AN ANNOTATED LIST OF THE BUTTERFLIES OF DELHI, INDIA

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Julian Purtee Donahue

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ABSTRACT

AN ANNOTATED LIST OF THE BUTTERFLIES

OF DELHI, INDIA

by Julian Purtee Donahue

A collection of over 5600 butterflies from Delhi, India, obtained from 1961 to 1965, contained 73 species. An additional five species have been reported in the literature or are represented by specimens in the Indian Agricultural Research Institute, New Delhi.

For each species the following information is given: habitat preference, flying time (seasonal), total number of specimens, number of specimens of each sex, the sex ratio, maximum and minimum sizes observed in the material examined (given as the length of one forewing), variation, and the distribution of the species in India.

Two diverse habitats were heavily collected: the xerophytic Reserved Forest on the Ridge, a low prolongation of the Aravalli Hills; and the mesophytic Sundar Nagar Nursery. The Nursery, and other parts of the cities of Delhi and New Delhi, have been so heavily irrigated that they differ radically from arid native habitats, such as the Ridge.

The development of the mesophytic urban habitat perhaps accounts for the presence of 14 species found in mesic areas east of Delhi, but which do not occur in the arid land west of Delhi. Conversely, three species of Colotis plus the hesperiid Pelopidas thrax thrax, which are characteristic of arid land west of Delhi, occur on the Ridge but do not occur east of Delhi. Finally, Pieris canidia indica, Colias electo fieldi, and possibly Argynnis hyperbius, appear to be visitors from the Himalaya.

The greatest numbers and variety of butterflies are found during the monsoon season, from July through September, and afterwards through early November. The wet season form, in those species which have seasonal forms, usually occurs during the monsoon. But in at least six species (Anapheis aurota, Cepora nerissa, Eurema hecabe, Colotis etrida, Ypthima inica, Precis almana, and possibly Precis orithya) the color pattern characteristic of the wet season appears as early as mid-April or May, two of the warmest, driest months of the year. This indicates that environmental factors other than humidity may be influencing the seasonal forms of these species.

The two female color forms of Colotis fausta faustina are seasonal: the white form occurs during the monsoon; the salmon-colored form occurs at other times of the year.

Gongylus gongylodes (Orthoptera: Mantidae) is reported as a predator of Colotis fausta, and Telenomus (Aholcus) talaus (Hymenoptera: Scelionidae) is recorded as an egg parasite of either Papilio demoleus demoleus or P. polytes romulus.

The "cyrus" female form of Papilio polytes, usually considered rare, is relatively common in Delhi.

The subspecies minuta Evans, originally ascribed to Euchrysops pandava, is merely the dry season form of E. parrhasius parrhasius.

A hypothetical list of 32 species which may occur in Delhi is included.

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By

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INTRODUCTION

It is indeed surprising that no one has published a list of the butterflies of India's capital city, but the hot, arid climate of the north Indian plains has never been famous for inspiring the pursuit of Lepidoptera. Consequently, the only list of Delhi butterflies is a partial list of 21 species that Longstaff (1912) collected there in November, 1903. Otherwise, no complete list is available for any locality nearer to Delhi than 250 miles.

DESCRIPTION OF THE STUDY AREA

Delhi is a chief commissioner's state of 574 square miles, wedged between the states of Punjab and Uttar Pradesh, on the Indo-Gangetic Plain at lat. 28° 40'N, long. 77° 10'E (figs. 1 and 2).

Although it was not possible to survey the entire state, large collections were made in two diverse habitats: the Sundar Nagar Nursery (figs. 2-4), a lush area between the Zoological Park and Humayun's Tomb, on the southeast side of the state; and the "Ridge" (figs. 2 and 5-8), a low (200-300 feet) prolongation of the Aravalli Hill Range that gradually disappears as it extends northeast to the

Jumna River, which flows from north to south on the east side of Delhi. Unless otherwise stated, specimens collected on the Ridge were obtained in a Reserved Forest west of the Ashoka Hotel, on either side of Link Road between Sardar Patel Road and Ridge Road (fig. 2).

The Nursery approaches a mesophytic habitat because of extensive irrigation throughout the year. Although flowers and shrubs are cultivated in much of the area, native grasses, shrubs, and trees occur in many parts of the Nursery (figs. 3 and 4). Some Delhi butterflies, such as Leptosia nina, Euploea core, and, to a great extent, Ypthima inica, have been found only in restricted parts of this area.

Mukherjee (1953) has classified the essentially native and little-disturbed vegetation of the Ridge (figs. 5-8) into two categories: (1) the permanent vegetation, which occurs throughout the year; and (2) the ephemeral vegetation, which consists of annuals growing chiefly during the rainy season. He states that "The permanent vegetation is xerophytic in ecological peculiarities due to the rigorous climatic and edaphic conditions and gives an appearance somewhat like a thorn scrub or bush jungle. But the number of plants is somewhat fewer than in other scrub jungles of India." According to Mukherjee (1953), the most

characteristic trees on the Ridge include Azadirachta indica, Salvadora persica, S. oleoides, Prosopis spicigera, Acacia modesta, A. senegal, A. leucophloea, Cassia fistula, Ehretia laevis, Tecomella undulata, Balanites roxburghii, and Butea monosperma. The more numerous thorny shrubs on the Ridge include Zizyphus nummularia, Grewia betulaefolia, Capparis aphylla, C. sepiaria, Celastrus senegalensis, Calotropis procera, and Carissa spinarum. Mukherjee (1953) lists 178 species of plants, representing 44 families, that occur on the Ridge.

Reference should be made to Maheshwari (1963) for a complete analysis of the flora of Delhi.

In addition to the two major collecting sites above, small collections have been made in xerophytic situations at Tughlakabad Fort, eight miles SSE of New Delhi, and at Okhla, the origin of the Agra Canal on the Jumna River, five miles southeast of New Delhi. A few specimens have also been collected near the Najafgarh Jheel, a large, shallow-water lake surrounded by open cultivated land 18 miles WSW of New Delhi. With the few exceptions noted later, these localities have produced nothing unusual.

Figure 1. Outline map of northwestern India and West Pakistan, showing the major collecting sites referred to in the text. The approximate extent of the Indo-Gangetic Plain is stippled. Scale: 1" = about 130 miles.


KASHMIR
N
WEST PAKISTAN
AMRITSAR
LAHORE
LUDHIANA
H.P.
TIBET
PUNJAB
SAHARANPUR
SIND
DELHI
UTTAR PRADESH
NEPAL
RAJASTHAN
ALWAR
ALIGARH
JAIPUR
AGRA
LUCKNOW
JODHPUR
KANPUR
PALI
SIND
MT ABU
GUJARAT
KUTCH
MADHYA PRADESH
KAIRA
MHOW
KATHIAWAR
MAHARASHTRA
ORISSA
ANDHRA PRADESH
MYSORE

FIG. 1

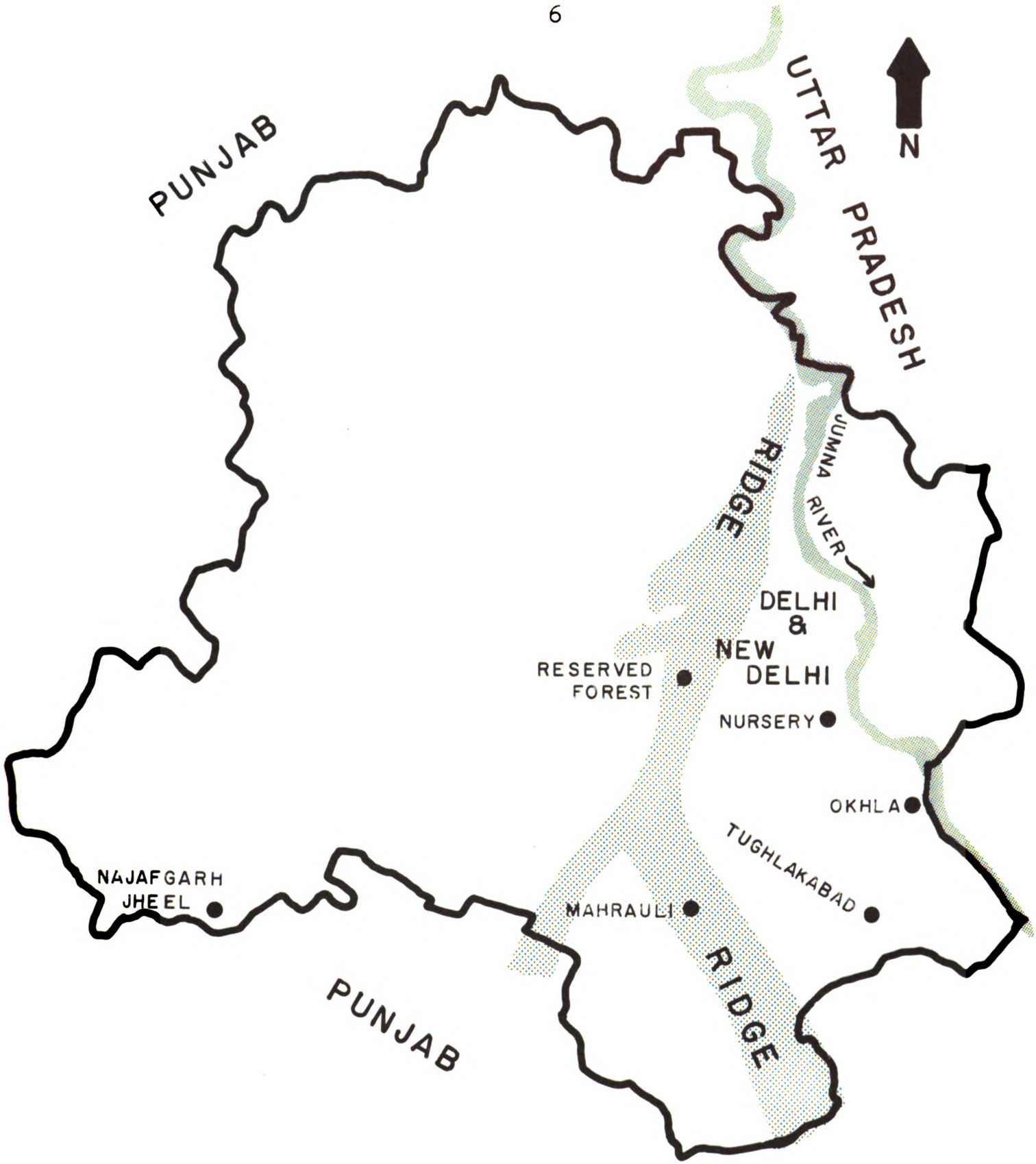

FIG. 2 Outline map of Delhi, India.

Fig. 3. An uncultivated lowland area on the north side of the Nursery (Zoo in background). Ypthima inica is most abundant in the tall grass in center of photo. 1 July 1962.

Fig. 4. Native grasses and thorn shrubs and trees in the Nursery, looking south from the area in Fig. 3, towards Humayun's Tomb (right center background). 1 July 1962.

Fig. 5. Dry season aspect of the vegetation in the Reserved Forest on the Ridge, 9 May 1962.

Fig. 6. Wet season aspect of the same area as Fig. 5, on 14 Aug. 1962. Note the change in the ground cover, in the foliage of the trees, and in the vine in the foreground.

Fig. 7. Dry season aspect of the vegetation in a second portion of the Reserved Forest on the Ridge, 9 May 1962.

Fig. 8. Wet season aspect of the same area as Fig. 7, on 14 Aug. 1962. Note the marked increase in grasses. The large tree on the right is *Azadirachta indica*.

CLIMATE AND SEASONAL ABUNDANCE

The climate of Delhi can be characterized as semi-arid, but there are marked seasonal changes. It is cool and dry from October to February, hot and dry from March to early June, and hot and humid during the monsoon from mid-June through September. The precipitation and temperature data are given for each month in Table 1, along with the number of species that have been collected in each month.

Of the mean annual rainfall of 26.24 inches, 84% occurs during the monsoon from June through September. The dry conditions prevailing from October to May dictate the arid nature of the native vegetation. During the monsoon, however, the vegetation flourishes. Most plants produce lush new growth at a rapid pace, and almost overnight the land is green where leafless trees and hard bare ground had been but a few weeks earlier (see figs. 5-8 for examples of the changes). The pronounced change in the vegetation during the monsoon has been studied in Gujarat by Saxton (1924).

The activity and abundance of the butterflies are strongly correlated with the climatic events in Delhi.

Table 1. Monthly rainfall and temperatures in Delhi, India (Source: Sohoni, 1953), with the number of species of butterflies recorded for each month.

MONTH	RAINFALL (inches)	TEMPERATURE (°F.) mean daily max.	TEMPERATURE (°F.) mean daily min.	NO. SPP. COLLECTED
January	0.99	70.5	43.3	26
February	0.83	74.7	49.2	32
March	0.51	85.0	57.1	38
April	0.33	96.6	67.7	31
May	0.52	104.8	78.8	26
June	3.03	102.4	82.5	13*
July	7.03	95.3	80.1	41
August	7.23	93.0	78.4	53
September	4.84	93.5	75.5	47
October	0.40	92.5	64.3	31*
November	0.10	83.2	51.8	55
December	0.43	73.7	45.0	38

* June and October appear not to have been well-collected. A fairly low number of species is expected in June, but over 50 species should be expected in October.

Most species either occur only during the monsoon, or are most common at that time (Table 1 and fig. 9). Butterfly numbers then decrease from mid-November to February, when specimens are scarce. Some species become extremely abundant during the hot season (Anapheis aurota and Colotis fausta, for example), but the variety of species on the wing gradually declines to a low point in June. About two weeks after the monsoon breaks (the onset is variable, but is usually in late June) the air is once again filled with butterflies.

The graph of monthly precipitation and the number of species occurring in a given month (fig. 9) demonstrates the time lag between a change in the pattern of rainfall and a change in the number of species flying. No attempt has been made to estimate relative numbers of butterflies during the different months, although the number of species collected was usually directly related to the number of individuals flying.

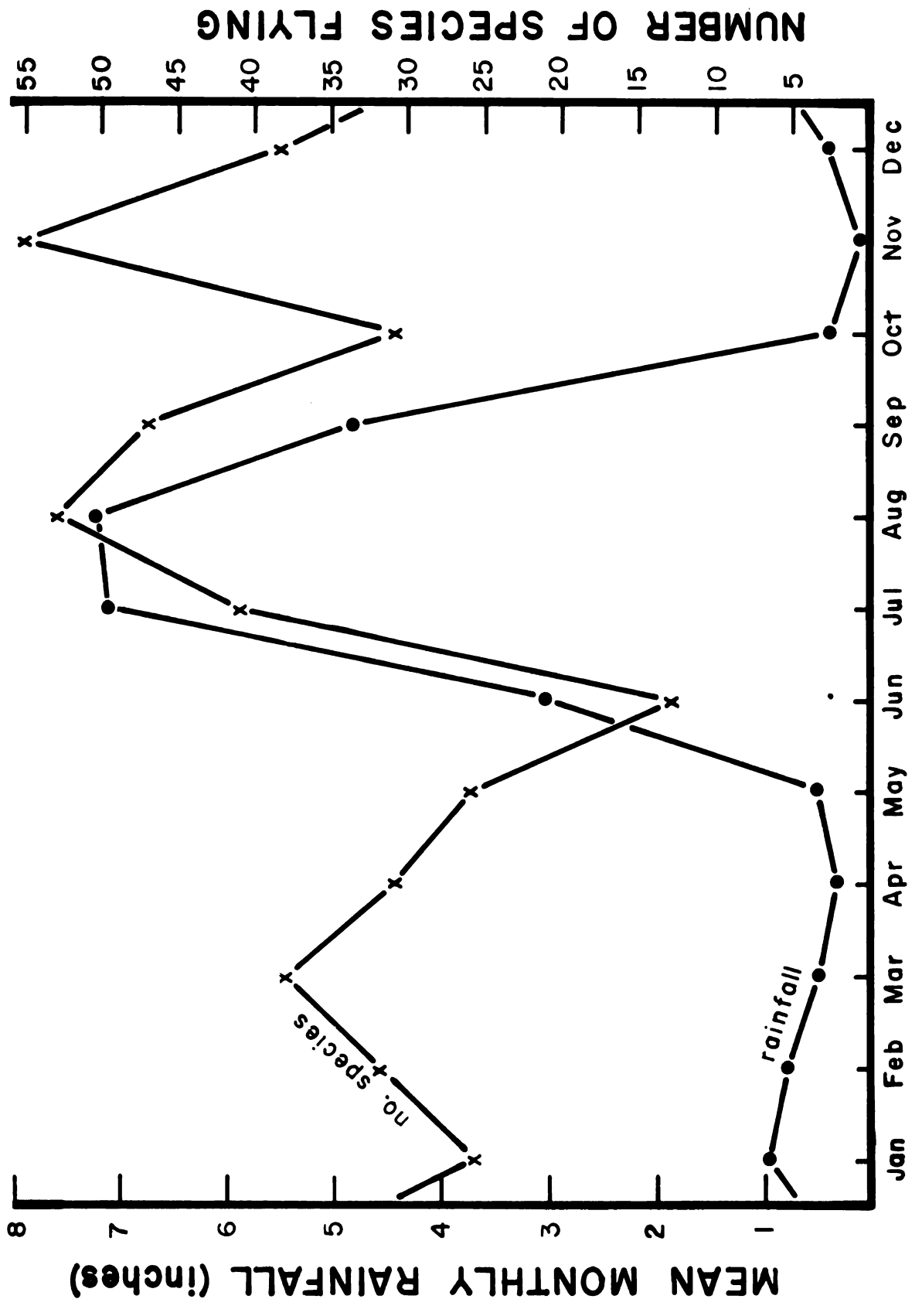

Figure 9. The number of species of butterflies recorded each month, correlated with the mean monthly rainfall.

SEASONAL VARIATION

Many species of Delhi butterflies have two well-marked seasonal forms, associated with the wet and dry seasons. The wet season specimens are usually larger and more conspicuously patterned, while some even have a different wing shape than in the dry season form. Eurema hecabe is an exception, in which the dry season form is heavily marked on the underside, while the wet season form is almost immaculate on the underside.

Previous authors have implied that the wet season form occurs only during the monsoon, but this certainly is not true in Delhi. In at least six species (Anapheis aurota, Cepora nerissa, Eurema hecabe, Colotis etrida, Ypthima inica, Precis almana, and possibly Precis orithya), the color pattern characteristic of the wet season appears in all specimens as early as mid-April or May--two of the hottest, driest months of the year--and lasts until sometime after the monsoon, depending on the species. These pre-wet season forms may be smaller than wet season specimens, but in their facies (and wing shape, in P. almana) they are identical to wet season individuals.

The factors responsible for the appearance of the seasonal forms have been the subject of some experimentation and much speculation. Marshall (1901) and Dixey (1902) concluded, after a series of experiments, that the seasonal forms were influenced by both temperature and humidity. Apparently no modern, more sophisticated, research has been conducted into the problem, but Sevastopulo (1944) believes that three factors operate, either separately or in conjunction, to influence the form of a butterfly: (1) condition of the food; (2) effect of atmospheric humidity on the larva; and (3) effect of atmospheric humidity on the pupa. He further believes that the nature of the food or relative humidity alone are not the complete explanation of the phenomenon.

The appearance of the "wet season" form of some Delhi species in the dry season, mentioned earlier, indicates that some factor other than humidity may affect those species, although the majority of the Delhi wet season specimens appear to be restricted to the monsoon season. It is quite possible that the factors affecting the form of a butterfly are different for different species.

METHODS OF COLLECTING

The butterfly collector in Delhi has poor success with special collecting methods--such as baits, models, or locating butterflies swarming on streambanks--which are often successful in a moist forest habitat. Collecting butterflies at flowers, stalking them (especially Precis), or chasing the fast-flying species are the only methods which have produced results in Delhi. Some species, such as Leptosia nina and Mycalesis perseus, must be beaten from the grass, while low-flying species (Eurema, Zizeeria, etc.) can be obtained by gentle sweeping. During warm weather it is advisable to do the bulk of the collecting before 10 a.m., while the butterflies are attracted to flowers and before they begin flying more rapidly. A warm day on the Ridge can be most exhausting, since the butterflies seldom pause in their headlong flight through the scrub, and many were the times when both collector and net became snagged and torn on the thorns.

No mass movements ("migrations") of butterflies have been observed in Delhi, although this phenomenon has been reported elsewhere in India for species which occur in

Delhi. But some species, such as Colias electo and Pieris canidia, probably emigrate to Delhi from the Himalaya, although so few specimens reach Delhi that it would be difficult to detect the movement.

METHOD OF STUDY

The list which follows is the result of the examination of 5,611 mounted specimens, representing 73 species, collected by the author from May 1961 to August 1962, and by Roy L. Donahue and Reed C. Finfrock from 1962 to 1965. A few additional specimens were purchased from Miss Nirmala of Delhi, who provided specimens collected by "Venu," Leela R. Menon, and herself. All these specimens form a part of the collection of Indian butterflies deposited in the Entomology Museum at Michigan State University (MSU). Five additional species that were not examined have either been reported from Delhi in the literature or are represented by single specimens in the collection of the Indian Agricultural Research Institute (I.A.R.I.), New Delhi.

The total number of specimens examined is given for each species, followed by the number of specimens of each sex and the sex ratio (given as the percentage of males). With only a few exceptions (such as Hypolimnas misippus,

Ixias pyrene, *Papilio polytes*, and *Colotis fausta*), males could not be distinguished from females in the field, so the sex ratio as given should reflect the relative abundance of the two sexes under field conditions at the time of collecting, although it is well known that behavior and other ecological factors generally make the females of some species very difficult to find. The relationship between the sex ratio observed in the field and the actual sex ratio of a species can only be derived from rearing experiments and studies of predation, parasitism, and behavior. The sex was determined by examining the abdomen of all specimens, even of those species which are sexually dichromic.

To simplify the presentation of data on seasonal occurrence, each month has been divided into quarters, designated by Roman numerals as follows: I = 1-7; II = 8-14; III = 15-21; and IV = 22-end of the month. Because of the probability that a given species was not collected during every week it was flying, and because most Delhi butterflies appear to be continuously brooded in all except the winter months, the flying time is assumed to be continuous if the interval between collection records is four quarters or less. For example, if a given species was collected the first and fourth weeks of October, and again in the third

week of November, the flying time will be presented as Oct. I to Nov. III. June, October, and, to some extent, September, have been poorly collected, and it is to be expected that additional records from these months may alter the known flying time of a species. The precise date of each capture is given if twelve or fewer specimens of a species have been collected.

The size of specimens, given in millimeters (mm), is the length of one forewing from base to apex.

The species included in this paper were identified according to the following references: Evans (1949)--Hesperiidae; Talbot (1939)--Papilionidae, Pieridae; Cantlie (1962)--Lycaenidae; Evans (1927)--Nymphalidae; and Talbot (1947)--Danaidae, Satyridae. A sustained attempt to procure a copy of Evans' second edition (1932) has not been successful. Monographs of certain groups have been referred to whenever possible. The names used in this paper follow the above authors, unless subsequent investigations have shown other names to be more appropriate. The arrangement of species follows the above authors, while the arrangement of families follows dos Passos (1964). The figures in Wynter-Blyth (1957), Seitz (1927), and in various volumes of Lepidoptera Indica (Moore, 1890-1900; Swinhoe, 1905-1913: volumes V and VI were not consulted) were occasionally consulted for the clarification of a description.

"Form" names are avoided whenever possible, especially for seasonal forms, since these names have no taxonomic validity. Some species, however, have distinct forms which, for the sake of recognition, are occasionally referred to by name.

Frequent reference is made in this paper to lists of butterflies published for other localities in northwestern India and West Pakistan. The nearest localities and their distances from Delhi are as follows (see fig. 1): Lucknow, Uttar Pradesh, 250 miles SE of Delhi (de Rhé-Philipe, 1902, 1905); Kanpur, U.P., 240 miles SE of Delhi (partial list, Sevastopulo, 1948); Lahore, West Pakistan, 250 miles NE of Delhi (de Rhé-Philipe, 1917); Amritsar, Punjab, 250 miles NW of Delhi (partial list; Sevastopulo, 1948); Fatehgarh, Punjab, 140 miles NNW of Delhi (partial list; Peile, 1911); Jodhpur, Rajasthan, 300 miles WSW of Delhi (MacPherson, 1927); and Lyallpur, West Pakistan, 300 miles NW of Delhi (partial list; Sevastopulo, 1948).

Other, more distant localities (fig. 1) whose lists have been consulted include Sind (the southern portion of the Indus Valley), West Pakistan, about 400 miles west to about 600 miles WSW of Delhi (Swinhoe, 1887; Menesse, 1950); Kutch (region), Gujarat, about 600 miles SW of Delhi (Nurse, 1899); Kathiawar (region), Gujarat, about 600 miles SW of

Delhi (Mosse, 1929); Mount Abu, Rajasthan, 380 miles SW of Delhi (MacPherson, 1927); Kaira District, Gujarat (near Ahmedabad), 580 miles SSW of Delhi (Aldrich, 1946); and Mhow, Madhya Pradesh, 420 miles SSW of Delhi (Swinhoe, 1886).

The terms used in this paper for the relative abundance ("common," "rare," etc.) are the terms used by the above authors, to indicate the status of species in their respective areas.

To clarify the range of certain species, occasional reference is made to specimens in the Michigan State University collection from the following localities (fig. 1): Saharanpur, Uttar Pradesh, 90 miles NNE of Delhi; Aligarh, U.P., 70 miles SE of Delhi; Agra, U.P., 110 miles SSE of Delhi; Ludhiana, Punjab, 170 miles NNW of Delhi; Siliserh, Rajasthan (5 miles south of Alwar), 90 miles SSW of Delhi; Jaipur, Raj., 140 miles SW of Delhi; and Sumerpur, Raj. (45 miles SSW of Pali), 340 miles SW of Delhi.

The following abbreviations are used in the text:

WING SURFACES

UPF--upperside (dorsal surface) of the forewing

UPH-- " " " " " hindwing

UNF--underside (ventral surface) of the forewing

UNH-- " " " " " hindwing

SEASONAL FORMS

WSF--wet season form

DSF--dry season form

COLLECTORS

JPD--Julian P. Donahue

RLD--Roy L. Donahue

RCF--Reed C. Finfrock

AFFINITIES OF THE DELHI BUTTERFLY FAUNA

The butterfly fauna of Delhi is poor compared to that of the montane, mesophytic habitats of the Western Ghats or the Himalaya. With the exception of Colias electo, Pieris canidia, and possibly Argynnis hyperbius, which are presumably immigrants from the Himalaya, all Delhi butterflies are characteristic of the populations of Peninsular India, rather than of the adjacent Himalaya.

On the Indo-Gangetic Plain, a deep alluvial Tertiary deposit between the Himalaya and Peninsular India, the number of species decreases as one goes west. The annual precipitation also decreases as one goes west to the Great Indian Desert where, in some years, there is no precipitation at all. Conversely, the hill ranges of India generally receive a great amount of precipitation and have a rich butterfly fauna.

The 78 species of Delhi butterflies represent seven families (Table 2). For comparison with other localities

on the Indo-Gangetic Plain, 84 species have been recorded southeast of Delhi in Lucknow District, U.P. (de Rhé-Philipe, 1902, 1905); 54 species northwest of Delhi in Lahore, West Pakistan (de Rhé-Philipe, 1917); and 51 species WSW of Delhi in Jodhpur, Rajasthan (MacPherson, 1927).

Table 2. Family representation in Delhi.

FAMILY	NUMBER OF SPECIES
Hesperiidae	11
Papilionidae	4
Pieridae	20
Lycaenidae	23
Nymphalidae	13
Danaidae	4
Satyridae	3
TOTAL	78

Extensive irrigation and the introduction of a multitude of exotic trees and shrubs have apparently altered the microclimate of the cities of Delhi and New Delhi to the point where the shaded residential areas have a lower temperature and a higher humidity. The cities are verdant oases set in a parched land, and several species of butterflies are virtually restricted to the irrigated city. Were it not for the creation of this mesophytic habitat, there is little doubt that fewer species would occur in Delhi.

The diversity of the two major habitats in Delhi perhaps explains the occurrence in Delhi of over 20 species of butterflies which appear to be on the periphery of their known ranges (Table 3). The majority of these are more or less restricted to the mesophytic city habitat and have not been reported west of Delhi, where the climate becomes even more arid. Some of these species may occur in the Great Indian Desert, but collections have apparently not been made there.

Four of the remaining peripheral species are characteristic of the arid land west and southwest of Delhi, but have not been recorded east of Delhi, while three species appear to be stragglers or strays from the Himalaya.

In the Delhi area, as is true wherever man goes, the native vegetation must have been considerably altered when land was cleared, crops were planted, and livestock were turned loose to overgraze the land (see Donahue, 1962c). The vegetation on the Ridge probably represents only a portion of once-extensive thorn forests.

Beirne (1947a, 1947b) has noted that, at least in the British Isles, the net result of the activity of man and his animals is the decline or disappearance of populations of many species of Lepidoptera, while relatively few species become more numerous. Apparently no studies of the

population ecology of Indian butterflies have been undertaken, but this list of species could well form the foundation for such an investigation in Delhi itself.

Table 3. Delhi butterflies that appear to be on the periphery of their known ranges.

SPECIES	PERIPHERY
Spialia galba galba	western
Suastus gremius	"
Parnara naso bada	"
Borbo cinnara	"
Graphium nomius nomius	"
Leptosia nina nina	"
Delias eucharis	"
Ixias marianne marianne	"
Ixias pyrene sesia	"
Rapala iarbus ssp.	"
Charaxes fabius fabius	"
Euthalia nais	"
Mycalesis perseus tabitha	"
Ypthima inica	"
Pieris canidia indica	southwestern
Colias electo fieldi	"
Plebejus sephyrus indica?	southeastern
Pelopidas thrax thrax	eastern
Colotis calais amata	northeastern
Colotis vestalis vestalis	"
Colotis fausta faustina	"

A C C O U N T O F S P E C I E S

H E S P E R I I D A E

Several of the 11 known species of skippers from Delhi are very similar in appearance. Although there are many characters to separate the groups, such as tibial spines, genitalia, and antennae, only the salient features of the facies of each species are listed here. Complete keys and figures of male genitalia will be found in Evans (1949).

Gangara thyrsis, Hasora chromus, and Badamia exclamationis are large species, all of which are figured by Wynter-Blyth (1957). Spialia galba, a small species with many white spots, is also figured by Wynter-Blyth. Telicota colon is the only orange skipper so far recorded from Delhi (figured in Wynter-Blyth as Astychus augias). Gegenes nostrodamus is a very pale brown species, whose male has no spots on the upperside, while Suastus gremius is the only Delhi species with black spots UNH. Both these latter species are also figured by Wynter-Blyth.

The remaining four species are spotted UPF and are very similar in appearance. Parnara naso has no spot in space 1b UPF and no male stigma; Borbo cinnara has no spot in the cell UNH, has no male stigma UPF, and usually does not have two spots in the cell UPF. The two species of Pelopidas have male stigmas, two spots in the cell UPF, and one spot in the cell UNH. The combinations of these characters will separate the species that have been recorded from Delhi, but additional skippers undoubtedly will occur and should be looked for.

Because of recent taxonomic changes and the recognition of new species in this family, published records of the distribution of some species cannot be considered totally reliable.

HASORA CHROMUS CHROMUS (CRAMER)

The Common Banded Awl is, as the name implies, the most common and widespread Hasora in India, although only five specimens have been collected in Delhi. Two males were collected on Lantana flowers by the author in the Nursery (26 Aug. and 21 Sept. 1961), while Leela R. Menon collected two males and a female in Delhi (Oct. 1962). These last records indicate that the species may be locally common in suitable habitats. A large skipper, probably

this species, was observed on Lantana in the Nursery, 4 Nov. 1961, but was not collected.

SIZE: The specimens range in size from 17mm to 22mm.

DISTRIBUTION: This subspecies occurs throughout India (Evans, 1949; Wynter-Blyth, 1957), and has been recorded as far west as Karachi (Menesse, 1950), where it is very rare.

BADAMIA EXCLAMATIONIS (FABRICIUS)

Only two males have been examined, both of which were collected by the author in the Nursery. The first (23mm) was taken on 20 July 1962 as it fed on a white-flowered Lantana at midday. A second specimen (26mm) was collected the following day on Lantana, and another was seen but not secured. A few days later Reed C. Finfrock obtained three specimens, which remain in his personal collection.

DISTRIBUTION: The Brown Awl occurs rather locally throughout India (Wynter-Blyth, 1957), but the British Museum (N.H.) has no specimens west of "North India" (Evans, 1949). It has been recorded from Lucknow (de Rhé-Philipe, 1902), where the eggs and larvae were found on Bignonia gracilis (de Rhé-Philipe, 1905). It has also been recorded from Mount Abu, but not in Jodhpur, by MacPherson (1927); Kutch (Nurse, 1899); and Kathiawar (Mosse, 1929). It is

very rare in Karachi (Swinhoe, 1887; Menesse, 1950), which is apparently the western-most record for the species.

SPIALIA GALBA GALBA (FABRICIUS)

The Indian Skipper, a small but distinctive species, has been collected only sporadically in Delhi. In the Nursery, a female was taken on 15 July 1961 (JPD), and another was collected on 18 Nov. 1962 (RLD). On the Ridge, a male was obtained on 26 Feb. 1963 (RCF), while a female was collected on 9 Aug. 1962 (JPD). In addition, two males and a female were collected in Delhi by Venu, Dec. 1962.

SIZE: Males and females range from 8mm to 11mm.

DISTRIBUTION: This subspecies occurs throughout India, west to Kutch and Sind, east to Assam (Evans, 1949). It has not been reported from Jodhpur (MacPherson, 1927), is apparently rare in Lahore (de Rhé-Philipe, 1917), but is fairly common to common in Lucknow (de Rhé-Philipe, 1902), Kutch (Nurse, 1899), Kathiawar (Mosse, 1929), and Sind (Swinhoe, 1887; Menesse, 1950). This species may be near the western limits of its range at the latitude of Delhi.

SUASTUS GREMIUS GREMIUS (FABRICIUS)

Only five males of the Indian Palm Bob have been collected in Delhi. Two came from the Nursery (25 Sept. 1961,

JPD; 17 Nov. 1962, RCF), while Leela R. Menon collected three in Delhi in Nov. 1962. These last records would imply that this species may be more common on the north side of Delhi where the foodplant, palm, is more common.

SIZE: The forewings are from 11mm to 12mm long.

DISTRIBUTION: This distinctive subspecies occurs in South and Central India, the northwest Himalaya, and Bengal, Sikkim, and Assam (Evans, 1949; Wynter-Blyth, 1957). It is the most common hesperiid in Lucknow (de Rhé-Philipe, 1902), though it is uncommon in Lahore (de Rhé-Philipe, 1917), rare in Kutch (Nurse, 1899) and Kathiawar (Mosse, 1929), very rare in Karachi (Menesse, 1950), and apparently absent from Jodhpur (MacPherson, 1927). This species appears to be near the western limit of its range at the latitude of Delhi.

GANGARA THYRSIS THYRSIS (FABRICIUS)

The only Delhi record of this species is a single specimen in the British Museum (N.H.) from the Godman-Salvin collection [B.M. No. 1913-2] (T.G. Howarth, pers. comm.: specimen cited in Evans, 1949, p. 325).

This subspecies of the Giant Redeye occurs from South India to Bombay and Calcutta, and again from Kangra (Punjab Himalaya) to Sikkim, Assam, and farther east. The specimen

from Delhi, assuming no labeling error, is apparently the only record from the Indo-Gangetic Plain, and should be substantiated with additional material. This huge skipper is crepuscular, and should be looked for near palm trees, the foodplant. Beating the bushes during the daytime may dislodge a resting specimen.

TELICOTA COLON COLON (FABRICIUS)

The Pale Palm Dart, the only orange skipper so far recorded from Delhi, has been collected from Sept. IV to Nov. IV, a period during which most of the Delhi hesperiids make their appearance. This species reportedly feeds on sugar cane, so it may be locally common in the parts of Delhi where this crop is grown. Miss Nirmala collected three males in Delhi in Nov. 1962, but all the rest of the specimens examined were taken in the Nursery. One male on 25 Sept. 1961 (JPD), one male on 3 Nov. 1962 (RCF), two males on 4 Nov. 1961 (JPD), a male and a female on 17 Nov. 1962 (RCF), and one male on 25 Nov. 1962 (RCF).

The only hesperiid collected in Delhi by Longstaff (1912), 7-12 Nov. 1903, was probably this species.

SIZE: The specimens range in size from 14mm to 16mm.

DISTRIBUTION: Evans (1949) records specimens in the British Museum (N.H.) from South and Central India,

Kathiawar, Kumaon, and from the U.P. to Sikkim. Two other subspecies occur in Ceylon, the Andaman Islands, and Assam.

Distributional lists published prior to the appearance of Evans' Catalogue (1949) are unreliable, since there appears to have been a considerable amount of confusion and mis-application of names in the two similar genera of Potanthus and Telicota. Specimens on which earlier lists were based should be re-examined in the light of the recent taxonomic changes before they can be included in our present knowledge of the distribution of the species. An examination of the genitalia, which are figured in Evans (1949), is virtually essential for the proper identification of most species.

This species is described and figured as Astychus augias (Linnaeus) in Wynter-Blyth (1957), who omits reference to two other species of Indian Telicota.

GEGENES NOSTRODAMUS (FABRICIUS)

Only nine males of this arid-land skipper have been collected in Delhi, all from the Nursery: 26 June 1961, 20 July 1962 (3 specimens), 21 and 31 July 1962 (JPD); 3 and 9 Sept. 1962 (RLD); and 4 Nov. 1962 (RCF). Darker specimens occur from late July (when light specimens also occur) to November. The genitalia of all specimens were

examined, but G. pumilio (Hoffmansegg) was not found, although it has been recorded as far east as the Punjab and Kulu (Evans, 1949). This latter species was omitted by Wynter-Blyth (1957).

SIZE: The specimens range from 13mm to 14mm.

DISTRIBUTION: The Dingy Swift has been recorded east to Sind; Kutch; Deesa, Gujarat; N.W. Frontier Province; and the Punjab, then becomes rare through the U.P. to Bengal (Evans, 1949). Longstaff (1912) took it in Lahore, although de Rhé-Philipe (1917) failed to find it there; Aldrich (1946) records it from Kaira District; Menesse (1950) and Swinhoe (1887) have collected it in Sind; and Nurse (1899) took it in Kutch. There are two additional specimens in the Michigan State University collection from Ludhiana, Punjab (12 Sept. 1961).

PARNARA NASO BADA (MOORE)

This is the only white-spotted brown skipper so far recorded from Delhi which does not have a spot in space 1b UPF or UNF. Only six specimens have been collected in Delhi, all of which came from the Nursery, Aug. IV to Nov. IV: one male on 26 Aug. 1961 (JPD); one female on 21 Sept. 1961 (JPD); one female on 4 Nov. 1961 (JPD); a male and a female on 4 Nov. 1962 (RCF), and a male on 22 Nov. 1962 (RCF).

SIZE: The forewing is from 14mm to 15mm long.

DISTRIBUTION: This butterfly occurs in India from Ceylon north to Kashmir and east to Sikkim and Assam (Evans, 1949). Wynter-Blyth (1957) apparently included this species with P. guttatus mangala (Moore), which is only known to occur in the Himalaya from Chitral to Sikkim and Assam (Evans, 1949). Parnara naso bada has been recorded from Mount Abu (MacPherson, 1927), but other authors have failed to report its occurrence in localities nearer Delhi. There is an additional specimen in the MSU collection from Aligarh, U.P., 17 Nov. 1962 (RLD). Delhi appears to be the western-most locality recorded for this species at this latitude.

BORBO CINNARA (WALLACE)

This species is similar to Pelopidas females, but can be separated with the characters listed in the introduction to the family. It has been collected only in the Nursery from July III to Nov. IV. 41 specimens: 20 males (49%), 21 females.

SIZE: The forewing length of males and females varies from 14mm to 17mm.

VARIATION: In one female (28 Aug. 1961, JPD) the subapical spots UPF are almost indiscernible, and the spot in

space 1b UPF is absent. The other spots UPF are smaller than usual.

DISTRIBUTION: Although the British Museum (N.H.) has many specimens from India, there appear to be none from west of "Central India" (Evans, 1949). B. cinnara has also been recorded from Mount Abu (MacPherson, 1927) and Kathiawar (Mosse, 1929) as Baoris colaca (Moore), a synonym. Previous authors may have confused this species with Borbo bevani (Moore) which, though not yet collected in Delhi, has been reported from Lahore (de Rhé-Philipe, 1917) and Karachi (Swinhoe, 1887). All these records should be re-examined in the light of the revisional work by Evans (1949).

PELOPIDAS THRAX THRAX (HÜBNER)

This species is very similar to P. mathias, but it is less common. The males can be distinguished by the position of the stigma UPF: in P. thrax the posterior end of the stigma is under the origin of Cu_1, while in P. mathias the posterior end of the stigma is well proximad to the origin of Cu_1. The male and female genitalia of all Delhi Pelopidas have been examined.

The females of these two species are very similar, and only an examination of the genitalia can separate them.

Among the Delhi Pelopidas, two types of female genitalia were found: (a) the less common type of female has a lateral, linear, well-defined sclerotized signum on both the right and left sides of the bursa copulatrix; (b) the more common type of female has only a diffuse, indistinct signum on the left side of the bursa copulatrix.

Since no copulating pairs of Pelopidas have come into the author's possession, there is still some doubt as to which type of female to associate with which species. The author has arbitrarily assumed that the more common female, type (b), is associated with the more common male, P. mathias. Conversely, the type (a) female has been associated with P. thrax.

Pelopidas thrax is usually encountered in the Nursery, where it flies with P. mathias, but five specimens have been collected on the Ridge. It is probably more frequent on the Ridge than the records indicate, but the dearth of attractive flowers makes this fast-flying species difficult to collect. It has been collected in Feb. IV and March II (Ridge), from July II to Nov. IV (Nursery), and in Dec. IV (Ridge). 35 specimens: 23 males (66%), 12 females).

SIZE: Males and females range from 15mm to 17mm.

DISTRIBUTION: The only Indian record of this western subspecies in the British Museum (N.H.) is a single male

from Kutch (Evans, 1949), although Evans (1949) and Menesse (1950) report that this species is common in Sind. Evans (1949) also records two males of a second subspecies, P. t. masta Evans from Sikkim. There appear to be no other published records of this species from India, but earlier authors may have confused it with other species. Wynter-Blyth (1957) has omitted it from his book, on which many collectors rely. The author has also collected two males 15 miles south of Saharanpur, U.P., 8 May 1961.

PELOPIDAS MATHIAS MATHIAS (FABRICIUS)

The most common Delhi skipper, numerous on Lantana during and after the monsoon. It has been collected in most habitats, March I and IV, and from July III to Dec. I, although it is most frequently collected in the Nursery. 100 specimens: 69 males (69%), 31 females.

Although the males can be distinguished from the preceding species by the position of the stigma and by examining the genitalia, the only sure way to separate the females is by examining their genitalia.

SIZE: The males and females range in size from 14mm to 16mm, averaging only about 1mm smaller than P. thrax thrax from Delhi.

DISTRIBUTION: Evans (1949) records specimens in the British Museum (N.H.) from virtually throughout India, including Punjab, Sind, and U.P. It has also been recorded from Lucknow (de Rhé-Philipe, 1902), Jodhpur (MacPherson, 1927), Lahore (de Rhé-Philipe, 1917), and Sind (Menesse, 1950). There is a male in the MSU collection from Aligarh, U.P. (17 Nov. 1962, RLD).

P A P I L I O N I D A E

ATROPHANEURA ASCANIUS DIPHILUS (ESPER)

Recent taxonomic changes have radically altered the name of this familiar species: it was formerly known as Polydorus (or Tros) aristolochiae aristolochiae (Fabricius). Only four Delhi specimens have been examined: a male collected by the author in the Nursery on 27 Sept. 1961 (46mm), two males collected in Delhi in Oct. 1962 by Leela R. Menon (both 48mm), and a male collected in Delhi in Nov. 1962 by Miss Nirmala (48mm). The fact that three specimens were collected on the north side of Delhi in a two-month period may indicate that the species is more common there.

Longstaff (1912) reported that he saw "many" in Delhi, 7-12 Nov. 1903.

DISTRIBUTION: The Common Rose is widespread throughout India (Talbot, 1939; Wynter-Blyth, 1957), and has been recorded as far west as West Pakistan (Menesse, 1950).

PAPILIO POLYTES ROMULUS CRAMER

This swallowtail, the subject of a great deal of study because of the mimetic color patterns of the females, is not very common in Delhi. It has been collected on the Ridge only once (Feb. IV), and at scattered times in the Nursery: March I and IV; May I; and July II to Nov. I. 31 specimens: 13 males (42%), 18 females, of which two (11%) are form "romulus" Cramer, a mimic of Atrophaneura hector (Linnaeus), which has not been recorded in Delhi; seven (39%) are form "cyrus" Fabricius, which has the same facies as the male; and nine (50%) are form "stichius" (Hübner), whose model is Atrophaneura ascanius--a species which appears to be less common in Delhi than its mimic.

The "cyrus" form of the female has been observed ovipositing on lime bushes (Citrus) on two occasions: on 21 Aug. 1962; and on 6 Sept. 1961, when one laid nine eggs (one egg to a leaf) on a single lime bush before the specimen was collected.

The larvae of both P. polytes and P. demoleus may be found on the Citrus bushes in the Nursery, but only one male was reared: the larvae pupated on 5 Sept. 1961, and the adult emerged 14 Sept. 1961.

On 27 July 1961 an egg of either P. polytes or P. demoleus was collected from a lime bush in the Nursery (the egg was about 3mm from the edge, on the underside of the leaf). On the evening of 28 July 1961 a hymenopterous parasite was observed emerging from the egg, and by the next day three parasites had emerged. They have been identified as Telenomus (Aholcus) talaus Nixon (Scelionidae) by C.F.W. Muesebeck of the U.S. National Museum, where all three specimens are deposited. The type series of this parasite was described from the eggs of Graphium agamemnon (Linnaeus) in Malaya.

SIZE: ♂♂ 38mm (7 March 1964, RLD) to 50mm (several); ♀ form "stichius" 46mm (15 July 1961, JPD) to 53mm (28 Aug. 1961, JPD); ♀ form "cyrus" 44mm (26 Aug. 1961, JPD) to 52mm (22 July 1961, JPD); ♀ form "romulus" 51mm (2 May 1963, RLD) and 52mm (13 Aug. 1962, JPD).

VARIATION: Papilio polytes is one of the classic examples of polychromic mimicry. Goldschmidt (1945) proposes hypothetical genotypes for all forms of this species, and includes a good bibliography on the subject.

Annandale and Dover (1921) have summarized the relative abundance of the three female forms in India. In general, the most common is "stichius," followed by "romulus" and "cyrus." The "cyrus" form is considered to be absent or rare in many localities. In North India, including Delhi, the "romulus" form becomes less common, where its model, Atrophaneura hector, apparently does not occur.

Sevastopulo (1947, 1956) reared 175 P. polytes from eggs in Calcutta. Of the 95 females he obtained, 68% were "stichius," 19% were "cyrus," and 13% were "romulus." Sanders (1955), however, found that the "cyrus" form was only very rarely collected in Calcutta.

The most important point concerning the Delhi female forms is that the male-like "cyrus" form is relatively common, perhaps because there is little natural selection for the two mimetic forms when the models are uncommon (A. ascanius) or absent (A. hector) in Delhi.

DISTRIBUTION: The Common Mormon is found throughout India (Talbot, 1939; Wynter-Blyth, 1957). In Lucknow the "stichius" female is most common, "romulus" is rare, and "cyrus" has not been found (de Rhé-Philipe, 1902). In Jodhpur the "cyrus" female has not been recorded (MacPherson, 1927). It is interesting to note that MacPherson (1927) found Atrophaneura hector, the model for the

"romulus" form of P. polytes, in Jodhpur in 1924, which is apparently the northern-most record for that species.

PAPILIO DEMOLEUS DEMOLEUS (LINNAEUS)

The Lime Butterfly is the most common Delhi swallowtail, and is usually found in the Nursery where its foodplant, Citrus, is cultivated, although specimens are occasionally encountered on the Ridge. It has been recorded in March II (Ridge) and May IV, from July I to Sept. IV, and Nov. I. The poor representation of some months may be because the species is so common and easily recognized that it is not collected. 48 specimens: 28 males (58%), 20 females. Females have only been collected from July I to Sept. IV.

A copulating pair was collected on 13 July 1961 (JPD), and a female was observed ovipositing on young basal leaves of Citrus on 15 July 1961. Several larvae, which are very similar to the larvae of P. polytes, were collected from Citrus, and four were reared through to adults. The pupation dates were 1 Aug., 2 Sept., 2 Sept., and 3 Sept. 1961. The emergence dates were 16 Aug. (?), 13 Sept., 14 Sept., and 14 Sept. 1961, respectively.

See the comments under P. polytes for notes on egg parasites of either P. demoleus or P. polytes.

SIZE: ♂♂ 33mm (4 Aug. 1962, JPD) to 47mm (15 July 1961, JPD). ♀♀ vary only slightly, from 44 to 50mm. Assuming that "expanse" is twice the length of one forewing, the small male cited here is about the same size as the smallest P. demoleus (? sex) cited by Crawford (1930).

DISTRIBUTION: This species is common throughout India (Talbot, 1939; Wynter-Blyth, 1957).

GRAPHIUM NOMIUS NOMIUS (ESPER)

The only known Delhi specimen of the Spot Swordtail was collected at midday in the Nursery on 20 July 1962 as it fed on a white-flowered Lantana. The specimen, a female, is virtually perfect (the left tail is missing), and the forewing is 40mm long.

DISTRIBUTION: The distribution given by Talbot (1939), "Ceylon, Southern India to the Sikkim lowlands," leaves much to be desired. According to Wynter-Blyth (1957) this species occurs in the Himalaya from Simla east, and in peninsular India north to Madhya Pradesh and southern Bihar, west to Saurashtra and Lucknow. At first de Rhé-Philipe (1902) considered it rare in Lucknow, but later he (1905) reported that it was regular in July and August. It was observed at Mahuva, on the west coast of the Gulf of Cambay, Gujarat, by Mosse (1929), and has been taken on Mount Abu

(MacPherson, 1927). Delhi appears to be the western-most record of this species in the Indo-Gangetic plain north of Gujarat.

P I E R I D A E

LEPTOSIA NINA NINA (FABRICIUS)

The Psyche is rare in Delhi: it has been found only in moist, shaded portions of the Nursery, where it may be found by beating the grass. Its habitat is essentially the same as that of Euploea core. The three specimens were collected on 26 Aug. (♀, 17mm), 25 Sept. (♀, 14mm), and 4 Nov. 1961 (♂, 18mm).

Longstaff (1912) found this species in Delhi, 7-12 Nov. 1903.

DISTRIBUTION: This fragile butterfly occurs more or less throughout India, but the western limits of its range are not well-defined (Wynter-Blyth, 1957; Talbot, 1939). It is very local in Lucknow (de Rhé-Philipe, 1905), but it has not been reported southwest or west of Delhi. Despite Wynter-Blyth's (1957) statement that it occurs in Sind, Menesse (1950) and Swinhoe (1887) have failed to record it from that region. Delhi, therefore, appears to be the western-most record of this species in India.

DELIAS EUCHARIS (DRURY)

This species was first observed feeding on Lantana in the Nursery on 5 Nov. 1961, and another specimen was observed flying over the Nursery the next day, but the first specimen was not collected until 23 Nov. 1961, when a worn female was caught on Lantana in the Nursery. The only other Delhi specimen examined was another worn female collected by Roy L. Donahue in the Nursery on 21 March 1965.

SIZE: The forewing of both specimens is 38mm long.

DISTRIBUTION: The Common Jezebel occurs from the lower slopes of the Himalaya south to Ceylon (Talbot, 1939), although it is less common in the northwestern part of its range. It is seasonally common in Lucknow (de Rhé-Philipe, 1902) and Fatehgarh (Peile, 1911), but is apparently rare in Jodhpur (MacPherson, 1927), Lahore (de Rhé-Philipe, 1917), and Kanpur, U.P. (Sevastopulo, 1948). Delhi appears to be near the western periphery of the range of this species, since there are no records from West Pakistan.

CEPORA NERISSA PHRYNE (FABRICIUS)

The Common Gull occurs from July II to May I in all habitats, although it is more frequently collected in the Nursery. It is uncommon from December through May, a period in which the females are more frequent than males.

Longstaff (1912) found only males of this species in Delhi, 7-12 Nov. 1903. 126 specimens: 65 males (52%), 61 females.

SIZE: ♂♂ 20 mm (25 Dec. 1962, RCF) to 29mm (31 July 1962, JPD). ♀♀ 18mm (26 Feb. 1963, RCF) to 29mm (17 Aug. 1962, JPD).

VARIATION: Males and females from mid-April to mid-November are larger and darker, with the veins UNH prominently blackened, while dry-season specimens are smaller, with the UNH ground color a paler yellow, with the veins blackened faintly or not at all.

DISTRIBUTION: Throughout peninsular India (Talbot, 1939), at least as far west as Jodhpur (MacPherson, 1927) and Lahore (de Rhé-Philipe, 1917). It has not been recorded from Sind (Menesse, 1950).

ANAPHEIS AUROTA AUROTA (FABRICIUS)

The Pioneer is one of the most common Delhi butterflies, occurring in all habitats throughout the year: abundant from March to May, then becoming less frequent until November, when it becomes common again. Uncommon in January. 362 specimens: 205 males (57%), 157 females.

Longstaff (1912) says this species was "abundant at flowers" 7-12 Nov. 1903, and saw "countless crowds" at Mahrauli (8 miles SSW of New Delhi).

The sex ratio of field-collected specimens varies markedly: 46% males April II (20 specimens); 53% males for the month of March (166 specimens); 73% males in a series of 41 specimens collected at Tughlakabad, 10 Nov. 1962 (RCF); and 84% males May I (25 specimens).

Four copulating pairs have been collected: 24 March 1963 (2 pairs, RLD); 10 April 1962 (JPD); and 13 April 1962 (JPD, male very worn). On 2 May 1962 a cluster of four pupae and nine pupal cases was found on a thorny twig on the Ridge. Adults emerged from three of the pupae the next day (the fourth was preserved before emergence). Nurse (1899) has also observed over a dozen pupae on a single twig, in Kutch. Two larvae were also collected on 2 May. One was lost, but the second pupated on 4 May and emerged (♂) on 10 May 1962.

Adults were observed on Neem flowers (Azadirachta indica) on 2 May 1962. This species has also been observed attracted to light in Delhi (Donahue, MS in preparation).

SIZE: ♂♂ 18mm (2 May 1962, JPD; 16 June 1964, RCF) to 27mm (many specimens throughout the year). ♀♀ 18mm (14 Nov. 1963, RLD) to 29mm (11 March 1963, RLD; 10 Nov. 1962, RCF).

VARIATION: The seasonal forms are difficult to characterize, but specimens collected from May to August generally have less black suffusion on the veins and a paler ground

color UNH than dry season specimens. Three males collected in March (RCF) and May (JPD) have the spot at the end of the cell UPF detached from the costa, as opposed to most specimens, which have the spot connected to the costa with a dark band.

DISTRIBUTION: The Pioneer is common in India, extending west to Palestine and Africa (Talbot, 1939).

APPIAS LIBYTHEA LIBYTHEA (FABRICIUS)

The Striped Albatross is the least common of the large Delhi "whites." It occurs on both the Ridge and in the Nursery, Aug. IV (Nursery only), Nov. I to Dec. III, and Feb. IV (Ridge, one male). The females have only been collected in Aug. IV and again in December. This butterfly may be more frequent in Delhi, but it is possibly overlooked because of its general resemblance to several other pierids (Cepora nerissa, Catopsilia spp., Anapheis aurota). A copulating pair was collected on 28 Aug. 1961 (JPD). 20 specimens: 15 males (75%), 5 females.

SIZE: ♂♂ 22mm (1 Dec. 1962, RLD) to 29mm (29 Aug. 1961, JPD). ♀♀ 21mm (25 Dec. 1962, RCF) to 24mm (28 Aug. 1961, JPD).

VARIATION: The August specimens are largest. The four August males have darker markings on the apex and margin UPF

than dry season specimens; the only August female is darker on the upperside than the December females, e.g., UPH with large marginal spots, a discal band, and streaks connecting the spots with the band.

DISTRIBUTION: Peninsular India to the Punjab (Talbot, 1939). It is rare in Lucknow (de Rhé-Philipe, 1902, 1905, who identified it as A. paulina, which does not occur in North India) and on Mount Abu (MacPherson, 1927). It has also been recorded from Lahore (de Rhé-Philipe, 1917), and southward in peninsular India. There is also a female in the MSU collection from Siliserh, Raj., 19 Nov. 1963 (RLD). This species is apparently uncommon but widely-distributed in India.

PIERIS CANIDIA INDICA EVANS

The Indian Cabbage White is one of the butterflies whose occurrence in Delhi came as a surprise. Only five specimens have been collected: a male from the Nursery on 28 March 1963 (RLD), 26mm; and four specimens from the Ridge --a female on 21 Feb. 1963 (RCF), 25mm; two females on 12 April 1963 (RCF), 22 & 23mm; and a male on 13 April 1963 (RCF), 23mm. There is also a single specimen in the I.A.R.I. collection, obtained in Delhi by M.G. Ramdas Menon, 6 March 1958.

DISTRIBUTION: This subspecies is normally confined to the Himalaya, where it is very common (Wynter-Blyth, 1957; Talbot, 1939), but it has been reported south of the hills several times. Sanders (1930) found it 15 miles NE of Amritsar, Punjab, on 23 Feb., and again in late March, when it was present in "considerable quantities." Sevastopulo (1948) also reports that it is "common at Amritsar before the weather gets hot," and de Rhé-Philipe (1902) captured a single faded female in Lucknow in April. Although de Rhé-Philipe (1917) failed to record it from Lahore, he did observe P. brassicae there in Nov., Jan., and Feb. Pieris brassicae is also reportedly common in Fatehgarh in the early spring (Peile, 1911).

Delhi is apparently the southwestern-most record of this species.

IXIAS MARIANNE MARIANNE (CRAMER)

The White Orange Tip, like many other Delhi butterflies, is rare in the cold months of January and February, and again in the hot dry months from April to early July. It is common during the monsoon, but the population tapers off again in December. Although more frequently collected in the Nursery, it also occurs on the Ridge where it is occasionally numerous. It has been recorded in Delhi from

July I to Jan. I, and Feb. II to May II. 210 specimens: 118 males (56%), 92 females. The sex ratio of field-collected specimens appears to remain fairly constant.

Longstaff (1912) collected this species at Mahrauli (10 Nov. 1903) and in Delhi (7-12 Nov. 1903).

SIZE: ♂♂ 19mm (23 March 1963, RCF; 21 Feb. 1963, RCF) to 28mm (28 Aug. 1961, JPD). ♀♀ 21mm (several August specimens) to 27mm (29 Aug. 1961, JPD).

VARIATION: Wet season specimens of this variable species tend to be more heavily marked. Three of the females examined had none of the usual black spots in the orange subapical band UPF (13 April 1963, RCF; 25 Sept. 1961, JPD; and 24 Nov. 1962, RCF). In the dry season form of the female, which occurs from early November through May, the dark band bordering the proximal edge of the orange subapical band UPF is absent.

DISTRIBUTION: This handsome species is endemic to India, and occurs from the Punjab, U.P., and Nepal south to Ceylon (Talbot, 1939; Gabriel, 1943). Wynter-Blyth (1957) adds Saurashtra and Bengal to this range. It is common in Lucknow (de Rhé-Philipe, 1902); apparently absent from Jodhpur, although it is common on Mount Abu (MacPherson, 1927); and very rare in Lahore (de Rhé-Philipe, 1917). It appears to be absent from Kutch, but it is common in

adjacent Kathiawar (Mosse, 1929). The MSU collection contains specimens from 15 miles south of Saharanpur, U.P. (8-9 May, 1961); Aligarh, U.P. (17 Nov. 1962, RLD); and Amber, Raj. (7 miles north of Jaipur, 15 Nov. 1963, RLD). Delhi may be near the western periphery of the range of this species, since the specimen from Amber is the only record from northern or central Rajasthan known to the author.

IXIAS PYRENE SESIA (FABRICIUS)

There is still some doubt surrounding the subspecies to which the Delhi population should belong. According to Talbot (1939), Delhi specimens would belong to I. p. kausala Moore, since the female is often white. But Gabriel, who revised the genus in 1943, ascribes white female forms to both I. p. sesia and to I. p. kausala, and only gives Himalayan localities for the distribution of the latter. A careful examination of the descriptions in Talbot (1939) and Gabriel (1943), an examination of the figures in Swinhoe (1905-1910), and a comparison of Delhi specimens with I. p. sesia from South India, led to the conclusion that the Delhi population is probably referable to Ixias pyrene sesia (Fabricius).

The Yellow Orange Tip is less common in Delhi than I. marianne, and occurs from Aug. III to Sept. IV, and again

from Nov. I to May II. There are no records from June, July, or October, although this may be due to incomplete sampling. This species is common in March, and apparently common from the wet season through December. 86 specimens: 62 males (72%), 24 females.

Longstaff (1912) found the Yellow Orange Tip in Mahrauli (10 Nov. 1903) and in Delhi (7-12 Nov. 1903), when he saw only two specimens.

SIZE: ♂♂ 19mm (29 March 1964, RCF) to 27mm (3 Sept. 1962, RLD). ♀♀ 19mm (26 Feb. 1963, RCF) to 27mm (17 Aug. 1962, JPD).

VARIATION: Both seasonal and sexual dichromism are conspicuous in this species. The wet season form, characterized by its larger size and wide marginal band UPH, occurs in August and September. Wet season females are further characterized by the wide discal band UPF, which is more or less uniform in width to the tornus. Transitional forms with a macular margin UPH occur in early November, but the dry season form appears in late November and flies until May. Most dry season specimens have no trace of the marginal band UPH, and the females have only a narrow line connecting the bar at the end of the cell UPF with the tornus.

Two color phases of the female occur: ground color white or greenish-white, with a slightly darker subapical

band UPF; and ground color pale yellow or greenish-yellow, with the subapical band UPF of the same color or pale orange. Both forms are about equal in frequency, fly together, and are apparently not associated with a particular season as are the female forms of Colotis fausta.

DISTRIBUTION: The Yellow Orange Tip appears to be uncommon in the arid plains of northwestern India. The male is common in Lucknow, but the female has not been taken there (de Rhé-Philipe, 1902); it is absent from Jodhpur but common on Mount Abu (MacPherson, 1927); and apparently rare in Fatehgarh (Peile, 1911). Menesse (1950) never observed this species in Sind, so it would appear that Delhi is near the western edge of the range at this latitude.

COLOTIS CALAIS AMATA (FABRICIUS)

This is a small version of C. fausta but, unlike that species, it is found almost exclusively in the Nursery--there are only two records, Feb. IV and March II, from the Ridge. It occurs from July III to May IV (no June records). 175 specimens: 113 males (65%), 60 females, 2 unsexed. Infrequent from January to March, and in September and October (insufficient collecting?).

Longstaff (1912) found this butterfly "abundant alike in the Kudsia gardens and close to the hotel . . . ," in Delhi, 7-12 Nov. 1903. He also noted that one specimen was "very small."

SIZE: ♂♂ 13.5mm (22 Nov. 1962, RCF) to 20mm (26 Aug. 1962, RLD). ♀♀ 15mm (29 May 1962, JPD) to 21mm (29 Aug. 1961, JPD).

VARIATION: Specimens collected from July III through March are generally larger and darker than specimens collected in April and May. This is an unusual distribution of seasonal forms, since the forms do not correlate well with precipitation patterns. But April and May are two of the warmest months of the year, so temperature or insolation may be the dominant environmental factors affecting the appearance of the forms. There are no records from June, which is another of the warmest months.

DISTRIBUTION: This subspecies of the Small Salmon Arab occurs from Bombay north to Sind, Baluchistan, and U.P., west to Iran and Syria (Talbot, 1939). It has not been reported from Lucknow (de Rhé-Philipe, 1902), but it is fairly common in Jodhpur (MacPherson, 1927), common in Lahore (de Rhé-Philipe, 1917), and common in Sind (Fraser, 1911; Menesse, 1950). Two additional specimens are in the MSU collection from Agra, U.P. (21 Nov. 1957). Delhi

appears to be near the northeastern edge of the range of this species.

COLOTIS VESTALIS VESTALIS (BUTLER)

The White Arab, like its relative C. calais, is found exclusively in the Nursery, where it is very common during the monsoon, although it has been collected there every month of the year. 167 specimens: 102 males (61%), 65 females.

SIZE: ♂♂ 15mm (29 May 1962, JPD) to 20mm (several specimens collected during the monsoon). ♀♀ 14mm (30 April 1963, RLD) to 21mm (two specimens, 31 July 1962, JPD).

VARIATION: The seasonal forms are not well-differentiated, except that specimens flying during the monsoon are brighter yellow on the underside.

DISTRIBUTION: This species occurs from the Persian Gulf east to Sind, Baluchistan, and the U.P. (Talbot, 1939). It is common in Sind throughout the year (Fraser, 1911; Menesse, 1950); "exceedingly abundant" during all months except May and June in Lahore (de Rhé-Philipe, 1917); common in Lyallpur, W. Pakistan (70 miles west of Lahore: Sevastopulo, 1948); and common during the fall and winter months in Jodhpur (MacPherson, 1927). It has not been recorded from Lucknow (de Rhé-Philipe, 1902). The author obtained several specimens in Agra, U.P. (21 Nov. 1957).

Delhi is apparently near the northeastern edge of the range of this species.

COLOTIS FAUSTA FAUSTINA (C. & R. FELDER)

The Large Salmon Arab, the most striking of the Delhi Colotis, was not found until the first trip to the Ridge, to which it is restricted and where it is abundant virtually throughout the year, Nov. I to Dec. IV, and Feb. III to Sept. IV. Cold weather may account for its absence in January, but it should occur in October. 214 specimens: 146 males (68%), 68 females.

The sex ratio varies somewhat, although probably not significantly. On 14 Aug. 1962, 27 specimens were collected, of which 22 (81%) were males. On 20 Aug. 1962, 18 specimens were obtained, of which 12 (68%) were males. Only the white form of the female occurs in August and, since they are not frequent, they were collected in preference to the males--hence the actual percentage of males flying was probably greater than indicated by the figures above. On 18 Nov. 1962, when the salmon-colored females could not be distinguished from the males, 27 specimens were collected (RCF), of which 19 (70%) were males.

VARIATION: The females occur in two forms: a form with a white or salmon-white ground color on the upper- and

undersides, which flies from Aug. II to Nov. I (no October records); and a salmon-colored form, indistinguishable from males, which flies from Nov. I to Dec. IV and from Feb. IV to July I. Previous authors have failed to observe that these two color phases are seasonal--the white or salmon-white form flying in the wet season, with the salmon form flying in the dry season. Both forms fly together in the first week of November, and may also be found to occur together in October.

The dry season form of both sexes (Nov. I to July I) is also characterized by being smaller and having the black markings on the upperside reduced: the black apical markings UPF are less extensive, and the black margin UPH is reduced to separate spots, a very narrow line, or is entirely absent.

One symmetrically aberrant male (15 Feb. 1964, RCF) has a rounded apex on both forewings, quite unlike the apex of normal specimens. The black apical markings UPF are consequently more reduced than usual for the DSF.

PREDATOR RECORD: On 20 August 1962 a specimen was observed being eaten by a praying mantis, identified as a nymph of Gongylus gongylodes (Linnaeus) (Orthoptera: Mantidae) by Dr. Irving J. Cantrall of The University of Michigan.

DISTRIBUTION: This subspecies is reported as "not rare" from the Punjab to Sind and Karwar, Mysore. The nominotypical

subspecies occurs as far west as South Arabia, Turkey, and Egypt (Talbot, 1939). Published records of this species are sparse, perhaps due to its very local occurrence. The only records near Delhi are a few sight records in Jodhpur (MacPherson, 1927), a single specimen collected in Lahore in October (de Rhé-Philipe, 1917), a female in the MSU collection from Pali, Raj. (4 Oct. 1961), and a male from Siliserh, Raj. (19 Nov. 1963, RLD). This species is more common in Kutch (Nurse, 1899) and Kathiawar (1929), but Aldrich (1946) records it as "not rare" in Kaira District. It is reportedly rare in Sind (Fraser, 1911; Menesse, 1950).

Delhi is apparently the northeastern-most record of this species in India.

COLOTIS ETRIDA ETRIDA (BOISDUVAL)

The Little Orange Tip is the only Colotis which is common in all Delhi habitats. It occurs from Nov. I to Sept. I, but appears to be uncommon (or poorly-collected) in January, June, September, and October. 322 specimens: 192 males (60%), 130 females.

Longstaff (1912) found it "in abundance, flying close to the ground" in Mahrauli, 10 Nov. 1903.

SIZE: ♂♂ 13mm (3 March 1963, RCF) to 19.5mm (9 Aug. 1962, JPD). ♀♀ 11mm (9 May 1962, JPD) to 20mm (17 Aug. 1962, JPD).

VARIATION: Wet season specimens are usually larger and darker on the upperside than dry season specimens. The wet season form, which flies from April through September, is almost immaculate UNH, but males have marginal black spots UPH. The dry season form, which occurs from November through March, has a considerable amount of black dusting UNH, while the males have almost no trace of the marginal spots UPH.

Two extreme wet season females (9 Aug. 1962, JPD) have the apical black UPF so extensive that only a trace of the orange band shows. The underside of these specimens is more yellow than usual.

DISTRIBUTION: This species occurs from peninsular India to the Himalaya (Talbot, 1939). It is rare in Lucknow (de Rhé-Philipe, 1902); fairly common in Jodhpur (MacPherson, 1927); common in the Hardoi District, 190 miles SE of Delhi (de Rhé-Philipe, 1902); common in Lahore (de Rhé-Philipe, 1917); and common in Sind (Fraser, 1911; Menesse, 1950). Additional specimens from Siliserh, Raj. (19 Nov. 1963, RLD) and Agra, U.P. (21 Nov. 1957) are in the MSU collection.

Genus CATOPSILIA Hübner

There is a strong belief by many workers that C. crocale and C. pomona are conspecific, and that C. florella and C. pyranthe are also conspecific (see Sevastopulo, 1950; and Talbot, 1939 and 1947, p. 493, for a summary of current thinking). The four "species" are treated as entities in this paper merely because they can be easily separated. No endorsement, expressed or implied, is intended concerning the conspecific or distinct status of these four "species."

CATOPSILIA CROCALE CROCALE (CRAMER)

The Common Emigrant has been collected only in the Nursery, from July II to Nov. I (no October records). 38 specimens: 23 males (61%), 15 females, of which 10 (67%) are form "jugurtha" (Cramer), 3 (20%) are form "crocale" (Cramer), and 2 (13%) are form "jugurthina" (Godart). The "crocale" and "jugurthina" forms have only been collected in July. The male forms "alcmeone" (Cramer) and "flavescens" Fruhstorfer are considered together, since there is some overlap in the color pattern.

SIZE: ♂♂ 29mm (15 July 1961, JPD) to 37mm (13 July 1961, JPD). ♀♀ 24mm ("jugurthina," 15 July 1961, JPD) to 39mm ("crocale," 14 July 1961, JPD).

DISTRIBUTION: "Very common" throughout India (Wynter-Blyth, 1957; Talbot, 1939). It has been recorded as common in Lucknow (de Rhé-Philipe, 1902), Lahore (de Rhé-Philipe, 1917), Jodhpur (MacPherson, 1927), and Sind (Menesse, 1950).

CATOPSILIA POMONA (FABRICIUS)

The Lemon Emigrant is apparently the rarest of the four "species" of Catopsilia in Delhi. Less than 4% of the Catopsilia specimens are referable to this "species." The rapid flight of Catopsilia makes them difficult to collect, so this "species" may be more common than the records indicate. All ten specimens are from the Nursery, except for a male collected on the Ridge, 23 April 1963 (RCF), 36mm. Males were collected in the Nursery on 15 July 1961 (JPD), 37mm; 28 Aug. 1961 (JPD), 31mm; and 29 Aug. 1961 (JPD), 32mm. The female form "hilaria" (Stoll) has been collected on 5 Jan. 1963 (RLD), 27mm; 6 Jan. 1963 (RCF), 31mm; and 21 July 1962 (JPD), 28mm. The female form "catilla" (Cramer), usually considered "not rare," has been collected in the Nursery on 14 July 1961 (JPD), 36mm; 31 Aug. 1961 (JPD), 35mm; and 28 Oct. 1962 (RLD), 29mm.

DISTRIBUTION: As for C. crocale, except that C. pomona is uncommon in Jodhpur (MacPherson, 1927) and Sind (Menesse, 1950).

CATOPSILIA PYRANTHE PYRANTHE (LINNAEUS)

The Mottled Emigrant is confined to the Nursery, with the exception of three males from the Ridge in August. It has been collected April IV, May IV, and from July II to Nov. III. Females have only been collected between April IV and Sept. IV. Copulating pairs have been collected on 20 July 1962 (JPD) and 29 Aug. 1961 (JPD). 109 specimens: 64 males (59%), 45 females.

SIZE: ♂♂ 22mm (3 Sept. 1962, RLD) to 32mm (11 Aug. 1962, RLD). ♀♀ 19mm (29 May 1962, JPD) to 32mm (31 July 1962 and 26 Aug. 1961, JPD).

DISTRIBUTION: As for C. crocale.

CATOPSILIA FLORELLA GNOMA (FABRICIUS)

The African Emigrant is less common and more scattered throughout the year than C. pyranthe. It has been collected in July III and IV, from Sept. I to Jan. I, and from Feb. III to April IV. Further collecting may produce specimens from February, May, June and August, the months for which there are no records. Specimens have been collected on the Ridge only in the last weeks of February, March, and December. Only four specimens have been collected in Delhi during the monsoon season, when C. pyranthe is most abundant,

thus lending support to Talbot's (1939) belief that C. florella is a dry-season form of C. pyranthe.

SIZE: ♂♂ 23mm (1 Dec. 1962, RLD) to 31mm (29 March 1964, RCF). ♀♀ 21mm (30 April 1963, RLD) to 31mm (3 Sept. 1962, RLD).

DISTRIBUTION: As for C. crocale.

EUREMA BRIGITTA RUBELLA (WALLACE)

The Small Grass Yellow is the least common Delhi Eurema. It is found in all habitats from Aug. II to Jan. I, and again in Feb. III and IV (Ridge). It is most frequently collected in August (10 specimens), September (12 specimens), and November (23 specimens). Females have only been collected from Aug. II to Dec. IV. 57 specimens: 39 males (68%), 17 females, 1 unsexed.

SIZE: ♂♂ 14mm (several, Nov. & Dec.) to 19mm (29 Sept. 1961, JPD). ♀♀ 15mm (20 Aug. 1962, JPD; 18 Nov. 1962, RCF) to 19mm (several, late Sept. to early Nov.).

VARIATION: The marginal band UPH is continuous and broad from Aug. II to early November, after which it becomes reduced and macular. Wet season females (Aug. to Oct.) have a considerable amount of black scaling on the upper- and undersides.

DISTRIBUTION: Throughout India, while other subspecies occur west to the Ethiopian Region (Talbot, 1939). It is reportedly scarce in Lucknow (de Rhé-Philipe, 1902), uncommon in Jodhpur (MacPherson, 1927), and occasionally abundant, though usually uncommon, in Lahore (de Rhé-Philipe, 1917). There are additional specimens in the MSU collection from Ludhiana, Punjab (11-12 Sept. 1961), Siliserh, Raj. (19 Nov. 1963, RLD), and Agra, U.P. (21 Nov. 1957).

EUREMA LAETA LAETA (BOISDUVAL)

The Spotless Grass Yellow is more common on the Ridge, but it occurs in all habitats from Aug. II to April II. 103 specimens: 61 males (59%), 42 females.

SIZE: ♂♂ 13.5mm (26 Feb. 1963, RCF) to 18mm (18 Nov. 1962, RCF). ♀♀ 14mm (20 Aug. 1962, JPD) to 19mm (29 Sept. 1961, JPD).

VARIATION: The wet season form "venata" (Moore) occurs from Aug. II to Sept. IV. DSF "laeta" (Boisduval) occurs from Oct. IV to April II. There are no records from early October, when both forms or a transitional form should occur. The dry season form is so pale that it appears almost white in flight.

DISTRIBUTION: Throughout India (Talbot, 1939). A few specimens, of form "laeta" only, have been reported

from Lahore (de Rhé-Philipe, 1917), but it is common in Jodhpur (MacPherson, 1927). It has not been recorded from Lucknow (de Rhé-Philipe, 1902). There are additional specimens in the MSU collection from 15 miles south of Saharanpur, U.P. (8-9 May 1961), Siliserh, Raj. (19 Nov. 1963, RLD), and Pali, Raj. (9 May 1961).

EUREMA HECABE SIMULATA (MOORE)

The Common Grass Yellow is, appropriately, the most common Eurema in Delhi, flying from June IV to May III in all habitats, although it is more frequently collected in the Nursery. It is apparently rare from January to June. A copulating pair was collected on 25 Sept. 1961 (JPD). 247 specimens: 156 males (63%), 91 females.

The sex ratio of field-collected specimens varies considerably, with the percentage of males increasing from Aug. IV to Sept. I, then decreasing to Nov. IV: 64% males Aug. IV (47 specimens), 88% males Sept. I (16 specimens), 69% males Nov. I (32 specimens), 53% males Nov. III (17 specimens), and 47% males Nov. IV (19 specimens).

SIZE: ♂♂ 15mm (26 Feb. 1963, RCF) to 22mm (18 Nov. 1962, RCF; 7 Sept. 1962, RLD). ♀♀ 15mm (22 Nov. 1962, RCF) to 22mm (2 specimens, 28 Aug. 1961, JPD).

VARIATION: It is interesting to note that the dry season form of this species is more heavily marked than the wet season form. The DSF, which flies from about early November to late April, has conspicuous rusty markings on the underside, and a prominent rusty subapical patch UNF. The wet season specimens are poorly marked on the underside, without the rusty subapical patch UNF, and usually with no trace of the two cell spots UNF--the often-used key character for the species. The "dogface" pattern UPF is more pronounced in the WSF than in dry season specimens, in which the black margin UPF is occasionally reduced to a narrow border somewhat as in E. brigitta (although there are some males from Oct. 28 and Nov. I with the reduced margin).

Because many specimens are poorly marked, the genitalia of all males were examined, but no specimens of the similar E. blanda silhetana (Wallace) were found. Despite the statements in Talbot (1939) and Wynter-Blyth (1957) that Eurema blanda occurs from Ceylon and Peninsular India to Sikkim, Assam, and eastwards, the author has collected it only in Ceylon, the Western Ghats, and the eastern Himalaya. If it does occur on the Deccan Plateau or the Gangetic Plain it must be very local.

Because Eurema hecabe is so very variable in both size and coloration, it is my opinion that at least some of the

Indian subspecies are not valid, but Talbot (1939) will be followed until more work can be done on the genus.

DISTRIBUTION: E. hecabe occurs throughout India, with E. hecabe simulata presumably restricted to Ceylon, Peninsular India, and the Central Provinces (Talbot, 1939). E. hecabe fimbriata (Wallace) is said to occur from the Punjab to Chitral and Kumaon (Talbot, 1939), but all the records cited indicate that this is a Himalayan subspecies, hence the assignment of the Delhi population to E. h. simulata. The species is common throughout the Indo-Gangetic Plain, and extends westward to Africa (Talbot, 1939).

COLIAS ELECTO FIELDI MÉNÉTRIÈS

As with Pieris canidia, the occurrence of this hill species in Delhi was unexpected. Roy L. Donahue has collected the only five Delhi specimens, which are identical to large series the author has collected in the Himalaya. A female was collected in the Nursery on 3 March 1963, and on 24 March 1963 a male and a female were obtained. A male and a female were also obtained on the North Ridge, near I.A.R.I., on 29 March 1964.

SIZE: The two males measure 19mm and 20mm, while the females are 23mm, 25mm, and 25mm.

DISTRIBUTION: The Dark Clouded Yellow occurs throughout the Himalaya (Talbot, 1939), but it has also been recorded from the following localities on the plains, where it is presumably a non-breeding straggler in the winter and spring: 15 miles NE Amritsar, Punjab, in late March (Sanders, 1930, who also found C. erate erate (Esper) there in late Feb. and late March); Amritsar (Sevastopulo, 1948, who also collected C. erate); Lahore, in the "early cold weather months" and again in Feb. and March (de Rhé-Philipe, 1917); Fatehgarh (Peile, 1911); and Lucknow, in the winter, and also in Feb. near Goshainganj, 130 miles SE of Lucknow (de Rhé-Philipe, 1902). Delhi appears to be the southwestern-most record of this species.

L Y C A E N I D A E

TARUCUS NARA (KOLLAR)

The Striped Pierrot is by far the most common of the four Tarucus in Delhi: large numbers of them can be collected by beating a thorny bush, possibly Zizyphus sp., when it is in flower on the Ridge. Only nine of the specimens have come from the Nursery, but the species is common at Tughlakabad. The flying time appears to be divided into two periods, based on the available records: Aug. II to Dec. IV, and Feb. III to May IV. 486 specimens: 326 males (67%), 160 females. The genitalia of all males have been examined.

Wynter-Blyth (1957) records T. alteratus Moore, a synonym of T. nara, from Delhi, but he was unable to tell me the original source for this record (pers. comm.). Longstaff (1912) reported collecting T. theophrastus in Delhi, 7-12 Nov. 1903, but since this is an African species he probably had T. nara, the most common Delhi Tarucus.

SIZE: Males and females vary from 9mm in the dry season to 12mm in the wet season.

VARIATION: The seasonal forms are strikingly different. Wet season specimens have the markings on the underside large and dark, while in dry season specimens these markings become very much reduced and rusty. As Evans (1955) pointed out, the valvae of T. nara appear to be variable. In Delhi the genitalic variation appears to be associated with the season: dry season forms have smaller lobes at the apex of the valva than do wet season specimens. An occasional "wet season" form has been collected during the dry season. These specimens are not only marked like wet season specimens, but they have the larger apical lobes on the valva associated with that form. Whether these specimens occur as a result of an undetermined environmental condition, or whether they actually represent a second species can only be ascertained after further study.

DISTRIBUTION: Because of the confusion in the genus prior to its revision by Evans in 1955, records published before that date cannot be heavily relied upon. Further, an examination of the male genitalia (the female genitalia have not been studied) is essential to a proper identification of most species of Tarucus. Evans (1955) lists the following localities in the plains of northwestern India and Pakistan that are represented by specimens of T. nara in the British Museum (N.H.): Kutch and Kathiawar, Gujarat;

Karachi, Pakistan; "Punjab," Ambala, Punjab; and "United Provinces." The species occurs south to Ceylon, east to Sikkim, and west to the Persian Gulf. There are additional specimens in the MSU collection from Amber, Raj. (15 Nov. 1963, RLD) and Ludhiana, Punjab (11-12 Sept. 1961, JPD).

This species is in Wynter-Blyth (1957) as T. nara, T. extricatus, and T. alteratus--the last two names are synonyms.

TARUCUS BALKANICA NIGRA BETHUNE-BAKER

This rare species would probably have been missed entirely if long series of Tarucus had not been collected. Only four males have been obtained, plus a female that may be this species. As pointed out earlier, it is impossible to positively identify any Tarucus females except those of T. callinara. The genitalia of all four males were examined.

The only specimen from the Nursery was obtained on 3 Nov. 1962 (RCF), 10mm. The other specimens, all from the Ridge, were taken on 21 Feb. 1963 (RCF), 10.5mm; 29 Feb. 1964 (RCF), 10mm; and 20 Aug. 1962 (JPD), 11mm. The possible female was collected on the Ridge 14 April 1963 (RCF), 11mm.

It is interesting to note that only one nigra was found in a series of about 35 Tarucus collected on the Ridge on 20 Aug. 1962.

Wynter-Blyth (1957) lists Delhi as a locality where this species occurs, but he was unable to tell me the original source for this record (pers. comm.).

DISTRIBUTION: For reasons stated earlier, published records of Tarucus cannot be relied upon, even for this species, the male of which is characterized by having black discal spots UPF. The following plains localities are represented by specimens in the British Museum (N.H.), as reported by Evans (1955): Karachi, Pakistan; Kutch (the type locality); Rajasthan; Punjab; Satna and Jubbulpore, Madhya Pradesh; and "Dinapore, Bengal" (= Dinapore, Bihar or Dinajpur, East Pakistan?). It has been collected in the Himalaya from Peshawar and Baluchistan to Kumaon.

TARUCUS INDICA EVANS

An examination of the genitalia of all male Tarucus from Delhi yielded only two specimens of this species, which can be considered the rarest of the four Delhi Tarucus. If any females were collected, they are included in the account of T. nara, since no valid character of the facies could be found to separate the two.

Both specimens were collected on the Ridge by Reed C. Finfrock. The first, a well-marked specimen, was obtained on 26 Sept. 1963 (13mm). The spot at the end of the cell

UPF is conspicuous (not inconspicuous as stated by Evans, 1955). The second specimen, collected on 29 March 1964 (11mm), is worn: the upperside has very little blue, and the markings UPH resemble those of Tarucus females.

DISTRIBUTION: According to Evans (1955), specimens in the British Museum (N.H.) have come from Baluchistan to Kumaon in the Himalaya, and from Lahore and Karachi east to Bengal and south to Madras in Peninsular India. Three males from Meerut, U.P. (35 miles NE of Delhi) are the records nearest Delhi. The only other specimens in the MSU collection are three males from Ludhiana, Punjab, 12 Sept. 1961 (JPD).

TARUCUS CALLINARA BUTLER

The Spotted Pierrot is the only Delhi Tarucus whose female can be identified with a reasonable degree of certainty. It has been collected both on the Ridge and in the Nursery at scattered times throughout the year: Feb. I, March II, April II, Aug. I & II, Sept. I, Nov. III, and Dec. I & IV. 15 specimens: 5 males (33%), 10 females.

SIZE: The males and females vary from 9mm (Feb., Dec.) to 12mm (a Sept. ♀) and 13mm (a Nov. ♂).

DISTRIBUTION: Recorded from virtually throughout India by Evans (1955). He also records one male and six females

from Delhi: T.G. Howarth and G.E. Tite of the British Museum (N.H.) found a male and three females in the B.M. collection, which are probably the specimens referred to by Evans. They are labeled "N. India, Delhi, Nov. 1932," [B.M. No. 1935-7].

SYNTARUCUS PLINIUS (FABRICIUS)

The Zebra Blue occurs in all habitats, but appears to be much more common in the Nursery. It is relatively rare during the dry season, but is especially abundant in November. It flies from Aug. IV to Jan. III, and Feb. IV to May IV. 122 specimens: 87 males (71%), 35 females.

SIZE: Males and females vary in size throughout the year, from 11mm to 13mm.

DISTRIBUTION: This species is common throughout India and Pakistan (Cantlie, 1962), and has been recorded on all sides of Delhi.

AZANUS UBALDUS (CRAMER)

Only 12 specimens of the Bright Babul Blue have been examined. In the Nursery, a female was collected on 3 Nov. 1962, and males were collected on 17 and 22 Nov. 1962 (all by RCF). On the Ridge, a female was collected on 9 Aug. 1962 (JPD), five females on 20 Aug. 1962 (JPD), two males

on 3 Nov. 1962 (RCF), and a male was collected there on 1 Dec. 1962 (RCF).

SIZE: Both sexes range from 9mm to 11mm.

DISTRIBUTION: This species is found in India west to West Pakistan (Cantlie, 1962). It has been recorded on all sides of Delhi.

AZANUS URANUS BUTLER

The Dull Babul Blue is the most common Azanus in Delhi. Although it is most common on the Ridge, five specimens have been collected in the Nursery, and one male was collected at the Najafgarh Jheel (RLD). It has only been collected from Nov. I to Dec. IV. 45 specimens: 32 males (71%), 13 females.

SIZE: Males and females vary from 8mm to 11mm.

DISTRIBUTION: Reportedly common throughout India and Pakistan (Cantlie, 1962).

AZANUS JESOUS GAMRA (LEDERER)

Reed C. Finfrock has collected the only 10 specimens known from Delhi. They were all collected on the Ridge, as follows: two males and two females on 18 Nov. 1962, one male on 24 Nov. 1962, three males and a female on 1 Dec. 1962, and a male on 22 Dec. 1962.

These butterflies should be looked for near Acacia spp., for the flowers are fed upon by the larvae (Wynter-Blyth, 1957).

SIZE: The males range from 9mm to 11mm, while the females vary from 10mm to 12mm.

DISTRIBUTION: The African Babul Blue is found throughout the more arid portions of India and West Pakistan (Cantlie, 1962; Wynter-Blyth, 1957), but de Rhé-Philipe (1902) failed to include it in the Lucknow list. MacPherson (1927) did not collect it in Jodhpur, nor did de Rhé-Philipe (1917) record it in Lahore. The published records nearest Delhi appear to be those of Aldrich (1946) in Kaira District, Gujarat, and Mosse (1929) in Kathiawar, to the southwest. However, there are specimens in the MSU collection from Siliserh, Raj. (19 Nov. 1963, RLD), and Amber, Raj. (15 Nov. 1963, RLD).

PLEBEJUS SEPHYRUS INDICA (EVANS) ?

The discovery of a worn male of what may be this species was totally unexpected. According to the label it was collected by the author in the Nursery on 26 Aug. 1961. Mr. G.E. Tite of the British Museum of Natural History has kindly examined the specimen, but he was unable to identify it because of its worn condition. He does not believe it

is this species, although he was unable to suggest any other alternatives. The specimen in question is certainly not a species known to occur in the plains, and is most likely a Himalayan species. There is always the possibility that the specimen was accidentally imported, perhaps in some nursery stock, or perhaps when the specimen was in the relaxing chamber it became separated from its proper locality label.

DISTRIBUTION: According to Cantlie (1962), the Baluchi Jewel occurs in Baluchistan, Waziristan, and Karachi (!), but Menesse (1950) has failed to include this species in his list of Sind butterflies. Additional specimens, in better condition, are needed before the identity of this butterfly can be ascertained.

CHILADES LAIUS LAIUS (CRAMER)

The Lime Blue occurs sparingly in Delhi, and should be looked for in the vicinity of its foodplant, Citrus (Bell, 1918). It has been seen or collected from July IV to Dec. IV (no October records) in the Nursery. One female was collected on the Ridge, Nov. I. 23 specimens: 13 males (57%), 10 females.

Longstaff (1912) collected this species in Delhi, 7-12 Nov. 1903.

The absence of tails is the major character that differentiates this species from Euchrysops pandava pandava (Horsfield), although the larvae reportedly have different foodplants: E. pandava feeds on cycads, according to Swinhoe (1910-1911). No significant differences were found when the genitalia of C. laius were compared with the genitalia of E. p. pandava from Karwar, Mysore, and Darjeeling, West Bengal. The genitalia of both species resemble fig. 146 (E. pandava) in Corbet and Pendlebury (1956), except that the vinculum is narrower than they have drawn it. The valva of E. pandava has also been figured by Corbet (1941). The congeneric, or even conspecific, status of these two butterflies should be investigated.

SIZE: The males vary from 11mm to 13mm, while the females range from 9mm (14 Nov. 1963, RLD) to 14mm (in August and September).

OVIPOSITION: On 19 Sept. 1961 two females were observed flying around a Citrus bush. At least one of them laid an egg on the bush.

On 26 July 1961 a female was observed flying around another Citrus bush. Eventually she landed on an irregular knob in the axil of a leaf and deposited an egg, rubbing her hind wings together as she did so. This process was repeated several times before I collected several of the

twigs on which eggs had been laid. An examination of the irregularities on which the eggs had been deposited revealed that they were small clusters of aphids (Homoptera: Aphidae). The eggs failed to hatch, so it could not be determined whether the larvae would have fed on the Citrus (the recorded foodplant) or on the aphids. It appears that carnivorous behavior has never been reported for this species (Clark, 1926), although the larvae are attended by ants (Swinhoe, 1905-1910; de Rhé-Philipe, 1902).

DISTRIBUTION: The Lime Blue occurs throughout India (Cantlie, 1962; Wynter-Blyth, 1957), west to Jodhpur? (Mac-Pherson, 1927), Lahore (de Rhé-Philipe, 1917), and Kathiawar (Mosse, 1929).

FREYERIA TROCHILUS PUTLI (KOLLAR)

The Grass Jewel is the smallest Delhi butterfly. It has been recorded from July IV to Dec. IV, and Feb. I. Although it is usually found in the Nursery, it has been collected at Tughlakabad and on the Ridge (1♂, Dec. I). 42 specimens: 27 males (68%), 13 females, 2 unsexed.

SIZE: Males and females vary from 6mm to 9mm.

DISTRIBUTION: This subspecies, which does not have prominently orange-crowned marginal spots on the hindwing, occurs from south to northeast India. The nominate

subspecies is found in West Pakistan (Cantlie, 1962). One or two of the Delhi specimens have prominently orange-crowned marginal spots, thus indicating a tendency towards the Pakistan subspecies. The Grass Jewel has been recorded on all sides of Delhi.

ZIZINA OTIS INDICA (MURRAY)

The Lesser Grass Blue is common in Delhi, though it is not collected as frequently as Zizeeria maha and knysna. Only two specimens have been collected during the monsoon (July IV, Aug. II); the rest have been collected from Nov. I to Feb. I and March IV to May III. It is most common in November and December. Systematic collecting would probably yield specimens from throughout the year. 74 specimens: 39 males (53%), 35 females.

SIZE: Males and females range from 8mm to 11mm.

DISTRIBUTION: This subspecies occurs in Peninsular India north to Sikkim and west to West Pakistan (Cantlie, 1962). A second subspecies, Z. otis sangra (Moore), occurs from Sikkim and West Bengal east. The genitalic differences between the two "subspecies" have been noted by previous workers, who have retained the subspecific status of the two populations. The differences between the two, illus-

trated by Chapman (1910), would appear to be significant enough to warrant the recognition of two distinct species.

This butterfly has been recorded from Lucknow (de Rhé-Philipe, 1902) and Lahore (de Rhé-Philipe, 1917), but not from Jodhpur (MacPherson, 1927). The author has also collected it in Ludhiana, Punjab (11-12 Sept. 1961) and 15 miles south of Saharanpur, U.P. (8-9 May 1961). There are additional specimens in the MSU collection from Aligarh, U.P. (17 Nov. 1962 and 7 April 1964, RLD).

ZIZEERIA MAHA MAHA (KOLLAR)

Although the males of the Pale Grass Blue can be easily separated from males of Z. knysna, the females of the two species tend to overlap in size so that their identification becomes difficult. A good character to separate the two, in Delhi, is the arrangement of the discal spots UNF. In maha the spots in spaces 3, 4, and 5 are similar in shape, and the distal edges are more or less in line. In knysna the spot in space 4 is usually lengthened and oblique, and is shifted laterad from a line drawn through the spots in spaces 3 and 5.

This species has been recorded throughout the year, both on the Ridge and in the Nursery. It is most common

in March and April, and again from late July through November. 223 specimens: 178 males (80%), 45 females.

SIZE: Males and females range from 10mm to 13mm.

VARIATION: The seasonal forms are well-marked. The WSF occurs from July III to Oct. I, in which the males have the marginal band on the upperside much wider than in dry season specimens, accompanied by dark suffusion over the greater part of both wings. The females are dark brown above, with at most a trace of the basal blue. The DSF occurs during the remainder of the year (Oct. IV to June III), in which the males are pale lilac blue above, with narrow brown borders on both wings, and no suffusion. The females have a varying amount of blue on the upperside--often as much as in a wet season male.

DISTRIBUTION: This subspecies is common from West Pakistan east to Assam and south to "Central India" (Cantlie, 1962). Common in Lucknow (de Rhé-Philipe, 1902) and Lahore (de Rhé-Philipe, 1917), but MacPherson (1927) only records a few specimens from Udaipur, southern Rajasthan, and none from Jodhpur. There are, however, additional specimens in the MSU collection from Jaipur, Raj. (16-17 Nov. 1963, RLD), 170 miles ENE of Jodhpur.

ZIZEERIA KNYSNA KARSANDRA (MOORE)

The Dark Grass Blue is the most common of the Delhi grass blues. It occurs in the Nursery throughout the year, and is common on the Ridge from March IV to April IV, and again in November and December. It is most common in the Nursery during and after the monsoon. 463 specimens: 269 males (58%), 194 females. The sex ratio of field-collected specimens is apparently subject to great variation: of 76 specimens collected April II, only 38% were males, but of 67 specimens collected Aug. IV, 63% were males. A copulating pair was collected on 25 Sept. 1961 (JPD).

SIZE: Males and females range from 8mm to 11mm.

DISTRIBUTION: This species is common throughout West Pakistan and India (Cantlie, 1962; Wynter-Blyth, 1957). Only a few specimens were collected in Lucknow by de Rhé-Philipe (1902), but it has been reported as common in Lahore (de Rhé-Philipe, 1917) and Jodhpur (MacPherson, 1927).

ZIZULA HYLAX (FABRICIUS)

This tiny butterfly has long been known as Z. gaika (Trimen), but Corbet (1940) has shown that the Fabrician name has priority. It is the least common of the Delhi grass blues, and is usually collected as single specimens from March IV to Dec. IV (no records for January, February,

May, June, September, or October). Although the majority of specimens has been collected in the Nursery, three have been collected on the Ridge (March IV, Aug. III, Dec. IV), and five specimens were collected at Tughlakabad on 29 Sept. 1961 (JPD), indicating that it may be locally common during and after the monsoon. 23 specimens: 14 males (61%), 9 females.

SIZE: Males and females range from 8mm to 11mm.

DISTRIBUTION: The Tiny Grass Blue occurs throughout India and Pakistan (Cantlie, 1962; Wynter-Blyth, 1957). It has been recorded on all sides of Delhi.

EUCHRYSOPS CNEJUS (FABRICIUS)

The Gram Blue has been found in the Nursery, on the Ridge, and at Tughlakabad. It flies from Aug. IV to Sept. IV, Nov. I to Dec. I, and Feb. III to March II. It has been most frequently collected in late February, early March, and early November. Longstaff (1912) collected it in Delhi, 7-12 Nov. 1903.

In the process of examining the genitalia of all males, it was found that the uncus of this species is quite different from that of the other two Euchrysops in India. 33 specimens: 25 males (76%), 8 females.

SIZE: Males and females range from 9mm to 15mm, with the smaller specimens generally occurring during the dry season.

DISTRIBUTION: This species is common throughout India and Pakistan (Cantlie, 1962). It has been recorded from Lucknow (de Rhé-Philipe, 1902) and Jodhpur (MacPherson, 1927), but not from Lahore (de Rhé-Philipe, 1917).

EUCHRYSOPS PARRHASIUS PARRHASIUS (FABRICIUS)

The Small Cupid has long been known as E. contracta (Butler), but Corbet (1941) has shown that the Hesperia parrhasius of Fabricius actually refers to this species rather than to an Everes (the former Everes parrhasius parrhasius of South India is now known as Everes lacturnus syntala Cantlie). It occurs in all Delhi habitats, from July III to Nov. IV, Dec. IV, Jan. IV, and from March IV to May IV (not yet recorded in Feb. or June). 91 specimens: 62 males (68%), 29 females.

SIZE: Males and females vary from 9mm to 12mm.

VARIATION: Males occurring from Nov. I to March IV are darker blue above than are males flying at other times. Females during this same period have a large amount of blue on the upperside, as opposed to July females, for example, which have only a few basal blue scales. The underside of

these dry season specimens is very dusky, and the markings are greatly suffused and indistinct. The spot in space 1c UNH is smaller than the spot in space 2, and a light post-discal band is well-developed.

The dry season specimens appear to fit the description of E. pandava minuta Evans, a subspecies which is supposed to occur in Sind, Punjab, Baluchistan, and the N.W. Frontier (Cantlie, 1962). But the genitalia of all males were examined and compared with the genitalia of specimens of E. pandava pandava (Horsfield) in the MSU collection from Karwar, Mysore and Darjeeling, West Bengal. No Delhi specimen had genitalia conforming to E. pandava, although it was noted that the genitalia are virtually identical to those of Chilades laius, q.v.

Corbet (1941) figures the valvae of Euchrysops pandava, E. parrhasius parrhasius, E. cnejus, and what he calls E. parrhasius minuta Evans. Unfortunately, the apparent transfer of minuta from E. pandava to E. parrhasius was not discussed, and no indication was given of the authority for the change.

Mr. G.E. Tite of the British Museum (Natural History) has been kind enough to examine Evans' type of minuta, and he informs me (pers. comm.) that minuta and parrhasius are one and the same species, thus confirming Corbet's (1941)

observations. It appears, therefore, that minuta Evans only refers to the dry season form of Euchrysops parrhasius parrhasius (Fabricius), and is thus a NEW SYNONYM.

DISTRIBUTION: E. parrhasius parrhasius occurs from South India north to Nepal, west to Sind, Punjab, Baluchistan, and the N.W. Frontier (Cantlie, 1962). It has not been recorded from Lucknow (de Rhé-Philipe, 1902) or Lahore (de Rhé-Philipe, 1917), although it has been recorded from Jodhpur (MacPherson, 1927) and Kanpur, U.P. (Sanders, 1955).

CATOCHRYSOPS STRABO STRABO (FABRICIUS)

The Forget-Me-Not appears to be locally common but generally rare in Delhi. It occurs more or less throughout the year in all habitats: Jan. IV, March III & IV, May I & IV, Aug. IV, Sept. IV, and Nov. I to IV. The only place where it was found to be common was at Tughlakabad, where 27 males (no females) were collected on 29 Sept. 1961 (JPD). At other times in other localities only one or two specimens have been collected at any one time. 43 specimens: 37 males (86%), 6 females.

SIZE: Males and females vary from 13mm to 16mm.

DISTRIBUTION: This subspecies is common throughout Peninsular India (Wynter-Blyth, 1957; Cantlie, 1962; Tite,

1959). It has been recorded in Lucknow (de Rhé-Philipe, 1902) and Jodhpur (MacPherson, 1927), but not in Lahore (de Rhé-Philipe, 1917). There are additional specimens in the MSU collection from Ludhiana, Punjab (11-12 Sept. 1961, JPD) and Jaipur, Raj. (16 Nov. 1963, RLD).

LAMPIDES BOETICUS (LINNAEUS)

The Peablue is another of the most common Delhi butterflies. It has been recorded in all habitats throughout the year, except in the months of July and September. It appears to be most abundant from February to April and again in November, but it may have been heavily collected in the dry season when many species are not common, and may have been neglected for more desirable species during the monsoon, when more butterflies are flying. 312 specimens: 163 males (52%), 149 females.

SIZE: Males and females vary from 12mm in the dry season to 17mm after the monsoon.

DISTRIBUTION: This ubiquitous species is common throughout India and Pakistan (Cantlie, 1962).

PROSOTAS NORA ARDATES (MOORE)

Only three males of the Common Lineblue have been examined, all of which were collected in Delhi by Leela R.

Menon in October 1962 (11mm). The genitalia of all three specimens were dissected and compared with figures in Tite (1963), which should be consulted for information concerning the removal of this species from Nacaduba.

DISTRIBUTION: This subspecies occurs in Ceylon and throughout West Pakistan and India to Burma (Cantlie, 1962; Wynter-Blyth, 1957). It has not been collected in Lucknow (de Rhé-Philipe, 1902), Sind (Menesse, 1950), or Lahore (de Rhé-Philipe, 1917), but MacPherson (1927) found it in Jodhpur, and Mosse (1929) collected it in Rajkot, Kathiawar, in December 1927. The foodplant is reported to be Acacia caesia (Wynter-Blyth, 1957), so these trees should be more closely examined in Delhi.

SPINDASIS VULCANUS VULCANUS (FABRICIUS)

Only two males of the Common Silverline have been collected in Delhi. One was obtained by Roy L. Donahue in the Nursery on 28 Oct. 1962 (11mm), and the other was collected by Reed C. Finfrock on the Ridge, 21 Feb. 1963 (12.5mm). The male genitalia of both this and the following species were examined and compared with the figures in Cantlie (1963).

DISTRIBUTION: This subspecies occurs throughout India and West Pakistan, except in the eastern Himalaya and Assam (Cantlie, 1962; Wynter-Blyth, 1957). It has been recorded

from Lucknow (de Rhé-Philipe, 1902), but not from Jodhpur (MacPherson, 1927) or Lahore (de Rhé-Philipe, 1917).

SPINDASIS ICTIS ICTIS (HEWITSON)

Only eleven specimens of the Common Shot Silverline have been collected. Three males were collected in Delhi by Leela R. Menon in November 1962, while the rest of the specimens were collected on the Ridge: a male on 24 Feb. 1963, two males on 26 Feb. 1963, one male on 29 Feb. 1964, two males and a female on 11 March 1963 (all by RCF), and a female on 3 July 1962 (JPD).

SIZE: The males range from 12mm to 14mm, while the females are 13mm and 14mm.

DISTRIBUTION: This subspecies occurs locally throughout West Pakistan and India (Cantlie, 1962; Wynter-Blyth, 1957), but the only published record near Delhi is from Fyzabad, U.P. (de Rhé-Philipe, 1902).

RAPALA IARBUS (FABRICIUS) ssp.

Only four Delhi specimens of the Indian Red Flash, formerly known as R. melampus (Cramer), have been examined. Two males were collected in Delhi in November 1962 by Miss Nirmala (16mm, 18mm), one male was collected in Delhi in December 1962 by Venu (17mm), and a female was collected in

the Nursery by the author on 29 May 1962 (15mm). This last specimen was collected as it sat on a Citrus leaf in the shade.

According to Cantlie (1962) the prominent orange-crowned spot in space 2 UNH of the Delhi specimens is indicative of R. i. iarbus, which presumably occurs from Nepal to Burma, but the paucity of orange scales in the tornal lobe UPH would indicate R. i. sorya (Kollar), which reportedly occurs from South India to Muree, Nepal, and Calcutta, and in Amritsar and Kanpur. Since the range of the latter subspecies encompasses Delhi, these specimens are probably referable to Rapala iarbus sorya (Kollar).

DISTRIBUTION: In addition to the ranges given above, specimens have been collected on Mount Abu (MacPherson, 1927), in Kutch (Nurse, 1899), and in Kathiawar (Mosse, 1929). Menesse (1950) does not report its presence in Sind. Delhi appears to be on the western edge of the range of this species, at the latitude of Delhi.

N Y M P H A L I D A E

CHARAXES FABIUS FABIUS (FABRICIUS)

The Black Rajah is an uncommon species in India, and Wynter-Blyth (1957) states that it has been recorded from Delhi, although he was unable to tell me the original source for this record (pers. comm.). No specimens or further records have been located, although the foodplant, tamarind (Tamarindus indica), occurs in Delhi.

DISTRIBUTION: According to Evans (1927) this subspecies is found in Peninsular India north to Kangra and Sikkim in the Himalaya. In the plains of northwestern India it has been recorded from Lucknow (de Rhé-Philipe, 1902), Kathiawar (Mosse, 1929), and in Kaira District (Aldrich, 1946). Delhi appears to be on the western edge of the known range of this species, which should be looked for near tamarind, at sugar, and on exuding tree sap.

EUTHALIA NAIS (FORSTER)

The only Delhi specimen known is in the I.A.R.I. collection, caught by Dr. M.G. Ramdas Menon on 2 April 1958.

DISTRIBUTION: The Baronet is locally common from Dehra Dun to Sikkim, south throughout Peninsular India to Ceylon (Evans, 1927; Wynter-Blyth, 1957). South of Dehra Dun, the only record near Delhi is from Lucknow (de Rhé-Philipe, 1902), where only one specimen (♂) was collected in March. Delhi is apparently the western-most record for the species at this latitude.

PSEUDERGOLIS WEDAH (KOLLAR)

A single specimen in the I.A.R.I. collection, caught by Dr. M.G. Ramdas Menon, is the only known specimen from Delhi.

DISTRIBUTION: The Tabby is a Himalayan species, occurring from Kulu to Assam and Burma (Evans, 1927; Wynter-Blyth, 1957), and, since it has apparently not been previously reported south of the Himalaya, its occurrence in Delhi is exceptional and should be verified with further specimens.

HYPOLIMNAS MISIPPUS (LINNAEUS)

The Danaid Eggfly is a widespread species whose female mimics all three forms of Danaus chrysippus found in India. The typical female form, which is extremely difficult to distinguish from D. chrysippus in the field, is the only form which has been collected in Delhi. It is perhaps only

a matter of time before the other two, more rare, forms are found. The species has been collected in the Nursery, on the Ridge, and at Tughlakabad, from June IV to Sept. IV, and Nov. I. 25 specimens: 17 males (68%), 8 females.

SIZE: ♂♂ 26mm (3 Nov. 1963, RLD) to 34mm (2 specimens, 28 Aug. 1961, JPD). ♀♀ 36mm (30 June and 29 Sept. 1961, JPD) to 41mm (4 Nov. 1961, JPD).

DISTRIBUTION: This butterfly occurs throughout India (Wynter-Blyth, 1957), and has been recorded on all sides of Delhi. It is interesting to note that de Rhé-Philipe (1917) found this species less common than H. bolina in Lahore, while the converse is true in Delhi.

HYPOLIMNAS BOLINA BOLINA (LINNAEUS)

Although the Great Eggfly is common in many parts of India, it is rare in Delhi. Only four females have been collected in the Nursery: 15 July 1962 (37mm), 20 July 1962 (43mm), 9 Aug. 1962 (39mm), and 21 Sept. 1961 (42mm). These specimens are small compared with females from South India. No males have ever been seen by the author, either in Delhi or elsewhere in India.

DISTRIBUTION: This species is reportedly common throughout India (Evans, 1927; Wynter-Blyth, 1957). It is common in Lucknow (de Rhé-Philipe, 1902), Lahore (de Rhé-

Philipe, 1917), Kutch (Nurse, 1899), and Kathiawar (Mosse, 1929), while it is fairly common in Amritsar (Sevastopulo, 1948), uncommon in Jodhpur (MacPherson, 1927), and very rare or extirpated in Karachi (Swinhoe, 1887; Menesse, 1950), where it has not been collected since 1886.

PRECIS LINTINGENSIS LINTINGENSIS (OSBECK)

The Yellow Pansy appears to be the least common Precis in Delhi. It is usually encountered in the Nursery, although a few specimens have been taken at Tughlakabad and on the Ridge. It has been collected from July III to Sept. IV, Nov. I to Jan. III, and on March IV and May IV. 26 specimens: 19 males (73%), 7 females.

Corbet (1945) has shown that Papilio lintingensis Osbeck, 1765, has priority over the well-known Papilio hierta of Fabricius, 1798.

SIZE: ♂♂ 20mm (10 Nov. 1962, RCF) to 25mm (3 Nov. 1963, RLD). ♀♀ 24mm (several, July & Nov.) to 27mm (9 Aug. 1962, JPD).

VARIATION: The wet season form, which has a darker ground color UNH than the dry season form, occurs from July III to Sept. IV.

DISTRIBUTION: This species is very common throughout India (Wynter-Blyth, 1957), and has been recorded on all sides of Delhi.

PRECIS ORITHYA SWINHOEI (BUTLER)

The Blue Pansy is the most common Delhi Precis. It occurs in all habitats throughout the year except in June and early July, for which there are no records. It is most abundant during and after the monsoon, especially in the Nursery. A tattered male and a fresh female were collected in copula on 3 March 1962, and a female was collected at light on 17 November 1961 (Donahue, 1962b). 118 specimens: 64 males (54%), 54 females.

SIZE: ♂♂ 17mm (2 Dec. 1962, 3 Feb. 1963, RCF) to 25mm (3 Nov. 1962, RCF). ♀♀ 18mm (21 Feb. 1963, RCF) to 26mm (24 July and 8 Sept. 1961, JPD). The smallest specimens are as small as, or smaller than, the record "dwarf" reported by Crawford (1930), which had an "expanse" of 36mm (sex not stated).

VARIATION: The wet season form, with two prominent ocelli UNH, has been collected from July III to Oct. I. Traces of the ocelli reappear in specimens from March to May, reminiscent of the appearance of ocelli in April and May specimens of Precis almana.

DISTRIBUTION: The Blue Pansy occurs throughout India (Wynter-Blyth, 1957), and has been recorded on all sides of Delhi.

PRECIS LEMONIAS LEMONIAS (LINNAEUS)

According to Evans (1927) this subspecies occurs from Sikkim to Burma. Fruhstorfer's (1912) original descriptions of persicaria, aenaria, and vaisya indicate that these taxa as he knew them occurred in widely-scattered localities. Persicaria, in fact, was described as a form, with a peach-colored underside. Because no constant subspecific differences can be found among a large series of specimens from all over India, the author has chosen to refer to the entire Indian population of this variable butterfly as Precis lemonias lemonias (Linnaeus).

The Lemon Pansy occurs in all habitats, but is more frequently collected in the Nursery. It is most abundant during and after the monsoon, but single specimens may be encountered during the winter and dry season. It has been recorded from June IV to Jan. I, and Feb. IV to April II (the seven specimens collected in the latter period are all males). 82 specimens: 53 males (65%), 29 females.

Longstaff (1912) wrote that from 7-12 Nov. 1903 it ". . . appeared to be rather fond of shade; they settled

upon the ground in preference to flowers, and then were hard to see."

SIZE: ♂♂ 22mm (several, March II & III, June IV) to 27mm (29 Aug. 1961, JPD). ♀♀ 21.5mm (25 Dec. 1962, RCF) to 29mm (21 Sept. 1961, JPD).

VARIATION: The wet season form, which has a well-marked pattern with ocelli UNH, occurs from June IV to Oct. I. The dry season form has the pattern and ocelli reduced UNH and has a falcate apex on the forewing.

DISTRIBUTION: This species occurs in the Himalaya from Kashmir to Assam and Burma, in Ceylon and on the Deccan Plateau, and in Saurashtra (Wynter-Blyth, 1957)--a range which circumvents Delhi. However it is also common in Lucknow (de Rhé-Philipe, 1902), Jodhpur and Mount Abu (MacPherson, 1927), and Lahore (de Rhé-Philipe, 1917). It has even been collected in Karachi (Swinhoe, 1887) and elsewhere in Sind (Menesse, 1950), where it is apparently very cyclic in its abundance.

PRECIS ALMANA ALMANA (LINNAEUS)

The Peacock Pansy has been collected in the Nursery every month except February. It is most common during and after the monsoon, from mid-July through December. Only

one specimen, a male, has been collected on the Ridge.

61 specimens: 43 males (70%), 18 females.

SIZE: ♂♂ 24mm (3 specimens, from March IV, May IV, and Dec. IV) to 28mm (25 Sept. 1961, JPD). ♀♀ 22mm (15 March 1964, RLD) to 29mm (31 July 1962, JPD).

VARIATION: The seasonal forms are well-marked. The DSF has the "dead-leaf" pattern on the underside, where the ocelli are absent UNH, the hindwing tornus is produced, and the forewing apex is falcate. The WSF has prominent ocelli UNH, a rounded tornus on the hindwing, and a rounded apex on the forewing. This is another of the Delhi butterflies in which the "wet season" form begins flying before the wet season begins. The WSF has been collected April II and May IV to Nov. II. The DSF flies from Sept. IV to March IV, with both forms occurring from Sept. IV to Nov. II.

DISTRIBUTION: The Peacock Pansy occurs throughout India (Wynter-Blyth, 1957), and has been recorded on all sides of Delhi.

VANESSA CARDUI (LINNAEUS)

Only two specimens of this cosmopolitan species have been collected in Delhi. The author collected a male on 20 Jan. 1962, and Reed C. Finfrock obtained a female on 23

March 1963. Both specimens came from the Nursery, and the forewing of both is 27mm long.

DISTRIBUTION: The Painted Lady occurs throughout India (Evans, 1927; Wynter-Blyth, 1957), and usually occurs during the fall and winter on the plains of northern India. It appears to be less common in the desert tracts west of Delhi. Presumably it "migrates" to Delhi from the Himalaya, so it may be more abundant in some years than in others.

ARGYNNIS HYPERBIUS HYPERBIUS (JOHANNSEN)

Only two specimens of the Indian Fritillary have been collected in Delhi: the author collected a perfect male (36mm) as it visited wildflowers in the Nursery on 13 April 1962, and Reed C. Finfrock collected a second male (34mm) on the Ridge, 27 March 1964.

DISTRIBUTION: The appearance of this Himalayan species in Delhi came as a surprise. It is resident on Mount Abu (Evans, 1927; MacPherson, 1927; Wynter-Blyth, 1957) and in the Himalaya (Evans, 1927; Wynter-Blyth, 1957), where the larva feeds on violets. Most authors have assumed that this butterfly occasionally strays from the hills onto the plains, but de Rhé-Philipe (1902) collected specimens from late September to March and found the larvae feeding on Lobelia and potted violets in Lucknow, while Longstaff

(1912) collected a female there 24-25 Nov. 1903. Robson (1893) found and reared the larvae on cultivated pansies (Viola sp.) in Bankipore, Bihar (near Patna), and Sanders (1955) reared adults from larvae he found on pansies in his garden in Kanpur, U.P.

Other records from the plains include specimens taken during the winter in Agra, U.P. (de Nicéville, 1886) and a single male taken and another seen in Feb. 1929 at Kundla, west of Bhavnagar, Gujarat by M sse (1929), who has also seen several females during the monsoon at Sadra, 30 north of Ahmedabad, Gujarat. Swinhoe (quoted in Moore, 1899-1900) reportedly took several specimens in Bombay in 1877, but it has apparently not been seen there since.

A careful search may show the species to be established in Delhi, since the larvae could feed on the pansies which are cultivated there during the winter.

ATELLA PHALANTHA (DRURY)

The Common Leopard is never abundant in Delhi. The females occur on the Ridge and in the Nursery with approximately equal frequency, but only one of the males has been collected in the Nursery. It flies during and after the monsoon, from July II to Aug. IV, and Nov. III & IV.

28 specimens: 15 males (54%), 13 females.

SIZE: ♂♂ 19mm (18 Nov. 1962, RCF) to 28mm (9 Aug. 1962, JPD; 18 Nov. 1962, RCF). ♀♀ 25mm (28 Aug. 1961, JPD) to 31mm (28 July 1961; 5 Aug. 1962, JPD).

VARIATION: The females are generally larger and more heavily marked than the males.

DISTRIBUTION: This species is common throughout India (Wynter-Blyth, 1957), and has been recorded on all sides of Delhi.

ERGOLIS MERIONE TAPESTRINA MOORE

The only record of the Common Castor from Delhi is a specimen in the I.A.R.I. collection, caught by Dr. M.G. Ramdas Menon.

DISTRIBUTION: This subspecies occurs from the Central Provinces to Orissa, and Kashmir to Kumaon (Evans, 1927). The only other record near Delhi is from Lucknow, where de Rhé-Philipe (1902) saw two specimens in October.

The adults should be looked for near castor plants (Tragia spp.), the larval foodplant, some of which grow in the Nursery and probably elsewhere in Delhi.

D A N A I D A E

DANAUS CHRYSIPPUS CHRYSIPPUS (LINNAEUS)

The Plain Tiger is one of the most common and conspicuous butterflies in Delhi, occurring throughout the year in all habitats, although it is uncommon in January, February, May, and June. 317 specimens: 199 males (63%), 118 females.

Longstaff (1912) found this species common in Delhi, 7-12 Nov. 1903.

Nine copulating pairs have been collected, from March IV to Nov. I (Table 4). With one major exception (1 Nov. 1962), the copulating males are almost the same size as, or slightly larger than, the females.

Table 4. Records of copulating pairs of Danaus chrysippus.

DATE	FOREWING LENGTH (mm) ♂	♀	COLLECTOR
24 March 1963	35	30	RLD
28 July 1961	33	34	JPD
11 Aug. 1962	35	33	RLD
28 Aug. 1961	40	38	JPD
21 Sept. 1963	37	34	RCF
25 Sept. 1961	37	37	JPD
1 Nov. 1962	30	40	RLD
3 Nov. 1962	39	36	RCF
4 Nov. 1961	42	35	JPD

A photograph taken of a copulating pair in November 1961 clearly shows that the male is doing the transporting, while the female is passive. It may be noted that Pronin (1964) observed that the female of D. plexippus was the transporter during the flight of a copulating pair in California.

Danaus chrysippus has been attracted to lights in New Delhi (Donahue, 1962b).

SIZE: ♂♂ 26mm (9 May 1962, JPD) to 42mm (13 April 1962, JPD). ♀♀ 25mm (31 March 1963, RCF) to 40mm (several). "Dwarf" specimens are relatively frequent. Both the male and female dwarfs indicated above are smaller than the dwarf reported by Crawford (1930), which had an "expanse" of 58mm. A dwarf from Lucknow has been reported with an "expanse" of "not more than 2.1 inches" [= 53mm] (de Rhé-Philipe, 1902).

VARIATION: Of the two most distinctive forms of this species, "dorippus" (Klug) and "alcippoides" Moore, only the latter has been collected in Delhi--a fresh male collected in the Nursery on 23 March 1963 (41mm) by Reed C. Finfrock. Elsewhere in India, the "alcippoides" form has been recorded from Lucknow (de Rhé-Philipe, 1902); Lahore (de Rhé-Philipe, 1917); Bhavnagar, Kathiawar (Mosse, 1929); Karachi, Pakistan (Swinhoe, 1887) and elsewhere in Sind

(Menesse, 1950); Calcutta (Percy-Lancaster, 1949); and Campbellpore, West Pakistan (Butler, 1886). In addition to some of the localities above, Moore (1890-1892) records its occurrence in Nepal, Nurpur, W. Pakistan; Deesa, Gujarat; Nimuch, Panghur (near Nimuch), and Mhow, Madhya Pradesh. Quoting de Nicéville (Journ. Asiatic Soc. Bengal, 1885, p. 40), Moore also adds Fyzabad, U.P.; Bholahat, Malda District, West Bengal; and Khurda, Orissa, to the list of localities where the "alcippoides" form has been collected.

The more frequent "dorippus" form has been recorded from a number of arid localities in India (Donahue, 1962a), and it is probably only a matter of time before a specimen is collected in Delhi.

DISTRIBUTION: The Plain Tiger is very common throughout India (Talbot, 1947; Wynter-Blyth, 1957), and the arid plains of northwestern India are no exception.

DANAUS GENUTIA (CRAMER)

Although Talbot (1947) refers to this species as D. plexippus plexippus (Linnaeus), Cramer's name is in general use in the Orient, and it is employed here to differentiate this species from the American species which Western taxonomists call D. plexippus. This butterfly has only been recorded during the monsoon season, July II to Sept. II, from

both the Nursery and the Ridge. A copulating pair was collected on 5 August 1962 (JPD). 25 specimens: 14 males (56%), 11 females.

SIZE: ♂♂ 37mm (5 Aug. 1962, JPD) to 46mm (5 Aug. 1962, 26 Aug. 1961, JPD). ♀♀ 36mm (14 Aug. 1962, JPD) to 46mm (21 July 1962, JPD).

DISTRIBUTION: The Common Tiger occurs throughout India (Talbot, 1947; Wynter-Blyth, 1957). It has been recorded during the monsoon season from other localities on all sides of Delhi.

DANAUS LIMNIACE LEOPARDUS (BUTLER)

The Blue Tiger is rare in Delhi--only two males have been collected, both from the Nursery: 26 July 1962 (41mm) and 28 Aug. 1961 (36mm).

DISTRIBUTION: This species is common in Peninsular India, although it also occurs in the Himalaya (Talbot, 1947). It occurs during the monsoon on all sides of Delhi.

EUPLOEA CORE CORE (CRAMER)

The Common Indian Crow is a very local and uncommon species that has only been found in a particular shaded, damp area in the Nursery, where Leptosia nina and Mycalesis perseus also occur. It has only been collected from July II

to Nov. I (no October specimens). Longstaff (1912) found it ". . . common in shady places under mango trees, but was rarely seen at flowers," 7-12 Nov. 1903. 12 specimens: 3 males (25%), 9 females--one of the few Delhi butterflies whose females are more frequently collected than the males.

SIZE: ♂♂ 41mm (28 July & 29 Aug. 1961, JPD) to 45mm (3 Nov. 1963, RLD). ♀♀ 41mm (21 July 1962, JPD) to 47mm (19 July 1961, JPD).

DISTRIBUTION: This species occurs throughout India, where it is generally common (Talbot, 1947; Wynter-Blyth, 1957), although it apparently does not occur as far west as Sind (Menesse, 1950).

S A T Y R I D A E

MYCALESIS PERSEUS TABITHA (FABRICIUS)

Like Euploea core, the Common Bushbrown has only been found in a small, damp, shady area of the Nursery, where it flies from July III to Nov. III. Although the valva resembles that found in some populations of M. mineus figured by Evans (1920), all other characters of the facies listed by

Talbot (1947) point to this species. 30 specimens: 18 males (60%), 12 females.

SIZE: ♂♂ 18.5mm (17 Nov. 1962, RCF) to 21mm (several). ♀♀ 21mm (2 specimens, 25 Sept. 1961, JPD) to 25mm (2 specimens, 4 Nov. 1961, JPD).

VARIATION: As in the other two Delhi satyrids, the seasonal forms are well-marked. The WSF, with prominent ocelli UNH, occurs from July III to Oct. I, while the DSF, with greatly-reduced ocelli UNH, has been collected from Nov. I to Nov. III. Only five of the 30 specimens are of the dry season form.

DISTRIBUTION: Talbot (1947) records this subspecies from Ceylon north to the U.P. It has been reported from Lucknow (de Rhé-Philipe, 1902) and Fatehgarh (Peile, 1911), but there appear to be no other records west of Delhi, indicating that Delhi is near the western edge of the range of this species. The similar M. mineus polydecta (Cramer) apparently does not occur as far north or west as Delhi.

YPTHIMA INICA HEWITSON

Despite the status of "not rare" given the Lesser Threering by Talbot (1947) and Wynter-Blyth (1957), it is locally very common in Delhi. This little butterfly is virtually restricted to a wet grassy lowland area on the north

side of the Nursery (figure 3), where it has been found from July IV to April II, and on May IV. A few stray specimens have also been collected on the Ridge, at Tughlakabad (29 Sept. 1961, JPD), and at Okhla (1 Dec. 1962, RLD). The species is most common during the monsoon season (59 specimens have been collected Aug. IV, of which 76% were males). Two copulating pairs were collected on 21 Sept. 1961 (JPD). 204 specimens: 137 males (67%), 67 females.

SIZE: Both sexes vary from 14mm to 18mm, although dry season specimens are usually somewhat smaller than those from the wet season.

VARIATION: The seasonal forms are well-marked, but have an unusual temporal distribution. The dry season form "inica" Hewitson, with the ocelli UNH represented by mere dots, flies from Oct. IV to April II. But the ocellated wet season form "ariaspa" Moore has also been collected on April II, again in May IV, and during the monsoon from July IV to Nov. IV. The appearance of the "wet season" form in two of the hottest, driest months of the year, similar to the situation in several other species noted on page 14, is an unexplained phenomenon that has apparently escaped the notice of other authors.

DISTRIBUTION: The Lesser Threering has been recorded from the Punjab to Bengal by Talbot (1947), while Swinhoe

(1886) has recorded it in Mhow and Debalpore, Madhya Pradesh. de Rhé-Philipe (1917) has recorded two specimens from Lahore, and Sevastopulo (1948) says it is common in Amritsar, Punjab, but no other records from west of Delhi have been found.

Neither the widespread Y. asterope mahratta Moore nor Y. ceylonica Hewitson have been found in Delhi, even though the genitalia of all Delhi males were examined and compared with representatives of those species in the MSU collection, and with the figures in Cantlie and Norman (1959). Y. ceylonica hubneri Kirby has been recorded from Lucknow (de Rhé-Philipe, 1902), while Y. asterope mahratta has been collected in Jodhpur and on Mount Abu (MacPherson, 1927), Kathiawar (Mosse, 1929), and Karachi (Swinhoe, 1887). The author has also collected Y. mahratta in Sumerpur, Rajasthan, 320 miles southwest of Delhi (5 Oct. 1961).

Either of these two species may be found in Delhi, but intensive collecting has so far failed to yield a specimen.

MELANITIS LEDA ISMENE (CRAMER)

This crepuscular species is best collected in the evening, although one may find specimens during the day by beating the bushes in the Nursery. It has also been collected at light (Donahue, 1962b). Outside the Nursery it has only

been taken at Tughlakabad (29 Sept. 1961, JPD), though it probably occurs in other favorable habitats in the state. It flies only during and after the monsoon, from July III to December III. 35 specimens: 13 males (37%), 22 females --another of the few Delhi species in which the female is collected more often than the male.

SIZE: The forewing of both males and females varies from 32mm to 37mm in length.

VARIATION: The seasonal forms are very different from each other in the markings on the underside of the hindwing: the WSF "determinata" Butler, which flies from July III to Oct. I, has conspicuous ocelli UNH, while the DSF "ismene" (Cramer), which flies from Oct. I to Dec. III, has no ocelli. Both forms have been collected together the first week of October.

DISTRIBUTION: The Common Evening Brown is found throughout India, although it becomes less common in the desert areas of western India (Talbot, 1947). It has apparently not been recorded in Sind since 1886, when Swinhoe (1887) caught two specimens in Karachi.

H Y P O T H E T I C A L L I S T

In addition to the 78 species recorded from Delhi in this paper, there are a number of other species which have been recorded from neighboring localities that may yet be found to occur in Delhi. The authorities for the records are the same as those which have been cited in the text, unless another source is cited. A question-mark indicates doubt on my part concerning the proper identification of the species.

HESPERIIDAE

SARANGESA DASAHARA (Moore) ssp.: Lucknow; Mount Abu (Evans, 1949; MacPherson, 1927).

UDASPES FOLUS (Cramer): Lucknow, Mount Abu, Kathiawar.

ORIENS GOLA PSEUDOLUS (Mabille)?: Lucknow? (de Rhé-Philipe, 1905); the western-most record in the B.M. is the Nepal Terai (Evans, 1949).

TELICOTA ANCILLA BAMBUSAE (Moore): Amritsar? (Sevastopulo, 1948); Lucknow (de Rhé-Philipe, 1902; Evans, 1910). The distribution given by Evans (1949) indicates that this species may occur as far west as Delhi.

BORBO BEVANI (Moore)?: Lahore; Karachi (Swinhoe, 1887), possibly confused with B. cinnara. Nearest record in B.M. is "Central India" and Kumaon (Evans, 1949).

PAPILIONIDAE

ATROPHANEURA HECTOR (Linnaeus): Jodhpur.

PAPILIO CLYTIA CLYTIA Linnaeus, form "dissimilis" Linnaeus: Lucknow; Fatehgarh (Peile, 1911).

PIERIDAE

APPIAS LYNCIDA (Cramer) ssp.: Lucknow (reported as A. hippoides Moore, a synonym); Fatehgarh? (Peile, 1911).

PIERIS BRASSICAE NEPALENSIS Doubleday: Lucknow, Amritsar (Sanders, 1930); Lahore.

COLOTIS PHISADIA PROTRACTUS (Butler): Lahore?; Jodhpur; Kutch, Sind; Kaira District, Gujarat; Lyallpore, West Pakistan (Sevastopulo, 1948). In flight it will resemble C. calais.

COLOTIS DANAE DULCIS (Butler): Jodhpur; Kutch; Sind; Kathiawar; Gujarat (MSU collection).

VALERIA VALERIA ANAIS (Lesson) (formerly V. v. hippia): Lucknow; Fatehgarh (Peile, 1911).

RIODINIDAE

ABISARA ECHERIUS (Stoll) ssp.: Fatehgarh.

LYCAENIDAE

EVERES LACTURNUS (Godart) ss.: Kanpur, U.P. (Sanders, 1955).

JAMIDES BOCHUS BOCHUS (Cramer): Jodhpur; Kaira Dist.; possibly a specimen in I.A.R.I. collection, obtained in Delhi, April 1958, by M.G. Ramdas Menon. Specimen could not be examined by author. West Pakistan? (Cantlie, 1962, but Menesse, 1950, did not record it).

IRAOTA TIMOLEON (Stoll) ssp.: Lucknow.

APHARITIS ACAMAS HYPARGYRUS (Butler): Kutch; Sind; Kathiawar; Punjab (Cantlie, 1962). A stray specimen may occur as far east as Delhi.

SPINDASIS ELIMA ELIMA (Moore): Lucknow; Sind.

TAJURIA JEHANA Moore: Lucknow.

TAJURIA CIPPUS CIPPUS (Fabricius): Lucknow; "Pakistan. India. Burma. Common." (Cantlie, 1962).

VIRACHOLA ISOCRATES (Fabricius): Lucknow; Mount Abu; Kutch; Kathiawar; Karachi; Kaira District. The larva feeds on fruits of pomegranate and guava, and the adults should be looked for in groves of these plants.

RAPALA VARUNA ORSEIS (Hewitson): Lucknow. The larva feeds on the flowers of Zizyphus xylopyrus.

RAPALA MANEA SCHISTACEA (Moore): Bareilly, U.P. (de Rhé-Philipe, 1902). Larvae have been reared on flowers of the Rangoon Creeper (Quisqualis indica) and Acacia caesia.

NYMPHALIDAE

EUTHALIA GARUDA (Moore) ssp.: Lucknow; Lahore; Amritsar. The larva has usually been reared on mango and cashew.

NEPTIS HYLAS VARMONA Moore: Lucknow. A widespread species that may stray into Delhi.

PRECIS ATLITES (Linnaeus): Lucknow.

PRECIS IPHITA (Cramer) ssp.: Lucknow; Kanpur, U.P. (Sanders, 1955).

CIRROCHROA TYCHE MITHILA Moore: Lucknow; Fatehgarh--remarkable records, since this species is not normally considered to occur west of Sikkim.

ACRAEIDAE

ACRAEA VIOLAE (Fabricius): Lucknow, where it is abundant some years and rare in others (de Rhé-Philipe, 1902); Fatehgarh, probably the northwestern-most record of this South Indian species.

SATYRIDAE

YPTHIMA ASTEROPE MAHRATTA Moore may be found in Delhi.

See the comments on page 111, under Y. inica.

ORSOTRIOENA MEDUS (Fabricius) ssp.: Lucknow.

MELANITIS PHEDIMA (Stoll) ssp.: Lucknow.

L I T E R A T U R E C I T E D

Aldrich, Herschel C. 1946. Butterflies of Kaira District--a list. Jour. Bombay nat. Hist. Soc. 46: 374-377.

Annandale, N. and Cedric Dover. 1921. The butterflies of Barkuda Island. Rec. Ind. Mus. 22: 349-375.

Beirne, Bryan P. 1947a. Changes in the distribution and abundance of the Lepidoptera. Ent. Rec. Jour. Var. 59: 65-66.

_____. 1947b. The effects of human activities on the distribution and abundance of the Lepidoptera. Ent. Rec. Jour. Var. 59: 37-42.

Bell, T.R. 1918. The common butterflies of the plains of India. Part XX. Jour. Bombay nat. Hist. Soc. 25: 636-664.

Butler, Arthur G. 1886. On Lepidoptera collected by Major Yerbury in western India. Proc. Zool. Soc. Lond. 1886: 355-395, 1 pl.

Cantlie, Keith. 1962. The Lycaenidae portion (except the Arhopala Group) of Brigadier Evans' The Identification

of Indian Butterflies 1932 (India, Pakistan, Ceylon, Burma). Bombay Natural History Society, Bombay. vi + 159 pp., 5 pls.

Cantlie, Keith. 1963. Genitalia of the butterfly genus Spindasis Wallengren. Jour. Bombay nat. Hist. Soc. 60: 466-468, 1 pl.

_____ and T. Norman. 1959. Notes on the butterfly genus Ypthima. Jour. Bombay nat. Hist. Soc. 56: 66-71, 12 figs.

Chapman, T.A. 1910. On Zizeeria (Chapman), Zizera (Moore), a group of lycaenid butterflies. Trans. Lond. Ent. Soc. 1910: 479-497, 10 pls.

Clark, Austin H. 1926. Carnivorous butterflies. Ann. Rept. Smithsonian Inst. 1925: 439-508.

Corbet, A. Steven. 1940. The identity of the Fabrician species Papilio sphinx and Papilio hylax. Entomologist 73: 275-277.

_____. 1941. Observations on certain of the Fabrician names of Indo-Australian Rhopalocera (Lepid.). Proc. Roy. Ent. Soc. London (B) 10: 98-106, 1 fig.

_____. 1945. The Linnaean names of Indo-Australian Rhopalocera. Part 4. The Chinese butterflies in the Linnaean collection obtained by Peter Osbeck in 1751. Proc. Roy. Ent. Soc. London (B) 14: 91-94.

Corbet, A. Steven and H.M. Pendlebury. 1956. The butterflies of the Malay Peninsula, 2nd ed., rev. Oliver and Boyd, Edinburgh. xi + 537 pp., 55 pls. (8 col.).

Crawford, W.M. 1930. Dwarf specimens of butterflies. Jour. Bombay nat. Hist. Soc. 34: 261-262, 1 pl.

Dixey, Frederick A. 1902. Notes on some cases of seasonal dimorphism in butterflies, with an account of experiments by Mr. G.A.K. Marshall, F.Z.S. Trans. Ent. Soc. Lond. 1902: 189-218, 1 pl.

Donahue, Julian P. 1962a. Danaus chrysippus form dorippus in Rajasthan. Jour. Bombay nat. Hist. Soc. 59: 311-312.

_____, 1962b. Observations and records of butterflies attracted to light in India. Jour. lepid. Soc. 16: 131-135, 1 pl.

_____, 1962c. Are domestic animals overgrazing the Keoladeo Ghana Sanctuary in Rajasthan? Jour. Bombay nat. Hist. Soc. 59: 645-649, 2 pls.

dos Passos, Cyril F. 1964. A Synonymic List of the Nearctic Rhopalocera. Lepid. Soc. Mem. No. 1, v + 145 pp.

Evans, W.H. 1910. Additions and corrections to certain local butterfly lists, with the description of a new species. Jour. Bombay nat. Hist. Soc. 20: 423-427.

Evans, W.H. 1920. A note on the species of the genus Mycalesis (Lepidoptera), occurring within Indian limits. Jour. Bombay nat. Hist. Soc. 27: 354-362, 4 pls.

_____. 1927. The Identification of Indian Butterflies, 1st ed. Bombay Natural History Society, Bombay. xi + 302 pp., 32 pls.

_____. 1932. The Identification of Indian Butterflies, 2nd ed., rev. Bombay Natural History Society, Bombay. xi + 302 pp., 32 pls.

_____. 1949. A Catalogue of the Hesperiidae from Europe, Asia, and Australia in the British Museum (Natural History). The British Museum (N.H.), London. xix + 502 pp., 53 pls. (11 col.).

_____. 1955. A revision of the genus Tarucus (Lepidoptera: Lycaenidae) of Europe, North Africa and Asia. Entomologist 88: 179-187, 14 figs.

Fraser, F.C. 1911. Notes on Colotis in Sind. Jour. Bombay nat. Hist. Soc. 20: 867-869.

Fruhstorfer, H. 1912. Nymphalidae (pars), pp. 453-640. In A. Seitz, 1927, The Macrolepidoptera of the World. vol. 9, The Indo-Australian Rhopalocera. Alfred Kernen, Stuttgart.

Gabriel, A.G. 1943. A revision of the genus Ixias Hübner (Lepidoptera: Pieridae). Proc. Roy. Ent. Soc. Lond. (B) 12: 55-70.

Goldschmidt, Richard B. 1945. Mimetic polymorphism, a controversial chapter of Darwinism. Quart. Rev. Biol. 20: 147-164; 205-230.

Longstaff, George B. 1912. Butterfly-Hunting in Many Lands. Longmans, Green and Co., London. xviii + 728 pp., 16 pls. (7 col.)

MacPherson, A.D. 1927. Notes on a collection of butterflies made in Jodhpur and Mount Abu during the years 1924, 1925 and 1926. Jour. Bombay nat. Hist. Soc. 32: 228-230.

Maheshwari, J.K. 1963. The Flora of Delhi. Council of Scientific and Industrial Research, New Delhi. 447 pp.

Marshall, Guy A.K. 1901. Some experiments in seasonal dimorphism. Ann. Mag. Nat. Hist. 8 (7th ser.): 398-403.

Menesse, N.H. 1950. Butterflies of Sind. Jour. Bombay nat. Hist. Soc. 49: 20-24.

Moore, F. 1890-1892. Lepidoptera Indica, vol. 1. Lovell Reeve & Co., London. xii + 317 pp., 94 pls.

_____. 1893-1896. Lepidoptera Indica, vol. 2. Lovell Reeve & Co., London. vii + 274 pp., 96 pls.

_____. 1896-1899. Lepidoptera Indica, vol. 3. Lovell Reeve & Co., London. viii + 254 pp., 96 pls.

Moore, F. 1899-1900. Lepidoptera Indica, vol. 4. Lovell Reeve & Co., London. viii + 260 pp., 92 pls.

Mosse, A.H. 1929. A note on the butterflies and hawk-moths of Kathiawar. Jour. Bombay nat. Hist. Soc. 33: 888-892.

Mukherjee, Sunil Kumar. 1953. Vegetation of the Delhi "Ridge." Jour. Bombay nat. Hist. Soc. 51: 439-465.

Nicéville, Lionel de. 1886. The Butterflies of India, Burmah, and Ceylon, vol. 2. Calcutta Central Press Co., Ltd., Calcutta.

Nurse, C.G. 1899. Lepidoptera taken in Cutch. Jour. Bombay nat. Hist. Soc. 12: 511-514.

Peile, H.D. 1911. Some butterflies taken at Fatehgarh. Jour. Bombay nat. Hist. Soc. 20: 873-875.

Percy-Lancaster, S. 1949. The butterfly Danaus chrysippus in Calcutta. Jour. Bombay nat. Hist. Soc. 48: 381.

Pronin, Georg. 1964. The mating time of Lepidoptera. Jour. lepid. Soc. 18: 35-41.

Rhé-Philipe, George W.V. de. 1902. The butterflies of the Lucknow District. Jour. Bombay nat. Hist. Soc. 14: 481-493.

_____. 1905. Further notes on the butterflies of Lucknow District. Jour. Bombay nat. Hist. Soc. 16: 720-722.

Rhé-Philipe, George W.V. de. 1917. The butterflies of Lahore. Jour. Bombay nat. Hist. Soc. 25: 136-142.

Robson, S. 1893. Notes on Argynnis niphe, Linnaeus, a nymphalid butterfly. Jour. Bombay nat. Hist. Soc. 8: 151-152.

Sanders, D.F. 1930. Occurrence of Colias hyale hyale and Pieris canidia indica in the plains. Jour. Bombay nat. Hist. Soc. 34: 591.

_____. 1955. Miscellaneous notes on Indian butterflies. Jour. Bombay nat. Hist. Soc. 52: 803-830.

Saxton, W.T. 1924. Phases of vegetation under monsoon conditions. Jour. Ecol. 12: 1-38, 57 figs.

Seitz, Adalbert. 1927. The Macrolepidoptera of the World. Vol. 9, The Indo-Australian Rhopalocera. Alfred Kernen, Stuttgart. vii + 1197 pp., 177 col. pls.

Sevastopulo, D.G. 1944. Seasonal forms of Indian Satyridae (Lep. Rhop.). Entomologist 77: 164-166.

_____. 1947. The relative abundance of the various female forms of Papilio polytes L. in Calcutta. Entomologist 80: 172-173.

_____. 1948. Local lists of Lepidoptera from the Punjab and U.P. Jour. Bombay nat. Hist. Soc. 47: 586-593.

_____. 1950. Seasonal forms of Catopsilia spp. Jour. Bombay nat. Hist. Soc. 49: 570.

Sevastopulo, D.G. 1956. The relative abundance of the three female forms of Papilio polytes L. in Calcutta. Jour. Bombay nat. Hist. Soc. 53: 741.

Sohoni, V.V. 1953. Climatological Tables of Observatories in India. Government Central Press, Bombay.

Swinhoe, C. 1886. On the Lepidoptera of Mhow, in Central India. Proc. Zool. Soc. Lond. 1886: 421-465, 2 pls.

_____. 1887. On the Lepidoptera of Karachi and its neighbourhood. (Part I.). Jour. Bombay nat. Hist. Soc. 2: 269-280.

_____. 1905-1910. Lepidoptera Indica, vol. 7. Lovell Reeve & Co., London. x + 286 pp., 89 col. pls.

_____. 1910-1911. Lepidoptera Indica, vol. 8. Lovell Reeve & Co., London. ix + 293 pp., 67 col. pls.

_____. 1911-1912. Lepidoptera Indica, vol. 9. Lovell Reeve & Co., London. viii + 278 pp., 51 col. pls.

_____. 1912-1913. Lepidoptera Indica, vol. 10. Lovell Reeve & Co., London. x + 364 pp., 79 col. pls.

Talbot, G. 1939. The Fauna of British India--Butterflies. Vol. 1, 2nd ed. Taylor and Francis, Ltd., London. xxix + 600 pp., 3 col. pls.

_____. 1947. The Fauna of British India--Butterflies. Vol. 2, 2nd ed. Taylor and Francis, Ltd., London. xv + 506 pp., 2 col. pls., 1 map.

Tite, G.E. 1959. The genus Catochrysops Lepidoptera: Lycaenidae. Entomologist 92: 201-212, 2 pls.

_____. 1963. A synonymic list of the genus Nacaduba and allied genera (Lepidoptera: Lycaenidae). Bull. Brit. Mus. (N.H.) Ent. 13: 67-116, 2 pls, 91 figs.

Wynter-Blyth, M.A. 1957. Butterflies of the Indian Region. Bombay Natural History Society, Bombay. xx + 523 pp., 72 pls. (27 col.).