	38
8/13/79	2628.8	70	54
8/14/79	2644.3	63	48
8/15/79	2660.8	70	43
8/16/79	2674.6	73	31
8/17/79	2691.1	63	50
8/18/79	2716.6	76	55
8/19/79	2742.1	77	54
8/20/79	2768.1	72	60
8/21/79	2794.6	79	54
8/22/79	2821.6	76	58
8/23/79	2853.1	79	64
8/24/79	2879.1	69	53
8/25/79	2902.1	72	54
8/26/79	2923.1	78	44
8/27/79	2941.6	65	52
8/28/79	2969.6	74	62
8/29/79	2999.6	78	62
8/30/79	3030.1	83	58
8/31/79	3060.6	83	58
9/ 1/79	3090.6	80	60
9/ 2/79	3123.6	79	67
9/ 3/79	3149.6	78	54
9/ 4/79	3176.6	78	56
9/ 5/79	3204.1	83	52
9/ 6/79	3232.1	92	54
9/ 7/79	3247.6	59	52
9/ 8/79	3257.5	64	33
9/ 9/79	3272.1	70	39
9/10/79	3297.6	73	58
9/11/79	3320.1	75	50
9/12/79	3350.1	84	56
9/13/79	3377.6	71	64
9/14/79	3394.1	64	49
9/15/79	3405.5	66	35
9/16/79	3423.1	77	38
9/17/79	3442.6	77	42
9/18/79	3467.6	76	54
9/19/79	3477.0	65	27
9/20/79	3493.7	75	38
9/21/79	3513.7	68	52
9/22/79	3524.1	67	28
9/23/79	3534.9	67	30
9/24/79	3550.1	72	38
9/25/79	3566.6	73	40
9/26/79	3584.3	79	35
9/27/79	3604.4	81	39
9/28/79	3624.9	90	41
9/29/79	3652.4	83	52
9/30/79	3676.9	77	52
10/ 1/79	3691.2	74	31
10/ 2/79	3710.2	64	54
10/ 3/79	3723.2	62	44
10/ 4/79	3731.2	60	33
10/ 5/79	3738.3	59	30
10/ 6/79	3747.3	55	43
10/ 7/79	3752.8	51	40
10/ 8/79	3758.1	54	33
10/ 9/79	3763.4	52	38
10/10/79	3766.4	49	32
10/11/79	3767.4	44	32
10/12/79	3770.3	47	38
10/13/79	3772.0	45	36
10/14/79	3774.4	49	25
10/15/79	3784.4	64	33
10/16/79	3790.5	55	35
10/17/79	3805.5	60	50
10/18/79	3818.0	60	45
10/19/79	3838.5	66	55
10/20/79	3860.5	70	54
10/21/79	3890.0	73	56
10/22/79	3920.5	75	56
10/23/79	3924.0	45	42
10/24/79	3925.7	45	36
10/25/79	3925.7	38	33
10/26/79	3926.7	44	32
10/27/79	3929.8	50	29
10/28/79	3935.8	51	41
10/29/79	3940.7	55	26
10/30/79	3947.5	57	34
10/31/79	3964.3	72	42
4/ 1/80	2.1	48	26
4/ 2/80	10.9	61	34
4/ 3/80	11.0	41	33
4/ 4/80	12.4	45	32
4/ 5/80	18.7	57	31
4/ 6/80	28.9	64	34
4/ 7/80	41.4	59	46
4/ 8/80	54.4	59	47
4/ 9/80	55.0	42	38
4/10/80	55.0	38	32
4/11/80	56.2	44	35
4/12/80	56.7	42	36
4/13/80	57.3	45	29
4/14/80	57.3	37	28
4/15/80	58.3	42	32
4/16/80	60.0	47	24
4/17/80	63.5	52	24
4/18/80	63.5	37	36
4/19/80	75.4	68	37
4/20/80	90.3	74	32
4/21/80	106.9	72	40
4/22/80	133.9	84	50
4/23/80	141.5	56	39
4/24/80	141.6	41	26
4/25/80	145.4	52	27
4/26/80	151.4	54	37
4/27/80	159.4	55	41
4/28/80	167.4	55	41
4/29/80	175.4	53	43
4/30/80	186.9	58	45
5/ 1/80	203.9	68	46
5/ 2/80	220.0	73	39
5/ 3/80	240.5	82	39
5/ 4/80	262.5	84	40
5/ 5/80	285.5	83	43
5/ 6/80	298.1	68	36
5/ 7/80	302.1	51	33
5/ 8/80	306.0	52	39
5/ 9/80	312.7	57	33
5/10/80	326.4	69	38
5/11/80	344.4	67	49
5/12/80	360.4	70	42
5/13/80	376.4	63	49
5/14/80	384.0	59	33
5/15/80	393.2	62	34
5/16/80	404.8	68	32
5/17/80	419.3	61	46
5/18/80	437.3	64	54
5/19/80	458.3	75	47
5/20/80	478.3	75	45
5/21/80	498.0	83	35

TABLE C1 CONTINUED

DATE	ACC. DEGDAY	MAX TEMP	MIN TEMP
5/22/80	521.0	95	41
5/23/80	546.0	85	45
5/24/80	580.0	84	64
5/25/80	608.0	82	54
5/26/80	625.0	77	36
5/27/80	645.0	80	40
5/28/80	670.0	90	50
5/29/80	695.5	73	58
5/30/80	723.5	79	57
5/31/80	747.5	71	57
6/ 1/80	760.0	58	47
6/ 2/80	782.5	73	52
6/ 3/80	806.5	73	55
6/ 4/80	823.5	74	40
6/ 5/80	841.0	71	44
6/ 6/80	867.5	78	55
6/ 7/80	895.0	79	56
6/ 8/80	905.0	58	42
6/ 9/80	917.0	64	40
6/10/80	924.0	59	29
6/11/80	937.1	72	30
6/12/80	955.2	77	39
6/13/80	976.7	80	43
6/14/80	1005.2	91	56
6/15/80	1026.7	93	50
6/16/80	1041.2	69	40
6/17/80	1054.5	71	33
6/18/80	1078.0	77	50
6/19/80	1094.0	57	55
6/20/80	1110.2	74	38
6/21/80	1132.7	78	47
6/22/80	1161.7	82	56
6/23/80	1192.2	87	54
6/24/80	1225.7	88	59
6/25/80	1259.2	88	59
6/26/80	1296.7	89	66
6/27/80	1324.7	80	56
6/28/80	1354.7	84	56
6/29/80	1382.7	76	60
6/30/80	1407.7	75	55
7/ 1/80	1433.7	83	49
7/ 2/80	1461.2	91	54
7/ 3/80	1486.2	97	43
7/ 4/80	1516.7	95	56
7/ 5/80	1550.7	94	64
7/ 6/80	1574.2	79	48
7/ 7/80	1606.2	88	56
7/ 8/80	1638.2	85	59
7/ 9/80	1665.7	83	52
7/10/80	1696.7	89	53
7/11/80	1735.7	93	65
7/12/80	1772.2	95	68
7/13/80	1805.7	89	58
7/14/80	1843.7	94	62
7/15/80	1882.7	96	72
7/16/80	1915.2	86	59
7/17/80	1947.2	80	64
7/18/80	1975.7	86	51
7/19/80	2014.7	92	66
7/20/80	2057.7	96	70
7/21/80	2089.2	75	68
7/22/80	2119.7	79	62
7/23/80	2145.7	80	52
7/24/80	2170.2	82	47
7/25/80	2199.2	86	52
7/26/80	2228.2	72	66
7/27/80	2257.2	76	62
7/28/80	2292.2	83	67
7/29/80	2323.2	82	50
7/30/80	2345.7	76	49
7/31/80	2376.7	94	58
8/ 1/80	2411.2	87	52
8/ 2/80	2438.2	75	59
8/ 3/80	2468.7	83	58
8/ 4/80	2495.2	86	47
8/ 5/80	2525.2	93	57
8/ 6/80	2556.7	87	56
8/ 7/80	2593.2	87	56
8/ 8/80	2627.7	86	53
8/ 9/80	2662.7	84	56
8/10/80	2697.7	84	56
8/11/80	2724.7	73	51
8/12/80	2751.2	76	57
8/13/80	2771.2	72	48
8/14/80	2800.2	81	57
8/15/80	2821.2	76	50
8/16/80	2841.2	74	42
8/17/80	2865.7	67	62
8/18/80	2897.7	81	53
8/19/80	2925.2	86	49
8/20/80	2956.7	86	57
8/21/80	2990.2	81	66
8/22/80	3016.7	81	52
8/23/80	3042.7	87	45
8/24/80	3068.2	84	47
8/25/80	3096.2	75	61
8/26/80	3129.7	95	62
8/27/80	3163.2	87	60
8/28/80	3197.7	84	65
8/29/80	3234.7	89	65
8/30/80	3268.2	82	65
8/31/80	3298.7	74	67
9/ 1/80	3327.7	74	54
9/ 2/80	3358.7	76	66
9/ 3/80	3383.2	80	49
9/ 4/80	3410.2	82	52
9/ 5/80	3432.7	78	47
9/ 6/80	3457.7	90	50
9/ 7/80	3483.7	81	51
9/ 8/80	3512.2	84	53
9/ 9/80	3534.7	71	54
9/10/80	3549.2	70	39
9/11/80	3566.7	73	42
9/12/80	3584.2	65	50
9/13/80	3614.2	81	59
9/14/80	3641.2	74	60
9/15/80	3658.7	62	53
9/16/80	3676.7	64	52
9/17/80	3690.2	61	46
9/18/80	3702.9	68	36
9/19/80	3719.9	72	42
9/20/80	3747.4	75	50
9/21/80	3776.9	75	64
9/22/80	3795.4	69	48
9/23/80	3806.4	61	41
9/24/80	3817.8	65	37
9/25/80	3831.8	66	42
9/26/80	3838.8	56	37
9/27/80	3849.0	64	34
9/28/80	3862.5	63	44
9/29/80	3880.5	73	43
9/30/80	3900.0	76	43
10/ 1/80	3920.5	73	48
10/ 2/80	3933.5	64	42
10/ 3/80	3936.1	46	39
10/ 4/80	3937.6	45	34
10/ 5/80	3941.1	49	36
10/ 6/80	3947.4	57	31
10/ 7/80	3957.6	66	29
10/ 8/80	3962.2	53	32
10/ 9/80	3969.3	59	30
10/10/80	3979.5	64	34
10/11/80	3988.0	49	48
10/12/80	3994.5	53	40
10/13/80	4002.2	50	31
10/14/80	4002.6	42	33
10/15/80	4005.9	49	35
10/16/80	4017.9	63	41
10/17/80	4034.9	67	47
10/18/80	4042.9	50	46
10/19/80	4049.9	52	42
10/20/80	4053.3	48	40
10/21/80	4057.9	50	36
10/22/80	4061.4	52	25
10/23/80	4068.0	55	37
10/24/80	4077.9	62	37
10/25/80	4079.9	43	41
10/26/80	4079.9	39	36
10/27/80	4080.0	41	28
10/28/80	4080.1	41	25
10/29/80	4081.3	46	16
10/30/80	4083.5	49	19
10/31/80	4088.8	52	18

TABLE C2 .

DATE	DEGREE DAY 3	DEGREE DAY 8	DEGREE DAY 15	ACC. DEGDAY 3	ACC. DEGDAY 8	ACC. DEGDAY 15
61	0.0	0.0	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0
73	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0
76	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0
78	0.0	0.0	0.0	0.0	0.0	0.0
79	0.0	0.0	0.0	0.0	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0
81	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0
83	0.0	0.0	0.0	0.0	0.0	0.0
84	0.0	0.0	0.0	0.0	0.0	0.0
85	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0
87	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0
89	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0	0.0	0.0
93	.1	0.0	0.0	.1	0.0	0.0
94	0.0	0.0	0.0	.1	0.0	0.0
95	0.0	0.0	0.0	.1	0.0	0.0
96	0.0	0.0	0.0	.1	0.0	0.0
97	0.0	0.0	0.0	.1	0.0	0.0
98	.3	0.0	0.0	.4	0.0	0.0
99	4.7	2.9	2.3	5.1	2.9	2.3
100	.2	.5	0.0	5.3	3.4	2.3
101	0.0	0.0	0.0	5.3	3.4	2.3
102	0.0	0.0	0.0	5.3	3.4	2.3
103	0.0	0.0	0.0	5.3	3.4	2.3
104	0.0	0.0	0.0	5.3	3.4	2.3
105	.1	.2	0.0	5.4	3.6	2.3
106	0.0	0.0	0.0	5.4	3.6	2.3
107	0.0	0.0	0.0	5.4	3.6	2.3
108	.8	.3	0.0	6.2	3.9	2.3
109	3.8	2.4	0.0	10.0	6.3	2.3
110	6.0	3.4	0.0	16.0	9.7	2.3
111	9.1	7.8	1.8	25.1	17.5	4.1
112	10.5	9.3	4.1	35.6	26.8	8.2
113	14.8	11.0	5.5	50.4	37.8	13.7
114	12.4	11.3	6.7	62.8	49.1	20.4
115	4.3	7.0	4.4	67.1	56.1	24.8
116	3.0	5.9	4.6	70.1	62.0	29.4
117	7.4	7.9	6.4	77.5	69.9	35.8
118	6.8	6.8	5.9	84.3	76.7	41.7
119	6.2	6.1	6.2	90.5	82.8	47.9
120	7.4	7.5	6.1	97.9	90.3	54.0
121	11.8	11.5	8.4	109.7	101.8	62.4
122	16.1	14.8	14.2	125.8	116.6	76.6
123	17.2	12.3	10.2	143.0	128.9	86.8
124	16.8	13.3	11.4	159.8	142.2	98.2
125	16.8	13.3	11.4	176.6	155.5	109.6
126	16.8	13.3	11.4	193.4	168.8	121.0
127	15.7	14.0	13.1	209.1	182.8	134.1
128	10.2	11.8	11.4	219.3	194.6	145.5
129	6.7	8.7	7.9	226.0	203.3	153.4
130	8.2	9.0	7.8	234.2	212.3	161.2
131	9.6	9.1	7.3	243.8	221.4	168.5
132	20.8	15.3	12.6	264.6	236.7	181.1
133	21.8	16.3	14.3	286.4	253.0	195.4
134	12.7	13.1	12.7	299.1	266.1	208.1
135	13.1	11.2	10.1	312.2	277.3	218.2
136	9.9	8.6	7.7	322.1	285.9	225.9
137	13.6	8.7	7.5	335.7	294.6	233.4
138	10.1	8.8	8.2	345.8	303.4	241.6
139	16.0	12.6	10.8	361.8	316.0	252.4
140	20.5	15.0	13.3	382.3	331.0	265.7

TABLE C2 . CONTINUED

DATE	DEGREE DAY 3	DEGREE DAY 8	DEGREE DAY 15	ACC. DEGDAY 3	ACC. DEGDAY 8	ACC. DEGDAY 15
141	23.0	16.8	15.0	405.3	347.8	280.7
142	25.1	18.3	16.7	430.4	366.1	297.4
143	25.2	20.7	19.3	455.6	386.8	316.7
144	27.5	21.3	19.7	483.1	408.1	336.4
145	31.3	25.2	22.8	514.4	433.3	359.2
146	31.3	25.1	23.2	545.7	458.4	382.4
147	28.5	23.3	22.1	574.2	481.7	404.5
148	31.3	25.0	23.5	605.5	506.7	428.0
149	31.7	25.6	24.6	637.2	532.3	452.6
150	27.7	24.3	24.0	664.9	556.6	476.6
151	27.5	23.0	22.4	692.4	579.6	499.0
152	24.0	21.7	21.4	716.4	601.3	520.4
153	14.3	15.4	16.3	730.7	616.7	536.7
154	22.1	18.0	17.3	752.8	634.7	554.0
155	28.1	23.1	21.6	780.9	657.8	575.6
156	24.5	21.0	19.9	805.4	678.8	595.5
157	18.4	18.3	18.0	823.8	697.1	613.5
158	26.9	22.0	21.0	850.7	719.1	634.5
159	27.0	24.8	25.1	877.7	743.9	659.6
160	19.5	19.9	19.9	897.2	763.8	679.5
161	18.1	16.8	16.8	915.3	780.6	696.3
162	14.9	13.8	13.1	930.2	794.4	709.4
163	18.8	15.7	13.9	949.0	810.1	723.3
164	23.0	18.5	16.5	972.0	828.6	739.8
165	27.8	21.3	20.2	999.8	849.9	760.0
166	26.9	22.1	21.8	1026.7	872.0	781.8
167	19.5	18.8	19.3	1046.2	890.8	801.1
168	19.9	17.3	16.4	1066.1	908.1	817.5
169	20.8	17.2	16.2	1086.9	925.3	833.7
170	25.5	20.1	18.9	1112.4	945.4	852.6
171	19.0	20.1	20.1	1131.4	965.5	872.7
172	23.1	20.7	19.4	1154.5	986.2	892.1
173	27.0	22.8	21.7	1181.5	1009.0	913.8
174	33.3	26.9	25.5	1214.8	1035.9	939.3
175	37.2	29.6	28.3	1252.0	1065.5	967.6
176	40.1	31.6	30.8	1292.1	1097.1	998.4
177	40.5	32.4	32.1	1332.6	1129.5	1030.5
178	42.6	34.2	33.5	1375.2	1163.7	1064.0
179	37.6	32.9	32.8	1412.8	1196.6	1096.8
180	36.4	31.1	31.2	1449.2	1227.7	1128.0
181	33.2	29.9	29.9	1482.4	1257.6	1157.9
182	30.7	27.9	27.6	1513.1	1285.5	1185.5
183	32.4	27.9	27.3	1545.5	1313.4	1212.8
184	38.8	31.8	31.1	1584.3	1345.2	1243.9
185	36.4	31.0	30.0	1620.7	1376.2	1273.9
186	34.4	29.3	28.8	1655.1	1405.5	1302.7
187	34.4	30.0	29.8	1689.5	1435.5	1332.5
188	30.6	27.0	26.6	1720.1	1462.5	1359.1
189	32.0	27.3	26.8	1752.1	1489.8	1385.9
190	41.8	33.6	32.8	1793.9	1523.4	1418.7
191	33.8	29.8	29.9	1827.7	1553.2	1448.6
192	36.5	31.7	31.6	1864.2	1584.9	1480.2
193	39.7	33.1	33.3	1903.9	1618.0	1513.5
194	34.5	31.0	31.2	1938.4	1649.0	1544.7
195	38.3	32.5	31.2	1976.7	1681.5	1575.9
196	41.3	34.6	33.6	2018.0	1716.1	1609.5
197	39.2	34.0	34.5	2057.2	1750.1	1644.0
198	36.5	31.9	32.3	2093.7	1762.0	1676.3
199	36.0	31.9	32.1	2129.7	1813.9	1708.4
200	32.3	29.2	29.3	2162.0	1843.1	1737.7
201	41.5	34.3	33.9	2203.5	1877.4	1771.6
202	41.9	35.0	35.0	2245.4	1912.4	1806.6
203	35.0	32.1	33.3	2280.4	1944.5	1839.9
204	35.2	31.5	32.0	2315.6	1976.0	1871.9
205	32.9	30.3	30.8	2348.5	2006.3	1902.7
206	32.2	28.9	29.0	2380.7	2035.2	1931.7
207	31.7	27.9	28.0	2412.4	2063.1	1959.7
208	28.2	26.9	27.6	2440.6	2090.0	1987.3
209	29.6	26.4	26.3	2470.2	2116.4	2013.6
210	33.9	29.0	29.0	2504.1	2145.4	2042.6
211	32.4	28.4	28.5	2536.5	2173.8	2071.1
212	27.5	25.3	25.6	2564.0	2199.1	2096.7
213	34.0	29.3	29.4	2598.0	2228.4	2126.1
214	37.6	32.5	33.0	2635.6	2260.9	2159.1
215	33.6	30.7	31.5	2669.2	2291.6	2190.6
216	36.8	32.0	32.4	2706.0	2323.6	2223.0
217	36.5	31.8	32.5	2742.5	2355.4	2255.5
218	35.9	31.8	32.6	2778.4	2387.2	2288.1
219	37.0	31.3	32.0	2815.4	2418.5	2320.1
220	40.8	34.1	35.3	2856.2	2452.6	2355.4

TABLE C2. CONTINUED

DATE	DEGREE DAY 3	DEGREE DAY 8	DEGREE DAY 15	ACC. DEGDAY 3	ACC. DEGDAY 8	ACC. DEGDAY 15
221	39.6	33.2	33.6	2895.8	2485.8	2389.0
222	36.6	33.0	33.9	2932.4	2518.8	2422.9
223	31.7	30.1	31.2	2964.1	2548.9	2454.1
224	31.3	29.1	30.0	2995.4	2578.0	2484.1
225	30.2	28.5	29.3	3025.6	2606.5	2513.4
226	24.1	24.2	24.9	3049.7	2630.7	2538.3
227	30.7	27.5	27.7	3080.4	2658.2	2566.0
228	27.8	27.3	28.0	3108.2	2685.5	2594.0
229	24.4	24.9	25.6	3132.6	2710.4	2619.6
230	24.7	24.4	25.3	3157.3	2734.8	2644.9
231	31.4	28.0	28.1	3188.7	2762.8	2673.0
232	30.0	27.1	27.4	3218.7	2789.9	2700.4
233	34.3	29.6	30.2	3253.0	2819.5	2730.6
234	36.1	31.8	32.3	3289.1	2851.3	2762.9
235	30.6	29.3	30.2	3319.7	2880.6	2793.1
236	29.0	27.6	28.8	3348.7	2908.2	2821.9
237	30.5	28.0	29.0	3379.2	2936.2	2850.9
238	30.1	28.0	28.6	3409.3	2964.2	2879.5
239	34.3	29.8	30.4	3443.6	2994.0	2909.9
240	35.4	30.8	31.7	3479.0	3024.8	2941.6
241	36.1	31.9	33.1	3515.1	3056.7	2974.7
242	37.7	33.2	33.9	3552.8	3089.9	3008.6
243	35.9	32.1	33.3	3588.7	3122.0	3041.9
244	32.6	30.4	31.3	3621.3	3152.4	3073.2
245	32.1	29.5	30.4	3653.4	3181.9	3103.6
246	30.5	28.4	29.1	3683.9	3210.3	3132.7
247	28.8	27.1	27.7	3712.7	3237.4	3160.4
248	30.5	27.8	28.8	3743.2	3265.2	3189.2
249	27.4	26.2	27.0	3770.6	3291.4	3216.2
250	27.6	26.5	27.1	3798.2	3317.9	3243.3
251	26.8	25.2	26.0	3825.0	3343.1	3269.3
252	30.0	27.0	27.5	3855.0	3370.1	3296.8
253	28.5	27.3	27.9	3883.5	3397.4	3324.7
254	21.0	21.7	22.5	3904.5	3419.1	3347.2
255	21.3	21.0	21.3	3925.8	3440.1	3368.5
256	21.9	21.8	21.8	3947.7	3461.9	3390.3
257	27.3	24.2	23.7	3975.0	3486.1	3414.0
258	25.0	24.5	24.5	4000.0	3510.6	3438.5
259	21.2	21.6	22.0	4021.2	3532.2	3460.5
260	19.8	20.5	21.0	4041.0	3552.7	3481.5
261	17.8	18.4	18.5	4058.8	3571.1	3500.0
262	16.5	17.2	17.1	4075.3	3588.3	3517.1

TABLE C3 -

DATE	DEGREE DAY 3	DEGREE DAY 8	DEGREE DAY 15	ACC. DEGDAY 3	ACC. DEGDAY 8	ACC. DEGDAY 15
91	0.0	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0	0.0	0.0
93	0.0	0.0	0.0	0.0	0.0	0.0
94	0.0	0.0	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0	0.0	0.0
96	0.0	0.0	0.0	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0
101	0.0	0.0	0.0	0.0	0.0	0.0
102	0.0	0.0	0.0	0.0	0.0	0.0
103	0.0	0.0	0.0	0.0	0.0	0.0
104	0.0	0.0	0.0	0.0	0.0	0.0
105	0.0	0.0	0.0	0.0	0.0	0.0
106	0.0	0.0	0.0	0.0	0.0	0.0
107	0.0	0.0	0.0	0.0	0.0	0.0
108	10.8	8.3	9.4	19.3	8.3	9.4
109	10.5	8.0	2.9	21.3	16.3	12.3
110	13.1	8.2	3.9	34.4	24.5	16.2
111	8.9	7.4	5.9	43.3	31.9	22.1
112	11.6	8.1	5.5	54.9	40.0	27.6
113	15.4	10.9	7.3	70.3	50.9	34.9
114	12.3	9.4	8.6	82.6	60.3	43.5
115	12.6	9.0	8.2	95.2	69.3	51.7
116	5.8	4.5	6.1	101.8	73.8	57.8
117	10.6	8.3	5.8	111.6	82.1	63.6
118	12.3	9.4	7.8	123.9	91.5	71.4
119	12.7	9.2	8.0	136.6	100.7	79.4
120	4.9	4.5	5.9	141.5	105.2	85.3
121	10.6	8.3	4.1	152.1	113.5	89.4
122	12.3	9.4	7.8	164.4	122.9	97.2
123	12.7	9.1	8.0	177.1	132.0	105.2
124	5.8	4.5	5.0	182.9	136.5	110.2
125	10.6	8.3	3.7	193.5	144.8	113.9
126	12.3	9.4	7.5	205.8	154.2	121.4
127	12.6	8.9	8.1	218.4	163.1	129.5
128	13.1	8.9	8.4	231.5	172.0	137.9
129	19.6	18.0	10.2	251.1	190.0	148.1
130	24.9	13.0	12.8	276.0	200.0	160.9
131	26.8	19.8	15.5	302.8	227.8	176.4
132	19.3	17.5	16.5	322.1	245.3	192.9
133	7.2	8.0	10.9	329.3	253.3	203.8
134	14.4	8.9	8.2	343.7	262.2	212.0
135	14.2	11.3	10.0	357.9	273.5	222.0
136	14.0	11.0	10.0	371.9	284.5	232.0
137	10.7	14.4	10.0	382.6	298.9	242.0
138	9.4	12.0	10.2	392.0	310.9	252.2
139	9.3	12.5	10.9	401.3	323.4	263.1
140	17.0	18.4	12.1	418.3	341.8	275.2
141	19.7	19.6	14.2	438.0	361.4	289.4
142	18.1	18.3	15.1	456.1	379.7	305.5
143	21.7	19.8	17.1	477.8	399.5	322.6
144	17.6	17.4	16.6	495.4	416.9	339.2
145	20.4	18.1	15.3	515.8	435.0	354.5
146	18.7	17.3	15.8	534.5	452.3	370.3
147	18.9	16.6	15.4	553.4	468.9	385.7
148	18.5	16.3	14.7	571.9	485.2	400.4
149	23.5	18.4	14.6	595.4	503.6	415.0
150	20.2	17.8	16.9	615.6	521.4	431.9
151	25.9	18.4	14.6	641.5	539.8	446.5
152	25.9	17.9	14.6	667.4	557.7	461.1
153	25.7	18.1	16.6	693.1	575.8	477.7
154	24.6	18.0	15.8	717.7	593.8	493.5
155	22.2	15.1	15.1	739.9	608.9	508.6
156	27.9	22.9	17.2	767.8	631.8	525.8
157	27.8	21.2	19.3	795.6	653.0	545.1
158	25.8	22.0	20.5	821.4	675.0	565.6
159	28.5	22.8	20.2	849.9	697.8	585.8
160	27.2	23.3	21.8	877.1	721.1	607.6
161	19.5	19.4	20.3	896.6	740.5	627.9
162	20.4	17.3	16.8	917.0	757.8	644.7
163	22.7	18.7	19.0	939.7	776.5	663.7
164	22.6	19.5	18.6	962.3	796.0	682.3
165	26.2	21.6	20.2	988.5	817.6	702.5
166	29.6	24.8	22.5	1018.1	842.4	725.0
167	30.3	26.0	23.4	1048.4	868.4	748.4
168	25.9	24.0	22.3	1074.3	892.4	770.7
169	21.9	21.8	22.4	1096.2	914.2	793.1
170	23.0	25.3	26.6	1119.2	939.5	819.7

TABLE C3 . CONTINUED

DATE	DEGREE DAY 3	DEGREE DAY 8	DEGREE DAY 15	ACC. DEGDAY 3	ACC. DEGDAY 8	ACC. DEGDAY 15
171	27.0	24.6	25.6	1146.2	964.1	845.3
172	27.5	23.8	25.7	1173.7	987.9	871.0
173	27.9	24.2	25.6	1201.6	1012.1	896.6
174	28.3	25.4	25.7	1229.9	1037.5	922.3
175	27.2	24.0	25.3	1257.1	1061.5	947.6
176	23.4	24.5	24.3	1280.5	1086.0	972.4
177	24.8	24.5	24.4	1305.3	1110.5	996.8
178	26.6	26.8	25.9	1331.9	1137.3	1022.7
179	27.0	26.9	25.9	1358.9	1164.2	1048.6
180	25.6	26.1	26.5	1384.5	1190.3	1075.1
181	25.4	25.7	26.0	1409.9	1216.0	1101.1
182	25.2	25.6	26.1	1435.1	1241.6	1127.2
183	31.2	31.4	27.5	1466.3	1273.0	1154.7
184	28.3	28.7	28.0	1494.6	1301.7	1182.7
185	28.2	30.0	28.3	1522.8	1331.7	1211.0
186	25.4	27.4	26.6	1548.2	1359.1	1237.6
187	25.6	27.4	26.4	1573.8	1386.5	1264.0
188	27.4	28.3	26.9	1601.2	1414.8	1290.9
189	29.5	30.0	28.1	1630.7	1444.8	1319.0
190	31.6	31.3	29.2	1662.3	1476.1	1348.2
191	31.2	31.0	28.1	1693.5	1507.1	1376.3
192	33.7	33.0	30.2	1727.2	1540.1	1406.5
193	35.6	34.8	31.5	1762.8	1574.9	1438.0
194	37.4	36.3	32.8	1800.2	1611.2	1470.8
195	36.2	35.7	33.0	1836.4	1646.9	1503.8
196	35.4	34.6	32.2	1871.8	1681.5	1536.0
197	32.2	32.5	31.5	1904.0	1714.0	1567.5
198	30.6	32.0	31.5	1934.6	1746.0	1599.0
199	27.9	29.0	28.6	1962.5	1775.0	1627.6
200	27.4	28.0	27.3	1989.9	1803.0	1654.9
201	28.5	28.6	27.8	2018.4	1831.6	1682.7
202	29.6	30.1	28.0	2048.0	1861.7	1710.7
203	30.9	30.1	28.2	2078.9	1891.8	1738.9
204	33.1	32.3	29.0	2112.0	1924.1	1767.9
205	32.9	32.6	30.1	2144.9	1956.7	1798.0
206	34.9	33.8	32.0	2179.8	1990.5	1830.0
207	33.0	32.5	30.1	2212.8	2023.0	1860.1
208	33.2	32.6	29.7	2246.0	2055.6	1889.8
209	37.1	35.4	30.6	2283.1	2091.0	1920.4
210	35.6	35.3	32.0	2318.7	2126.3	1952.4
211	29.2	30.9	29.5	2347.9	2157.2	1981.9
212	31.0	30.9	27.5	2378.9	2188.1	2009.4
213	33.3	33.9	31.3	2412.2	2222.0	2040.7
214	30.8	31.9	30.5	2443.0	2253.9	2071.2
215	30.4	31.7	29.8	2473.4	2285.6	2101.0
216	30.9	31.2	29.7	2504.3	2316.8	2130.7
217	29.2	30.4	29.0	2533.5	2347.2	2159.7
218	31.0	31.4	29.5	2564.5	2378.6	2189.2
219	34.9	35.1	32.2	2599.4	2413.7	2221.4
220	36.6	36.8	33.0	2636.0	2450.5	2254.4
221	31.2	33.5	32.4	2667.2	2484.0	2286.8
222	33.9	34.4	32.4	2701.1	2518.4	2319.2
223	30.3	33.1	31.8	2731.4	2551.5	2351.0
224	26.0	29.7	29.3	2757.4	2581.2	2380.3
225	28.1	29.2	26.9	2785.5	2610.4	2407.2
226	23.2	25.3	25.3	2808.7	2635.7	2432.5
227	23.0	25.2	24.0	2831.7	2660.9	2456.5
228	20.5	23.4	23.3	2852.2	2684.3	2479.8
229	21.8	23.8	24.0	2874.0	2708.1	2503.8
230	25.5	26.5	25.0	2899.5	2734.6	2528.8
231	27.2	28.8	26.6	2926.7	2763.4	2555.4
232	32.2	31.3	29.2	2958.9	2794.7	2584.6
233	37.1	37.3	30.3	2996.0	2832.0	2614.9
234	31.3	32.3	30.9	3027.3	2864.3	2645.8
235	32.4	33.0	31.1	3059.7	2897.3	2676.9
236	31.3	32.7	31.3	3091.0	2930.0	2708.2
237	29.2	30.8	29.9	3120.2	2960.8	2738.1
238	27.4	29.1	28.0	3147.6	2989.9	2766.1
239	27.4	29.8	29.0	3175.0	3019.7	2795.1
240	29.1	30.6	29.3	3204.1	3050.3	2824.4
241	30.4	31.8	30.0	3234.5	3082.1	2854.4
242	31.6	32.2	30.1	3266.1	3114.3	2884.5
243	33.0	33.2	31.5	3299.1	3147.5	2916.0
244	33.2	33.5	32.0	3332.3	3181.0	2948.0
245	35.1	35.2	32.8	3367.4	3216.2	2980.8
246	29.9	32.4	32.1	3397.3	3248.6	3012.9
247	33.8	33.4	31.7	3431.1	3282.0	3044.6
248	31.4	32.5	31.5	3462.5	3314.5	3076.1
249	31.2	32.4	31.8	3493.7	3346.9	3107.9
250	25.0	28.7	28.8	3518.7	3375.6	3136.7

TABLE C3. CONTINUED

DATE	DEGREE DAY 3	DEGREE DAY 8	DEGREE DAY 15	ACC. DEGDAY 3	ACC. DEGDAY 8	ACC. DEGDAY 15
251	19.0	23.1	24.4	3537.7	3398.7	3161.1
252	19.5	22.5	23.2	3557.2	3421.2	3184.3

TABLE C4.

DATE	DAILY PRECIP	ACCUMULATION	DATE	DAILY PRECIP	ACCUMULATION	DATE	DAILY PRECIP	ACCUMULATION
4/ 1/78	0.00	0.00	6/20/78	0.00	8.04	9/ 8/78	0.00	17.66
4/ 2/78	.06	.06	6/21/78	0.00	8.04	9/ 9/78	0.00	17.66
4/ 3/78	1.00	1.06	6/22/78	0.00	8.04	9/10/78	0.00	17.66
4/ 4/78	0.00	1.06	6/23/78	0.00	8.04	9/11/78	1.00	18.66
4/ 5/78	.30	1.36	6/24/78	0.00	8.04	9/12/78	.46	19.12
4/ 6/78	.59	1.95	6/25/78	1.80	9.84	9/13/78	.67	19.79
4/ 7/78	0.00	1.95	6/26/78	0.00	9.84	9/14/78	.67	20.46
4/ 8/78	0.00	1.95	6/27/78	0.00	9.84	9/15/78	0.00	20.46
4/ 9/78	.37	2.32	6/28/78	0.00	9.84	9/16/78	0.00	20.46
4/10/78	.44	2.76	6/29/78	0.00	9.84	9/17/78	.70	21.16
4/11/78	.02	2.78	6/30/78	0.00	9.84	9/18/78	.02	21.18
4/12/78	.02	2.80	7/ 1/78	.50	10.34	9/19/78	0.00	21.18
4/13/78	0.00	2.80	7/ 2/78	0.00	10.34	9/20/78	.15	21.33
4/14/78	0.00	2.80	7/ 3/78	0.00	10.34	9/21/78	0.00	21.33
4/15/78	0.00	2.80	7/ 4/78	0.00	10.34	9/22/78	0.00	21.33
4/16/78	0.00	2.80	7/ 5/78	0.00	10.34	9/23/78	0.00	21.33
4/17/78	0.00	2.80	7/ 6/78	0.00	10.34	9/24/78	0.00	21.33
4/18/78	.12	2.92	7/ 7/78	0.00	10.34	9/25/78	0.00	21.33
4/19/78	.03	2.95	7/ 8/78	0.00	10.34	9/26/78	0.00	21.33
4/20/78	.03	2.98	7/ 9/78	.21	10.55	9/27/78	.28	21.61
4/21/78	0.00	2.98	7/10/78	0.00	10.55	9/28/78	.03	21.64
4/22/78	0.00	2.98	7/11/78	0.00	10.55	9/29/78	0.00	21.64
4/23/78	.15	3.13	7/12/78	.01	10.56	9/30/78	.01	21.65
4/24/78	0.00	3.13	7/13/78	.01	10.57	10/ 1/78	0.00	21.65
4/25/78	0.00	3.13	7/14/78	0.00	10.57	10/ 2/78	.24	21.89
4/26/78	0.00	3.13	7/15/78	0.00	10.57	10/ 3/78	.40	22.29
4/27/78	0.00	3.13	7/16/78	0.00	10.57	10/ 4/78	.13	22.42
4/28/78	0.00	3.13	7/17/78	0.00	10.57	10/ 5/78	.80	23.22
4/29/78	0.00	3.13	7/18/78	0.00	10.57	10/ 6/78	0.00	23.22
4/30/78	0.00	3.13	7/19/78	0.00	10.57	10/ 7/78	0.00	23.22
5/ 1/78	0.00	3.13	7/20/78	.20	10.77	10/ 8/78	0.00	23.22
5/ 2/78	0.00	3.13	7/21/78	.09	10.86	10/ 9/78	.10	23.32
5/ 3/78	0.00	3.13	7/22/78	.05	10.91	10/10/78	0.00	23.32
5/ 4/78	.09	3.22	7/23/78	0.00	10.91	10/11/78	0.00	23.32
5/ 5/78	0.00	3.22	7/24/78	0.00	10.91	10/12/78	0.00	23.32
5/ 6/78	0.00	3.22	7/25/78	0.00	10.91	10/13/78	0.00	23.32
5/ 7/78	.11	3.33	7/26/78	.13	11.04	10/14/78	0.00	23.32
5/ 8/78	.07	3.40	7/27/78	0.00	11.04	10/15/78	.52	23.84
5/ 9/78	.01	3.41	7/28/78	.04	11.08	10/16/78	0.00	23.84
5/10/78	0.00	3.41	7/29/78	0.00	11.08	10/17/78	.01	23.85
5/11/78	.40	3.81	7/30/78	0.00	11.08	10/18/78	.02	23.87
5/12/78	.65	4.46	7/31/78	0.00	11.08	10/19/78	0.00	23.87
5/13/78	.55	5.01	8/ 1/78	0.00	11.08	10/20/78	0.00	23.87
5/14/78	.05	5.06	8/ 2/78	.04	11.12	10/21/78	0.00	23.87
5/15/78	0.00	5.06	8/ 3/78	0.00	11.12	10/22/78	.04	23.91
5/16/78	0.00	5.06	8/ 4/78	0.00	11.12	10/23/78	0.00	23.91
5/17/78	0.00	5.06	8/ 5/78	0.00	11.12	10/24/78	0.00	23.91
5/18/78	0.00	5.06	8/ 6/78	0.00	11.12	10/25/78	.46	24.37
5/19/78	0.00	5.06	8/ 7/78	0.00	11.12	10/26/78	.04	24.41
5/20/78	.13	5.19	8/ 8/78	.22	11.34	10/27/78	0.00	24.41
5/21/78	0.00	5.19	8/ 9/78	0.00	11.34	10/28/78	0.00	24.41
5/22/78	0.00	5.19	8/10/78	0.00	11.34	10/29/78	0.00	24.41
5/23/78	0.00	5.19	8/11/78	0.00	11.34	10/30/78	0.00	24.41
5/24/78	0.00	5.19	8/12/78	0.00	11.34	10/31/78	0.00	24.41
5/25/78	0.00	5.19	8/13/78	0.00	11.34	4/ 1/79	.29	.29
5/26/78	0.00	5.19	8/14/78	0.00	11.34	4/ 2/79	0.00	.29
5/27/78	0.00	5.19	8/15/78	.87	12.21	4/ 3/79	0.00	.29
5/28/78	0.00	5.19	8/16/78	.03	12.24	4/ 4/79	.03	.32
5/29/78	0.00	5.19	8/17/78	0.00	12.24	4/ 5/79	.23	.55
5/30/78	0.00	5.19	8/18/78	4.60	16.84	4/ 6/79	0.00	.55
5/31/78	0.00	5.19	8/19/78	0.00	16.84	4/ 7/79	0.00	.55
6/ 1/78	0.00	5.19	8/20/78	0.00	16.84	4/ 8/79	0.00	.55
6/ 2/78	0.00	5.19	8/21/78	0.00	16.84	4/ 9/79	0.00	.55
6/ 3/78	0.00	5.19	8/22/78	0.00	16.84	4/10/79	0.00	.55
6/ 4/78	.11	5.30	8/23/78	.09	16.93	4/11/79	.27	.82
6/ 5/78	0.00	5.30	8/24/78	0.00	16.93	4/12/79	.17	.99
6/ 6/78	0.00	5.30	8/25/78	0.00	16.93	4/13/79	0.00	.99
6/ 7/78	.30	5.60	8/26/78	0.00	16.93	4/14/79	0.00	.99
6/ 8/78	0.00	5.60	8/27/78	.70	17.63	4/15/79	0.00	.99
6/ 9/78	0.00	5.60	8/28/78	.03	17.66	4/16/79	0.00	.99
6/10/78	0.00	5.60	8/29/78	0.00	17.66	4/17/79	0.00	.99
6/11/78	.49	6.09	8/30/78	0.00	17.66	4/18/79	0.00	.99
6/12/78	0.00	6.09	8/31/78	0.00	17.66	4/19/79	0.00	.99
6/13/78	0.00	6.09	9/ 1/78	0.00	17.66	4/20/79	0.00	.99
6/14/78	0.00	6.09	9/ 2/78	0.00	17.66	4/21/79	0.00	.99
6/15/78	.11	6.20	9/ 3/78	0.00	17.66	4/22/79	0.00	.99
6/16/78	.40	6.60	9/ 4/78	0.00	17.66	4/23/79	0.00	.99
6/17/78	1.44	8.04	9/ 5/78	0.00	17.66	4/24/79	.25	1.24
6/18/78	0.00	8.04	9/ 6/78	0.00	17.66	4/25/79	.76	2.00
6/19/78	0.00	8.04	9/ 7/78	0.00	17.66	4/26/79	.60	2.60

TABLE C4. CONTINUED

DATE	DAILY PRECIP	ACCUMULATION	DATE	DAILY PRECIP	ACCUMULATION	DATE	DAILY PRECIP	ACCUMULATION
4/27/79	0.00	2.60	7/16/79	0.00	12.67	10/ 4/79	0.00	19.65
4/28/79	0.00	2.60	7/17/79	0.00	12.67	10/ 5/79	.06	19.71
4/29/79	.83	3.43	7/18/79	0.00	12.67	10/ 6/79	.16	19.87
4/30/79	0.00	3.43	7/19/79	0.00	12.67	10/ 7/79	0.00	19.87
5/ 1/79	.02	3.45	7/20/79	0.00	12.67	10/ 8/79	.30	20.17
5/ 2/79	.94	4.39	7/21/79	0.00	12.67	10/ 9/79	.02	20.19
5/ 3/79	0.00	4.39	7/22/79	0.00	12.67	10/10/79	.04	20.23
5/ 4/79	0.00	4.39	7/23/79	0.00	12.67	10/11/79	.39	20.62
5/ 5/79	.05	4.44	7/24/79	.40	13.07	10/12/79	.44	21.06
5/ 6/79	0.00	4.44	7/25/79	0.00	13.07	10/13/79	0.00	21.06
5/ 7/79	0.00	4.44	7/26/79	0.00	13.07	10/14/79	0.00	21.06
5/ 8/79	0.00	4.44	7/27/79	.97	14.04	10/15/79	0.00	21.06
5/ 9/79	0.00	4.44	7/28/79	0.00	14.04	10/16/79	.07	21.13
5/10/79	0.00	4.44	7/29/79	0.00	14.04	10/17/79	0.00	21.13
5/11/79	0.00	4.44	7/30/79	.20	14.24	10/18/79	.37	21.50
5/12/79	0.00	4.44	7/31/79	0.00	14.24	10/19/79	.23	21.73
5/13/79	.38	4.82	8/ 1/79	0.00	14.24	10/20/79	0.00	21.73
5/14/79	0.00	4.82	8/ 2/79	0.00	14.24	10/21/79	0.00	21.73
5/15/79	0.00	4.82	8/ 3/79	0.00	14.24	10/22/79	.35	22.08
5/16/79	0.00	4.82	8/ 4/79	.50	14.74	10/23/79	.35	22.43
5/17/79	0.00	4.82	8/ 5/79	0.00	14.74	10/24/79	.35	22.78
5/18/79	0.00	4.82	8/ 6/79	0.00	14.74	10/25/79	0.00	22.78
5/19/79	.18	5.00	8/ 7/79	0.00	14.74	10/26/79	0.00	22.78
5/20/79	0.00	5.00	8/ 8/79	0.00	14.74	10/27/79	0.00	22.78
5/21/79	0.00	5.00	8/ 9/79	1.07	15.81	10/28/79	.13	22.91
5/22/79	.01	5.01	8/10/79	0.00	15.81	10/29/79	0.00	22.91
5/23/79	0.00	5.01	8/11/79	0.00	15.81	10/30/79	0.00	22.91
5/24/79	0.00	5.01	8/12/79	.02	15.83	10/31/79	.29	23.20
5/25/79	0.00	5.01	8/13/79	.02	15.85	4/ 1/80	.02	.02
5/26/79	0.00	5.01	8/14/79	0.00	15.85	4/ 2/80	0.00	.02
5/27/79	0.00	5.01	8/15/79	0.00	15.85	4/ 3/80	.00	.02
5/28/79	0.00	5.01	8/16/79	.36	16.21	4/ 4/80	0.00	.02
5/29/79	0.00	5.01	8/17/79	.30	16.51	4/ 5/80	0.00	.02
5/30/79	0.00	5.01	8/18/79	0.00	16.51	4/ 6/80	.04	.06
5/31/79	.46	5.47	8/19/79	.29	16.80	4/ 7/80	.32	1.16
6/ 1/79	0.00	5.47	8/20/79	.39	17.19	4/ 8/80	1.07	2.25
6/ 2/79	0.00	5.47	8/21/79	0.00	17.19	4/ 9/80	.10	2.35
6/ 3/79	0.00	5.47	8/22/79	1.35	18.54	4/10/80	0.00	2.35
6/ 4/79	0.00	5.47	8/23/79	.25	18.79	4/11/80	.31	2.66
6/ 5/79	0.00	5.47	8/24/79	0.00	18.79	4/12/80	0.00	2.66
6/ 6/79	0.00	5.47	8/25/79	0.00	18.79	4/13/80	.31	2.97
6/ 7/79	.44	5.91	8/26/79	0.00	18.79	4/14/80	.49	3.46
6/ 8/79	0.00	5.91	8/27/79	.27	19.06	4/15/80	0.00	3.46
6/ 9/79	0.00	5.91	8/28/79	.27	19.33	4/16/80	0.00	3.46
6/10/79	.62	6.53	8/29/79	0.00	19.33	4/17/80	.01	3.47
6/11/79	0.00	6.53	8/30/79	0.00	19.33	4/18/80	0.00	3.47
6/12/79	0.00	6.53	8/31/79	0.00	19.33	4/19/80	0.00	3.47
6/13/79	0.00	6.53	9/ 1/79	.09	19.42	4/20/80	0.00	3.47
6/14/79	0.00	6.53	9/ 2/79	0.00	19.42	4/21/80	0.00	3.47
6/15/79	0.00	6.53	9/ 3/79	0.00	19.42	4/22/80	0.00	3.47
6/16/79	0.00	6.53	9/ 4/79	0.00	19.42	4/23/80	.24	3.71
6/17/79	0.00	6.53	9/ 5/79	.02	19.44	4/24/80	.02	3.73
6/18/79	0.00	6.53	9/ 6/79	0.00	19.44	4/25/80	0.00	3.73
6/19/79	.09	6.62	9/ 7/79	0.00	19.44	4/26/80	0.00	3.73
6/20/79	4.02	10.64	9/ 8/79	0.00	19.44	4/27/80	.09	3.82
6/21/79	0.00	10.64	9/ 9/79	0.00	19.44	4/28/80	.26	4.08
6/22/79	0.00	10.64	9/10/79	0.00	19.44	4/29/80	.19	4.27
6/23/79	0.00	10.64	9/11/79	0.00	19.44	4/30/80	0.00	4.27
6/24/79	0.00	10.64	9/12/79	0.00	19.44	5/ 1/80	0.00	4.27
6/25/79	0.00	10.64	9/13/79	0.00	19.44	5/ 2/80	.06	4.33
6/26/79	0.00	10.64	9/14/79	0.00	19.44	5/ 3/80	0.00	4.33
6/27/79	0.00	10.64	9/15/79	0.00	19.44	5/ 4/80	0.00	4.33
6/28/79	.29	10.93	9/16/79	0.00	19.44	5/ 5/80	0.00	4.33
6/29/79	0.00	10.93	9/17/79	0.00	19.44	5/ 6/80	0.00	4.33
6/30/79	.90	11.83	9/18/79	0.00	19.44	5/ 7/80	0.00	4.33
7/ 1/79	0.00	11.83	9/19/79	0.00	19.44	5/ 8/80	0.00	4.33
7/ 2/79	0.00	11.83	9/20/79	0.00	19.44	5/ 9/80	0.00	4.33
7/ 3/79	.41	12.24	9/21/79	0.00	19.44	5/10/80	0.00	4.33
7/ 4/79	0.00	12.24	9/22/79	0.00	19.44	5/11/80	.09	4.42
7/ 5/79	0.00	12.24	9/23/79	0.00	19.44	5/12/80	.29	4.71
7/ 6/79	0.00	12.24	9/24/79	.06	19.50	5/13/80	.03	4.74
7/ 7/79	0.00	12.24	9/25/79	0.00	19.50	5/14/80	.06	4.80
7/ 8/79	0.00	12.24	9/26/79	0.00	19.50	5/15/80	0.00	4.80
7/ 9/79	.42	12.66	9/27/79	0.00	19.50	5/16/80	0.00	4.80
7/10/79	.01	12.67	9/28/79	0.00	19.50	5/17/80	.88	5.68
7/11/79	0.00	12.67	9/29/79	0.00	19.50	5/18/80	0.00	5.68
7/12/79	0.00	12.67	9/30/79	0.00	19.50	5/19/80	.03	5.71
7/13/79	0.00	12.67	10/ 1/79	.03	19.53	5/20/80	0.00	5.71
7/14/79	0.00	12.67	10/ 2/79	0.00	19.53	5/21/80	0.00	5.71
7/15/79	0.00	12.67	10/ 3/79	.12	19.65	5/22/80	0.00	5.71

TABLE C4. CONTINUED

DATE	DAILY PRECIP	ACCUMULATION	DATE	DAILY PRECIP	ACCUMULATION	DATE	DAILY PRECIP	ACCUMULATION
5/23/80	.03	5.74	8/11/80	.79	14.60	10/30/80	0.00	29.09
5/24/80	0.00	5.74	8/12/80	0.00	14.60	10/31/80	0.00	29.09
5/25/80	0.00	5.74	8/13/80	0.00	14.60			
5/26/80	0.00	5.74	8/14/80	0.00	14.60			
5/27/80	0.00	5.74	8/15/80	0.00	14.60			
5/28/80	0.00	5.74	8/16/80	.02	14.62			
5/29/80	.02	5.76	8/17/80	0.00	14.62			
5/30/80	.51	6.27	8/18/80	0.00	14.62			
5/31/80	0.00	6.27	8/19/80	3.99	18.61			
6/ 1/80	.11	6.38	8/20/80	.26	18.87			
6/ 2/80	.45	6.83	8/21/80	0.00	18.87			
6/ 3/80	0.00	6.83	8/22/80	0.00	18.87			
6/ 4/80	0.00	6.83	8/23/80	0.00	18.87			
6/ 5/80	0.00	6.83	8/24/80	0.00	18.87			
6/ 6/80	0.00	6.83	8/25/80	0.00	18.87			
6/ 7/80	1.00	7.83	8/26/80	0.00	18.87			
6/ 8/80	0.00	7.83	8/27/80	0.00	18.87			
6/ 9/80	0.00	7.83	8/28/80	0.00	18.87			
6/10/80	0.00	7.83	8/29/80	0.00	18.87			
6/11/80	0.00	7.83	8/30/80	0.00	18.87			
6/12/80	0.00	7.83	8/31/80	.19	19.06			
6/13/80	.63	8.46	9/ 1/80	.45	19.51			
6/14/80	0.00	8.46	9/ 2/80	1.70	21.21			
6/15/80	.02	8.48	9/ 3/80	0.00	21.21			
6/16/80	0.00	8.48	9/ 4/80	0.00	21.21			
6/17/80	0.00	8.48	9/ 5/80	0.00	21.21			
6/18/80	0.00	8.48	9/ 6/80	0.00	21.21			
6/19/80	.35	8.83	9/ 7/80	0.00	21.21			
6/20/80	0.00	8.83	9/ 8/80	.33	21.54			
6/21/80	0.00	8.83	9/ 9/80	0.00	21.54			
6/22/80	0.00	8.83	9/10/80	0.00	21.54			
6/23/80	0.00	8.83	9/11/80	.05	21.59			
6/24/80	0.00	8.83	9/12/80	1.04	22.63			
6/25/80	0.00	8.83	9/13/80	.04	22.67			
6/26/80	0.00	8.83	9/14/80	.02	22.69			
6/27/80	.22	9.05	9/15/80	0.00	22.69			
6/28/80	0.00	9.05	9/16/80	1.61	24.30			
6/29/80	0.00	9.05	9/17/80	0.00	24.30			
6/30/80	0.00	9.05	9/18/80	0.00	24.30			
7/ 1/80	0.00	9.05	9/19/80	.39	24.69			
7/ 2/80	0.00	9.05	9/20/80	.09	24.78			
7/ 3/80	.61	9.66	9/21/80	.70	25.48			
7/ 4/80	0.00	9.66	9/22/80	.72	26.20			
7/ 5/80	0.00	9.66	9/23/80	0.00	26.20			
7/ 6/80	0.00	9.66	9/24/80	0.00	26.20			
7/ 7/80	0.00	9.66	9/25/80	.34	26.54			
7/ 8/80	0.00	9.66	9/26/80	0.00	26.54			
7/ 9/80	0.00	9.66	9/27/80	0.00	26.54			
7/10/80	0.00	9.66	9/28/80	0.00	26.54			
7/11/80	0.00	9.66	9/29/80	0.00	26.54			
7/12/80	.03	9.69	9/30/80	0.00	26.54			
7/13/80	0.00	9.69	10/ 1/80	.07	26.61			
7/14/80	.04	9.73	10/ 2/80	.24	26.85			
7/15/80	.01	9.74	10/ 3/80	.02	26.87			
7/16/80	0.00	9.74	10/ 4/80	0.00	26.87			
7/17/80	0.00	9.74	10/ 5/80	0.00	26.87			
7/18/80	0.00	9.74	10/ 6/80	0.00	26.87			
7/19/80	0.00	9.74	10/ 7/80	0.00	26.87			
7/20/80	1.02	10.76	10/ 8/80	0.00	26.87			
7/21/80	.11	10.87	10/ 9/80	0.00	26.87			
7/22/80	0.00	10.87	10/10/80	0.00	26.87			
7/23/80	0.00	10.87	10/11/80	0.00	26.87			
7/24/80	0.00	10.87	10/12/80	0.00	26.87			
7/25/80	0.00	10.87	10/13/80	.03	26.90			
7/26/80	.72	11.59	10/14/80	.37	27.27			
7/27/80	0.00	11.59	10/15/80	.75	28.02			
7/28/80	0.00	11.59	10/16/80	.27	28.29			
7/29/80	0.00	11.59	10/17/80	.11	28.40			
7/30/80	0.00	11.59	10/18/80	.02	28.42			
7/31/80	0.00	11.59	10/19/80	0.00	28.42			
8/ 1/80	0.00	11.59	10/20/80	.15	28.57			
8/ 2/80	.11	11.70	10/21/80	0.00	28.57			
8/ 3/80	0.00	11.70	10/22/80	0.00	28.57			
8/ 4/80	0.00	11.70	10/23/80	0.00	28.57			
8/ 5/80	.03	11.73	10/24/80	.52	29.09			
8/ 6/80	.03	11.76	10/25/80	0.00	29.09			
8/ 7/80	1.55	13.31	10/26/80	0.00	29.09			
8/ 8/80	.50	13.81	10/27/80	0.00	29.09			
8/ 9/80	0.00	13.81	10/28/80	0.00	29.09			
8/10/80	0.00	13.81	10/29/80	0.00	29.09			

APPENDIX D

Appendix D.

Tables D1-3. Summary of first, second and third generation emergence in 1978-1980.

Raw data of male and female adult catch for OM and SC by trap and date are on dump tapes UP2017 and UP2018 at the Michigan State University Computer Center.

CDDA78EMGRANT2
CDDA78EMGRANT3
CDDA79EMGRANT1
CDDA79EMGRANT2
CDDA79EMGRANT3
CDDA80EMGRANT1
CDDA80EMGRANT2
CDDA80EMGRANT3

TABLE D1. Summary of first and second generation emergence in 1978.

DATE	TOTAL MALE OM	TOTAL FEMALE OM	TOTAL MALE SC	TOTAL FEMALE SC
198	25	16	0	5
200	32	31	0	2
202	62	36	5	9
206	75	52	1	3
209	45	24	1	3
212	45	39	2	1
214	17	38	0	1
216	4	8	0	0
218	21	18	5	14
221	7	12	2	9
223	4	12	2	14
227	8	24	10	9
235	4	13	0	5
237	13	9	1	3
232	0	0	0	0
235	30	12	0	1
237	30	22	0	2
240	39	40	1	5
243	56	63	47	42
248	93	135	50	55
251	66	90	54	88
254	70	68	36	25
257	58	57	52	70
261	57	63	31	29
264	14	11	8	8
268	2	3	5	4

Table D2. Summary of first, second and third generation emergence in 1979.

DATE	TOTAL MALE OM	TOTAL FEMALE OM	TOTAL MALE SC	TOTAL FEMALE SC
130	0	0	0	0
132	1	0	6	4
139	8	13	7	7
144	12	17	4	4
151	34	21	3	4
154	22	26	2	3
158	66	43	11	14
160	23	29	7	8
164	27	38	16	7
167	5	9	11	4
173	7	10	20	10
178	0	2	0	2
185	16	6	7	8
186	2	2	0	0
187	0	2	2	0
188	14	8	6	6
194	7	12	2	1
195	13	17	1	3
198	29	31	2	7
199	10	1	2	4
200	15	10	3	9
201	8	14	9	5
202	7	7	3	1
205	29	21	11	13
206	3	6	6	1
207	9	9	5	3
208	12	7	2	3
209	9	16	4	4
212	19	25	6	8
213	9	11	0	0
214	1	3	0	0
215	4	7	0	0
217	3	1	0	0
219	5	4	0	4
220	0	1	1	0
221	0	1	0	0
229	0	0	0	0
230	0	3	1	2
233	7	11	0	2
234	3	5	2	0

TABLE D2. CONTINUED

DATE	TOTAL MALE OM	TOTAL FEMALE OM	TOTAL MALE SC	TOTAL FEMALE SC
235	5	4	Ø	Ø
236	2	3	Ø	1
237	5	3	Ø	Ø
24Ø	4	6	Ø	Ø
241	4	4	1	1
242	Ø	4	Ø	2
243	Ø	Ø	1	1
244	1	8	Ø	Ø
248	21	8	2	Ø
249	13	15	Ø	2
25Ø	8	11	Ø	Ø
251	2	3	Ø	Ø
254	11	15	16	4
255	5	7	17	12
256	17	14	23	15
257	18	15	1Ø	18
258	1	1	7	5
262	12	21	6	1Ø
271	1Ø	13	Ø	Ø
276	Ø	Ø	Ø	Ø

Table D3. Summary of first, second and third generation emergence in 1979.

DATE	TOTAL MALE OM	TOTAL FEMALE OM	TOTAL MALE SC	TOTAL FEMALE SC
130	0	0		
134	14	6		
135	13	7		
136	0	0		
137	10	10		
140	16	31		
141	40	35		
142	35	37		
143	41	40		
144	9	23		
148	120	103		
149	10	31		
150	13	15		
151	6	9		
154	5	10		
155	2	4		
156	2	2		
157	0	3		
158	0	0		
161	2	2		
162	1	7		
163	0	0		
164	0	2		
165	0	0		
168	2	4		
169	0	0		
170	0	0		
171	0	0		
172	0	0		
174	0	0		
182	6	4	3	1
183	4	3	0	0
184	7	2	0	0
185	8	8	2	0
190	83	48	5	3
191	11	9	0	1
192	3	6	0	1
193	11	10	4	1
196	34	15	8	2
197	24	9	1	1

TABLE D3. CONTINUED

DATE	TOTAL MALE OM	TOTAL FEMALE OM	TOTAL MALE SC	TOTAL FEMALE SC
198	9	7	0	2
199	12	18	8	2
204	55	45	7	8
205	0	6	0	1
206	2	4	3	1
207	2	6	0	0
210	4	9	0	0
211	0	3	2	0
213	3	4	0	0
217	0	1	0	0
218	2	1	0	0
221	1	2	0	0
223	1	2	0	0
224	0	0	0	0
225	0	0	0	0
231	28	14	0	7
232	22	20	0	0
233	60	43	0	0
234	42	42	6	12
235	33	26	9	11
238	313	220	56	72
239	175	139	23	24
240	200	143	18	22
241	301	229	16	30
242	310	233	12	21
246	362	355	55	55
249	301	291	21	26
253	420	346	26	27
254	39	49	4	12
255	39	38	6	2
256	69	74	10	10
262	143	118	5	12
265	15	15	13	9
268	3	1	1	3

APPENDIX E

Appendix E.

Table E1. Adult male and female catch of SC and OM by stickyboard traps in 1978.

Table E2. Adult male and female catch of SC and OM by stickyboard traps in 1979.

Table E3. Adult male and female catch of SC and OM by activity traps in 1978.

Table E4. Adult male and female catch of SC and OM by activity traps in 1979.

Table E5. Adult male and female catch of SC and OM by flight interception traps for all fields in 1979 and 1980.

All data files are located on UP2017 and UP2018 dump tapes at the Michigan State University Computer Center.

CDDA78STICKYBOARD
CDDA79STICKYBOARD
CDDA78ACTIVITY
CDDA79ACTIVITY
CDDA79INTERCFIELDR
CDDA79INTERCFIELD1
CDDA79INTERCFIELD2
CDDA79INTERCFIELD3
CDDA79INTERCFIELD4
CDDA79INTERCFIELD5
CDDA79INTERCFIELD6
CDDA80INTERCFIELD8
CDDA80INTERCFIELD9
CDDA80INTERCFIELD10
CDDA80INTERCFIELD11
CDDA80INTERCFIELD12
CDDA80INTERCFIELD13
CDDA80INTERCFIELD14

TABLE E1

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
139	1	4	1	4	1
139	2	12	5	3	1
139	3	0	0	1	1
139	4	2	1	2	2
139	5	3	0	4	13
139	6	1	1	10	17
139	7	0	1	4	7
139	8	0	1	17	9
139	9	1	1	0	2
139	10	1	1	12	14
139	11	0	0	7	0
139	12	1	0	12	16
139	13	0	0	4	3
139	14	2	0	15	14
139	15	0	1	4	4
139	16	2	0	21	13
139	17	0	1	4	1
139	18	1	2	13	9
139	19	0	0	0	0
139	20	0	0	7	1
139	21	1	1	0	0
139	22	4	1	4	1
139	23	1	0	5	0
139	24	4	2	10	0
139	25	0	0	0	2
139	26	0	0	1	0
139	27	4	1	7	4
139	28	7	8	7	5
139	29	0	0	15	4
139	30	0	0	3	6
139	31	4	0	10	4
139	32	2	1	11	7
139	33	0	1	5	12
139	34	2	0	12	6
139	35	7	1	2	12
139	36	1	0	6	10
139	37	2	2	4	1
139	38	1	3	4	5
139	39	1	0	3	0
139	40	0	0	2	0
139	41	0	1	5	4
139	42	0	1	2	3
139	43	1	0	4	4
139	44	4	0	16	2
139	45	1	0	3	0
139	46	1	2	4	5
139	47	0	1	1	0
139	48	2	0	1	3
139	49	0	0	1	4
139	50	0	0	15	1
139	51	0	0	2	1
139	52	0	0	4	1
139	53	0	0	1	1
139	54	2	0	25	7
139	55	1	0	1	2
139	56	2	0	2	0
139	57	0	1	3	3
139	58	2	0	10	6
139	59	2	0	4	0
139	60	0	2	2	0
139	61	1	2	1	0
139	62	0	2	10	13
139	63	0	1	2	1
139	64	1	0	6	4
139	65	0	0	7	1
139	66	4	2	12	8
139	67	0	1	5	2
139	68	0	1	8	7
139	69	0	0	2	1
139	70	0	0	14	9
139	71	0	2	4	5
139	72	0	0	8	5
139	73	0	0	7	0
139	74	0	1	2	0
139	75	0	0	2	0
139	76	4	1	0	1
139	77	0	0	1	6
139	78	1	0	12	6
139	79	0	1	5	8
139	80	1	1	7	3
139	81	0	0	1	0
139	82	0	0	1	1
139	83	0	0	5	5
139	84	0	0	24	5
139	85	0	0	3	4
139	86	0	0	3	2
139	87	0	0	7	6
139	88	0	0	31	2
139	89	0	0	0	0
139	90	0	0	0	0
143	1	0	0	0	0
143	2	2	2	1	0
143	3	3	6	1	0
143	4	0	2	0	0
143	5	4	10	0	0
143	6	0	1	0	0
143	7	1	5	1	0
143	8	1	1	0	0
143	9	2	1	1	1
143	10	2	0	2	0
143	11	0	0	0	0
143	12	6	3	0	0
143	13	2	14	0	0
143	14	0	3	3	1
143	15	5	3	1	1
143	16	1	6	0	0
143	17	1	3	0	0
143	18	1	0	1	0
143	19	1	0	0	0
143	20	0	0	0	0
143	21	4	4	2	1
143	22	0	2	0	0
143	23	2	4	1	0
143	24	0	3	0	1
143	25	0	1	0	0
143	26	0	0	0	0
143	27	0	0	1	1
143	28	0	0	0	0
143	29	1	2	0	0
143	30	1	2	1	2
143	31	1	4	8	2
143	32	0	0	0	0
143	33	0	1	0	0
143	34	0	0	0	0
143	35	3	0	2	2
143	36	2	8	1	4
143	37	0	4	0	0
143	38	2	1	1	1
143	39	3	2	0	0
143	40	8	4	0	2
143	41	0	1	0	1
143	42	4	3	0	0
143	43	1	0	1	2
143	44	3	2	0	0
143	45	0	2	3	5
143	46	3	7	0	1
143	47	0	1	0	0
143	48	2	2	0	1
143	49	0	2	1	2
143	50	0	1	0	1
143	51	2	1	0	0
143	52	0	0	0	0
143	53	0	0	0	4
143	54	2	7	0	0
143	55	8	2	0	3
143	56	2	5	0	0
143	57	1	4	1	1
143	58	0	0	3	0
143	59	1	1	0	0
143	60	1	1	1	0
143	61	1	2	0	0
143	62	0	4	2	0
143	63	0	1	1	2
143	64	2	0	0	0
143	65	1	0	0	1
143	66	0	0	0	0
143	67	1	3	1	3
143	68	0	0	1	0
143	69	0	1	0	0
143	70	1	0	0	0

TABLE E1 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
143	71	1	0	1	0
143	72	1	2	1	1
143	73	2	5	0	1
143	74	1	1	0	0
143	75	0	8	0	4
143	76	2	2	0	2
143	77	1	1	0	0
143	78	0	1	0	2
143	79	0	1	0	0
143	80	3	4	0	0
143	81	1	2	0	3
143	82	0	8	0	0
143	83	0	0	0	0
143	84	0	1	1	2
143	85	3	2	0	0
143	86	1	2	1	2
143	87	1	1	1	5
143	88	1	1	0	1
143	89	1	0	0	0
143	90	1	3	0	0
146	1	0	0	0	0
146	2	2	2	0	0
146	3	2	0	0	0
146	4	2	5	0	0
146	5	1	1	0	0
146	6	0	3	0	0
146	7	1	7	1	1
146	8	2	1	1	0
146	9	0	3	1	0
146	10	0	1	0	0
146	11	2	0	0	0
146	12	2	0	0	0
146	13	0	3	1	0
146	14	1	1	0	1
146	15	1	2	0	1
146	16	0	0	0	0
146	17	0	3	0	1
146	18	2	2	1	0
146	19	0	0	0	0
146	20	0	0	0	0
146	21	1	1	0	0
146	22	1	0	0	0
146	23	0	0	0	0
146	24	0	1	0	0
146	25	0	0	0	0
146	26	0	0	0	0
146	27	0	0	0	0
146	28	0	0	0	0
146	29	0	1	0	0
146	30	0	1	0	0
146	31	2	6	2	1
146	32	0	0	0	0
146	33	0	1	0	0
146	34	0	2	1	0
146	35	0	0	1	0
146	36	0	0	0	0
146	37	0	0	0	1
146	38	2	1	1	1
146	39	0	0	0	1
146	40	5	18	1	3
146	41	0	1	0	0
146	42	1	0	0	0
146	43	0	0	0	0
146	44	3	1	0	0
146	45	0	2	1	0
146	46	0	1	0	0
146	47	0	1	0	0
146	48	1	6	0	0
146	49	0	2	2	2
146	50	1	1	0	3
146	51	1	0	0	0
146	52	1	3	3	0
146	53	0	0	0	0
146	54	2	7	2	6
146	55	2	3	0	0
146	56	0	1	0	3
146	57	7	7	3	2
146	58	0	5	0	2
146	59	1	3	0	3
146	60	4	0	1	0
146	61	1	1	2	1
146	62	1	1	1	0
146	63	3	3	0	0
146	64	0	1	1	0
146	65	0	0	1	0
146	66	0	2	2	1
146	67	6	6	5	9
146	68	0	1	0	0
146	69	1	0	3	1
146	70	0	2	2	0
146	71	1	2	0	1
146	72	0	3	0	1
146	73	0	0	0	2
146	74	0	1	0	0
146	75	2	3	0	1
146	76	1	0	1	2
146	77	0	1	0	0
146	78	0	0	0	0
146	79	0	2	0	1
146	80	0	0	0	0
146	81	4	2	1	7
146	82	2	1	0	0
146	83	0	0	0	0
146	84	0	5	0	1
146	85	3	3	0	0
146	86	0	1	0	0
146	87	1	1	0	1
146	88	1	0	0	0
146	89	0	0	0	0
146	90	0	7	0	1
153	1	0	0	0	0
153	2	0	0	0	0
153	3	0	0	0	0
153	4	0	5	0	0
153	5	0	0	0	0
153	6	1	0	0	0
153	7	0	0	0	0
153	8	1	5	0	0
153	9	0	0	0	0
153	10	0	0	0	1
153	11	0	0	0	0
153	12	0	0	0	0
153	13	0	0	0	0
153	14	2	3	0	0
153	15	0	0	0	0
153	16	0	1	0	0
153	17	0	3	0	0
153	18	0	0	0	0
153	19	0	0	0	0
153	20	0	0	0	0
153	21	0	1	0	0
153	22	0	0	0	0
153	23	0	1	0	1
153	24	0	0	0	0
153	25	0	2	0	1
153	26	0	0	0	0
153	27	0	1	0	0
153	28	0	0	0	0
153	29	0	2	0	0
153	30	0	0	0	0
153	31	1	0	0	2
153	32	0	0	0	0
153	33	0	0	0	0
153	34	0	1	0	0
153	35	0	2	0	0
153	36	0	0	0	0
153	37	0	0	0	0
153	38	0	0	0	0
153	39	0	0	0	0
153	40	0	3	0	0
153	41	0	0	0	0
153	42	0	2	0	0
153	43	0	0	0	0
153	44	0	1	0	0
153	45	0	0	0	0
153	46	0	0	0	0
153	47	0	0	0	0
153	48	0	0	0	0
153	49	0	0	0	0
153	50	0	0	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
153	51	0	0	0	0
153	52	0	0	0	0
153	53	0	2	0	0
153	54	1	1	0	0
153	55	1	3	0	0
153	56	0	0	0	0
153	57	3	1	0	0
153	58	0	0	0	0
153	59	0	0	0	0
153	60	0	0	0	0
153	61	0	0	0	0
153	62	0	0	0	0
153	63	1	2	0	0
153	64	0	0	0	0
153	65	0	0	0	0
153	66	0	0	0	0
153	67	3	2	0	0
153	68	0	1	0	0
153	69	0	3	0	0
153	70	0	0	0	0
153	71	1	3	0	0
153	72	0	0	0	0
153	73	0	0	0	0
153	74	1	2	0	0
153	75	0	0	0	0
153	76	2	1	0	0
153	77	0	0	0	0
153	78	0	0	0	0
153	79	0	0	0	0
153	80	2	2	0	0
153	81	1	0	0	0
153	82	1	0	0	0
153	83	0	2	0	0
153	84	0	0	0	0
153	85	0	1	0	0
153	86	0	1	0	1
153	87	1	2	0	0
153	88	1	4	1	0
153	89	0	0	0	0
153	90	0	3	0	0
157	1	1	1	0	1
157	2	1	0	0	0
157	3	1	0	0	0
157	4	9	1	1	1
157	5	0	1	1	2
157	6	1	3	0	1
157	7	0	0	0	0
157	8	0	0	2	0
157	9	1	0	0	0
157	10	0	1	0	0
157	11	0	0	0	0
157	12	0	0	0	0
157	13	0	0	0	0
157	14	0	0	0	0
157	15	0	2	0	1
157	16	0	0	0	0
157	17	2	0	0	0
157	18	0	0	0	0
157	19	0	0	0	0
157	20	0	0	0	0
157	21	4	0	1	0
157	22	2	3	1	0
157	23	2	1	0	0
157	24	1	0	0	0
157	25	0	0	0	0
157	26	2	0	0	0
157	27	0	0	0	0
157	28	0	0	0	0
157	29	0	0	0	0
157	30	0	0	0	0
157	31	0	0	0	0
157	32	0	0	0	0
157	33	0	0	0	0
157	34	0	0	0	0
157	35	0	0	0	0
157	36	0	0	0	0
157	37	1	0	0	0
157	38	0	1	0	0
157	39	1	0	1	0
157	40	1	0	0	0
157	41	0	0	0	0
157	42	2	0	0	0
157	43	2	0	2	0
157	45	0	0	0	0
157	46	0	0	0	0
157	47	1	1	0	0
157	48	0	0	0	0
157	49	0	0	0	0
157	50	0	0	0	0
157	51	0	1	0	0
157	52	1	0	0	0
157	53	1	0	0	0
157	54	0	1	0	0
157	55	0	2	0	0
157	56	0	0	0	0
157	57	0	0	0	0
157	58	3	0	0	0
157	59	1	0	0	0
157	60	0	0	0	0
157	61	0	1	1	0
157	62	0	1	0	0
157	63	0	1	0	0
157	64	0	0	0	0
157	65	0	0	0	0
157	66	0	1	0	0
157	67	0	2	0	0
157	68	0	0	0	0
157	69	0	0	0	0
157	70	0	0	0	0
157	71	0	0	0	0
157	72	0	0	0	0
157	73	0	2	0	0
157	74	0	0	0	0
157	75	2	1	0	0
157	76	1	1	0	1
157	77	0	0	0	0
157	78	1	0	0	0
157	79	0	0	0	0
157	80	0	0	0	0
157	81	0	0	0	0
157	82	0	0	0	0
157	83	0	0	0	0
157	84	0	0	0	0
157	85	0	0	0	0
157	86	0	1	0	0
157	87	0	0	0	0
157	88	1	0	0	0
157	89	0	0	0	0
157	90	1	0	0	0
157	434	1	0	0	0
158	1	0	3	0	0
158	2	0	3	0	0
158	3	1	0	0	0
158	4	2	0	0	0
158	5	0	1	0	0
158	6	0	1	0	0
158	7	0	0	0	0
158	8	1	0	0	0
158	9	0	2	0	0
158	10	0	2	1	0
158	11	1	0	0	0
158	12	1	0	0	0
158	13	0	0	0	0
158	14	0	0	0	0
158	15	0	0	0	0
158	16	0	0	0	1
158	17	0	1	0	0
158	18	0	2	0	1
158	19	0	0	0	0
158	20	0	0	0	0
158	21	0	5	0	0
158	22	2	1	0	1
158	23	0	0	0	1
158	24	0	0	0	0
158	25	1	2	0	1
158	26	1	0	0	0
158	27	0	0	0	0
158	28	0	0	0	0
158	29	7	2	1	0
158	30	0	1	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
158	31	2	5	1	0	160	21	0	4	1	0
158	32	2	3	1	1	160	22	1	5	1	2
158	33	1	1	0	0	160	23	0	0	0	0
158	34	0	0	0	0	160	24	0	0	0	0
158	35	0	0	0	0	160	25	0	2	0	0
158	36	0	2	0	0	160	26	0	0	0	0
158	37	0	0	0	0	160	27	0	0	0	0
158	38	1	3	1	0	160	28	0	0	0	0
158	39	1	2	1	1	160	29	0	0	0	0
158	40	4	4	0	0	160	30	0	0	0	0
158	41	0	0	1	0	160	31	0	0	0	0
158	42	2	0	0	0	160	32	0	0	0	0
158	43	1	2	2	0	160	33	0	0	0	0
158	44	0	0	0	1	160	34	0	0	0	0
158	45	1	1	0	1	160	35	0	0	0	0
158	46	0	1	0	0	160	36	0	0	0	0
158	47	1	0	0	0	160	37	0	0	0	0
158	48	0	5	0	0	160	38	0	0	0	0
158	49	1	1	0	0	160	39	0	0	0	0
158	50	0	0	0	0	160	40	0	0	0	0
158	51	1	0	0	0	160	41	0	0	0	0
158	52	0	0	0	1	160	42	0	0	0	0
158	53	0	0	0	0	160	43	0	0	0	3
158	54	0	0	0	0	160	44	0	0	0	3
158	55	0	0	0	1	160	45	0	0	0	0
158	56	0	0	0	1	160	46	1	2	0	1
158	57	0	0	0	0	160	47	0	2	0	1
158	58	0	0	0	0	160	48	0	1	0	1
158	59	1	0	1	0	160	49	0	1	0	0
158	60	0	1	0	0	160	50	0	0	0	0
158	61	1	3	0	0	160	51	0	1	0	0
158	62	0	0	0	0	160	52	1	1	0	1
158	63	2	3	0	1	160	53	0	2	0	0
158	64	0	0	0	0	160	54	0	0	0	0
158	65	3	2	0	2	160	55	0	0	0	0
158	66	1	0	0	0	160	56	0	0	0	0
158	67	1	5	0	0	160	57	1	4	0	0
158	68	0	0	0	0	160	58	0	0	0	0
158	69	0	2	0	0	160	59	1	0	0	0
158	70	0	0	0	0	160	60	0	0	0	0
158	71	0	0	0	0	160	61	0	0	0	0
158	72	0	0	0	0	160	62	0	0	0	0
158	73	0	0	0	0	160	63	0	1	0	0
158	74	5	10	0	1	160	64	0	0	0	0
158	75	1	0	0	0	160	65	2	7	0	2
158	76	0	2	1	0	160	66	0	0	0	0
158	77	1	0	0	0	160	67	0	2	0	0
158	78	0	0	0	0	160	68	0	0	0	0
158	79	1	1	0	0	160	69	1	0	0	1
158	80	1	2	1	1	160	70	0	1	0	1
158	81	0	0	1	1	160	71	2	0	1	0
158	82	0	0	0	0	160	72	0	0	0	0
158	83	2	0	1	0	160	73	0	0	0	0
158	84	3	3	0	2	160	74	3	8	1	1
158	85	0	0	0	1	160	75	0	0	0	0
158	86	0	0	0	1	160	76	0	0	0	0
158	87	0	0	0	0	160	77	0	0	0	0
158	88	3	4	0	1	160	78	0	2	0	1
158	89	0	1	0	0	160	79	1	1	0	1
158	90	0	0	0	0	160	80	0	1	0	3
160	1	1	3	0	0	160	81	0	0	0	0
160	2	1	2	0	0	160	82	0	1	0	1
160	3	0	0	0	0	160	83	1	1	0	0
160	4	0	2	0	0	160	84	0	4	1	1
160	5	0	0	0	0	160	85	0	0	0	0
160	6	0	0	0	0	160	86	0	1	0	2
160	7	0	0	0	0	160	87	1	1	0	0
160	8	0	0	0	0	160	88	0	1	1	0
160	9	0	0	0	0	160	89	0	0	0	0
160	10	0	1	0	1	160	90	0	0	0	0
160	11	1	4	2	1	163	1	0	0	0	0
160	12	1	0	0	0	163	2	0	0	0	0
160	13	0	2	0	1	163	3	0	0	0	0
160	14	0	0	0	0	163	4	0	0	0	0
160	15	0	0	0	0	163	5	0	0	0	0
160	16	0	0	0	0	163	6	0	0	0	0
160	17	0	0	0	0	163	7	0	0	0	0
160	18	0	2	0	1	163	8	0	0	0	0
160	19	0	0	0	0	163	9	0	0	0	0
160	20	1	0	0	0	163	10	0	0	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
163	11	0	2	0	1	165	1	5	14	1	8
163	12	0	0	0	0	165	2	3	5	2	3
163	13	0	1	0	0	165	3	0	2	1	1
163	14	0	0	0	0	165	4	1	3	1	1
163	15	1	1	0	0	165	5	0	1	1	0
163	16	0	0	0	0	165	6	3	2	0	1
163	17	0	0	0	0	165	7	0	0	0	0
163	18	0	0	0	0	165	8	0	1	0	2
163	19	1	0	0	0	165	9	2	3	0	0
163	20	0	0	0	0	165	10	1	1	0	1
163	21	0	3	0	0	165	11	1	1	1	3
163	22	1	7	0	4	165	12	1	1	2	0
163	23	0	0	0	0	165	13	3	2	3	0
163	24	0	3	0	1	165	14	2	8	2	5
163	25	1	1	0	0	165	15	0	2	0	2
163	26	0	1	0	0	165	16	1	1	1	1
163	27	0	0	0	0	165	17	3	1	0	0
163	28	0	0	0	0	165	18	1	1	1	1
163	29	0	0	0	0	165	19	7	4	3	1
163	30	1	0	0	0	165	20	0	0	1	1
163	31	0	0	0	0	165	21	1	0	1	1
163	32	0	0	0	0	165	22	2	0	1	2
163	33	0	0	0	0	165	23	2	2	1	0
163	34	0	0	0	0	165	24	0	0	0	1
163	35	0	0	0	0	165	25	0	0	2	0
163	36	0	1	0	0	165	26	0	0	2	2
163	37	0	0	0	0	165	27	0	0	0	0
163	38	0	0	0	0	165	28	4	1	7	3
163	39	0	0	0	0	165	29	0	1	0	0
163	40	0	0	0	0	165	30	3	2	0	0
163	41	0	0	0	2	165	31	0	0	1	0
163	42	0	0	0	0	165	32	1	0	0	1
163	43	0	0	0	0	165	33	0	0	0	0
163	44	0	0	0	0	165	34	1	3	1	0
163	45	0	0	0	0	165	35	0	2	0	0
163	46	0	0	0	0	165	36	3	1	0	2
163	47	0	0	0	0	165	37	7	2	2	0
163	48	0	0	0	0	165	38	0	3	0	0
163	49	0	0	1	1	165	39	0	0	1	0
163	50	0	0	0	0	165	40	0	0	0	0
163	51	0	0	0	0	165	41	0	1	0	1
163	52	1	2	0	0	165	42	0	0	0	1
163	53	0	0	0	0	165	43	0	1	0	0
163	54	0	1	0	0	165	44	0	2	1	1
163	55	0	0	0	0	165	45	0	1	0	0
163	56	0	1	0	0	165	46	5	9	7	4
163	57	0	0	1	1	165	47	0	0	0	1
163	58	1	2	1	1	165	48	3	3	0	1
163	59	0	0	0	0	165	49	4	0	0	1
163	60	0	2	0	2	165	50	1	0	1	0
163	61	0	0	0	0	165	51	2	1	1	1
163	62	1	0	0	0	165	52	6	2	0	1
163	63	0	2	0	1	165	53	0	2	1	1
163	64	0	0	0	0	165	54	2	5	1	0
163	65	0	0	0	0	165	55	12	10	3	3
163	66	0	0	0	0	165	56	1	5	1	2
163	67	0	0	0	0	165	57	3	1	0	1
163	68	1	1	1	1	165	58	2	4	1	1
163	69	0	0	0	0	165	59	0	2	0	0
163	70	0	0	0	0	165	60	0	1	0	2
163	71	0	0	0	0	165	61	2	2	2	1
163	72	0	0	0	0	165	62	0	0	1	1
163	73	0	0	0	0	165	63	1	3	1	1
163	74	0	0	0	0	165	64	5	2	0	2
163	75	1	0	0	0	165	65	1	0	0	1
163	76	0	0	0	0	165	66	0	0	0	0
163	77	0	0	0	0	165	67	0	1	0	0
163	78	0	2	0	0	165	68	0	0	0	0
163	79	0	0	0	0	165	69	0	0	0	0
163	80	0	0	0	0	165	70	0	0	0	0
163	81	0	0	0	0	165	71	0	0	0	0
163	82	1	0	0	0	165	72	0	0	0	1
163	83	0	0	0	0	165	73	2	1	1	1
163	84	1	4	1	0	165	74	1	1	0	0
163	85	0	1	0	0	165	75	0	0	0	0
163	86	0	1	1	0	165	76	0	0	0	0
163	87	0	0	0	0	165	77	0	1	0	0
163	88	3	4	1	8	165	78	0	0	0	0
163	89	3	5	0	2	165	79	0	0	2	0
163	90	0	0	0	0	165	80	0	1	0	1

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
165	81	0	0	0	0
165	82	7	4	1	0
165	83	0	2	0	1
165	84	2	0	0	0
165	85	0	1	0	0
165	86	1	2	1	1
165	87	0	1	0	0
165	88	0	1	1	0
165	89	1	1	0	0
165	90	0	1	0	0
167	1	1	1	0	0
167	2	1	0	0	0
167	3	1	1	0	0
167	4	0	0	1	0
167	5	0	2	1	0
167	6	0	0	0	0
167	7	0	0	0	0
167	8	0	0	0	1
167	9	0	1	0	0
167	10	1	2	0	0
167	11	2	2	0	0
167	12	0	1	0	1
167	13	1	4	0	1
167	14	0	4	0	0
167	15	1	3	2	0
167	16	1	2	1	1
167	17	1	0	0	0
167	18	0	2	0	0
167	19	1	6	0	1
167	20	0	0	0	0
167	21	2	2	2	2
167	22	0	0	0	2
167	23	0	0	0	2
167	24	0	1	0	0
167	25	1	2	0	0
167	26	0	0	0	0
167	27	0	1	0	0
167	28	0	2	1	1
167	29	0	0	0	1
167	30	0	0	0	0
167	31	0	0	0	0
167	32	0	0	0	0
167	33	0	0	0	0
167	34	1	0	1	0
167	35	1	0	0	0
167	36	1	1	0	0
167	37	1	2	1	1
167	38	1	1	0	0
167	39	0	0	0	0
167	40	0	1	0	1
167	41	0	0	0	0
167	42	1	0	0	0
167	43	0	0	0	0
167	44	1	1	1	1
167	45	1	0	0	0
167	46	2	1	0	1
167	47	1	3	0	2
167	48	0	2	0	0
167	49	2	0	0	1
167	50	1	1	0	0
167	51	1	2	1	1
167	52	2	1	0	0
167	53	1	1	1	1
167	54	1	1	1	1
167	55	6	9	1	0
167	56	0	1	0	0
167	57	0	1	1	1
167	58	0	4	0	1
167	59	1	3	1	1
167	60	1	6	0	0
167	61	1	2	0	3
167	62	1	8	2	1
167	63	1	0	0	0
167	64	0	0	0	0
167	65	0	1	0	0
167	66	0	0	0	0
167	67	1	2	1	0
167	68	0	0	1	0
167	69	2	2	0	1
167	70	0	1	0	0
167	71	1	2	0	1
167	72	2	3	2	2
167	73	0	1	2	0
167	74	0	1	0	0
167	75	1	0	1	1
167	76	0	1	1	1
167	77	0	1	1	1
167	78	3	1	0	0
167	79	0	0	0	2
167	80	0	0	2	1
167	81	0	0	0	0
167	82	2	5	2	4
167	83	2	4	2	2
167	84	1	1	0	0
167	85	7	6	0	3
167	86	0	1	0	0
167	87	0	0	1	0
167	88	2	3	0	0
167	89	2	5	2	0
167	90	2	0	2	0
170	1	1	2	0	0
170	2	2	3	0	3
170	3	4	3	3	2
170	4	1	0	0	0
170	5	1	0	0	0
170	6	2	0	0	0
170	7	0	4	1	3
170	8	0	2	0	2
170	9	1	0	0	0
170	10	3	9	2	1
170	11	5	2	2	0
170	12	0	9	5	2
170	13	4	8	1	3
170	14	8	13	2	1
170	15	4	3	0	0
170	16	0	0	0	0
170	17	2	1	2	1
170	18	1	2	0	0
170	19	5	8	5	4
170	20	5	3	1	2
170	21	0	2	0	2
170	22	8	19	3	7
170	23	1	2	0	1
170	24	1	7	1	1
170	25	1	4	1	1
170	26	1	3	1	3
170	27	0	0	0	0
170	28	4	1	1	0
170	29	0	0	0	0
170	30	2	4	0	1
170	31	1	1	0	0
170	32	0	1	0	0
170	33	0	0	0	0
170	34	0	0	0	0
170	35	0	1	0	0
170	36	5	7	4	8
170	37	0	3	0	0
170	38	2	2	1	0
170	39	1	0	0	0
170	40	0	0	0	0
170	41	2	1	0	0
170	42	0	0	1	0
170	43	0	0	0	1
170	44	1	1	0	0
170	45	0	0	2	1
170	46	22	30	10	9
170	47	1	2	1	0
170	48	7	3	0	5
170	49	0	5	2	2
170	50	1	2	0	1
170	51	0	4	0	0
170	52	9	7	1	4
170	53	0	0	1	3
170	54	20	19	6	11
170	55	6	15	0	1
170	56	2	4	1	2
170	57	7	9	0	4
170	58	0	0	0	0
170	59	1	0	1	0
170	60	15	8	3	2

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
170	61	0	1	0	2
170	62	4	12	2	2
170	63	8	7	1	2
170	64	4	0	2	0
170	65	4	1	0	0
170	66	0	0	0	0
170	67	0	1	0	0
170	68	2	1	1	1
170	69	0	0	0	0
170	70	0	0	0	0
170	71	0	0	0	0
170	72	4	0	0	1
170	73	1	0	0	0
170	74	3	2	2	0
170	75	0	0	0	0
170	76	1	1	0	0
170	77	0	1	0	0
170	78	7	4	2	2
170	79	0	0	0	0
170	80	3	0	0	3
170	81	0	0	0	1
170	82	8	17	6	10
170	83	3	7	4	8
170	84	3	3	5	4
170	85	4	5	3	5
170	86	2	2	0	1
170	87	0	0	0	0
170	88	3	3	1	3
170	89	2	2	1	1
170	90	8	6	2	2
172	1	1	6	3	0
172	2	1	1	2	2
172	3	0	0	1	0
172	4	4	3	2	0
172	5	0	2	0	0
172	6	1	0	0	0
172	7	0	3	0	0
172	8	1	0	2	0
172	9	3	5	2	0
172	10	6	3	1	2
172	11	0	2	0	0
172	12	3	4	0	1
172	13	5	2	1	0
172	14	1	7	1	0
172	15	1	1	0	0
172	16	1	0	1	0
172	17	2	1	0	0
172	18	4	12	3	2
172	19	1	3	1	1
172	20	0	2	1	0
172	21	2	0	1	0
172	22	0	5	1	1
172	23	1	0	1	0
172	24	1	0	1	0
172	25	4	2	0	1
172	26	2	1	1	0
172	27	0	1	0	0
172	28	2	0	0	0
172	29	0	0	1	0
172	30	0	1	0	0
172	31	0	1	0	0
172	32	0	0	0	0
172	33	0	1	0	1
172	34	0	0	0	1
172	35	0	0	0	0
172	36	3	1	1	0
172	37	1	1	1	0
172	38	0	0	0	0
172	39	1	0	0	1
172	40	0	0	0	0
172	41	0	0	0	0
172	42	0	2	0	0
172	43	0	1	0	0
172	44	0	1	0	1
172	45	2	2	0	1
172	46	2	2	0	1
172	47	0	2	0	0
172	48	0	0	0	0
172	49	2	5	0	0
172	50	1	1	0	0
172	51	0	1	0	0
172	52	2	2	1	0
172	53	0	1	0	0
172	54	7	8	0	1
172	55	2	2	2	0
172	56	0	2	0	3
172	57	0	2	1	0
172	58	0	1	1	1
172	59	0	0	0	0
172	60	0	2	1	0
172	61	0	3	1	0
172	62	5	4	0	1
172	63	4	10	1	1
172	64	1	1	0	0
172	65	0	0	0	0
172	66	0	0	0	0
172	67	0	1	0	1
172	68	1	1	0	0
172	69	1	1	0	0
172	70	0	0	0	1
172	71	2	1	0	1
172	72	4	7	1	1
172	73	1	1	0	0
172	74	0	1	0	0
172	75	0	0	0	0
172	76	0	0	0	0
172	77	0	0	0	0
172	78	0	2	0	0
172	79	3	0	0	0
172	80	0	3	0	0
172	81	2	0	0	0
172	82	1	1	1	0
172	83	1	5	0	0
172	84	2	2	0	1
172	85	0	0	0	0
172	86	0	0	0	0
172	87	0	1	0	0
172	88	0	3	0	2
172	89	3	3	0	0
172	90	3	4	0	2
174	1	0	0	0	0
174	2	0	1	0	1
174	3	0	0	0	0
174	4	0	0	0	0
174	5	0	0	0	0
174	6	0	0	0	0
174	7	0	0	0	0
174	8	0	1	0	1
174	9	0	0	0	0
174	10	1	3	1	0
174	11	1	0	0	0
174	12	0	0	0	0
174	13	0	0	0	0
174	14	0	2	0	1
174	15	0	0	0	0
174	16	1	0	0	0
174	17	1	0	0	0
174	18	2	2	1	0
174	19	0	0	0	1
174	20	1	1	0	0
174	21	0	0	0	0
174	22	5	4	3	1
174	23	0	0	1	0
174	24	0	0	0	1
174	25	1	1	0	0
174	26	0	0	0	0
174	27	0	0	0	0
174	28	0	1	0	0
174	29	0	1	0	0
174	30	0	1	0	0
174	31	0	0	0	1
174	32	0	0	0	0
174	33	1	1	0	1
174	34	1	0	0	0
174	35	0	0	0	0
174	36	1	6	0	2
174	37	0	1	0	1
174	38	0	0	0	0
174	39	0	0	0	0
174	40	0	0	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
174	41	0	0	0	0
174	42	0	0	0	0
174	43	0	1	0	0
174	44	1	0	0	0
174	45	0	0	0	0
174	46	3	0	1	0
174	47	0	0	0	1
174	48	0	0	0	1
174	49	1	3	0	0
174	50	0	3	0	0
174	51	1	0	0	0
174	52	1	3	1	2
174	53	1	1	0	0
174	54	4	4	0	0
174	55	0	0	0	0
174	56	0	0	0	0
174	57	0	1	0	0
174	58	0	0	0	0
174	59	0	1	0	0
174	60	0	0	0	0
174	61	0	0	0	0
174	62	0	1	0	1
174	63	0	1	0	0
174	64	0	0	0	0
174	65	0	1	0	0
174	66	0	0	0	0
174	67	1	0	0	0
174	68	0	0	0	0
174	69	0	0	0	1
174	70	0	0	0	0
174	71	0	0	0	1
174	72	0	1	0	0
174	73	0	0	0	0
174	74	0	1	0	0
174	75	0	0	0	2
174	76	0	0	0	1
174	77	0	1	0	0
174	78	0	0	0	1
174	79	0	0	0	1
174	80	0	1	0	0
174	81	0	0	0	0
174	82	1	0	0	0
174	83	0	0	0	0
174	84	0	2	0	0
174	85	0	0	0	0
174	86	1	1	0	0
174	87	1	1	0	0
174	88	0	2	0	1
174	89	1	2	1	1
174	90	0	2	0	0
179	1	2	3	2	0
179	2	3	2	1	2
179	3	0	0	0	0
179	4	1	2	1	0
179	5	1	0	2	1
179	6	0	0	0	0
179	7	1	0	0	0
179	8	0	1	0	0
179	9	1	0	0	0
179	10	2	3	0	0
179	11	1	2	0	1
179	12	0	1	2	1
179	13	3	0	1	1
179	14	1	3	1	2
179	15	1	0	0	0
179	16	2	0	2	0
179	17	0	1	1	0
179	18	4	5	1	2
179	19	2	1	1	2
179	20	2	2	0	0
179	21	0	2	1	1
179	22	1	3	3	2
179	23	5	5	2	0
179	24	5	2	0	1
179	25	5	1	0	0
179	26	3	0	0	0
179	27	1	0	1	1
179	28	0	0	0	0
179	29	4	5	1	0
179	30	1	2	1	0
179	31	1	2	1	1
179	32	5	2	0	0
179	33	2	2	0	1
179	34	0	0	0	0
179	35	0	0	0	0
179	36	3	5	1	0
179	37	3	1	1	0
179	38	2	0	0	1
179	39	0	0	0	0
179	40	2	0	1	0
179	41	6	3	0	0
179	42	0	3	0	0
179	43	0	0	1	0
179	44	0	1	0	0
179	45	0	0	0	0
179	46	3	4	1	0
179	47	0	1	0	0
179	48	2	0	1	2
179	49	1	1	0	0
179	50	0	1	0	1
179	51	0	0	1	0
179	52	1	2	0	1
179	53	0	0	0	0
179	54	3	4	1	3
179	55	0	0	0	0
179	56	2	1	0	0
179	57	0	0	0	0
179	58	0	2	0	0
179	59	0	0	0	0
179	60	2	1	1	0
179	61	0	1	0	0
179	62	2	5	2	0
179	63	2	5	0	0
179	64	0	0	0	0
179	65	0	0	0	0
179	66	0	0	3	0
179	67	1	0	0	0
179	68	0	1	0	0
179	69	0	0	0	0
179	70	0	0	0	0
179	71	0	0	0	0
179	72	1	4	1	1
179	73	0	1	0	0
179	74	1	0	0	1
179	75	1	0	0	0
179	76	1	0	1	0
179	77	0	0	0	1
179	78	6	6	0	0
179	79	0	0	0	0
179	80	0	1	0	0
179	81	0	0	0	0
179	82	1	2	0	0
179	83	1	3	0	0
179	84	1	4	1	1
179	85	3	2	0	0
179	86	4	3	0	0
179	87	0	0	0	0
179	88	0	0	0	1
179	89	2	1	0	0
179	90	8	6	0	0
181	1	0	0	3	1
181	2	0	0	0	0
181	3	0	0	1	0
181	4	4	2	0	1
181	5	0	0	2	0
181	6	2	1	0	0
181	7	0	0	0	0
181	8	1	0	0	1
181	9	1	3	0	0
181	10	1	2	2	1
181	11	0	0	1	3
181	12	1	0	2	3
181	13	0	0	0	0
181	14	3	3	1	2
181	15	0	1	0	0
181	16	2	0	0	0
181	17	0	0	0	4
181	18	0	2	0	1
181	19	1	0	0	0
181	20	2	2	1	3

TABLE E1. CONTINUED

DATE	TRAP	ON FEMALE	ON MALE	SC FEMALE	SC MALE	DATE	TRAP	ON FEMALE	ON MALE	SC FEMALE	SC MALE
181	21	1	0	0	0	184	11	0	3	0	0
181	22	3	4	1	2	184	12	0	0	0	0
181	23	0	2	0	2	184	13	3	4	2	3
181	24	2	1	1	0	184	14	0	0	0	0
181	25	1	0	3	1	184	15	0	0	1	0
181	26	2	1	0	0	184	16	0	0	1	0
181	27	2	1	2	1	184	17	2	0	0	0
181	28	0	1	0	0	184	18	1	2	3	2
181	29	1	1	0	0	184	19	0	0	2	0
181	30	2	0	0	1	184	20	0	3	0	0
181	31	0	0	0	2	184	21	2	1	2	4
181	32	0	3	0	0	184	22	5	0	3	1
181	33	2	0	0	1	184	23	2	2	3	2
181	34	1	0	0	0	184	24	4	3	2	1
181	35	0	0	0	2	184	25	0	0	0	0
181	36	1	3	1	0	184	26	0	0	0	0
181	37	1	0	0	1	184	27	1	3	1	1
181	38	3	1	0	0	184	28	0	2	0	2
181	39	0	0	0	0	184	29	1	1	0	0
181	40	4	0	1	0	184	30	0	1	0	3
181	41	1	0	2	0	184	31	4	6	6	11
181	42	1	0	1	0	184	32	2	1	1	2
181	43	2	0	0	0	184	33	3	4	3	2
181	44	0	0	0	0	184	34	0	0	0	0
181	45	2	1	0	0	184	35	0	0	0	2
181	46	1	0	1	2	184	36	0	0	2	2
181	47	1	4	0	0	184	37	2	4	1	3
181	48	0	0	0	0	184	38	3	0	2	0
181	49	3	0	0	0	184	39	0	0	0	0
181	50	1	0	0	1	184	40	1	0	2	3
181	51	7	0	0	0	184	41	1	5	5	2
181	52	1	0	1	3	184	42	4	1	4	1
181	53	0	1	0	0	184	43	1	0	3	0
181	54	0	4	1	0	184	44	0	0	0	0
181	55	1	0	1	1	184	45	1	4	0	0
181	56	0	2	0	0	184	46	0	0	3	0
181	57	0	1	1	1	184	47	3	1	3	1
181	58	0	1	1	1	184	48	0	0	0	0
181	59	0	1	0	3	184	49	3	1	0	1
181	60	0	0	0	0	184	50	2	1	1	0
181	61	1	1	0	0	184	51	0	0	0	0
181	62	0	1	0	1	184	52	0	0	0	3
181	63	2	4	0	0	184	53	0	0	0	0
181	64	1	1	2	0	184	54	1	0	1	1
181	65	3	0	2	0	184	55	7	2	0	2
181	66	4	1	0	0	184	56	0	0	1	0
181	67	1	3	0	0	184	57	1	0	1	4
181	68	3	3	0	0	184	58	0	0	4	2
181	69	1	1	4	0	184	59	0	0	0	0
181	70	0	1	0	1	184	60	0	1	0	0
181	71	2	1	0	0	184	61	0	0	0	0
181	72	3	2	0	0	184	62	0	0	0	0
181	73	1	1	2	1	184	63	2	1	1	2
181	74	0	1	0	0	184	64	0	2	4	2
181	75	1	2	1	1	184	65	4	4	4	1
181	76	3	0	0	0	184	66	0	0	2	0
181	77	3	2	0	0	184	67	2	1	6	1
181	78	1	1	0	0	184	68	4	0	4	0
181	79	1	0	3	0	184	69	2	1	1	1
181	80	0	2	0	2	184	70	1	1	0	0
181	81	5	5	2	0	184	71	0	0	0	1
181	82	0	1	0	0	184	72	2	3	4	0
181	93	2	2	0	0	184	73	5	2	0	1
181	84	1	3	0	1	184	74	5	1	1	0
181	85	1	2	0	0	184	75	5	2	3	3
181	86	1	0	0	0	184	76	1	1	2	0
181	87	6	6	0	1	184	77	5	5	6	2
181	88	0	0	0	0	184	78	1	0	1	2
181	89	0	2	0	1	184	79	3	0	3	1
181	90	0	2	0	0	184	80	6	0	0	4
184	1	7	10	1	2	184	81	4	0	2	4
184	2	2	2	7	4	184	82	0	0	3	1
184	3	0	0	0	0	184	83	5	0	0	0
184	4	3	2	0	4	184	84	0	0	4	3
184	5	4	0	2	1	184	85	4	1	3	2
184	6	2	4	3	2	184	86	2	0	4	2
184	7	0	1	2	0	184	87	12	3	1	3
184	8	0	3	2	1	184	88	0	0	0	1
184	9	8	6	1	2	184	89	1	0	0	0
184	10	0	2	0	3	184	90	1	0	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
186	1	1	0	1	1
186	2	2	0	0	1
186	3	0	2	2	1
186	4	1	0	0	0
186	5	0	0	0	0
186	6	0	0	1	0
186	7	0	0	2	1
186	8	1	1	0	2
186	9	2	1	3	2
186	10	1	0	4	1
186	11	0	2	0	0
186	12	0	0	0	0
186	13	0	1	1	0
186	14	0	1	3	3
186	15	1	3	3	1
186	16	0	0	1	3
186	17	1	0	0	4
186	18	0	0	0	2
186	19	5	1	3	0
186	20	3	1	2	1
186	21	2	3	1	1
186	22	6	5	1	4
186	23	2	5	1	1
186	24	2	2	2	5
186	25	4	0	1	4
186	26	0	0	0	0
186	27	2	1	0	0
186	28	0	2	4	2
186	29	3	1	1	2
186	30	5	6	3	2
186	31	5	5	9	16
186	32	4	1	1	3
186	33	0	1	2	5
186	34	2	0	2	0
186	35	0	0	2	2
186	36	0	0	0	0
186	37	2	0	3	8
186	38	3	0	0	2
186	39	0	1	0	1
186	40	3	0	0	0
186	41	1	0	7	5
186	42	2	1	0	0
186	43	1	0	2	1
186	44	0	0	1	0
186	45	2	1	1	1
186	46	1	2	1	0
186	47	2	0	0	0
186	48	0	0	0	0
186	49	1	0	0	1
186	50	5	1	2	1
186	51	1	1	0	0
186	52	0	0	0	0
186	53	0	0	0	0
186	54	1	2	0	0
186	55	0	1	4	2
186	56	0	0	3	1
186	57	1	0	1	0
186	58	0	1	3	0
186	59	0	0	3	0
186	60	1	0	1	0
186	61	1	0	0	0
186	62	2	0	0	0
186	63	0	1	1	0
186	64	0	0	1	0
186	65	1	2	2	3
186	66	0	0	1	0
186	67	1	0	4	2
186	68	4	1	1	0
186	69	2	0	1	0
186	70	1	0	0	0
186	71	0	2	1	1
186	72	0	0	3	0
186	73	3	1	3	2
186	74	0	1	2	0
186	75	3	2	1	1
186	76	1	1	0	5
186	77	2	0	0	1
186	78	2	2	1	1
186	79	1	1	0	1
186	80	0	0	0	0

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
186	81	3	4	0	0
186	82	1	1	0	1
186	83	0	0	2	0
186	84	0	0	0	1
186	85	2	0	1	0
186	86	0	1	1	0
186	87	0	2	1	1
186	88	0	0	0	1
186	89	0	0	1	1
186	90	3	0	0	2
188	1	0	0	0	0
188	2	0	0	0	0
188	3	0	0	0	1
188	4	0	0	0	0
188	5	0	0	0	0
188	6	0	1	0	0
188	7	0	0	0	0
188	8	0	0	0	0
188	9	0	0	0	0
188	10	0	0	0	0
188	11	0	0	0	0
188	12	0	0	0	0
188	13	0	0	1	0
188	14	0	0	0	0
188	15	0	0	0	0
188	16	0	0	1	0
188	17	0	0	0	0
188	18	0	0	0	0
188	19	2	1	0	1
188	20	0	1	0	1
188	21	0	0	0	0
188	22	0	0	0	0
188	23	0	0	0	0
188	24	0	0	0	0
188	25	0	0	0	1
188	26	0	0	1	0
188	27	1	2	0	1
188	28	1	0	0	0
188	29	1	0	0	1
188	30	0	2	0	0
188	31	0	0	0	0
188	32	0	0	0	0
188	33	0	1	0	0
188	34	0	0	0	0
188	35	0	0	0	0
188	36	0	1	0	0
188	37	0	2	0	2
188	38	0	0	0	0
188	39	0	0	0	0
188	40	0	0	0	0
188	41	0	0	0	0
188	42	0	0	0	1
188	43	0	0	0	0
188	44	0	0	0	0
188	45	0	0	0	0
188	46	0	2	0	0
188	47	1	3	0	0
188	48	0	0	0	0
188	49	0	0	0	0
188	50	0	1	1	0
188	51	0	1	0	0
188	52	0	0	0	0
188	53	1	0	0	0
188	54	0	0	0	1
188	55	2	0	0	3
188	56	0	2	1	0
188	57	0	1	0	0
188	58	3	0	1	1
188	59	0	0	0	1
188	60	0	0	1	0
188	61	0	0	0	0
188	62	0	1	0	0
188	63	0	0	1	0
188	64	0	0	0	0
188	65	0	0	0	0
188	66	0	0	0	0
188	67	0	0	0	0
188	68	1	0	0	0
188	69	0	0	0	0
188	70	0	1	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
188	71	0	0	0	1	191	61	0	1	0	1
188	72	0	2	1	1	191	62	0	0	1	1
188	73	0	0	0	0	191	63	0	0	1	2
188	74	0	1	0	0	191	64	0	2	0	0
188	75	0	0	0	0	191	65	0	0	0	0
188	76	0	0	0	0	191	66	0	1	0	0
188	77	2	0	0	0	191	67	0	0	1	2
188	78	0	0	0	0	191	68	0	0	0	2
188	79	0	0	0	0	191	69	0	0	0	0
188	80	0	0	0	0	191	70	0	0	2	1
188	81	0	0	0	1	191	71	0	0	0	0
188	82	1	2	0	0	191	72	1	0	0	0
188	83	0	0	0	0	191	73	0	0	2	2
188	84	1	0	0	0	191	74	0	0	0	0
188	85	1	0	0	0	191	75	0	1	0	0
188	86	0	1	0	0	191	76	1	2	0	0
188	87	0	0	0	0	191	77	0	2	0	0
188	88	1	0	0	0	191	78	1	1	0	1
188	89	0	0	0	0	191	79	0	0	0	0
188	90	0	0	0	0	191	80	0	1	0	1
191	1	0	0	0	0	191	81	0	0	0	0
191	2	0	0	0	0	191	82	2	0	3	0
191	3	0	0	0	0	191	83	0	3	1	2
191	4	0	0	0	0	191	84	1	1	0	0
191	5	0	0	0	1	191	85	0	2	0	2
191	6	0	0	0	0	191	86	0	2	0	2
191	7	0	0	0	2	191	87	0	0	0	1
191	8	0	0	0	2	191	88	0	0	0	0
191	9	1	0	0	1	191	89	0	0	0	2
191	10	1	0	0	0	191	90	1	0	0	1
191	11	1	0	0	0	193	1	1	1	1	1
191	12	1	0	0	1	193	2	0	1	1	1
191	13	1	1	1	0	193	3	0	0	0	0
191	14	0	0	0	0	193	4	1	0	0	0
191	15	2	0	1	1	193	5	2	0	0	0
191	16	0	0	0	0	193	6	0	0	0	0
191	17	0	0	3	2	193	7	1	0	0	0
191	18	1	1	0	0	193	8	0	1	0	1
191	19	1	0	0	0	193	9	0	0	0	1
191	20	0	0	0	0	193	10	0	0	0	0
191	21	0	0	1	1	193	11	1	1	0	0
191	22	2	3	0	0	193	12	0	2	0	1
191	23	0	0	1	0	193	13	1	0	0	0
191	24	0	1	1	0	193	14	0	0	0	0
191	25	0	0	0	1	193	15	0	0	0	0
191	26	0	0	0	0	193	16	0	0	0	0
191	27	0	0	0	0	193	17	1	0	1	0
191	28	1	0	2	0	193	18	0	0	0	1
191	29	0	0	0	0	193	19	0	0	2	0
191	30	0	2	0	0	193	20	1	2	2	2
191	31	0	3	1	5	193	21	0	2	1	3
191	32	0	0	0	1	193	22	1	2	1	3
191	33	0	0	1	0	193	23	0	2	1	0
191	34	0	0	0	2	193	24	0	0	0	0
191	35	1	0	0	0	193	25	0	0	0	0
191	36	0	3	0	1	193	26	0	0	0	0
191	37	1	0	0	0	193	27	0	0	0	0
191	38	1	2	1	1	193	28	0	0	0	0
191	39	2	0	2	0	193	29	1	3	1	2
191	40	0	2	0	0	193	30	1	1	2	2
191	41	1	1	0	0	193	31	0	1	1	1
191	42	0	0	2	2	193	32	0	2	0	0
191	43	0	0	1	0	193	33	0	0	0	0
191	44	0	0	1	2	193	34	0	0	0	0
191	45	0	0	1	0	193	35	0	0	0	0
191	46	0	1	0	0	193	36	0	0	0	0
191	47	4	1	2	2	193	37	0	2	2	2
191	48	1	1	0	2	193	38	0	0	3	0
191	49	0	0	0	0	193	39	1	0	1	0
191	50	0	0	1	0	193	40	0	0	0	0
191	51	0	0	0	0	193	41	1	2	3	2
191	52	0	0	0	0	193	42	0	0	0	0
191	53	1	0	0	1	193	43	0	0	0	0
191	54	1	2	0	0	193	44	0	0	0	0
191	55	1	1	0	0	193	45	0	0	0	0
191	56	0	0	0	1	193	46	0	0	0	0
191	57	1	0	0	1	193	47	0	2	2	0
191	58	0	1	0	0	193	48	0	0	0	0
191	59	0	1	1	1	193	49	0	0	0	0
191	60	0	1	0	1	193	50	0	0	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
193	51	0	0	0	0
193	52	0	0	0	0
193	53	0	0	0	0
193	54	0	0	0	0
193	55	1	1	1	2
193	56	1	0	0	0
193	57	0	0	0	0
193	58	1	0	0	0
193	59	0	1	0	1
193	60	1	1	0	1
193	61	0	0	0	0
193	62	1	0	1	0
193	63	0	0	0	0
193	64	2	1	0	0
193	65	0	1	0	0
193	66	0	2	1	0
193	67	1	4	1	2
193	68	0	0	0	0
193	69	0	0	0	0
193	70	0	0	0	0
193	71	0	0	0	0
193	72	0	0	0	0
193	73	0	1	2	2
193	74	0	0	1	0
193	75	1	3	1	1
193	76	1	2	0	0
193	77	0	0	0	0
193	78	2	0	2	0
193	79	0	0	0	0
193	80	0	0	0	0
193	81	0	0	0	0
193	82	1	2	2	1
193	83	0	1	1	0
193	84	2	2	1	2
193	85	1	2	1	0
193	86	1	0	2	0
193	87	1	0	0	0
193	88	0	0	0	0
193	89	0	0	0	0
193	90	0	0	0	0
195	1	1	2	1	0
195	2	1	1	0	0
195	3	0	1	1	0
195	4	2	0	0	0
195	5	0	0	0	0
195	6	0	0	0	0
195	7	2	1	1	1
195	8	0	0	1	0
195	9	1	0	0	0
195	10	1	0	0	1
195	11	0	0	0	0
195	12	0	0	0	0
195	13	1	1	0	1
195	14	1	1	0	0
195	15	0	0	0	0
195	16	0	0	0	0
195	17	1	0	0	1
195	18	1	1	0	0
195	19	1	2	2	2
195	20	0	0	2	2
195	21	1	1	2	2
195	22	0	0	0	0
195	23	2	0	3	1
195	24	0	0	0	0
195	25	0	0	0	0
195	26	0	0	0	0
195	27	0	0	0	0
195	28	0	0	0	0
195	29	0	0	0	0
195	30	1	0	1	0
195	31	1	1	1	2
195	32	0	1	0	0
195	33	0	0	0	0
195	34	0	0	0	0
195	35	0	0	0	0
195	36	0	0	0	0
195	37	1	0	2	1
195	38	2	0	1	0
195	39	2	0	1	1
195	40	1	0	0	0
195	41	0	3	2	0
195	42	0	0	0	0
195	43	0	0	0	0
195	44	0	0	0	0
195	45	0	0	0	0
195	46	0	3	3	5
195	47	0	1	0	5
195	48	0	4	0	0
195	49	1	0	1	1
195	50	0	3	2	2
195	51	0	0	0	0
195	52	0	0	0	0
195	53	0	0	0	0
195	54	0	0	0	0
195	55	1	4	4	3
195	56	0	1	1	1
195	57	0	1	0	0
195	58	0	0	1	0
195	59	0	1	0	0
195	60	0	0	0	0
195	61	0	0	0	0
195	62	0	0	0	0
195	63	0	0	0	0
195	64	0	4	1	1
195	65	0	0	1	0
195	66	0	1	1	0
195	67	0	0	1	0
195	68	0	1	1	2
195	69	0	0	0	0
195	70	0	0	0	0
195	71	0	0	0	0
195	72	0	0	0	0
195	73	0	0	1	0
195	74	0	0	0	1
195	75	0	0	0	1
195	76	0	0	0	0
195	77	1	2	2	2
195	78	0	0	0	0
195	79	0	0	0	0
195	80	0	0	0	0
195	81	0	0	0	0
195	82	0	1	3	0
195	83	0	0	0	0
195	84	0	1	2	2
195	85	0	0	2	7
195	86	1	4	1	0
195	87	0	0	0	0
195	88	0	0	0	0
195	89	0	0	0	0
195	90	0	0	0	0
198	1	1	1	1	1
198	2	0	2	0	0
198	3	1	0	0	0
198	4	1	1	0	0
198	5	1	1	1	1
198	6	0	1	1	0
198	7	2	0	0	0
198	8	0	0	0	0
198	9	1	1	0	0
198	10	1	0	0	0
198	11	1	1	0	1
198	12	1	0	0	0
198	13	0	0	0	0
198	14	1	2	0	1
198	15	1	1	0	1
198	16	0	0	0	0
198	17	1	2	0	0
198	18	1	0	0	0
198	19	2	2	1	1
198	20	1	0	0	0
198	21	1	3	1	0
198	22	0	0	1	1
198	23	0	0	0	1
198	24	1	1	0	0
198	25	1	0	1	0
198	26	1	0	0	0
198	27	0	0	0	0
198	28	1	2	2	0
198	29	1	3	2	0
198	30	0	2	0	4

TABLE E1 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
198	31	2	8	0	0	200	21	2	6	0	0
198	32	3	0	0	1	200	22	2	2	6	0
198	33	0	0	0	0	200	23	0	1	0	0
198	34	0	0	0	0	200	24	0	0	0	0
198	35	0	0	0	0	200	25	0	0	0	0
198	36	0	0	0	0	200	26	0	0	0	0
198	37	0	2	1	2	200	27	0	0	0	0
198	38	0	1	0	0	200	28	0	1	0	0
198	39	1	2	0	0	200	29	0	1	0	0
198	40	2	0	0	2	200	30	3	1	0	0
198	41	1	1	0	1	200	31	5	5	0	0
198	42	0	0	0	0	200	32	0	0	0	1
198	43	0	0	0	0	200	33	0	0	0	0
198	44	0	0	0	0	200	34	0	0	0	0
198	45	0	0	0	0	200	35	0	0	0	0
198	46	0	0	3	2	200	36	0	0	0	0
198	47	0	0	0	0	200	37	0	3	0	0
198	48	0	1	1	3	200	38	3	1	0	0
198	49	0	1	1	2	200	39	1	1	0	1
198	50	1	0	2	0	200	40	3	0	0	0
198	51	0	0	0	0	200	41	0	1	0	0
198	52	0	0	0	0	200	42	0	0	0	0
198	53	0	0	0	0	200	43	0	0	0	0
198	54	0	0	0	0	200	44	0	0	0	0
198	55	0	6	3	1	200	45	0	0	0	0
198	56	0	0	0	3	200	46	1	6	2	0
198	57	1	0	1	0	200	47	1	0	0	0
198	58	0	3	1	0	200	48	1	5	1	0
198	59	1	1	1	0	200	49	1	1	1	0
198	60	0	0	0	0	200	50	0	1	0	2
198	61	0	0	0	0	200	51	0	0	0	0
198	62	0	0	0	0	200	52	0	0	0	0
198	63	0	0	0	0	200	53	0	0	0	0
198	64	0	1	0	1	200	54	0	0	0	0
198	65	3	2	1	0	200	55	0	2	0	0
198	66	0	0	3	0	200	56	0	1	0	0
198	67	1	0	0	0	200	57	2	3	0	0
198	68	2	0	0	1	200	58	0	0	0	0
198	69	0	0	0	0	200	59	1	5	0	0
198	70	0	0	0	0	200	60	0	0	0	0
198	71	0	0	0	0	200	61	0	0	0	0
198	72	0	0	0	0	200	62	0	0	0	0
198	73	0	2	4	4	200	63	0	0	0	0
198	74	0	0	0	0	200	64	1	0	0	0
198	75	1	1	2	3	200	65	0	0	0	0
198	76	0	2	0	0	200	66	0	0	0	0
198	77	0	8	2	1	200	67	2	2	0	0
198	78	0	0	0	0	200	68	0	0	0	0
198	79	0	0	0	0	200	69	0	0	0	0
198	80	0	0	0	0	200	70	0	0	0	0
198	81	0	0	0	0	200	71	0	0	0	0
198	82	0	2	2	3	200	72	0	0	0	0
198	83	0	2	2	2	200	73	1	2	0	0
198	84	1	1	1	2	200	74	1	0	0	0
198	85	0	1	1	1	200	75	0	1	0	1
198	86	1	1	0	2	200	76	2	1	0	0
198	87	0	0	0	0	200	77	0	0	0	0
198	88	0	0	0	0	200	78	0	0	0	0
198	89	0	0	0	0	200	79	0	0	0	0
198	90	0	0	0	0	200	80	0	0	0	0
200	1	2	1	0	0	200	81	0	0	0	0
200	2	1	0	0	0	200	82	0	2	0	0
200	3	0	0	0	0	200	83	0	2	0	0
200	4	0	0	0	0	200	84	3	2	1	1
200	5	1	1	0	1	200	85	0	1	0	0
200	6	0	1	0	0	200	86	2	3	1	1
200	7	1	0	0	1	200	87	1	1	0	0
200	8	0	1	1	0	200	88	1	0	0	0
200	9	1	0	0	0	200	89	0	0	0	0
200	10	1	1	0	0	200	90	0	0	0	0
200	11	0	0	0	0	202	1	2	3	0	0
200	12	0	0	0	0	202	2	5	4	2	0
200	13	1	2	0	1	202	3	0	4	0	3
200	14	1	0	0	0	202	4	4	9	0	0
200	15	0	0	1	0	202	5	4	6	2	0
200	16	1	0	0	0	202	6	8	12	0	0
200	17	0	0	0	0	202	7	3	17	0	0
200	18	0	0	0	0	202	8	15	1	0	1
200	19	0	3	0	1	202	9	9	14	0	1
200	20	0	1	0	0	202	10	9	6	0	0

TABLE E1 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
202	11	6	7	7	2
202	12	2	10	0	0
202	13	2	9	0	0
202	14	6	17	0	0
202	15	1	7	1	1
202	16	3	4	3	0
202	17	0	7	1	0
202	18	6	22	0	1
202	19	7	10	1	0
202	20	1	1	0	0
202	21	5	4	1	0
202	22	5	10	1	0
202	23	3	4	2	0
202	24	4	10	0	0
202	25	5	4	2	1
202	26	2	1	0	2
202	27	2	9	0	0
202	28	2	2	0	2
202	29	3	4	1	0
202	30	5	8	0	0
202	31	4	20	2	1
202	32	1	3	1	1
202	33	5	14	0	0
202	34	6	6	1	0
202	35	7	10	1	1
202	36	4	5	1	1
202	37	2	5	0	0
202	38	1	3	0	1
202	39	1	3	0	0
202	40	1	2	0	0
202	41	1	3	2	1
202	42	1	3	0	0
202	43	3	6	0	0
202	44	5	13	0	0
202	45	1	2	0	0
202	46	6	2	0	0
202	47	1	4	0	0
202	48	5	5	1	0
202	49	0	1	0	0
202	50	2	4	0	0
202	51	1	5	0	0
202	52	7	10	0	3
202	53	4	8	0	1
202	54	6	12	1	5
202	55	2	2	0	0
202	56	2	0	0	0
202	57	0	4	4	1
202	58	1	3	0	0
202	59	5	6	1	0
202	60	0	6	0	2
202	61	6	11	0	1
202	62	2	9	0	1
202	63	7	17	2	1
202	64	1	1	1	0
202	65	0	10	1	0
202	66	1	0	1	0
202	67	3	4	0	0
202	68	1	1	0	0
202	69	5	11	0	0
202	70	3	8	0	0
202	71	4	15	0	3
202	72	6	18	3	2
202	73	4	2	1	0
202	74	5	3	0	0
202	75	1	3	0	0
202	76	1	7	0	1
202	77	2	0	0	0
202	78	3	5	0	0
202	79	1	3	0	0
202	80	1	9	0	1
202	81	0	5	0	4
202	82	1	3	0	0
202	83	3	3	1	1
202	84	3	3	1	1
202	85	3	3	2	2
202	86	4	6	1	2
202	87	7	8	2	1
202	88	4	10	2	0
202	89	2	4	0	0
202	90	5	6	1	1

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
207	1	0	4	2	0
207	2	5	10	0	1
207	3	0	1	0	0
207	4	3	8	0	1
207	5	1	8	0	0
207	6	5	8	2	0
207	7	17	25	6	0
207	8	4	15	0	0
207	9	11	12	2	1
207	10	4	7	0	0
207	11	4	14	1	2
207	12	1	9	2	0
207	13	3	5	0	1
207	14	3	15	0	3
207	15	6	12	1	0
207	16	9	13	1	1
207	17	1	8	0	0
207	18	7	18	0	0
207	19	9	25	9	3
207	20	10	21	3	3
207	21	14	17	1	2
207	22	5	8	1	1
207	23	5	5	1	1
207	24	11	5	2	3
207	25	5	7	3	0
207	26	5	8	0	1
207	27	1	0	1	1
207	28	1	0	2	0
207	29	7	10	4	0
207	30	19	18	3	1
207	31	10	13	7	2
207	32	9	10	1	0
207	33	5	6	0	0
207	34	7	11	0	0
207	35	2	7	0	0
207	36	6	4	0	0
207	37	2	5	1	1
207	38	3	6	1	1
207	39	6	12	2	1
207	41	4	10	0	0
207	42	11	9	1	2
207	43	7	13	0	3
207	44	8	8	0	1
207	45	6	12	1	1
207	46	7	20	12	1
207	47	10	9	3	0
207	48	15	12	9	0
207	49	5	7	1	1
207	50	3	13	0	2
207	51	4	5	1	0
207	52	5	12	0	1
207	53	5	10	2	0
207	54	7	8	1	0
207	55	5	14	0	1
207	56	5	9	3	0
207	57	8	10	1	0
207	58	8	9	2	1
207	59	2	11	0	0
207	60	17	18	3	5
207	61	7	18	3	0
207	62	9	17	0	0
207	63	9	14	1	0
207	64	8	9	1	0
207	65	2	7	0	0
207	66	3	6	0	1
207	67	3	14	1	0
207	68	6	4	1	0
207	69	8	8	1	0
207	70	10	12	3	2
207	71	3	8	0	0
207	72	6	5	2	1
207	73	4	6	1	0
207	74	9	8	2	0
207	75	7	5	1	0
207	76	4	2	0	0
207	77	3	4	0	3
207	78	7	7	0	1
207	79	0	3	1	0
207	80	2	7	3	1

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
207	81	2	11	2	1	209	71	0	3	3	0
207	82	4	15	1	2	209	72	2	2	0	0
207	83	8	18	2	1	209	73	4	4	0	0
207	84	9	7	3	1	209	74	2	6	0	0
207	85	6	0	0	0	209	75	1	3	0	1
207	86	4	5	0	0	209	76	2	2	0	0
207	87	0	0	0	0	209	77	1	0	0	0
207	88	4	9	1	1	209	78	2	8	0	2
207	89	2	1	2	2	209	79	2	3	1	0
207	90	2	2	1	1	209	80	0	1	0	0
209	1	0	2	0	0	209	81	2	2	0	0
209	2	1	5	0	0	209	82	2	3	0	0
209	3	1	2	0	0	209	83	1	5	0	1
209	4	1	1	0	0	209	84	3	9	1	0
209	5	0	1	0	0	209	85	2	6	1	2
209	6	2	2	0	0	209	86	3	4	0	0
209	7	5	2	0	0	209	87	1	2	0	0
209	8	2	0	0	0	209	88	7	7	0	0
209	9	2	4	0	0	209	89	2	0	0	1
209	10	3	1	1	1	209	90	2	1	0	0
209	11	0	0	0	0	212	1	5	5	2	0
209	12	3	2	0	0	212	2	4	2	0	0
209	13	2	2	0	0	212	3	0	5	1	1
209	14	0	1	0	0	212	4	2	5	0	0
209	15	0	0	0	0	212	5	5	7	0	2
209	16	0	1	0	0	212	6	4	4	0	0
209	17	2	4	0	0	212	7	3	6	0	0
209	18	2	3	0	0	212	8	1	4	0	0
209	19	0	1	0	0	212	9	0	0	0	0
209	20	0	4	0	0	212	10	1	4	0	0
209	21	1	3	1	0	212	11	1	6	0	0
209	22	6	7	1	0	212	12	5	9	0	1
209	23	1	2	0	0	212	13	4	3	0	0
209	24	0	1	0	0	212	14	2	6	0	0
209	25	0	0	0	0	212	15	0	1	0	0
209	26	2	2	0	0	212	16	0	0	0	0
209	27	1	0	1	0	212	17	0	1	0	0
209	28	3	2	0	0	212	18	1	21	0	0
209	29	2	1	0	0	212	19	2	2	3	0
209	30	2	7	0	0	212	20	0	2	0	0
209	31	2	2	0	0	212	21	0	1	0	0
209	32	1	1	0	0	212	22	4	14	1	2
209	33	0	0	0	0	212	23	2	3	0	0
209	34	3	1	0	0	212	24	3	6	1	0
209	35	0	0	0	0	212	25	2	2	2	1
209	36	0	1	1	0	212	26	0	6	0	0
209	37	2	1	1	0	212	27	1	0	0	0
209	38	1	1	0	0	212	28	9	11	2	0
209	39	0	1	0	0	212	29	5	4	1	0
209	40	0	5	0	0	212	30	2	5	0	0
209	41	1	0	0	0	212	31	3	8	0	1
209	42	1	4	0	0	212	32	1	3	0	1
209	43	0	3	0	0	212	33	2	7	0	0
209	44	4	1	1	0	212	34	2	2	0	0
209	45	0	2	0	0	212	35	3	0	0	0
209	46	5	10	1	0	212	36	2	6	0	1
209	47	1	1	0	0	212	37	1	8	0	0
209	48	5	12	1	0	212	38	0	1	0	0
209	49	3	1	0	0	212	39	7	16	1	0
209	50	3	3	0	0	212	40	6	10	1	0
209	51	1	3	0	0	212	41	5	6	0	0
209	52	6	4	0	0	212	42	3	10	0	0
209	53	0	1	0	0	212	43	5	15	0	0
209	54	4	4	0	0	212	44	3	5	0	1
209	55	6	4	1	0	212	45	2	4	0	0
209	56	7	6	0	0	212	46	7	7	0	0
209	57	0	4	0	0	212	47	0	4	0	0
209	58	1	3	1	0	212	48	0	5	0	0
209	59	1	2	0	0	212	49	2	2	0	0
209	60	1	2	0	0	212	50	5	8	0	0
209	61	3	4	0	0	212	51	2	6	0	0
209	62	2	1	0	0	212	52	2	3	0	0
209	63	3	4	0	0	212	53	4	2	0	1
209	64	2	4	0	0	212	54	2	8	1	0
209	65	2	1	1	0	212	55	2	4	0	0
209	66	0	3	0	0	212	56	4	5	0	0
209	67	0	3	2	1	212	57	3	4	0	0
209	68	7	2	0	0	212	58	1	4	0	0
209	69	3	2	0	0	212	59	1	0	0	0
209	70	2	3	0	0	212	60	3	5	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
212	61	2	4	0	0	214	51	5	5	1	0
212	62	2	5	0	0	214	52	6	4	1	1
212	63	2	9	0	0	214	53	1	4	0	3
212	64	1	4	0	0	214	54	4	6	0	0
212	65	2	1	0	0	214	55	6	2	0	0
212	66	0	2	0	0	214	56	1	6	0	0
212	67	3	12	0	2	214	57	1	1	0	0
212	68	4	2	0	0	214	58	2	2	0	0
212	69	4	7	2	2	214	59	5	2	0	0
212	70	4	7	0	0	214	60	2	4	0	0
212	71	2	4	0	2	214	61	3	2	0	0
212	72	2	3	2	1	214	62	3	3	0	1
212	73	0	2	1	1	214	63	1	7	0	0
212	74	2	1	1	0	214	64	4	5	1	1
212	75	3	7	0	1	214	65	6	4	0	0
212	76	4	3	0	0	214	66	3	6	0	0
212	77	3	4	1	0	214	67	4	5	0	0
212	78	4	5	0	1	214	68	3	4	0	0
212	79	0	5	0	0	214	69	2	5	1	0
212	80	3	1	0	0	214	70	4	2	0	0
212	81	2	4	0	0	214	71	0	3	1	0
212	82	2	3	0	0	214	72	0	1	0	0
212	83	5	7	0	0	214	73	2	8	0	0
212	84	3	3	0	0	214	74	9	3	1	0
212	85	0	5	1	0	214	75	3	4	1	0
212	86	2	5	0	0	214	76	2	3	0	0
212	97	7	9	0	1	214	77	4	0	0	0
212	88	7	8	1	0	214	78	3	6	1	0
212	89	3	2	0	0	214	79	0	1	0	0
212	90	4	6	0	0	214	80	4	0	1	0
214	1	0	2	1	0	214	81	0	2	0	0
214	2	2	0	0	0	214	82	3	7	0	0
214	3	0	2	0	0	214	93	3	1	0	0
214	4	0	0	0	1	214	84	3	6	0	1
214	5	1	2	0	0	214	85	2	1	1	0
214	6	2	1	0	0	214	86	4	4	0	0
214	7	1	3	0	0	214	87	1	3	0	0
214	8	3	0	0	0	214	88	2	1	0	0
214	9	1	1	0	0	214	89	6	1	0	0
214	10	1	3	1	0	214	90	2	4	0	0
214	11	1	3	0	0	216	1	1	3	0	1
214	12	2	3	0	0	216	2	2	5	0	0
214	13	2	0	0	0	216	3	0	2	0	0
214	14	1	2	0	0	216	4	1	5	0	0
214	15	2	1	0	0	216	5	1	0	0	0
214	16	1	0	0	0	216	6	2	0	0	0
214	17	5	0	1	0	216	7	4	1	0	0
214	18	0	5	0	0	216	8	0	1	1	0
214	19	10	9	1	0	216	9	0	0	0	0
214	20	0	0	0	0	216	10	2	2	0	0
214	21	4	1	0	1	216	11	3	1	0	0
214	22	3	2	0	0	216	12	1	4	0	0
214	23	0	0	0	0	216	13	0	0	0	0
214	24	4	3	0	0	216	14	3	6	1	0
214	25	4	5	0	0	216	15	3	1	0	0
214	26	3	4	0	0	216	16	1	1	0	0
214	27	3	7	0	0	216	17	1	2	0	0
214	28	3	6	0	0	216	18	1	7	0	0
214	29	1	3	0	0	216	19	4	5	0	0
214	30	6	3	0	0	216	20	1	4	0	0
214	31	2	3	0	0	216	21	2	0	0	0
214	32	2	0	2	0	216	22	1	1	0	0
214	33	5	4	1	0	216	23	1	1	0	0
214	34	44	2	0	0	216	24	2	2	0	0
214	35	1	1	0	0	216	25	2	1	0	0
214	36	1	1	0	0	216	26	3	1	0	0
214	37	4	2	0	0	216	27	0	0	0	0
214	38	0	4	0	0	216	28	2	4	0	0
214	39	2	3	0	0	216	29	0	3	0	0
214	40	1	2	1	0	216	30	2	1	0	0
214	41	0	1	0	0	216	31	1	0	0	0
214	42	1	3	0	0	216	32	1	1	0	0
214	43	3	5	0	0	216	33	2	2	0	0
214	44	3	2	0	0	216	34	1	0	0	0
214	45	3	6	1	0	216	35	0	1	0	0
214	46	2	8	0	0	216	36	1	3	0	0
214	47	5	2	1	0	216	37	1	0	0	0
214	48	7	6	1	0	216	38	0	0	0	0
214	49	1	3	0	0	216	39	0	1	0	0
214	50	4	7	0	0	216	40	1	3	1	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
216	41	0	3	0	0
216	42	5	16	0	0
216	43	2	1	0	0
216	44	0	2	0	0
216	45	2	3	0	0
216	46	1	6	0	0
216	47	1	4	1	0
216	48	3	6	0	0
216	49	0	1	0	0
216	50	3	6	0	0
216	51	0	0	0	0
216	52	0	2	0	0
216	53	0	3	0	0
216	54	5	3	0	0
216	55	2	2	2	0
216	56	2	2	0	1
216	57	1	3	0	0
216	58	0	4	1	0
216	59	1	2	0	1
216	60	2	3	0	0
216	61	0	0	0	0
216	62	3	3	0	0
216	63	0	6	0	0
216	64	2	6	0	0
216	65	1	1	0	0
216	66	1	3	0	0
216	67	2	3	0	0
216	68	1	1	0	0
216	69	2	2	0	0
216	70	0	0	0	0
216	71	0	0	0	0
216	72	3	2	0	0
216	73	1	4	1	0
216	74	1	1	0	0
216	75	2	3	0	0
216	76	3	2	0	0
216	77	1	3	0	0
216	78	0	2	1	0
216	79	3	6	1	0
216	80	0	0	0	0
216	81	3	3	0	0
216	82	4	10	1	0
216	83	3	8	0	0
216	84	1	2	0	0
216	85	0	1	0	0
216	86	0	0	0	0
216	87	1	9	0	0
216	88	2	1	0	0
216	89	1	0	0	0
216	90	0	4	0	0
221	1	0	1	1	0
221	2	3	2	0	0
221	3	0	3	0	0
221	4	1	0	0	0
221	5	1	2	0	0
221	6	1	0	0	0
221	7	0	0	0	0
221	8	0	0	0	0
221	9	0	1	0	0
221	10	3	4	0	0
221	11	0	1	0	0
221	12	4	5	0	0
221	13	0	1	0	0
221	14	4	1	0	0
221	15	1	2	0	0
221	16	1	1	0	0
221	17	0	0	0	0
221	18	3	4	0	0
221	19	5	3	0	0
221	20	4	3	0	0
221	21	1	1	0	0
221	22	6	6	0	0
221	23	5	1	0	0
221	24	4	4	0	0
221	25	7	3	0	0
221	26	6	3	0	0
221	27	1	2	0	0
221	28	2	0	0	0
221	29	0	0	0	0
221	30	3	3	0	0
221	31	0	0	0	0
221	32	2	2	0	0
221	33	0	0	0	0
221	34	1	1	0	0
221	35	0	0	0	0
221	36	5	4	0	0
221	37	2	4	1	1
221	38	3	0	0	0
221	39	0	1	0	0
221	40	2	1	0	0
221	41	1	5	0	0
221	42	2	1	0	0
221	43	6	4	0	0
221	44	0	0	0	0
221	45	0	0	0	0
221	46	5	10	0	0
221	47	2	6	0	0
221	48	3	9	0	0
221	49	3	2	0	0
221	50	2	7	0	0
221	51	4	11	0	0
221	52	1	1	0	1
221	53	1	3	0	0
221	54	5	14	0	0
221	55	7	8	0	0
221	56	5	6	0	1
221	57	4	5	0	0
221	58	3	6	0	0
221	59	3	2	0	0
221	60	4	4	0	0
221	61	3	1	0	0
221	62	5	2	0	0
221	63	9	4	0	0
221	64	1	4	0	0
221	65	1	3	1	0
221	66	2	2	0	0
221	67	0	5	0	0
221	68	2	4	0	0
221	69	3	7	0	0
221	70	5	7	0	0
221	71	2	2	1	0
221	72	4	4	0	0
221	73	2	3	1	0
221	74	3	3	0	0
221	75	6	15	1	2
221	76	1	0	0	0
221	77	4	5	0	1
221	78	2	10	0	0
221	79	0	2	1	0
221	80	1	1	0	0
221	81	0	3	0	0
221	82	5	12	0	1
221	83	3	7	1	0
221	84	8	3	1	0
221	85	6	8	0	0
221	86	1	3	0	0
221	87	6	11	0	0
221	88	1	3	0	0
221	89	5	1	2	0
221	90	4	7	0	0
223	1	0	2	0	0
223	2	0	2	0	0
223	3	0	0	1	0
223	4	0	0	0	0
223	5	1	1	0	0
223	6	0	0	0	0
223	7	0	1	0	0
223	8	0	0	0	0
223	9	0	0	0	0
223	10	0	1	0	0
223	11	0	0	0	0
223	12	0	0	0	0
223	13	0	3	0	0
223	14	0	0	0	0
223	15	0	1	0	0
223	16	1	0	0	0
223	17	1	0	0	0
223	18	0	0	0	0
223	19	0	2	0	0
223	20	1	0	0	0

TABLE EI. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
223	21	0	1	0	0
223	22	1	1	0	0
223	23	0	1	0	0
223	24	1	0	1	0
223	25	0	2	0	0
223	26	0	0	0	0
223	27	0	0	0	0
223	28	1	4	0	0
223	29	1	0	1	0
223	30	1	1	0	0
223	31	0	0	0	0
223	32	0	1	0	0
223	33	0	2	0	0
223	34	1	2	0	0
223	35	0	0	0	0
223	36	1	0	1	1
223	37	0	1	0	0
223	38	0	0	1	0
223	39	1	1	1	1
223	40	1	0	1	0
223	41	0	1	0	0
223	42	0	0	0	0
223	43	1	3	1	0
223	44	0	1	0	0
223	45	0	0	0	1
223	46	2	2	0	1
223	47	0	0	0	0
223	48	1	2	0	0
223	49	0	0	1	1
223	50	1	2	0	0
223	51	1	2	0	0
223	52	4	1	2	0
223	53	0	1	0	0
223	54	3	3	0	0
223	55	0	0	0	0
223	56	0	2	0	0
223	57	0	0	0	0
223	58	0	0	0	0
223	59	0	1	0	0
223	60	1	0	0	0
223	61	1	0	0	0
223	62	0	0	0	0
223	63	0	1	0	0
223	64	0	0	0	0
223	65	1	2	0	0
223	66	0	0	0	0
223	67	0	2	0	0
223	68	1	2	0	0
223	69	1	0	0	0
223	70	0	0	0	0
223	71	0	1	0	0
223	72	1	0	0	0
223	73	3	0	0	0
223	74	0	0	0	0
223	75	2	1	0	0
223	76	0	1	0	0
223	77	0	1	0	0
223	78	1	2	0	0
223	79	0	0	0	0
223	80	0	0	0	0
223	81	0	0	0	0
223	82	1	1	0	0
223	83	0	0	0	0
223	84	2	2	0	0
223	85	0	1	0	0
223	86	1	0	0	0
223	87	0	0	0	0
223	88	0	1	0	0
223	89	1	1	0	0
223	90	1	3	0	0
227	1	1	4	0	0
227	2	0	3	0	0
227	3	0	3	0	0
227	4	0	3	0	0
227	5	8	7	0	0
227	6	2	2	0	0
227	7	10	10	0	0
227	8	8	0	0	0
227	9	14	0	0	0
227	10	1	2	0	0
227	11	0	2	0	0
227	12	2	7	0	0
227	13	2	3	0	0
227	14	7	8	0	0
227	15	4	3	0	0
227	16	1	1	0	0
227	17	5	0	0	0
227	18	15	0	0	0
227	19	2	0	0	0
227	20	2	1	0	0
227	21	3	4	0	0
227	22	2	9	0	0
227	23	7	6	0	0
227	24	7	7	1	1
227	25	13	5	0	0
227	26	7	6	1	0
227	27	2	5	0	0
227	28	0	0	0	0
227	29	4	1	0	0
227	30	0	8	0	0
227	31	1	6	0	0
227	32	2	5	2	0
227	33	2	4	1	0
227	34	1	5	0	0
227	35	7	7	2	2
227	36	3	3	0	0
227	37	1	2	0	0
227	38	2	1	0	0
227	39	2	2	0	0
227	40	0	0	0	0
227	41	3	1	0	0
227	42	0	0	0	0
227	43	4	5	0	0
227	44	0	1	0	0
227	45	2	5	0	0
227	46	2	1	0	0
227	47	2	3	0	0
227	48	1	0	0	0
227	49	3	1	0	0
227	50	1	3	0	0
227	51	2	0	0	0
227	52	8	3	1	0
227	53	9	9	0	0
227	54	9	7	0	0
227	55	5	5	0	0
227	56	4	4	0	0
227	57	5	1	0	0
227	58	3	2	1	0
227	59	3	0	0	0
227	60	5	2	0	0
227	61	3	3	0	0
227	62	2	2	0	0
227	63	9	7	0	0
227	64	1	2	0	0
227	65	1	4	0	0
227	66	0	4	0	0
227	67	3	1	0	0
227	68	4	1	1	0
227	69	4	3	1	0
227	70	4	0	0	0
227	71	2	0	0	0
227	72	0	3	0	0
227	73	2	3	1	2
227	74	2	0	0	0
227	75	1	0	0	0
227	76	2	1	0	0
227	77	5	4	0	0
227	78	2	2	0	0
227	79	2	1	0	0
227	80	4	3	0	0
227	81	3	8	0	0
227	82	1	0	0	0
227	93	1	1	0	0
227	84	4	2	0	0
227	85	2	3	0	0
227	86	1	4	0	0
227	87	3	3	0	0
227	88	7	0	0	0
227	89	5	3	0	0
227	90	1	3	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
230	1	1	0	0	0
230	2	0	1	0	0
230	3	2	0	0	0
230	4	0	0	0	0
230	5	0	0	0	0
230	6	0	2	0	0
230	7	0	0	0	0
230	8	1	1	0	0
230	9	0	0	0	0
230	10	0	0	0	0
230	11	1	0	0	0
230	12	0	0	0	0
230	13	1	2	0	0
230	14	3	1	0	0
230	15	2	0	0	0
230	16	1	0	0	0
230	17	2	2	0	0
230	18	4	1	0	2
230	19	0	0	1	0
230	20	1	1	0	0
230	21	0	0	0	0
230	22	2	4	0	0
230	23	2	1	1	0
230	24	3	1	0	0
230	25	0	0	0	0
230	26	0	3	0	0
230	27	0	0	0	0
230	28	1	0	0	0
230	29	2	0	0	0
230	30	0	2	0	0
230	31	0	0	0	0
230	32	0	0	0	0
230	33	0	0	0	1
230	34	0	1	1	0
230	35	1	0	0	0
230	36	1	1	0	0
230	37	0	1	0	0
230	38	1	1	0	1
230	39	0	1	0	0
230	40	0	0	0	0
230	41	1	1	0	0
230	42	0	1	0	0
230	43	1	2	0	0
230	44	3	1	0	0
230	45	1	0	0	0
230	46	0	1	0	0
230	47	0	1	0	0
230	48	2	4	0	0
230	49	0	0	0	0
230	50	0	1	0	0
230	51	1	0	1	0
230	52	8	1	0	0
230	53	1	1	0	0
230	54	2	6	0	0
230	55	0	0	0	0
230	56	1	6	0	0
230	57	1	1	0	0
230	58	1	3	0	0
230	59	0	0	0	0
230	60	1	7	2	0
230	61	1	1	0	0
230	62	0	0	0	0
230	63	0	1	0	0
230	64	0	0	0	0
230	65	0	0	0	0
230	66	2	1	0	0
230	67	0	1	0	1
230	68	2	0	0	0
230	69	1	2	0	0
230	70	4	0	0	0
230	71	0	0	0	0
230	72	0	1	0	0
230	73	0	0	0	0
230	74	0	0	0	0
230	75	1	1	1	0
230	76	0	2	0	0
230	77	0	1	1	0
230	78	2	2	0	0
230	79	0	0	0	0
230	80	1	0	0	0
230	81	0	0	0	0
230	82	0	1	0	0
230	83	2	5	1	1
230	84	1	2	1	1
230	85	1	2	0	2
230	86	2	0	1	0
230	87	2	0	0	0
230	88	1	2	0	0
230	89	1	0	0	0
230	90	0	1	0	0
233	1	0	0	0	0
233	2	1	0	0	0
233	3	0	1	0	0
233	4	1	0	0	0
233	5	1	0	0	0
233	6	1	0	0	0
233	7	0	0	0	0
233	8	1	0	0	0
233	9	0	0	0	0
233	10	0	0	0	0
233	11	0	1	0	0
233	12	0	0	0	0
233	13	0	3	1	0
233	14	1	0	1	0
233	15	0	0	1	0
233	16	1	0	0	0
233	17	1	0	0	0
233	18	2	0	0	0
233	19	0	0	0	0
233	20	0	3	0	0
233	21	0	0	0	0
233	22	0	4	0	0
233	23	1	0	1	0
233	24	1	1	0	0
233	25	1	0	0	0
233	26	2	1	0	0
233	27	1	0	0	0
233	28	0	0	0	0
233	29	0	0	0	0
233	30	0	0	0	0
233	31	0	0	1	0
233	32	0	0	0	1
233	33	2	0	0	0
233	34	2	2	0	0
233	35	0	0	0	0
233	36	0	0	0	0
233	37	0	0	0	0
233	38	0	1	0	0
233	39	0	0	0	0
233	40	2	2	0	0
233	41	2	1	1	0
233	42	1	1	0	1
233	43	0	0	0	0
233	44	0	0	0	0
233	45	0	1	0	0
233	46	1	0	0	0
233	47	0	1	0	1
233	48	1	6	0	0
233	49	0	0	0	0
233	50	0	0	0	0
233	51	2	1	1	0
233	52	5	0	2	0
233	53	2	3	0	0
233	54	2	2	2	0
233	55	0	0	0	0
233	56	0	3	0	0
233	57	1	0	0	0
233	58	2	2	1	0
233	59	0	1	0	0
233	60	2	2	0	0
233	61	0	2	0	0
233	62	1	1	0	2
233	63	1	0	0	0
233	64	0	2	0	1
233	65	0	0	0	0
233	66	0	0	0	0
233	67	1	1	1	0
233	68	1	1	0	0
233	69	2	0	0	0
233	70	1	2	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
233	71	2	0	0	0
233	72	0	0	0	0
233	73	0	0	0	0
233	74	1	2	0	0
233	75	0	1	1	0
233	76	0	0	0	0
233	77	0	0	0	0
233	78	0	2	1	0
233	79	2	0	0	0
233	80	0	1	0	0
233	81	0	0	0	0
233	82	0	0	0	0
233	83	0	0	0	0
233	84	0	1	1	0
233	85	0	0	1	0
233	86	2	3	0	0
233	87	0	3	0	0
233	88	0	0	0	0
233	89	1	1	0	0
233	90	1	0	0	0
237	1	5	5	2	0
237	2	2	0	0	0
237	3	1	0	0	0
237	4	0	0	0	0
237	5	1	0	0	0
237	6	1	1	0	1
237	7	0	0	0	0
237	8	0	0	0	0
237	9	0	0	0	0
237	10	0	1	1	0
237	11	0	0	0	0
237	12	2	0	0	0
237	13	1	1	0	0
237	14	0	0	0	0
237	15	0	0	0	0
237	16	0	0	0	0
237	17	0	0	0	0
237	18	1	1	0	0
237	19	0	0	0	0
237	20	1	3	0	0
237	21	0	0	0	0
237	22	0	0	0	0
237	23	0	0	0	0
237	24	0	0	0	0
237	25	0	0	0	0
237	26	0	0	0	0
237	27	0	0	0	0
237	28	3	2	0	0
237	29	1	3	0	0
237	30	0	0	0	0
237	31	0	0	0	0
237	32	0	0	0	0
237	33	0	0	0	0
237	34	0	0	0	0
237	35	0	0	0	0
237	36	0	0	0	0
237	37	1	1	0	0
237	38	0	2	0	0
237	39	0	0	0	0
237	40	0	0	0	0
237	41	0	3	1	0
237	42	0	0	0	0
237	43	0	0	0	0
237	44	0	0	0	0
237	45	0	0	0	0
237	46	1	1	0	0
237	47	0	0	0	0
237	48	0	0	0	0
237	49	0	0	0	0
237	50	0	0	0	0
237	51	0	0	0	0
237	52	0	0	0	0
237	53	0	0	0	0
237	54	0	0	0	0
237	55	2	1	0	0
237	56	1	0	0	0
237	57	0	0	0	0
237	58	0	0	0	0
237	59	0	0	0	0
237	60	0	0	0	0
237	61	1	0	0	0
237	62	0	0	0	0
237	63	0	0	0	0
237	64	0	2	0	0
237	65	1	0	0	0
237	66	0	0	0	0
237	67	0	0	0	0
237	68	0	0	0	0
237	69	0	0	0	0
237	70	0	0	0	0
237	71	0	0	0	0
237	72	0	0	0	0
237	73	3	1	0	0
237	74	3	2	0	1
237	75	0	0	0	0
237	76	0	0	0	0
237	77	0	0	0	0
237	78	0	0	0	0
237	79	0	0	0	0
237	80	0	0	0	0
237	81	0	0	0	0
237	82	0	0	0	0
237	83	1	1	0	0
237	84	1	0	0	1
237	85	0	0	0	0
237	86	1	1	1	1
237	87	2	0	0	0
237	88	0	0	0	0
237	89	0	0	0	0
237	90	0	0	0	0
240	1	8	20	1	0
240	2	9	16	0	0
240	3	20	22	1	0
240	4	4	13	1	0
240	5	16	29	0	0
240	6	3	10	0	0
240	7	11	28	0	7
240	8	5	20	0	0
240	9	27	65	1	1
240	11	10	16	0	0
240	12	13	25	1	0
240	13	13	33	0	1
240	14	8	30	1	0
240	15	9	37	0	5
240	16	4	16	0	0
240	17	28	25	0	0
240	18	12	45	1	0
240	19	2	6	0	0
240	20	6	13	1	0
240	21	13	8	0	0
240	22	15	42	0	2
240	23	16	11	0	0
240	24	6	7	0	0
240	25	10	12	0	0
240	26	1	11	1	0
240	27	6	20	0	0
240	28	1	1	0	0
240	29	8	11	0	3
240	30	3	10	0	0
240	31	17	27	0	0
240	32	3	29	3	1
240	33	12	16	1	0
240	34	2	7	0	0
240	35	5	10	1	0
240	36	8	6	1	0
240	37	3	1	1	0
240	38	0	5	0	0
240	39	2	12	2	0
240	40	4	5	0	0
240	41	8	10	0	0
240	42	1	4	1	0
240	43	6	5	1	0
240	44	6	5	1	0
240	45	3	29	0	1
240	46	2	6	1	0
240	47	8	11	0	0
240	48	5	15	0	1
240	49	1	0	1	0
240	50	8	11	0	0

TABLE E1, CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
240	51	5	5	1	0
240	52	1	2	0	0
240	53	1	12	1	0
240	54	0	16	0	0
240	55	5	8	0	2
240	56	2	8	0	0
240	57	1	8	0	0
240	58	1	6	2	0
240	59	3	9	0	0
240	60	28	0	0	0
240	61	3	10	0	3
240	62	3	1	0	0
240	63	10	12	0	0
240	64	3	4	2	0
240	65	3	12	1	0
240	66	2	1	0	0
240	67	1	10	0	0
240	68	6	6	0	0
240	69	1	9	2	0
240	70	7	11	0	0
240	71	1	2	1	0
240	72	2	6	0	0
240	73	4	13	2	0
240	74	6	23	0	1
240	75	11	19	0	1
240	76	3	7	0	0
240	77	3	6	0	0
240	78	6	12	0	0
240	79	5	32	2	1
240	80	4	10	0	0
240	81	5	14	2	0
240	82	2	4	0	0
240	83	2	12	0	0
240	84	0	0	0	0
240	85	7	26	2	1
240	86	7	10	1	0
240	87	2	16	2	0
240	88	12	12	0	0
240	89	13	13	1	1
240	90	9	11	1	0
242	1	3	4	0	0
242	2	13	24	0	0
242	3	5	26	0	3
242	4	7	18	0	2
242	5	7	15	1	0
242	6	0	3	1	1
242	7	8	7	0	0
242	8	6	7	1	0
242	9	14	28	0	12
242	10	9	15	1	4
242	11	2	5	0	2
242	12	10	0	5	0
242	13	1	8	0	1
242	14	11	19	4	6
242	15	7	12	1	0
242	16	4	13	2	0
242	17	4	11	1	0
242	18	24	46	3	4
242	19	1	3	1	1
242	20	1	10	0	0
242	21	2	2	0	0
242	22	9	26	2	0
242	23	1	5	1	0
242	24	9	14	3	1
242	25	6	9	0	1
242	26	13	21	0	0
242	27	0	3	0	0
242	28	2	5	1	0
242	29	1	0	0	0
242	30	4	6	0	0
242	31	11	14	2	0
242	32	16	13	1	0
242	33	5	4	3	1
242	34	3	11	2	0
242	35	2	3	0	0
242	36	10	14	1	1
242	37	1	3	0	0
242	38	1	10	0	1
242	39	1	1	0	0
242	40	2	10	0	0
242	41	4	6	0	0
242	42	4	13	0	0
242	43	0	6	0	0
242	44	11	14	1	1
242	45	2	5	1	0
242	46	4	5	1	0
242	47	1	8	0	0
242	48	4	25	0	1
242	49	1	6	0	0
242	50	7	20	0	0
242	51	5	5	0	0
242	52	7	9	1	0
242	53	1	3	1	0
242	54	11	20	0	0
242	55	1	3	0	0
242	56	6	12	1	0
242	57	0	4	0	0
242	58	4	7	1	0
242	59	5	5	0	0
242	60	5	14	0	0
242	61	4	8	0	0
242	62	2	9	4	0
242	63	5	12	1	0
242	64	0	3	0	0
242	65	1	2	2	0
242	66	5	9	0	1
242	67	1	4	0	0
242	68	3	10	0	0
242	69	2	7	0	0
242	70	3	11	0	0
242	71	1	4	2	0
242	72	10	20	0	0
242	73	2	9	0	0
242	74	2	6	1	0
242	75	4	7	1	0
242	76	5	10	1	0
242	77	3	6	0	0
242	78	26	42	1	0
242	79	3	13	0	0
242	80	13	36	1	1
242	81	2	10	0	0
242	82	3	5	0	0
242	83	4	17	2	0
242	84	12	33	3	0
242	85	4	7	0	0
242	85	8	19	0	0
242	87	2	16	0	0
242	88	10	41	1	1
242	89	10	13	0	0
242	90	20	29	2	0
244	1	0	4	0	0
244	2	3	11	0	0
244	3	0	4	0	0
244	4	1	4	0	0
244	5	1	8	0	0
244	6	0	2	0	0
244	7	1	2	0	0
244	8	2	2	1	0
244	9	0	11	0	0
244	10	5	10	0	0
244	11	0	3	0	1
244	12	5	2	0	0
244	13	1	1	0	0
244	14	1	4	0	0
244	15	0	4	0	0
244	16	1	0	0	0
244	17	0	1	0	0
244	18	4	11	0	0
244	19	1	3	0	0
244	20	0	3	0	0
244	21	1	0	0	0
244	22	0	5	0	0
244	23	1	3	0	0
244	24	0	0	0	0
244	25	0	0	0	0
244	26	1	3	0	0
244	27	3	3	0	0
244	28	1	0	0	1
244	29	2	2	0	0
244	30	1	1	1	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
244	31	1	3	0	0
244	32	1	6	0	0
244	33	2	2	0	0
244	34	0	0	0	0
244	35	1	3	0	0
244	36	0	6	2	0
244	37	1	0	0	0
244	38	1	1	0	1
244	39	1	0	0	0
244	40	1	0	0	0
244	41	2	1	0	0
244	42	0	1	0	0
244	43	8	1	0	0
244	44	0	3	0	0
244	45	1	9	0	0
244	46	4	3	0	1
244	47	1	0	0	0
244	48	2	2	0	0
244	49	1	0	0	0
244	50	1	3	0	0
244	51	1	1	0	0
244	52	0	3	0	0
244	53	1	3	0	0
244	54	0	3	0	0
244	55	1	8	0	0
244	56	2	5	0	0
244	57	1	1	0	0
244	58	3	6	0	0
244	59	0	1	0	0
244	60	0	4	0	0
244	61	1	5	0	0
244	62	0	5	0	0
244	63	1	4	0	0
244	64	2	3	0	0
244	65	2	2	0	0
244	66	1	0	0	0
244	67	2	3	0	0
244	68	0	1	0	0
244	69	2	3	0	0
244	70	3	5	0	0
244	71	0	2	0	0
244	72	0	3	0	0
244	73	1	2	0	0
244	74	5	5	1	0
244	75	1	12	1	0
244	76	2	9	0	0
244	77	0	3	0	0
244	78	2	6	1	0
244	79	1	3	0	0
244	80	5	8	0	0
244	81	1	7	0	0
244	92	1	6	0	0
244	83	3	6	0	0
244	84	3	2	0	0
244	85	1	3	0	0
244	86	0	3	0	0
244	87	1	8	0	0
244	88	3	4	1	0
244	89	1	2	1	0
244	90	0	2	0	0
247	1	0	3	0	0
247	2	2	12	0	1
247	3	1	18	0	0
247	4	1	13	1	1
247	5	2	8	2	0
247	6	1	9	0	0
247	7	2	7	0	0
247	8	2	15	1	1
247	9	4	41	1	0
247	10	4	9	1	3
247	11	14	1	0	0
247	12	2	12	0	1
247	13	1	16	1	0
247	14	4	14	3	1
247	15	1	18	0	0
247	16	3	13	0	0
247	17	0	9	0	0
247	18	3	28	0	0
247	19	3	5	0	0
247	20	3	4	0	0
247	21	2	9	1	1
247	22	4	20	8	0
247	23	3	6	2	0
247	24	3	18	1	0
247	25	7	6	0	0
247	26	5	11	0	3
247	27	3	9	0	0
247	28	1	4	0	0
247	29	0	1	0	0
247	30	1	2	0	0
247	31	6	14	1	4
247	32	3	19	0	0
247	33	3	8	2	0
247	34	3	10	1	1
247	35	3	7	1	1
247	36	6	16	0	1
247	37	1	5	1	0
247	38	3	9	0	0
247	39	2	8	0	3
247	40	3	7	0	0
247	41	2	7	1	1
247	42	6	4	0	2
247	43	1	14	0	1
247	44	4	23	0	1
247	45	0	5	0	0
247	46	1	11	0	0
247	47	0	4	0	0
247	48	1	6	0	0
247	49	0	0	0	0
247	50	0	18	1	1
247	51	2	10	0	0
247	52	1	4	0	1
247	53	2	3	0	0
247	54	3	11	0	2
247	55	1	5	0	0
247	56	2	10	0	0
247	57	2	4	0	1
247	58	0	11	1	0
247	59	2	8	1	1
247	60	6	13	1	1
247	61	1	10	3	1
247	62	3	6	1	0
247	63	1	12	0	0
247	64	5	6	1	0
247	65	0	3	1	0
247	66	1	3	1	0
247	67	0	5	0	0
247	68	4	19	0	0
247	69	0	10	0	0
247	70	5	17	2	0
247	71	0	3	0	0
247	72	5	15	2	0
247	73	5	13	1	1
247	74	3	7	3	0
247	75	0	4	0	0
247	76	4	2	0	0
247	77	2	3	1	0
247	78	0	30	0	0
247	79	3	9	0	1
247	80	3	17	0	0
247	81	2	13	0	1
247	82	3	2	0	0
247	83	5	22	1	1
247	84	0	8	0	1
247	85	5	14	3	1
247	86	1	9	0	0
247	87	4	20	1	0
247	88	10	40	0	0
247	89	2	15	1	2
247	90	5	3	0	0
250	1	1	2	0	0
250	2	0	8	0	0
250	3	2	3	0	0
250	4	0	5	0	0
250	5	0	1	0	0
250	6	0	0	2	1
250	7	0	5	0	2
250	8	0	1	0	0
250	9	1	15	0	0
250	10	1	8	0	0

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
250	11	0	7	0	0	254	1	0	2	2	2
250	12	0	6	0	0	254	2	6	32	3	4
250	13	0	7	0	0	254	3	2	29	1	1
250	14.	1	3	0	0	254	4	0	10	2	1
250	15	0	5	0	0	254	5	1	6	1	1
250	16	0	2	1	0	254	6	0	3	1	1
250	17	0	5	0	1	254	7	2	9	1	0
250	18	0	5	0	0	254	8	0	10	1	2
250	19	0	3	0	0	254	9	0	14	1	2
250	20	4	6	0	0	254	10	3	22	2	1
250	21	0	1	0	0	254	11	4	12	0	1
250	22	2	17	3	2	254	12	3	11	2	3
250	23	1	1	0	0	254	13	2	9	0	1
250	24	2	9	1	2	254	14	1	8	1	1
250	25	1	5	0	1	254	15	4	13	2	3
250	26	2	1	3	0	254	16	1	5	0	1
250	27	2	6	1	1	254	17	2	3	1	1
250	28	0	4	2	2	254	18	3	6	2	1
250	29	2	0	0	0	254	19	5	22	1	2
250	30	0	9	0	0	254	20	0	3	0	1
250	31	1	6	0	2	254	21	4	14	3	3
250	32	0	5	0	2	254	22	2	15	13	13
250	33	0	3	0	0	254	23	4	38	2	3
250	34	4	6	0	0	254	24	5	9	5	5
250	35	1	1	0	2	254	25	7	29	1	2
250	36	2	12	3	0	254	26	1	9	2	1
250	37	2	4	0	0	254	27	2	28	3	4
250	38	1	1	2	2	254	28	0	10	2	2
250	39	3	6	0	0	254	29	3	26	0	0
250	40	1	2	0	0	254	30	1	12	2	3
250	41	1	3	0	1	254	31	11	37	22	22
250	42	3	0	3	0	254	32	1	10	2	2
250	43	0	2	0	2	254	33	2	24	3	3
250	44	1	0	1	0	254	34	1	4	2	3
250	45	0	3	0	0	254	35	5	12	1	1
250	46	1	9	0	1	254	36	3	19	1	1
250	47	0	14	0	0	254	37	1	12	1	2
250	48	0	12	0	0	254	38	3	5	0	1
250	49	1	0	0	0	254	39	2	23	2	2
250	51	0	7	0	0	254	40	1	4	2	3
250	52	2	6	0	2	254	41	1	15	0	0
250	53	1	7	1	0	254	42	1	7	5	6
250	54	1	3	0	1	254	43	2	10	2	1
250	55	0	8	0	0	254	44	0	9	4	4
250	56	1	3	0	0	254	45	4	18	5	5
250	57	1	4	0	2	254	46	0	16	15	15
250	58	0	2	0	0	254	47	5	34	5	5
250	59	1	3	0	0	254	48	1	9	2	1
250	60	1	7	0	2	254	49	5	28	2	2
250	61	3	4	0	0	254	50	3	15	2	3
250	62	0	9	0	0	254	51	5	26	2	3
250	63	2	7	0	1	254	52	3	12	9	10
250	64	0	4	2	0	254	53	5	17	2	2
250	65	2	1	1	0	254	54	1	15	0	1
250	66	2	1	0	0	254	55	1	18	2	3
250	67	1	10	1	0	254	56	2	27	0	1
250	68	1	1	0	0	254	57	6	17	4	5
250	69	0	2	0	0	254	58	3	22	3	4
250	70	0	0	0	0	254	59	3	19	2	3
250	71	0	1	0	0	254	60	2	22	3	3
250	72	1	4	1	0	254	61	5	28	7	8
250	73	0	2	0	2	254	62	2	20	8	8
250	74	2	3	0	1	254	63	2	100	5	6
250	75	1	1	0	1	254	64	0	9	2	2
250	76	1	4	0	0	254	65	5	47	2	3
250	77	0	1	0	0	254	66	0	2	5	6
250	78	0	2	0	0	254	67	3	30	4	4
250	79	1	6	0	1	254	68	0	11	3	4
250	80	0	3	0	0	254	69	1	39	10	10
250	81	1	2	1	1	254	70	3	11	6	7
250	82	3	3	0	2	254	71	1	18	3	4
250	83	1	9	0	0	254	72	1	21	2	1
250	84	1	4	0	0	254	73	2	8	2	2
250	85	1	3	0	0	254	74	0	19	12	13
250	86	3	4	3	3	254	75	2	12	16	17
250	87	3	12	1	0	254	76	0	7	2	3
250	88	3	1	1	0	254	77	5	27	6	7
250	89	1	1	1	1	254	78	2	18	2	2
250	90	1	3	9	3	254	79	2	17	7	8
						254	80	1	12	4	4

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
254	81	4	16	7	8
254	82	0	18	10	10
254	83	12	23	12	13
254	84	0	10	7	7
254	85	5	25	18	18
254	86	0	14	5	4
254	87	4	30	16	17
254	88	4	23	5	5
254	89	10	43	3	4
254	90	0	14	4	5
257	1	1	9	5	5
257	2	2	6	1	2
257	3	2	6	3	4
257	4	0	0	0	0
257	5	0	4	4	4
257	6	1	2	3	4
257	7	8	5	1	2
257	8	1	2	1	1
257	9	4	13	2	2
257	10	2	4	0	0
257	11	1	0	0	1
257	12	4	3	2	2
257	13	1	4	2	2
257	14	2	6	2	2
257	15	2	2	1	1
257	16	0	1	1	0
257	17	0	12	1	2
257	18	3	8	1	1
257	19	4	11	11	11
257	20	0	0	0	0
257	21	2	1	2	2
257	22	0	2	4	4
257	23	1	1	1	2
257	24	4	1	1	2
257	25	7	11	4	4
257	26	3	1	3	4
257	27	4	2	3	4
257	28	3	4	0	1
257	29	0	2	3	3
257	30	0	0	0	1
257	31	2	3	18	19
257	32	0	0	1	1
257	33	0	2	2	3
257	34	0	1	0	0
257	35	1	3	1	1
257	36	1	3	1	1
257	37	13	14	15	15
257	38	2	5	7	7
257	39	4	5	6	7
257	40	2	7	8	8
257	41	3	7	6	6
257	42	1	4	5	6
257	43	6	3	8	8
257	44	7	5	8	8
257	45	1	8	5	5
257	46	11	6	15	15
257	47	1	5	10	10
257	48	2	19	7	7
257	49	1	10	15	15
257	50	0	5	8	9
257	51	9	11	11	11
257	52	2	5	6	6
257	53	11	14	11	11
257	54	3	9	10	10
257	55	12	5	44	43
257	56	4	7	14	15
257	57	0	4	6	6
257	58	3	3	28	28
257	59	2	4	12	12
257	60	5	5	13	13
257	61	2	13	17	18
257	62	7	12	23	22
257	63	6	11	11	12
257	64	2	8	19	20
257	65	6	10	19	19
257	66	7	5	18	19
257	67	5	11	12	13
257	68	2	6	7	7
257	69	6	8	13	13
257	70	7	19	38	38
257	71	5	8	12	12
257	72	3	14	9	9
257	73	5	16	14	14
257	74	0	1	1	1
257	75	0	1	5	4
257	76	1	2	1	2
257	77	2	4	4	5
257	78	3	4	3	4
257	79	2	8	5	5
257	80	1	1	1	2
257	81	2	3	3	3
257	82	0	2	2	3
257	83	4	7	21	20
257	84	0	1	4	5
257	85	2	5	19	20
257	86	1	2	7	8
257	87	0	4	5	6
257	88	2	8	4	4
257	89	14	11	8	8
257	90	1	7	2	2
261	1	0	29	5	5
261	2	3	10	1	1
261	3	1	8	0	0
261	4	0	0	0	0
261	5	1	3	0	1
261	6	4	6	2	2
261	7	0	2	0	0
261	8	8	12	1	1
261	9	1	27	1	1
261	10	4	7	4	4
261	11	1	1	0	0
261	12	1	7	0	0
261	13	0	6	0	1
261	14	0	7	2	1
261	15	0	3	0	0
261	16	2	5	2	1
261	17	1	4	1	1
261	18	4	2	0	1
261	19	3	16	7	7
261	20	0	0	4	4
261	21	1	5	2	1
261	22	0	4	2	2
261	23	0	2	1	1
261	24	4	7	5	5
261	25	3	8	2	3
261	26	3	2	1	1
261	27	1	11	4	4
261	28	1	25	18	0
261	29	2	2	1	1
261	30	2	4	3	4
261	31	0	6	21	21
261	32	3	9	2	2
261	33	0	4	7	7
261	34	5	13	2	1
261	35	2	4	2	2
261	36	5	6	2	1
261	37	1	41	16	15
261	38	5	13	1	1
261	39	0	5	1	1
261	40	4	1	3	3
261	41	0	4	2	3
261	42	1	11	2	2
261	43	2	9	2	1
261	44	10	22	4	4
261	45	2	13	2	2
261	46	7	7	3	4
261	47	0	9	2	2
261	48	1	1	2	1
261	49	1	6	0	1
261	50	4	4	2	3
261	51	3	8	2	3
261	52	10	14	4	4
261	53	4	9	2	1
261	54	7	17	2	3
261	55	7	30	6	7
261	56	6	10	2	3
261	57	0	1	1	1
261	58	1	12	2	2
261	59	1	3	4	4
261	60	12	15	2	2

TABLE E1. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
261	61	3	16	8	9
261	62	10	13	4	4
261	63	2	8	2	2
261	64	3	45	3	4
261	65	2	16	6	6
261	66	1	4	3	4
261	67	0	2	1	1
261	68	8	25	3	4
261	69	1	14	9	9
261	70	9	34	5	5
261	71	2	8	5	5
261	72	7	10	2	2
261	73	2	47	10	10
261	74	5	12	5	5
261	75	0	4	1	2
261	76	10	19	4	4
261	77	0	13	5	6
261	78	5	26	5	6
261	79	2	17	7	7
261	80	41	8	9	0
261	81	1	14	6	7
261	82	5	34	7	7
261	83	1	25	10	10
261	84	2	9	1	2
261	85	1	14	4	5
261	86	6	7	5	7
261	87	1	10	6	6
261	88	9	27	7	8
261	89	4	36	9	10
261	90	4	19	6	5

TABLE E2

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
132	1	1	0	12	6
132	2	2	0	12	12
132	3	2	0	8	5
132	4	0	0	0	0
132	5	0	0	0	0
132	6	0	0	3	1
132	7	0	0	1	1
132	8	0	0	0	0
132	9	0	0	0	0
132	10	0	0	1	1
132	11	0	0	1	1
132	12	0	0	0	1
132	13	0	0	0	0
132	14	1	0	2	0
132	15	0	0	0	0
132	16	0	0	0	0
132	17	0	0	0	0
132	18	0	0	1	2
132	19	0	0	3	0
132	20	0	0	0	0
132	21	0	0	0	0
132	22	0	0	0	0
132	23	0	0	0	0
132	24	0	0	0	0
132	25	0	0	0	0
132	26	0	0	0	0
132	27	0	0	1	1
132	28	0	0	0	0
132	29	0	0	0	0
132	30	0	0	0	0
132	31	0	0	1	1
132	32	0	0	0	0
132	33	0	0	1	1
132	34	0	0	1	1
132	35	0	0	1	1
132	36	0	0	3	1
132	37	3	3	7	4
132	38	3	5	5	6
132	39	0	0	0	0
132	40	0	0	2	0
132	41	0	0	1	0
132	42	0	0	4	0
132	43	0	0	0	0
132	44	0	0	5	1
132	45	0	0	0	0
132	46	0	0	0	0
132	47	0	0	0	2
132	48	0	0	0	1
132	49	1	0	0	0
132	50	0	0	0	1
132	51	0	0	0	1
132	52	0	0	0	0
132	53	0	0	0	0
132	54	1	1	3	2
132	55	0	0	1	0
132	56	1	1	4	1
132	57	0	0	1	0
132	58	1	0	4	0
132	59	0	0	0	1
132	60	0	0	1	0
132	61	0	0	0	0
132	62	0	0	0	0
132	63	0	0	0	0
132	64	0	0	1	1
132	65	0	0	0	1
132	66	0	0	2	0
132	67	0	0	2	0
132	68	0	3	1	0
132	69	0	0	1	0
132	70	0	0	0	0
132	71	1	0	3	1
132	72	3	2	9	3
132	73	1	1	4	1
132	74	1	0	11	2
132	75	9	1	6	2
132	76	1	1	1	1
132	77	0	0	0	0
132	78	1	1	1	1
132	79	0	0	0	0
132	80	0	0	2	0
132	81	0	0	0	1
132	82	1	0	0	0
132	83	0	0	0	0
132	84	0	0	0	0
132	85	0	0	0	2
132	86	2	0	10	3
132	87	0	0	0	1
132	88	0	0	2	0
132	89	0	0	0	1
132	90	0	0	4	1
138	1	1	0	1	4
138	2	0	2	6	4
138	3	0	1	0	1
138	4	1	1	2	7
138	5	0	0	1	4
138	6	2	1	3	1
138	7	3	2	3	5
138	8	1	1	1	3
138	9	2	1	5	4
138	10	0	1	3	3
138	11	1	0	2	2
138	12	1	0	1	3
138	13	1	1	1	0
138	14	2	0	9	2
138	15	1	1	2	1
138	16	0	0	1	2
138	17	1	0	0	2
138	18	1	2	1	1
138	19	1	0	1	4
138	20	2	0	1	1
138	21	0	1	3	1
138	22	1	1	2	4
138	23	1	1	3	1
138	24	2	1	4	2
138	25	1	1	2	1
138	26	1	0	5	1
138	27	1	1	1	3
138	28	1	0	4	1
138	29	0	0	2	1
138	30	1	1	8	2
138	31	1	0	1	2
138	32	1	1	4	1
138	33	1	1	2	1
138	34	1	0	1	1
138	35	0	1	2	4
138	36	0	1	1	1
138	37	2	0	9	2
138	38	5	1	30	9
138	39	1	1	5	3
138	40	1	1	2	4
138	41	1	1	2	5
138	42	1	0	18	3
138	43	3	1	14	9
138	44	6	3	30	21
138	45	1	1	4	0
138	46	1	0	3	2
138	47	1	1	2	2
138	48	1	0	3	1
138	49	0	0	2	4
138	50	1	0	2	3
138	51	0	0	1	2
138	52	0	1	7	1
138	53	0	0	1	1
138	54	0	0	5	2
138	55	1	0	6	2
138	56	1	2	9	1
138	57	1	1	2	3
138	58	1	1	9	1
138	59	1	2	1	1
138	60	3	2	2	2
138	61	0	0	3	1
138	62	1	1	4	1
138	63	1	1	2	0
138	64	1	1	5	1
138	65	2	1	1	1
138	66	1	1	3	2
138	67	1	1	5	2
138	68	1	0	3	2
138	69	0	2	3	1
138	70	1	1	7	1

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
138	71	1	1	3	2
138	72	1	2	14	1
138	73	1	1	5	1
138	74	1	1	21	3
138	75	1	3	5	3
138	76	3	0	18	4
138	77	1	2	3	1
138	78	4	3	16	4
138	79	1	0	1	0
138	80	1	0	4	1
138	81	1	0	4	7
138	82	1	0	7	6
138	83	0	1	3	1
138	84	0	0	7	1
138	85	4	3	2	1
138	86	0	0	1	6
138	87	1	1	6	0
138	88	2	0	8	2
138	89	1	1	4	2
138	90	1	1	10	2
155	1	7	0	1	0
155	2	4	2	0	1
155	3	4	3	4	3
155	4	18	1	3	2
155	5	2	0	1	0
155	6	5	4	2	1
155	7	0	2	0	0
155	8	2	5	3	1
155	9	7	5	2	1
155	10	4	3	1	0
155	11	4	4	1	3
155	12	11	2	1	2
155	13	1	2	0	1
155	14	7	11	1	3
155	15	7	5	0	2
155	16	16	8	2	1
155	17	3	8	0	1
155	18	5	10	0	2
155	19	9	8	0	1
155	20	18	14	0	2
155	21	25	20	3	4
155	22	22	19	4	4
155	23	11	5	3	0
155	24	20	18	5	2
155	25	10	2	2	1
155	26	19	10	3	2
155	27	16	8	3	1
155	28	9	7	2	1
155	29	11	1	2	2
155	30	26	9	4	1
155	31	4	2	0	0
155	32	15	9	3	3
155	33	4	1	2	2
155	34	2	0	1	0
155	35	2	1	1	1
155	36	1	1	0	0
155	37	7	6	2	1
155	38	7	0	0	1
155	39	4	2	1	1
155	40	12	1	12	12
155	41	5	2	0	0
155	42	12	6	2	1
155	43	14	2	0	0
155	44	19	7	4	2
155	45	9	1	2	1
155	46	13	13	2	2
155	47	2	5	2	1
155	48	11	5	1	2
155	49	5	3	1	1
155	50	13	10	0	2
155	51	5	1	0	1
155	52	3	2	0	0
155	53	5	1	1	1
155	54	27	6	3	1
155	55	14	12	0	0
155	56	16	6	3	2
155	57	6	2	0	0
155	58	10	5	4	0
155	59	13	1	2	0
155	60	12	5	1	2
155	61	3	2	1	1
155	62	8	6	0	2
155	63	4	3	1	0
155	64	18	8	5	0
155	65	11	1	0	0
155	66	15	7	3	1
155	67	10	2	2	0
155	68	17	10	12	3
155	69	5	0	0	0
155	70	23	7	9	1
155	71	3	1	2	1
155	72	18	3	4	0
155	73	4	1	1	2
155	74	9	3	2	0
155	75	4	1	3	1
155	76	25	8	9	0
155	77	9	7	3	0
155	78	11	6	11	2
155	79	5	0	1	0
155	80	13	3	0	0
155	81	5	2	4	0
155	82	33	11	8	4
155	83	12	2	3	1
155	84	10	6	5	2
155	85	5	3	2	1
155	86	9	9	2	1
155	87	5	1	2	1
155	88	10	6	3	1
155	89	9	5	2	1
155	90	11	6	3	2
166	1	5	0	2	0
166	2	3	0	4	0
166	3	3	0	1	0
166	4	0	0	0	0
166	5	0	0	0	0
166	6	2	1	1	0
166	7	0	1	0	0
166	8	1	0	0	0
166	9	1	0	1	0
166	10	2	0	1	0
166	11	0	0	0	0
166	12	1	0	0	0
166	13	0	0	0	0
166	14	3	1	1	0
166	15	0	0	0	0
166	16	4	0	2	4
166	17	0	0	0	0
166	18	0	0	0	0
166	19	0	0	0	0
166	20	0	0	0	0
166	21	4	9	1	2
166	22	3	3	4	0
166	23	2	1	1	1
166	24	0	0	0	0
166	25	0	0	0	0
166	26	3	1	1	2
166	27	3	1	1	1
166	28	4	5	6	3
166	29	0	0	0	0
166	30	2	1	1	2
166	31	4	2	2	1
166	32	7	12	6	1
166	33	1	2	1	1
166	34	7	2	7	2
166	35	0	0	3	0
166	36	5	5	1	3
166	37	1	0	2	2
166	38	6	2	6	1
166	39	3	1	0	0
166	40	1	0	0	1
166	41	1	1	0	1
166	42	1	0	2	0
166	43	0	0	1	1
166	44	1	2	2	2
166	45	3	1	2	1
166	46	0	0	3	1
166	47	0	0	0	1
166	48	1	1	0	1
166	49	0	0	0	0
166	50	1	2	0	0

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
166	51	3	3	1	2	177	41	1	1	4	2
166	52	3	2	0	0	177	42	3	3	6	6
166	53	0	0	1	0	177	43	0	0	0	0
166	54	1	2	0	0	177	44	0	0	0	0
166	55	0	0	0	0	177	45	0	1	2	1
166	56	4	2	1	0	177	46	6	2	4	7
166	57	3	2	1	0	177	47	0	0	0	0
166	58	1	2	1	1	177	48	0	0	0	0
166	59	0	0	0	0	177	49	2	0	4	4
166	60	0	1	1	0	177	50	5	7	5	5
166	61	1	0	0	1	177	51	0	0	0	0
166	62	4	1	1	0	177	52	0	0	0	0
166	63	1	2	1	0	177	53	2	0	4	4
166	64	4	3	4	2	177	54	2	5	12	18
166	65	0	0	0	0	177	55	13	12	10	9
166	66	1	0	3	0	177	56	1	6	10	12
166	67	2	2	0	2	177	57	0	0	0	0
166	68	4	4	1	1	177	58	0	0	0	0
166	69	3	1	0	0	177	59	5	5	7	11
166	70	3	2	1	1	177	60	2	1	4	7
166	71	0	1	2	0	177	61	0	0	0	0
166	72	5	2	2	1	177	62	0	0	0	0
166	73	2	3	3	1	177	63	3	2	3	2
166	74	1	2	3	0	177	64	3	3	4	10
166	75	0	0	0	1	177	65	0	0	0	0
166	76	1	1	1	0	177	66	0	0	0	0
166	77	0	1	0	1	177	67	4	2	1	0
166	78	3	2	10	1	177	68	2	0	4	6
166	79	0	0	0	0	177	69	0	0	0	0
166	80	3	2	7	1	177	70	0	0	0	0
166	81	2	0	1	0	177	71	4	1	3	1
166	82	1	2	7	0	177	72	1	2	6	14
166	83	0	0	1	0	177	73	0	0	0	0
166	84	5	2	2	0	177	74	0	0	0	0
166	85	0	0	0	0	177	75	0	0	0	0
166	86	2	1	1	0	177	76	0	0	0	0
166	87	0	0	0	0	177	77	0	1	2	0
166	88	7	5	8	3	177	78	3	6	7	18
166	89	0	0	1	0	177	79	0	0	0	0
166	90	2	1	1	1	177	80	0	0	0	0
177	1	1	0	1	2	177	81	2	2	5	2
177	2	0	2	5	8	177	82	9	2	13	5
177	3	0	0	0	0	177	83	0	0	0	0
177	4	0	0	0	0	177	84	0	0	0	0
177	5	3	3	3	4	177	85	1	2	0	3
177	6	3	1	8	15	177	86	8	9	13	20
177	7	0	0	0	0	177	87	0	0	0	0
177	8	0	0	0	0	177	88	0	0	0	0
177	9	2	4	0	4	177	89	0	2	3	0
177	10	1	0	5	15	177	90	3	7	11	17
177	11	0	0	0	0	179	1	0	1	0	1
177	12	0	0	0	0	179	2	0	1	0	0
177	13	1	1	4	3	179	3	0	0	0	0
177	14	4	3	4	14	179	4	0	0	0	0
177	15	0	0	0	0	179	5	0	0	1	2
177	16	0	0	0	0	179	6	0	1	1	0
177	17	4	4	9	8	179	7	0	0	0	0
177	18	3	3	13	12	179	8	0	0	0	0
177	19	6	3	6	4	179	9	0	0	1	0
177	20	1	2	5	13	179	10	0	1	0	1
177	21	0	0	0	0	179	11	0	1	0	0
177	22	0	0	0	0	179	12	0	0	0	0
177	23	3	8	4	7	179	13	0	0	0	0
177	24	2	1	3	5	179	14	0	1	1	0
177	25	0	0	0	0	179	15	0	0	0	0
177	26	0	0	0	0	179	16	0	0	0	0
177	27	7	12	19	16	179	17	0	0	1	1
177	28	5	4	15	13	179	18	0	0	0	0
177	29	0	0	0	0	179	19	0	0	1	0
177	30	0	0	0	0	179	20	1	1	1	0
177	31	1	7	7	8	179	21	0	0	0	0
177	32	6	7	8	11	179	22	0	0	0	0
177	33	0	0	0	0	179	23	1	1	0	1
177	34	0	0	0	0	179	24	0	2	0	0
177	35	2	5	4	4	179	25	0	0	0	0
177	36	3	0	4	6	179	26	0	0	0	0
177	37	5	2	2	3	179	27	1	1	1	0
177	38	2	1	12	15	179	28	0	1	1	1
177	39	0	0	0	0	179	29	0	0	0	0
177	40	0	0	0	0	179	30	0	0	0	0

TABLE E2 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
179	31	0	0	0	0
179	32	0	0	0	0
179	33	0	0	0	0
179	34	0	0	0	0
179	35	0	0	0	1
179	36	0	1	1	1
179	37	0	1	0	1
179	38	0	0	4	1
179	39	0	0	0	0
179	40	0	0	0	0
179	41	0	0	2	3
179	42	1	0	0	0
179	43	0	0	0	0
179	44	0	0	0	0
179	45	2	0	1	0
179	46	0	0	1	0
179	47	0	0	0	0
179	48	0	0	0	0
179	49	0	1	1	0
179	50	1	1	2	0
179	51	0	0	0	0
179	52	0	0	0	0
179	53	1	0	1	1
179	54	2	1	4	3
179	55	1	0	0	0
179	56	1	1	1	1
179	57	0	0	0	0
179	58	0	0	0	0
179	59	0	0	1	0
179	60	1	0	0	0
179	61	0	0	0	0
179	62	0	0	0	0
179	63	1	1	1	1
179	64	0	1	1	2
179	65	0	0	0	0
179	66	0	0	0	0
179	67	0	1	3	2
179	68	0	0	0	0
179	69	0	0	0	0
179	70	0	0	0	1
179	71	1	0	1	2
179	72	0	0	1	0
179	73	0	0	0	0
179	74	0	0	0	0
179	75	0	0	0	0
179	76	0	0	0	0
179	77	1	0	5	3
179	78	1	2	7	5
179	79	0	0	0	0
179	80	0	0	0	0
179	81	0	0	2	2
179	82	0	3	1	1
179	83	0	0	0	0
179	84	0	0	0	0
179	85	0	0	2	1
179	86	0	4	4	4
179	87	0	0	0	0
179	88	0	0	0	0
179	89	0	0	1	2
179	90	1	1	1	0
183	1	1	1	6	4
183	2	0	0	11	9
183	3	0	0	0	0
183	4	0	0	0	0
183	5	1	0	8	7
183	6	5	2	15	10
183	7	0	0	0	0
183	8	0	0	0	0
183	9	1	2	12	9
183	10	0	0	24	20
183	11	0	0	0	0
183	12	0	0	0	0
183	13	2	3	14	15
183	14	2	4	14	12
183	15	0	0	0	0
183	16	0	0	0	0
183	17	2	5	8	10
183	18	0	1	11	7
183	19	3	5	13	10
183	20	1	4	5	7
183	21	0	0	0	0
183	22	0	0	0	0
183	23	6	5	2	4
183	24	1	1	7	4
183	25	0	0	0	0
183	26	0	0	0	0
183	27	7	7	54	45
183	28	7	7	26	27
183	29	0	0	0	0
183	30	0	0	0	0
183	31	1	5	19	15
183	32	2	2	20	17
183	33	0	0	0	0
183	34	0	0	0	0
183	35	3	2	10	8
183	36	1	1	2	4
183	37	0	0	0	0
183	38	0	0	0	0
183	39	0	0	0	0
183	40	0	0	0	0
183	41	2	2	10	7
183	42	2	0	6	10
183	43	0	0	0	0
183	44	0	0	0	0
183	45	2	2	8	9
183	46	1	2	9	11
183	47	0	0	0	0
183	48	0	0	0	0
183	49	2	1	8	11
183	50	2	5	5	8
183	51	0	0	0	0
183	52	0	0	0	0
183	53	4	2	4	3
183	54	2	4	5	7
183	55	6	6	32	29
183	56	2	3	13	11
183	57	0	0	0	0
183	58	0	0	0	0
183	59	5	2	28	18
183	60	6	2	8	5
183	61	0	0	0	0
183	62	0	0	0	0
183	63	1	7	10	21
183	64	4	1	3	7
183	65	0	0	0	0
183	66	0	0	0	0
183	67	2	4	7	8
183	68	1	1	5	7
183	69	0	0	0	0
183	70	0	0	0	0
183	71	2	3	15	3
183	72	0	6	17	17
183	73	3	4	15	14
183	74	2	1	28	23
183	75	0	0	0	0
183	76	0	0	0	0
183	77	1	0	5	8
183	78	0	0	23	17
183	79	0	0	0	0
183	80	0	0	0	0
183	81	0	0	9	7
183	82	4	1	21	13
183	83	0	0	0	0
183	84	0	0	0	0
183	85	2	1	12	9
183	86	2	3	18	21
183	87	0	0	0	0
183	88	0	0	0	0
183	89	0	0	0	0
183	90	0	0	0	0
190	1	0	0	3	2
190	2	2	0	7	4
190	3	0	0	0	0
190	4	0	0	0	0
190	5	1	0	2	2
190	6	3	0	4	3
190	7	0	0	0	0
190	8	0	0	0	0
190	9	5	1	7	7
190	10	1	0	8	1

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
190	11	0	0	0	0	194	1	0	0	0	0
190	12	0	0	0	0	194	2	0	0	0	0
190	13	1	1	3	3	194	3	0	0	0	0
190	14	0	1	6	5	194	4	0	0	0	0
190	15	0	0	0	0	194	5	1	0	0	0
190	16	0	0	0	0	194	6	1	0	1	0
190	17	5	3	10	7	194	7	0	0	0	0
190	18	1	2	1	1	194	8	0	0	0	0
190	19	1	0	4	2	194	9	0	1	1	0
190	20	2	1	0	0	194	10	1	1	0	0
190	21	0	0	0	0	194	11	0	0	0	0
190	22	0	0	0	0	194	12	0	0	0	0
190	23	2	2	4	9	194	13	0	2	0	0
190	24	2	1	4	1	194	14	2	0	1	2
190	25	0	0	0	0	194	15	0	0	0	0
190	26	0	0	0	0	194	16	0	0	0	0
190	27	3	6	28	15	194	17	1	0	2	1
190	28	2	1	12	4	194	18	1	2	0	2
190	29	0	0	0	0	194	19	1	0	0	0
190	30	0	0	0	0	194	20	1	0	0	1
190	31	3	2	9	3	194	21	0	0	0	0
190	32	0	3	7	2	194	22	0	0	0	0
190	33	0	0	0	0	194	23	0	0	1	0
190	34	0	0	0	0	194	24	1	1	0	1
190	35	1	7	6	5	194	25	0	0	0	0
190	36	1	2	3	2	194	26	0	0	0	0
190	37	1	0	6	7	194	27	2	1	2	1
190	38	1	3	9	6	194	28	2	1	2	2
190	39	0	0	0	0	194	29	0	0	0	0
190	40	0	0	0	0	194	30	0	0	0	0
190	41	0	0	1	2	194	31	1	4	0	0
130	42	0	0	0	4	194	32	1	1	0	0
190	43	0	0	0	0	194	33	0	0	0	0
190	44	0	0	0	0	194	34	0	0	0	0
190	45	1	1	3	3	194	35	0	0	0	0
130	46	1	0	2	1	194	36	0	0	0	0
190	47	0	0	0	0	194	37	0	0	0	0
190	48	0	0	0	0	194	38	0	1	0	0
190	49	2	0	3	1	194	39	0	0	0	0
190	50	0	1	1	1	194	40	0	0	0	0
190	51	0	0	0	0	194	41	0	0	0	1
190	52	0	0	0	0	194	42	0	1	3	1
190	53	1	2	5	6	194	43	0	0	0	0
190	54	1	0	4	3	194	44	0	0	0	0
190	55	0	0	0	0	194	45	1	0	0	2
190	56	0	0	0	0	194	46	6	0	0	0
190	57	0	0	0	0	194	47	0	0	0	0
190	58	0	0	0	0	194	48	0	0	0	0
190	59	1	1	4	5	194	49	2	2	2	0
190	60	1	1	4	4	194	50	6	1	2	2
190	61	0	0	0	0	194	51	0	0	0	0
190	62	0	0	0	0	194	52	0	0	0	0
190	63	0	0	6	2	194	53	2	2	1	1
190	64	3	0	1	1	194	54	5	2	3	1
190	65	0	0	0	0	194	55	2	1	4	1
190	66	0	0	0	0	194	56	4	0	2	2
190	67	0	0	0	0	194	57	0	0	0	0
190	68	2	1	4	4	194	58	0	0	0	0
190	69	0	0	0	0	194	59	1	1	1	2
190	70	0	0	0	0	194	60	2	2	4	3
190	71	3	0	4	3	194	61	0	0	0	0
190	72	2	3	8	8	194	62	0	0	0	0
190	73	5	7	22	5	194	63	2	2	1	4
190	74	1	5	9	7	194	64	3	0	2	1
190	75	0	0	0	0	194	65	0	0	0	0
190	76	0	0	0	0	194	66	0	0	0	0
190	77	2	1	5	1	194	67	0	0	0	0
190	78	2	3	3	0	194	68	0	0	0	0
190	79	0	0	0	0	194	69	0	0	0	0
190	80	0	0	0	0	194	70	0	0	0	0
190	81	1	1	5	1	194	71	0	0	2	1
190	82	0	2	9	3	194	72	2	0	1	1
190	83	0	0	0	0	194	73	2	0	2	1
190	84	0	0	0	0	194	74	0	0	0	3
190	85	0	3	7	3	194	75	0	0	0	0
190	86	1	1	10	7	194	76	0	0	0	0
190	87	0	0	0	0	194	77	1	0	3	2
190	88	0	0	0	0	194	78	4	0	4	2
190	89	2	1	3	2	194	79	0	0	0	0
190	90	0	1	1	2	194	80	0	0	0	0

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
194	81	1	0	0	3	198	71	0	0	0	0
194	82	0	3	4	3	198	72	2	0	0	1
194	83	0	0	0	0	198	73	0	0	0	0
194	84	0	0	0	0	198	74	1	0	1	0
194	85	1	0	3	0	198	75	0	0	0	0
194	86	0	5	3	1	198	76	0	0	0	0
194	87	0	0	0	0	198	77	2	1	1	0
194	88	0	0	0	0	198	78	3	2	1	1
194	89	2	0	1	1	198	79	0	0	0	0
194	90	4	0	4	2	198	80	0	0	0	0
198	1	1	0	0	1	198	81	1	0	0	0
198	2	0	0	1	0	198	82	2	1	1	2
198	3	0	0	0	0	198	83	0	0	0	0
198	4	0	0	0	0	198	84	0	0	0	0
198	5	1	0	1	3	198	85	1	1	1	2
198	6	2	2	0	0	198	86	4	3	4	4
198	7	0	0	0	0	198	87	0	0	0	0
198	8	0	0	0	0	198	88	0	0	0	0
198	9	0	0	0	0	198	89	1	1	5	4
198	10	0	0	1	0	198	90	0	0	3	2
198	11	0	0	0	0	201	1	0	1	1	0
198	12	0	0	0	0	201	2	1	0	0	1
198	13	2	2	2	2	201	3	0	0	0	0
198	14	1	1	2	0	201	4	0	0	0	0
198	15	0	0	0	0	201	5	3	0	1	0
198	16	0	0	0	0	201	6	0	0	0	0
198	17	1	0	5	1	201	7	0	0	0	0
198	18	1	1	2	3	201	8	0	0	0	0
198	19	4	1	12	10	201	9	0	0	1	2
198	20	5	1	7	6	201	10	0	0	0	1
198	21	0	0	0	0	201	11	0	0	0	0
198	22	2	1	1	1	201	12	0	0	0	0
198	23	0	0	0	0	201	13	0	0	0	2
198	24	7	2	5	1	201	14	0	0	3	3
198	25	0	0	0	0	201	15	0	0	0	0
198	26	0	0	0	0	201	16	0	0	0	0
198	27	1	1	2	0	201	17	0	0	6	5
198	28	4	0	0	0	201	18	2	0	9	7
198	29	0	0	0	0	201	19	0	2	5	6
198	30	0	0	0	0	201	20	2	4	3	4
198	31	0	0	0	0	201	21	0	0	0	0
198	32	2	2	1	1	201	22	0	0	0	0
198	33	0	0	0	0	201	23	1	2	4	3
198	34	0	0	0	0	201	24	1	1	1	1
198	35	0	0	0	2	201	25	0	0	0	0
198	36	1	1	0	0	201	26	0	0	0	0
198	37	1	0	0	0	201	27	2	2	0	0
198	38	1	1	0	1	201	28	0	1	2	0
198	39	0	0	0	0	201	29	0	0	0	0
198	40	0	0	0	0	201	30	0	0	0	0
198	41	2	0	0	0	201	31	1	1	0	0
198	42	0	0	3	2	201	32	1	1	2	0
198	43	0	0	0	0	201	33	0	0	0	0
198	44	0	0	0	0	201	34	0	0	0	0
198	45	1	0	1	1	201	35	0	0	0	0
198	46	0	0	0	0	201	36	1	0	0	0
198	47	0	0	0	0	201	37	0	0	2	2
198	48	0	0	0	0	201	38	0	1	0	0
198	49	1	2	1	0	201	39	0	0	0	0
198	50	1	0	1	1	201	40	0	0	0	0
198	51	0	0	0	0	201	41	0	0	0	0
198	52	0	0	0	0	201	42	1	1	2	1
198	53	3	1	4	2	201	43	0	0	0	0
198	54	3	1	1	1	201	44	0	0	0	0
198	55	4	3	7	7	201	45	0	0	0	1
198	56	6	4	5	1	201	46	0	1	1	0
198	57	0	0	0	0	201	47	0	0	0	0
198	58	0	0	0	0	201	48	0	0	0	0
198	59	2	0	1	2	201	49	0	1	2	1
198	60	5	0	1	2	201	50	1	2	2	3
198	61	0	0	0	0	201	51	0	0	0	0
198	62	0	0	0	0	201	52	0	0	0	0
198	63	1	0	0	1	201	53	5	3	1	0
198	64	1	1	1	1	201	54	0	1	2	1
198	65	0	0	0	0	201	55	3	2	4	3
198	66	0	0	0	0	201	56	1	2	2	0
198	67	1	0	0	0	201	57	0	0	0	0
198	68	0	0	0	0	201	58	0	0	0	0
198	69	0	0	0	0	201	59	2	0	2	0
198	70	0	0	0	0	201	60	4	1	1	0

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
201	61	0	0	0	0
201	62	0	0	0	0
201	63	0	0	0	0
201	64	0	0	0	0
201	65	0	0	0	0
201	66	0	0	0	0
201	67	1	0	0	1
201	68	2	1	0	0
201	69	0	0	0	0
201	70	0	0	0	0
201	71	0	0	1	0
201	72	1	2	2	0
201	73	0	1	1	0
201	74	0	2	2	1
201	75	0	0	0	0
201	76	0	0	0	0
201	77	0	0	1	0
201	78	4	1	2	2
201	79	0	0	0	0
201	80	0	0	0	0
201	81	2	0	1	0
201	82	4	4	2	0
201	83	0	0	0	0
201	84	0	0	0	0
201	85	0	0	0	0
201	86	0	0	0	0
201	87	0	0	0	0
201	88	0	0	0	0
201	89	0	0	0	0
201	90	0	0	0	0
204	1	1	0	0	0
204	2	0	0	1	0
204	3	0	0	0	0
204	4	0	0	0	0
204	5	1	0	2	1
204	6	0	0	0	1
204	7	0	0	0	0
204	8	0	0	0	0
204	9	0	0	0	0
204	10	0	0	2	1
204	11	0	0	0	0
204	12	0	0	0	0
204	13	0	0	0	1
204	14	0	0	0	1
204	15	0	0	0	0
204	16	0	0	0	0
204	17	0	0	3	2
204	18	1	2	1	1
204	19	1	0	2	1
204	20	4	4	0	1
204	21	0	0	0	0
204	22	0	0	0	0
204	23	1	0	0	0
204	24	2	0	0	0
204	25	0	0	0	0
204	26	0	0	0	0
204	27	2	1	0	0
204	28	1	2	1	0
204	29	0	0	0	0
204	30	0	0	0	0
204	31	1	0	1	0
204	32	0	2	1	0
204	33	0	0	0	0
204	34	0	0	0	0
204	35	0	0	0	0
204	36	0	0	0	0
204	37	0	0	0	0
204	38	0	0	0	0
204	39	0	0	0	1
204	40	1	1	0	0
204	41	2	1	0	0
204	42	0	0	0	0
204	43	0	0	0	0
204	44	0	0	0	0
204	45	0	1	0	1
204	46	1	0	1	1
204	47	0	0	0	0
204	48	0	0	0	0
204	49	0	0	1	1
204	50	0	2	1	2
204	51	0	0	0	0
204	52	0	0	0	0
204	53	0	0	1	1
204	54	1	1	0	0
204	55	0	0	0	1
204	56	0	1	0	2
204	57	0	0	0	0
204	58	0	0	0	0
204	59	1	2	2	1
204	60	2	0	1	1
204	61	0	0	0	0
204	62	0	0	0	0
204	63	2	1	0	0
204	64	0	3	2	0
204	65	0	0	0	0
204	66	0	0	0	0
204	67	1	0	0	0
204	68	0	1	1	1
204	69	0	0	0	0
204	70	0	0	0	0
204	71	0	0	0	0
204	72	0	0	2	1
204	73	0	0	0	0
204	74	0	0	0	0
204	75	0	0	0	1
204	76	0	0	1	2
204	77	0	1	0	1
204	78	1	1	1	1
204	79	0	0	0	0
204	80	0	0	0	0
204	81	1	1	1	3
204	82	0	0	0	3
204	83	0	0	0	0
204	84	0	0	0	0
204	85	4	3	2	3
204	86	0	0	1	0
204	87	0	0	0	0
204	88	0	0	0	0
204	89	0	0	0	0
204	90	0	0	0	0
188	1	1	0	0	0
188	2	4	2	0	0
188	3	0	0	0	0
188	4	0	0	0	0
188	5	2	0	1	0
188	6	5	2	1	0
188	7	0	0	0	0
188	8	0	0	0	0
188	9	1	1	0	2
188	10	5	2	2	2
188	11	0	0	0	0
188	12	0	0	0	0
188	13	0	1	0	0
188	14	1	1	2	0
188	15	0	0	0	0
188	16	0	0	0	0
188	17	0	1	1	0
188	18	2	0	3	1
188	19	0	0	0	0
188	20	0	0	0	0
188	21	0	0	0	0
188	22	0	0	0	0
188	23	6	3	1	1
188	24	5	1	4	0
188	25	0	0	0	0
188	26	0	0	0	0
188	27	0	0	0	0
188	28	9	3	1	1
188	29	3	0	0	0
188	30	0	0	0	0
188	31	4	2	1	0
188	32	1	7	2	0
188	33	6	3	10	2
188	34	8	2	0	1
188	35	3	0	0	0
188	36	5	2	0	1
188	37	8	2	2	1
188	38	3	0	0	0
188	39	0	0	0	0
188	40	0	0	0	0

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
188	41	5	0	1	0
188	42	5	2	3	0
188	43	0	0	0	0
188	44	0	0	0	0
188	45	0	0	0	0
188	46	0	0	0	0
188	47	0	0	0	0
188	48	0	0	0	0
188	49	0	0	0	0
188	50	0	0	0	0
188	51	0	0	0	0
188	52	0	0	0	0
188	53	6	0	2	0
188	54	8	2	1	1
188	55	4	0	3	2
188	56	1	0	2	2
188	57	7	5	3	1
188	58	11	3	0	0
188	59	1	0	0	1
188	60	0	0	0	0
188	61	7	0	1	0
188	62	9	3	0	1
188	63	6	2	0	0
188	64	5	1	2	0
188	65	0	0	0	0
188	66	0	0	0	0
188	67	0	0	0	0
188	68	0	0	0	0
188	69	0	0	0	0
188	70	0	0	0	0
188	71	4	1	0	2
188	72	7	3	1	2
188	73	6	1	0	0
188	74	4	0	1	0
188	75	0	0	0	0
188	76	0	0	0	0
188	77	4	3	2	1
188	78	9	5	1	1
188	79	0	0	0	0
188	80	0	0	0	0
188	81	4	3	0	0
188	82	3	4	1	0
188	83	0	0	0	0
188	84	0	0	0	0
188	85	2	1	0	0
188	86	0	2	1	1
188	87	0	0	0	0
188	88	0	0	0	0
188	89	0	0	0	0
188	90	0	0	0	0
211	1	1	1	0	0
211	2	3	2	0	1
211	3	0	0	0	0
211	4	0	0	0	0
211	5	2	0	0	1
211	6	2	2	0	2
211	7	0	0	0	0
211	8	0	0	0	0
211	9	2	0	0	1
211	10	1	2	1	0
211	11	0	0	0	0
211	12	0	0	0	0
211	13	2	1	1	0
211	14	3	2	2	2
211	15	0	0	0	0
211	16	0	0	0	0
211	17	0	3	0	0
211	18	0	3	0	0
211	19	5	1	3	2
211	20	8	3	3	3
211	21	0	0	0	0
211	22	0	0	0	0
211	23	4	1	3	2
211	24	2	2	0	1
211	25	0	0	0	0
211	26	0	0	0	0
211	27	1	0	0	1
211	28	4	2	1	3
211	29	0	0	0	0
211	30	0	0	0	0
211	31	2	0	1	0
211	32	4	1	2	0
211	33	0	0	0	0
211	34	0	0	0	0
211	35	5	5	0	1
211	36	3	4	0	1
211	37	3	2	1	1
211	38	2	0	0	1
211	39	0	0	0	0
211	40	0	0	0	0
211	41	2	0	0	0
211	42	3	0	0	0
211	43	0	0	0	0
211	44	0	0	0	0
211	45	4	1	1	0
211	46	5	3	3	4
211	47	0	0	0	0
211	48	0	0	0	0
211	49	5	1	0	3
211	50	9	2	5	5
211	51	0	0	0	0
211	52	0	0	0	0
211	53	6	3	1	0
211	54	6	2	2	2
211	55	3	3	2	2
211	56	7	7	4	1
211	57	0	0	0	0
211	58	0	0	0	0
211	59	1	3	0	0
211	60	3	3	2	1
211	61	0	0	0	0
211	62	0	0	0	0
211	63	1	1	2	2
211	64	3	0	1	1
211	65	0	0	0	0
211	66	0	0	0	0
211	67	3	0	0	0
211	68	3	2	0	0
211	69	0	0	0	0
211	70	0	0	0	0
211	71	3	3	0	1
211	72	5	5	1	1
211	73	4	3	3	2
211	74	7	2	0	0
211	75	0	0	0	0
211	76	0	0	0	0
211	77	1	0	1	1
211	78	2	1	4	0
211	79	0	0	0	0
211	80	0	0	0	0
211	81	1	2	1	1
211	82	1	3	1	2
211	83	0	0	0	0
211	84	0	0	0	0
211	85	0	0	0	1
211	86	5	5	2	3
211	87	0	0	0	0
211	88	0	0	0	0
211	89	5	2	4	2
211	90	5	4	1	3
214	1	0	0	0	0
214	2	4	0	3	2
214	3	0	0	0	0
214	4	0	0	0	0
214	5	3	1	0	1
214	6	2	1	1	2
214	7	0	0	0	0
214	8	0	0	0	0
214	9	1	0	0	0
214	10	3	3	0	2
214	11	0	0	0	0
214	12	0	0	0	0
214	13	2	0	0	0
214	14	5	0	0	0
214	15	0	0	0	0
214	16	0	0	0	0
214	17	2	1	1	0
214	18	6	0	1	0
214	19	7	3	0	3
214	20	7	1	1	2

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
214	21	0	0	0	0	218	11	0	0	0	0
214	22	0	0	0	0	218	12	0	0	0	0
214	23	1	0	1	1	218	13	2	2	0	1
214	24	5	1	0	0	218	14	0	1	0	1
214	25	0	0	0	0	218	15	0	0	0	0
214	26	0	0	0	0	218	16	0	0	0	0
214	27	0	0	0	2	218	17	4	1	0	1
214	28	9	3	0	1	218	18	3	1	0	1
214	29	0	0	0	0	218	19	2	0	1	0
214	30	0	0	0	0	218	20	2	1	0	0
214	31	9	4	1	1	218	21	0	0	0	0
214	32	2	0	0	2	218	22	0	0	0	0
214	33	0	0	0	0	218	23	4	0	1	0
214	34	0	0	0	0	218	24	0	1	0	0
214	35	2	3	0	0	218	25	0	0	0	0
214	36	10	1	0	0	218	26	0	0	0	0
214	37	4	1	0	0	218	27	0	0	0	0
214	38	10	0	0	2	218	28	2	1	2	1
214	39	0	0	0	0	218	29	0	0	0	0
214	40	0	0	0	0	218	30	0	0	0	0
214	41	4	2	0	0	218	31	3	0	0	0
214	42	2	2	0	0	218	32	1	0	0	0
214	43	0	0	0	0	218	33	0	0	0	0
214	44	0	0	0	0	218	34	0	0	0	0
214	45	0	0	0	0	218	35	6	2	0	0
214	46	0	0	0	0	218	36	2	1	0	0
214	47	0	0	0	0	218	37	3	2	1	3
214	48	0	0	0	0	218	38	6	3	2	2
214	49	0	0	0	0	218	39	0	0	0	0
214	50	0	0	0	0	218	40	0	0	0	0
214	51	0	0	0	0	218	41	1	1	1	1
214	52	0	0	0	0	218	42	4	3	0	0
214	53	4	0	3	2	218	43	0	0	0	0
214	54	3	3	0	3	218	44	0	0	0	0
214	55	6	2	3	2	218	45	4	0	1	0
214	56	14	4	0	1	218	46	9	4	2	1
214	57	8	1	2	1	218	47	0	0	0	0
214	58	3	1	0	2	218	48	0	0	0	0
214	59	0	1	0	1	218	49	2	2	0	1
214	60	4	1	0	1	218	50	6	2	0	0
214	61	0	0	0	0	218	51	0	0	0	0
214	62	0	0	0	0	218	52	0	0	0	0
214	63	6	3	0	1	218	53	5	1	0	1
214	64	0	0	0	3	218	54	8	0	1	1
214	65	0	0	0	0	218	55	3	6	1	0
214	66	0	0	0	0	218	56	1	2	4	3
214	67	0	0	0	0	218	57	0	0	0	0
214	68	4	0	0	1	218	58	0	0	0	0
214	69	0	0	0	0	218	59	2	0	1	0
214	70	0	0	0	0	218	60	2	1	0	0
214	71	2	1	0	0	218	61	0	0	0	0
214	72	3	4	0	3	218	62	0	0	0	0
214	73	8	6	0	0	218	63	2	0	0	0
214	74	10	6	0	4	218	64	6	1	0	0
214	75	0	0	0	0	218	65	0	0	0	0
214	76	0	0	0	0	218	66	0	0	0	0
214	77	3	0	1	2	218	67	2	3	0	1
214	78	6	0	0	4	218	68	4	3	1	0
214	79	0	0	0	0	218	69	0	0	0	0
214	80	0	0	0	0	218	70	0	0	0	0
214	81	3	0	0	0	218	71	3	0	1	1
214	82	5	1	1	2	218	72	3	2	0	0
214	83	0	0	0	0	218	73	1	1	1	1
214	84	0	0	0	0	218	74	4	3	1	2
214	85	1	0	1	0	218	75	0	0	0	0
214	86	4	0	1	1	218	76	0	0	0	0
214	87	0	0	0	0	218	77	5	1	0	0
214	88	0	0	0	0	218	78	4	1	0	1
214	89	3	1	1	2	218	79	0	0	0	0
214	90	9	2	0	7	218	80	0	0	0	0
218	1	0	0	1	1	218	81	1	2	0	0
218	2	2	1	0	0	218	82	4	0	0	0
218	3	0	0	0	0	218	83	0	0	0	0
218	4	0	0	0	0	218	84	0	0	0	0
218	5	0	0	0	0	218	85	0	2	0	1
218	6	3	0	0	0	218	86	0	0	1	2
218	7	0	0	0	0	218	87	0	0	0	0
218	8	0	0	0	0	218	88	0	0	0	0
218	9	1	2	0	0	218	89	4	0	1	0
218	10	3	2	0	0	218	90	4	1	1	2

TABLE E2. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
221	1	0	0	0	0	221	81	1	1	0	0
221	2	3	1	0	0	221	82	0	0	0	0
221	3	0	0	0	0	221	83	0	0	0	0
221	4	0	0	0	0	221	84	0	0	0	0
221	5	0	0	0	0	221	85	0	0	0	0
221	6	2	0	0	0	221	86	0	1	0	0
221	7	0	0	0	0	221	87	0	0	0	0
221	8	0	0	0	0	221	88	0	0	0	0
221	9	0	0	0	0	221	89	2	0	1	1
221	10	1	1	1	2	221	90	2	1	0	0
221	11	0	0	0	0	225	1	0	0	0	0
221	12	0	0	0	0	225	2	0	0	0	0
221	13	1	1	0	0	225	3	0	0	0	0
221	14	4	0	0	0	225	4	0	0	0	0
221	15	0	0	0	0	225	5	0	1	0	0
221	16	0	0	0	0	225	6	1	1	0	0
221	17	3	1	0	1	225	7	0	0	0	0
221	18	0	0	0	0	225	8	0	0	0	0
221	19	1	0	1	0	225	9	1	0	0	0
221	20	2	1	1	1	225	10	2	2	0	0
221	21	0	0	0	0	225	11	0	0	0	0
221	22	0	0	0	0	225	12	0	0	0	0
221	23	2	1	0	0	225	13	3	0	0	0
221	24	2	0	1	0	225	14	0	1	0	0
221	25	0	0	0	0	225	15	0	0	0	0
221	26	0	0	0	0	225	16	0	0	0	0
221	27	0	0	0	0	225	17	0	1	0	0
221	28	4	0	0	0	225	18	0	0	0	0
221	29	0	0	0	0	225	19	0	1	0	0
221	30	0	0	0	0	225	20	1	2	0	0
221	31	2	1	0	0	225	21	0	0	0	0
221	32	2	1	0	0	225	22	0	0	0	0
221	33	0	0	0	0	225	23	5	0	0	0
221	34	0	0	0	0	225	24	1	2	0	1
221	35	1	1	0	0	225	25	0	0	0	0
221	36	0	1	0	0	225	26	0	0	0	0
221	37	1	1	1	1	225	27	0	1	0	0
221	38	1	1	0	0	225	28	0	2	0	0
221	39	0	0	0	0	225	29	0	0	0	0
221	40	0	0	0	0	225	30	0	0	0	0
221	41	0	0	1	1	225	31	0	1	0	0
221	42	0	2	2	0	225	32	0	0	0	0
221	43	0	0	0	0	225	33	0	0	0	0
221	44	0	0	0	0	225	34	0	0	0	0
221	45	1	0	1	0	225	35	0	1	0	0
221	46	1	1	0	0	225	36	1	0	0	0
221	47	0	0	0	0	225	37	1	0	0	0
221	48	0	0	0	0	225	38	2	0	0	0
221	49	2	0	0	0	225	39	0	0	0	0
221	50	1	1	0	0	225	40	0	0	0	0
221	51	0	0	0	0	225	41	0	0	0	0
221	52	0	0	0	0	225	42	1	1	0	0
221	53	2	0	1	1	225	43	0	0	0	0
221	54	3	0	0	0	225	44	0	0	0	0
221	55	1	0	0	0	225	45	1	1	0	0
221	56	0	2	1	0	225	46	1	0	0	0
221	57	0	0	0	0	225	47	0	0	0	0
221	58	0	0	0	0	225	48	0	0	0	0
221	59	0	1	0	0	225	49	0	0	0	0
221	60	0	1	0	0	225	50	0	0	0	0
221	61	0	0	0	0	225	51	0	0	0	0
221	62	0	0	0	0	225	52	0	0	0	0
221	63	1	3	0	0	225	53	3	2	1	0
221	64	2	0	0	0	225	54	4	1	0	0
221	65	0	0	0	0	225	55	4	1	1	0
221	66	0	0	0	0	225	56	1	0	1	0
221	67	0	1	0	1	225	57	0	0	0	0
221	68	1	0	0	0	225	58	0	1	0	0
221	69	0	0	0	0	225	59	1	0	0	0
221	70	0	0	0	0	225	60	2	1	0	0
221	71	0	2	0	0	225	61	0	0	0	0
221	72	3	2	0	0	225	62	3	1	0	0
221	73	7	1	0	0	225	63	1	1	0	0
221	74	2	1	0	0	225	64	1	0	0	0
221	75	0	0	0	0	225	65	0	0	0	0
221	76	0	0	0	0	225	66	0	0	0	0
221	77	2	0	0	0	225	67	0	0	0	0
221	78	5	2	0	0	225	68	0	0	0	0
221	79	0	0	0	0	225	69	0	0	0	0
221	80	0	0	0	0	225	70	0	0	0	0

TABLE E2 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
225	71	1	1	0	0
225	72	0	1	1	0
225	73	0	0	0	0
225	74	0	0	0	0
225	75	0	0	0	0
225	76	0	0	0	0
225	77	0	1	0	0
225	78	3	5	0	0
225	79	0	0	0	0
225	80	0	0	0	0
225	81	4	1	1	1
225	82	8	2	1	0
225	83	0	0	0	0
225	84	0	0	0	0
225	85	2	0	0	0
225	86	0	0	0	0
225	87	0	0	0	0
225	98	0	0	0	0
225	89	1	0	1	0
225	90	0	0	2	0
228	1	1	0	0	1
228	2	2	0	0	0
228	3	0	0	0	0
228	4	0	0	0	0
228	5	0	1	0	1
228	6	2	1	0	0
228	7	0	0	0	0
228	8	0	0	0	0
228	9	0	0	0	0
228	10	0	0	0	0
228	11	0	0	0	0
228	12	0	0	0	0
228	13	1	0	1	0
228	14	0	0	0	0
228	15	0	0	0	0
228	16	0	0	0	0
228	17	0	0	0	0
228	18	1	1	0	0
228	19	1	1	0	0
228	20	1	0	0	1
228	21	0	0	0	0
228	22	0	0	0	0
228	23	2	2	1	1
228	24	0	0	0	2
228	25	0	0	0	0
228	26	0	0	0	0
228	27	3	2	0	0
228	28	0	0	1	0
228	29	0	0	0	0
228	30	0	0	0	0
228	31	2	0	0	1
228	32	1	0	0	0
228	33	0	0	0	0
228	34	0	0	0	0
228	35	1	2	0	0
228	36	0	0	0	0
228	37	2	0	0	0
228	38	3	1	1	1
228	39	0	0	0	0
228	40	0	0	0	0
228	41	0	0	0	0
228	42	0	1	0	0
228	43	0	0	0	0
228	44	0	0	0	0
228	45	1	0	0	0
228	46	0	0	0	1
228	47	0	0	0	0
228	48	0	0	0	0
228	49	0	0	0	0
228	50	0	0	0	0
228	51	0	0	0	0
228	52	0	0	0	0
228	53	1	0	1	2
228	54	0	3	0	2
228	55	0	0	1	0
228	56	1	0	0	0
228	57	0	0	1	0
228	58	0	1	0	0
228	59	2	1	0	2
228	60	0	0	0	0
228	61	0	0	0	0
228	62	0	0	0	0
228	63	3	0	0	0
228	64	0	0	0	0
228	65	0	0	0	0
228	66	4	0	0	0
228	67	0	0	0	0
228	68	0	0	0	0
228	69	0	0	0	0
228	70	0	0	0	0
228	71	2	0	0	0
228	72	2	0	0	0
228	73	0	0	0	0
228	74	2	1	0	0
228	75	0	0	0	0
228	76	0	0	0	0
228	77	5	1	1	1
228	78	4	1	0	0
228	79	0	0	0	0
228	80	0	0	0	0
228	81	1	3	0	2
228	82	3	1	0	1
228	83	0	0	0	0
228	84	0	0	0	0
228	85	0	0	0	0
228	86	1	0	0	1
228	87	0	0	0	0
228	88	0	0	0	0
228	89	0	4	0	4
228	90	3	4	2	12
233	1	2	0	0	0
233	2	1	1	0	1
233	3	0	0	0	0
233	4	0	0	0	0
233	5	2	0	0	0
233	6	0	0	0	0
233	7	0	0	0	0
233	8	0	0	0	0
233	9	0	0	0	0
233	10	5	2	0	0
233	11	0	0	0	0
233	12	0	0	0	0
233	13	1	0	0	1
233	14	1	4	1	1
233	15	0	0	0	0
233	16	0	0	0	0
233	17	1	1	0	1
233	18	1	0	0	2
233	19	0	2	0	0
233	20	0	3	0	4
233	21	0	0	0	0
233	22	0	0	0	0
233	23	1	0	0	0
233	24	0	0	0	0
233	25	0	0	0	0
233	26	0	0	0	0
233	27	0	0	0	0
233	28	0	0	0	1
233	29	0	0	0	0
233	30	0	0	0	0
233	31	0	1	0	0
233	32	0	0	0	0
233	33	0	0	0	0
233	34	0	0	0	0
233	35	4	0	0	0
233	36	1	5	0	0
233	37	2	1	0	1
233	38	1	1	0	1
233	39	0	0	0	0
233	40	0	0	0	0
233	41	0	1	0	0
233	42	0	0	0	0
233	43	0	0	0	0
233	44	0	0	0	0
233	45	1	0	0	2
233	46	1	1	1	2
233	47	0	0	0	0
233	48	0	0	0	0
233	49	1	1	0	0
233	50	3	3	0	0

TABLE E2 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
233	51	0	0	0	0
233	52	0	0	0	0
233	53	0	1	0	1
233	54	7	0	0	5
233	55	1	1	0	10
233	56	5	1	1	7
233	57	0	0	0	0
233	58	0	0	0	0
233	59	1	1	0	1
233	60	0	0	0	0
233	61	0	0	0	0
233	62	0	0	0	0
233	63	0	1	0	0
233	64	2	2	0	2
233	65	0	0	0	0
233	66	1	2	2	1
233	67	2	0	0	1
233	68	0	0	0	0
233	69	0	0	0	0
233	70	0	0	0	0
233	71	2	1	0	0
233	72	2	1	0	2
233	73	2	1	0	0
233	74	3	2	0	0
233	75	0	0	0	0
233	76	0	0	0	0
233	77	5	3	0	0
233	78	3	1	1	0
233	79	0	0	0	0
233	80	0	0	0	0
233	81	5	1	0	4
233	82	5	0	0	5
233	83	0	0	0	0
233	84	0	0	0	0
233	85	2	1	0	0
233	86	0	0	0	0
233	87	0	0	0	0
233	88	0	0	0	0
233	89	3	1	1	7
233	90	2	3	1	9
236	1	0	0	0	0
236	2	2	3	0	0
236	3	0	0	0	0
236	4	0	0	0	0
236	5	0	0	0	0
236	6	0	0	0	1
236	7	0	0	0	0
236	8	0	0	0	0
236	9	2	0	0	0
236	10	1	0	0	4
236	11	0	0	0	0
236	12	0	0	0	0
236	13	1	0	0	0
236	14	3	2	1	1
236	15	0	0	0	0
236	16	0	0	0	0
236	17	1	0	0	0
236	18	3	1	0	2
236	19	0	0	0	0
236	20	0	0	0	0
236	21	0	0	0	0
236	22	0	0	0	0
236	23	1	0	0	2
236	24	0	0	0	0
236	25	0	0	0	0
236	26	0	0	0	0
236	27	0	0	0	0
236	28	3	0	0	0
236	29	0	0	0	0
236	30	0	0	0	0
236	31	2	0	0	0
236	32	0	0	0	0
236	33	0	0	0	0
236	34	0	0	0	0
236	35	3	1	0	0
236	36	2	0	0	0
236	37	2	0	0	0
236	38	5	0	0	0
236	39	0	0	0	0
236	40	0	0	0	0
236	41	1	1	0	1
236	42	3	0	0	1
236	43	0	0	0	0
236	44	0	0	0	0
236	45	1	0	0	0
236	46	1	1	1	1
236	47	0	0	0	0
236	48	0	0	0	0
236	49	0	0	0	0
236	50	1	1	0	1
236	51	0	0	0	0
236	52	0	0	0	0
236	53	1	0	1	0
236	54	2	1	1	2
236	55	1	0	0	1
236	56	1	1	2	2
236	57	0	0	0	0
236	58	0	0	0	0
236	59	2	0	0	4
236	60	1	0	0	0
236	61	0	0	0	0
236	62	0	0	0	0
236	63	2	0	0	0
236	64	0	0	2	1
236	65	0	0	0	0
236	66	1	0	0	1
236	67	1	0	0	0
236	68	0	0	0	0
236	69	0	0	0	0
236	70	0	0	0	0
236	71	0	0	0	0
236	72	1	0	1	0
236	73	1	0	0	0
236	74	3	0	0	2
236	75	0	0	0	0.
236	76	0	0	0	0
236	77	1	1	0	0
236	78	8	0	0	0
236	79	0	0	0	0
236	80	0	0	0	0
236	81	0	0	0	0
236	82	8	2	0	1
236	83	0	0	0	0
236	84	0	0	0	0
236	85	1	0	0	0
236	86	0	0	0	0
236	87	0	0	0	0
236	88	0	0	0	0
236	89	2	0	1	0
236	90	1	0	0	0

TABLE E3

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
139	50	0	0	8	7
139	51	0	2	7	2
139	52	2	2	5	2
139	53	1	6	12	6
139	54	0	0	6	1
139	55	0	1	5	0
139	56	0	0	2	1
139	57	2	0	7	13
139	58	0	0	1	0
139	59	0	1	1	1
139	60	1	2	1	1
139	61	0	0	4	9
139	62	1	4	4	5
139	63	0	0	4	0
139	64	0	0	8	2
139	65	0	0	8	8
139	66	0	0	4	1
139	67	0	2	7	0
139	68	2	1	7	2
139	69	1	0	3	5
139	70	1	0	6	3
143	50	0	2	3	2
143	51	1	1	3	5
143	52	0	0	3	2
143	53	2	3	4	5
143	54	0	1	2	2
143	55	1	0	2	2
143	56	0	0	0	0
143	57	4	4	9	4
143	58	2	0	2	3
143	59	1	3	1	1
143	60	4	1	8	7
143	61	5	4	8	4
143	62	0	0	0	0
143	63	2	3	4	3
143	64	0	1	3	0
143	65	6	5	3	8
143	66	4	5	9	10
143	67	4	3	1	4
143	68	2	2	7	1
143	69	1	0	0	3
143	70	4	2	9	9
146	50	4	2	8	1
146	51	4	6	5	2
146	52	0	1	3	1
146	53	1	1	1	2
146	54	0	4	1	3
146	55	3	7	4	2
146	56	13	9	2	1
146	57	5	2	2	0
146	58	3	2	2	1
146	59	2	0	0	0
146	60	5	6	2	1
146	61	15	10	10	8
146	62	2	2	0	0
146	63	3	0	4	1
146	64	6	6	1	2
146	65	10	14	5	6
146	66	13	13	7	15
146	67	4	3	1	3
146	68	5	1	3	2
146	69	1	0	0	0
146	70	7	13	12	9
149	50	4	4	0	1
149	51	3	3	1	0
149	52	3	5	2	0
149	53	4	0	2	1
149	54	8	3	3	2
149	55	7	4	3	2
149	56	10	17	3	2
149	57	4	0	1	0
149	58	1	3	2	2
149	59	3	0	1	0
149	60	8	11	6	16
149	61	21	15	7	5
149	62	0	0	0	0
149	63	2	2	2	1
149	64	5	3	8	3
149	65	9	16	2	14
149	66	15	14	12	7
149	67	6	7	0	2
149	68	5	3	7	6
149	69	9	3	1	3
149	70	9	18	19	8
151	50	5	4	1	1
151	51	0	2	1	0
151	52	3	2	1	0
151	53	7	5	0	0
151	54	5	4	1	2
151	55	2	3	0	0
151	56	10	18	1	0
151	57	4	4	3	0
151	58	0	4	0	0
151	59	0	0	1	0
151	60	4	13	2	1
151	61	12	12	2	6
151	62	0	0	0	0
151	63	2	3	1	1
151	64	8	6	2	1
151	65	14	11	3	6
151	66	5	13	4	5
151	67	4	12	0	3
151	68	2	6	2	5
151	69	1	0	0	0
151	70	9	9	8	0
153	50	9	5	1	0
153	51	5	4	1	1
153	52	1	3	1	0
153	53	25	3	4	1
153	54	5	2	1	0
153	55	0	0	0	0
153	56	14	11	2	0
153	57	4	4	3	1
153	58	4	1	1	0
153	59	1	1	0	0
153	60	8	9	1	1
153	61	2	2	0	1
153	62	0	0	0	0
153	63	1	1	1	1
153	64	8	6	6	0
153	65	5	2	1	1
153	66	7	5	7	7
153	67	3	6	0	0
153	68	4	11	2	1
153	69	3	1	0	0
153	70	11	9	2	0
156	50	6	0	2	0
156	51	3	2	1	0
156	52	4	3	0	0
156	53	8	6	5	0
156	54	4	6	0	0
156	55	6	4	1	0
156	56	8	6	3	1
156	57	2	4	1	0
156	58	5	1	4	0
156	59	2	0	0	0
156	60	3	1	0	1
156	61	3	0	3	0
156	62	6	4	1	0
156	63	3	1	0	0
156	64	0	2	3	0
156	65	1	3	5	4
156	66	7	2	2	0
156	67	3	0	0	0
156	68	2	2	2	2
156	69	4	1	2	1
156	70	0	0	0	0
157	50	3	1	1	1
157	51	9	3	9	1
157	52	6	6	0	0
157	53	10	5	3	1
157	54	2	2	0	0
157	55	2	2	1	2
157	56	8	2	4	1
157	57	4	5	3	1
157	58	7	3	3	0
157	59	2	0	0	1
157	60	4	11	5	0
157	61	5	7	1	1
157	62	11	6	3	2

TABLE E3. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
157	63	2	2	1	0
157	64	0	1	1	2
157	65	7	8	12	0
157	56	6	7	7	2
157	67	1	4	2	1
157	68	3	3	1	0
157	69	10	1	4	0
157	70	16	18	4	1
158	50	6	4	1	2
158	51	5	1	1	0
158	52	5	1	2	1
158	53	11	2	0	0
158	54	5	2	0	0
158	55	6	1	4	2
158	56	11	7	0	1
158	57	5	3	2	0
158	58	6	0	4	3
158	59	2	0	0	0
158	60	8	5	2	8
158	61	2	3	3	0
158	62	6	3	1	1
158	63	2	0	0	0
158	64	3	2	1	0
158	65	6	4	0	0
158	66	11	13	3	0
158	67	0	1	3	0
158	68	2	2	1	0
158	69	0	1	1	1
158	70	8	5	2	3
160	50	8	3	3	0
160	51	6	1	5	0
160	52	11	1	2	0
160	53	19	4	12	1
160	54	6	5	13	0
160	55	3	6	0	1
160	56	6	6	5	1
160	57	9	4	2	0
160	58	10	1	8	1
160	59	0	1	0	0
160	60	8	6	2	1
160	61	3	5	2	3
160	62	8	10	2	2
160	63	4	1	5	0
160	64	2	0	0	2
160	65	3	11	2	3
160	66	4	4	6	1
160	67	1	1	1	0
160	68	3	8	0	1
160	69	2	1	1	2
160	70	4	5	3	2
163	50	15	4	7	9
163	51	0	0	0	0
163	52	0	0	0	0
163	53	0	0	0	0
163	54	8	1	1	2
163	55	12	2	2	5
163	56	26	10	7	5
163	57	0	0	0	0
163	58	10	4	8	5
163	59	5	3	3	2
163	60	11	9	5	7
163	61	0	0	0	0
163	62	0	0	0	0
163	63	7	6	2	0
163	64	4	4	4	1
163	65	8	15	21	30
163	66	14	11	11	10
163	67	8	3	2	4
163	68	0	0	0	0
163	69	12	17	6	6
163	70	20	27	17	14
165	50	3	0	0	1
165	51	2	0	3	1
165	52	2	0	2	2
165	53	9	6	2	1
165	54	7	1	2	0
165	55	0	0	0	0
165	56	8	1	3	0
165	57	8	1	2	1
165	58	2	0	1	0
165	59	2	0	1	0
165	60	4	1	12	0
165	61	1	1	1	1
165	62	9	4	3	0
165	63	1	1	1	1
165	64	4	0	2	0
165	65	6	2	9	0
165	66	5	3	5	0
165	67	3	2	5	1
165	68	7	3	2	1
165	69	0	0	2	0
165	70	9	4	0	1
170	50	13	6	6	5
170	51	0	0	0	0
170	52	0	0	0	0
170	53	0	0	0	0
170	54	11	2	17	7
170	55	2	2	6	5
170	56	25	13	12	12
170	57	0	0	0	0
170	58	4	0	9	5
170	59	10	3	1	1
170	60	16	11	18	13
170	61	7	5	3	1
170	62	0	0	0	0
170	63	4	2	14	6
170	64	7	6	16	6
170	65	35	37	63	29
170	66	13	13	19	20
170	67	15	15	14	6
170	68	0	0	0	0
170	69	5	1	19	8
170	70	47	39	46	26
172	50	3	2	1	0
172	51	3	2	1	0
172	52	2	5	1	1
172	53	12	9	1	1
172	54	4	8	1	1
172	55	1	3	1	0
172	56	7	6	3	1
172	57	4	4	5	1
172	58	5	10	4	2
172	59	1	0	0	0
172	60	10	8	0	1
172	61	2	6	2	2
172	62	2	0	0	0
172	63	6	8	2	1
172	64	5	5	1	0
172	65	9	12	3	3
172	66	4	4	5	1
172	67	8	8	1	1
172	68	2	6	0	0
172	69	6	5	7	4
172	70	15	23	7	3
174	50	0	0	0	0
174	51	0	4	2	1
174	52	2	1	2	0
174	53	6	2	2	0
174	54	2	0	0	0
174	55	1	1	1	0
174	56	3	1	0	2
174	57	0	1	0	0
174	58	6	1	3	0
174	59	3	2	1	1
174	60	2	3	1	0
174	61	1	1	0	0
174	62	0	0	0	0
174	63	2	0	0	0
174	64	1	1	2	0
174	65	2	4	2	0
174	66	2	0	2	1
174	67	2	3	2	1
174	68	3	1	0	0
174	69	2	2	3	0
174	70	6	7	2	0
177	50	2	0	3	1
177	51	2	1	10	2
177	52	5	1	13	3
177	53	6	2	6	4
177	54	7	3	5	5

TABLE E3. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
177	55	3	1	0	2
177	56	15	0	8	6
177	57	4	7	2	3
177	58	0	0	0	0
177	59	2	2	0	1
177	60	8	1	4	6
177	61	6	3	7	6
177	62	5	4	7	4
177	63	10	6	4	5
177	64	4	1	2	4
177	65	12	11	14	12
177	66	9	4	20	10
177	67	8	8	8	17
177	68	2	2	1	3
177	69	0	0	0	0
177	70	13	14	11	6
179	50	20	4	1	0
179	51	11	1	6	1
179	52	5	1	6	1
179	53	11	4	6	1
179	54	3	1	7	0
179	55	5	3	1	0
179	56	14	5	7	5
179	57	2	1	2	2
179	58	5	2	5	1
179	59	3	2	2	1
179	60	6	4	1	0
179	61	3	0	4	3
179	62	15	3	2	2
179	63	2	1	3	2
179	64	6	4	2	2
179	65	9	7	3	3
179	66	11	7	8	3
179	67	1	0	0	0
179	68	5	1	2	2
179	69	12	13	10	1
179	70	26	26	6	6
181	50	2	0	0	0
181	51	3	1	9	3
181	52	0	2	5	2
181	53	3	4	1	3
181	54	3	2	14	2
181	55	3	5	0	0
181	56	3	1	3	2
181	57	0	5	3	0
181	58	1	4	4	1
181	59	0	0	0	1
181	60	2	2	2	0
181	61	0	5	4	0
181	62	0	0	0	1
181	63	1	5	0	1
181	64	3	2	3	1
181	65	2	0	1	0
181	66	4	1	5	2
181	67	0	0	0	0
181	68	2	1	0	2
181	69	0	0	0	0
181	70	10	20	4	1
184	50	3	2	9	6
184	51	5	0	9	10
184	52	3	0	4	0
184	53	9	4	4	3
184	54	7	0	6	1
184	55	4	2	4	4
184	56	4	1	10	4
184	57	1	1	4	1
184	58	2	0	7	1
184	59	2	1	2	0
184	60	3	3	8	6
184	61	6	1	14	5
184	62	3	2	11	3
184	63	1	2	10	4
184	64	1	0	6	4
184	65	0	2	6	5
184	66	0	2	9	0
184	67	1	2	5	6
184	68	2	1	3	2
184	69	1	1	3	1
184	70	5	7	11	4
186	50	2	0	1	2
186	51	1	1	1	0
186	52	0	1	1	4
186	53	4	2	5	3
186	54	5	3	4	2
186	55	5	4	4	2
186	56	5	1	8	1
186	57	2	1	4	0
186	58	1	2	2	1
186	59	2	4	10	3
186	60	1	0	0	0
186	61	5	1	5	3
186	62	3	2	1	0
186	63	2	1	6	0
186	64	6	1	1	0
186	65	1	2	3	0
186	66	2	1	3	1
186	67	1	0	0	0
186	68	3	2	1	0
186	69	1	1	1	0
186	70	18	17	2	1
188	50	0	0	0	0
188	51	0	0	2	0
188	52	0	0	1	0
188	53	0	0	3	0
188	54	1	0	3	0
188	55	0	0	0	0
188	56	0	0	0	3
188	57	0	1	1	1
188	58	0	1	3	1
188	59	0	0	0	0
188	60	0	0	1	0
188	61	0	0	4	2
188	62	0	0	0	0
188	63	0	1	1	0
188	64	2	0	1	2
188	65	1	2	2	0
188	66	3	3	4	0
188	67	0	0	0	0
188	68	0	1	1	0
188	69	0	0	3	1
188	70	1	2	4	2
191	50	0	0	0	1
191	51	2	2	10	0
191	52	1	2	2	0
191	53	3	3	1	0
191	54	1	1	1	3
191	55	0	2	0	0
191	56	1	3	5	4
191	57	1	0	4	1
191	58	1	0	4	1
191	59	0	1	0	1
191	60	0	1	4	1
191	61	2	1	5	4
191	62	2	1	8	5
191	63	1	2	2	1
191	64	0	0	2	0
191	65	2	3	3	0
191	66	1	4	7	0
191	67	1	0	1	0
191	68	0	1	0	0
191	69	1	0	3	1
191	70	1	3	4	2
193	50	0	0	0	0
193	51	2	0	3	1
193	52	0	2	1	0
193	53	0	1	2	0
193	54	4	2	0	0
193	55	1	0	0	0
193	56	2	1	2	1
193	57	0	2	2	0
193	58	1	2	7	0
193	59	0	1	3	0
193	60	0	1	1	0
193	61	1	1	4	1
193	62	0	3	0	0
193	63	0	2	0	1
193	64	0	0	3	0
193	65	0	0	0	0
193	66	1	2	0	0
193	67	1	1	1	0

TABLE E3 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
193	68	0	2	0	0	202	64	10	5	5	2
193	69	0	0	1	0	202	65	11	7	1	1
193	70	1	1	1	1	202	66	7	4	8	2
195	50	6	9	9	8	202	67	13	4	0	0
195	51	3	2	3	3	202	68	7	10	2	0
195	52	15	11	3	5	202	69	10	5	6	1
195	53	6	9	3	4	202	70	8	11	8	1
195	54	4	5	3	0	203	50	4	0	6	1
195	55	12	6	4	4	203	51	5	2	8	2
195	56	2	2	0	0	203	52	3	1	2	2
195	57	0	0	0	0	203	53	5	1	7	2
195	58	44	30	9	8	203	54	6	1	7	1
195	59	8	5	4	11	203	55	10	8	6	1
195	60	9	4	11	14	203	56	7	9	3	3
195	61	9	3	4	5	203	57	1	2	0	0
195	62	10	5	8	2	203	58	5	1	6	0
195	63	27	19	9	9	203	59	9	0	0	0
195	64	12	10	7	5	203	60	13	5	11	2
195	65	3	2	7	4	203	61	9	6	12	3
195	66	10	7	7	6	203	62	11	2	8	1
195	67	9	1	5	5	203	63	8	1	6	3
195	68	18	9	13	3	203	64	3	4	1	0
195	69	7	12	7	4	203	65	4	4	6	0
195	70	17	16	4	4	203	66	2	2	0	0
198	50	3	2	0	0	203	67	4	8	2	0
198	51	2	3	4	0	203	68	7	9	2	3
198	52	1	9	1	0	203	69	7	16	9	2
198	53	5	3	1	0	203	70	0	0	0	0
198	54	3	2	4	0	206	50	5	7	1	0
198	55	3	2	1	3	206	51	9	7	2	0
198	56	9	1	2	1	206	52	14	13	1	0
198	57	6	4	2	4	206	53	8	6	1	0
198	58	2	1	4	1	206	54	16	7	3	0
198	59	0	0	0	0	206	55	5	5	0	0
198	60	3	2	1	2	206	56	12	13	1	0
198	61	5	6	9	3	206	57	4	9	1	0
198	62	4	6	7	0	206	58	12	7	8	0
198	63	1	1	2	4	206	59	1	1	1	0
198	64	1	1	4	3	206	60	8	3	3	1
198	65	2	4	5	0	206	61	10	10	0	0
198	66	7	7	4	3	206	62	13	11	2	1
198	67	4	6	8	2	206	63	10	12	3	1
198	68	1	2	1	0	206	64	11	8	5	0
198	69	5	2	1	1	206	65	2	6	0	0
198	70	7	2	3	4	206	66	6	10	0	1
200	50	0	2	0	0	206	67	14	8	2	0
200	51	5	1	3	2	206	68	4	11	4	0
200	52	5	2	3	1	206	69	7	7	4	1
200	53	7	6	1	1	206	70	8	13	2	1
200	54	0	4	2	1	209	50	11	3	0	0
200	55	1	1	1	0	209	51	7	1	1	0
200	56	2	4	4	0	209	52	10	2	0	0
200	57	2	2	3	1	209	53	8	1	1	0
200	58	5	4	4	2	209	54	7	3	0	0
200	59	1	1	0	0	209	55	9	7	0	0
200	60	6	0	2	1	209	56	8	3	1	0
200	61	4	2	7	3	209	57	5	6	1	1
200	62	9	9	3	0	209	58	11	3	3	2
200	63	4	2	2	1	209	59	1	1	0	0
200	64	1	6	0	0	209	60	1	7	1	0
200	65	3	0	1	0	209	61	10	1	1	0
200	66	4	2	3	1	209	62	11	6	2	0
200	67	4	7	0	0	209	63	8	6	0	0
200	68	1	3	1	0	209	64	5	11	1	0
200	69	6	5	3	1	209	65	3	3	0	0
200	70	5	4	2	2	209	66	2	2	1	0
202	50	3	4	3	0	209	67	8	3	1	0
202	51	13	9	4	0	209	68	2	2	1	0
202	52	14	17	1	1	209	69	2	0	0	0
202	53	10	14	7	0	209	70	7	3	0	0
202	54	7	2	2	0	212	50	6	3	2	0
202	55	6	5	4	1	212	51	6	2	3	0
202	56	11	7	6	1	212	52	11	5	0	0
202	57	12	8	1	0	212	53	15	3	0	0
202	58	18	3	11	1	212	54	8	4	2	0
202	59	3	3	1	0	212	55	11	3	1	1
202	60	4	4	1	0	212	56	11	4	7	0
202	61	12	10	7	1	212	57	9	5	0	0
202	62	14	6	4	3	212	58	9	3	5	0
202	63	9	4	4	1	212	59	6	1	1	0

TABLE E3. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
212	60	9	5	0	0
212	61	16	7	0	1
212	62	13	14	0	0
212	63	13	7	0	0
212	64	10	9	1	2
212	65	1	2	0	0
212	66	8	7	1	0
212	67	8	6	1	0
212	68	5	9	0	0
212	69	6	9	2	1
212	70	5	10	0	0
214	50	4	1	0	0
214	51	4	2	0	0
214	52	8	1	1	0
214	53	17	2	0	0
214	54	7	8	0	0
214	55	2	1	0	0
214	56	8	1	1	0
214	57	5	4	3	0
214	58	5	5	2	0
214	59	0	0	0	0
214	60	4	3	0	0
214	61	6	1	1	0
214	62	9	1	1	0
214	63	6	3	0	0
214	64	2	6	0	0
214	65	3	1	0	0
214	66	0	8	6	6
214	67	4	1	0	0
214	68	4	2	1	0
214	69	2	3	2	0
214	70	2	1	2	0
216	50	3	2	0	0
216	51	6	2	1	0
216	52	1	0	1	0
216	53	7	1	1	0
216	54	4	2	0	0
216	55	4	1	1	0
216	56	7	2	0	0
216	57	1	2	0	0
216	58	2	1	1	0
216	59	0	0	0	0
216	60	4	1	0	0
216	61	6	0	0	0
216	62	3	1	0	0
216	63	7	1	0	0
216	64	2	2	0	0
216	65	7	0	0	0
216	66	1	5	0	0
216	67	4	0	1	0
216	68	1	5	0	0
216	69	1	2	0	0
216	70	0	4	2	0
218	50	2	0	1	0
218	51	6	3	1	1
218	52	4	6	0	0
218	53	15	1	0	0
218	54	13	2	1	0
218	55	7	3	0	0
218	56	6	2	1	1
218	57	2	2	1	0
218	58	5	0	1	0
218	59	1	0	0	0
218	60	3	2	0	0
218	61	7	1	1	0
218	62	6	2	1	0
218	63	7	4	1	0
218	64	3	3	0	0
218	65	6	2	2	0
218	66	9	10	1	1
218	67	2	6	0	0
218	68	3	3	0	0
218	69	0	4	0	0
218	70	4	5	3	0
221	50	3	0	0	0
221	51	2	1	0	0
221	52	0	2	0	0
221	53	4	2	0	0
221	54	9	2	1	0
221	55	4	3	0	0
221	56	1	2	2	0
221	57	2	3	0	0
221	58	1	1	1	0
221	59	2	0	0	0
221	60	4	3	0	0
221	61	6	2	0	0
221	62	3	2	0	0
221	63	7	5	0	0
221	64	0	30	0	0
221	65	3	1	0	0
221	66	2	5	1	0
221	67	1	2	0	0
221	68	3	3	1	0
221	69	0	3	2	0
221	70	2	4	0	0
223	50	0	1	0	0
223	51	0	0	3	0
223	52	2	0	1	1
223	53	3	0	0	0
223	54	5	0	4	1
223	55	4	1	1	0
223	56	5	2	3	1
223	57	4	8	2	0
223	58	0	1	0	0
223	59	0	1	0	0
223	60	0	3	0	0
223	61	6	0	1	1
223	62	0	0	0	0
223	63	0	0	0	0
223	64	0	0	0	0
223	65	0	0	0	0
223	66	6	4	1	0
223	67	1	2	0	0
223	68	3	5	0	0
223	69	2	4	1	0
223	70	1	2	2	1
227	50	0	1	0	0
227	51	2	3	1	0
227	52	6	4	0	0
227	53	2	0	5	0
227	54	1	2	3	0
227	55	3	2	5	2
227	56	10	5	5	1
227	57	15	4	2	0
227	58	4	3	0	0
227	59	0	0	0	0
227	60	8	3	2	0
227	61	9	2	0	1
227	62	5	7	2	0
227	63	2	4	1	4
227	64	2	2	2	2
227	65	4	0	1	2
227	66	3	1	1	1
227	67	0	1	0	1
227	68	2	1	1	1
227	69	4	1	2	1
227	70	3	2	1	0
228	50	3	2	1	1
228	51	0	1	0	0
228	52	0	1	0	0
228	53	0	0	0	0
228	54	0	1	0	0
228	55	1	0	0	0
228	56	2	0	0	0
228	57	0	2	0	0
228	58	1	0	0	0
228	59	0	2	0	0
228	60	0	1	0	0
228	61	0	2	0	1
228	62	0	0	0	0
228	63	0	0	0	0
228	64	1	0	0	0
228	65	0	0	0	0
228	66	0	5	0	0
228	67	0	0	0	0
228	68	0	2	0	0
228	69	0	2	0	0
228	70	0	6	0	0
229	50	3	0	0	0
229	51	0	0	0	0

TABLE E3. CONTINUED

DATE	TRAP	ON FEMALE	ON MALE	SC FEMALE	SC MALE
229	52	0	0	1	0
229	53	0	0	0	0
229	54	1	0	1	1
229	55	2	2	1	1
229	56	2	2	7	1
229	57	3	1	2	0
229	58	0	0	0	0
229	59	2	0	2	0
229	60	1	1	0	0
229	61	3	1	1	0
229	62	4	1	0	0
229	63	1	1	0	0
229	64	0	0	0	0
229	65	1	4	2	0
229	66	0	0	1	0
229	67	0	0	0	0
229	68	2	1	0	0
229	69	0	6	0	0
229	70	5	6	0	0
235	50	8	3	2	0
235	51	1	2	2	0
235	52	6	2	0	0
235	53	7	4	2	0
235	54	5	2	5	0
235	55	7	4	0	0
235	56	12	11	14	0
235	57	7	5	2	0
235	58	2	5	4	1
235	59	6	5	1	1
235	60	5	1	3	2
235	61	5	4	6	0
235	62	14	10	7	0
235	63	0	0	0	0
235	64	2	0	3	0
235	65	0	0	0	0
235	66	4	9	5	1
235	67	3	5	0	0
235	68	2	2	2	0
235	69	6	5	11	0
235	70	3	8	6	2
237	50	5	6	0	0
237	51	3	0	0	0
237	52	2	4	0	0
237	53	2	0	0	0
237	54	3	2	0	0
237	55	3	2	1	0
237	56	5	6	3	0
237	57	1	0	1	0
237	58	0	0	0	0
237	59	3	1	0	0
237	60	3	2	0	0
237	61	3	4	1	0
237	62	2	1	0	0
237	63	1	1	0	0
237	64	0	0	0	0
237	65	2	2	0	0
237	66	3	7	6	0
237	67	0	2	0	0
237	68	0	0	0	0
237	69	0	0	0	0
237	70	1	1	1	1
240	50	12	8	2	3
240	51	3	1	1	2
240	52	6	1	0	1
240	53	3	4	0	0
240	54	5	1	1	0
240	55	4	5	0	0
240	56	6	11	3	0
240	57	5	1	2	0
240	58	7	4	9	2
240	59	2	5	0	0
240	60	8	5	4	1
240	61	7	1	6	2
240	62	2	1	2	1
240	63	2	1	8	3
240	64	4	1	3	0
240	65	4	3	1	2
240	66	8	10	5	0
240	67	5	3	1	1
240	68	6	7	2	2
240	69	3	12	0	1
240	70	4	2	1	0
242	50	2	1	0	0
242	51	2	2	1	0
242	52	3	1	2	0
242	53	1	1	0	0
242	54	0	1	0	0
242	55	4	0	0	0
242	56	5	5	1	0
242	57	1	3	0	0
242	58	2	1	0	0
242	59	0	0	0	0
242	60	0	1	0	0
242	61	3	3	0	0
242	62	4	1	1	1
242	63	5	5	2	1
242	64	1	0	1	0
242	65	5	7	1	0
242	66	5	9	3	0
242	67	3	2	0	0
242	68	2	3	1	0
242	69	8	4	0	0
242	70	3	4	0	0
244	50	1	1	0	0
244	51	1	0	0	0
244	52	0	0	0	0
244	53	0	0	0	0
244	54	1	1	0	0
244	55	1	0	0	0
244	56	0	2	0	0
244	57	0	1	0	0
244	58	1	3	0	0
244	59	1	0	0	0
244	60	2	1	0	0
244	61	1	3	1	0
244	62	1	0	1	0
244	63	5	0	1	0
244	64	2	1	1	1
244	65	0	3	0	0
244	66	1	1	0	0
244	67	1	0	0	0
244	68	0	2	0	0
244	69	2	2	1	1
244	70	1	3	1	0
247	50	2	2	1	0
247	51	4	6	0	0
247	52	1	8	0	0
247	53	3	7	1	0
247	54	3	4	0	0
247	55	6	2	1	1
247	56	4	8	2	0
247	57	5	3	0	1
247	58	7	8	1	1
247	59	0	1	0	0
247	60	1	3	1	0
247	61	8	4	3	0
247	62	2	4	0	1
247	63	12	5	4	0
247	64	9	15	1	1
247	65	3	14	0	0
247	66	9	10	0	0
247	67	6	7	0	0
247	68	1	2	0	0
247	69	4	13	0	0
247	70	5	7	0	1
250	50	0	2	0	0
250	51	2	1	0	0
250	52	3	8	0	0
250	53	4	2	2	1
250	54	1	1	0	0
250	55	6	1	2	0
250	56	3	6	1	0
250	57	2	2	0	0
250	58	6	4	1	0
250	59	0	0	0	0
250	60	3	6	1	0
250	61	3	1	0	0
250	62	3	3	0	0
250	63	5	1	2	2
250	64	2	5	0	2

TABLE E3 . CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
250	65	2	4	0	0
250	66	3	4	0	0
250	67	1	2	0	0
250	68	3	3	0	0
250	69	4	7	1	2
250	70	1	5	0	1
254	50	25	18	4	1
254	51	10	1	3	0
254	52	17	11	4	1
254	53	5	5	0	1
254	54	8	6	0	0
254	55	17	7	5	2
254	56	3	5	1	0
254	57	0	0	0	0
254	58	41	51	11	8
254	59	0	0	2	0
254	60	20	12	7	1
254	61	21	8	6	1
254	62	0	0	0	0
254	63	19	26	10	8
254	64	16	6	2	4
254	65	5	5	3	2
254	66	25	28	4	9
254	67	11	15	1	1
254	68	26	17	4	2
254	69	17	11	4	4
254	70	12	15	4	2

TABLE E4

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE	DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
179	1	1	1	0	0	170	1	0	3	0	0
179	2	0	0	1	0	170	2	2	1	0	1
179	3	0	0	0	0	170	3	1	0	0	0
179	4	0	0	0	0	170	4	3	0	3	2
179	5	0	0	0	0	170	5	6	1	0	0
179	6	1	1	0	0	170	6	1	4	0	0
179	7	0	0	0	0	170	7	5	13	0	0
179	8	0	0	4	3	170	8	5	5	0	0
179	9	0	0	0	0	170	9	0	4	0	0
179	10	0	1	0	0	170	10	0	0	0	0
179	11	2	12	5	2	170	11	0	0	0	0
179	12	0	0	2	0	170	12	1	3	0	0
179	13	0	0	2	2	170	13	3	5	0	0
179	14	0	0	0	0	170	14	0	2	0	0
179	15	0	0	0	0	170	15	1	0	0	0
179	16	0	0	0	0	170	16	0	1	0	0
179	17	0	0	1	0	170	17	0	0	0	0
179	18	0	0	0	0	170	18	0	1	0	0
179	19	0	1	0	0	170	19	0	0	0	0
179	20	0	0	3	2	170	20	2	3	0	0
173	1	2	5	3	5	159	1	5	4	0	0
173	2	3	1	0	2	159	2	3	2	1	0
173	3	1	0	0	0	159	3	1	2	0	0
173	4	0	0	0	0	159	4	11	5	3	2
173	5	8	13	3	2	159	5	6	5	0	2
173	6	0	1	0	0	159	6	2	1	0	0
173	7	0	0	0	0	159	7	7	3	1	4
173	8	0	1	0	0	159	8	4	4	0	0
173	9	1	1	0	0	159	9	3	7	0	0
173	10	0	0	0	0	159	10	8	4	1	1
173	11	0	0	0	0	159	11	9	8	0	1
173	12	6	2	2	0	159	12	2	1	0	0
173	13	1	1	0	0	159	13	2	2	0	0
173	14	3	5	0	0	159	14	2	1	1	1
173	15	0	0	0	0	159	15	0	1	3	0
173	16	1	5	6	2	159	16	1	1	0	0
173	17	0	0	0	0	159	17	1	1	0	0
173	18	2	0	0	0	159	18	1	0	0	0
173	19	1	1	0	0	159	19	0	0	0	0
173	20	4	13	3	11	159	20	13	15	2	0
145	1	0	0	0	0	177	1	0	3	0	1
145	2	0	2	1	0	177	2	0	0	0	0
145	3	1	0	0	0	177	3	0	2	1	2
145	4	0	1	1	1	177	4	1	0	1	0
145	5	1	0	1	0	177	5	0	3	1	1
145	6	0	0	0	0	177	6	1	0	0	0
145	7	0	0	0	0	177	7	0	0	1	0
145	8	0	0	0	0	177	8	0	2	0	0
145	9	0	0	1	1	177	9	2	0	1	0
145	10	0	0	0	0	177	10	0	0	0	0
145	11	1	1	0	3	177	11	0	0	0	0
145	12	0	1	0	1	177	12	0	0	1	0
145	13	0	2	2	1	177	13	0	0	1	0
145	14	1	1	0	0	177	14	0	0	0	2
145	15	0	0	0	1	177	15	0	0	0	0
145	16	0	0	0	0	177	16	0	0	2	2
145	17	0	0	0	0	177	17	0	0	0	0
145	18	0	0	0	0	177	18	0	0	0	0
145	19	0	1	2	1	177	19	0	0	0	2
145	20	0	2	0	1	177	20	0	0	2	4
183	1	1	0	0	0	166	1	6	4	1	5
183	2	2	2	5	0	166	2	2	1	1	3
183	3	2	1	0	0	166	3	0	4	2	3
183	4	13	11	1	2	166	4	0	0	0	1
183	5	1	0	1	1	166	5	3	4	0	2
183	6	0	2	0	3	166	6	2	0	1	0
183	7	2	3	3	5	166	7	1	2	5	2
183	8	2	4	4	4	166	8	2	1	1	3
183	9	0	0	0	0	166	9	1	4	1	4
183	10	0	1	2	4	166	10	4	2	1	1
183	11	0	0	2	1	166	11	3	3	0	2
183	12	2	0	4	3	166	12	0	0	2	1
183	13	2	3	4	10	166	13	0	0	2	2
183	14	0	0	1	0	166	14	2	2	0	0
183	15	1	0	0	0	166	15	1	0	1	2
183	16	2	1	0	0	166	16	2	4	0	2
183	17	0	0	2	1	166	17	0	0	1	1
183	18	2	2	0	0	166	18	0	0	0	0
183	19	1	1	0	0	166	19	0	0	0	0
183	20	0	1	1	4	166	20	6	10	3	9

TABLE E4. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
193	1	0	1	0	0
193	2	0	0	0	0
193	3	1	2	0	0
193	4	0	0	0	3
193	5	1	1	0	0
193	6	0	0	0	0
193	7	0	4	0	2
193	8	4	3	2	4
193	9	0	0	0	1
193	10	0	2	1	0
193	11	2	0	0	0
193	12	0	1	0	2
193	13	2	4	0	0
193	14	0	0	1	0
193	15	0	0	1	0
193	16	0	0	1	0
193	17	2	1	1	0
193	18	1	1	0	0
193	19	0	0	0	0
193	20	3	7	1	0
185	1	2	0	1	0
185	2	2	1	0	0
185	3	0	0	0	0
185	4	1	4	5	2
185	5	0	0	0	0
185	6	0	0	0	0
185	7	2	0	1	0
185	8	1	1	2	0
185	9	0	0	0	0
185	10	1	1	0	0
185	11	0	0	0	0
185	12	1	1	1	2
185	13	0	1	2	1
185	14	0	0	0	0
185	15	0	0	0	0
185	16	0	0	0	0
185	17	0	0	0	0
185	18	0	0	2	0
185	19	1	0	3	1
185	20	1	2	0	0
190	1	1	1	0	0
190	2	1	0	0	0
190	3	2	1	0	0
190	4	3	0	0	0
190	5	0	1	0	0
190	6	0	0	0	0
190	7	2	0	0	0
190	8	1	0	0	0
190	9	0	1	0	0
190	10	1	0	3	0
190	11	0	1	1	1
190	12	1	1	0	1
190	13	2	1	1	0
190	14	1	0	0	0
190	15	1	0	0	0
190	16	0	0	1	0
190	17	0	0	0	0
190	18	0	0	0	0
190	19	0	0	0	0
190	20	2	2	1	1
197	1	0	0	0	0
197	2	0	2	0	0
197	3	1	3	0	1
197	4	2	2	0	0
197	5	0	1	0	0
197	6	0	2	0	0
197	7	3	7	0	0
197	8	2	4	1	1
197	9	0	0	1	0
197	10	0	0	0	0
197	11	2	1	1	1
197	12	0	1	0	0
197	13	0	2	0	1
197	14	0	0	0	0
197	15	0	0	0	0
197	16	0	0	0	0
197	17	0	1	0	0
197	18	0	0	0	0
197	19	0	0	0	0
197	20	3	14	4	1

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
200	1	0	0	0	0
200	2	0	0	0	0
200	3	0	0	0	0
200	4	1	0	0	0
200	5	0	1	0	0
200	6	0	1	0	0
200	7	1	1	0	0
200	8	0	1	0	0
200	9	0	0	0	0
200	10	0	1	0	0
200	11	0	0	0	0
200	12	1	0	0	0
200	13	0	3	0	0
200	14	0	0	0	0
200	15	0	0	0	0
200	16	0	0	0	0
200	17	0	0	0	0
200	18	0	0	0	0
200	19	0	0	0	0
200	20	0	9	6	0
204	1	0	0	0	0
204	2	0	0	0	0
204	3	1	2	0	0
204	4	1	0	0	0
204	5	2	1	0	0
204	6	3	2	0	0
204	7	3	0	0	1
204	8	1	0	0	0
204	9	0	0	0	0
204	10	0	0	0	0
204	11	0	1	0	0
204	12	0	0	0	0
204	13	1	2	0	1
204	14	1	0	0	0
204	15	0	0	0	0
204	16	0	0	0	0
204	17	0	0	0	0
204	18	0	0	0	0
204	19	0	0	0	0
204	20	1	6	0	2
207	1	1	0	0	0
207	2	1	1	0	1
207	3	0	0	0	0
207	4	0	1	1	0
207	5	2	1	0	1
207	6	0	0	0	1
207	7	1	1	2	0
207	8	1	1	0	1
207	9	4	1	0	0
207	10	0	2	0	0
207	11	4	6	0	0
207	12	0	0	0	0
207	13	1	1	0	1
207	14	0	0	0	0
207	15	1	0	0	0
207	16	0	0	0	0
207	17	0	1	0	0
207	18	0	1	0	0
207	19	0	0	0	0
207	20	1	3	0	0
211	1	1	2	0	0
211	2	0	0	0	1
211	3	1	4	0	0
211	4	0	0	0	0
211	5	3	1	0	0
211	6	2	4	0	0
211	7	1	1	2	0
211	8	0	0	0	0
211	9	0	0	0	0
211	10	0	0	0	0
211	11	2	1	0	1
211	12	1	0	0	0
211	13	3	1	2	4
211	14	0	0	0	0
211	15	1	0	0	0
211	16	0	0	0	0
211	17	0	0	0	0
211	18	2	3	1	0
211	19	0	0	0	0
211	20	4	5	3	6

TABLE E4. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
214	1	1	2	0	0
214	2	0	0	0	0
214	3	1	3	0	0
214	4	1	2	0	2
214	5	1	0	0	0
214	6	0	2	0	0
214	7	0	0	0	0
214	8	0	1	0	0
214	9	1	7	0	0
214	10	1	0	0	0
214	11	0	2	1	1
214	12	0	0	0	0
214	13	3	4	0	2
214	14	0	1	0	0
214	15	1	0	0	0
214	16	0	0	0	0
214	17	0	0	0	0
214	18	0	0	0	0
214	19	0	0	2	0
214	20	0	1	0	0
218	1	1	0	0	1
218	2	0	0	1	0
218	3	0	0	0	0
218	4	0	0	0	0
218	5	0	0	0	0
218	6	0	2	0	0
218	7	0	0	2	0
218	8	0	0	0	0
218	9	0	1	0	0
218	10	0	0	1	0
218	11	1	2	0	0
218	12	1	1	0	0
218	13	1	2	3	0
218	14	1	3	0	1
218	15	0	0	0	0
218	16	2	0	0	0
218	17	0	0	0	0
218	18	0	1	0	0
218	19	1	1	0	0
218	20	0	0	0	0
221	1	0	1	1	1
221	2	1	0	0	0
221	3	0	0	0	0
221	4	0	0	0	0
221	5	0	3	0	0
221	6	0	1	0	0
221	7	0	0	0	0
221	8	0	0	0	0
221	9	0	1	0	0
221	10	0	0	0	0
221	11	0	1	0	0
221	12	0	0	0	0
221	13	0	0	1	0
221	14	0	1	0	0
221	15	0	1	0	0
221	16	1	0	0	0
221	17	0	0	0	0
221	18	0	0	1	0
221	19	1	0	0	0
221	20	0	0	0	0
225	1	0	1	0	0
225	2	0	0	0	0
225	3	2	0	0	0
225	4	0	0	0	0
225	5	1	0	0	0
225	6	0	0	0	0
225	7	0	0	0	0
225	8	0	0	0	0
225	9	0	0	0	0
225	10	0	0	0	0
225	11	0	1	0	0
225	12	0	1	0	0
225	13	3	1	0	0
225	14	0	0	0	0
225	15	0	0	0	0
225	16	0	0	0	0
225	17	0	0	0	0
225	18	0	0	0	0
225	19	0	0	0	0
225	20	3	0	0	0
228	1	0	0	0	0
228	2	0	0	0	0
228	3	0	0	0	0
228	4	0	0	0	0
228	5	0	0	0	0
228	6	0	0	0	0
228	7	0	0	0	0
228	8	0	0	0	0
228	9	0	0	0	0
228	10	0	0	0	0
228	11	0	0	0	0
228	12	0	0	0	0
228	13	0	0	0	0
228	14	0	0	0	0
228	15	0	0	0	0
228	16	0	0	0	0
228	17	0	0	0	0
228	18	0	0	0	0
228	19	0	0	0	0
228	20	0	0	0	0
232	1	0	0	0	0
232	2	0	0	0	0
232	3	0	0	0	0
232	4	0	0	0	0
232	5	0	0	0	0
232	6	0	0	0	0
232	7	0	1	0	0
232	8	0	0	0	0
232	9	0	0	0	0
232	10	0	0	0	0
232	11	0	0	0	0
232	12	0	0	0	0
232	13	1	1	0	0
232	14	0	1	0	0
232	15	0	0	0	0
232	16	0	0	0	0
232	17	0	0	0	0
232	18	0	0	0	0
232	19	0	0	2	0
232	20	0	1	0	0
236	1	2	1	0	0
236	2	0	0	0	0
236	3	0	0	0	0
236	4	0	0	0	0
236	5	0	0	0	0
236	6	1	0	0	0
236	7	0	0	0	0
236	8	0	0	0	0
236	9	0	1	0	0
236	10	0	0	0	0
236	11	0	0	0	0
236	12	0	0	0	0
236	13	1	1	3	1
236	14	0	1	0	0
236	15	0	0	0	0
236	16	0	0	0	0
236	17	0	0	0	0
236	18	0	0	0	0
236	19	0	0	0	0
236	20	0	0	0	0
240	1	0	4	0	0
240	2	2	6	0	2
240	3	0	0	0	0
240	4	0	0	0	0
240	5	0	0	0	0
240	6	0	0	1	0
240	7	0	0	1	2
240	8	0	1	0	0
240	9	1	0	0	0
240	10	0	4	1	0
240	11	0	1	0	0
240	12	0	0	0	0
240	13	1	0	3	0
240	14	0	2	0	1
240	15	0	0	0	0
240	16	0	0	0	0
240	17	0	0	0	0
240	18	0	0	0	0
240	19	0	0	0	0
240	20	0	0	0	0

TABLE E4. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
242	1	0	4	0	0
242	2	0	2	0	0
242	3	0	0	0	0
242	4	1	1	0	0
242	5	0	0	0	0
242	6	1	0	0	0
242	7	0	1	0	1
242	8	1	2	0	0
242	9	0	0	0	0
242	10	0	0	0	0
242	11	0	1	1	1
242	12	3	0	0	0
242	13	0	1	0	0
242	14	1	0	0	0
242	15	0	0	0	0
242	16	0	0	0	0
242	17	0	0	0	0
242	18	0	0	0	0
242	19	0	0	0	0
242	20	0	0	0	0
248	1	1	0	0	0
248	2	0	1	0	0
248	3	0	1	0	0
248	4	0	0	0	0
248	5	0	3	0	0
248	6	0	0	0	0
248	7	0	1	0	0
248	8	1	0	0	0
248	9	0	0	0	0
248	10	2	0	0	0
248	11	0	2	0	0
248	12	0	1	0	1
248	13	1	5	1	1
248	14	2	1	0	0
248	15	0	0	0	0
248	16	0	0	0	0
248	17	0	1	0	0
248	18	0	0	0	0
248	19	0	0	0	0
248	20	1	1	0	0
250	1	1	0	0	0
250	2	0	0	0	0
250	3	0	0	0	0
250	4	0	0	0	0
250	5	0	0	0	0
250	6	0	0	0	0
250	7	1	0	0	0
250	8	0	0	0	0
250	9	0	1	0	0
250	10	0	1	0	0
250	11	0	0	0	0
250	12	0	0	0	0
250	13	0	0	0	0
250	14	1	0	1	0
250	15	0	0	0	0
250	16	0	0	0	0
250	17	0	0	0	0
250	18	0	0	0	0
250	19	0	2	0	0
250	20	1	0	0	0
253	1	0	0	0	0
253	2	0	0	0	0
253	3	0	0	0	0
253	4	0	0	0	0
253	5	0	0	0	0
253	6	0	0	0	0
253	7	0	0	0	0
253	8	0	1	0	0
253	9	0	2	0	0
253	10	0	1	0	0
253	11	0	0	0	0
253	12	0	0	0	0
253	13	0	1	0	0
253	14	0	0	0	0
253	15	0	1	0	0
253	16	0	1	0	0
253	17	0	0	0	0
253	18	0	0	0	0
253	19	1	0	0	0
253	20	0	0	0	0
129	1	0	0	1	3
129	2	0	0	1	2
129	3	0	0	1	0
129	4	0	0	3	4
129	5	1	1	7	1
129	6	0	2	1	4
129	7	0	0	1	0
129	8	0	0	1	1
129	9	0	0	4	6
129	10	0	0	4	3
129	11	0	0	4	3
129	12	0	0	0	2
129	13	2	1	0	1
129	14	1	2	0	3
129	15	1	0	2	2
129	16	0	0	1	2
129	17	0	1	4	1
129	18	0	0	1	0
129	19	0	0	0	0
129	20	0	0	7	8
131	1	0	0	2	0
131	2	0	0	0	0
131	3	0	0	0	0
131	4	0	0	4	6
131	5	0	2	2	0
131	6	0	0	0	0
131	7	0	0	0	0
131	8	0	0	0	0
131	9	3	1	0	0
131	10	0	0	0	1
131	11	2	0	0	3
131	12	0	0	0	0
131	13	0	0	1	0
131	14	0	0	0	0
131	15	0	0	0	0
131	16	0	0	0	0
131	17	0	0	0	0
131	18	0	0	0	0
131	19	0	0	0	0
131	20	2	4	7	5
135	1	1	0	0	0
135	2	0	2	1	0
135	3	0	1	0	0
135	4	0	0	1	1
135	5	1	0	1	1
135	6	0	0	0	0
135	7	0	0	0	1
135	8	0	0	0	0
135	9	0	1	0	0
135	10	0	0	0	0
135	11	0	3	0	2
135	12	0	0	0	0
135	13	0	0	0	1
135	14	0	1	0	0
135	15	0	0	0	0
135	16	1	0	0	0
135	17	0	0	0	3
135	18	0	0	0	0
135	19	0	0	1	0
135	20	1	5	4	6
138	1	0	1	0	1
138	2	0	0	0	0
138	3	0	1	0	0
138	4	0	3	0	0
138	5	2	1	0	0
138	6	0	0	0	0
138	7	0	0	0	0
138	8	0	0	1	0
138	9	0	0	0	0
138	10	0	0	1	2
138	11	1	3	1	2
138	12	0	0	0	0
138	13	0	0	0	0
138	14	0	1	0	0
138	15	0	0	0	0
138	16	0	0	0	0
138	17	0	0	0	1
138	18	0	0	0	0
138	19	0	0	0	0
138	20	4	4	4	1

TABLE E4. CONTINUED

DATE	TRAP	OM FEMALE	OM MALE	SC FEMALE	SC MALE
162	1	3	7	1	3
162	2	21	10	2	1
162	3	2	2	1	1
162	4	12	7	3	2
162	5	7	4	1	2
162	7	7	8	0	0
162	8	2	3	4	0
162	9	8	5	0	3
162	10	15	7	0	0
162	11	31	17	1	2
162	12	4	3	0	0
162	13	3	2	0	1
162	14	8	6	4	0
162	15	2	0	0	2
162	16	2	3	1	0
162	17	6	4	3	1
162	18	2	0	2	2
162	19	15	8	1	2
162	20	7	5	2	3
162	20	14	24	2	3
149	1	1	2	0	0
149	2	0	0	0	0
149	3	0	0	0	0
149	4	1	1	0	0
149	5	0	0	0	0
149	6	0	0	0	0
149	7	0	0	0	0
149	8	0	0	0	0
149	9	0	0	1	0
149	10	1	0	0	1
149	11	0	0	0	0
149	12	0	0	0	0
149	13	0	0	0	0
149	14	0	0	0	0
149	15	0	0	0	0
149	16	0	0	0	0
149	17	14	8	2	2
149	18	0	0	0	0
149	19	2	4	0	0
149	20	0	0	0	0
143	1	0	2	0	0
143	2	0	2	1	0
143	3	0	1	0	1
143	4	2	2	5	5
143	5	1	1	0	0
143	6	0	1	1	1
143	7	1	0	0	0
143	8	0	3	2	0
143	9	2	3	2	5
143	10	2	1	1	1
143	11	7	9	1	4
143	12	0	0	1	1
143	13	0	0	0	0
143	14	1	2	0	0
143	15	0	2	0	0
143	16	2	3	1	1
143	17	2	1	0	0
143	18	1	2	0	0
143	19	2	0	0	0
143	20	16	9	2	4
156	1	4	5	0	0
156	2	0	0	0	0
156	3	5	4	0	0
156	4	6	2	0	0
156	5	9	7	1	2
156	6	0	3	0	0
156	7	3	3	0	0
156	8	9	3	1	2
156	9	15	12	1	0
156	10	2	5	0	0
156	11	0	0	0	0
156	12	4	10	0	0
156	13	3	3	0	0
156	14	0	1	0	0
156	15	0	4	0	0
156	16	4	10	0	0
156	17	0	0	0	0
156	18	0	0	0	0
156	19	3	2	0	0
156	20	23	55	5	8
152	1	4	2	0	0
152	2	2	2	0	0
152	3	1	0	0	0
152	4	6	2	1	1
152	5	0	0	0	0
152	6	1	5	0	0
152	7	5	0	0	0
152	8	3	2	1	3
152	9	0	0	0	0
152	10	6	8	0	2
152	11	0	3	1	1
152	12	0	0	0	0
152	13	0	0	1	1
152	14	0	0	0	0
152	15	0	1	0	0
152	16	0	0	0	3
152	17	0	1	0	0
152	18	4	6	0	0
152	19	0	0	0	0
152	20	0	0	0	0

TABLE E5

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
LOC 1	1	169	20	31	51	52
	2	169	23	45	79	85
	3	169	10	5	11	5
	4	169	3	1	3	0
	1	172	0	0	1	1
	2	172	2	0	2	4
	3	172	17	18	81	55
	4	172	18	9	54	23
	1	176	11	13	37	20
	2	176	11	11	61	53
	3	176	4	2	1	0
	4	176	1	0	1	0
	1	179	3	0	2	2
	2	179	2	0	2	0
	3	179	2	0	1	3
	4	179	0	0	0	0
	1	183	7	3	35	0
	2	183	4	1	17	11
	3	183	1	0	5	3
	4	183	0	1	3	0
	1	185	2	2	12	3
	2	185	1	2	10	3
	3	185	0	0	4	2
	4	185	0	0	0	0
	1	190	0	0	2	0
	2	190	1	1	0	4
	3	190	0	0	1	0
	4	190	1	0	2	0
	1	193	3	0	5	1
	2	193	3	1	5	3
	3	193	3	0	1	0
	4	193	1	1	0	0
	1	197	1	0	1	0
	2	197	0	0	0	0
	3	197	2	0	0	0
	4	197	0	0	1	1
	1	200	0	0	0	0
	2	200	3	1	0	0
	3	200	0	0	0	0
	4	200	0	0	0	0
	1	204	1	1	1	0
	2	204	3	0	0	1
	3	204	2	0	0	0
	4	204	2	0	0	0
	1	207	10	15	0	1
	2	207	35	26	1	1
	3	207	8	10	1	2
	4	207	3	10	0	0
	1	211	2	0	0	0
	2	211	5	2	2	0
	3	211	4	0	0	0
	4	211	3	0	0	0
	1	214	5	0	3	1
	2	214	9	2	0	1
	3	214	0	0	0	0
	4	214	1	0	0	0
	1	217	0	3	0	0
	2	217	3	3	0	0
	3	217	1	1	0	0
	4	217	0	0	0	0
	1	221	2	0	0	0
	2	221	1	0	1	0
	3	221	1	0	0	0
	4	221	0	0	0	0
	1	225	2	0	0	1
	2	225	0	2	0	0
	3	225	0	0	0	1
	4	225	0	0	0	0
	1	228	0	0	0	0
	2	228	0	0	0	0
	3	228	0	0	0	0
	4	228	0	0	0	0
	1	232	0	1	2	0
	2	232	0	2	0	0
	3	232	0	0	0	0
	4	232	0	0	0	0
	1	235	0	2	0	0
	2	235	2	2	0	2
	3	235	1	6	0	1
	4	235	2	0	0	0
	1	239	3	2	0	1
	2	239	5	3	0	1
	3	239	0	0	0	0
	4	239	0	0	0	0
	1	242	0	5	0	0
	2	242	3	5	0	0
	3	242	1	1	0	0
	4	242	1	1	0	0
	1	247	13	10	0	0
	2	247	4	5	0	[illegible]
	3	247	0	1	0	0
	4	247	0	0	0	0
	1	250	1	7	1	0
	2	250	5	6	0	3
	3	250	1	0	0	0
	4	250	0	0	0	0
	1	253	5	1	0	1
	2	253	12	1	2	1
	3	253	0	1	0	0
	4	253	0	0	0	0
	1	256	11	9	0	0
	2	256	20	15	2	5
	3	256	0	2	0	0
	4	256	0	0	0	0
	1	261	17	12	1	2
	2	261	18	11	0	2
	3	261	0	0	0	0
	4	261	0	1	0	0
	1	264	5	5	0	0
	2	264	6	6	0	3
	3	264	1	1	0	0
	4	264	0	0	0	0
	1	281	2	0	0	0
	2	281	3	5	0	0
	3	281	0	1	0	0
	4	281	0	0	1	0
	1	283	2	0	0	0
	2	283	0	1	0	0
	3	283	3	1	0	0
	4	283	1	0	0	0
	1	290	2	1	0	0
	2	290	0	0	0	0
	3	290	0	1	0	0
	4	290	0	0	0	0
	1	295	3	2	0	0
	2	295	2	0	0	0
	3	295	1	0	0	0
	4	295	0	0	0	1
	1	298	0	1	0	0
	2	298	2	1	0	0
	3	298	1	0	0	0
	4	298	0	0	0	0
LOC 2	1	169	104	141	221	243
	2	169	130	139	205	201
	3	169	49	27	45	40
	4	169	80	100	60	90
	1	172	73	30	121	83
	2	172	45	25	66	30
	3	172	23	11	7	5
	4	172	50	30	70	43
	1	176	71	69	313	241
	2	176	93	83	319	307
	3	176	21	12	69	26
	4	176	70	70	141	75
	1	179	20	4	54	17
	2	179	14	6	21	14
	3	179	3	2	7	2
	4	179	24	19	22	13
	1	183	26	14	176	119
	2	183	17	6	91	37
	3	183	19	10	48	12
	4	183	7	3	47	3
	1	185	12	6	104	57
	2	185	9	7	31	7
	3	185	7	10	27	10
	4	185	2	2	19	14
	1	190	4	6	15	3
	2	190	2	1	5	5
	3	190	3	1	8	6
	4	190	3	4	1	1

E5 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
1	193	7	3	29	7
2	193	8	5	27	5
3	193	7	9	21	8
4	193	2	2	2	5
1	197	4	2	0	0
2	197	5	6	2	0
3	197	1	1	0	1
4	197	1	0	1	0
1	200	7	4	3	0
2	200	4	3	4	2
3	200	5	1	2	0
4	200	0	1	0	1
1	204	6	2	2	2
2	204	13	7	3	2
3	204	2	9	1	1
4	204	1	5	0	0
1	207	0	0	1	1
2	207	0	0	0	0
3	207	0	0	0	0
4	207	0	0	0	0
1	211	10	6	1	0
2	211	9	15	1	1
3	211	9	13	2	0
4	211	2	5	0	0
1	214	43	9	6	1
2	214	26	21	8	0
3	214	11	14	4	0
4	214	9	7	0	0
1	217	15	6	1	0
2	217	19	15	1	0
3	217	5	11	0	0
4	217	1	0	0	0
1	221	9	0	0	0
2	221	12	5	0	0
3	221	3	5	0	0
4	221	5	2	0	0
1	225	0	1	0	0
2	225	3	3	3	0
3	225	1	6	0	0
4	225	6	2	0	0
1	228	1	0	0	3
2	228	1	0	0	4
3	228	1	6	0	3
4	228	0	1	0	0
1	232	0	1	0	0
2	232	0	0	1	0
3	232	0	0	0	2
4	232	1	0	0	0
1	235	2	1	0	0
2	235	2	3	0	1
3	235	0	0	0	0
4	235	1	0	0	0
1	239	0	1	1	4
2	239	4	3	0	1
3	239	9	2	0	5
4	239	0	0	0	2
1	242	0	3	2	0
2	242	16	9	1	3
3	242	17	9	0	0
4	242	18	10	2	4
1	247	6	3	0	0
2	247	27	15	0	0
3	247	28	6	3	0
4	247	18	5	0	0
1	250	2	4	0	0
2	250	37	13	0	0
3	250	11	9	0	0
4	250	9	4	2	0
1	253	3	7	11	2
2	253	2	12	8	2
3	253	3	4	3	1
4	253	2	2	0	8
1	256	2	12	10	12
2	256	22	35	0	18
3	256	13	11	12	10
4	256	9	12	11	3
1	261	8	9	12	18
2	261	33	53	1	13
3	261	22	15	10	8
4	261	18	18	8	18

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	1	264	4	16	5	5
	2	264	18	30	15	31
	3	264	5	9	4	4
	4	264	7	15	1	1
	1	281	3	4	0	0
	2	281	3	0	0	0
	3	281	0	1	0	0
	4	281	2	1	0	0
	1	283	1	0	0	0
	2	283	1	1	0	0
	3	283	2	0	0	0
	4	283	0	0	0	0
	1	290	4	2	0	0
	2	290	2	0	0	1
	3	290	2	0	0	0
	4	290	4	1	0	0
	1	296	5	1	0	0
	2	296	2	1	1	0
	3	296	7	3	0	0
	4	296	6	4	0	0
	1	298	0	2	0	0
	2	298	1	0	1	0
	3	298	1	0	0	0
	4	298	2	1	0	0
LOC	1	169	20	5	23	7
3	2	169	29	10	45	53
	3	169	26	9	36	45
	4	169	27	12	38	43
	1	172	15	10	88	44
	2	172	36	13	89	35
	3	172	22	11	62	38
	4	172	36	15	70	49
	1	176	19	12	69	29
	2	176	12	13	31	29
	3	176	14	7	17	14
	4	176	13	8	25	15
	1	179	9	2	32	11
	2	179	2	1	19	9
	3	179	8	2	25	5
	4	179	6	4	13	4
	1	183	3	0	26	4
	2	183	17	6	91	17
	3	183	2	1	28	18
	4	183	2	1	7	5
	1	185	1	0	3	3
	2	185	1	0	8	0
	3	185	0	1	9	8
	4	185	1	1	6	2
	1	190	1	0	10	7
	2	190	4	0	9	15
	3	190	0	0	18	7
	4	190	0	3	4	7
	1	193	7	3	11	3
	2	193	7	2	17	3
	3	193	10	1	12	0
	4	193	4	3	4	1
	1	197	1	0	0	0
	2	197	5	1	2	0
	3	197	1	1	0	1
	4	197	0	0	0	0
	1	200	2	5	0	1
	2	200	5	7	1	4
	3	200	4	7	1	0
	4	200	6	3	3	1
	1	204	3	3	0	1
	2	204	6	2	0	1
	3	204	6	1	1	0
	4	204	8	2	0	0
	1	207	11	7	6	3
	2	207	14	14	13	1
	3	207	4	6	6	0
	4	207	11	14	3	2
	1	211	9	4	6	0
	2	211	17	13	9	3
	3	211	8	7	7	1
	4	211	11	6	4	2
	1	214	19	7	13	1
	2	214	46	40	29	6
	3	214	27	24	25	9
	4	214	36	19	24	2

25 CONTINUED

	TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
	1	217	13	15	1	0
	2	217	27	45	1	14
	3	217	20	33	4	12
	4	217	12	24	2	3
	1	221	14	8	12	1
	2	221	23	19	34	5
	3	221	18	13	14	1
	4	221	9	5	3	0
	1	225	21	4	12	0
	2	225	35	13	26	1
	3	225	21	7	11	1
	4	225	10	3	5	2
	1	228	2	4	0	1
	2	228	5	9	0	5
	3	228	3	5	0	6
	4	228	1	5	0	5
	1	232	3	2	0	2
	2	232	3	5	0	6
	3	232	2	3	0	9
	4	232	0	0	0	1
	1	235	0	5	0	0
	2	235	0	3	0	4
	3	235	2	5	0	3
	4	235	2	3	0	0
	1	239	6	5	1	9
	2	239	4	12	1	16
	3	239	7	8	1	9
	4	239	3	4	1	1
	2	242	5	4	0	0
	1	242	2	6	0	1
	3	242	3	3	0	0
	4	242	0	1	0	0
	1	247	12	7	7	0
	2	247	28	25	15	9
	3	247	17	11	2	3
	4	247	5	2	0	2
	1	250	11	6	3	7
	2	250	30	15	12	10
	3	250	13	10	9	9
	4	250	4	1	4	0
	1	253	14	7	0	1
	2	253	53	25	5	13
	3	253	17	11	0	4
	4	253	5	3	0	0
	1	256	11	14	1	2
	2	256	67	52	0	2
	3	256	25	28	1	16
	4	256	4	6	2	3
	1	261	17	17	0	1
	2	261	33	53	1	3
	3	261	13	16	0	0
	4	261	6	7	0	0
	1	264	4	6	0	1
	2	264	29	14	1	0
	3	264	12	9	0	1
	4	264	7	6	0	0
	1	281	2	4	0	0
	2	281	0	2	0	0
	3	281	5	2	0	0
	4	281	4	3	0	0
	1	283	3	2	0	0
	2	283	2	0	0	0
	3	283	4	1	0	0
	4	283	2	1	0	0
	1	290	8	2	0	0
	2	290	9	3	0	0
	3	290	11	3	0	0
	4	290	7	1	1	0
	1	295	4	1	0	0
	2	295	7	3	0	0
	3	295	4	2	0	0
	4	295	5	1	0	0
	1	298	5	2	0	0
	2	298	9	4	1	2
	3	298	7	3	0	1
	4	298	5	1	0	0
LOC	1	169	98	44	291	319
4	2	169	52	35	272	354
	3	169	59	36	230	219
	4	169	58	65	275	327

TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
1	172	37	19	91	98
2	172	49	17	109	83
3	172	33	12	63	29
4	172	64	20	95	55
1	176	33	29	206	132
2	176	53	23	105	133
3	176	15	15	39	28
4	176	34	28	79	69
1	179	18	4	106	35
2	179	21	6	62	22
3	179	17	0	27	13
4	179	24	3	48	11
1	183	32	7	51	18
2	183	34	8	42	22
3	183	30	11	19	10
4	183	21	9	13	13
1	185	16	3	14	10
2	185	12	1	23	10
3	185	15	1	9	3
4	185	3	4	3	2
1	190	14	11	29	24
2	190	17	18	33	31
3	190	17	8	33	31
4	190	7	6	8	3
1	193	23	15	56	26
2	193	30	29	41	24
3	193	17	14	37	30
4	193	10	10	33	8
1	197	18	12	12	2
3	197	12	6	6	5
2	197	35	9	20	3
4	197	3	0	7	3
1	200	2	5	6	3
2	200	5	12	13	6
3	200	3	3	6	3
4	200	8	3	4	1
1	204	11	9	4	5
2	204	12	13	4	4
3	204	8	3	10	1
4	204	4	1	1	2
1	207	10	10	5	2
2	207	24	17	5	0
3	207	7	3	6	1
4	207	23	0	3	0
1	211	23	14	7	5
2	211	33	19	5	3
3	211	21	14	4	2
4	211	14	6	0	0
1	214	26	14	27	1
2	214	32	9	8	7
3	214	27	10	11	3
4	214	18	7	6	2
1	217	18	7	5	0
2	217	33	16	2	2
3	217	19	3	3	1
4	217	14	1	3	2
1	221	13	7	9	0
2	221	14	6	8	7
3	221	12	7	7	0
4	221	26	8	2	3
1	225	19	5	5	0
2	225	12	10	0	0
3	225	19	2	1	0
4	225	17	6	11	0
1	228	1	4	0	6
2	228	4	2	0	2
3	228	0	1	0	1
4	228	4	5	0	1
1	232	0	0	0	3
2	232	0	2	0	1
3	232	2	7	0	1
4	232	2	2	0	0
1	235	0	0	0	0
2	235	1	1	0	0
3	235	0	0	0	0
4	235	2	2	0	4
1	239	4	5	0	2
2	239	1	5	0	5
3	239	5	6	1	5
4	239	5	9	1	6

E5 CONTINUED

	TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
	1	242	5	2	0	3
	2	242	1	4	0	0
	3	242	1	5	0	1
	4	242	4	10	0	0
	1	247	8	7	0	0
	2	247	7	9	0	1
	3	247	10	9	1	2
	4	247	6	11	3	3
	1	250	2	2	2	0
	2	250	2	9	1	1
	3	250	2	6	0	1
	4	250	2	2	2	1
	1	253	2	1	3	0
	2	253	0	0	0	0
	3	253	1	5	0	0
	4	253	1	5	0	0
	1	256	2	11	0	0
	2	256	5	11	0	0
	3	256	0	5	0	0
	4	256	0	10	0	0
	1	261	3	15	0	0
	2	261	3	11	0	0
	3	261	3	7	0	0
	4	261	2	17	0	0
	1	264	8	3	0	0
	2	264	3	4	0	0
	3	264	3	9	0	0
	4	264	2	9	0	0
	1	290	1	0	0	0
	2	290	0	2	0	0
	3	290	0	0	0	0
	4	290	0	1	0	0
	1	281	1	2	0	0
	2	291	0	0	0	0
	3	281	1	2	0	0
	4	291	9	2	0	0
	1	283	3	0	0	0
	2	283	1	2	0	0
	3	283	3	1	0	0
	4	293	2	0	0	0
	1	295	3	1	0	0
	2	295	3	0	0	0
	3	295	1	0	0	0
	4	295	3	0	0	0
	1	298	0	2	0	0
	2	298	3	0	1	3
	3	298	2	1	0	0
	4	298	3	0	0	0
LOC 5	1	169	19	12	69	61
	2	169	24	15	39	34
	3	169	33	24	77	77
	4	169	46	26	42	44
	1	172	12	9	100	83
	2	172	13	8	89	48
	3	172	3	3	51	39
	4	172	21	10	93	81
	1	176	20	12	152	136
	2	176	7	11	255	267
	3	176	2	3	54	56
	4	176	14	6	72	69
	1	179	0	0	19	13
	2	179	0	6	23	21
	3	179	1	1	1	3
	4	179	2	0	6	6
	1	183	3	1	128	39
	2	183	0	1	34	34
	3	183	0	0	22	11
	4	183	7	0	37	12
	1	185	2	0	18	13
	2	185	2	0	18	13
	3	185	1	0	0	0
	4	185	3	0	4	2
	1	190	2	0	6	3
	2	190	0	1	4	0
	3	190	0	0	3	0
	4	190	0	0	5	0
	1	193	5	4	5	0
	2	193	2	2	4	0
	3	193	1	0	3	0
	4	193	2	1	3	2

TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
1	197	3	2	4	3
2	197	8	1	7	5
3	197	5	3	17	6
4	197	2	3	8	16
1	200	2	1	0	1
2	200	0	1	1	1
3	200	1	4	2	0
4	200	3	1	2	2
1	204	4	1	3	0
2	204	5	0	1	0
3	204	3	1	1	0
4	204	6	1	0	0
1	207	11	2	0	0
2	207	9	1	2	0
3	207	13	4	0	0
4	207	22	5	0	0
1	211	12	6	1	1
2	211	29	15	10	4
3	211	19	6	1	0
4	211	22	8	4	0
1	214	5	3	3	1
2	214	21	12	4	0
3	214	10	6	0	1
4	214	18	7	1	1
1	217	14	3	4	3
2	217	34	16	10	1
3	217	10	9	3	3
4	217	21	4	0	0
1	221	1	0	0	0
2	221	9	2	2	0
3	221	1	1	0	0
4	221	4	5	0	0
1	225	1	0	2	0
2	225	13	4	3	1
3	225	1	3	1	1
4	225	10	3	3	1
1	228	0	2	0	1
2	228	1	2	0	1
3	228	0	0	0	1
4	228	0	1	0	0
1	232	1	1	0	0
2	232	1	3	0	1
3	232	1	2	0	0
4	232	0	1	0	0
1	235	0	1	0	1
2	235	1	1	0	1
3	235	0	0	0	0
4	235	0	1	0	0
1	239	1	2	0	0
2	239	2	2	0	13
3	239	2	3	0	0
4	239	1	3	0	1
1	242	1	3	0	1
2	242	9	17	1	0
3	242	1	2	0	0
4	242	2	4	0	1
1	247	1	4	2	1
2	247	6	6	3	2
3	247	0	3	3	3
4	247	12	0	2	3
1	250	0	2	10	12
2	250	7	9	7	13
3	250	2	0	2	10
4	250	4	6	4	16
1	253	10	10	20	10
2	253	12	8	18	16
3	253	12	10	10	14
4	253	6	15	11	20
1	256	21	13	20	10
2	256	13	14	22	11
3	256	12	17	10	18
4	256	15	19	20	10
1	261	10	12	10	20
2	261	24	18	13	2
3	261	10	2	20	10
4	261	10	11	10	0
1	264	1	1	0	0
2	264	3	15	2	1
3	264	5	2	0	0
4	264	2	0	0	0

E5 CONTINUED

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	1	290	1	0	0	0
	2	290	3	2	0	0
	3	290	2	0	0	0
	4	290	2	0	1	0
	1	281	1	0	0	0
	2	281	3	4	0	0
	3	281	3	1	0	0
	4	281	2	1	0	0
	2	283	2	0	0	0
	1	283	1	1	0	0
	3	283	0	0	0	1
	4	283	1	0	0	0
	1	299	3	0	1	0
	2	299	2	1	0	0
	4	299	1	1	0	0
	3	299	2	0	0	0
LOC 6	1	169	60	31	140	121
	2	169	51	24	156	154
	3	169	37	8	48	40
	4	169	30	21	59	49
	1	172	17	22	118	83
	2	172	40	16	221	128
	3	172	18	9	73	49
	4	172	17	11	43	22
	2	176	21	12	128	96
	1	176	43	31	63	59
	3	176	12	9	59	33
	4	176	13	8	25	15
	1	179	7	6	22	13
	2	179	6	6	22	7
	3	179	2	1	5	4
	4	179	2	2	2	5
	1	183	15	4	36	9
	2	133	7	8	61	19
	3	183	4	0	15	2
	4	133	3	4	14	3
	1	185	3	2	12	5
	2	185	5	13	23	13
	3	185	0	2	4	2
	4	185	6	1	10	7
	1	190	4	5	15	4
	2	190	8	9	16	9
	3	190	2	3	8	2
	4	190	4	4	12	4
	1	193	12	6	7	2
	2	193	18	13	18	2
	3	193	5	6	1	2
	4	193	3	0	8	2
	1	197	53	25	7	2
	2	197	98	38	15	1
	3	197	42	48	9	1
	4	197	29	13	8	0
	1	200	50	30	13	3
	2	200	44	36	17	10
	3	200	18	19	12	4
	4	200	12	18	13	0
	1	204	36	20	0	0
	2	204	73	45	0	0
	3	204	36	24	0	0
	4	204	29	12	5	0
	1	207	33	19	0	0
	2	207	55	28	6	1
	3	207	38	33	0	0
	4	207	28	12	2	0
	1	211	45	35	2	1
	2	211	79	53	0	0
	3	211	73	35	3	0
	4	211	60	41	4	2
	1	214	44	11	5	0
	2	214	75	27	15	0
	3	214	25	10	13	0
	4	214	30	8	3	1
	1	217	48	19	14	6
	2	217	76	37	14	4
	3	217	32	9	7	3
	4	217	11	14	1	1
	1	221	11	7	5	0
	2	221	12	14	5	1
	3	221	6	2	0	0
	4	221	7	1	2	2

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	1	225	11	6	3	1
	2	225	15	18	9	1
	3	225	8	1	4	1
	4	225	6	3	1	0
	1	228	0	0	0	0
	2	228	9	6	0	3
	3	228	2	4	0	0
	4	228	1	1	1	0
	1	232	18	14	1	7
	2	232	23	18	1	17
	3	232	21	6	4	1
	4	232	2	1	0	0
	1	235	7	9	4	19
	2	235	30	24	1	9
	3	235	7	9	1	3
	4	235	2	6	0	1
	1	239	31	19	3	25
	2	239	59	51	2	34
	3	239	32	14	0	13
	4	239	11	8	0	7
	1	242	31	22	20	10
	2	242	26	27	10	18
	3	242	29	32	10	20
	4	242	11	12	18	19
	1	247	65	18	12	6
	2	247	115	47	18	21
	3	247	68	29	10	12
	4	247	8	11	0	0
	1	250	22	5	1	9
	2	250	38	25	2	1
	3	250	13	14	3	3
	4	250	7	3	0	3
	1	253	16	8	1	2
	2	253	20	7	2	6
	3	253	12	11	0	3
	4	253	3	5	0	1
	1	256	15	14	2	2
	2	256	26	30	0	2
	3	256	30	24	0	1
	4	256	9	14	1	2
	1	261	17	11	0	0
	2	261	16	15	0	0
	3	261	23	25	0	0
	4	261	7	13	0	0
	1	264	9	3	2	1
	2	264	16	8	0	3
	3	264	7	9	1	1
	4	264	4	4	0	1
	1	290	2	0	0	3
	2	290	2	1	0	2
	3	290	3	1	0	0
	4	290	0	1	3	1
	1	281	3	0	3	0
	2	281	0	6	0	0
	3	281	5	2	0	0
	4	281	1	2	0	0
	1	283	2	0	0	0
	2	283	1	2	0	0
	3	283	2	0	0	0
	4	283	3	1	0	0
	2	296	6	1	7	3
	1	296	5	1	0	1
	3	296	3	0	0	0
	4	296	4	1	3	2
	1	298	1	1	3	0
	2	298	1	1	0	0
	3	298	1	0	0	1
	4	298	0	0	1	0
LOC. 7	1	156	30	20	11	7
	2	156	73	79	45	72
	3	156	186	354	58	63
	4	156	127	194	69	68
	5	156	101	99	42	28
	6	156	122	165	59	35
	7	156	313	187	213	130
	8	156	136	124	89	43
	9	156	187	90	45	19
	1	283	11	6	0	1
	2	283	15	7	2	1
	3	283	10	4	0	0

25 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
4	283	4	1	0	0
5	283	2	0	0	1
6	283	4	2	0	0
7	283	8	5	0	0
8	283	2	0	0	0
9	283	3	1	0	0
10	283	7	2	0	0
11	283	6	1	0	0
12	283	7	3	0	0
13	283	4	2	0	0
14	283	4	1	0	0
15	283	2	0	0	0
16	283	5	2	0	0
17	283	3	1	0	0
18	283	2	0	0	0
19	283	0	1	0	0
20	283	3	0	0	0
21	283	3	1	0	0
22	283	1	2	0	0
1	290	3	1	0	0
2	290	1	0	0	0
3	290	0	0	0	0
4	290	1	1	0	0
5	290	4	2	0	0
6	290	0	1	0	0
7	290	2	0	0	0
8	290	1	2	0	0
9	290	3	0	0	0
10	290	4	1	0	1
11	290	5	1	0	1
12	290	4	0	0	0
13	290	1	0	0	0
14	290	4	0	0	0
15	290	2	0	0	1
16	290	0	1	0	0
17	290	1	0	0	1
18	290	1	0	0	0
19	290	0	1	1	0
20	290	0	0	0	1
21	290	0	0	0	1
22	290	0	1	0	1
1	297	6	0	0	0
2	297	2	0	0	0
3	297	10	3	0	1
4	297	3	1	0	0
5	297	3	2	0	0
6	297	4	2	2	0
7	297	7	2	1	2
8	297	3	1	1	0
9	297	8	3	1	2
10	297	3	1	0	1
11	297	15	7	0	0
12	297	6	2	2	0
13	297	0	0	0	1
14	297	4	1	1	1
15	297	3	0	0	0
16	297	4	2	0	0
17	297	4	1	0	0
18	297	1	1	0	0
19	297	5	2	1	1
20	297	3	0	0	1
21	297	3	0	0	0
22	297	0	0	1	0
1	299	0	0	0	0
2	299	0	0	0	0
3	299	0	0	0	0
4	299	0	0	0	0
5	299	0	0	0	0
6	299	0	0	0	0
7	299	0	0	0	0
8	299	0	0	0	0
9	299	0	0	0	0
10	299	0	0	0	0
11	299	0	0	0	0
12	299	0	0	0	0
13	299	0	0	0	0
14	299	0	0	0	0
15	299	0	0	0	0
16	299	0	0	0	0
17	299	0	0	0	0
18	299	0	0	0	0
19	299	0	0	0	0
20	299	0	0	0	0
21	299	0	0	0	0
22	299	0	0	0	0
1	184	1	1	14	7
2	184	4	1	79	43
3	184	12	8	90	71
4	184	7	7	110	47
5	184	12	4	73	35
6	184	10	5	147	61
7	184	18	6	157	92
8	184	19	7	156	69
9	184	20	4	71	53
10	184	9	3	100	57
11	184	6	6	32	9
12	184	1	1	6	4
1	166	2	2	38	21
2	186	7	4	12	2
3	186	3	7	8	3
4	186	4	6	14	14
5	186	5	1	6	4
6	186	5	5	21	16
7	186	3	5	14	15
8	186	7	16	23	26
9	186	5	9	4	11
10	186	3	2	14	7
11	186	7	3	19	24
12	186	4	1	16	5
1	191	12	6	34	6
2	191	8	14	27	20
3	191	4	12	23	13
4	191	25	13	36	17
5	191	10	7	9	4
6	191	16	15	130	27
7	191	9	13	30	13
8	191	17	12	22	6
9	191	13	6	11	9
10	191	8	4	13	6
11	191	19	12	22	14
12	191	16	14	48	11
1	194	4	5	20	11
2	194	14	14	15	14
3	194	7	19	40	16
4	194	9	26	63	19
5	194	6	12	10	8
6	194	31	27	38	20
7	194	12	24	88	41
8	194	5	4	20	8
9	194	11	25	20	7
10	194	3	4	7	2
11	194	14	8	16	4
12	194	21	14	46	26
1	198	6	2	2	0
2	198	37	29	16	4
3	198	23	26	13	3
4	198	28	37	19	18
5	198	11	23	53	26
6	198	15	9	9	4
7	198	40	39	76	53
8	198	28	16	54	21
9	198	28	15	28	13
10	198	9	2	2	5
11	198	22	8	7	4
12	198	23	25	17	10
1	201	5	2	1	1
2	201	7	14	9	5
3	201	5	6	3	5
4	201	15	13	11	5
5	201	4	7	8	15
6	201	3	1	10	2
7	201	10	13	35	31
8	201	3	6	15	22
9	201	16	7	7	9
10	201	4	2	1	2
11	201	4	4	2	0
12	201	10	4	4	0
1	205	4	2	1	0
2	205	28	18	7	4
3	205	5	15	4	3

E5 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
4	205	14	16	3	0
5	205	3	2	2	0
6	205	6	5	4	1
7	205	28	11	13	5
8	205	20	16	19	4
9	205	9	4	1	0
10	205	11	3	2	0
11	205	24	8	6	1
12	205	15	9	3	0
1	208	1	3	2	0
2	208	16	31	16	6
3	208	27	20	8	6
4	208	15	17	16	2
5	208	3	2	8	1
6	208	20	21	29	6
7	208	16	12	9	5
8	208	11	7	3	3
9	208	11	13	13	4
10	208	18	2	2	2
11	208	9	7	1	0
12	208	25	9	9	3
1	212	8	4	4	0
2	212	45	39	20	7
3	212	17	28	28	12
4	212	34	40	31	25
5	212	10	11	11	11
6	212	63	30	71	11
7	212	68	26	127	20
8	212	23	22	40	7
9	212	29	33	22	7
10	212	19	4	17	2
11	212	22	11	8	2
12	212	42	19	26	3
1	214	0	1	0	0
2	214	8	15	2	2
3	214	23	19	12	5
4	214	18	11	5	1
5	214	2	2	1	1
6	214	14	7	7	2
7	214	19	17	18	3
8	214	5	13	16	4
9	214	10	4	4	0
10	214	4	2	1	1
11	214	4	2	1	0
12	214	20	4	7	1
13	214	0	1	1	0
14	214	2	0	0	0
15	214	3	2	1	0
16	214	2	1	0	0
17	214	9	1	3	1
18	214	3	1	2	1
19	214	1	3	0	0
20	214	10	3	0	0
21	214	1	3	3	0
22	214	2	2	1	0
1	219	13	7	4	4
2	219	17	8	6	2
3	219	33	32	10	4
4	219	7	12	6	2
5	219	16	12	2	2
6	219	32	26	29	0
7	219	59	26	21	10
8	219	17	17	11	0
9	219	19	10	10	2
10	219	20	7	13	0
11	219	17	7	2	0
12	219	26	9	6	3
13	219	18	11	4	3
14	219	10	2	2	4
15	219	16	6	2	2
16	219	16	7	3	2
17	219	8	6	10	1
18	219	29	9	0	2
19	219	14	6	5	1
20	219	30	8	1	1
21	219	17	13	0	0
22	219	22	11	0	0
1	226	2	0	1	0
2	226	9	5	4	1
3	226	13	12	13	11
4	226	10	5	3	4
5	226	3	2	4	2
6	226	15	13	34	17
7	226	15	2	16	2
8	226	1	1	2	2
9	226	9	6	5	0
10	226	1	0	2	0
11	226	4	1	0	1
12	226	4	0	2	0
13	226	1	1	6	2
14	226	2	0	0	3
15	226	1	2	0	1
16	226	2	0	2	2
17	226	8	1	8	1
18	226	1	1	0	3
19	226	2	0	0	0
20	226	1	1	1	1
21	226	1	1	0	1
22	226	0	4	0	0
1	229	1	0	0	1
2	229	3	7	0	1
3	229	6	5	0	1
4	229	2	0	0	4
5	229	1	0	0	3
6	229	14	1	3	22
7	229	3	8	1	41
8	229	0	1	0	1
9	229	2	0	0	1
10	229	1	1	0	4
11	229	1	4	0	1
12	229	0	1	1	3
13	229	3	1	1	1
14	229	1	0	0	2
15	229	2	0	0	3
16	229	0	0	0	2
17	229	0	2	0	2
18	229	1	0	0	0
19	229	0	0	0	2
20	229	0	0	0	1
21	229	0	1	0	0
22	229	2	2	2	3
1	233	1	0	0	2
2	233	5	7	0	3
3	233	8	4	1	10
4	233	0	7	2	9
5	233	0	0	0	0
6	233	11	47	4	90
7	233	4	20	8	52
8	233	5	12	1	7
9	233	2	14	5	17
10	233	2	2	1	0
11	233	2	1	0	0
12	233	1	3	1	6
13	233	2	5	0	4
14	233	0	9	0	2
15	233	0	7	0	3
16	233	1	3	1	13
17	233	0	8	0	2
18	233	0	0	0	0
19	233	1	2	0	7
20	233	2	2	0	0
21	233	0	6	0	3
22	233	2	1	0	2
1	236	0	1	3	1
2	236	2	2	1	4
3	236	2	3	1	3
4	236	0	0	1	0
5	236	4	1	1	4
6	236	2	2	6	19
7	236	5	12	2	24
8	236	2	2	1	1
9	236	3	2	0	9
10	236	1	3	0	2
11	236	0	3	0	0
12	236	0	5	0	6
13	236	0	2	0	0
14	236	2	3	0	1
15	236	2	2	3	0
16	236	0	3	3	1
17	236	2	1	0	1

25 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
18	236	0	1	1	1
19	236	0	3	1	2
20	236	1	4	2	2
21	236	1	1	0	0
22	236	2	2	0	3
1	240	0	4	1	2
2	240	4	5	0	9
3	240	7	9	3	13
4	240	1	12	2	12
5	240	0	4	1	9
6	240	1	3	4	25
7	240	11	2	9	52
8	240	2	4	1	3
9	240	4	11	3	9
10	240	3	4	3	7
11	240	4	2	0	4
12	240	3	5	0	3
13	240	1	5	1	0
14	240	0	2	1	1
15	240	2	4	0	2
16	240	0	11	1	3
17	240	1	4	1	4
18	240	0	1	3	2
19	240	4	0	2	2
20	240	1	3	0	3
21	240	0	1	0	0
22	240	0	4	0	0
1	243	0	5	0	0
2	243	1	13	0	7
3	243	10	16	7	9
4	243	5	8	2	0
5	243	1	4	0	2
6	243	2	5	0	3
7	243	18	5	10	10
8	243	5	9	1	2
9	243	12	13	1	3
10	243	3	5	0	6
11	243	7	4	0	2
12	243	4	6	0	0
13	243	2	3	0	0
14	243	1	5	3	2
15	243	1	4	0	1
16	243	0	1	2	1
17	243	5	21	0	5
18	243	3	7	1	2
19	243	0	4	0	2
20	243	4	3	1	2
21	243	1	3	0	2
22	243	2	3	0	2
1	247	1	11	0	1
2	247	5	17	1	5
3	247	12	27	7	11
4	247	16	11	0	4
5	247	4	7	1	2
6	247	8	4	3	7
7	247	25	21	9	18
8	247	6	8	2	7
9	247	33	21	6	18
10	247	5	15	6	15
11	247	16	12	5	2
12	247	2	7	0	4
13	247	2	0	0	6
14	247	1	5	0	2
15	247	5	6	0	4
16	247	2	14	8	4
17	247	8	18	3	7
18	247	5	11	0	2
19	247	2	4	0	9
20	247	4	3	2	2
21	247	1	11	1	3
22	247	3	8	2	4
1	249	1	12	1	2
2	249	11	27	1	1
3	249	11	20	7	7
4	249	7	15	11	4
5	249	2	5	2	1
6	249	13	8	6	5
7	249	15	21	12	4
8	249	0	2	5	2
9	249	16	17	12	12
10	249	3	17	4	6
11	249	9	25	2	2
12	249	6	14	0	0
13	249	1	10	2	0
14	249	2	12	0	0
15	249	1	3	3	0
16	249	1	10	0	0
17	249	4	10	2	0
18	249	1	5	1	1
19	249	2	5	0	0
20	249	5	19	0	2
21	249	0	3	0	0
22	249	0	4	2	0
1	253	0	2	10	11
2	253	9	19	11	12
3	253	15	24	11	14
4	253	9	16	13	19
5	253	8	6	14	12
6	253	18	8	17	15
7	253	39	12	30	54
8	253	6	3	13	18
9	253	19	15	17	15
10	253	2	10	11	13
11	253	2	20	12	12
12	253	0	17	10	13
13	253	5	8	5	7
14	253	0	6	6	4
15	253	2	2	6	2
16	253	3	7	1	3
17	253	6	16	4	1
18	253	5	3	2	3
19	253	3	3	1	4
20	253	7	7	2	8
21	253	1	0	2	1
22	253	2	4	6	4
1	257	1	8	20	20
2	257	3	37	20	22
3	257	19	43	22	36
4	257	7	12	23	39
5	257	7	11	23	23
6	257	24	14	22	27
7	257	48	38	47	65
8	257	11	12	32	36
9	257	33	21	38	40
10	257	7	18	22	28
11	257	14	35	24	21
12	257	9	28	20	20
13	257	0	10	11	11
14	257	0	7	9	10
15	257	2	14	11	8
16	257	12	16	12	12
17	257	3	30	4	3
18	257	8	14	9	11
19	257	9	12	13	14
20	257	8	15	12	17
21	257	1	7	4	8
22	257	6	12	5	3
1	261	3	21	20	20
2	261	8	42	22	26
3	261	22	38	21	20
4	261	11	31	24	26
5	261	5	10	22	21
6	261	7	6	23	29
7	261	28	26	34	51
8	261	8	7	24	22
9	261	23	41	21	25
10	261	11	25	22	26
11	261	8	34	21	22
12	261	20	33	20	20
13	261	10	11	10	11
14	261	1	13	9	14
15	261	2	10	6	7
16	261	3	3	8	6
17	261	4	17	4	3
18	261	3	12	3	6
19	261	1	11	10	3
20	261	5	21	2	12
21	261	1	3	8	11
22	261	2	10	4	2
1	264	3	42	10	10

E5 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
2	264	9	28	10	10
3	264	14	34	13	14
4	264	8	21	13	14
5	264	5	10	10	13
6	264	6	7	10	10
7	264	15	14	16	13
8	264	4	8	11	13
9	264	19	38	15	5
10	264	2	25	10	11
11	264	3	30	11	13
12	264	8	28	8	10
13	264	5	7	10	10
14	264	1	5	11	6
15	264	0	7	4	3
16	264	0	4	2	1
17	264	3	16	3	2
18	264	2	9	1	4
19	264	1	9	1	4
20	264	3	8	2	3
21	264	1	1	1	6
22	264	2	11	4	1
1	269	51	24	7	7
2	269	32	23	9	6
3	269	59	36	9	8
4	269	28	12	14	4
5	269	11	9	8	7
6	269	14	7	11	7
7	269	13	9	9	6
8	269	10	13	9	11
9	269	16	12	10	7
10	269	21	18	11	7
11	269	13	16	14	3
12	269	29	13	6	8
13	269	16	8	7	9
14	269	13	7	4	3
15	269	11	3	2	5
16	269	21	11	2	0
17	269	19	15	1	0
18	269	9	6	2	0
19	269	14	9	3	0
20	269	14	10	2	0
21	269	5	1	0	0
22	269	3	2	1	0
1	275	51	23	3	5
2	275	30	21	0	2
3	275	47	33	4	6
4	275	26	21	2	3
5	275	16	18	0	2
6	275	23	17	3	4
7	275	39	26	5	7
8	275	16	15	2	4
9	275	41	36	8	9
10	275	31	28	7	10
11	275	37	30	3	6
12	275	68	41	7	8
13	275	10	6	0	1
14	275	29	12	0	0
15	275	18	26	1	2
16	275	38	36	5	3
17	275	29	27	4	6
18	275	23	29	3	5
19	275	17	12	2	3
20	275	22	18	1	4
21	275	7	4	0	2
22	275	14	7	0	0
12	278	17	5	1	0
1	278	24	7	0	1
13	278	4	1	0	0
14	278	5	2	0	0
2	278	16	9	0	0
15	278	1	0	0	0
16	278	6	3	0	0
3	278	4	2	0	0
17	278	0	2	0	1
18	278	0	0	0	0
4	278	5	1	0	0
19	278	0	4	0	0
20	278	1	0	1	2
5	278	0	2	1	1
21	278	6	3	2	3

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
22	278	2	4	1	3
6	278	3	1	4	1
7	278	0	5	0	0
8	278	2	1	0	0
9	278	3	2	1	2
10	278	4	2	1	2
11	278	5	3	0	0
1	138	21	32	68	91
2	138	19	32	54	32
3	138	16	41	71	62
4	138	8	14	91	48
5	138	41	22	101	59
6	138	17	21	60	31
7	138	9	51	72	13
8	138	16	8	91	14
9	138	7	19	21	8
10	138	8	32	71	34
11	138	14	24	52	19
12	138	19	41	16	13
1	130	0	0	13	15
2	130	0	0	12	14
3	130	0	0	19	25
4	130	0	0	51	22
5	130	0	0	16	25
6	130	0	0	41	16
7	130	0	0	18	21
8	130	0	0	20	35
9	130	0	0	42	19
10	130	0	0	18	21
11	130	0	0	16	30
12	130	0	0	14	19
1	135	0	8	81	70
2	135	0	16	150	130
3	135	4	3	101	120
4	135	15	21	160	150
5	135	21	10	110	160
6	135	14	19	80	100
7	135	10	23	35	112
8	135	16	41	120	70
9	135	8	19	52	161
10	135	11	32	118	178
11	135	19	31	112	118
12	135	2	11	171	111
1	129	0	0	10	20
2	129	0	0	10	• 20
3	129	0	0	8	40
4	129	0	0	16	18
5	129	0	0	40	10
6	129	0	0	30	5
7	129	0	0	20	10
8	129	0	0	23	5
9	129	0	0	30	30
10	129	0	0	8	10
11	129	0	0	10	5
12	129	0	0	22	16
1	142	25	39	42	32
2	142	75	22	24	27
3	142	50	24	29	17
4	142	76	55	23	33
5	142	92	24	46	8
6	142	139	66	57	38
7	142	21	33	17	19
8	142	29	66	14	9
9	142	133	108	73	117
10	142	33	34	29	38
11	142	54	45	52	33
12	142	70	79	12	11
1	145	7	1	1	1
2	145	40	55	31	11
3	145	21	8	7	3
4	145	56	42	29	15
5	145	40	7	9	2
6	145	23	32	20	5
7	145	13	10	6	1
8	145	24	24	11	10
9	145	24	20	7	1
10	145	21	18	16	13
11	145	39	21	20	14
12	145	32	7	6	3
1	149	10	5	10	13

E5 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
2	149	16	13	14	7
3	149	11	6	10	4
4	149	209	31	23	4
5	149	33	8	10	3
6	149	34	28	24	6
7	149	19	11	17	5
8	149	55	84	39	22
9	149	32	69	27	12
10	149	26	21	30	18
11	149	50	47	24	30
12	149	40	44	20	8
1	151	6	3	0	0
2	151	14	7	7	3
3	151	31	27	9	1
4	151	60	90	30	21
5	151	92	45	24	13
6	151	53	52	21	21
7	151	29	41	15	6
8	151	60	74	20	5
9	151	43	33	8	2
10	151	31	20	16	18
11	151	94	46	26	6
12	151	29	29	21	16
10	156	92	25	43	11
11	156	194	133	35	19
12	156	87	16	33	13
1	159	66	15	25	3
2	159	137	72	131	108
3	159	181	148	33	41
4	159	172	123	125	64
5	159	84	85	43	25
6	159	134	164	114	75
7	159	101	75	74	32
8	159	70	53	35	5
9	159	151	65	47	19
10	159	28	9	16	10
11	159	150	73	49	27
12	159	66	42	82	9
1	162	17	3	7	2
2	162	57	64	20	21
3	162	107	67	31	11
4	162	93	77	46	33
5	162	60	57	17	9
6	162	103	109	55	30
7	162	158	89	102	63
8	162	84	51	27	17
9	162	60	54	48	23
10	162	28	6	19	7
11	162	105	60	28	26
12	162	43	26	35	15
1	166	7	5	10	12
2	166	58	47	65	219
3	166	79	58	61	58
4	166	80	52	115	146
5	166	53	48	20	33
6	166	90	70	67	29
7	166	49	46	38	23
8	166	122	61	102	158
9	166	62	31	44	29
10	166	18	9	24	18
11	166	56	43	25	27
12	166	36	11	27	24
1	170	62	82	131	241
2	170	25	7	40	18
3	170	56	48	47	63
4	170	33	48	69	115
5	170	26	14	58	52
6	170	79	50	169	100
7	170	98	83	179	174
8	170	86	37	107	198
9	170	62	38	85	77
10	170	25	22	32	35
11	170	73	33	44	39
12	170	38	18	23	12
1	173	27	11	41	24
2	173	28	28	188	288
3	173	13	13	75	52
4	173	21	15	76	573
5	173	6	6	33	22
6	173	29	29	139	87

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
7	173	39	39	190	127
8	173	14	14	120	70
9	173	46	19	60	51
10	173	27	15	61	42
11	173	40	27	44	38
12	173	23	17	79	42
1	177	5	2	14	3
2	177	12	11	41	26
3	177	7	7	37	19
4	177	8	5	32	24
5	177	8	5	32	24
6	177	14	19	54	28
7	177	15	7	55	19
8	177	7	6	67	26
9	177	8	6	24	17
10	177	8	2	20	24
11	177	6	4	8	8
12	177	8	0	15	5
1	180	2	6	2	0
2	180	16	9	98	124
3	180	2	33	7	10
4	180	19	10	30	33
5	180	3	3	10	10
6	180	6	10	32	16
7	180	4	5	13	11
8	180	4	0	6	16
9	180	3	1	1	3
10	180	3	0	8	5
11	180	3	2	0	3
12	180	0	1	2	2
1	221	22	2	1	3
2	221	14	7	2	4
3	221	24	5	2	1
4	221	9	7	3	1
5	221	5	3	0	0
6	221	23	3	1	2
7	221	31	3	8	2
8	221	11	6	2	1
9	221	10	3	2	3
10	221	8	2	1	1
11	221	18	4	2	2
12	221	16	2	2	3
13	221	18	6	9	4
14	221	8	5	3	0
15	221	8	2	1	1
16	221	4	3	1	0
17	221	15	3	1	3
18	221	9	0	1	2
19	221	10	3	0	0
20	221	13	6	1	3
21	221	4	0	1	1
22	221	2	1	1	1
1	222	12	3	1	0
2	222	10	2	2	2
3	222	11	1	0	3
4	222	17	5	2	4
5	222	14	4	5	0
6	222	8	6	1	2
7	222	9	7	1	2
8	222	11	3	1	9
9	222	14	9	3	0
10	222	9	2	4	0
11	222	16	1	2	0
12	222	7	5	5	1
13	222	8	4	2	3
14	222	15	3	1	2
15	222	13	7	8	0
16	222	11	2	5	1
17	222	3	2	1	2
18	222	2	3	1	2
19	222	1	2	0	0
20	222	3	4	1	1
21	222	3	3	1	2
22	222	1	3	1	2
1	220	15	3	1	0
2	220	11	2	2	0
3	220	17	1	1	1
4	220	9	1	0	0
5	220	1	2	2	2
6	220	5	0	1	3

E5 CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
7	220	5	2	3	1
8	220	3	3	0	0
9	220	3	0	1	4
10	220	2	0	0	0
11	220	9	1	4	1
12	220	2	4	0	3
13	220	6	0	2	0
14	220	3	0	0	1
15	220	6	0	3	0
16	220	4	0	1	2
17	220	3	0	1	1
18	220	2	3	2	0
19	220	0	0	0	2
20	220	5	0	5	1
21	220	1	0	0	1
22	220	0	0	1	0
1	227	1	2	1	0
2	227	2	1	2	0
3	227	1	0	1	1
4	227	4	0	0	2
5	227	2	0	1	0
6	227	1	0	1	1
7	227	3	0	2	0
8	227	2	1	0	2
9	227	1	4	3	0
10	227	0	1	1	1
11	227	0	0	0	1
12	227	2	0	1	0
13	227	3	0	2	2
14	227	1	0	0	0
15	227	2	0	0	1
16	227	3	0	1	0
17	227	4	1	2	2
18	227	5	2	1	1
19	227	2	1	0	1
20	227	3	0	1	0
21	227	2	1	0	2
22	227	3	1	2	1
1	228	1	1	1	1
2	228	2	1	1	0
3	228	1	2	2	1
4	228	3	0	0	0
5	228	0	1	1	2
6	228	1	0	0	2
7	228	2	1	2	0
8	228	1	0	0	1
9	228	4	0	3	0
10	228	0	1	0	1
11	228	1	1	1	2
12	228	2	0	0	0
13	228	3	1	2	1
14	228	0	0	2	0
15	228	3	2	1	2
16	228	1	0	0	0
17	228	2	0	0	1
18	228	0	3	2	0
19	228	5	0	0	2
20	228	0	1	1	2
21	228	2	0	0	0
22	228	3	2	2	1
1	234	1	0	0	1
2	234	2	1	1	0
3	234	0	1	0	1
4	234	1	0	1	0
5	234	2	0	1	1
6	234	4	2	0	1
7	234	3	0	2	2
8	234	2	1	0	0
9	234	1	0	1	3
10	234	3	2	0	0
11	234	2	0	1	1
12	234	1	3	1	0
13	234	4	1	0	2
14	234	0	1	2	0
15	234	5	0	0	3
16	234	1	1	3	1
17	234	2	2	1	0
18	234	3	0	2	3
19	234	2	1	0	2
20	234	1	0	1	0

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	21	234	3	1	1	1
	22	234	1	2	1	1
	1	241	2	2	1	0
	2	241	1	1	0	1
	3	241	3	2	2	2
	4	241	2	3	1	1
	5	241	1	2	2	1
	6	241	3	1	1	0
	7	241	1	3	0	2
	8	241	2	2	1	1
	9	241	0	4	2	3
	10	241	4	1	0	0
	11	241	0	3	1	2
	12	241	1	2	1	1
	13	241	3	1	2	3
	14	241	4	2	0	1
	15	241	1	5	1	2
	16	241	4	4	2	0
	17	241	0	2	1	1
	18	241	3	3	0	1
	19	241	2	1	1	2
	20	241	2	2	1	3
	21	241	3	3	1	1
	22	241	1	1	1	1
LOC 8	1	130	1	0	1	6
	2	130	0	0	2	1
	3	130	0	0	0	3
	4	130	1	0	2	2
	1	135	1	1	45	16
	2	135	5	0	35	16
	3	135	1	0	31	13
	4	135	1	2	3	2
	1	140	6	41	15	5
	2	140	6	8	15	4
	3	140	1	0	4	1
	4	140	0	0	3	1
	1	142	19	30	47	11
	2	142	3	8	14	2
	3	142	0	1	3	1
	4	142	0	0	1	3
	1	149	30	84	26	19
	2	149	5	21	9	14
	3	149	2	3	6	0
	4	149	0	1	0	0
	1	150	16	37	4	0
	2	150	5	17	1	3
	3	150	1	0	0	3
	4	150	0	0	1	0
	1	154	19	97	26	9
	2	154	6	47	10	11
	3	154	9	32	9	11
	4	154	0	0	0	0
	1	156	58	129	29	11
	2	156	43	77	16	7
	3	156	6	5	3	0
	4	156	1	0	1	0
	1	161	35	175	39	36
	2	161	15	59	17	18
	3	161	5	6	0	2
	4	161	1	0	1	0
	1	163	10	15	4	6
	2	163	15	12	4	4
	3	163	2	6	1	1
	4	163	0	0	0	0
	1	169	8	60	6	9
	2	169	4	19	4	0
	3	169	5	1	3	1
	4	169	2	0	1	0
	1	170	4	3	4	2
	2	170	4	5	3	4
	3	170	1	0	0	0
	4	170	0	0	0	0
	1	175	4	7	0	0
	2	175	3	14	1	2
	3	175	1	4	0	0
	4	175	1	0	1	0
	1	177	5	7	3	3
	2	177	1	1	2	4
	3	177	0	0	0	0
	4	177	1	0	0	0

E5 CONTINUED

TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE		TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
1	182	8	7	4	1	LOC	1	130	0	0	0	0
2	182	4	0	6	10	9	2	130	0	0	1	3
3	182	2	1	1	0		3	130	0	0	1	2
4	182	0	1	0	0		4	130	0	1	1	2
1	184	1	3	1	1		1	135	2	2	5	4
2	184	0	1	2	5		2	135	1	1	8	6
3	184	0	0	3	2		3	135	3	1	15	13
4	184	0	0	0	0		4	135	2	2	9	10
1	190	2	3	1	0		1	141	3	5	13	2
2	190	0	2	0	0		2	141	4	6	2	5
3	190	1	1	0	0		3	141	3	10	4	5
4	190	0	0	0	0		4	141	2	6	10	10
1	192	3	0	0	0		1	143	3	4	3	4
2	192	0	0	0	2		2	143	1	12	1	3
3	192	1	1	1	0		3	143	5	17	7	13
4	192	0	1	0	3		4	143	5	14	3	9
1	196	0	0	1	0		1	149	11	18	5	7
2	196	0	2	1	0		2	149	4	18	3	6
3	196	1	1	0	0		3	149	18	43	10	5
4	196	0	0	0	0		4	149	16	41	6	4
1	198	8	1	0	0		1	150	9	11	1	1
2	198	7	2	1	1		2	150	4	14	3	1
3	198	1	6	1	0		3	150	12	16	7	2
4	198	10	0	0	0		4	150	6	14	4	1
1	204	25	30	0	0		1	155	38	71	21	30
2	204	21	26	5	1		2	155	43	68	14	10
3	204	30	20	0	0		3	155	35	89	33	18
4	201	10	38	0	0		4	155	60	75	38	26
1	205	4	1	0	0		1	157	83	147	128	123
2	205	3	1	0	0		2	157	15	29	8	16
3	205	8	1	0	3		3	157	13	66	30	41
4	205	0	6	0	0		4	157	21	13	11	1
1	210	1	0	0	0		1	162	4	6	3	1
2	210	3	2	0	0		2	162	9	4	5	1
3	210	0	0	0	0		3	162	6	2	11	5
4	210	0	0	0	0		4	162	19	53	68	66
1	212	2	0	0	0		1	164	3	1	9	3
2	212	0	0	0	0		2	164	5	8	2	6
3	212	0	0	0	0		3	164	3	6	11	2
4	212	0	0	0	0		4	164	11	7	11	3
1	217	1	0	0	0		1	169	11	3	8	24
2	217	0	0	0	0		2	169	9	3	1	2
3	217	1	0	0	0		3	169	2	5	3	3
4	217	0	0	0	0		4	169	13	13	3	4
1	219	0	0	0	0		1	171	1	3	5	3
2	219	0	0	0	0		2	171	3	3	1	1
3	219	0	0	0	0		3	171	3	10	6	5
4	219	0	0	0	0		4	171	3	4	8	6
1	224	0	0	3	0		1	177	11	2	14	15
2	224	0	1	0	0		2	177	13	7	6	9
3	224	0	0	0	0		3	177	3	13	10	10
4	224	0	0	0	0		4	177	7	5	11	15
1	226	0	0	0	0		1	178	2	0	7	14
2	226	0	0	0	0		2	178	4	0	2	6
3	226	0	0	0	0		3	179	1	1	4	5
4	226	0	0	0	0		4	178	4	2	5	3
1	231	0	0	0	0		1	183	7	9	33	39
2	231	0	0	0	0		2	183	5	7	16	12
3	231	1	0	0	0		3	183	2	11	17	16
4	231	0	0	0	0		4	183	16	6	28	43
1	238	1	0	0	0		1	185	2	3	12	6
2	238	0	0	0	0		2	185	3	2	1	3
3	238	0	0	0	0		3	185	3	1	2	1
4	238	0	0	0	0		4	185	9	2	13	8
1	240	0	0	0	0		1	192	11	6	10	13
2	240	0	0	0	0		2	192	5	10	0	3
3	240	0	0	0	0		3	192	14	25	16	13
4	240	0	0	0	0		4	192	7	14	36	15
1	248	0	0	0	0		1	193	5	2	18	22
2	248	3	2	0	0		2	193	4	2	4	7
3	248	0	0	0	0		3	193	3	2	17	12
4	248	0	0	0	0		4	193	4	2	5	17
1	252	0	0	0	0		1	197	6	8	22	18
2	252	1	0	0	0		2	197	4	11	18	29
3	252	0	0	0	0		3	197	4	12	16	21
4	252	0	0	0	0		4	197	4	23	10	29
1	254	0	0	0	0		1	199	13	3	6	2
2	254	0	1	0	0		2	199	2	18	6	5
3	254	0	0	0	0		3	199	14	15	4	0
4	254	0	0	0	0		4	199	6	9	5	7

25 CONTINUED

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	1	203	6	9	2	2
	2	203	6	17	1	6
	3	203	17	19	4	1
	4	203	6	13	3	4
	1	206	19	18	12	1
	2	206	16	21	5	1
	3	206	8	23	4	1
	4	206	16	27	3	2
	1	211	14	5	9	2
	2	211	16	10	2	3
	3	211	29	28	7	6
	4	211	27	23	11	4
	1	213	1	6	1	0
	2	213	7	4	2	0
	3	213	5	11	0	0
	4	213	10	10	4	1
	1	218	2	1	0	3
	2	218	3	8	0	0
	3	218	1	3	0	0
	4	218	7	12	0	0
	1	221	4	1	1	0
	2	221	3	3	1	0
	3	221	1	4	0	0
	4	221	5	2	1	0
	1	225	1	3	0	0
	2	225	2	4	0	0
	3	225	11	0	0	0
	4	225	7	17	0	0
	1	228	1	2	1	0
	2	228	4	0	1	0
	3	228	2	3	1	1
	4	228	5	6	0	9
	1	232	2	4	1	0
	2	232	2	2	0	0
	3	232	1	2	0	0
	4	232	3	5	7	1
	1	234	5	4	0	0
	2	234	0	0	0	0
	3	234	0	5	0	0
	4	234	1	4	1	1
	1	239	2	5	1	1
	2	239	1	3	0	0
	3	239	3	10	0	0
	4	239	6	6	3	0
	1	241	1	0	0	0
	2	241	1	0	0	0
	3	241	1	2	0	0
	4	241	1	3	0	0
	1	246	7	12	25	14
	2	246	1	6	20	10
	3	246	6	19	22	5
	4	246	4	9	11	21
	1	248	9	7	5	5
	2	248	2	2	6	4
	3	248	6	7	12	0
	4	248	7	0	8	1
LOC.	1	130	0	1	1	0
10	2	130	0	0	0	0
	3	130	0	1	0	0
	4	130	1	1	1	0
	1	135	2	0	9	10
	2	135	0	0	0	10
	3	135	5	0	13	9
	4	135	2	0	13	8
	1	140	5	1	20	6
	2	140	2	6	7	7
	3	140	3	1	22	11
	4	140	5	0	25	8
	1	142	1	6	11	16
	2	142	5	0	6	10
	3	142	4	4	20	12
	4	142	2	5	27	17
	1	149	18	37	16	23
	2	149	24	59	29	31
	3	149	17	41	15	41
	4	149	25	45	28	51
	1	150	7	6	3	1
	2	150	16	15	7	3
	3	150	5	6	5	4
	4	150	11	3	4	2
	1	154	34	31	16	6
	2	154	35	54	26	14
	3	154	48	56	15	3
	4	154	31	47	19	13
	1	156	26	22	14	4
	2	156	15	16	5	4
	3	156	30	15	13	6
	4	156	14	14	13	4
	1	161	24	69	38	34
	2	161	26	46	26	19
	3	161	22	36	29	14
	4	161	39	47	45	38
	1	163	5	4	0	1
	2	163	5	3	1	5
	3	163	6	2	13	9
	4	163	30	7	5	7
	1	168	19	18	9	6
	2	168	22	18	6	6
	3	168	38	18	19	9
	4	168	29	21	17	13
	1	170	5	0	6	4
	2	170	5	7	5	4
	3	170	5	3	0	1
	4	170	4	1	1	2
	1	175	13	9	4	12
	2	175	16	4	7	20
	3	175	14	3	11	13
	4	175	3	6	9	12
	1	177	5	6	6	28
	2	177	14	13	14	27
	3	177	9	7	9	18
	4	177	3	9	17	15
	1	182	17	12	14	11
	2	182	25	8	14	15
	3	182	10	7	19	19
	4	182	14	5	16	16
	1	184	3	1	7	4
	2	184	4	3	1	4
	3	184	4	4	12	4
	4	184	3	1	7	9
	1	190	13	11	12	5
	2	190	8	0	6	13
	3	190	8	17	5	28
	4	190	20	13	9	9
	1	191	7	2	3	0
	2	191	7	6	2	0
	3	191	4	9	2	1
	4	191	15	10	12	4
	1	195	5	12	4	6
	2	196	10	21	1	0
	3	196	18	28	6	5
	4	196	11	16	10	4
	1	198	17	24	1	9
	2	198	13	19	4	6
	3	198	14	19	4	1
	4	198	19	26	5	6
	1	203	20	27	0	4
	2	203	34	45	1	2
	3	203	21	22	9	2
	4	203	11	20	2	7
	1	205	16	6	1	1
	2	205	9	13	0	1
	3	205	12	10	2	1
	4	205	22	20	2	1
	1	210	13	16	1	0
	2	210	14	15	0	0
	3	210	16	22	0	0
	4	210	32	31	1	1
	1	212	10	4	0	0
	2	212	15	3	3	0
	3	212	10	4	0	0
	4	212	14	10	1	0
	1	217	18	4	0	3

E5 CONTINUED

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	2	217	14	5	1	0
	3	217	16	10	2	0
	4	217	24	28	2	15
	1	219	2	5	1	0
	2	219	2	3	0	0
	3	219	9	15	0	0
	4	219	16	9	0	0
	1	224	7	4	0	0
	2	224	2	1	0	0
	3	224	8	10	1	0
	4	224	18	23	1	0
	1	226	4	2	0	0
	2	226	4	2	0	0
	3	226	12	6	0	0
	4	226	10	3	0	0
	1	231	14	15	0	0
	2	231	7	0	1	0
	3	231	23	20	1	0
	4	231	27	30	1	4
	1	233	2	2	0	0
	2	233	2	0	0	0
	3	233	4	4	0	0
	4	233	15	11	0	0
	1	238	16	9	0	0
	2	238	5	8	0	0
	3	238	9	8	0	0
	4	238	32	51	0	0
	1	240	3	1	2	3
	2	240	0	8	1	4
	3	240	1	0	2	6
	4	240	14	5	2	3
	1	247	23	29	20	30
	2	247	14	9	26	14
	3	247	30	19	31	9
	4	247	123	149	22	25
	1	249	3	6	6	6
	2	249	11	13	0	0
	3	249	5	7	0	0
	2	249	11	13	8	4
	1	252	7	10	10	3
	2	252	12	15	12	3
	3	252	3	10	16	0
	4	252	12	28	13	2
	1	254	12	10	6	0
	2	254	9	6	4	1
	3	254	16	8	7	0
	4	254	17	38	8	3
LOC.	1	134	4	2	3	11
11	2	134	1	0	14	8
	3	134	3	1	20	25
	4	134	3	1	16	11
	1	135	0	0	1	1
	2	135	1	0	0	1
	3	135	0	1	0	1
	4	135	0	1	0	1
	1	140	8	8	14	4
	2	140	9	9	21	14
	3	140	3	7	35	24
	4	140	2	23	36	19
	1	142	13	21	24	19
	2	142	13	24	41	32
	3	142	10	28	44	70
	4	142	14	58	41	35
	1	148	33	67	19	25
	2	148	30	76	37	30
	3	148	43	137	52	40
	4	148	62	204	45	35
	1	149	3	1	1	1
	2	149	17	7	3	1
	3	149	14	10	4	0
	4	149	18	20	3	1
	1	154	52	51	9	4
	2	154	74	93	10	6
	3	154	83	111	24	14
	4	154	110	136	26	23
	1	156	18	19	7	3
	2	156	29	57	20	8
	3	156	26	40	21	14
	4	156	61	74	15	4
	1	161	24	27	7	18

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
2	161	43	54	29	59
3	161	44	63	33	19
4	161	58	84	26	8
1	163	3	0	16	2
2	163	10	0	36	25
3	163	6	12	21	11
4	163	21	12	60	15
1	168	25	13	94	32
2	168	50	25	178	79
3	168	27	47	68	154
4	168	64	148	44	129
1	170	5	3	4	3
2	170	20	13	34	24
3	170	7	6	33	24
4	170	50	27	34	22
1	175	15	8	5	4
2	175	37	24	12	20
3	175	22	42	12	62
4	175	41	39	22	41
1	177	2	2	6	5
2	177	5	4	15	17
3	177	6	5	11	32
4	177	9	2	2	8
1	182	10	9	15	11
2	182	33	47	89	116
3	182	22	8	71	114
4	182	37	23	66	77
1	184	7	4	10	8
2	184	7	3	19	8
3	184	7	7	22	15
4	184	13	8	43	20
1	190	6	6	0	2
2	190	12	11	11	7
3	190	8	7	5	29
4	190	20	13	9	9
1	191	2	5	3	1
2	191	6	13	4	4
3	191	3	10	7	2
4	191	8	8	2	3
1	196	8	3	4	4
2	196	14	23	9	4
3	196	9	29	2	19
4	196	7	31	1	3
1	198	5	5	0	0
2	198	10	11	1	0
3	198	13	13	4	8
4	198	7	13	1	6
1	203	6	10	7	0
2	203	7	21	2	6
3	203	7	23	5	2
4	203	6	13	3	6
1	205	1	3	2	0
2	205	6	7	6	0
3	205	7	12	4	7
4	205	27	18	6	0
1	210	4	1	1	0
2	210	5	3	0	0
3	210	15	21	0	1
4	210	5	6	1	3
1	212	1	0	0	0
2	212	7	4	1	0
3	212	5	6	1	1
4	212	6	10	0	1
1	217	10	5	3	0
2	217	5	5	3	0
3	217	8	9	1	1
4	217	3	9	0	4
1	219	1	3	0	3
2	219	4	1	0	3
3	219	0	2	0	1
4	219	2	1	1	0
1	224	5	6	0	0
2	224	7	5	5	0
3	224	9	18	9	0
4	224	10	13	5	0
1	226	5	3	1	1
2	226	12	15	5	34
3	226	13	20	14	6
4	226	23	26	23	2
1	231	127	13	6	8

E5 CONTINUED

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	2	231	36	40	21	3
	3	231	20	24	7	3
	4	231	31	62	23	4
	1	233	17	5	1	2
	2	233	22	23	15	0
	3	233	30	25	17	2
	4	233	40	47	10	6
	1	238	41	19	7	0
	2	238	35	42	13	1
	3	238	30	80	15	1
	4	238	23	88	16	7
	1	240	10	3	1	0
	2	240	17	5	0	0
	3	240	13	16	9	0
	4	240	25	18	0	0
	1	247	51	32	12	8
	2	247	76	50	47	2
	3	247	56	47	35	18
	4	247	76	104	22	9
	1	249	8	9	5	1
	2	249	26	17	6	5
	3	249	22	16	11	0
	4	249	31	47	16	2
	1	252	8	8	2	0
	2	252	35	31	2	1
	3	252	26	26	4	2
	4	252	19	50	0	2
	1	254	6	3	0	0
	2	254	31	14	6	6
	3	254	18	25	19	10
	4	254	46	46	2	3
LOC 12	1	135	1	0	1	3
	2	134	3	5	12	9
	3	134	4	9	8	10
	4	134	4	3	33	23
	1	135	0	1	4	2
	2	135	1	1	2	3
	3	135	0	0	4	6
	4	135	0	0	1	0
	1	140	4	7	16	6
	2	140	13	32	32	0
	3	140	5	35	43	26
	4	140	1	11	18	13
	1	142	3	7	4	6
	2	142	14	11	7	10
	3	142	30	43	17	21
	4	142	25	60	16	22
	1	148	11	57	11	6
	2	148	29	130	37	59
	3	148	122	189	44	30
	4	148	64	161	41	23
	1	150	7	10	2	2
	2	150	50	47	4	6
	3	150	28	45	12	11
	4	150	24	31	5	3
	1	154	34	33	10	7
	2	154	61	50	15	6
	3	154	102	64	32	11
	4	154	37	44	10	13
	1	156	13	5	5	0
	2	156	12	16	4	2
	3	156	65	26	32	7
	4	156	14	14	13	4
	1	162	43	130	44	86
	2	162	93	55	23	26
	3	162	46	47	4	1
	4	162	194	135	78	65
	1	163	2	0	0	0
	2	163	0	0	0	0
	3	163	1	0	0	1
	4	163	0	0	0	1
	1	168	40	37	58	33
	2	168	9	4	10	14
	3	168	12	22	17	33
	4	168	4	0	10	4
	1	171	40	36	20	9
	2	171	2	2	3	5
	3	171	2	2	2	6
	4	171	2	2	2	1
	1	175	47	37	23	26

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
2	175	6	4	11	30
3	175	7	10	2	4
4	175	4	9	5	4
1	177	15	9	8	6
2	177	0	1	3	4
3	177	3	1	4	11
4	177	1	2	3	10
1	182	67	35	74	110
2	182	16	8	29	39
3	182	15	3	27	34
4	182	19	2	10	18
1	184	31	48	60	56
2	184	11	10	21	15
3	184	21	12	30	47
4	184	22	18	29	29
1	190	33	103	84	102
2	190	9	10	12	17
3	190	6	11	7	11
4	190	21	40	17	64
1	191	36	51	9	23
2	191	7	3	4	5
3	191	5	1	3	12
4	191	17	13	3	11
1	196	6	69	7	15
2	196	4	9	3	3
3	196	5	9	0	2
4	195	5	15	1	5
1	198	11	6	0	5
2	198	3	3	2	1
3	198	2	4	3	2
4	198	3	7	4	3
1	204	18	25	2	5
2	204	0	6	1	2
3	204	9	5	1	0
4	204	0	1	0	0
1	205	1	0	2	1
2	205	5	0	0	0
3	205	2	1	1	0
4	205	4	3	1	0
1	210	9	2	0	0
2	210	2	3	0	1
3	210	4	1	0	1
4	210	3	0	2	1
1	212	3	1	1	1
2	212	2	5	0	1
3	212	3	3	1	0
4	212	1	1	0	0
1	217	12	9	0	0
2	217	5	4	1	1
3	217	7	3	1	3
4	217	3	1	0	0
1	219	0	3	0	0
2	219	3	0	0	0
3	219	2	0	0	0
4	219	1	1	1	0
1	224	13	9	0	0
2	224	0	5	0	0
3	224	6	4	1	1
4	224	2	3	0	0
1	226	5	6	1	0
2	226	2	0	0	0
3	226	3	4	0	0
4	226	3	1	0	0
1	231	6	7	0	0
2	231	1	1	0	0
3	231	3	4	0	0
4	231	0	0	0	0
1	240	14	13	0	0
2	240	13	12	0	0
3	240	15	17	0	0
4	240	13	14	0	0
1	246	18	19	20	10
2	246	20	16	22	15
3	246	18	20	15	19
4	246	30	6	21	7
1	252	25	22	19	14
2	252	10	20	30	9
3	252	23	13	22	7
4	252	13	21	16	4
1	254	7	3	8	1

E5 CONTINUED

	TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
	2	254	2	2	7	0
	3	254	5	6	5	3
	4	254	5	4	6	4
LOC	1	130	0	0	2	0
13	2	130	0	0	5	0
	3	130	0	0	12	0
	4	130	0	0	2	0
	5	130	1	0	4	0
	6	130	1	0	15	0
	7	130	0	0	0	0
	8	130	0	0	15	8
	1	136	2	0	2	2
	2	136	2	0	30	13
	3	136	1	0	2	0
	4	136	2	0	9	5
	5	136	2	1	3	0
	6	136	6	0	68	10
	7	136	0	0	6	0
	8	136	3	4	72	17
	1	141	0	2	6	5
	2	141	3	2	13	6
	3	141	0	4	7	7
	4	141	1	0	4	0
	5	141	0	0	6	2
	6	141	3	3	11	1
	7	141	1	14	3	2
	8	141	1	6	10	5
	1	143	0	2	0	2
	2	143	1	2	7	3
	3	143	0	1	4	0
	4	143	0	0	0	2
	5	143	1	1	2	2
	6	143	0	1	3	0
	7	143	3	2	6	3
	8	143	2	0	8	2
	1	149	1	1	1	0
	2	149	4	9	8	0
	3	149	1	1	0	0
	4	149	1	1	1	0
	5	149	2	3	0	0
	6	149	7	5	7	2
	7	149	5	20	16	6
	8	149	5	6	9	4
	1	150	1	0	0	0
	2	150	1	3	0	0
	3	150	1	0	3	1
	4	150	2	1	0	0
	5	150	5	1	3	0
	6	150	4	3	1	0
	7	150	6	11	1	0
	8	150	4	2	13	1
	1	155	12	20	4	0
	2	155	37	25	7	3
	3	155	12	11	1	2
	4	155	11	3	8	1
	5	155	13	10	1	1
	6	155	24	14	7	2
	7	155	27	95	12	9
	8	155	12	30	4	3
	1	157	1	0	0	1
	2	157	7	6	0	1
	3	157	6	6	0	1
	4	157	4	1	1	0
	5	157	3	1	1	0
	6	157	10	10	0	4
	7	157	11	32	4	1
	8	157	8	7	1	4
	1	162	7	4	5	1
	2	162	29	21	10	4
	3	162	7	14	7	3
	4	162	10	8	3	2
	5	162	11	13	5	5
	6	162	21	13	4	3
	7	162	27	28	4	5
	8	162	14	22	0	2
	1	164	3	2	3	0
	2	164	9	2	3	1
	3	164	4	4	0	0
	4	164	8	0	0	0
	5	164	4	3	0	0
	6	164	6	4	0	0
	7	164	14	10	0	0
	8	164	6	0	2	0
	1	169	4	1	1	0
	2	169	12	3	3	1
	3	169	2	5	0	1
	4	169	6	4	2	0
	5	169	6	5	1	0
	6	169	9	4	2	2
	7	169	10	3	3	0
	8	169	6	3	3	3
	1	171	2	0	3	1
	2	171	1	1	0	0
	3	171	2	0	3	1
	4	171	0	0	2	0
	5	171	2	2	2	0
	6	171	4	0	1	0
	7	171	7	2	0	0
	8	171	1	1	1	0
	1	176	1	0	1	0
	2	176	3	7	0	3
	3	176	1	1	0	0
	4	176	1	1	0	0
	5	176	4	0	1	0
	6	176	4	0	1	0
	7	176	5	3	1	2
	8	176	4	2	3	2
	1	178	0	1	2	0
	2	178	1	1	1	0
	3	178	0	1	0	1
	4	178	2	3	2	1
	5	178	1	0	0	1
	6	178	3	2	0	0
	7	178	2	0	0	0
	8	178	0	1	1	0
	1	183	2	1	0	2
	2	183	0	2	0	0
	3	183	1	1	1	1
	4	183	0	1	0	0
	5	183	5	3	1	1
	6	183	1	2	4	0
	7	183	0	2	0	0
	8	183	3	1	1	3
	1	185	0	0	0	0
	2	185	0	1	0	1
	3	185	0	0	1	1
	4	185	0	0	1	0
	5	185	1	0	2	0
	6	185	2	0	2	0
	7	185	0	1	1	0
	8	185	1	0	2	0
	1	190	0	2	0	1
	2	190	2	2	3	0
	3	190	3	0	2	0
	4	190	2	2	1	0
	5	190	0	0	2	1
	6	190	0	2	0	0
	7	190	0	4	5	0
	8	190	1	1	0	0
	1	192	1	1	0	1
	2	192	5	0	0	1
	3	192	1	1	0	0
	4	192	0	1	1	3
	5	192	0	0	0	3
	6	192	2	0	0	0
	7	192	0	0	0	0
	8	192	0	0	0	0
	1	197	0	2	0	0
	2	197	2	8	0	2
	3	197	0	1	0	0
	4	197	1	2	0	0
	5	197	3	0	0	0
	6	197	3	2	1	0
	7	197	2	2	0	0
	8	197	0	0	0	0
	1	199	2	8	0	0
	2	199	11	5	0	0
	3	199	3	7	0	1
	4	199	1	0	0	0
	5	199	9	3	0	0

ES CONTINUED

TRAP NUMBER	DATE	OM FEMALE	OM MALE	SC FEMALE	SC MALE
6	199	8	5	1	0
7	199	6	3	1	0
8	199	2	2	0	0
1	201	0	3	1	0
2	201	2	6	2	1
3	201	9	1	0	0
4	201	4	5	1	2
5	201	12	11	0	2
6	201	0	6	0	1
7	201	5	4	4	1
8	201	9	1	0	2
1	204	12	7	1	0
2	204	14	13	1	2
3	204	9	6	1	2
4	204	4	1	0	0
5	204	7	10	1	1
6	204	2	4	2	0
7	204	0	4	0	0
8	204	6	1	1	3
1	206	7	5	0	0
2	206	8	1	1	1
3	206	1	3	0	0
4	206	2	1	0	0
5	206	0	0	0	0
6	206	10	9	0	0
7	206	6	2	0	0
8	206	5	3	0	0
1	211	4	1	0	0
2	211	8	2	0	0
3	211	7	2	0	0
4	211	1	3	0	0
5	211	5	4	0	0
6	211	5	2	0	0
7	211	3	2	0	0
8	211	9	0	0	0
1	213	2	1	0	0
2	213	4	2	0	0
3	213	1	1	1	1
4	213	1	0	0	0
5	213	2	2	0	1
6	213	3	1	0	0
7	213	2	1	0	0
8	213	0	1	0	0
1	218	0	2	1	0
2	218	4	0	0	0
3	218	1	0	1	0
4	218	0	2	0	0
5	218	0	3	0	0
6	218	3	2	0	0
7	218	5	0	1	0
8	218	2	0	0	0
1	221	0	0	0	0
2	221	2	1	0	0
3	221	1	0	0	0
4	221	0	1	0	0
5	221	0	1	0	0
6	221	0	1	1	0
7	221	0	0	1	0
8	221	0	0	0	0
1	225	0	0	0	0
2	225	0	0	0	0
3	225	1	0	0	0
4	225	0	0	0	0
5	225	1	0	0	0
6	225	1	0	0	0
7	225	3	31	0	0
8	225	2	0	0	0
1	228	0	0	0	0
2	228	0	0	0	0
3	228	0	0	0	0
4	228	0	0	0	0
5	228	0	0	0	0
6	228	1	0	0	0
7	228	1	0	0	0
8	228	0	1	0	0
1	232	0	0	0	0
2	232	0	0	0	0
3	232	0	0	0	0
4	232	0	0	0	0
5	232	0	0	0	0
6	232	0	0	0	0
7	232	0	0	0	0
8	232	1	0	0	0
1	234	1	0	0	0
2	234	1	0	0	0
3	234	0	0	0	0
4	234	0	0	0	0
5	234	1	1	0	0
6	234	0	0	0	0
7	234	0	1	0	0
8	234	2	0	0	0
1	239	2	1	0	0
2	239	2	2	0	0
3	239	0	0	0	0
4	239	0	0	0	0
5	239	0	0	0	0
6	239	0	0	0	0
7	239	0	1	0	0
8	239	3	4	0	0
1	241	0	0	0	0
2	241	2	0	0	0
3	241	0	0	0	0
4	241	0	0	0	0
5	241	0	0	0	0
6	241	0	0	0	0
7	241	0	0	0	0
8	241	1	0	0	0
1	244	3	1	3	2
2	244	4	0	1	6
3	244	6	1	1	7
4	244	2	4	6	3
5	244	3	2	7	1
6	244	0	0	2	9
7	244	4	6	11	4
8	244	1	5	10	3
1	245	3	2	5	3
2	245	1	6	1	4
3	245	0	4	5	1
4	245	9	1	3	2
5	245	3	1	0	6
6	245	4	2	7	1
7	245	5	1	4	2
8	245	0	3	1	3
1	246	0	0	2	2
2	246	0	2	1	3
3	246	2	1	0	4
4	246	1	0	3	1
5	246	1	0	6	2
6	246	2	1	2	2
7	246	1	0	0	0
8	246	12	10	4	0
1	248	2	3	5	1
2	248	1	4	3	3
3	248	2	0	3	1
4	248	0	0	6	2
5	248	4	0	4	4
6	248	0	1	0	0
7	248	0	1	0	0
8	248	9	7	0	0
1	250	0	1	1	1
2	250	4	2	1	2
3	250	5	1	4	1
4	250	0	3	3	2
5	250	2	1	1	0
6	250	4	0	3	2
7	250	1	3	1	4
8	250	2	0	1	5
1	251	1	1	1	3
2	251	0	2	2	1
3	251	3	0	1	1
4	251	1	0	2	1
5	251	0	0	1	1
6	251	0	1	0	2
7	251	0	2	1	3
8	251	1	0	0	0
1	253	0	0	1	1
2	253	0	5	2	2
3	253	0	0	4	1
4	253	0	0	5	0
5	253	0	0	1	2

E5 CONTINUED

	TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
	6	253	4	0	0	4
	7	253	2	4	1	3
	8	253	0	0	4	0
	1	255	0	0	1	2
	2	255	2	0	3	0
	3	255	1	0	1	2
	4	255	0	0	0	3
	5	255	0	0	1	1
	6	255	1	0	6	1
	7	255	2	1	0	0
	8	255	1	1	3	0
LOC 14	1	130	0	0	2	1
	2	130	0	0	0	0
	3	130	0	0	0	1
	4	130	0	0	0	1
	1	136	0	8	8	7
	2	136	1	5	10	3
	3	136	4	2	19	5
	4	136	3	14	4	10
	1	141	4	23	6	5
	2	141	4	23	11	10
	3	141	3	3	13	1
	4	141	12	12	16	8
	1	143	3	18	17	15
	2	143	13	16	9	22
	3	143	4	7	6	6
	4	143	12	29	14	17
	1	149	13	17	5	1
	2	149	24	25	4	8
	3	149	4	4	3	4
	4	149	6	16	15	6
	1	150	2	1	2	1
	2	150	0	2	0	0
	3	150	7	4	0	1
	4	150	2	3	3	2
	1	155	26	26	14	3
	2	155	27	22	11	2
	3	155	27	22	11	2
	4	155	23	40	9	3
	1	157	1	5	1	0
	2	157	11	9	2	1
	3	157	16	22	2	3
	4	157	3	14	1	2
	1	162	7	6	0	4
	2	162	32	26	6	8
	3	162	14	2	3	3
	4	162	21	31	6	1
	1	164	1	4	1	0
	2	164	13	4	2	1
	3	164	1	2	1	0
	4	164	6	1	1	0
	1	169	2	3	0	0
	2	169	22	24	4	5
	3	169	11	15	5	3
	4	169	7	11	0	1
	1	171	0	1	0	0
	2	171	6	6	0	0
	3	171	6	4	1	1
	4	171	0	5	1	0
	1	176	0	3	3	7
	2	176	10	10	5	4
	3	176	2	11	7	12
	4	176	4	7	1	2
	1	178	0	0	3	7
	2	179	9	1	9	3
	3	178	3	2	5	3
	4	178	3	2	2	5
	1	184	1	0	3	5
	2	184	9	14	12	14
	3	134	4	3	6	9
	4	184	3	2	3	1
	1	185	0	0	5	5
	2	185	2	1	2	1
	3	185	0	0	1	0
	4	185	0	2	3	0
	1	191	1	4	2	1
	2	191	4	7	3	3
	3	191	1	6	0	1
	4	191	3	4	3	7
	1	192	1	2	2	0

TRAP NUMBER	DATE	OH FEMALE	OH MALE	SC FEMALE	SC MALE
2	192	1	3	0	3
3	192	4	7	1	0
4	192	1	4	0	0
1	198	3	24	2	8
2	198	8	18	1	2
3	198	22	23	4	1
4	198	3	11	2	0
1	199	2	1	1	0
2	199	1	0	0	2
3	199	3	0	1	0
4	199	2	1	2	0
1	204	9	14	0	1
2	204	13	23	2	0
3	204	19	28	1	0
4	204	9	22	0	0
1	206	11	10	0	1
2	206	28	24	1	2
3	206	20	23	0	0
4	206	15	9	0	0
1	211	15	20	0	0
2	211	24	14	0	1
3	211	23	14	0	0
4	211	27	9	1	0
1	213	1	3	0	0
2	213	6	4	0	0
3	213	4	5	0	0
4	213	2	0	0	0
1	218	12	13	0	0
2	218	7	7	0	0
3	218	6	2	0	0
4	218	3	3	0	0
1	221	1	3	0	0
2	221	0	2	0	0
3	221	2	2	0	0
4	221	0	0	0	0
1	225	1	2	0	0
2	225	3	1	0	0
3	225	2	1	0	0
4	225	2	2	0	0
1	228	1	1	0	0
2	228	0	0	0	0
3	228	1	2	0	0
4	228	0	0	0	0
1	232	2	1	0	0
2	232	1	0	0	0
3	232	4	3	0	0
4	232	1	0	0	0
1	234	1	4	1	0
2	234	5	3	0	0
3	234	5	7	0	0
4	234	0	0	0	0
1	239	6	18	1	2
2	239	5	3	3	1
3	239	7	6	3	4
4	239	2	2	1	3
1	241	1	2	0	0
2	241	0	2	0	0
3	241	0	0	0	0
4	241	1	2	3	2
1	244	2	2	4	5
2	244	0	2	4	1
3	244	0	0	5	2
4	244	3	2	2	3
1	248	48	30	36	21
2	248	22	25	41	32
3	248	15	34	18	29
4	248	15	35	59	34
1	253	15	25	5	4
2	253	17	21	6	7
3	253	8	15	11	4
4	253	10	20	8	3
1	255	3	6	1	2
2	255	11	3	0	2
3	255	8	6	0	3
4	255	4	9	1	0

APPENDIX F

Appendix F.

Recorded number of onions damaged by OM for each sample, date and study field in 1979 and 1980.

All data files are located on UP2017 and UP2018 dump tapes at the Michigan State University Computer Center.

CDDA79GRANTDAM
CDDA80GRANTDAM

TABLE F .

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
131	1	1	0
131	1	2	0
131	1	3	0
131	1	4	0
131	1	5	0
131	1	6	0
131	1	7	0
131	1	8	0
131	1	9	0
131	1	10	0
131	1	11	0
131	1	12	0
131	1	13	0
131	1	14	0
131	1	15	0
131	1	16	0
131	1	17	0
131	1	18	0
131	1	19	0
131	1	20	0
131	2	1	0
131	2	2	0
131	2	3	0
131	2	4	0
131	2	5	0
131	2	6	0
131	2	7	0
131	2	8	0
131	2	9	0
131	2	10	0
131	2	11	0
131	2	12	0
131	2	13	0
131	2	14	0
131	2	15	0
131	2	16	0
131	2	17	0
131	2	18	0
131	2	19	0
131	2	20	0
131	3	1	0
131	3	2	0
131	3	3	0
131	3	4	0
131	3	5	0
131	3	6	0
131	3	7	0
131	3	8	0
131	3	9	0
131	3	10	0
131	3	11	0
131	3	12	0
131	3	13	0
131	3	14	0
131	3	15	0
131	3	16	0
131	3	17	0
131	3	18	0
131	3	19	0
131	3	20	0
131	4	1	0
131	4	2	0
131	4	3	0
131	4	4	0
131	4	5	0
131	4	6	0
131	4	7	0
131	4	8	0
131	4	9	0
131	4	10	0
131	4	11	0
131	4	12	0
131	4	13	0
131	4	14	0
131	4	15	0
131	4	16	0
131	4	17	0
131	4	18	0
131	4	19	0
131	4	20	0

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
131	5	1	0
131	5	2	0
131	5	3	0
131	5	4	0
131	5	5	0
131	5	6	0
131	5	7	0
131	5	8	0
131	5	9	0
131	5	10	0
131	5	11	0
131	5	12	0
131	5	13	0
131	5	14	0
131	5	15	0
131	5	16	0
131	5	17	0
131	5	18	0
131	5	19	0
131	5	20	0
131	6	1	0
131	6	2	0
131	6	3	0
131	6	4	0
131	6	5	0
131	6	6	0
131	6	7	0
131	6	8	0
131	6	9	0
131	6	10	0
131	6	11	0
131	6	12	0
131	6	13	0
131	6	14	0
131	6	15	0
131	6	16	0
131	6	17	0
131	6	18	0
131	6	19	0
131	6	20	0
131	7	1	0
131	7	2	0
131	7	3	0
131	7	4	0
131	7	5	0
131	7	6	0
131	7	7	0
131	7	8	0
131	7	9	0
131	7	10	0
131	7	11	0
131	7	12	0
131	7	13	0
131	7	14	0
131	7	15	0
131	7	16	0
131	7	17	0
131	7	18	0
131	7	19	0
131	7	20	0
136	13	1	0
136	13	2	0
136	13	3	0
136	13	4	0
136	13	5	0
136	13	6	0
136	13	7	0
136	13	8	0
136	13	9	0
136	13	10	0
136	13	11	0
136	13	12	0
136	13	13	0
136	13	14	0
136	13	15	0
136	13	16	0
136	13	17	0
136	13	18	0
136	13	19	0
136	13	20	0

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
136	14	1	0
136	14	2	0
136	14	3	0
136	14	4	0
136	14	5	0
136	14	6	0
136	14	7	0
136	14	8	0
136	14	9	0
136	14	10	0
136	14	11	0
136	14	12	0
136	14	13	0
136	14	14	0
136	14	15	0
136	14	16	0
136	14	17	0
136	14	18	0
136	14	19	0
136	14	20	0
138	1	1	0
138	1	2	0
138	1	3	0
138	1	4	0
138	1	5	0
138	1	6	0
138	1	7	0
138	1	8	0
138	1	9	0
138	1	10	0
138	1	11	0
138	1	12	0
138	1	13	0
138	1	14	0
138	1	15	0
138	1	16	0
138	1	17	0
138	1	18	0
138	1	19	0
138	1	20	0
138	2	1	0
138	2	2	0
138	2	3	0
138	2	4	0
138	2	5	0
138	2	6	0
138	2	7	0
138	2	8	0
138	2	9	0
138	2	10	0
138	2	11	0
138	2	12	0
138	2	13	0
138	2	14	0
138	2	15	0
138	2	16	0
138	2	17	0
138	2	18	0
138	2	19	0
138	2	20	0
138	3	1	0
138	3	2	0
138	3	3	0
138	3	4	0
138	3	5	0
138	3	6	0
138	3	7	0
138	3	8	0
138	3	9	0
138	3	10	0
138	3	11	0
138	3	12	0
138	3	13	0
138	3	14	0
138	3	15	0
138	3	16	0
138	3	17	0
138	3	18	0
138	3	19	0
138	3	20	0

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
138	4	1	0
138	4	2	0
138	4	3	0
138	4	4	0
138	4	5	0
138	4	6	0
138	4	7	0
138	4	8	0
138	4	9	0
138	4	10	0
138	4	11	0
138	4	12	0
138	4	13	0
138	4	14	0
138	4	15	0
138	4	16	0
138	4	17	0
138	4	18	0
138	4	19	0
138	4	20	0
138	5	1	0
138	5	2	0
138	5	3	0
138	5	4	0
138	5	5	0
138	5	6	0
138	5	7	0
138	5	8	0
138	5	9	0
138	5	10	0
138	5	11	0
138	5	12	0
138	5	13	0
138	5	14	0
138	5	15	0
138	5	16	0
138	5	17	0
138	5	18	0
138	5	19	0
138	5	20	0
138	6	1	0
138	6	2	0
138	6	3	0
138	6	4	0
138	6	5	0
138	6	6	0
138	6	7	0
138	6	8	0
138	6	9	0
138	6	10	0
138	6	11	0
138	6	12	0
138	6	13	0
138	6	14	0
138	6	15	0
138	6	16	0
138	6	17	0
138	6	18	0
138	6	19	0
138	6	20	0
138	7	1	0
138	7	2	0
138	7	3	0
138	7	4	0
138	7	5	0
138	7	6	0
138	7	7	0
138	7	8	0
138	7	9	0
138	7	10	0
138	7	11	0
138	7	12	0
138	7	13	0
138	7	14	0
138	7	15	0
138	7	16	0
138	7	17	0
138	7	18	0
138	7	19	0
138	7	20	0

TABLE F . CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
139	8	1	0
139	8	2	0
139	8	3	0
139	8	4	0
139	8	5	0
139	8	6	0
139	8	7	0
139	8	8	0
139	8	9	0
139	8	10	0
139	8	11	0
139	8	12	0
139	8	13	0
139	8	14	0
139	8	15	0
139	8	16	0
139	8	17	0
139	8	18	0
139	8	19	0
139	8	20	0
139	9	1	0
139	9	2	0
139	9	3	0
139	9	4	0
139	9	5	0
139	9	6	0
139	9	7	0
139	9	8	0
139	9	9	0
139	9	10	0
139	9	11	0
139	9	12	0
139	9	13	0
139	9	14	0
139	9	15	0
139	9	16	0
139	9	17	0
139	9	18	0
139	9	19	0
139	9	20	0
139	10	1	0
139	10	2	0
139	10	3	0
139	10	4	0
139	10	5	0
139	10	6	0
139	10	7	0
139	10	8	0
139	10	9	0
139	10	10	0
139	10	11	0
139	10	12	0
139	10	13	0
139	10	14	0
139	10	15	0
139	10	16	0
139	10	17	0
139	10	18	0
139	10	19	0
139	10	20	0
139	12	1	0
139	12	2	0
139	12	3	0
139	12	4	0
139	12	5	0
139	12	6	0
139	12	7	0
139	12	8	0
139	12	9	0
139	12	10	0
139	12	11	0
139	12	12	0
139	12	13	0
139	12	14	0
139	12	15	0
139	12	16	0
139	12	17	0
139	12	18	0
139	12	19	0
139	12	20	0
141	13	1	0
141	13	2	0
141	13	3	0
141	13	4	0
141	13	5	0
141	13	6	0
141	13	7	0
141	13	8	0
141	13	9	0
141	13	10	0
141	13	11	0
141	13	12	0
141	13	13	0
141	13	14	0
141	13	15	0
141	13	16	0
141	13	17	0
141	13	18	0
141	13	19	0
141	13	20	0
141	14	1	0
141	14	2	0
141	14	3	0
141	14	4	0
141	14	5	0
141	14	6	0
141	14	7	0
141	14	8	0
141	14	9	0
141	14	10	0
141	14	11	0
141	14	12	0
141	14	13	0
141	14	14	0
141	14	15	0
141	14	16	0
141	14	17	0
141	14	18	0
141	14	19	0
141	14	20	0
142	8	1	0
142	8	2	0
142	8	3	0
142	8	4	0
142	8	5	0
142	8	6	0
142	8	7	0
142	8	8	0
142	8	9	0
142	8	10	0
142	8	11	0
142	8	12	0
142	8	13	0
142	8	14	0
142	8	15	0
142	8	16	0
142	8	17	0
142	8	18	0
142	8	19	0
142	8	20	0
142	9	1	0
142	9	2	0
142	9	3	0
142	9	4	0
142	9	5	0
142	9	6	0
142	9	7	0
142	9	8	0
142	9	9	0
142	9	10	0
142	9	11	0
142	9	12	0
142	9	13	0
142	9	14	0
142	9	15	0
142	9	16	0
142	9	17	0
142	9	18	0
142	9	19	0
142	9	20	0
142	10	1	0
142	10	2	1
142	10	3	0
142	10	4	0
142	10	5	1
142	10	6	0
142	10	7	0
142	10	8	0
142	10	9	0
142	10	10	0
142	10	11	0
142	10	12	0
142	10	13	0
142	10	14	0
142	10	15	0
142	10	16	0
142	10	17	0
142	10	18	0
142	10	19	0
142	10	20	0
142	11	1	0
142	11	2	0
142	11	3	0
142	11	4	0
142	11	5	0
142	11	6	0
142	11	7	0
142	11	8	0
142	11	9	0
142	11	10	0
142	11	11	0
142	11	12	0
142	11	13	0
142	11	14	0
142	11	15	0
142	11	16	0
142	11	17	0
142	11	18	0
142	11	19	0
142	11	20	0
142	12	1	0
142	12	2	0
142	12	3	0
142	12	4	0
142	12	5	0
142	12	6	0
142	12	7	0
142	12	8	0
142	12	9	0
142	12	10	0
142	12	11	0
142	12	12	0
142	12	13	0
142	12	14	0
142	12	15	0
142	12	16	0
142	12	17	0
142	12	18	0
142	12	19	0
142	12	20	0
143	13	1	0
143	13	2	0
143	13	3	0
143	13	4	0
143	13	5	0
143	13	6	0
143	13	7	0
143	13	8	0
143	13	9	0
143	13	10	0
143	13	11	0
143	13	12	0
143	13	13	0
143	13	14	0
143	13	15	0
143	13	16	0
143	13	17	0
143	13	18	0
143	13	19	0
143	13	20	0
143	14	1	0
143	14	2	0
143	14	3	0
143	14	4	0
143	14	5	0
143	14	6	0
143	14	7	0
143	14	8	0
143	14	9	0
143	14	10	0
143	14	11	0
143	14	12	0
143	14	13	0
143	14	14	0
143	14	15	0
143	14	16	0
143	14	17	0
143	14	18	0
143	14	19	0
143	14	20	0
144	1	1	0
144	1	2	0
144	1	3	0
144	1	4	0
144	1	5	0
144	1	6	0
144	1	7	0
144	1	8	0
144	1	9	0
144	1	10	0
144	1	11	0
144	1	12	0
144	1	13	0
144	1	14	0
144	1	15	0
144	1	16	0
144	1	17	0
144	1	18	0
144	1	19	0
144	1	20	0
144	2	1	0
144	2	2	0
144	2	3	0
144	2	4	0
144	2	5	0
144	2	6	0
144	2	7	0
144	2	8	0
144	2	9	0
144	2	10	0
144	2	11	0
144	2	12	0
144	2	13	0
144	2	14	0
144	2	15	0
144	2	16	0
144	2	17	0
144	2	18	0
144	2	19	0
144	2	20	0
144	3	1	0
144	3	2	0
144	3	3	0
144	3	4	0
144	3	5	0
144	3	6	0
144	3	7	0
144	3	8	0
144	3	9	0
144	3	10	0
144	3	11	0
144	3	12	0
144	3	13	0
144	3	14	0
144	3	15	0
144	3	16	0
144	3	17	0
144	3	18	0
144	3	19	0
144	3	20	0

TABLE F. CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
152	7	1	0
152	7	2	0
152	7	3	0
152	7	4	0
152	7	5	0
152	7	6	0
152	7	7	0
152	7	8	0
152	7	9	0
152	7	10	0
152	7	11	0
152	7	12	0
152	7	13	0
152	7	14	0
152	7	15	0
152	7	16	0
152	7	17	0
152	7	18	0
152	7	19	0
152	7	20	0
152	13	1	0
152	13	2	0
152	13	3	0
152	13	4	0
152	13	5	0
152	13	6	0
152	13	7	0
152	13	8	0
152	13	9	0
152	13	10	0
152	13	11	0
152	13	12	0
152	13	13	0
152	13	14	0
152	13	15	0
152	13	16	0
152	13	17	0
152	13	18	0
152	13	19	0
152	13	20	0
152	14	1	0
152	14	2	0
152	14	3	0
152	14	4	0
152	14	5	0
152	14	6	0
152	14	7	0
152	14	8	0
152	14	9	0
152	14	10	0
152	14	11	0
152	14	12	0
152	14	13	0
152	14	14	0
152	14	15	0
152	14	16	0
152	14	17	0
152	14	18	0
152	14	19	0
152	14	20	0
153	8	1	0
153	8	2	0
153	8	3	0
153	8	4	0
153	8	5	0
153	8	6	0
153	8	7	0
153	8	8	0
153	8	9	0
153	8	10	0
153	8	11	0
153	8	12	0
153	8	13	0
153	8	14	0
153	8	15	0
153	8	16	0
153	8	17	0
153	8	18	0
153	8	19	0
153	8	20	0
153	9	1	0
153	9	2	0
153	9	3	0
153	9	4	0
153	9	5	0
153	9	6	0
153	9	7	0
153	9	8	0
153	9	9	0
153	9	10	0
153	9	11	0
153	9	12	0
153	9	13	0
153	9	14	0
153	9	15	0
153	9	16	0
153	9	17	0
153	9	18	0
153	9	19	0
153	9	20	0
153	10	1	0
153	10	2	0
153	10	3	0
153	10	4	0
153	10	5	0
153	10	6	0
153	10	7	0
153	10	8	0
153	10	9	0
153	10	10	0
153	10	11	0
153	10	12	0
153	10	13	0
153	10	14	0
153	10	15	0
153	10	16	0
153	10	17	0
153	10	18	0
153	10	19	0
153	10	20	0
153	11	1	0
153	11	2	0
153	11	3	0
153	11	4	0
153	11	5	0
153	11	6	0
153	11	7	0
153	11	8	0
153	11	9	0
153	11	10	0
153	11	11	0
153	11	12	0
153	11	13	0
153	11	14	0
153	11	15	0
153	11	16	0
153	11	17	0
153	11	18	1
153	11	19	0
153	11	20	0
153	12	1	0
153	12	2	0
153	12	3	0
153	12	4	0
153	12	5	0
153	12	6	0
153	12	7	0
153	12	8	0
153	12	9	0
153	12	10	0
153	12	11	0
153	12	12	0
153	12	13	0
153	12	14	0
153	12	15	0
153	12	16	0
153	12	17	0
153	12	18	0
153	12	19	0
153	12	20	0
155	13	1	0
155	13	2	0
155	13	3	0
155	13	4	0
155	13	5	0
155	13	6	0
155	13	7	0
155	13	8	0
155	13	9	0
155	13	10	0
155	13	11	0
155	13	12	0
155	13	13	0
155	13	14	0
155	13	15	0
155	13	16	0
155	13	17	0
155	13	18	0
155	13	19	0
155	13	20	0
155	14	1	0
155	14	2	0
155	14	3	0
155	14	4	0
155	14	5	0
155	14	6	0
155	14	7	0
155	14	8	0
155	14	9	0
155	14	10	0
155	14	11	0
155	14	12	0
155	14	13	0
155	14	14	0
155	14	15	0
155	14	16	0
155	14	17	0
155	14	18	0
155	14	19	0
155	14	20	0
156	1	1	0
156	1	2	0
156	1	3	0
156	1	4	0
156	1	5	0
156	1	6	0
156	1	7	0
156	1	8	0
156	1	9	0
156	1	10	0
156	1	11	0
156	1	12	0
156	1	13	0
156	1	14	0
156	1	15	0
156	1	16	0
156	1	17	0
156	1	18	0
156	1	19	0
156	1	20	0
156	2	1	0
156	2	2	0
156	2	3	0
156	2	4	0
156	2	5	0
156	2	6	0
156	2	7	0
156	2	8	0
156	2	9	0
156	2	10	0
156	2	11	0
156	2	12	0
156	2	13	0
156	2	14	0
156	2	15	0
156	2	16	0
156	2	17	0
156	2	18	0
156	2	19	0
156	2	20	0
156	3	1	0
156	3	2	0
156	3	3	0
156	3	4	0
156	3	5	0
156	3	6	0
156	3	7	0
156	3	8	0
156	3	9	0
156	3	10	0
156	3	11	0
156	3	12	0
156	3	13	0
156	3	14	0
156	3	15	0
156	3	16	0
156	3	17	0
156	3	18	0
156	3	19	0
156	3	20	0
156	4	1	0
156	4	2	0
156	4	3	0
156	4	4	0
156	4	5	0
156	4	5	0
156	4	7	0
156	4	8	0
156	4	9	0
156	4	10	0
156	4	11	0
156	4	12	0
156	4	13	0
156	4	14	0
156	4	15	0
156	4	16	0
156	4	17	0
156	4	18	0
156	4	19	0
156	4	20	0
156	5	1	0
156	5	2	0
156	5	3	0
156	5	4	0
156	5	5	0
156	5	6	0
156	5	7	0
156	5	8	0
156	5	9	0
156	5	10	0
156	5	11	0
156	5	12	0
156	5	13	0
156	5	14	0
156	5	15	0
156	5	16	0
156	5	17	0
156	5	18	0
156	5	19	0
156	5	20	0
156	6	1	0
156	6	2	0
156	6	3	0
156	6	4	0
156	6	5	0
156	6	6	0
156	6	7	0
156	6	8	0
156	6	9	0
156	6	10	0
156	6	11	0
156	6	12	0
156	6	13	0
156	6	14	0
156	6	15	0
156	6	16	0
156	6	17	0
156	6	18	0
156	6	19	0
156	6	20	0

TABLE F. CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
144	4	1	0	145	13	1	0	150	13	1	0	152	3	1	0
144	4	2	0	145	13	2	0	150	13	2	0	152	3	2	0
144	4	3	0	145	13	3	0	150	13	3	0	152	3	3	0
144	4	4	0	145	13	4	0	150	13	4	0	152	3	4	0
144	4	5	0	145	13	5	0	150	13	5	0	152	3	5	0
144	4	6	0	145	13	6	0	150	13	6	0	152	3	6	0
144	4	7	0	145	13	7	0	150	13	7	0	152	3	7	0
144	4	8	0	145	13	8	0	150	13	8	0	152	3	8	0
144	4	9	0	145	13	9	0	150	13	9	0	152	3	9	0
144	4	10	0	145	13	10	0	150	13	10	0	152	3	10	0
144	4	11	0	145	13	11	0	150	13	11	0	152	3	11	0
144	4	12	0	145	13	12	0	150	13	12	0	152	3	12	0
144	4	13	0	145	13	13	0	150	13	13	0	152	3	13	0
144	4	14	0	145	13	14	0	150	13	14	0	152	3	14	0
144	4	15	0	145	13	15	0	150	13	15	0	152	3	15	0
144	4	16	0	145	13	16	0	150	13	16	0	152	3	16	0
144	4	17	0	145	13	17	0	150	13	17	0	152	3	17	0
144	4	18	0	145	13	18	0	150	13	18	0	152	3	18	0
144	4	19	0	145	13	19	0	150	13	19	0	152	3	19	0
144	4	20	0	145	13	20	0	150	13	20	0	152	3	20	0
144	5	1	0	145	14	1	0	150	14	1	0	152	4	1	0
144	5	2	0	145	14	2	0	150	14	2	0	152	4	2	0
144	5	3	0	145	14	3	0	150	14	3	0	152	4	3	0
144	5	4	0	145	14	4	0	150	14	4	0	152	4	4	0
144	5	5	0	145	14	5	0	150	14	5	0	152	4	5	0
144	5	6	0	145	14	6	0	150	14	6	0	152	4	6	0
144	5	7	0	145	14	7	0	150	14	7	0	152	4	7	0
144	5	8	0	145	14	8	0	150	14	8	0	152	4	8	0
144	5	9	0	145	14	9	0	150	14	9	0	152	4	9	0
144	5	10	0	145	14	10	0	150	14	10	0	152	4	10	0
144	5	11	0	145	14	11	0	150	14	11	0	152	4	11	0
144	5	12	0	145	14	12	0	150	14	12	0	152	4	12	0
144	5	13	0	145	14	13	0	150	14	13	0	152	4	13	0
144	5	14	0	145	14	14	0	150	14	14	0	152	4	14	0
144	5	15	0	145	14	15	0	150	14	15	0	152	4	15	0
144	5	16	0	145	14	16	0	150	14	16	0	152	4	16	0
144	5	17	0	145	14	17	0	150	14	17	0	152	4	17	0
144	5	18	0	145	14	18	0	150	14	18	0	152	4	18	0
144	5	19	0	145	14	19	0	150	14	19	0	152	4	19	0
144	5	20	0	145	14	20	0	150	14	20	0	152	4	20	0
144	6	1	0	148	13	1	2	152	1	1	0	152	5	1	0
144	6	2	0	148	13	2	0	152	1	2	0	152	5	2	0
144	6	3	0	148	13	3	0	152	1	3	0	152	5	3	0
144	6	4	0	148	13	4	0	152	1	4	0	152	5	4	0
144	6	5	0	148	13	5	0	152	1	5	0	152	5	5	0
144	6	6	0	148	13	6	0	152	1	6	0	152	5	6	0
144	6	7	0	148	13	7	0	152	1	7	0	152	5	7	0
144	6	8	0	148	13	8	0	152	1	8	0	152	5	8	0
144	6	9	0	148	13	9	0	152	1	9	0	152	5	9	0
144	6	10	0	148	13	10	0	152	1	10	0	152	5	10	0
144	6	11	0	148	13	11	0	152	1	11	0	152	5	11	0
144	6	12	0	148	13	12	0	152	1	12	0	152	5	12	0
144	6	13	0	148	13	13	0	152	1	13	0	152	5	13	0
144	6	14	0	148	13	14	0	152	1	14	0	152	5	14	0
144	6	15	0	148	13	15	0	152	1	15	0	152	5	15	0
144	6	16	0	148	13	16	0	152	1	16	0	152	5	16	0
144	6	17	0	148	13	17	0	152	1	17	0	152	5	17	0
144	6	18	0	148	13	18	0	152	1	18	0	152	5	18	0
144	6	19	0	148	13	19	0	152	1	19	0	152	5	19	0
144	6	20	0	148	13	20	0	152	1	20	0	152	5	20	0
144	7	1	0	148	14	1	0	152	2	1	0	152	6	1	0
144	7	2	0	148	14	2	0	152	2	2	0	152	6	2	0
144	7	3	0	148	14	3	0	152	2	3	0	152	6	3	0
144	7	4	0	148	14	4	0	152	2	4	0	152	6	4	0
144	7	5	0	148	14	5	0	152	2	5	0	152	6	5	0
144	7	6	0	148	14	6	0	152	2	6	0	152	6	6	0
144	7	7	0	148	14	7	0	152	2	7	0	152	6	7	0
144	7	8	0	148	14	8	0	152	2	8	0	152	6	8	0
144	7	9	0	148	14	9	0	152	2	9	0	152	6	9	0
144	7	10	0	148	14	10	0	152	2	10	0	152	6	10	0
144	7	11	0	148	14	11	0	152	2	11	0	152	6	11	0
144	7	12	0	148	14	12	0	152	2	12	0	152	6	12	0
144	7	13	0	148	14	13	0	152	2	13	0	152	6	13	0
144	7	14	0	148	14	14	0	152	2	14	0	152	6	14	0
144	7	15	0	148	14	15	0	152	2	15	0	152	6	15	0
144	7	16	0	148	14	16	0	152	2	16	0	152	6	16	0
144	7	17	0	148	14	17	0	152	2	17	0	152	6	17	0
144	7	18	0	148	14	18	0	152	2	18	0	152	6	18	0
144	7	19	0	148	14	19	0	152	2	19	0	152	6	19	0
144	7	20	0	148	14	20	0	152	2	20	0	152	6	20	0

TABLE F . CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
156	7	1	0	160	9	1	4	160	13	1	3	162	3	1	4
156	7	2	0	160	9	2	8	160	13	2	10	162	3	2	6
156	7	3	0	160	9	3	10	160	13	3	11	162	3	3	15
156	7	4	0	160	9	4	14	160	13	4	3	162	3	4	7
156	7	5	0	160	9	5	4	160	13	5	15	162	3	5	2
156	7	6	0	160	9	6	60	160	13	6	9	162	3	6	1
156	7	7	0	160	9	7	0	160	13	7	2	162	3	7	20
156	7	8	0	160	9	8	12	160	13	8	1	162	3	8	1
156	7	9	0	160	9	9	17	160	13	9	6	162	3	9	1
156	7	10	0	160	9	10	9	160	13	10	1	162	3	10	6
156	7	11	0	160	9	11	8	160	13	11	0	162	3	11	4
156	7	12	0	160	9	12	23	160	13	12	0	162	3	12	2
156	7	13	0	160	9	13	5	160	13	13	0	162	3	13	1
156	7	14	0	160	9	14	6	160	13	14	0	162	3	14	6
156	7	15	0	160	9	15	22	160	13	15	0	162	3	15	12
156	7	16	0	160	9	16	21	160	13	16	0	162	3	16	8
156	7	17	0	160	9	17	16	160	13	17	0	162	3	17	2
156	7	18	0	160	9	18	3	160	13	18	0	162	3	18	4
156	7	19	0	160	9	19	18	160	13	19	0	162	3	19	7
156	7	20	0	160	9	20	10	160	13	20	0	162	3	20	3
157	13	1	1	160	10	1	3	160	14	1	3	162	4	1	1
157	13	2	2	160	10	2	2	160	14	2	6	162	4	2	5
157	13	3	3	160	10	3	1	160	14	3	22	162	4	3	3
157	13	4	3	160	10	4	19	160	14	4	3	162	4	4	13
157	13	5	3	160	10	5	19	160	14	5	5	162	4	5	8
157	13	6	10	160	10	6	7	160	14	6	5	162	4	6	0
157	13	7	0	160	10	7	1	160	14	7	1	162	4	7	2
157	13	8	0	160	10	8	0	160	14	8	0	162	4	8	8
157	13	9	0	160	10	9	17	160	14	9	0	162	4	9	4
157	13	10	0	160	10	10	32	160	14	10	9	162	4	10	1
157	13	11	1	160	10	11	24	160	14	11	1	162	4	11	4
157	13	12	0	160	10	12	16	160	14	12	0	162	4	12	1
157	13	13	0	160	10	13	25	160	14	13	0	162	4	13	2
157	13	14	0	160	10	14	28	160	14	14	0	162	4	14	6
157	13	15	0	160	10	15	16	160	14	15	0	162	4	15	0
157	13	16	0	160	10	16	22	160	14	16	7	162	4	16	8
157	13	17	0	160	10	17	26	160	14	17	1	162	4	17	2
157	13	18	0	160	10	18	25	160	14	18	4	162	4	18	1
157	13	19	0	160	10	19	19	160	14	19	8	162	4	19	4
157	13	20	0	160	10	20	13	160	14	20	4	162	4	20	3
157	14	1	5	160	11	1	5	162	1	1	0	162	5	1	0
157	14	2	0	160	11	2	2	162	1	2	0	162	5	2	8
157	14	3	1	160	11	3	1	162	1	3	0	162	5	3	8
157	14	4	1	160	11	4	2	162	1	4	0	162	5	4	12
157	14	5	1	160	11	5	0	162	1	5	0	162	5	5	28
157	14	6	1	160	11	6	3	162	1	6	0	162	5	6	9
157	14	7	1	160	11	7	7	162	1	7	0	162	5	7	6
157	14	8	1	160	11	8	18	162	1	8	0	162	5	8	0
157	14	9	2	160	11	9	5	162	1	9	0	162	5	9	0
157	14	10	0	160	11	10	2	162	1	10	0	162	5	10	30
157	14	11	0	160	11	11	20	162	1	11	0	162	5	11	10
157	14	12	0	160	11	12	13	162	1	12	0	162	5	12	9
157	14	13	0	160	11	13	7	162	1	13	0	162	5	13	7
157	14	14	0	160	11	14	6	162	1	14	0	162	5	14	0
157	14	15	0	160	11	15	10	162	1	15	0	162	5	15	20
157	14	16	0	160	11	16	25	162	1	16	0	162	5	16	0
157	14	17	0	160	11	17	17	162	1	17	0	162	5	17	18
157	14	18	0	160	11	18	20	162	1	18	0	162	5	18	10
157	14	19	0	160	11	19	12	162	1	19	0	162	5	19	7
157	14	20	0	160	11	20	8	162	1	20	0	162	5	20	8
160	8	1	2	160	12	1	0	162	2	1	28	162	6	1	10
160	8	2	0	160	12	2	0	162	2	2	3	162	6	2	5
160	8	3	10	160	12	3	7	162	2	3	4	162	6	3	8
160	8	4	0	160	12	4	20	162	2	4	0	162	6	4	10
160	8	5	0	160	12	5	7	162	2	5	2	162	6	5	4
160	8	6	0	160	12	6	0	162	2	6	1	162	6	6	39
160	8	7	0	160	12	7	0	162	2	7	0	162	6	7	31
160	8	8	5	160	12	8	112	162	2	8	0	162	6	8	22
160	8	9	0	160	12	9	2	162	2	9	6	162	6	9	20
160	8	10	0	160	12	10	0	162	2	10	2	162	6	10	18
160	8	11	37	160	12	11	1	162	2	11	13	162	6	11	4
160	8	12	15	160	12	12	0	162	2	12	3	162	6	12	3
160	8	13	7	160	12	13	2	162	2	13	4	162	6	13	10
160	8	14	3	160	12	14	4	162	2	14	2	162	6	14	4
160	8	15	1	160	12	15	1	162	2	15	5	162	6	15	18
160	8	16	0	160	12	16	5	162	2	16	0	162	6	16	10
160	8	17	3	160	12	17	7	162	2	17	3	162	6	17	5
160	8	18	9	160	12	18	5	162	2	18	2	162	6	18	6
160	8	19	1	160	12	19	17	162	2	19	3	162	6	19	7
160	8	20	1	160	12	20	16	162	2	20	0	162	6	20	9

TABLE F. CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
162	7	1	12	165	14	1	24	168	9	1	6	169	1	1	0
162	7	2	4	165	14	2	25	168	9	2	11	169	1	2	0
162	7	3	72	165	14	3	24	168	9	3	7	169	1	3	0
162	7	4	15	165	14	4	86	168	9	4	10	169	1	4	0
162	7	5	59	165	14	5	17	168	9	5	4	169	1	5	0
162	7	6	20	165	14	6	78	168	9	6	1	169	1	6	1
162	7	7	35	165	14	7	15	168	9	7	3	169	1	7	5
162	7	8	62	165	14	8	18	168	9	8	4	169	1	8	0
162	7	9	6	165	14	9	16	168	9	9	4	169	1	9	0
162	7	10	18	165	14	10	5	168	9	10	21	169	1	10	0
162	7	11	16	165	14	11	1	168	9	11	10	169	1	11	0
162	7	12	12	165	14	12	0	168	9	12	28	169	1	12	0
162	7	13	14	165	14	13	1	168	9	13	10	169	1	13	0
162	7	14	19	165	14	14	1	168	9	14	12	169	1	14	0
162	7	15	26	165	14	15	3	168	9	15	4	169	1	15	0
162	7	16	32	165	14	16	0	168	9	16	2	169	1	16	0
162	7	17	41	165	14	17	0	168	9	17	14	169	1	17	0
162	7	18	8	165	14	18	7	168	9	18	9	169	1	18	0
162	7	19	10	165	14	19	3	168	9	19	5	169	1	19	0
162	7	20	12	165	14	20	4	168	9	20	8	169	1	20	0
162	13	1	2	167	13	1	42	168	10	1	1	169	2	1	8
162	13	2	1	167	13	2	30	168	10	2	75	169	2	2	0
162	13	3	0	167	13	3	19	168	10	3	10	169	2	3	12
162	13	4	0	167	13	4	15	168	10	4	4	169	2	4	0
162	13	5	0	167	13	5	0	168	10	5	11	169	2	5	2
162	13	6	8	167	13	6	3	168	10	6	18	169	2	6	2
162	13	7	30	167	13	7	1	168	10	7	75	169	2	7	16
162	13	8	48	167	13	8	0	168	10	8	1	169	2	8	8
162	13	9	9	167	13	9	2	168	10	9	4	169	2	9	1
162	13	10	23	167	13	10	0	168	10	10	1	169	2	10	0
162	13	11	1	167	13	11	0	168	10	11	7	169	2	11	4
162	13	12	3	167	13	12	4	168	10	12	16	169	2	12	1
162	13	13	4	167	13	13	0	168	10	13	18	169	2	13	1
162	13	14	2	167	13	14	3	168	10	14	26	169	2	14	1
162	13	15	14	167	13	15	18	168	10	15	25	169	2	15	6
162	13	16	18	167	13	16	39	168	10	16	30	169	2	16	1
162	13	17	34	167	13	17	44	168	10	17	24	169	2	17	2
162	13	18	69	167	13	18	41	168	10	18	9	169	2	18	2
162	13	19	55	167	13	19	29	168	10	19	28	169	2	19	9
162	13	20	8	167	13	20	37	168	10	20	15	169	2	20	1
162	14	1	5	167	14	1	4	168	11	1	7	169	3	1	0
162	14	2	4	167	14	2	2	168	11	2	4	169	3	2	1
162	14	3	0	167	14	3	14	168	11	3	4	169	3	3	1
162	14	4	0	167	14	4	0	168	11	4	25	169	3	4	1
162	14	5	1	167	14	5	0	168	11	5	8	169	3	5	10
162	14	6	31	167	14	6	2	168	11	6	18	169	3	6	3
162	14	7	13	167	14	7	31	168	11	7	11	169	3	7	67
162	14	8	6	167	14	8	4	168	11	8	1	169	3	8	7
162	14	9	4	167	14	9	3	168	11	9	0	169	3	9	1
162	14	10	16	167	14	10	0	168	11	10	12	169	3	10	1
162	14	11	21	167	14	11	7	168	11	11	17	169	3	11	0
162	14	12	12	167	14	12	13	168	11	12	14	169	3	12	11
162	14	13	5	167	14	13	17	168	11	13	13	169	3	13	0
162	14	14	17	167	14	14	21	168	11	14	15	169	3	14	1
162	14	15	0	167	14	15	48	168	11	15	21	169	3	15	1
162	14	16	26	167	14	16	30	168	11	16	13	169	3	16	9
162	14	17	12	167	14	17	10	168	11	17	11	169	3	17	5
162	14	18	18	167	14	18	21	168	11	18	20	169	3	18	8
162	14	19	31	167	14	19	15	168	11	19	17	169	3	19	12
162	14	20	19	167	14	20	62	168	11	20	27	169	3	20	6
165	13	1	16	168	8	1	8	168	12	1	0	169	4	1	13
165	13	2	0	168	8	2	1	168	12	2	2	169	4	2	4
165	13	3	0	168	8	3	24	168	12	3	2	169	4	3	8
165	13	4	6	168	8	4	0	168	12	4	43	169	4	4	10
165	13	5	2	168	8	5	0	168	12	5	54	169	4	5	20
165	13	6	199	168	8	6	0	168	12	6	16	169	4	6	10
165	13	7	52	168	8	7	6	168	12	7	13	169	4	7	21
165	13	8	14	168	8	8	3	168	12	8	12	169	4	8	22
165	13	9	1	168	8	9	0	168	12	9	28	169	4	9	17
165	13	10	17	168	8	10	6	168	12	10	3	169	4	10	17
165	13	11	20	168	8	11	12	168	12	11	3	169	4	11	18
165	13	12	5	168	8	12	35	168	12	12	2	169	4	12	6
165	13	13	5	168	8	13	0	168	12	13	0	169	4	13	2
165	13	14	0	168	8	14	29	168	12	14	0	169	4	14	8
165	13	15	0	168	8	15	0	168	12	15	35	169	4	15	0
165	13	16	8	168	8	16	2	168	12	16	6	169	4	16	4
165	13	17	2	168	8	17	9	168	12	17	18	169	4	17	10
165	13	18	8	168	8	18	1	168	12	18	5	169	4	18	6
165	13	19	0	168	8	19	3	168	12	19	3	169	4	19	2
165	13	20	0	168	8	20	10	168	12	20	2	69	4	20	2

TABLE F. CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
169	5	1	10	170	14	1	0	175	14	1	59	176	4	1	25
169	5	2	29	170	14	2	0	175	14	2	33	176	4	2	18
169	5	3	7	170	14	3	2	175	14	3	11	176	4	3	4
169	5	4	0	170	14	4	3	175	14	4	95	176	4	4	3
169	5	5	0	170	14	5	11	175	14	5	37	176	4	5	0
169	5	6	0	170	14	6	5	175	14	6	87	176	4	6	0
169	5	7	1	170	14	7	30	175	14	7	36	176	4	7	0
169	5	8	0	170	14	8	13	175	14	8	6	176	4	8	2
169	5	9	0	170	14	9	64	175	14	9	93	176	4	9	0
169	5	10	4	170	14	10	72	175	14	10	19	176	4	10	0
169	5	11	0	170	14	11	47	175	14	11	104	176	4	11	2
169	5	12	0	170	14	12	92	175	14	12	29	176	4	12	0
169	5	13	0	170	14	13	33	175	14	13	52	176	4	13	0
169	5	14	3	170	14	14	22	175	14	14	38	176	4	14	0
169	5	15	25	170	14	15	57	175	14	15	97	176	4	15	1
169	5	16	4	170	14	16	15	175	14	16	82	176	4	16	3
169	5	17	14	170	14	17	9	175	14	17	23	176	4	17	5
169	5	18	5	170	14	18	5	175	14	18	45	176	4	18	1
169	5	19	6	170	14	19	18	175	14	19	0	176	4	19	1
169	5	20	0	170	14	20	13	175	14	20	68	176	4	20	3
169	6	1	6	174	13	1	3	176	1	1	0	176	5	1	9
169	6	2	15	174	13	2	8	176	1	2	0	176	5	2	0
169	6	3	20	174	13	3	0	176	1	3	1	176	5	3	0
169	6	4	6	174	13	4	0	176	1	4	4	176	5	4	0
169	6	5	2	174	13	5	0	176	1	5	0	176	5	5	0
169	6	6	41	174	13	6	0	176	1	6	1	176	5	6	0
169	6	7	55	174	13	7	5	176	1	7	0	176	5	7	12
169	6	8	17	174	13	8	21	176	1	8	0	176	5	8	6
169	6	9	19	174	13	9	5	176	1	9	0	176	5	9	0
169	6	10	59	174	13	10	4	176	1	10	0	176	5	10	0
169	6	11	20	174	13	11	8	176	1	11	0	176	5	11	1
169	6	12	45	174	13	12	92	176	1	12	0	176	5	12	0
169	6	13	30	174	13	13	8	176	1	13	0	176	5	13	0
169	6	14	46	174	13	14	101	176	1	14	0	176	5	14	0
169	6	15	4	174	13	15	82	176	1	15	0	176	5	15	0
169	6	16	23	174	13	16	59	176	1	16	0	176	5	16	7
169	6	17	18	174	13	17	85	176	1	17	0	176	5	17	1
169	6	18	6	174	13	18	54	176	1	18	3	176	5	18	0
169	6	19	0	174	13	19	81	176	1	19	0	176	5	19	0
169	6	20	0	174	13	20	65	176	1	20	0	176	5	20	0
169	7	1	0	174	14	1	59	176	2	1	2	176	6	1	10
169	7	2	1	174	14	2	33	176	2	2	3	176	6	2	22
169	7	3	0	174	14	3	11	176	2	3	9	176	6	3	16
169	7	4	5	174	14	4	95	176	2	4	28	176	6	4	8
169	7	5	5	174	14	5	37	176	2	5	20	176	6	5	15
169	7	6	13	174	14	6	87	176	2	6	11	176	6	6	7
169	7	7	0	174	14	7	36	176	2	7	0	176	6	7	0
169	7	8	0	174	14	8	6	176	2	8	0	176	6	8	12
169	7	9	0	174	14	9	93	176	2	9	2	176	6	9	12
169	7	10	0	174	14	10	19	176	2	10	3	176	6	10	9
169	7	11	2	174	14	11	104	176	2	11	0	176	6	11	0
169	7	12	3	174	14	12	29	176	2	12	5	176	6	12	18
169	7	13	8	174	14	13	53	176	2	13	15	176	6	13	5
169	7	14	0	174	14	14	36	176	2	14	3	176	6	14	10
169	7	15	2	174	14	15	97	176	2	15	7	176	6	15	13
169	7	16	0	174	14	16	82	176	2	16	8	176	6	16	16
169	7	17	7	174	14	17	23	176	2	17	2	176	6	17	22
169	7	18	3	174	14	18	45	176	2	18	5	176	6	18	20
169	7	19	0	174	14	19	0	176	2	19	21	176	6	19	34
169	7	20	2	174	14	20	68	176	2	20	0	176	6	20	14
170	13	1	0	175	13	1	3	176	3	1	12	176	7	1	0
170	13	2	3	175	13	2	0	176	3	2	0	176	7	2	6
170	13	3	1	175	13	3	0	176	3	3	1	176	7	3	10
170	13	4	0	175	13	4	8	176	3	4	17	176	7	4	0
170	13	5	3	175	13	5	0	176	3	5	0	176	7	5	5
170	13	6	2	175	13	6	0	176	3	6	8	176	7	6	0
170	13	7	65	175	13	7	5	176	3	7	9	176	7	7	3
170	13	8	92	175	13	8	21	176	3	8	4	176	7	9	0
170	13	9	94	175	13	9	5	176	3	9	0	176	7	9	1
170	13	10	63	175	13	10	4	176	3	10	8	176	7	10	9
170	13	11	68	175	13	11	8	176	3	11	4	176	7	11	4
170	13	12	90	175	13	12	82	176	3	12	7	176	7	12	0
170	13	13	149	175	13	13	8	176	3	13	2	176	7	13	2
170	13	14	91	175	13	14	101	176	3	14	3	176	7	14	1
170	13	15	9	175	13	15	82	176	3	15	0	176	7	15	0
170	13	16	0	175	13	16	59	176	3	16	7	176	7	16	2
170	13	17	3	175	13	17	85	176	3	17	2	176	7	17	0
170	13	18	3	175	13	18	54	176	3	18	5	176	7	18	3
170	13	19	4	175	13	19	81	176	3	19	2	176	7	19	4
170	13	20	4	175	13	20	65	176	3	20	5	176	7	20	0

TABLE F. CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
176	8	1	4	176	12	1	0	180	14	1	0	181	11	1	15
176	8	2	2	176	12	2	0	180	14	2	0	181	11	2	36
176	8	3	0	176	12	3	1	180	14	3	1	181	11	3	19
176	8	4	0	176	12	4	5	180	14	4	0	181	11	4	9
176	8	5	0	176	12	5	4	180	14	5	2	181	11	5	21
176	8	6	0	176	12	6	17	180	14	6	18	181	11	6	14
176	8	7	2	176	12	7	13	180	14	7	42	181	11	7	37
176	8	8	0	176	12	8	14	180	14	8	36	181	11	8	12
176	8	9	1	176	12	9	17	180	14	9	45	181	11	9	29
176	8	10	7	176	12	10	2	180	14	10	41	181	11	10	26
176	8	11	7	176	12	11	3	180	14	11	42	181	11	11	13
176	8	12	12	176	12	12	7	180	14	12	51	181	11	12	6
176	8	13	13	176	12	13	8	180	14	13	38	181	11	13	2
176	8	14	4	176	12	14	11	180	14	14	18	181	11	14	16
176	8	15	3	176	12	15	7	180	14	15	8	181	11	15	20
176	8	16	2	176	12	16	8	180	14	16	8	181	11	16	34
176	8	17	5	176	12	17	22	180	14	17	9	181	11	17	17
176	8	18	3	176	12	18	8	180	14	18	6	181	11	18	25
176	8	19	1	176	12	19	6	180	14	19	1	181	11	19	19
176	8	20	2	176	12	20	1	180	14	20	0	181	11	20	15
176	9	1	2	178	13	1	2	181	8	1	1	181	12	1	3
176	9	2	2	178	13	2	0	181	8	2	0	181	12	2	5
176	9	3	6	178	13	3	2	181	8	3	0	181	12	3	0
176	9	4	2	178	13	4	6	181	8	4	3	181	12	4	0
176	9	5	0	178	13	5	79	181	8	5	0	181	12	5	0
176	9	6	0	178	13	6	56	181	8	6	2	181	12	6	47
176	9	7	0	178	13	7	63	181	8	7	7	181	12	7	57
176	9	8	4	178	13	8	45	181	8	8	0	181	12	8	11
176	9	9	1	178	13	9	0	181	8	9	0	181	12	9	5
176	9	10	0	178	13	10	0	181	9	10	6	181	12	10	10
176	9	11	5	178	13	11	0	181	8	11	0	181	12	11	2
176	9	12	4	178	13	12	0	181	8	12	0	181	12	12	5
176	9	13	1	178	13	13	8	181	8	13	5	181	12	13	0
176	9	14	16	178	13	14	72	181	8	14	1	181	12	14	5
176	9	15	3	178	13	15	81	181	8	15	1	181	12	15	15
176	9	16	7	178	13	16	48	181	8	16	4	181	12	16	4
176	9	17	12	178	13	17	62	181	8	17	7	181	12	17	3
176	9	18	5	178	13	18	19	181	8	18	31	181	12	18	29
176	9	19	4	178	13	19	0	181	8	19	2	181	12	19	12
176	10	1	5	178	14	1	20	181	8	20	3	181	12	20	2
176	10	2	92	178	14	2	41	181	9	1	1	183	1	1	33
176	10	3	61	178	14	3	29	181	9	2	17	183	1	2	3
176	10	4	43	178	14	4	37	181	9	3	2	183	1	3	0
176	10	5	119	178	14	5	58	181	9	4	19	183	1	4	0
176	10	6	72	178	14	6	26	181	9	5	2	183	1	5	0
176	10	7	71	178	14	7	32	181	9	6	0	183	1	6	2
176	10	8	45	178	14	8	7	181	9	7	0	183	1	7	0
176	10	9	57	178	14	9	11	181	9	8	5	183	1	8	4
176	10	10	8	178	14	10	9	181	9	9	6	183	1	9	4
176	10	11	12	178	14	11	30	181	9	10	19	183	1	10	0
176	10	12	10	178	14	12	38	181	9	11	0	183	1	11	0
176	10	13	18	178	14	13	18	181	9	12	4	183	1	12	1
176	10	14	17	178	14	14	48	181	9	13	1	183	1	13	0
176	10	15	43	178	14	15	19	181	9	14	1	183	1	14	0
176	10	16	21	178	14	16	39	181	9	15	5	183	1	15	3
176	10	17	21	178	14	17	0	181	9	16	6	183	1	16	0
176	10	18	11	178	14	18	6	181	9	17	0	183	1	17	1
176	10	19	30	178	14	19	5	181	9	18	20	183	1	18	3
176	10	20	22	178	14	20	19	181	9	19	2	183	1	19	1
176	11	1	10	180	13	1	38	181	9	20	0	183	1	20	3
176	11	2	11	180	13	2	51	181	10	1	3	183	2	1	8
176	11	3	1	180	13	3	42	181	10	2	0	183	2	2	0
176	11	4	1	180	13	4	23	181	10	3	17	183	2	3	5
176	11	5	9	180	13	5	0	181	10	4	76	183	2	4	3
176	11	6	7	180	13	6	0	181	10	5	66	183	2	5	4
176	11	7	11	180	13	7	0	181	10	6	74	183	2	6	6
176	11	8	13	180	13	8	3	181	10	7	31	183	2	7	10
176	11	9	1	180	13	9	8	181	10	8	39	183	2	8	0
176	11	10	2	180	13	10	21	181	10	9	38	183	2	9	8
176	11	11	43	180	13	11	49	181	10	10	78	183	2	10	0
176	11	12	19	180	13	12	51	181	10	11	22	183	2	11	5
176	11	13	11	180	13	13	33	181	10	12	67	183	2	12	15
176	11	14	4	180	13	14	31	181	10	13	77	183	2	13	2
176	11	15	6	180	13	15	42	181	10	14	56	183	2	14	2
176	11	16	37	180	13	16	44	181	10	15	68	183	2	15	3
176	11	17	4	180	13	17	9	181	10	16	33	183	2	16	2
176	11	18	15	180	13	18	2	181	10	17	48	183	2	17	4
176	11	19	7	180	13	19	0	181	10	18	52	183	2	18	11
176	11	20	27	180	13	20	0	181	19	19	66	183	2	19	3
								181	10	20	63	193	2	20	5

TABLE F . CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
183	3	1	2	189	8	1	2	189	12	1	0	190	4	1	7
183	3	2	1	189	8	2	2	189	12	2	0	190	4	2	3
183	3	3	0	189	8	3	0	189	12	3	0	190	4	3	5
183	3	4	0	189	8	4	0	189	12	4	4	190	4	4	1
183	3	5	12	189	8	5	3	189	12	5	5	190	4	5	1
183	3	6	8	189	8	6	2	189	12	6	1	190	4	6	1
183	3	7	5	189	8	7	1	189	12	7	21	190	4	7	5
183	3	8	7	189	8	8	0	189	12	8	11	190	4	8	3
183	3	9	7	189	8	9	8	189	12	9	13	190	4	9	3
183	3	10	12	189	8	10	0	189	12	10	2	190	4	10	3
183	3	11	2	189	8	11	9	189	12	11	17	190	4	11	1
183	3	12	10	189	8	12	1	189	12	12	4	190	4	12	1
183	3	13	7	189	8	13	1	189	12	13	9	190	4	13	6
183	3	14	4	189	8	14	2	189	12	14	4	190	4	14	1
183	3	15	7	189	8	15	3	189	12	15	8	190	4	15	0
183	3	16	8	189	8	16	2	189	12	16	31	190	4	16	2
183	3	17	3	189	8	17	0	189	12	17	27	190	4	17	4
183	3	18	16	189	8	18	0	189	12	18	4	190	4	18	12
183	3	19	4	189	8	19	1	189	12	19	17	190	4	19	2
183	3	20	3	189	8	20	3	189	12	20	5	190	4	20	9
183	4	1	4	189	9	1	22	190	1	1	0	190	5	1	0
183	4	2	5	189	9	2	5	190	1	2	0	190	5	2	9
183	4	3	2	189	9	3	20	190	1	3	0	190	5	3	1
183	4	4	1	189	9	4	6	190	1	4	0	190	5	4	0
183	4	5	2	189	9	5	8	190	1	5	1	190	5	5	6
183	4	6	0	189	9	6	3	190	1	6	0	190	5	6	4
183	4	7	2	189	9	7	10	190	1	7	0	190	5	7	1
183	4	8	0	189	9	8	4	190	1	8	0	190	5	8	17
183	4	9	1	189	9	9	15	190	1	9	1	190	5	9	3
183	4	10	2	189	9	10	4	190	1	10	0	190	5	10	1
183	4	11	4	189	9	11	2	190	1	11	0	190	5	11	7
183	4	12	2	189	9	12	11	190	1	12	0	190	5	12	4
183	4	13	0	189	9	13	0	190	1	13	0	190	5	13	7
183	4	14	0	189	9	14	3	190	1	14	1	190	5	14	1
183	4	15	1	189	9	15	4	190	1	15	0	190	5	15	3
183	4	16	0	189	9	16	1	190	1	16	0	190	5	16	3
183	4	17	2	189	9	17	5	190	1	17	0	190	5	17	0
183	4	18	0	189	9	18	1	190	1	18	0	190	5	18	0
183	4	19	3	189	9	19	2	190	1	19	0	190	5	19	0
183	4	20	10	189	9	20	1	190	1	20	0	190	5	20	5
183	5	1	0	189	10	1	27	190	2	1	7	190	6	1	6
183	5	2	0	189	10	2	53	190	2	2	0	190	6	2	0
183	5	3	33	189	10	3	61	190	2	3	0	190	6	3	3
183	5	4	8	189	10	4	10	190	2	4	0	190	6	4	0
183	5	5	2	189	10	5	19	190	2	5	0	190	6	5	1
183	5	6	0	189	10	6	29	190	2	6	0	190	6	6	3
183	5	7	0	189	10	7	62	190	2	7	0	190	6	7	0
183	5	8	0	189	10	8	38	190	2	8	2	190	6	8	0
183	5	9	1	189	10	9	48	190	2	9	1	190	6	9	1
183	5	10	0	189	10	10	33	190	2	10	10	190	6	10	1
183	5	11	2	189	10	11	0	190	2	11	3	190	6	11	2
183	5	12	1	189	10	12	0	190	2	12	5	190	6	12	1
183	5	13	6	189	10	13	16	190	2	13	3	190	6	13	2
183	5	14	3	189	10	14	10	190	2	14	1	190	6	14	2
183	5	15	2	189	10	15	14	190	2	15	1	190	6	15	2
183	5	16	1	189	10	16	10	190	2	16	1	190	6	16	0
183	5	17	9	189	10	17	42	190	2	17	1	190	6	17	0
183	5	18	2	189	10	18	19	190	2	18	1	190	6	18	2
183	5	19	5	189	10	19	17	190	2	19	2	190	6	19	0
183	5	20	16	189	10	20	5	190	2	20	1	190	6	20	1
183	6	1	10	189	11	1	41	190	3	1	11	191	13	1	1
183	6	2	12	189	11	2	9	190	3	2	1	191	13	2	30
183	6	3	19	189	11	3	26	190	3	3	3	191	13	3	21
183	6	4	2	189	11	4	23	190	3	4	9	191	13	4	53
183	6	5	9	189	11	5	29	190	3	5	0	191	13	5	27
183	6	6	2	189	11	6	21	190	3	6	1	191	13	6	1
183	6	7	0	189	11	7	18	190	3	7	1	191	13	7	6
183	6	8	3	189	11	8	6	190	3	8	4	191	13	8	6
183	6	9	7	189	11	9	15	190	3	9	0	191	13	9	0
183	6	10	4	189	11	10	34	190	3	10	6	191	13	10	19
183	6	11	7	189	11	11	4	190	3	11	1	191	13	11	40
183	6	12	5	189	11	12	19	190	3	12	1	191	13	12	17
183	6	13	8	189	11	13	8	190	3	13	0	191	13	13	35
183	6	14	11	189	11	14	10	190	3	14	4	191	13	14	42
183	6	15	10	189	11	15	15	190	3	15	2	191	13	15	18
183	6	16	53	189	11	16	12	190	3	16	2	191	13	16	17
183	6	17	17	189	11	17	13	190	3	17	2	191	13	17	44
183	6	18	0	189	11	18	7	190	3	18	4	191	13	18	34
183	6	19	3	189	11	19	11	190	3	19	12	191	13	19	2
183	6	20	2	189	11	20	29	190	3	20	0	191	13	20	0

TABLE F . CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
191	14	1	3	195	9	1	2	197	1	1	1	197	5	1	2
191	14	2	30	195	9	2	3	197	1	2	1	197	5	2	1
191	14	3	25	195	9	3	4	197	1	3	0	197	5	3	1
191	14	4	31	195	9	4	2	197	1	4	0	197	5	4	1
191	14	5	23	195	9	5	6	197	1	5	0	197	5	5	0
191	14	6	28	195	9	6	0	197	1	6	0	197	5	6	0
191	14	7	24	195	9	7	0	197	1	7	0	197	5	7	0
191	14	8	20	195	9	8	2	197	1	8	3	197	5	8	0
191	14	9	21	195	9	9	3	197	1	9	1	197	5	9	0
191	14	10	28	195	9	10	3	197	1	10	0	197	5	10	0
191	14	11	13	195	9	11	3	197	1	11	0	197	5	11	0
191	14	12	20	195	9	12	4	197	1	12	0	197	5	12	0
191	14	13	2	195	9	13	11	197	1	13	0	197	5	13	0
191	14	14	1	195	9	14	12	197	1	14	0	197	5	14	0
191	14	15	0	195	9	15	1	197	1	15	0	197	5	15	0
191	14	16	2	195	9	16	3	197	1	16	0	197	5	16	0
191	14	17	2	195	9	17	1	197	1	17	1	197	5	17	0
191	14	18	3	195	9	18	8	197	1	18	1	197	5	18	0
191	14	19	1	195	9	19	6	197	1	19	2	197	5	19	0
191	14	20	7	195	9	20	9	197	1	20	1	197	5	20	0
193	13	1	2	195	10	1	16	197	2	1	4	197	6	1	3
193	13	2	2	195	10	2	5	197	2	2	4	197	6	2	1
193	13	3	3	195	10	3	23	197	2	3	2	197	6	3	0
193	13	4	6	195	10	4	7	197	2	4	1	197	6	4	1
193	13	5	1	195	10	5	24	197	2	5	2	197	6	5	1
193	13	6	4	195	10	6	29	197	2	6	4	197	6	6	1
193	13	7	27	195	10	7	17	197	2	7	4	197	6	7	1
193	13	8	60	195	10	8	16	197	2	8	4	197	6	8	0
193	13	9	24	195	10	9	4	197	2	9	0	197	6	9	0
193	13	10	31	195	10	10	30	197	2	10	1	197	6	10	0
193	13	11	0	195	10	11	0	197	2	11	13	197	6	11	0
193	13	12	6	195	10	12	14	197	2	12	1	197	6	12	0
193	13	13	18	195	10	13	6	197	2	13	2	197	6	13	0
193	13	14	12	195	10	14	10	197	2	14	4	197	6	14	0
193	13	15	0	195	10	15	7	197	2	15	10	197	6	15	0
193	13	16	1	195	10	16	0	197	2	16	2	197	6	16	0
193	13	17	2	195	10	17	14	197	2	17	1	197	6	17	0
193	13	18	11	195	10	18	10	197	2	18	0	197	6	18	0
193	13	19	16	195	10	19	3	197	2	19	0	197	6	19	0
193	13	20	18	195	10	20	23	197	2	20	0	197	6	20	0
193	14	1	29	195	11	1	3	197	3	1	0	197	13	1	3
193	14	2	8	195	11	2	9	197	3	2	0	197	13	2	0
193	14	3	16	195	11	3	11	197	3	3	0	197	13	3	0
193	14	4	16	195	11	4	0	197	3	4	2	197	13	4	8
193	14	5	7	195	11	5	18	197	3	5	1	197	13	5	14
193	14	6	21	195	11	6	4	197	3	6	0	197	13	6	7
193	14	7	9	195	11	7	12	197	3	7	1	197	13	7	13
193	14	8	2	195	11	8	3	197	3	8	0	197	13	8	17
193	14	9	5	195	11	9	3	197	3	9	1	197	13	9	9
193	14	10	2	195	11	10	10	197	3	10	0	197	13	10	4
193	14	11	10	195	11	11	24	197	3	11	0	197	13	11	13
193	14	12	0	195	11	12	8	197	3	12	0	197	13	12	17
193	14	13	1	195	11	13	8	197	3	13	0	197	13	13	8
193	14	14	2	195	11	14	9	197	3	14	0	197	13	14	5
193	14	15	4	195	11	15	3	197	3	15	0	197	13	15	6
193	14	16	8	195	11	16	16	197	3	16	0	197	13	16	5
193	14	17	0	195	11	17	11	197	3	17	1	197	13	17	11
193	14	18	5	195	11	18	5	197	3	18	0	197	13	18	4
193	14	19	0	195	11	19	3	197	3	19	0	197	13	19	4
193	14	20	8	195	11	20	13	197	3	20	0	197	13	20	8
195	8	1	0	195	12	1	2	197	4	1	1	197	14	1	0
195	8	2	4	195	12	2	0	197	4	2	0	197	14	2	2
195	8	3	14	195	12	3	4	197	4	3	0	197	14	3	5
195	8	4	11	195	12	4	10	197	4	4	0	197	14	4	7
195	8	5	10	195	12	5	2	197	4	5	0	197	14	5	3
195	8	6	2	195	12	6	2	197	4	6	1	197	14	6	6
195	8	7	5	195	12	7	3	197	4	7	0	197	14	7	8
195	8	8	8	195	12	8	3	197	4	8	1	197	14	8	11
195	8	9	2	195	12	9	8	197	4	9	2	197	14	9	13
195	8	10	8	195	12	10	8	197	4	10	0	197	14	10	7
195	8	11	0	195	12	11	1	197	4	11	0	197	14	11	0
195	8	12	0	195	12	12	3	197	4	12	0	197	14	12	1
195	8	13	0	195	12	13	6	197	4	13	0	197	14	13	7
195	8	14	1	195	12	14	3	197	4	14	1	197	14	14	12
195	8	15	1	195	12	15	5	197	4	15	1	197	14	15	5
195	8	16	2	195	12	16	4	197	4	16	0	197	14	16	7
195	8	17	0	195	12	17	0	197	4	17	0	197	14	17	5
195	8	18	0	195	12	18	0	197	4	18	1	197	14	18	10
195	8	19	3	195	12	19	0	197	4	19	1	197	14	19	9
195	8	20	5	195	12	20	3	197	4	20	1	197	14	20	7

TABLE F. CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
199	13	1	0	203	10	1	1	204	2	1	1	204	6	1	1
199	13	2	3	203	10	2	0	204	2	2	2	204	6	2	1
199	13	3	0	203	10	3	5	204	2	3	1	204	6	3	1
199	13	4	1	203	10	4	0	204	2	4	1	204	6	4	2
199	13	5	2	203	10	5	7	204	2	5	0	204	6	5	1
199	13	6	0	203	10	6	2	204	2	6	0	204	6	6	1
199	13	7	0	203	10	7	0	204	2	7	0	204	6	7	1
199	13	8	6	203	10	8	2	204	2	8	0	204	6	8	1
199	13	9	10	203	10	9	3	204	2	9	0	204	6	9	1
199	13	10	14	203	10	10	11	204	2	10	0	204	6	10	0
199	13	11	7	203	10	11	0	204	2	11	0	204	6	11	0
199	13	12	5	203	10	12	2	204	2	12	0	204	6	12	0
199	13	13	1	203	10	13	5	204	2	13	0	204	6	13	0
199	13	14	0	203	10	14	2	204	2	14	0	204	6	14	0
199	13	15	3	203	10	15	12	204	2	15	0	204	6	15	0
199	13	16	0	203	10	16	7	204	2	16	0	204	6	16	0
199	13	17	5	203	10	17	1	204	2	17	0	204	6	17	0
199	13	18	6	203	10	18	2	204	2	18	0	204	6	18	0
199	13	19	0	203	10	19	1	204	2	19	0	204	6	19	0
199	13	20	0	203	10	20	3	204	2	20	0	204	6	20	0
199	14	1	4	203	11	1	1	204	3	1	1	205	13	1	1
199	14	2	0	203	11	2	5	204	3	2	0	205	13	2	0
199	14	3	2	203	11	3	4	204	3	3	0	205	13	3	3
199	14	4	0	203	11	4	2	204	3	4	0	205	13	4	0
199	14	5	5	203	11	5	4	204	3	5	0	205	13	5	1
199	14	6	6	203	11	6	2	204	3	6	0	205	13	6	1
199	14	7	0	203	11	7	5	204	3	7	0	205	13	7	2
199	14	8	0	203	11	8	3	204	3	8	0	205	13	8	4
199	14	9	9	203	11	9	3	204	3	9	0	205	13	9	1
199	14	10	7	203	11	10	2	204	3	10	0	205	13	10	5
199	14	11	5	203	11	11	3	204	3	11	0	205	13	11	1
199	14	12	0	203	11	12	2	204	3	12	0	205	13	12	0
199	14	13	2	203	11	13	6	204	3	13	0	205	13	13	0
199	14	14	3	203	11	14	2	204	3	14	0	205	13	14	2
199	14	15	0	203	11	15	4	204	3	15	0	205	13	15	0
199	14	16	1	203	11	16	2	204	3	16	0	205	13	16	0
199	14	17	0	203	11	17	0	204	3	17	0	205	13	17	0
199	14	18	0	203	11	18	0	204	3	18	0	205	13	18	0
199	14	19	2	203	11	19	0	204	3	19	0	205	13	19	0
199	14	20	2	203	11	20	5	204	3	20	0	205	13	20	0
203	8	1	0	203	12	1	1	204	4	1	1	205	14	1	0
203	8	2	0	203	12	2	0	204	4	2	0	205	14	2	1
203	8	3	2	203	12	3	0	204	4	3	0	205	14	3	1
203	8	4	0	203	12	4	1	204	4	4	0	205	14	4	0
203	8	5	1	203	12	5	0	204	4	5	0	205	14	5	2
203	8	6	6	203	12	6	2	204	4	6	0	205	14	6	1
203	8	7	0	203	12	7	9	204	4	7	0	205	14	7	2
203	8	8	1	203	12	8	6	204	4	8	0	205	14	8	0
203	8	9	0	203	12	9	4	204	4	9	0	205	14	9	0
203	8	10	3	203	12	10	4	204	4	10	0	205	14	10	3
203	8	11	0	203	12	11	2	204	4	11	0	205	14	11	3
203	8	12	0	203	12	12	2	204	4	12	0	205	14	12	2
203	8	13	2	203	12	13	4	204	4	13	0	205	14	13	0
203	8	14	2	203	12	14	5	204	4	14	0	205	14	14	2
203	8	15	0	203	12	15	6	204	4	15	0	205	14	15	0
203	8	16	4	203	12	16	6	204	4	16	0	205	14	16	0
203	8	17	1	203	12	17	1	204	4	17	0	205	14	17	0
203	8	18	1	203	12	18	0	204	4	18	0	205	14	18	2
203	8	19	0	203	12	19	1	204	4	19	0	205	14	19	0
203	8	20	5	203	12	20	2	204	4	20	0	205	14	20	0
203	9	1	2	204	1	1	3	204	5	1	1	207	13	1	0
203	9	2	2	204	1	2	3	204	5	2	1	207	13	2	1
203	9	3	1	204	1	3	1	204	5	3	0	207	13	3	1
203	9	4	0	204	1	4	0	204	5	4	0	207	13	4	0
203	9	5	1	204	1	5	0	204	5	5	0	207	13	5	0
203	9	6	1	204	1	6	0	204	5	6	0	207	13	6	0
203	9	7	0	204	1	7	0	204	5	7	0	207	13	7	4
203	9	8	1	204	1	8	0	204	5	8	0	207	13	8	2
203	9	9	0	204	1	9	0	204	5	9	0	207	13	9	3
203	9	10	0	204	1	10	0	204	5	10	0	207	13	10	3
203	9	11	0	204	1	11	0	204	5	11	0	207	13	11	4
203	9	12	2	204	1	12	0	204	5	12	0	207	13	12	0
203	9	13	0	204	1	13	0	204	5	13	0	207	13	13	1
203	9	14	4	204	1	14	0	204	5	14	0	207	13	14	0
203	9	15	2	204	1	15	0	204	5	15	0	207	13	15	0
203	9	16	1	204	1	16	0	204	5	16	0	207	13	16	2
203	9	17	1	204	1	17	0	204	5	17	0	207	13	17	1
203	9	18	0	204	1	18	0	204	5	18	0	207	13	18	0
203	9	19	0	204	1	19	0	204	5	19	0	207	13	19	3
203	9	20	2	204	1	20	0	204	5	20	0	207	13	20	1

TABLE F . CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
207	14	1	0	211	4	1	2	212	14	1	2	216	9	1	2
207	14	2	4	211	4	2	1	212	14	2	4	216	9	2	0
207	14	3	1	211	4	3	1	212	14	3	6	216	9	3	1
207	14	4	3	211	4	4	1	212	14	4	4	216	9	4	2
207	14	5	2	211	4	5	0	212	14	5	4	216	9	5	2
207	14	6	1	211	4	6	0	212	14	6	2	216	9	6	1
207	14	7	6	211	4	7	0	212	14	7	0	216	9	7	4
207	14	8	1	211	4	8	0	212	14	8	4	216	9	8	0
207	14	9	1	211	4	9	0	212	14	9	1	216	9	9	1
207	14	10	2	211	4	10	0	212	14	10	1	216	9	10	1
207	14	11	1	211	4	11	0	212	14	11	0	216	9	11	0
207	14	12	3	211	4	12	0	212	14	12	0	216	9	12	0
207	14	13	2	211	4	13	0	212	14	13	1	216	9	13	0
207	14	14	0	211	4	14	0	212	14	14	2	216	9	14	0
207	14	15	2	211	4	15	0	212	14	15	1	216	9	15	0
207	14	16	0	211	4	16	0	212	14	16	0	216	9	16	0
207	14	17	0	211	4	17	0	212	14	17	1	216	9	17	1
207	14	18	1	211	4	18	0	212	14	18	1	216	9	18	1
207	14	19	0	211	4	19	0	212	14	19	0	216	9	19	1
207	14	20	0	211	4	20	0	212	14	20	1	216	9	20	2
211	1	1	1	211	5	1	3	214	13	1	0	216	10	1	0
211	1	2	1	211	5	2	1	214	13	2	2	216	10	2	1
211	1	3	1	211	5	3	1	214	13	3	1	216	10	3	0
211	1	4	1	211	5	4	1	214	13	4	0	216	10	4	17
211	1	5	2	211	5	5	1	214	13	5	0	216	10	5	27
211	1	6	0	211	5	6	1	214	13	6	3	216	10	6	5
211	1	7	0	211	5	7	0	214	13	7	1	216	10	7	9
211	1	8	0	211	5	8	0	214	13	8	7	216	10	8	6
211	1	9	0	211	5	9	0	214	13	9	6	216	10	9	10
211	1	10	0	211	5	10	0	214	13	10	9	216	10	10	21
211	1	11	0	211	5	11	0	214	13	11	5	216	10	11	4
211	1	12	0	211	5	12	0	214	13	12	0	216	10	12	12
211	1	13	0	211	5	13	0	214	13	13	5	216	10	13	6
211	1	14	0	211	5	14	0	214	13	14	3	216	10	14	11
211	1	15	0	211	5	15	0	214	13	15	2	216	10	15	4
211	1	16	0	211	5	16	0	214	13	16	0	216	10	16	9
211	1	17	0	211	5	17	0	214	13	17	1	216	10	17	21
211	1	18	0	211	5	18	0	214	13	18	1	216	10	18	5
211	1	19	0	211	5	19	0	214	13	19	2	216	10	19	5
211	1	20	0	211	5	20	0	214	13	20	1	216	10	20	4
211	2	1	1	211	6	1	2	214	14	1	2	216	11	1	7
211	2	2	1	211	6	2	1	214	14	2	0	216	11	2	5
211	2	3	1	211	6	3	1	214	14	3	2	216	11	3	5
211	2	4	1	211	6	4	1	214	14	4	1	216	11	4	5
211	2	5	0	211	6	5	1	214	14	5	1	216	11	5	3
211	2	6	0	211	6	6	1	214	14	6	3	216	11	6	2
211	2	7	0	211	6	7	1	214	14	7	4	216	11	7	3
211	2	8	0	211	6	8	0	214	14	8	3	216	11	8	3
211	2	9	0	211	6	9	0	214	14	9	7	216	11	9	6
211	2	10	0	211	6	10	0	214	14	10	7	216	11	10	6
211	2	11	0	211	6	11	0	214	14	11	0	216	11	11	2
211	2	12	0	211	6	12	0	214	14	12	2	216	11	12	3
211	2	13	0	211	6	13	0	214	14	13	0	216	11	13	2
211	2	14	0	212	6	14	0	214	14	14	2	216	11	14	0
211	2	15	0	211	6	15	0	214	14	15	0	216	11	15	3
211	2	16	0	211	6	16	0	214	14	16	1	216	11	16	1
211	2	17	0	211	6	17	0	214	14	17	1	216	11	17	0
211	2	18	0	211	6	18	0	214	14	18	0	216	11	18	0
211	2	19	0	211	6	19	0	214	14	19	0	216	11	19	1
211	2	20	0	211	6	20	0	214	14	20	1	216	11	20	4
211	3	1	0	212	13	1	0	216	8	1	4	216	12	1	1
211	3	2	0	212	13	2	0	216	8	2	2	216	12	2	2
211	3	3	0	212	13	3	0	216	8	3	1	216	12	3	0
211	3	4	0	212	13	4	0	216	8	4	2	216	12	4	5
211	3	5	0	212	13	5	1	216	8	5	0	216	12	5	5
211	3	6	0	212	13	6	0	216	8	6	1	216	12	6	6
211	3	7	0	212	13	7	0	216	8	7	0	216	12	7	0
211	3	8	0	212	13	8	0	216	8	8	0	216	12	8	3
211	3	9	0	212	13	9	2	216	8	9	0	216	12	9	2
211	3	10	0	212	13	10	1	216	8	10	1	216	12	10	1
211	3	11	0	212	13	11	3	216	8	11	0	216	12	11	4
211	3	12	0	212	13	12	1	216	8	12	0	216	12	12	2
211	3	13	0	212	13	13	10	216	8	13	0	216	12	13	6
211	3	14	0	212	13	14	1	216	8	14	2	216	12	14	2
211	3	15	0	212	13	15	0	216	8	15	1	216	12	15	3
211	3	16	0	212	13	16	3	216	8	16	1	216	12	16	0
211	3	17	0	212	13	17	0	216	8	17	0	216	12	17	0
211	3	18	0	212	13	18	1	216	8	18	1	216	12	18	0
211	3	19	0	212	13	19	3	216	8	19	0	216	12	19	0
211	3	20	0	212	13	20	2	216	8	20	0	216	12	20	0

TABLE F . CONTINUED

DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS	DATE	FIELD	SAMPLE NUMBER	DAMAGED PLANTS
218	1	1	1	218	5	1	0
218	1	2	2	218	5	2	3
218	1	3	0	218	5	3	0
218	1	4	0	218	5	4	1
218	1	5	0	218	5	5	1
218	1	6	0	218	5	6	2
218	1	7	0	218	5	7	2
218	1	8	0	218	5	8	1
218	1	9	0	218	5	9	4
218	1	10	0	218	5	10	0
218	1	11	0	218	5	11	1
218	1	12	0	218	5	12	0
218	1	13	0	218	5	13	0
218	1	14	0	218	5	14	0
218	1	15	0	218	5	15	4
218	1	16	0	218	5	16	0
218	1	17	0	218	5	17	0
218	1	18	0	218	5	18	0
218	1	19	0	218	5	19	0
218	1	20	0	218	5	20	1
218	2	1	2	218	6	1	1
218	2	2	2	218	6	2	1
218	2	3	1	218	6	3	1
218	2	4	0	218	6	4	1
218	2	5	0	218	6	5	3
218	2	6	0	218	6	6	3
218	2	7	0	218	6	7	4
218	2	8	0	218	6	8	2
218	2	9	0	218	6	9	0
218	2	10	0	218	6	10	0
218	2	11	0	218	6	11	0
218	2	12	0	218	6	12	0
218	2	13	0	218	6	13	0
218	2	14	0	218	6	14	0
218	2	15	0	218	6	15	0
218	2	16	0	218	6	16	0
218	2	17	0	218	6	17	0
218	2	18	0	218	6	18	0
218	2	19	0	218	6	19	0
218	2	20	0	218	6	20	0
218	3	1	4	221	13	1	0
218	3	2	2	221	13	2	0
218	3	3	1	221	13	3	1
218	3	4	1	221	13	4	0
218	3	5	1	221	13	5	0
218	3	6	1	221	13	6	0
218	3	7	0	221	13	7	0
218	3	8	0	221	13	8	0
218	3	9	0	221	13	9	0
218	3	10	0	221	13	10	3
218	3	11	0	221	13	11	1
218	3	12	0	221	13	12	2
218	3	13	0	221	13	13	0
218	3	14	0	221	13	14	1
218	3	15	0	221	13	15	0
218	3	16	0	221	13	16	0
218	3	17	0	221	13	17	0
218	3	18	0	221	13	18	1
218	3	19	0	221	13	19	0
218	3	20	0	221	13	20	2
218	4	1	2	221	14	1	0
218	4	2	2	221	14	2	2
218	4	3	1	221	14	3	1
218	4	4	1	221	14	4	4
218	4	5	0	221	14	5	1
218	4	6	0	221	14	6	1
218	4	7	0	221	14	7	1
218	4	8	0	221	14	8	2
218	4	9	0	221	14	9	2
218	4	10	0	221	14	10	0
218	4	11	0	221	14	11	2
218	4	12	0	221	14	12	3
218	4	13	0	221	14	13	1
218	4	14	0	221	14	14	0
218	4	15	0	221	14	15	0
218	4	16	0	221	14	16	0
218	4	17	0	221	14	17	0
218	4	18	0	221	14	18	1
218	4	19	0	221	14	19	2
218	4	20	0	221	14	20	0

APPENDIX G

Appendix G.

Table G1. Computer program for adjusting adult trap catch according to hourly temperatures and within day activity.

Table G2. Computer program for calculation of Batcheler's B ratio from plots of damaged onions (Lampert, 1980).

Table G3. Computer program for calculation of Clark and Evan's dispersion statistic from plots of damaged onions.

Table G4. Computer program for calculation of distance measurements A and D and the test statistic P from plots of damaged onions with different volunteer onion densities.

Table G5. Computer program listing of the OM population dynamics submodel.

TABLE G1

```
      PROGRAM TEMPJUS(INPUT,OUTPUT,TAPE1,TAPE3,TAPE4,TAPE5)
      REAL NDAY,NMF,NMM,NSF,NSM
      REAL JDAY
      INTEGER HTIME
      DIMENSION IDATES(100),CUMDD(100),RDATES(100)
      DIMENSION ARGT(10),CD(10),CTAB(24)
      DATA CTAB/5*0,.087,.102,.067,.052,.029,.028,.018,.036,.019,.034,.
     +39,.084,.123,.143,.132,.008,0,0,0/
      DATA CD/21.9,31.2,43.8,75.0,100.0,125.,156.2,181.2,207.,231.2/
      DATA ARGT/53.6,57.2,60.8,64.4,68.,71.6,75.2,78.8,82.4,86./
      DO 23 K1=1,76
      IDATES(K1)=0
      RDATES(K1)=0.
23    CUMDD(K1)=0.
      PRINT*,"ENTER LENGTH OF DATA FILE"
      READ*,IK
      DO 24 K1=1,IK
24    READ(4,69)RDATES(K1),IDATES(K1),CUMDD(K1)
69    FORMAT(1X,F6.2,I6,10X,F10.4)
      PRINT*,"ENTER IPDATE---(FIRST DATE)"
      READ*,IPDATE
      ODAY=IPDATE
      OOMF=OOMM=OOSF=OOSM=0.
      PI=3.14159265
      HOUR=PI/12
      PRINT*,"HOW MANY DAYS TO RUN?  "
      READ*, NDAYS
      TOTMF=TOTMM=TOTSF=TOTSM=0.
      REWIND 4
      DO 1000 L=1,NDAYS
      READ(4,56)INDAY,NMF,NMM,NSF,NSM
56    FORMAT(7X,I6,20X,4(2X,F9.1))
      IF(EOF(4).NE.0)GO TO 99
      NDAY=FLOAT(INDAY)
      GAP=NDAY-ODAY
      DMF=(NMF-OOMF)
      DMM=(NMM-OOMM)
      DSF=(NSF-OOSF)
      DSM=(NSM-OOSM)
      IGAP=GAP
      DO 600 I=1,IGAP
      HTIME=0
      OMF=OOMF+I*DMF/GAP
      OMM=OOMM+I*DMM/GAP
      OSF=OOSF+I*DSF/GAP
      OSM=OOSM+I*DSM/GAP
      JDAY=ODAY+I
      READ(3,50) IDAY,TMAX,TMIN
50    FORMAT (6X,I3,2(5X,F3.0))
      IF(EOF(3).NE.0)GOTO99
      TTMF=TTMM=TTSF=TTSM=0
      TMEAN=(TMAX+TMIN)/2
      RANGE=(TMAX-TMIN)/2
      DO 900 J=1,24
      HTIME=HTIME+1
      THETA=(HTIME-9)*HOUR
      TEMP=TMEAN+RANGE*SIN(THETA)
51    FORMAT (1X,I3,5X,I3,5X,F5.1)
      IF (HTIME.LT.6)GOTO900
      IF(HTIME.GT.21)GOTO87
      CF=TABEX(CD,ARGT,TEMP,9)
      IF(CF.LT.20) CF=20
      D=CTAB(HTIME)
      TTMF=TTMF+OMF*D*(100/CF)
      TTMM=TTMM+OMM*D*(100/CF)
      TTSF=TTSF+OSF*D*(100/CF)
      TTSM=TTSM+OSM*D*(100/CF)
900   CONTINUE
87    TOTMF=TOTMF+TTMF
      TOTMM=TOTMM+TTMM
      TOTSF=TOTSF+TTSF
      TOTSM=TOTSM+TTSM
      IDAY=JDAY+.0005
      DO 12 K1=1,IK
      IF(IDAY.EQ.IDATES(K1))GO TO 80
12    CONTINUE
      GO TO 600
80    TOTMF=TOTMF/(IDAY-IPDATE)
      TOTMM=TOTMM/(IDAY-IPDATE)
      TOTSF=TOTSF/(IDAY-IPDATE)
      TOTSM=TOTSM/(IDAY-IPDATE)
      WRITE(5,34)RDATES(K1),CUMDD(K1),TOTMF,TOTMM,TOTSF,TOTSM
34    FORMAT(1X,F6.2,5F10.4)
      TOTMF=TOTMM=TOTSF=TOTSM=0.
      TTMF=TTMM=TTSF=TTSM=0.
      IPDATE=IDAY
600   CONTINUE
      ODAY=NDAY
      OOMF=NMF
      OOMM=NMM
```

TABLE G1 CONTINUED

```
      OOSF=NSF
      OOSM=NSM
1000  CONTINUE
99    END
C
      FUNCTION TABEX(VAL,ARG,DUM,K)
      DIMENSION VAL(1),ARG(1)
      DO 1 J=2,K
      IF(DUM.GT.ARG(J)) GOTO 1
2     TABEX=(DUM-ARG(J-1))*(VAL(J)-VAL(J-1))/(ARG(J)-ARG(J-1))+VAL(J-1)
      RETURN
1     CONTINUE
      TABEX=(DUM-ARG(K-1))*(VAL(K)-VAL(K-1))/(ARG(K)-ARG(K-1))+VAL(K-1)
      RETURN
      END
```

TABLE G2

```
      PROGRAM BATCHER(INPUT,OUTPUT,TAPE1,TAPE3)
      DIMENSION X(300),Y(300)
C***
C***THIS PROGRAM WAS WRITTEN TO COMPUTE THE RATIOS OF
C***MEAN NORP DISTANCE/MEAN NN DISTANCE.
C***
      REWIND 3
1     REWIND 1
C***
C***INITIALIZE NUMBER OF SAMPLES AND PLOT SIZE
C***
      PRINT*,"ENTER NUMBER OF SAMPLES."
      READ*,NUM
      PRINT*,"ENTER PLOT SIZE--WIDTH,LENGTH."
      READ*,XSIZE,YSIZE
C***
C***READ IN DATA HEADER AND X,Y COORDINATES FOR OBSERVATIONS
C***
2     READ(1,100)IDATE,ITREAT,IPLOT,IROW,N
      IF(EOF(1)) 200,201
201   DO 10 I=1,N
10    READ(1,101) X(I),Y(I)
C***
C***CHECK IF USER WANTS TO CONTINUE IF N TOO SMALL
C***
      IF(N.GT.1) GO TO 80
      PRINT*,"SINCE N =",N," , DO YOU WANT TO CONTINUE HERE?"
      READ 300, IANS2
      IF(IANS2.EQ.1HN) GO TO 2
C***
C***ZERO OUT VARIABLES
C***
80    SUMNN=0.
      SUMNNSQ=0.
      SUMNN2=0.
      SUMNORP=0.
      SSQNORP=0.
C***
C***CALCULATE RANDOM POINT AND RANDOM INDIVIDUAL
C***FROM WHICH TO FIND NEAREST NEIGHBOR.  ALSO FIND
C***NEAREST NEIGHBOR TO THE NEAREST NEIGHBOR TO THE
C***RANDOM POINT.
C***
      DO 12 I=1,NUM
      XPT=RANF(-1)*XSIZE
      YPT=RANF(-1)*YSIZE
      IND=1+RANF(-1)*N
      SMALL1=100.
      SMALL2=100.
      SMALL3=100.
      DO 13 J=1,N
      DIST1=(((X(J)-XPT)**2.)+((Y(J)-YPT)**2.))**.5
      IF(DIST1.LT.SMALL1) IC=J
      IF(DIST1.LT.SMALL1) SMALL1=DIST1
      IF(N.LT.2) GO TO 13
      DIST2=(((X(J)-X(IND))**2.)+((Y(J)-Y(IND))**2.))**.5
      IF(DIST2.NE.0.0.AND.DIST2.LT.SMALL2) SMALL2=DIST2
13    CONTINUE
C***
C***FIND NEAREST NEIGHBOR TO NEAREST NEIGHBOR TO RAN PT
C***
      DO 14 L=1,N
      DIST3=(((X(L)-X(IC))**2.)+((Y(L)-Y(IC))**2.))**.5
14    IF(DIST3.NE.0.0.AND.DIST3.LT.SMALL3) SMALL3=DIST3
      SUMNN=SUMNN+SMALL2
      SUMNNSQ=SUMNNSQ+SMALL2**2.
      SUMNN2=SUMNN2+SMALL3
      SUMNORP=SUMNORP+SMALL1
      SSQNORP=SSQNORP+SMALL1**2.
12    CONTINUE
C***
C***CALCULATE MEAN NEAREST DISTANCE FOR NUM SAMPLES
C***
      R=FLOAT(NUM)
      R2=FLOAT(N)
      XBNORP=SUMNORP/R
      XBNN=SUMNN/R
      XBNNSQ=SUMNNSQ/R
      XBNN2=SUMNN2/R
      XBNORP2=SSQNORP/R
C***
C***CALCULATE MEAN DENSITY FROM MOORE
C***CALCULATE BATCHELERS B FOR NN AND NN2
C***
      RMU=R2/(XSIZE*YSIZE)
      DMOORE=((R-1.)/R)*(1./(3.14159*XBNORP2))
      B=XBNORP/XBNN
      B2=XBNORP/XBNN2
      RATIO=DMOORE/RMU
      RATIO2=XBNORP2/XBNNSQ
```

TABLE G2 CONTINUED

```
C***
C***OUTPUT VARIABLES
C***
      WRITE(3,901) IDATE,ITREAT,IPLOT,IROW,N,NUM,RMU,XBNORP2,XBNNSQ,RAT
     +O2
      GO TO 2
200   PRINT*,"ARE YOU DONE?"
      READ 300,IANS
      IF(IANS.EQ.1HN) GO TO 1
100   FORMAT(1X,I6,1X,I1,1X,I1,1X,I1,1X,I3)
101   FORMAT(1X,2(F10.4,2X))
901   FORMAT(1X,I6,1X,I1,1X,I1,1X,I1,1X,I4,1X,I5,1X,4F7.3)
300   FORMAT(A1)
      STOP
      END
```

TABLE G3

```
      PROGRAM ONSTATS (INPUT,ONION,OUTPUT,TAPE1=INPUT,TAPE2=ONION,TAPE3
     +OUTPUT)
      DIMENSION XON(500),YON(500),IHOLD(8)
C CALCULATES STATISTICS USING DATA ONLY FROM ONIONS THAT MEET THE
C  INPUTED VALUES.
C  R=CLARK AND EVANS R=RA/RE
C  RA=THE MEAN DISTANCE OF THE NEAREST NEIGHBOR TO A RANDOMLY SELECTED
C   INDIVIDUAL.
C  RE=THE EXPECTED DISTANCE OF THE NEAREST NEIGHBOR TO A RANDOMLY
C   SELECTED INDIVIDUAL IN A RANDOM POPULATION AND IS EQUAL TO
C   1/(2*SQRT(RHO))
C  RHO=POPULATION DENSITY FOR GIVEN STATUS VALUE
C  R IS JUDGED SIGNIFICANTLY DEVIANT FROM RANDOM AT THE .05 AND .01
C   LEVELS WHEN C EXCEEDS 1.96 AND 2.58 RESPECTIVELY.
C  C=(RA-RE)/ORE
C  ORE=THE STANDARD ERROR OF RE IN A RANDOM POPULATION, CALCULATED
C   BY .26136/SQRT(N*RHO) WHERE N=THE NUMBER OF DISTANCES MEASURED.
5     REWIND 2
C INITIALIZE
      M=SUM=0
      M1=1
      PRINT*,"NUMBER OF ONION COORDINATES TO BE READ FROM FILE  "
      READ*,N
      PRINT*,"NUMBER OF SAMPLES THIS RUN?  "
      READ*,NUM
      PRINT*,"ONION STATUS (0,1,2,3,4=[1+2+3],5=ALL)    "
      READ*,IONSTAT
      PRINT*,"DAY (1-8)  "
      READ*,IDAY
C READ DATA
      DO 10 I=1,N
      READ (2,101) XON(M1),YON(M1),(IHOLD(IN),IN=1,8)
101   FORMAT(1X,2(F10.4,2X),8I1)
      IF (IONSTAT.EQ.5) GOTO 20
      IF ((IONSTAT.NE.4).AND.(IHOLD(IDAY).NE.IONSTAT)) GOTO 10
      IF ((IONSTAT.EQ.4).AND.(IHOLD(IDAY).EQ.0)) GOTO 10
20    M=M+1
      M1=M1+1
10    CONTINUE
C PLOT SIZE IS 144X10 INCHES
      RHO=M/1440
      PRINT*,"RHO=",RHO
      RE=1/(2*SQRT(RHO))
      PRINT*,"RE=",RE
      ORE=.26136/SQRT(NUM*RHO)
      PRINT*,"ORE=",ORE
C SAMPLE LOOP
      D=150
C RANDOM POINT
      XPT=144*RANF(TIME(A))
      YPT=10*RANF(TIME(A))
C LOOP TO FIND NEAREST ONION TO RANDOM POINT
      DO 40  J=1,M
      DD=((XON(J)-XPT)**2+(YON(J)-YPT)**2)**.5
      IF (DD.LT.D) D=DD
40    CONTINUE
30    SUM=SUM+D
C MEAN DISTANCE OF NEAREST ONION
      RA=SUM/NUM
      PRINT*,"RA=",RA
      R=RA/RE
      PRINT*,"R=",R
      C=(RA-RE)/ORE
      PRINT*,"C=",C
      PRINT*,"ANOTHER RUN?  "
      READ*,J
      IF (J.EQ."Y" ) GOTO 5
      END
```

TABLE G4

```
      PROGRAM ONDIST (INPUT=65,ONIONS=65,OUTPUT=65,BAITS=65,NEWF=65,TAP
     +1=INPUT,TAPE2=ONIONS,TAPE3=OUTPUT,TAPE4=BAITS,TAPE5=NEWF,TAPE88=6
     +)
      DIMENSION XONION(500), YONION(500), XBAIT(50),YBAIT(50),RTO1O(500
     +2), IHOLD(8),VTO2O(500,2)
C  OUTPUTS DATA AND STATISTICS TO BE USED AS DATA GIVEN THE CO-ORDINATE
C    AND STATUS OF EACH ONION IN A FIELD AND THE CO-ORDINATES OF
C    THE BAITS (VOLUNTEERS) AS INPUT.  PROGRAM CHOOSES A RANDOM POINT
C    INSIDE A ROW AND THEN PROCEEDS TO FIND THE NEAREST VOLUNTEER, THE
C    NV-TH CLOSEST ONION TO THE POINT, THE NV-TH CLOSEST ONION TO THE
C    VOLUNTEER, AND THE DISTANCES BETWEEN EACH OF THOSE FOUR LOCATIONS.
C    TWO TEST STATISTICS ARE ALSO GENERATED.
C
C  DIST=RANDOM POINT TO VOLUNTEER
C  DISTP2D=RANDOM POINT TO FIRST ONION
C  DISTB2D=VOLUNTEER TO SECOND ONION
C  D=FIRST ONION TO SECOND ONION
C  D1=RANDOM POINT TO SECOND ONION
C  P=A TEST STATISTIC
C  T=A TEST STATISTIC
C  NIP=1=A MARKER VALUE
      PPTOT=0.
      CALL RANSET(TIME(DUM))
      DO 111 L=1,50
 111  XBAIT(L)=YBAIT(L)=1000
C INITIALIZE RUN
      KLL=1
      NUM=20
      PRINT*,"HOW DO YOU WANT YOUR OUTPUT?"
      PRINT*, "1) TERMINAL ONLY   2) CODED FILE ONLY  3) TERMINAL AND F
     +LE  ."
      READ(1,99)OUTER
 99   FORMAT(I3)
      PRINT*,"NUMBER OF ONION COORDINATES TO BE READ FROM FILE?  ."
      READ(1,99)N
      IONSTAT=3
      IDAY=4
 102  FORMAT(" DATE ",I6," PLOT ",I1," N ",I3)
C PRINT HEADER
      IF (OUTER.NE.2)  WRITE(3,105)
 105  FORMAT("0SAMPLE  R TO V   R TO O1   O2 TO V  O1 TO O2   R TO O2
     +  P      T")
C READ IN DATA.
C   ONIONS
100   FORMAT (1X,I6,3(1X,I1),1X,I3)
      IF (EOF(2).NE.0) GOTO325
      NIP=1
      REWIND 2
      DO 10 I=1,N
      READ(2,101) XONION(I),YONION(I),(IHOLD(INT),INT=1,8)
101   FORMAT (1X,2(F10.4,2X),8I1)
      IF(IHOLD(IDAY).EQ.IONSTAT) GOTO10
      IF(IONSTAT.EQ.-1) GOTO10
      XONION(I)=YONION(I)=1000
10    CONTINUE
C   BAITS
325   M=1
300   READ(4,*) XBAIT(M),YBAIT(M),LINE
      IF (EOF(4).NE.0) GOTO305
      M=M+1
      GOTO 300
305   M=M-1
      DO 52 KK=1,5
      DO 51 KH=1,7
      DO 5 NUMSAM=1,NUM
C RESET DISTANCE ARRAYS
      DO 70 N1=1,500
      RTO1O(N1,1)=VTO2O(N1,1)=1000
70    RTO1O(N1,2)=VTO2O(N1,2)=0
C GET RANDOM POINT, PLOT SIZE IS 124X60.
      XPT=(RANF(DUM)*3)+1
      XP=RANF(DUM)*12.0
      IF(XP.GE.8.0)GO TO 403
      IF(XP.GE.4.0)GO TO 402
401   XPT=22.
      GOTO 404
402   XPT=56.
      GOTO 404
403   XPT=90.
404   XPT=XPT+XP
      YPT=RANF(DUM)*60
C NEAREST BAIT TO RANDOM POINT
      DIST=300
      NEARB=0
      DO 15 J=1,M
      DISTB=(((XBAIT(J)-XPT)**2)+((YBAIT(J)-YPT)**2))**.5
      IF (DISTB.LT.DIST) NEARB=J
      IF(DISTB.LT.DIST) DIST=DISTB
15    CONTINUE
```

TABLE 04 CONTINUED

```
C NEAREST DAMAGED ONION TO RANDOM POINT
C  AND
C NEAREST DAMAGED ONOIN TO BAIT(NEARB)
C       ASSUMING DAMAGED ONION FILE IS IN USE.
      NEAROP=NEAROB=0
      DISTP2D=DISTB2D=100
      DO 20 J=1,N
      DISTPD=(((XONION(J)-XPT)**2)+((YONION(J)-YPT)**2))**.5
      RTO1O(J,1)=DISTPD
      RTO1O(J,2)=J
      DISTBD=(((XONION(J)-XBAIT(NEARB))**2)+((YONION(J)-YBAIT(NEARB))
     + **2))**.5
      VTO2O(J,1)=DISTBD
      VTO2O(J,2)=J
20    CONTINUE
C SELECTION SORT
      IF(KLL.EQ.1)NV=1
      IF(KLL.EQ.2)NV=5
      IF(KLL.EQ.3)NV=10
      IF(KLL.EQ.4)NV=20
      IF(KLL.EQ.5)NV=25
      IF(KLL.EQ.6)NV=35
      IF(KLL.EQ.7)NV=50
      DO 30 J=1,NV
      M1=L=J
      JJ=J+1
      DO 40 I=JJ,500
      IF (RTO1O(L,1).LT.RTO1O(I,1)) GOTO 50
      L=I
50    IF (VTO2O(M1,1).LT.VTO2O(I,1)) GOTO 40
      M1=I
40    CONTINUE
C
      TEMP=RTO1O(L,1)
      T=RTO1O(L,2)
      RTO1O(L,1)=RTO1O(J,1)
      RTO1O(L,2)=RTO1O(J,2)
      RTO1O(J,1)=TEMP
      RTO1O(J,2)=T
C
      TEMP=VTO2O(M1,1)
      T=VTO2O(M1,2)
      VTO2O(M1,1)=VTO2O(J,1)
      VTO2O(M1,2)=VTO2O(J,2)
      VTO2O(J,1)=TEMP
      VTO2O(J,2)=T
30    CONTINUE
C SET OUTPUT VALUES
      DISTP2D=RTO1O(NV,1)
      NEAROP=RTO1O(NV,2)
      DISTB2D=VTO2O(NV,1)
      NEAROB=VTO2O(NV,2)
      D=(((XONION(NEAROB)-XONION(NEAROP))**2)+((YONION(NEAROB)-YONION(N
     +EAROP))**2))**.5
      D1=(((XPT-XONION(NEAROB))**2)+((YPT-YONION(NEAROB))**2))**.5
      P=(DISTP2D-DISTB2D)/(DISTP2D+DISTB2D)
      TTT=(P+1)/2
      PPTOT=PPTOT+P
      IF (OUTER.NE.2) WRITE(3,107) NUMSAM,DIST,DISTP2D,DISTB2D,D,D1,P
     +,T,NIP
      IF (OUTER.NE.1) WRITE (5,107) NUMSAM,DIST,DISTP2D,DISTB2D,D,D
     +1,P,TTT,NIP
107   FORMAT(1X,I4,7(2X,F8.4),2X,I2)
C NEXT SAMPLE
5     CONTINUE
      PFINAL=PPTOT/NUM
      WRITE(88,88)PFINAL,NV,NUM
88    FORMAT(F6.4,5X,I2,5X,I3)
      PPTOT=0.
      KLL=KLL+1
51    CONTINUE
      NUM=NUM+20
      KLL=1
52    CONTINUE
      END
```

TABLE G5

```
      PROGRAM MAGGOT(INPUT,OUTPUT,TAPE60=INPUT,TAPE61=OUTPUT,TAPE1,TAPE
     +6,TAPE3,TAPE5)
*  COMPUTER SIMULATION MODEL FOR THE ONION MAGGOT, HYLEMYA ANTIQUA
*     (MEIGEN).  THIS MODEL IS A MODIFIED VERSION OF A MODEL ORIGINALLY
*     PREPARED BY FRANK DRUMMOND, JOHN VALENTI, AND GARY WHITFIELD IN
*     SYSTEM SCIENCE 843.  THE MAIN PROGRAM (MAGGOT) CALLS A NUMBER OF
*     FUNCTIONS AND SUBROUTINES, AND A CONTINUOUS TIME MODEL IS
*     APPROXIMATED USING A DISCRETE APPROACH.  THE SIMULATION UTILIZES
*     PREVIOUSLY PUBLISHED DATA FROM MANY SOURCES TO DRIVE A CHAIN OF
*     TIME VARYING DELAYS WITH ATTRITION.  POPULATION DENSITIES AND
*     INSECTICIDE USE AND TIMING CAN BE MANIPULATED.  AIR AND SOIL
*     TEMPERATURE DATA CAN BE INPUT DIRECTLY.
*
*   MAIN PROGRAM MAGGOT
*   GLOSSARY
*
*       AFL=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR ADULT FEMALE
*       APEST=FOLIAR PESTICIDE (1=MALATHION, 2=PARATHION,3=DIAZINON)
*       ARGE=(DATA) TEMPERATURE ARGUMENT FOR EGG DEVELOPMENT
*       ARGES=(DATA) TEMPERATUR ARGUMENT FOR EGG SURVIVAL
*       ARGL1=(DATA) TEMPERATURE ARGUMENT FOR FIRST INSTAR DEVELOPMENT
*       ARGPF=(DATA) TEMPERATURE ARGUMENT FOR PUPAL DEVELOPMENT
*       ARGPS=(DATA) TEMPERATURE ARGUMENT FOR PUPAL SURVIVAL
*       ARGSL1=(DATA) TEMPERATURE ARGUMENT FPR FIRST INSTAR DEVELOPMENT
*       BIN=EGG CLASS (1-5)
*       DDTOT=DEGREE DAY TOTAL (AIR)
*       DEADM=NUMBER OF DEAD ADULT MALES
*       DEAD1=NUMBER OF DEAD ADULT FEMALES OF CLASS 1
*       DEAD2=NUMBER OF DEAD ADULT FEMALES OF CLASS 2
*       DEAD3=NUMBER OF DEAD ADULT FEMALES OF CLASS 3
*       DEAD4=NUMBER OF DEAD ADULT FEMALES OF CLASS 4
*       DEAD5=NUMBER OF DEAD ADULT FEMALES OF CLASS 5
*       DEGDAYS=DEGREE DAYS (AIR)
*       DEGG=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR EGGS
*       DELAFL=DEVELOPMENT TIME OF REPRODUCING FEMALES
*       DELEA=DEVELOPMENT TIME OF EGGS (AIR)
*       DELEAS=DEVELOPMENT TIMES OF EGGS (SOIL)
*       DELL1=DEVELOPMENT TIME OF FIRST INSTAR
*       DELL2=DEVELOPMENT TIME OF SECOND INSTAR
*       DELL3=DEVELOPMENT TIME OF THIRD INSTAR
*       DELMLG=DEVELOPMENT TIME OF ADULT MALES
*       DELMP=DEVELOPMENT TIME OF MALE PUPAE
*       DELPOP=DEVELOPMENT TIME OF PRE-OVIP FEMALES
*       DELPPF=DEVELOPMENT TIME OF FEMALE PUPAE
*       DELPPOP=PREVIOUS DELPOP
*       DL1=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR FIRST INSTAR
*       DL2=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR SECOND INSTAR
*       DL3=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR THIRD INSTAR
*       DM=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR MALE ADULTS
*       DPF=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR FEMALE PUPAE
*       DPM=(DATA) DEVELOPMENTAL TIME ARGUMENT FOR MALE PUPAE
*       DT=TIME INCREMENT (DELTA T)
*       EGGP=EGGS ON PLANT
*       EGGS=EGGS IN SOIL
*       FL3=THIRD INSTARS (FEMALES)
*       FP=FEMALE PUPAE
*       FPEST=FURROW INSECTICIDE (0=NONE, 1=DYFONATE, 2=ETHION)
*       FPS=SURVIVAL VALUE FOR FEMALE PUPAE
*       FREQ=FREQUENCY OF SPRAY APPLICATION
*       IDAY=(JULIAN DATE-90)
*       IPOP=NUMBER OF PRE-OVIP ADULTS
*       KEA=K FOR EGGS
*       KFL=K FOR REPRODUCING ADULTS
*       KFP=K FOR PUPAE
*       KL1=K FOR FIRST INSTAR
*       KL2=K FOR SECIND INSTAR
*       KL3=K FOR THIRD INSTAR
*       KM=K FOR MALE ADULTS
*       KP=K FOR PRE-OVIP ADULTS
*       L1=TOTAL NUMBER OF FIRST INSTAR
*       L1A=NUMBER OF FIRST INSTAR ON PLANT
*       L1S=NUMBER OF FIRST INSTAR IN SIOL
*       L2=NUMBER OF SECOND INSTAR
*       L3=NUMBER OF THIRD INSTAR
*       MA=NUMBER OF MALE ADULTS
*       MAXTEMP=MAXIMUM DAILY TEMPERATURE
*       MINTEMP=MINIMUM DAILY TEMPERATURE
*       MLG=SURVIVAL VALUE FOR ADULT MALES
*       ML3=MALES THIRD INSTAR LAVAE
*       MP=NUMBER OF MALE PUPAE
*       NEGGA=TOTAL STORAGE OF EGGS (AIR)
*       NEGGS=TOTAL STORAGE OF EGGS (SOIL)
*       NFL3=TOTAL STORAGE FEMALE THIRD INSTAR
*       NFP=TOTAL STORAGE OF FEMALE PUPAE
*       NL1=TOTAL STORAGE OF FIRST INSTAR
*       NL2=TOTAL STORAGE OF SECOND INSTAR
*       NL3=TOTAL STORAGE OF THIRD INSTAR
*       NML=TOTAL STORAGE OF MALE ADULTS
*       NML3=TOTAL STORAGE OF MALE THIRD INSTAR
*       NMP=TOTAL STORAGE OF MALE PUPAE
```

TABLE G5 CONTINUED

```
*         NPOP=TOTAL STORAGE OF PRE-OVIP ADULTS
*         NROLEF=TOTAL STORAGE OF REPRODUCING ADULTS
*         NROLEF1=STORAGE OF REPRODUCING ADULTS (CLASS 1)
*         NROLEF2=STORAGE OF REPRODUCING ADULTS (CLASS 2)
*         NROLEF3=STORAGE OF REPRODUCING ADULTS (CLASS 3)
*         NROLEF4=STORAGE OF REPRODUCING ADULTS (CLASS 4)
*         NROLEF5=STORAGE OF REPRODUCING ADULTS (CLASS 5)
*         NUMEGG1=STORAGE OF EGGS (CLASS 1)
*         NUMEGG2=STORAGE OF EGGS (CLASS 2)
*         NUMEGG3=STORAGE OF EGGS (CLASS 3)
*         NUMEGG4=STORAGE OF EGGS (CLASS 4)
*         NUMEGG5=STORAGE OF EGGS (CLASS 5)
*         PE=RATE OF ADULT EMERGENCE
*         PMORT=MORTALITY DUE TO PESTICIDE (FURROW)
*         PMORTD=EXPONENTIAL DECAY OF PMORT
*         PMORTE=MORTALITY DUE TO PESTICIDE (FOLIAR)
*         PMORTED=EXPONENTIAL DECAY OF PMORTE
*         POP=DEVELOPMENT VALUE FOR PRE-OVIP ADULTS
*         RAM1=RATE OF REPRODUCING ADULTS (CLASS 1)
*         RAM2=RATE OF REPRODUCING ADULTS (CLASS 2)
*         RAM3=RATE OF REPRODUCING ADULTS (CLASS 3)
*         RAM4=RATE OF REPRODUCING ADULTS (CLASS 4)
*         RAM5=RATE OF REPRODUCING ADULTS (CLASS 5)
*         RE=RATE OF EGGS (SOIL)
*         REA=RATE OF EGGS (AIR)
*         RFP=RATE OF FEMALE PUPAE
*         RLM3=RATE OF MALE THIRD INSTAR
*         RL1=RATE OF FIRST INSTAR
*         RL2=RATE OF SECIND INSTAR
*         RL3=RATE OF FEMALE THIRD INSTAR
*         RMA=RATE OF MALE ADULTS
*         RMP=RATE OF MALE PUPAE
*         RO=NUMBER OF REPRODUCING ADULTS
*         RPOP=RATE OF PRE-OVIP ADULTS
*         SEGG=SURVIVAL VALUE FOR EGGS
*         SL1=SURVIVAL VALUE FOR FIRST INSTAR
*         SL2=SURVIVAL VALUE FOR SECOND INSTAR
*         SL3=SURVIVAL VALUE FOR THIRD INSTAR
*         ST=SOIL TEMP (PER DT)
*         STEMP=SOIL TEMP (PER 2 HOURS)
*         SUMFP=TOTAL FEMALE PUPAE
*         SUMLT=TOTAL LARVAE
*         SUML1=TOTAL FIRST INSTAR
*         SUML2=TOTAL SECOND INSTAR
*         SUML3=TOTAL THIRD INSTAR
*         SUMMAPP=TOTAL MALE PUPAE
*         SUMMML=TOTAL MALE ADULTS
*         SUMNPO=TOTAL PRE-OVIP ADULTS
*         SUMNRO=TOTAL OF ADULTS IN CLASSES 1-5
*         SUMOM=TOTAL FEMALE ADULTS
*         SUMRO=TOTAL REPRODUCING ADULTS
*         SUREGAD=INSTANTANEOUS SURVIVAL OF EGGS (AIR)
*         SUREGGA=SURVIVAL OF EGGS (AIR)
*         SUREGGD=INSTANTANEOUS SURVIVAL OF EGGS (SOIL)
*         SUREGGS=SURVIVAL OF EGGS (SOIL)
*         SURFLD=SURVIVAL OF REPRODUCING FEMALES
*         SURFPS=SURVIVAL OF FEMALE PUPARE
*         SURFPSD=INSTANTANEOUS SURVIVAL OF FEMALE PUPAE
*         SURL1=SURVIVAL OF FIRST INSTAR
*         SURL1D=INSTANTANEOUS SURVIVAL OF FIRST INSTAR
*         SURL2=SURVIVAL OF SECOND INSTAR
*         SURL2D=INSTANTANEOUS SURVIVAL OF SECOND INSTAR
*         SURL3=SURVIVAL OF THIRD INSTAR
*         SURL3D=INSTANTANEOUS SURVIVAL OF THIRD INSTAR.
*         SURMLD=SURVIVAL OF MALES
*         SURPOPD=SURVIVAL OF PRE-OVIP FEMALES
*         T=TEMP PER DT (AIR)
*         TOMP=NUMBER IF STARTING PUPAE
*         TOTEGG=TOTAL EGGS (AIR AND SOIL)
*         TOTPUP=TOTAL PUPAE (MALE AND FEMALE)
*         TPOP=TOTAL ADULTS (MALE AND FEMALE)
*         TPP=TOTAL STORAGE OF PUPAE (MALE AND FEMALE)
*
*                 COMMON BLOCKS
*
          COMMON/PESTS/PDAY,PMORTE,A,APEST,FREQ,MFREQ
          COMMON /WEATHER/DEGDAYS(300),MAXTEMP(300),MINTEMP(300)
*
*                 TYPE DECLARATIONS FOR MAIN PROGRAM
*
          TYPE REAL NROLEF,IPOP,NPOP,NFP,MA,MP
          TYPE REAL NMP,NFL3,ML3,NML3,L3,L2,L1,NL3,NL2
          TYPE REAL NL1,L1S,L1A,NEGGSS,NEGGA
          TYPE REAL NROLEF1,NROLEF2,NROLEF3,NROLEF4,NROLEF5
          TYPE REAL NML,NUMEGG1,NUMEGG2
          TYPE REAL NUMEGG3,NUMEGG5,NUMEGG4
          TYPE REAL MLG
          TYPE INTEGER BIN,PDAY,DDTOT
          TYPE INTEGER DEGDAYS
          TYPE REAL MAXTEMP,MINTEMP,MFREQ
```

TABLE G5 CONTINUED

```
      TYPE INTEGER TOMP,FPEST,APEST,FREQ
*
*              DIMENSION STATEMENTS FOR MAIN PROGRAM
*
      DIMENSION DEGG(7)
      DIMENSION DPF(7)
      DIMENSION SEGG(8)
      DIMENSION SL1(4)
      DIMENSION SL2(4)
      DIMENSION SL3(4)
      DIMENSION AM(5),
      DIMENSION RAM1(10),RAM2(10),RAM3(10),RAM4(10),RAM5(10)
      DIMENSION AFL(6)
      DIMENSION DPM(7)
      DIMENSION RHA(10)
      DIMENSION POP(5)
      DIMENSION MLG(5)
      DIMENSION DL1(7)
      DIMENSION ARGE(7)
      DIMENSION ARGL1(7)
      DIMENSION ARGPF(7)
      DIMENSION FPS(5)
      DIMENSION ARGPS(5)
      DIMENSION ARGES(8)
      DIMENSION ARGSL1(4)
      DIMENSION RL3(10),RL2(10),RL1(10)
      DIMENSION RFP(20)
      DIMENSION RMP(20)
      DIMENSION RLM3(10)
      DIMENSION RE(10)
      DIMENSION REA(10)
      DIMENSION RPOP(10)
      DIMENSION STEMP(13)
      DIMENSION IVAL(1)
      DIMENSION IREADIN(1)
      DIMENSION DL2(5)
      DIMENSION DL3(5)
*
*              DATA STATEMENTS FOR MAIN PROGRAM
*
      DATA DL2/7.6,5.0,3.0,2.5,3.0/
      DATA DL1/7.1,4.3,3.5,2.5,2.2,1.6,1.7/
      DATA DEGG/10.0,7.0,5.6,4.0,3.2,2.4,2.6/
      DATA DL3/27.8,14.3,8.6,7.6,8.6/
      DATA DPF/50.0,33.0,25.0,20.0,17.0,12.0,13.0/
      DATA SEGG/-0.023,-0.031,-0.042,-0.059,-0.062,-0.058,
     + -0.12634,-0.176/
      DATA SL1/-0.0607,-0.2157,-0.5727,-0.92262/
      DATA SL2/-0.0378,-0.1124,-0.23104,-0.49515/
      DATA SL3/-0.0058,-0.0280,-0.0672,-0.10948/
      DATA DPM/47.0,30.0,22.0,17.0,14.0,9.0,10.0/
      DATA AFL/112.,55.,35.,22.,16.,10./
      DATA POP/22.0,10.0,7.0,5.0,3.0/
      DATA MLG/72.8,35.75,22.75,14.3,3.9/
      DATA ARGE/50.,55.,59.,64.,68.,77.,85./
      DATA ARGL1/50.,55.,59.,64.,68.,77.,85./
      DATA FPS/-.007,-.007,-.006,
     +  -.007,-.02/
      DATA ARGPS/50.0,60.0,70.0,84.0,90.0/
      DATA ARGPF/50.,55.,59.,64.,68.,77.,83./
      DATA ARGES/50.,54.,59.,63.5,68.,77.,80.,90./
      DATA ARGSL1/50.0,60.0,80.0,90.0/
*
*              INITIALIZE VARIOUS VARIABLES
*
      DM=DET=0.0
      DELPPF=DELPAFL=DELPPOP=1.0
      DELPMP=1.0
      DELPMLG=1.0
      A=0.0
      PDAY=0
      K5=214
      FREQ=1
      DDTOT=0
      K=10
      IPOP=0.0
      RO=0.0
      EGGSS=NEGGSS=EGGA=L1=L2=L3=0.0
      NL1=0.0
      NL2=0.0
      AM(1)=AM(2)=AM(3)=AM(4)=AM(5)=0.0
      NL3=0.0
      MA=0.0
      NPOP=FP=0.0
      FL3=NFL3=ML3=NML3=NML=0.0
      IDAY=0
      BIN=5
      MP=0.0
      NEGGA=0.0
      NMP=0.0
```

TABLE G5 CONTINUED

```
      NFP=0.0
      KL3=10
      KL2=10
      KL1=10
      KEA=10
      KFP=20
      KP=KM=KFL=10
      PMORT=1.0
      FPEST=APEST=0
      NROLEF1=NROLEF2=NROLEF3=NROLEF4=NROLEF5=0.0
      NROLEF=0.0
      SUMFP=SUMNRO=SUML1=SUML2=SUML3=0.0
      SUMNPO=0.0
      LX=0
      SUMMAP=0.0
      SUMNHL=0.0
      SUMRO=0.0
      EGG=0.0
      DT=.1
      ZI=DT*24.
      DELPL3=1.
      DELPL2=1.
      DELPL1=1.
      DELPEA=1.
      DELPES=1.
      L=0
*
*          LOOP TO INITIALIZE ARRAYS
*
      DO 13 J=1,K
           RL3(J)=0.0
           RL2(J)=0.0
           RL1(J)=0.0
           RE(J)=0.0
      RAM1(J)=0.0
      RAM2(J)=0.0
      RAM3(J)=0.0
      RAM4(J)=0.0
      RAM5(J)=0.0
      RMP(J)=0.0
      RMA(J)=0.0
           RPOP(J)=0.0
           RFP(J)=0.0
           RMP(J)=0.0
           RLH3(J)=0.0
      REA(J)=0.0
13    CONTINUE
      DO 112 J=11,20
      RFP(J)=0.0
      RMP(J)=0.0
112   CONTINUE
*
*   INPUT  SECTION...
*
*              FIRST THE WEATHER DATA
*
      DO 33 J=1,214
      READ(1,2500)MAXTEMP(J),MINTEMP(J)
      CALL DEGDAY(MAXTEMP(J),MINTEMP(J),39.0,IHEAT)
      DEGDAYS(J)=IHEAT
33    CONTINUE
2500  FORMAT(14X,F3.0,5X,F3.0)
*
*              AND THE RESULTS OF THE PREVIOUS RUN
*
      WRITE(61,1100)
1100  FORMAT(* ONION MAGGOT DENSITIES FROM PREVIOUS RUN#*)
      CALL INPUTER(IREADIN,2)
      TOMP=IREADIN(1)
      WRITE(61,1500)
1500  FORMAT(* INPUT FURROW PESTICIDE -- 0=NONE,1=OYFONATE,*
     +*2=ETHION*)
      CALL INPUTER(IREADIN,2)
      FPEST=IREADIN(1)
      WRITE(61,1600)  .
1600  FORMAT(* ENTER FOLIAR PESTICIDE CODE */* 0=NONE,*
     +*1=MALATHION,2=PARATHION,3=DIAZINON*)
      CALL INPUTER(IREADIN,2)
      APEST=IREADIN(1)
      IF(APEST.LE.0)GO TO 1651
      WRITE(61,1700)
1700  FORMAT(* ENTER FREQUENCY OF APPLICATION(DAYS)#*)
      CALL INPUTER(IREADIN,2)
      FREQ=IREADIN(1)
      WRITE(61,1650)
1650  FORMAT(* FIRST DAY FOR SPRAY APPLICATION= *)
      CALL INPUTER(IREADIN,2)
      KS=IREADIN(1)
1651  CONTINUE
*
```

TABLE G5 CONTINUED

```
*     FIRST CALCULATIONS
*
        PMORTE=1.0
        IF(FPEST.GT.0) PMORT=.07
        IF(APEST.EQ.1)MFREQ=1.0
        IF(APEST.EQ.2)MFREQ=2.0
        MP=FLOAT(TOMP)*5.0
        FP=FLOAT(TOMP)*5.0
        IF(APEST.EQ.3)MFREQ=3.0
*
*
*       OUTER LOOP FOR EACH DAY BEGINS HERE
9       CONTINUE
        PE=0.0
        HTIME=0.
        CALL SSTEMP(STEMP,LX)
        LX=1
        IDAY=IDAY+1
        DDTOT=DDTOT+DEGDAYS(IDAY)
        IF(APEST.EQ.0)GO TO 97
        IF(IDAY.LT.K5)GO TO 97
96      CALL SPRAY
97      CONTINUE
*
*          INNER LOOP FOR EACH DT BEGINS HERE
*
        DO 11 M=1,K
        CALL TEMCAL(MAXTEMP(IDAY),MINTEMP(IDAY),M,T)
        HTIME=HTIME+ZI
        ST=TABEXE(STEMP,0.,2.,12,HTIME)
        DELEA=TABEX(DEGG,ARGE,T,6)
        DELES=TABEX(DEGG,ARGE,ST,6)
        DELL1=TABEX(DL1,ARGL1,ST,6)
        DELL2=TABEXE(DL2,50.0,10.0,4,ST)
        DELMP=TABEX(DPM,ARGPF,ST,6)
        IF(ST.LE.40.)DELMP=100.
        DELL3=TABEXE(DL3,50.0,10.0,4,ST)
        DELPF=TABEX(DPF,ARGPF,ST,6)
        IF(ST.LE.40.)DELPF=100.
        DELPOP=TABEXE(POP,50.0,10.0,4,T)
        IF(DELPOP.LT.1.0)DELPOP=10.0
        DELAFL=TABEXE(AFL,50.0,10.0,5,T)
        IF(DELAFL.LT.1.0)DELAFL=10.0
        DELMLG=TABEXE(MLG,50.0,10.0,4,T)
        IF(DELMLG.LT.1.0)DELMLG=10.0
        SUREGGA=TABEX(SEGG,ARGES,T,7)
        SUREGGS=TABEX(SEGG,ARGES,ST,7)
        SURL1=TABEX(SL1,ARGSL1,ST,3)
        SURL2=TABEX(SL2,ARGSL1,ST,3)
        SURL3=TABEX(SL3,ARGSL1,ST,3)
        SUREGAD=AMIN1(EXP(SUREGGA*DT),1.)
        SURFPS=TABEX(FPS,ARGPS,ST,4)
        SUREGGD=AMIN1(EXP(SUREGGS*DT),1.)
        PMORTD=0.997185*PMORT**0.09549
        IF(FPEST.EQ.0)PMORTD=1.0
        PMORTED=0.997185*PMORTE**0.09549
        SURL1D=AMIN1(EXP(SURL1*DT)*PMORTD**(1.0/DELL1),1.)
        SURL2D=AMIN1(EXP(SURL2*DT)*PMORTD**(1.0/DELL2),1.)
        SURL3D=AMIN1(EXP(SURL3*DT)*PMORTD**(1.0/DELL3),1.)
        SURFPSD=AMIN1(EXP(SURFPS*DT),1.)
        IF(APEST.EQ.0)PMORTED=1.0
C      SURFLD=ADULT MORTALITY
        SURFLD=PMORTED
        SURMLD=PMORTED
        SURPOPD=PMORTED
        DEAD1=DELLVF(AM(1),RAM1,NROLEF1,SURFLD,DELAFL,DELPAFL,DT,KFL)
        DEAD2=DELLVF(AM(2),RAM2,NROLEF2,SURFLD,DELAFL,DELPAFL,DT,KFL)
        DEAD3=DELLVF(AM(3),RAM3,NROLEF3,SURFLD,DELAFL,DELPAFL,DT,KFL)
        DEAD4=DELLVF(AM(4),RAM4,NROLEF4,SURFLD,DELAFL,DELPAFL,DT,KFL)
        DEAD5=DELLVF(AM(5),RAM5,NROLEF5,SURFLD,DELAFL,DELPAFL,DT,KFL)
        DEADT=DEAD1+DEAD2+DEAD3+DEAD4+DEAD5
        RO=DELLVF(IPOP,RPOP,NPOP,SURPOPD,DELPOP,DELPPOP,DT,KP)
        IPOP=DELLVF(FP,RFP,NFP,SURFPSD,DELPF,DELPPF,DT,KPP)
        DEADM=DELLVF(MA,RMA,NML,SURMLD,DELMLG,DELPMLG,DT,KM)
        DM=DM+DEADM
        DET=DET+DEADT
        MA=DELLVF(MP,RMP,NMP,SURFPSD,DELMP,DELPMP,DT,KPP)
        PE=PE+IPOP+MA
        FP=DELLVF(FL3,RL3,NFL3,SURL3D,DELL3,DELPL3,DT,KL3)
        MP=DELLVF(ML3,RLM3,NML3,SURL3D,DELL3,DELPL3,DT,KL3)
        FL3=0.0
        L3=DELLVF(L2,RL2,NL2,SURL2D,DELL2,DELPL2,DT,KL2)
        L2=DELLVF(L1,RL1,NL1,SURL1D,DELL1,DELPL1,DT,KL1)
        L1S=DELLVF(EGGSS,RE,NEGGSS,SUREGGD,DELES,DELPES,DT,KEA)
        L1A=DELLVF(EGGA,REA,NEGGA,SUREGAD,DELEA,DELPEA,DT,KEA)
        L1=L1S+L1A
        NL3=NML3+NFL3
        SUMFP=NFP
        SUMNML=NML
        SUMRO=SUMRO+RO
```

TABLE G5 CONTINUED

```
      AM(BIN)=0.0
      SUML1=NL1
      SUML2=NL2
      SUML3=NML3+NFL3
      SUMMAP=NMP
11    CONTINUE
      IF(SUMNRO.LE.0.1 .AND. SUMRO.LE.0.1)GO TO 19
      CALL EGGRATE(IDAY,BIN)
      DO 10 L=1,5
10    AM(L)=0.0
      AM(BIN)=SUMRO
19    CONTINUE
      NROLEF=NROLEF1+NROLEF2+NROLEF3+NROLEF4+NROLEF5
      SUMNRO=NROLEF
      TPOP=NPOP+NML+NROLEF
      TPP=NFP+NMP
      DM=0.0
      DET=0.0
      NUMEGG1=0.0
      IF(NROLEF1.GT.0.0)NUMEGG1=NROLEF1*0.75
      NUMEGG2=0.0
      IF(NROLEF2.GT.0.0)NUMEGG2=NROLEF2*2.5
      NUMEGG3=0.0
      IF(NROLEF3.GT.0.0)NUMEGG3=NROLEF3*4.0
      NUMEGG4=0.0
      IF(NROLEF4.GT.0.0)NUMEGG4=NROLEF4/2.0
      NUMEGG5=0.0
      EGG=NUMEGG1+NUMEGG2+NUMEGG3+NUMEGG4+NUMEGG5
      IF(EGG.GT.0.0)EGGSS=0.65*EGG
      IF(EGG.GT.0.0)EGGA=EGG-EGGSS
      IF(DDTOT.GT.2400.)EGGSS=0.
      IF(DDTOT.GT.2400)EGGA=0.0
      SUMRO=0.0
      SUMLT=SUML1+SUML2+SUML3
      SUMOM=SUMNPO+NROLEF
      TOTPUP=SUMMAP+SUMFP
      TOTEGG=NEGGSS+NEGGA
*
*     OUTPUT SECTION
*
      WRITE(3,9999)IDAY,DDTOT,SUMNPO,NROLEF,
     +SUMLT,SUMOM,TOTEGG,TOTPUP,TPOP,TPP,PE
9999  FORMAT(2I5,8F10.2,F10.4)
      WRITE(5,666)IDAY,DDTOT,NL1,NL2,NL3,NEGGSS,NEGGA,
     +NROLEF1,NROLEF2,NROLEF3,NROLEF4
666   FORMAT(2I5,9F9.2)
      IF(IDAY.EQ.214)GO TO 16
      GO TO 9
16    CONTINUE
      STOP
      END
```

```
      FUNCTION DELLVF(RIN,R,STRG,PLR,DEL,DELP,DT,K)
*
*  -  TIME VARYING DISTRIBUTION DELAY WITH ATTRITION.
*  -  THIS FUNCTION RETURNS A LAGGED VARIABLE GIVEN AN INPUT OF AN
*     UNLAGGED VARIBLE
*  -  THE DELAY ADJUSTS GRADUALLY TO CHANGES IN THE INPUT SUCH THAT
*     THE AGGREGATE FLOW SUBJECT TO DELAY VARY FROM ENTITY TO ENTITY
*  -  A TIME VARYING DELAY PARAMETER IS USED
*
*     GLOSSARY:
*
*        DEL=DEVELOPMENTAL TIME (DAYS)
*        DELLVF=OUTPUT OF DELAY (RETURNED TO MAIN PROGRAM)
*        DELP=PREVIOUS DEVELOPMENTAL TIME (DEL)
*        DT=DELTA T (TIME INCREMENT)
*        I=STAGE
*        K=NUMBER OF DELAY STAGES
*        PLR=MORTALITY CONSTANT (INSTANTANEOUS SURVIVAL)
*        R=RATE OUT OF THE I-TH STAGE
*        RIN=RATE INTO THE DELAY
*        STRG=STORAGE (NUMBER OF ENTITIES IN EACH STAGE)
*
      DIMENSION R(1)
      VIN=RIN
      FK=FLOAT(K)
      B=1.+(DEL-DELP)/(FK*DT)
      A=FK*DT/DEL
      DELP=DEL
      DO 10 I=1,K
      DR=R(I)
      R(I)=DR+A*(VIN-DR*B)
```

TABLE G5 CONTINUED

```
      VIN=OR
10    CONTINUE
      STRG=0.0
      DO 30 I=1,K
      R(I)=R(I)*PLR
      STRG=STRG+R(I)*DEL/FK
30    CONTINUE
      DELLVF=R(K)
      RETURN
      END
```

```
      SUBROUTINE DEGDAY(XMAX,XMIN,BASE,IHEAT)
*
*  -  CALCULATES DEGREE DAY ACCUMULATION FROM AIR TEMP DATA (MAX,MIN)
*     FOR EACH DAY
*
*     GLOSSARY:
*
*       A=SIN FUNCTION
*       BASE=39 F (BASE DEVELOPMENTAL TEMPERATURE)
*       XMAX=MAXIMUM TEMPERATURE
*       XMIN=MINIMUM TEMPERATURE
*       XHEAT=DEGREE DAY
*
      DATA TPIE/6.283181/, HPIE/1.570795/
      IF (XMAX .GT. BASE)GO TO 1
      IHEAT=0
      RETURN
* IF MAXIMUM TEMPERATURE GREATER THAN BASE COME HERE
1     Z=XMAX-XMIN
      XM=XMAX+XMIN
      IF (XMIN .LT. BASE)GO TO 2
      XHEAT=XM/2.-BASE
* ROUNDOFF  ODD UP, EVEN DOWN
10    IHEAT=XHEAT
      CHECK=IHEAT
      IF(XHEAT-CHECK-0.5)8,6,7
6     HALF=IHEAT/2
      IF(HALF-CHECK/2.0) 7,8,8
7     IHEAT=IHEAT+1
8     RETURN
* IF MINIMUM LESS THAN BASE COME HERE
2     TBASE=BASE*2.0
      A=ASIN((TBASE-XM)/Z)
      XHEAT=(Z*COS(A)-(TBASE-XM)*(HPIE-A))/TPIE
* GO ROUND-OFF AND RETURN
      GO TO 10
      END
```

```
      SUBROUTINE EGGRATE(DAY,BIN)
*
*  -  CALCULATES WHICH FECUNDITY DELAY REPRODUCING ADULTS ARE PLACED IN
*  -  NUMBER OF EGGS OVIPOSITED IS DETERMINED BY TEMPERATURE EXPOSURE
*     DURING PRE-OVIP STAGE
*
*     GLOSSARY:
*
*      BIN=EGG CLASS (1,2,3,4,5)
*      CUMMDD=TOTAL DEGREE DAYS DURING PRE-OVIP DEVELOPMENT
*      DAY=DAY NUMBER
*      N=NUMBER OF DAYS TILL 120 DEGREE DAYS
*      TOTAL=SUM OF AVERAGE DAILY TEMPERATURES FOR PRE-OVIP PERIOD
*
      INTEGER DAY,DEGDAYS,BIN,CUMDD
      REAL MAXTEMP,MINTEMP
       COMMON /WEATHER/DEGDAYS(300),MAXTEMP(300),MINTEMP(300)
      CUMDD=0
* GO BACK IN TIME UNTIL 120 DEGREE DAYS ARE REACHED
      DO 100 N=1,100
      CUMDD=CUMDD+DEGDAYS(DAY-N)
      IF (CUMDD .GE. 120)GO TO 200
100   CONTINUE
* NOW N=THE NUMBER OF DAYS TO FIND AN AVERAGE TEMP. FOR
200   M=DAY-N
      TOTAL=0.0
      S=FLOAT(N)
      NDAY=DAY-1
      DO 300 I=M,NDAY
      TOTAL=TOTAL+(2.0*MAXTEMP(I)+MINTEMP(I)+MINTEMP(I+1))/4.0
300   CONTINUE
```

TABLE G5 CONTINUED

```
      _IN=INT(0.5+TOTAL/S/10.0)-4
      IF ((BIN .LT. 1 ).OR.( BIN  .GT. 5))BIN=5
      RETURN
      END
```

```
      SUBROUTINE SPRAY
*
*  -  CALCULATES EFFECTIVENESS OF A FOLIAR SPRAY WHEN APPLIED
*  -  APPLIES A SPRAY WHEN CALLED
*
*     GLOSSARY:
*
*      APEST=FOLIAR PESTICIDE (1=MALATHION, 2=PARATHION, 3=DIAZINON)
*      CPDAY=NUMBER OF DAYS BETWEEN SPRAYS
*      FREQ=FREQUENCY OF SPRAY
*      MI-REQ=RESIDUAL EFFECTIVENESS OF SPRAY APPLIED
*      PDAY=INTERNAL COUNTER
*      PMORTE=MORTALITY DUE TO SPRAY
*
      COMMON/PESTS/PDAY,PMORTE,A,APEST,FREQ,MFREQ
      INTEGER PDAY,FREQ
      INTEGER APEST
      TYPE REAL MFREQ
      I3=APEST
      A=A+1
      IF(A.EQ.1)GO TO 10
      IF(PDAY.EQ.FREQ)GO TO 10
      PDAY=PDAY+1
5     CPDAY=PDAY
      PMORTE=1.00-0.96*EXP((-CPDAY)*(0.69314)/MFREQ)
      RETURN
10    PDAY=0
      GO TO 5
      END
      FUNCTION TABEXE(VAL,SMALL,DIFF,K,DUMMY)
*
*  -  TABLE LOOK-UP FUNCTION THAT DOES EXTRAPULATION FROM A SET OF DATA
*  -  ELEMENTS OF ARGUMENT ARRAY ARE EQUALLY SPACED
*
*     GLOSSARY:
*
*      DIFF=DIFFERENCE BETWEEN ADJACENT ELEMENTS
*      DUM=DIFFERENCE BETWEEN DUMMY ARGUMENT AND SMALLEST VALUE (SMALL)
*      DUMMY=ARGUMENT VALUE (X VALUE INPUT)
*      SMALL=MINIMUM VALUE OF ARGUMENT ARRAY
*      TABEXE=RETURNED VALUE TO MAIN PROGRAM
*      VAL=ARRAY (VALUE RETURNED AS VAL)
*
      DIMENSION VAL(1)
      DUM=DUMMY-SMALL
      I=MIN0(MAX1(1.0+DUM/DIFF,1.0),K)
      TABEXE=(VAL(I+1)-VAL(I))*(DUM-FLOAT(I-1)*DIFF)/DIFF+VAL(I)
      RETURN
      END


      FUNCTION TABEX(VAL,ARG,DUM,K)
*
*  -  TABLE LOOK-UP FUNCTION THAT DOES EXTRAPULATION WHERE THE VALUES A
*     UNEQUALLY SPACED
*  -  A VALUE ARRAY AND ARGUMENT ARRAY ARE NEEDED
*
*     GLOSSARY:
*
*      ARG=ARGUMENT ARRAY
*      DUM=DUMMY UNLESS DUMMY IS TOO LARGE OR TOO SMALL
*      TABEX=RETURNED VALUE TO PROGRAM
*      VAL=ARGUMENT ARRAY
*
      DIMENSION VAL(1),ARG(1)
      DO 1 J=2,K
      IF(DUM.GT.ARG(J))GO TO 1
2     TABEX=(DUM-ARG(J-1))*(VAL(J)-VAL(J-1))/(ARG(J)-ARG(J-1))
     + +VAL(J-1)
      RETURN
1     CONTINUE
      TABEX=(DUM-ARG(K-1))*(VAL(K)-VAL(K-1))/(ARG(K)-ARG(K-1))
     ++VAL(K-1)
      RETURN
```

TABLE G5 CONTINUED

```
      END

      SUBROUTINE TEMCAL(MAX,MIN,M,T)
*
*  -  CALCULATES AIR TEMPERATURE FOR EACH DT BY FITTING A SINE CURVE TO
*     MAX AND MIN TWELVE HOURS APART
*
*     GLOSSARY:
*
*      MAX=MAXIMUM DAILY AIR TEMPERATURE
*      MIN=MINIMUM DAILY AIR TEMPERATURE
*      T=RETURNED AIR TEMPERATURE PER DT
*      TIME=HOUR OF THE DAY
*
      TYPE REAL MAX,MIN
      A=MAX-MIN
      TIME=2.4*FLOAT(M)
      S=TIME+3.1416
      T=MIN+A/2.0+(A/2.0*COS(S))
      RETURN
      END

      SUBROUTINE INPUTER(IVAL,M)
*
*  -  SPECIFIC TO CYBER 750 AND IT HANDLES THE INPUT FOR THE PROGRAM
*  -  FTN.   HAL=EASYIN.    LGO.    RUN PROGRAM
*     TAPE1=AIR TEMPERATURE DATA, TAPE88=SOIL TEMPERATURE DATA
*
      DIMENSION IVAL(1)
      N=1
10    CONTINUE
      CALL EASYIN(IVAL,N,J)
      IF(J.EQ.M)RETURN
      WRITE(61,1000)
1000  FORMAT(*   IMPROPER TYPE, TRY AGAIN*)
      GOTO 10
      END
      SUBROUTINE SSTEMP(STEMP,LX)
*
*  -  THIS SUBROUTINE CALCULATES AN ARRAY OF SOIL TEMPERATURE VALUES
*     FOR EACH DAY IT IS CALLED.  REAL SOIL TEMPERATURE VALUES ARE
*     ENTERED FROM TAPE88.
*
      DIMENSION STEMP(13)
      IF (LX.GT.0) GOTO 100
      SCUM=0
      DO 10 I=1,13
      READ(88,50) STEMP(I)
10    CONTINUE
      GO TO 30
100   CONTINUE
      STEMP(1)=STEMP(13)
      DO 20 I=2,13
      READ(88,50) STEMP(I)
20    CONTINUE
30    CONTINUE
50    FORMAT(F2.0)
      DO 60 I=2,13
      IF (STEMP(I).LE.40 .AND. STEMP(I-1).LE.40) GOTO 60
      IF (STEMP(I).LE.40) GOTO 55
      IF (STEMP(I-1).LE.40 ) GOTO 66
      SCUM=SCUM+((ABS(STEMP(I)-STEMP(I-1))/2+AMIN1(STEMP(I),STEMP(I-1))
     +-40)/12
      GOTO 60
55    DIF=STEMP(I-1)-STEMP(I)
      YDIF=STEMP(I-1)-40
      SCUM=SCUM+(YDIF/2)*(YDIF/DIF)/12
      GOTO60
66    DIF=STEMP(I)-STEMP(I-1)
      YDIF=STEMP(I)-40
      SCUM=SCUM+(YDIF/2)*(YDIF/DIF)/12
60    CONTINUE
      WRITE (6,9898) SCUM
9898  FORMAT(1X,F10.4)
      RETURN
      END
```

APPENDIX H

Appendix H, Table 1. Mean estimates of OM second instar density for samples of 60 cm of onion row in 1978.

ACC. DDAY	DATE	MEAN	VAR	SE
196.7	135	1.0	1.11	.33
261.1	140	2.9	2.77	.53
435.6	152	11.8	19.07	1.38
510.9	159	9.7	9.12	.96
588.8	166	7.1	29.66	1.72
661.0	171	4.2	16.18	1.27
684.1	173	4.2	12.84	1.13
742.9	177	2.0	8.00	.89
795.7	180	3.1	8.99	.95
850.2	184	2.5	5.39	.73
956.8	191	0.0	0.00	0.00
995.7	194	.2	.40	.20
1071.0	199	.2	.18	.13
1113.2	201	.5	1.61	.40
1211.6	207	3.6	16.04	1.27
1238.3	209	9.9	58.32	2.42
1288.8	213	7.5	11.83	1.09
1380.2	220	7.1	41.86	2.16
1409.1	222	7.0	24.44	1.56
1475.8	226	4.0	4.00	.63
1531.3	229	2.7	20.22	1.36
1641.1	236	1.6	1.82	.43
1670.8	238	1.4	1.60	.40
1720.8	241	.3	.90	.30
1747.2	243	.4	.49	.22
1836.6	249	0.0	0.00	0.00

Appendix H, Table 2. Mean estimates of OM third instar density for samples of 60 cm of onion row in 1978.

ACC. DDAY	DATE	MEAN	VAR	SE
196.7	135	.2	.40	.20
261.1	140	.2	.18	.13
435.6	152	2.8	6.84	.83
510.9	159	10.2	10.40	1.02
588.8	166	7.3	24.68	1.57
661.0	171	12.5	110.94	3.33
684.1	173	10.7	73.34	2.71
742.9	177	9.2	52.62	2.29
795.7	180	9.5	56.94	2.39
850.2	184	6.5	46.50	2.16
956.8	191	1.0	6.22	.79
995.7	194	1.9	4.32	.66
1071.0	199	1.8	8.18	.90
1113.2	201	1.0	1.78	.42
1211.6	207	4.9	24.32	1.56
1238.3	209	7.6	31.82	1.78
1288.8	213	9.5	18.72	1.37
1380.2	220	16.7	121.25	3.67
1409.1	222	17.6	88.93	2.98
1475.8	226	10.7	80.90	2.84
1531.3	229	5.6	19.25	1.32
1641.1	236	3.9	1.43	.38
1670.8	238	3.2	2.40	.49
1720.8	241	2.0	5.56	.75
1747.2	243	2.0	2.67	.52
1836.6	249	1.6	4.93	.70

Appendix H, Table 3. Mean estimates of OM pupal density for samples of 60 cm of onion row in 1978.

ACC. DDAY	DATE	MEAN	VAR	SE
196.7	135	0.0	0.00	0.00
261.1	140	0.0	0.00	0.00
435.6	152	0.0	0.00	0.00
510.9	159	0.0	0.00	0.00
588.8	166	0.0	0.00	0.00
661.0	171	1.4	4.93	.70
684.1	173	2.7	5.79	.76
742.9	177	8.6	45.82	2.14
795.7	180	6.9	48.54	2.20
850.2	184	13.9	90.32	3.01
956.8	191	10.9	110.99	3.33
995.7	194	12.5	87.61	2.96
1071.0	199	22.9	116.99	3.42
1113.2	201	8.6	32.71	1.81
1211.6	207	8.4	67.60	2.60
1238.3	209	4.6	4.93	.70
1288.8	213	1.8	11.51	1.07
1380.2	220	6.6	10.03	1.06
1409.1	222	18.8	64.84	2.55
1475.8	226	9.5	28.94	1.70
1531.3	229	12.6	130.45	3.44
1641.1	236	11.7	52.46	2.29
1670.8	238	25.9	55.66	2.36
1720.8	241	9.8	41.96	2.05
1747.2	243	15.1	155.66	3.95
1836.6	249	7.2	37.51	1.94

Appendix H, Table 4. Mean estimates of SC third instar density for samples of 60 cm of onion row in 1978.

ACC. DDAY	DATE	MEAN	VAR	SE
196.7	135	.8	.62	.25
261.1	140	1.0	1.56	.39
435.6	152	.3	.23	.15
510.9	159	0.0	0.00	0.00
588.8	166	0.0	0.00	0.00
661.0	171	1.2	3.07	.55
684.1	173	1.7	6.01	.78
742.9	177	2.1	8.10	.90
795.7	180	2.3	11.34	1.07
850.2	184	1.6	11.82	1.09
956.8	191	.6	1.60	.40
995.7	194	.6	.71	.27
1071.0	199	.1	.10	.10
1113.2	201	0.0	0.00	0.00
1211.6	207	.4	.71	.27
1238.3	209	2.6	9.16	.96
1288.8	213	0.0	0.00	0.00
1380.2	220	5.7	45.79	2.14
1409.1	222	5.8	10.18	1.01
1475.8	226	2.2	4.40	.66
1531.3	229	2.7	3.34	.58
1641.1	236	1.7	6.01	.78
1670.8	238	1.8	3.51	.59
1720.8	241	.3	.46	.21
1747.2	243	.2	.18	.13
1836.6	249	.6	1.16	.34

Appendix H, Table 5. Mean estimates of SC pupal density for samples of 60 cm of onion row in 1978.

ACC. DDAY	DATE	MEAN	VAR	SE
196.7	135	2.1	5.21	.72
261.1	140	2.5	9.39	.97
435.6	152	1.8	4.84	.70
510.9	159	.8	1.29	.36
588.8	166	.3	.46	.21
661.0	171	1.3	1.12	.34
684.1	173	.6	.49	.22
742.9	177	2.3	2.23	.47
795.7	180	1.6	1.60	.40
850.2	184	2.5	2.72	.52
956.8	191	2.6	3.60	.60
995.7	194	4.0	18.44	1.36
1071.0	199	7.9	16.32	1.28
1113.2	201	1.6	1.60	.40
1211.6	207	.4	.71	.27
1238.3	209	.9	2.77	.53
1288.8	213	.7	.46	.21
1380.2	220	.4	.49	.22
1409.1	222	.8	2.18	.47
1475.8	226	1.0	2.22	.47
1531.3	229	3.4	7.38	.86
1641.1	236	3.5	10.94	1.05
1670.8	238	5.1	6.99	.84
1720.8	241	4.3	32.68	1.81
1747.2	243	2.2	4.84	.70
1836.6	249	.6	1.60	.40

Appendix H, Table 6. Mean estimates of OM second instar density for samples of 60 cm of onion row in 1979.

ACC. DDAY	DATE	MEAN	VAR	SE
317.6	144	.5	.94	.31
344.1	148	1.1	.99	.31
360.7	150	1.8	3.07	.55
423.8	155	7.5	24.94	1.58
490.5	159	10.6	36.04	1.90
553.6	164	10.8	9.07	.95
662.7	171	7.4	10.80	1.47
692.4	173	5.4	15.80	1.78
760.6	179	2.8	8.70	1.32
790.8	181	2.0	1.50	.55
826.7	184	4.8	13.70	1.66
850.1	186	5.6	23.30	2.16
919.2	191	6.6	34.80	2.64
976.9	194	8.6	5.80	1.08
1056.4	199	11.0	21.50	2.07
1082.5	201	9.4	25.30	2.25
1168.9	206	11.0	28.50	2.39
1200.6	208	10.2	18.70	1.93
1282.8	213	8.6	28.30	2.38
1314.7	215	7.0	10.00	1.41
1381.4	219	4.0	16.50	1.82
1439.4	223	2.0	4.00	.89
1478.2	227	.8	1.20	.49
1495.1	229	.4	.30	.24
1585.1	235	1.0	3.00	.77
1612.3	237	0.0	0.00	0.00
1666.4	241	2.0	3.50	.84
1700.3	243	1.8	2.20	.66

Appendix H, Table 7. Mean estimates of OM third instar density for samples of 60 cm of onion row in 1979.

ACC. DDAY	DATE	MEAN	VAR	SE
317.6	144	0.0	0.00	0.00
344.1	148	.1	.10	.10
360.7	150	.7	1.12	.34
423.8	155	2.3	3.12	.56
490.5	159	3.8	6.62	.81
553.6	164	6.9	26.77	1.64
662.7	171	9.4	14.80	1.72
692.4	173	10.4	15.30	1.75
760.6	179	7.4	12.30	1.57
790.8	181	7.0	33.50	2.59
826.7	184	6.8	53.70	3.28
850.1	186	4.8	13.20	1.62
919.2	191	4.0	7.50	1.22
976.9	194	1.4	1.30	.51
1056.4	199	7.4	35.80	2.68
1082.5	201	8.2	13.70	1.66
1168.9	206	9.2	8.20	1.28
1200.6	208	10.4	28.30	2.38
1282.8	213	10.2	40.70	2.85
1314.7	215	8.6	8.30	1.29
1381.4	219	6.2	8.20	1.28
1439.4	223	5.0	6.50	1.14
1478.2	227	4.0	7.50	1.22
1495.1	229	2.2	3.70	.86
1585.1	235	3.2	27.20	2.33
1612.3	237	.2	.20	.20
1666.4	241	.8	.70	.37
1700.3	243	1.8	.70	.37

Appendix H, Table 8. Mean estimates of OM pupal density for samples of 60 cm of onion row in 1979.

ACC. DDAY	DATE	MEAN	VAR	SE
317.6	144	0.0	0.00	0.00
344.1	148	0.0	0.00	0.00
360.7	150	0.0	0.00	0.00
423.8	155	0.0	0.00	0.00
490.5	159	0.0	0.00	0.00
553.6	164	2.6	4.71	.69
662.7	171	3.6	14.80	1.72
692.4	173	1.2	1.70	.58
760.6	179	11.4	19.30	1.96
790.8	181	6.4	80.30	4.01
826.7	184	14.0	65.00	3.61
850.1	186	18.6	358.30	8.47
919.2	191	28.2	273.20	7.39
976.9	194	36.8	97.70	4.42
1056.4	199	33.4	210.80	6.49
1082.5	201	14.2	82.20	4.05
1168.9	206	24.4	271.80	7.37
1200.6	208	14.0	27.50	2.35
1282.8	213	9.6	17.30	1.86
1314.7	215	4.8	9.20	1.36
1381.4	219	16.6	93.80	4.33
1439.4	223	14.4	16.30	1.81
1478.2	227	15.0	70.50	3.76
1495.1	229	10.4	111.30	4.72
1585.1	235	17.2	55.70	3.34
1612.3	237	21.0	77.50	3.94
1666.4	241	8.0	33.50	2.59
1700.3	243	4.8	7.20	1.20

Appendix H, Table 9. Mean estimates of OM pupae parasitized by A. bilineata from samples of 60 cm of onion row in 1979.

ACC. DDAY	DATE	MEAN	VAR	SE
317.6	144	Ø.Ø	Ø.ØØ	Ø.ØØ
344.1	148	Ø.Ø	Ø.ØØ	Ø.ØØ
36Ø.7	15Ø	Ø.Ø	Ø.ØØ	Ø.ØØ
423.8	155	Ø.Ø	Ø.ØØ	Ø.ØØ
49Ø.5	159	Ø.Ø	Ø.ØØ	Ø.ØØ
553.6	164	Ø.Ø	Ø.ØØ	Ø.ØØ
662.7	171	Ø.Ø	Ø.ØØ	Ø.ØØ
692.4	173	Ø.Ø	Ø.ØØ	Ø.ØØ
76Ø.6	179	Ø.Ø	Ø.ØØ	Ø.ØØ
79Ø.8	181	.2	.2Ø	.2Ø
826.7	184	.4	.8Ø	.4Ø
85Ø.1	186	.6	.8Ø	.4Ø
919.2	191	1.Ø	.5Ø	.32
976.9	194	1.4	1.3Ø	.51
1Ø56.4	199	2.2	1.7Ø	.58
1Ø82.5	2Ø1	2.2	.7Ø	.37
1168.9	2Ø6	2.4	1.8Ø	.6Ø
12ØØ.6	2Ø8	2.4	1.3Ø	.51
1282.8	213	1.6	.8Ø	.4Ø
1314.7	215	1.Ø	1.ØØ	.45
1381.4	219	1.6	3.3Ø	.81
1439.4	223	1.8	1.2Ø	.49
1478.2	227	.8	.7Ø	.37
1495.1	229	.8	1.2Ø	.49
1585.1	235	2.2	1.7Ø	.58
1612.3	237	3.2	3.2Ø	.8Ø
1666.4	241	1.4	.8Ø	.4Ø
17ØØ.3	243	.8	.7Ø	.37

Appendix H, Table 10. Mean estimates of SC third instar density for samples of 60 cm of onion row in 1979.

ACC. DDAY	DATE	MEAN	VAR	SE
270.3	138	4.6	12.71	1.13
311.5	143	5.7	10.46	1.02
317.6	144	5.4	13.38	1.16
344.1	148	3.1	16.10	1.27
360.7	150	1.5	3.61	.60
423.8	155	.2	.18	.13
490.5	159	.7	1.12	.34
553.6	164	.4	.49	.22
662.7	171	2.4	4.30	.93
692.4	173	3.0	10.00	1.41
760.6	179	2.6	5.80	1.08
790.8	181	4.0	17.50	1.87
826.7	184	4.2	7.20	1.20
850.1	186	3.0	4.00	.89
919.2	191	1.2	1.70	.58
976.9	194	.4	.30	.24
1056.4	199	1.2	1.70	.58
1082.5	201	2.0	8.50	1.30
1168.9	206	1.6	4.30	.93
1200.6	208	1.4	1.30	.51
1282.8	213	2.6	7.30	1.21
1314.7	215	.4	.30	.24
1381.4	219	.6	.80	.40
1439.4	223	2.0	5.50	1.05
1478.2	227	2.4	4.30	.93
1495.1	229	1.4	6.80	1.17
1585.1	235	1.4	1.30	.51
1612.3	237	0.0	0.00	0.00
1666.4	241	0.0	0.00	0.00
1700.3	243	.4	.30	.24

Appendix H, Table 11. Mean estimates of SC pupal density for samples of 60 cm of onion row in 1979.

ACC. DDAY	DATE	MEAN	VAR	SE
270.3	138	3.0	11.11	1.05
311.5	143	7.0	43.33	2.08
317.6	144	6.1	18.99	1.38
344.1	148	5.0	28.89	1.70
360.7	150	5.6	40.49	2.01
423.8	155	2.4	6.27	.79
490.5	159	1.7	4.01	.63
553.6	164	.6	1.16	.34
662.7	171	.4	.80	.40
692.4	173	1.0	2.00	.63
760.6	179	2.2	6.20	1.11
790.8	181	1.2	1.70	.58
826.7	184	1.4	4.30	.93
850.1	186	2.8	15.20	1.74
919.2	191	1.6	1.30	.51
976.9	194	4.4	13.30	1.63
1056.4	199	4.8	3.70	.86
1082.5	201	2.2	1.70	.58
1168.9	206	3.6	7.30	1.21
1200.6	208	2.8	7.70	1.24
1282.8	213	3.8	15.70	1.77
1314.7	215	1.4	1.30	.51
1381.4	219	.8	1.70	.58
1439.4	223	1.0	.50	.32
1478.2	227	.2	.20	.20
1495.1	229	1.2	1.70	.58
1585.1	235	1.8	3.20	.80
1612.3	237	3.6	7.30	1.21
1666.4	241	3.4	5.30	1.03
1700.3	243	3.6	11.30	1.50