THE BIONOMICS OF THE DOGWOOD BORER, *THAMNOSPHECIA SCITULA* (HARRIS), ATTACKING BLUEBERRY IN MICHIGAN

Thesis for the Degree of M. S.
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ABSTRACT

THE BIONOMICS OF THE DOGWOOD BORER,
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by George Scott Ayers

Thamnosphecia scitula (Harris) is reported as a new pest of commercial blueberry plantings in Michigan. Studies were conducted to determine the distribution, life history and economic importance of this insect. Adult emergence was correlated with geographical locations for the years 1962-64 by caged larvae and pupae studies. The egg incubation period was determined under controlled conditions. Estimations of the number of instars and head capsule width range of individual instars were based on measurements of single larvae examined on a two week schedule. The effect of the insect upon blueberry production was investigated for several varieties over a two year period. In chemical control studies conducted at two locations, both Parathion and Thiodan gave promising results.

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INTRODUCTION

During the early summer of 1961, unidentified grub-like larvae were found girdling the crowns of high-bush blueberries, *Vaccinium corymbosum* L., in commercial plantings near Nunica and Grand Junction, Michigan. Having been alerted to this type of injury, many growers throughout the commercial blueberry growing regions of Michigan reported canker-like growths in 1962 and 1963. This new pest was particularly prevalent and damaging in the vicinity of Nunica. There appeared to be two distinct types of gall formation resulting from infestations of this unknown pest. In some instances callusing occurred in the juncture of branches or at the base of the plant. At times callusing was present in the center of the cane, often extending around it. It was believed that injury might be due to two species of insects, possibly borers.

The objectives of this study were as follows:

1. Obtain identification of the insect.
2. Determine the distribution of the insect in commercial blueberry plantings.
3. Determine the real economic importance of the insect in commercial blueberry plantings.
4. Determine the life history of the insect.
5. Work out a chemical control for this insect.

IDENTIFICATION

In the summer of 1961 a single specimen forwarded to Dr. Annette Braun was identified as *Ramosia rhododendri* (Beutenmuller). By 1962 considerable knowledge of the life history of this insect in Michigan had been obtained. Discrepancies in the life history of the unknown insect and *R. rhododendri* caused the writer to question the identity of the single specimen determined by Dr. Braun. In the fall of 1962 the writer visited a number of institutions and compared several field-collected male and female specimens with identified pinned specimens. Comparisons with specimens in the Carnegie Museum, Pittsburg; the Smithsonian Institution, Washington, D.C.; and the Connecticut Experiment Station, New Haven, strongly indicated that the unknown pest was an Aegeriid, *Thamnosphecia scitula* (Harris). A comparison of the genitalia with published drawings of Englehardt (1946) further confirmed the identification as *T. scitula*. During the summer of 1963 twenty specimens were forwarded to Dr. W. Donald Duckworth of the Smithsonian Institution. Dr. Duckworth concurred with the identification of *T. scitula*.

DESCRIPTION OF STAGES

The Adult

The adult is a typical black and yellow Aegeriid moth. In this study the sex was easily determined by the wide yellow band on the fourth abdominal segment of the female compared to the much narrower band on the corresponding segment of the male. See Plate I. Harris (1839) has published a detailed taxonomic description of this insect.

The Egg

The egg is oval with the dimensions of 0.5 mm by 0.3 mm. The larva leaves this structure via a hole made in one end. See Plate II.

The Larva

The larvae are typical Aegeriid larvae. The body color ranges from near white to a light pink. The head capsule is highly scleritized and usually deep brown in color. The first instar larva has a head capsule width of about 0.21 mm and a body length of about 0.68 mm. The last instar larva has a head capsule width which ranges from between 1.4 to 1.7 mm. The over-all body length of the last instar larva is about 12 to 13 mm.

The Hibernaculum

The hibernaculum is not the typically heavily constructed

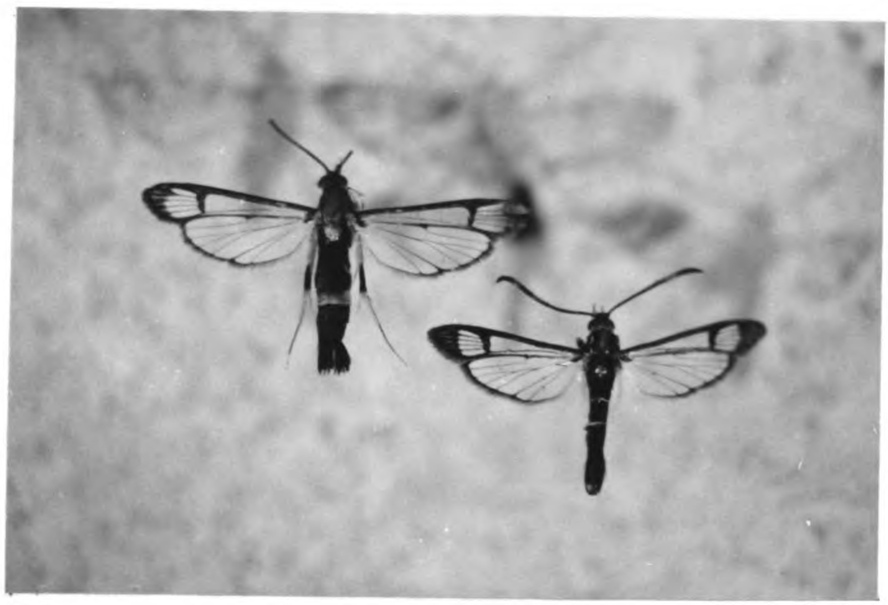

Plate I.--Adult moths.

Female left and male right.

Plate II.--Eggs after hatching.

hibernaculum but consists of little more than a thin silken webbing surrounding the larvae in their galleries just beneath the thin bark layer. The larva spends the winter in this construction.

The Pupa

The cocoon is made up of a silken web with fragments of frass adhering to it. It is usually positioned just beneath the thin loose bark of the plant in the gallery which has been prewidened for it. The pupa is dark brown and about 3/8 inch in length. After emergence is is usually found protruding about 3/4 of its length from the cocoon.

DISTRIBUTION AND HOST PLANTS

In addition to the writer's personal inspection of many commercial blueberry plantings, information for this distribution study has been compiled from a number of other sources (see Acknowledgements). Figure 1 shows a distribution of blueberry plantations in Muskegon, Kent, Ottawa, Allegan, Van Buren, Kalamazoo, Cass and Berrien Counties. This map accounts for about 95% of the blueberry production in Michigan. Superimposed on this distribution is a second distribution of plantations known to be infested. It is apparent from this map that this insect is found in all the major blueberry producing areas except the southwestern area between South Haven and Benton Harbor. Although the present study did not reveal its presence, the writer believes *T. scitula* is present in these areas since it feeds on a large number of plant species, many which are common to southwestern Michigan. This list includes the following:

Various Oaks
Dogwood (*Cornus florida*)
Cherry
Apple
Mountain ash
Hickory
Willow
Birch
Bayberry (*Myrica carolinensis*)
Hazelnut
Rattan vine (*Berchemia scandens*)
American Chestnut
Beech
Certain Pines
Nine-Bark shrub (*Physocarpus opulifolius*) Englehardt (1946)

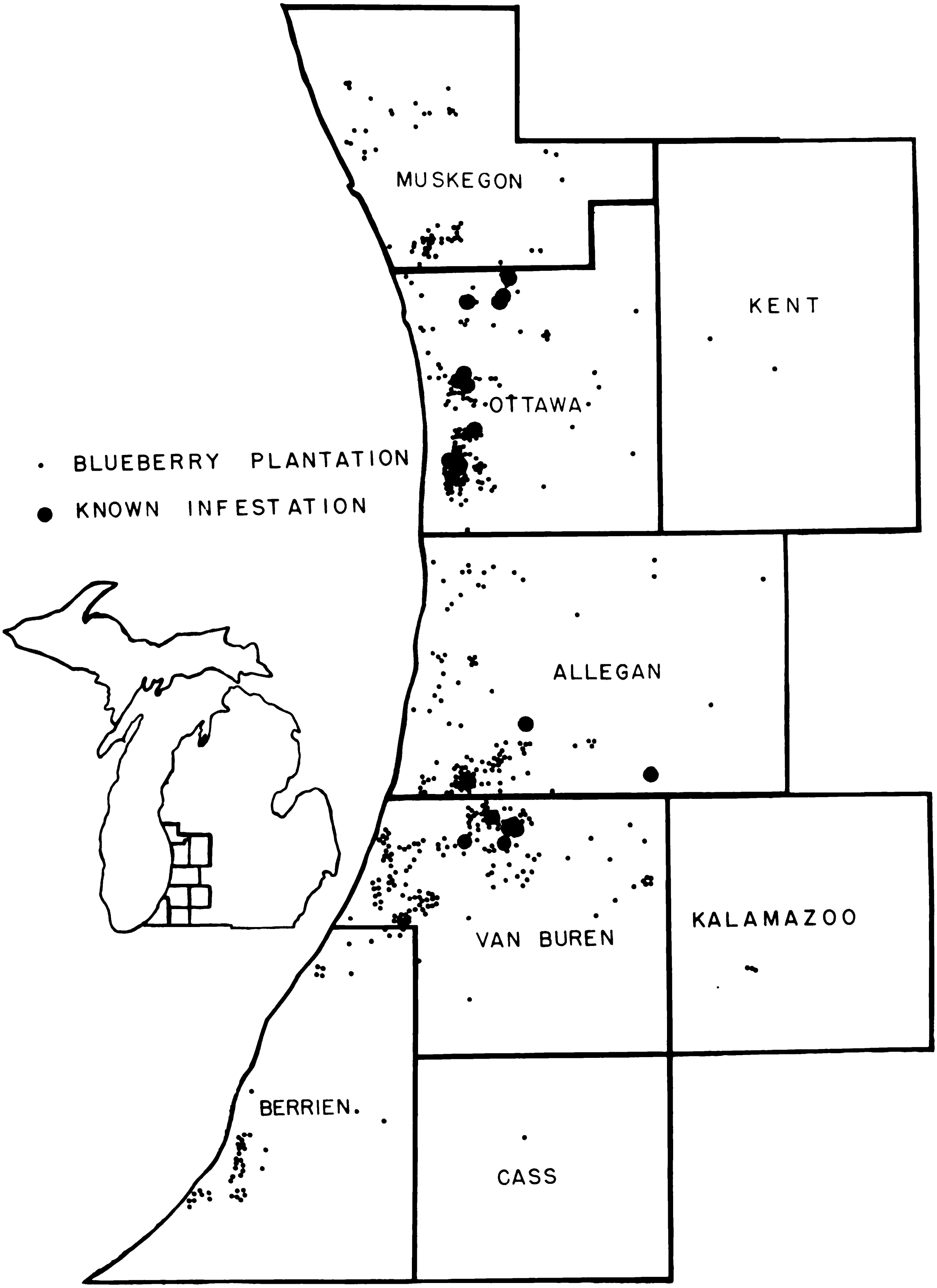

Fig. 1.--Dogwood Borer infestation superimposed on blueberry plantation distribution.

Myrtle	
Loquat	Pless (1963)
Elm	Pierce and Nickles (1941)

Oak, which is especially common in this part of the state, is considered to be the borer's natural plant food. However, this is the first time the insect has been reported to feed on blueberry. This insect has been reported from all parts of the United States except west of the Rocky Mountains; hence it would be unusual if it were not found in Southwestern Michigan.

MATERIALS

During this study, various plantations have served as material sources. These areas of study were selected on a basis of large infestations and accessibility for study purposes. When possible, study blocks were selected over as wide a range of the blueberry growing regions as feasible.

During 1962 and 1963 two areas, the M-45 and Grand Junction areas were used. The M-45 area, Ottawa Co., is located 1-1/2 miles east of the juncture of M-45 and US-31, and five miles south of Grand Haven. The Grand Junction area, Van Buren Co., is located within a half-mile radius of the village of Grand Junction. During 1964 these two areas of study were used as well as a third, the Allegan area. This area is in Allegan Co. and is 2-1/4 miles south and 2-1/2 miles east of Allegan.

METHODS

The Larva

The technique of moving larvae from the original infestation site to a new and artificial opening was improved upon during this study. The artificial wounds were made with a pointed awl at the juncture of two canes that were at least four years old in such a way that a cylindrical hole was made just beneath the bark. The larvae were made to crawl into this wound, then the opening and surrounding area was covered to prevent escape and desiccation. During 1963 the wounds were wrapped with dampened cloths, then covered with a thin sheet of Saran Wrap. It was determined later that this induced a high incidence of harmful fungi. In 1964 these coverings were replaced by commercial aluminum foil that proved more satisfactory than the original coverings. During 1964, 61.3% of such larval transplants were successful. Of the unsuccessful, 69% of the larvae could not be accounted for while the remainder was due to larval mortality.

Efforts were made to determine the number of instars and the range of head capsule widths. Because of the limited number of insects available, the usual method of measuring large numbers of larvae was not possible; thus the following method was employed. Beginning April 18, 1964, larvae were transplanted in the manner previously described after their head capsules had been measured. Each weekend a new set of larvae were measured and transplanted until

June 1, 1964. After the initial transplant was made it was reopened every two weeks, at which time the larva was measured and then returned to its original position. This procedure was carried out until the larvae died, disappeared, or pupated.

The Adult

During the three years observations were conducted, the following methods were used to determine the time of adult emergence:

Method I: Pupae cases were placed in milk cartons from which two sides had been removed. Leaves were placed in the base of the carton and a nylon stocking was fitted around it. The cage and contents were hung in a thicket near the blueberry fields so that they would not be tampered with by blueberry pickers. About once a week the pupae and leaves were moistened and the leaves changed. As the adults emerged, they were removed from the cage.

Method II: Larvae which had been transplanted as described previously were surrounded by fiberglass screen sleeves. Pupae were also caged in this manner.

Emergence data from both methods agree and compare favorably with the appearance of empty pupae cases in the field. These procedures were followed for larvae and pupae until the emergence of the adult. Pupae or larvae were no longer caged after the first emergence from a study area. This procedure was followed to avoid weighting the late part of the emergence curve.

Mating and Oviposition

During 1963 attempts were made to study egg laying and mating behavior by placing virgin females into a 22 x 22 x 6 foot cage enclosing nine Weymouth blueberry plants with males obtained from procedures previously described. The cage floor was covered with drill cloth fitted around the plants.

In 1964 four field-collected females, which were assumed to have mated, were placed in the cage on the assumption that mated females might oviposit in confinement while virgin females might not mate under these conditions.

In another method employed in 1964, field observations were maintained on five virgin and four field-captured females to determine if either mating or egg laying occurred during the period of observation. Both virgin and field-captured females were released at different intervals during the day. Observations were continued until the moths were no longer visible to the viewer.

An attempt was made to capture additional numbers of moths during early August of 1964 since only a few adults had been collected in the field up to that time. A cube-shaped cage containing approximately 512 cubic feet was placed over individual blueberry plants. The plant was then vigorously shaken in the hope that adults would fly to the screen and be more readily observed. No moths were caught in this manner during 1964 but because of the lateness of the season it was decided to try this same procedure again the following year. In 1965 the cage was constructed so that it could be slid rather than carried over the plant. When positioned over the plant, the two ends of the cage were lowered and then the plant was shaken. No moths were captured employing this type of cage.

On July 19, 1965 a single female caught in the field was placed in a petri dish which was lined on the bottom with a piece of filter paper. A slice of Red Delicious apple was placed in the petri dish along with the adult female. The apple slice and filter paper were changed every several days. The filter paper was kept just slightly damp by a few drops of water every day. Sometime between the period of 12:00 midnight July 23 and 4:00 AM July 24 the moth oviposited fourteen eggs. By noon July 24, the moth had died.

FIELD AND LABORATORY OBSERVATIONS

Observations on the Adult

In Figure 2 emergence data from both the milk carton and screen sleeve methods have been combined since the writer was confident that these data were in agreement. During 1963, moths of the M-45 area began to emerge in the cages only three days after caging; hence it is possible that the M-45-1963 curve is unduly weighted toward the late side. In Figure 3 the histograms from Figure 2 which the writer feels to be the most meaningful are shown with curves the writer feels to be appropriate for these histograms. The writer is aware that a certain amount of liberty has been taken in drawing these curves but they are used later in the chemical control discussion.

From these graphs it is evident that emergence within the same year differs with locality, and that emergence in a certain locality changes from year to year. For example emergence in 1964 was about seven days earlier than in 1963.

The behavior of the adult is striking in that the moths were very inactive during the day and remained in this condition for periods as long as six hours without flying. When they did fly, the distance was often very short, usually less than fifteen feet.

During the twilight and dawn hours the moths became more active. Since they were difficult to observe in the dim light due to increased

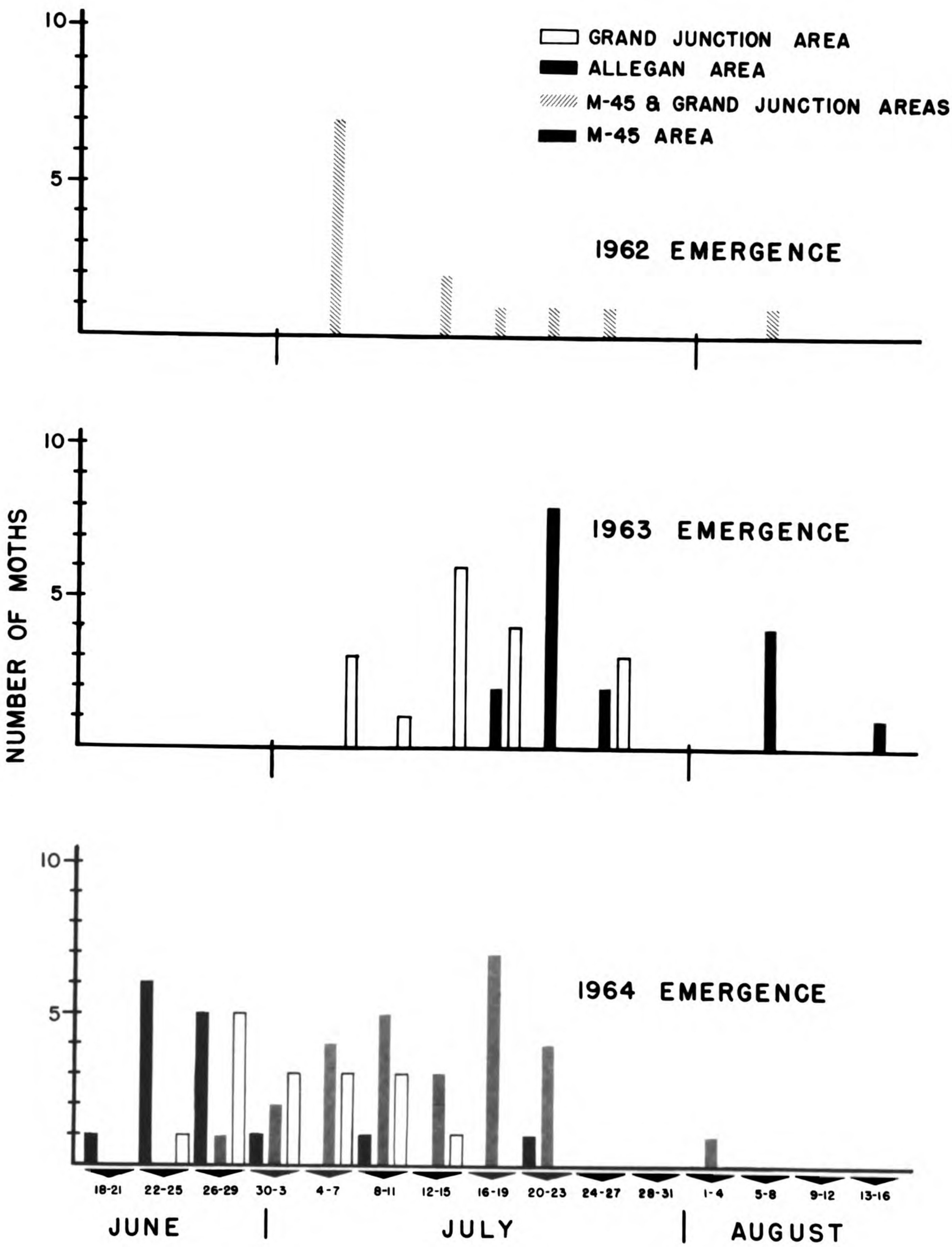

Fig. 2.--Adult emergence for 1962, 1963 and 1964.

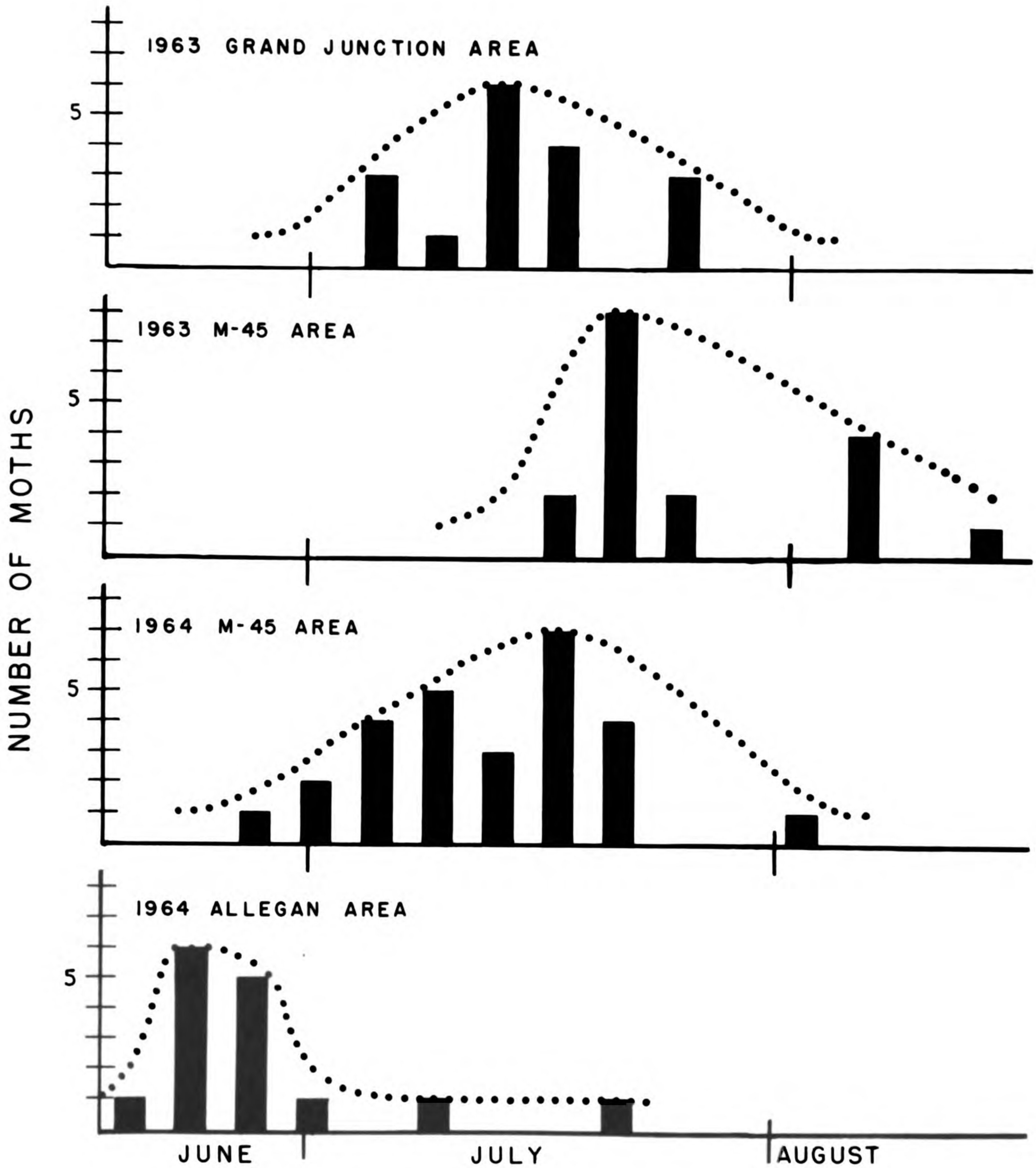

Fig. 3.--Selected adult emergence histograms with corresponding proposed adult emergence curves.

activity, detailed observations were not possible at these times. Because of this increased activity it seems probable that mating and egg laying would take place at one or both of these times. No mating or egg laying was observed during these periods.

The life span of the adults in the large screen cage where moisture was adequate was only four or five days. Underhill (1935) reports the average life span of females to be nine days and seven days for males. Pless (1963) found the average life span to be six to eight days.

Observations on the Eggs

The petri dish containing the fourteen eggs laid July 24, 1965 was placed under a fifteen hour photoperiod at approximately 30^{o} C. The filter paper lining the bottom of the dish was dampened every day with a drop of water but was not changed. By July 30 larval development was noted and on August 1 all fourteen eggs had hatched. See Plate II.

Observations on the Larva

Figure 4 shows the head capsule range of the larvae as well as head capsule size for different instars for individual larvae. The histogram combines the head capsule measurement data for the years 1963, 1964 and 1965. Width of head capsules for different instars of individual larvae are plotted above the histogram.

In Figure 5 an attempt has been made to correlate the two charts of Figure 4 and to draw conclusions concerning the number of instars and range of head capsule widths for individual instars. Since groups

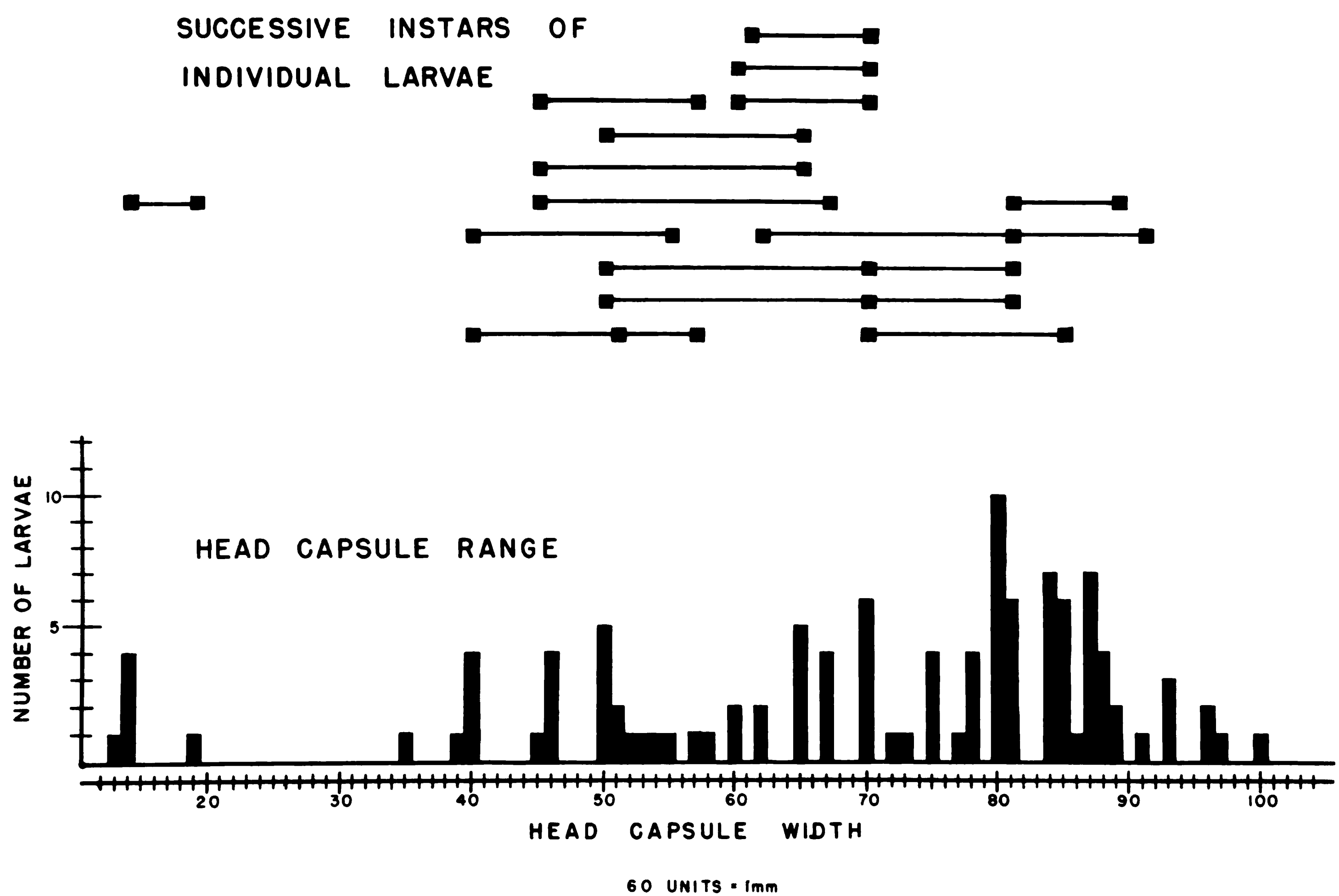

Fig. 4.--Head capsule width of all larvae measured and of successive instars for individual larvae. Each unbroken horizontal line represents a single larva. Squares represent head capsule widths based on the same scale as the histograms.

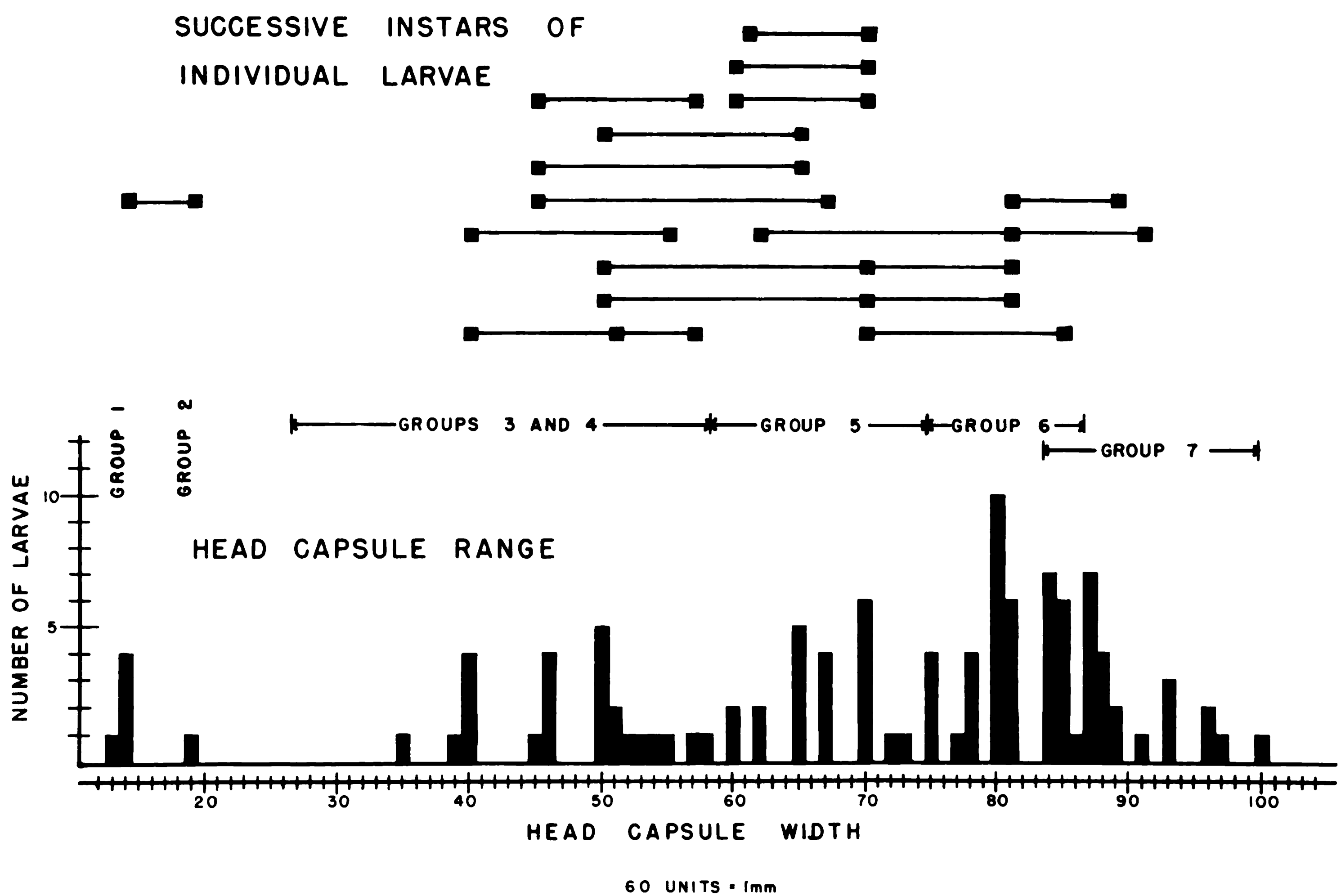

Fig. 5.--Head capsule width of all larvae measured and of successive instars for individual larvae correlated with proposed head capsule range of individual instars. Each unbroken line represents a single larva. Squares represent head capsule widths based on the same scale as the histogram.

1 and 2 represent larvae which were observed from hatching, these groups represent first and second instar larvae respectively. Groups 3 through 7 were not reared from eggs and no such statement of certainty can be made for these groups. The extreme right hand side of group 7 undoubtedly represents last instar larvae exclusively. The left hand side of group 7 and groups 3, 4, 5 and 6 represent the corresponding instar with increased uncertainty. Groups 3, 4 and 5 have little substantiating data to warrant these arbitrary divisions.

Observations on the Hibernaculum

In the fall of 1964 between mid October and mid November larvae of different instars began to enter a hibernaculum stage. During the spring of 1964 the hibernacula disappeared between late March and late April. Since the webbing is no longer found after late April, it is probable that the larvae ingest it upon emergence.

Observations on the Pupa

Often the cocoon is placed in a gallery which the larva has prewidened for it. On rare occasions cocoons were found in the debris under the plant. Since cocoons are extremely difficult to find in the leaf litter it was not possible to determine the frequency of this occurrence. On very rare occasions naked pupae were found beneath the loose bark of the plant. In the Allegan area where larvae were generally feeding on callused material possibly caused by Crown Gall, *Agrobacterium tumefaciens*, the cocoons were often placed under buttons of callused material. See Plates III and IV. Because of the high incidence of mortality involved in inspecting and transplanting larvae,

Plate III.--Crown Gall on Coville.

Plate IV.--Placement of cocoons.

Left to right: Heavily damaged area; just beneath the bark and under a calloused button.

this procedure was kept on a rigid two-week schedule; hence pupation was rarely observed during these periods. Consequently the duration of pupation is known for only a few individual cases. These cases are tabulated below.

Year	No. of cocoons	Pupation time
1963	1	23 days
1963	1	25 days
1963	2	26 days
1964	1	16 days

Pupation time was considered to be the time interval between initiation of cocoon formation and adult emergence. The lack of agreement between the years 1963 and 1964 might be a result of the small sample size but is also suggestive of an exogenous releasing mechanism.

Sometimes upon emergence the empty pupa case protrudes from beneath the bark. See Plate V. More frequently the empty pupal case simply protrudes from the empty cocoon.

Plate V.--Protruding pupa case.

VARIETAL SUSCEPTIBILITY

Most authors have considered it necessary for a wound or at least a roughened area to be present in order for entry to occur. This appears to be the case with infestations in blueberry, since few, if any, borers have been found where the entry was made in smooth bark. Entries are often made at pruning, cultivating, and other breakage scars. See Plate VI. In the Allegan area, entries were very often seen associated with Crown Gall. Often entry is made at the juncture of two or three-year-old canes with older wood. See Plate VI.

Originally it was thought that high infestations were confined to Berkeley and Weymouth varieties. Later, high infestations were found in Jersey, Pemberton, Coville and Burlington varieties without nearby infested plantings of Weymouth or Berkeley.

In 1963 a study was undertaken to determine if there were a difference in susceptibility among varieties. The M-45 area provided an excellent opportunity to conduct this study. Multiple rows of Jersey adjoined a single row of Berkeley to the east. Multiple rows of Weymouth, followed by Stanley, were located on the east side of the Berkeley row. The entire row of Berkeley and samples from the other varieties equal in size to the Weymouth planting were inspected for borer. From the results shown in Table 1 it is evident that there is a difference in varietal susceptibility to *T. scitula*. During 1965, although no counts were made, it was obvious that the incidence of

Plate VI.--Points of entry into the blueberry plant.

Top: Juncture of an old and young cane.
Bottom: Pruning injury.

TABLE 1.

Varietal susceptibility

Row #	Number of plants in row	Number of plants* infested	% infested
		Weymouth	
1	38	9	23.7
2	38	6	15.8
3	38	9	23.7
4	38	9	23.7
5	38	4	10.5
6	38	5	13.2
	228	42	$\bar{X}$ = 18.4
		Berkeley	
1	39	39	100
		Stanley	
1	37	6	16.2
2	37	10	27.0
3	37	1	2.7
4	38	6	15.8
5	38	5	13.2
6	38	1	2.6
	225	29	$\bar{X}$ = 12.9
		Jersey	
1	38	9	23.7
2	38	13	34.2
3	38	16	42.1
4	38	14	36.8
5	38	18	47.4
6	38	15	39.5
	228	85	$\bar{X}$ = 37.2

Locality: M-45 area.

*Includes injuries from spring and summer feeding plus new fall entries.

infestation in the Stanley was somewhat higher than it had been the year before.

Reports on the effect of the Dogwood Borer on blueberry production have varied quite considerably. For this reason, a study of the effect on berry production was initiated during the summer of 1963 with Weymouth, Jersey, Berkeley and Burlington varieties. Fields were selected in which at least ten infested plants could be found, except in the Berkeleys where there were only nine. Fields were purposely selected in which the infestation was rather low. This was done so that reinfestation into the same bush the following year would not be likely. In no case does there appear to have been a reinfestation, so that any differences in berry production must be attributed to a single borer. Ten infested plants and a corresponding non-infested bush immediately next in the row were selected and designated numerically. The berries from these plants were picked and weighed at various times. The same plants with the exception of the Weymouth were picked again during 1964. The Weymouth were not picked during 1964 because the markers used during the winter to mark the plants were pruned out by the grower.

In Tables 2-5 are tabulated the weights, s_x, t and approximate probability of obtaining a greater value of t for m = 0 for the individual pickings as well as for the corresponding totals.

During 1963 no significant differences were detected. Only in the Burlington variety was the weight production less for the infested plants than for the noninfested plants.

For the 1964 pickings, significance was achieved only in the Jersey variety. Although the total production did not reach the five

TABLE 2.

Analysis of blueberry weight production in Jersey for 1963 and 1964

	1963									
	1st picking Aug. 5		2nd picking Aug. 19		3rd picking Aug. 30		4th picking Sept. 13		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	12,566.0	2,819.1	2,666.9	2,629.3	1,411.9	1,503.6	935.2	1,017.7	17,580.0	7,969.7
S_x	775.57		34.80		17.84		15.73		749.17	
t	1.26		0.108		0.51		0.52		1.286	
p	0.26		0.9		0.62		0.61		0.23	

	1964							
	1st picking Aug. 4		2nd picking Aug. 14		3rd picking Sept. 1		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	10,750.5	13,742.0	2,142.0	4,098.1	2,975.1	4,907.4	15,867.6	22,747.5
S_x	219.0		61.38		59.7		314.0	
t	1.37		3.19		3.24		2.16	
p	0.21		0.019		0.0102		0.0735	

TABLE 3.

Analysis of blueberry weight production in Burlington for 1963 and 1964

	1963							
	1st picking July 5		2nd picking July 15		3rd picking July 20		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	13,428.8	16,180.5	6,709.9	6,219.5	1,438.9	1,486.8	21,577.6	23,886.8
S_x	159.29		157.03		28.79		187.52	
t	1.73		0.31		0.17		1.23	
p	0.12		0.76		0.87		0.25	
	1964							
	1st picking Aug. 7		2nd picking Aug. 13		3rd picking Sept. 2		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	20,100.9	22,932.7	833.8	1,249.1	2,458.4	2,872.3	23,393.1	27,054.1
S_x	4,168.1		283.4		673.0		4,740.0	
t	0.068		0.146		0.062		0.77	
p	0.9		0.89		0.9		0.47	

TABLE 4.

Analysis of blueberry weight production for Berkeley for 1963 and 1964

	1963									
	1st picking July 25		2nd picking Aug. 5		3rd picking Aug. 19		4th picking Aug. 30		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	3,759.6	2,282.7	5,063.7	4,456.4	2,331.8	2,590.8	581.1	1,020.4	11,736.2	10,350.3
S_x	122.62		107.51		73.64		43.05		297.46	
t	1.34		0.63		0.39		0.29		0.52	
p	0.22		0.55		0.71		0.29		0.62	

	1964									
	1st picking July 20		2nd picking July 31		3rd picking Aug. 13		4th picking Aug. 29		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	15,588.7	17,688.4	13,718.3	12,579.6	7,426.0	6,996.1	2,225.3	1,661.6	38,958.3	38,925.7
S_x	235.92		303.77		190.32		111.39		754.11	
t	0.999		0.42		0.25		0.51		0.0048	
p	0.35		0.61		0.81		0.62		0.9	

TABLE 5.

Analysis of blueberry weight production for Weymouth for 1963

	1st picking July 5		2nd picking July 15		3rd picking July 20		Total	
	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.	Inf.	Noninf.
Weight in Grams	1,527.4	1,460.1	4,101.3	3,075.7	851.7	794.4	6,480.4	5,960.2
S_x	19.15		65.92		17.23		77.51	
t	0.31		0.60		0.33		0.67	
p	0.76		0.57		0.75		0.52	

per cent level, significant differences in yield were noted in the second and third pickings.

Although the total production is not statistically significant, the five per cent level of significance was nearly reached. When the plants were inspected during the winter of 1964 it was evident that the new growth of the control plants was greater than that of the infested plants. Only in the Jersey variety was the production of the infested plants less for 1964 than 1963, while in all cases the production from the non-infested plants was greater in 1964 than in 1963. These facts strongly indicate that the borer had an adverse effect on the Jersey variety. There is however, no evidence to support adverse effects on any of the other three varieties.

It should be noted that these Jersey plants were very young. In 1963 they were only four years old and produced their first commercial crop. Since the bark before the fourth year is unsatisfactory for the borer, it was probably the first year of borer infestation. This is also true for the Burlington variety although significance was not achieved in either year for that variety. Both the Berkeley and the Weymouth were much older plantings and there is no assurance that controls were not at one time themselves infested. It is evident that in at least certain varieties of new plantings, the Dogwood Borer can lower production. If the infestations were great, production could be seriously affected probably even in older plantings.

CONTROL

Control Methods

During the summer of 1964 sprays were applied to test plots in both the Allegan and M-45 areas. Sprays were applied by hydraulic gun to the Coville variety in the Allegan area and to the Weymouth and Jersey varieties in the M-45 region. Plants in both plots were sprayed to a height of about twenty inches.

The sprays were evaluated 5/29-30/65 at the Allegan area and 6/10-12/65 in the M-45 area. Dates of application and results are tabulated in Table 6.

Control Discussion and Results

Timing the chemical control for this insect presents several problems. Generally a spray program for an Aegeriid borer is aimed at the first instar larva as it emerges from the egg and before it enters the host plant. With other Aegeriids attacking deciduous fruit trees, this stage does not coincide with the harvesting of fruit. For example, peak flights of Lesser Peach Tree Borer, *Synanthedon pictipes*, and the Peach Tree Borer, *Sanninoidea exitosa*, occur in advance of the harvesting period. Maximum emergence of adult Raspberry Cane Borer, *Bembecia marginita*, occurs during August and September after harvest. As already discussed, *T. scitula* flys from mid-June to mid-August, a period that includes almost all of the blueberry harvest.

TABLE 6.

Spray application for 1964-65

Name	Rate/100 gal.	Number of larvae found/rep. 1	2	3	4	Total
Location: Allegan area Variety: Coville Method: Gun app.; 900 gal/A.; 4 reps. with 4 plants/rep. Date of application: 6/22/64 Date of evaluation: 5/29-30/65						
Parathion 4 flowable	8 oz.	0	2	0	0	2
Thiodan 2 E.C.	1.5 qts.	0	1	0	1	2
Sevin 80 sprayable	2.5 lbs.	1	2	1	0	4
Check		4	4	8	0	16
Location: M-45 area Variety: Jersey Method: Gun app.; 350 gal/A.; 4 reps. with 20 plants/rep. Date of application: 7/15/64 Date of evaluation: 6/10-12/65						
Parathion 4 flowable	2 qts.	0	2	0	0	2
Thiodan 2 E.C.	1.5 qts.	0	2	0	1	3
SD 4072 4 E.C.	1 pt.	3	0	2	3	8
Check		18	20	19	8	65
Location: M-45 area Variety: Weymouth Method: Gun app.; 350 gal/A.; 4 reps. with 20 plants/rep. Date of application: SD 9129; 7/22/64 Guthion; 10/16/64 Date of evaluation: 10/10-12/65						
SD 9129 3.2 E.C.	1 pt.	4	5	1	1	11
Guthion 1 lb./gal.	1/4 lb. (act.)	6	2	1	0	9
Check		10	4	5	4	23

Figure 6 shows the curves of Figure 3 along with the harvest periods for Weymouth and Jersey for all three areas and Coville in the Allegan area. The dates at which pesticides were applied are also listed.

In order to consider as many conditions as possible and to use the available data to the fullest extent, the following factors were taken into consideration.

1. Eggs were considered to have an eight or nine day incubation period in agreement with Pless (1963) and Underhill (1935). Egg-hatching data for 1965 indicates this was a valid assumption.

2. Varieties were chosen so that both pre and post harvest sprays could be applied. A 21 day preharvest interval was assumed.

3. One application at peak emergence versus two applications, one on either side of peak-emergence, was investigated.

4. A late fall application (not shown in Fig. 6), of Guthion was also tried to determine the possibility of affecting larvae under the thin bark of the blueberry plant.

The writer feels that the results are decisive, with the results at both locations agreeing well. Parathion and Thiodan effected the best control. There are probably differences due to variety. For example, control would be easier to attain on Jersey than on Weymouth due to the bushiness of the latter. It appears that one application at the peak of the adult emergence is sufficient.

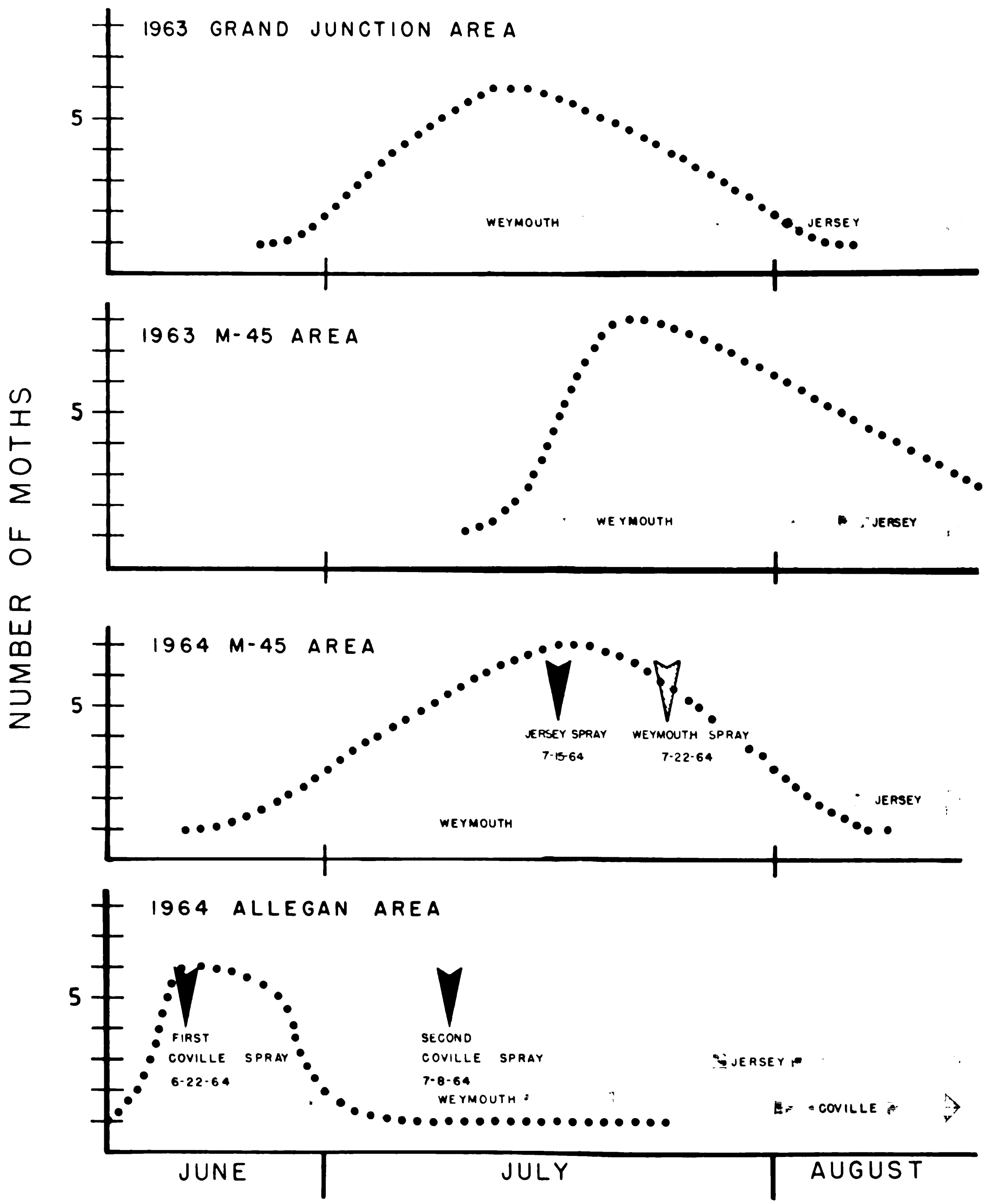

Fig. 6.--Selected adult emergence curves correlated with harvest periods and spray application dates.

SUMMARY

Thamnosphecia scitula (Harris) is reported as a new pest of commercial blueberry plantings in Michigan. Its distribution was determined to be throughout the commercial blueberry regions of Michigan.

Adult emergence was correlated with geographical location during the years 1962, 1963 and 1964. Peak adult emergence occurred in the Grand Junction area approximately one week prior to peak emergence in the Grand Haven (M-45) area during 1963 and 1964. During 1964 peak emergence of the Allegan area occurred one week prior to that of the Grand Junction area.

The egg incubation period was determined to be nine days under a fifteen hour photoperiod at 30° C.

Estimations of the number of instars and head capsule width range of individual instars were made based on measurements of single larvae examined on a two week schedule.

The effect of the insect upon blueberry production was investigated for the varieties Weymouth, Jersey, Berkeley and Burlington during the years 1963 and 1964. A decrease in production could be detected only for the Jersey variety.

In chemical control studies conducted at two locations, both Parathion and Thiodan gave promising results.

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