

THE BUTTERFLIES OF BARKUDA ISLAND

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We are indebted for the identification of all but a few common and conspicuous species of the butterflies to Lt.-Col. W. H. Evans, R.E., whose experience of the Indian species and races of this group renders the names we employ at any rate consistent. There are few groups of animals in which there is greater divergence of opinion as to taxonomy and nomenclature than the butterflies, and there are doubtless some entomologists to whom the names used by the late Col. Bingham in his two volumes in the "Fauna of British India," or those used in yet some other work by some other author, would be more acceptable. The names here used are mostly those employed by Col. Evans, in his valuable list of the Indian Butterflies published in the *Journal of the Bombay Natural History Society*, Vol. XXI (1911-13). The numbers in brackets after the name of each species refer to the page numbers of his paper. In a few minor cases names have been altered to accord with recent advances in knowledge. We must express to Col. Evans our sincere thanks for his assistance in naming specimens, without which our records would have had little value. We have also to thank him for looking through our manuscript and for making valuable suggestions.

GENERAL CHARACTER OF THE BUTTERFLY FAUNA.

The general character of the butterfly fauna of the island may be indicated briefly. It consists almost exclusively of wide-ranging, adaptable species of common occurrence in the central part of Peninsular India. None of the species or races peculiar to the Ganjam or adjacent districts are found. The only geographical interest of the fauna is that it provides evidence that the southern end of the Chilka Lake is to some extent the frontier, so far as the butterflies are concerned, between the fauna of the central and that of the southern districts of the Peninsula. The peculiar character of the vegetation of the island,¹ however, has proved a selective influence, and the caterpillars of the resident forms are such as are able to feed on tough, leathery leaves (e.g. *Papilio polytes* on *Glycosmis pentaphylla*), or, on very small herbs capable of existing on dry stony soil, as *Hypolimnas bolina* on *Justicia diffusa* var. *procumbens*. Species that feed on grasses or on the

¹ See Annandale, *Mem. Asiat. Soc. Bengal* VII, No. 4 (*in the Press*).

larger herbaceous plants are either absent, or occur merely as occasional visitors in the imago state. In many cases the food-plants are not those with which the caterpillar is commonly associated. The fact that a single larva of *Papilio aristolochiae* (usually a rare butterfly on the island, on which *Aristolochias* do not grow) was found associated with one of *P. hector* (a butterfly of fairly common occurrence but not abundant on Barkuda) and feeding on the leaves of the Sword-bean *Canavalia ensiformis* is particularly noteworthy in this connection. The scarcity of the Satyrinae and the comparative paucity of most Lycaenid and Hesperiid genera are also noteworthy features, and are probably due to the absence of suitable food-plants. The few skippers that occur are mostly immigrants.

The habit of immigration is also prevalent among some of the most abundant resident Nymphalidae and Papilionidae such as *Danais chrysippus*, *Papilio polytes* and *P. demoleus*, while it is probably habitual among the larger Pieridae such as the species of *Catopsilia*. No large flights of any butterfly were observed: the immigrants flew singly across the lake.

THE ENEMIES OF BUTTERFLIES ON BARKUDA.

Insectivorous mammals, birds and reptiles are scarce on Barkuda, and many of the common species known to feed on butterflies, absent. Those enemies of butterflies that exist on the island do not seem to be particularly discriminate in their choice of food, as the remains of unpalatable butterflies such as the Danaines are not infrequently to be found in circumstances that prove they have served as food for vertebrates. On the few occasions that mynas and crows were seen actually attacking a butterfly, it was either the "distasteful" *Danais chrysippus*, or a Lycaenid. The "Blues", however, seemed to form quite an appreciable part of the daily diet of the mynas, and these birds have been watched eating the butterflies, frequently denuding them of their wings and legs before doing so.

Small flocks of Bee-eaters (*Merops viridis*) often fly over from the mainland and do much damage among *Papilio polytes*, in spite of its skill in eluding pursuit among thickets of shrubs. The remains of this butterfly can be seen on the ground, under the branches where these birds have perched in the intervals of their short and rapid flights.¹

In short, the butterflies most liable to attack by birds on Barkuda are the commonest and most conspicuous species. Conditions are peculiar, however, in that the two genera of birds that most frequently attack butterflies are not habitual butterfly-eaters in the sense that the bee-eaters, etc., are. The more indis-

¹ Marshall, (*Trans. Ent. Soc. Lond.*, 1909, p. 339) remarks that Bee-eaters probably cut off the wings of the butterflies they capture before eating them. To this view we ourselves incline as the wings only of *P. polytes*, in most cases neatly severed from the humerus, were found.

criminate feeders among birds, such as crows and mynas, which (as is evident from their omnivorous habits) are indifferent to the precise nature and taste of their food, will probably eat almost anything not actually poisonous when pressed by hunger. Moreover, though the proof that birds do eat butterflies, unpalatable and otherwise, is now convincing, the number of individuals they destroy must be comparatively small, as is shown by the amount, and kind of evidence it was necessary to collect all over the tropics in order to prove that they did so. We have no evidence that the crows and mynas seen attacking distasteful butterflies on Barkuda were young birds. Nor were such attacks often observed, and it is by no means improbable that creatures so perverse as the Indian crows, in which something very like reason and almost what we may call a sense of humour are strongly developed, may sometimes attack and even devour butterflies in mere wantonness.

Lizards (*Calotes versicolor major*) were observed devouring *Danais chrysippus* both on the island and on the mainland a few miles away, and a tree-snake (*Dendrelaphis tristis*) was once seen eating a specimen of *Colotis calais amatus*. These reptiles, though by no means abundant on Barkuda, are not actually scarce.

EVIDENCES OF THE ATTACKS OF ENEMIES.

In writing on butterflies showing evidence of the attacks of enemies, it is necessary not to regard every damaged butterfly as one which has been attacked, for it is probable that butterflies are often damaged in sudden gusts of wind while wending their way through dense jungle, and that these damages sometimes look like the injuries caused by enemies. As a general rule, however, the results of wear and tear show mostly on the forewings, while the injuries caused by birds or lizards are usually present on the hind wings. The only instances in which it is reasonably certain that a butterfly has been attacked by a vertebrate enemy are those in which its injuries are quite symmetrical, but in others, with caution and experience, a fairly accurate conclusion may be reached. In drawing up the table on p. 352 we have been careful to include in the "injury" columns only those specimens which have been symmetrically injured, or, *perfectly fresh* specimens which have undoubtedly been injured by a bird or lizard, as is shown by the form of the injury. Worn specimens though apparently damaged by an enemy have been included in the "perfect or worn" section, as it is possible that their injuries have been caused by various accidents.

Only the commonest or more interesting species have been included in the table. The data we have collected would seem by themselves to show that the local Lycaenidae and Hesperidae are either rarely attacked by enemies, or, are not able to escape at the cost of a damaged wing, but it is significant that the Pieridae would seem also to be more or less immune from attack. This is probably due to a number of factors in environment and

Name of Species.	No. of individuals captured.	No. of symmetrically injured individuals.	No. of individuals apparently injured by birds.	No. of individuals apparently injured by lizards.	No. of perfect or worn individuals.	REMARKS.
NYMPHALIDAE.						
Danais chrysippus	15 ♂, 5 ♀	..	2 ♂, 1 ♀	1 ♀	13 ♂, 3 ♀	..
Euploea core	1 ♂, 10 ♀	1 ♀	..	..	1 ♂, 9 ♀	..
Hypolimnias bolina	6 ♂, 8 ♀	1 ♂, 1 ♀	1 ♂, 2 ♀	1 ♀	4 ♂, 4 ♀	The females seem to be more attacked than the male in spite of the "mimicry."
Junonia lemonias	8 ♂, 4 ♀	..	2 ♂	..	6 ♂, 4 ♀	....
Telchinia violae	12 ♂, 4 ♀	..	..	..	12 ♂, 4 ♀	..
PAPILIONIDAE.						
Papilio hector ..	3 ♂, 1 ♀	..	2 ♀	..	1 ♂ 1 ♀	One of the perfect specimens was bred from the larva.
Papilio aristolochiae	3 ♂, 4 ♀	2 ♀	..	..	3 ♂, 2 ♀	....
Papilio demoleus	4 ♂, 3 ♀	..	1 ♀	..	4 ♂, 2 ♀	This butterfly is very common at certain seasons, but damaged specimens have seldom been observed.
Papilio polytes romulus, ♂ ...	33	1	1	1	30	The males seem to possess the greatest protection.
Papilio polytes romulus, ♀ f. cyrus, ..	2	..	..	..	2	....
Papilio polytes romulus ♀ f. polytes, ..	30	2	2	1	25	Specimens have often been seen with the greater part of the hindwing torn off apparently by a bird.
Papilio polytes romulus, ♀ f. romulus, ..	11	1	..	..	10	Appears to be better protected than the preceding ♀ form.
PIERIDAE.						
Leptosia xiphia	8 ♂, 2 ♀	..	..	..	8 ♂, 2 ♀	..
Ixias pyrene pirenassa ..	7 ♂, 4 ♀	1 ♂	2 ♂	..	4 ♂, 4 ♀	..
Pareronia valeria hippia ..	12 ♂	..	2	..	10	..
Colotis calais amatus ..	15 ♂, 3 ♀	..	..	1 ♂	14 ♂, 3 ♀	..

habits, amongst others that bush-lizards are rare on the island, and bush-hunting birds practically non-existent, while the mynas usually seize butterflies by the body rather than the wings.

NOTES ON THE FLIGHT OF SUNDRY BUTTERFLIES ON THE ISLAND.

The mode of flight of butterflies is dependent to a large extent on circumstances such as the time of day, the strength and direction of the wind, the condition of the barometer, the approach of enemies and sexual excitement. Hence isolated observations are often apt to be misleading. We offer the following observations for what they are worth.

One of two captured specimens of the Satyrine, *Melanitis leda ismene*, was found flying at dusk in a slow jerky manner making short circuits and settling on a shrub for a moment. It returned again and again to the same tree. The same habit was observed in other specimens not captured.

The female of *Hypolimnas bolina* has occasionally been seen flying along at the height of about a hundred feet, rapidly vibrating its wings for a short while, then gliding for a few yards, often ascending higher and higher. Then, after reaching a considerable height, it descends quite near to the ground. Apparently *Euploea core* often flies in like manner, but it is impossible to distinguish the two species at the elevation reached, and it is only after they have descended that we have been able to discriminate them.

Neptis hylas astola (= *eurynome*, Bing.) has a peculiar, fluttering weak flight, but when alarmed it worms its way through thick shrubbery or ascends to considerable heights. It has a peculiar habit of returning to its old beat after a time.

The Junonias as a rule fly low and swiftly.

The Acraeid *Telchinia violae* hovers about low herbage and is quite easy to capture, though it seems to suffer little from the attacks of enemies.

Papilio hector does not fly swiftly, but it steers an even course and has a sustained flight. The general impression gained is that it is flying mainly with its forewings. *P. aristolochiae* flies in a somewhat similar manner, but sails about more slowly, and the vibrations of the forewings are not so pronounced.

The flight of all the forms of *Papilio polytes* is more or less similar, except that the *romulus* form of female has a stronger and higher flight than the rest. In *P. polytes* the flight is generally swift and erratic and it seems as if the whole wing surface and not only the forewings were being used. Often the flight is slow and somewhat similar to that of *Euploea core*, from which at a distance, the males and *cyrus* female can scarcely be distinguished.

Papilio demoleus flies rather low but very rapidly, and is one of the most difficult Papilios to capture.¹ A peculiarity about

¹ Dr. Hankin (*Proc. Third Ent. Meet. Pusa*, III, pp. 900-903, 1920) notes the comparative invisibility of *P. demoleus* during flight.

most Papilios is that while at rest on a tree, especially when feeding on flowers, they keep on fluttering their wings. This habit is least marked in *P. demoleus* and most pronounced in *P. polytes*, the "mimetic" females especially. It is possibly connected with the maintenance of balance.

The larger Pierids on the island fly high and swiftly, and are able to wend their way through thick jungle with remarkable dexterity. *Colotis calais amatus* flies rather feebly and low. The feeblest Pierid on the wing is the little *Leptosia xiphia*, which rarely rises more than a few feet from the ground and is most at home among undergrowth.

OBSERVATIONS ON THE DANAINAE.

On Barkuda the habits of this interesting group are very much the same as those described by previous authors elsewhere. The statement that the butterflies are capable of flying long distances is borne out by the fact that we have often seen individuals flying in their characteristic manner over a considerable stretch of water to the mainland, to the neighbouring islands and even across the lake, a distance of about six miles.

In *Euploea core*, *Danais plexippus* and *D. chrysippus* the mating is usually prolonged, the pair flying about from plant to plant. The male often takes an active part in the nuptial flight, but also, perhaps in the latter part of the flight, is often quite inert, being dragged behind her through the air by the female. The pair occasionally rest on a shrub for a period during which they are very sluggish and can be captured with ease. In *Euploea* the anal pencils of the male are erected continuously for long periods during flight, probably before mating takes place. The male of *Hypolimnas bolina* has on two occasions been observed hovering round *Euploea core*, as if uncertain whether it was the female of his own species or not.

When separated during mating, or when attacked, a drop of straw-coloured fluid is emitted at the tip of the pencils and from the scent glands on the wing, but we have not observed any approximation of the two pairs of organs.¹

MISCELLANEOUS NOTES.

In August, 1920 a single specimen of *Vanessa cardui* was observed to turn its tail towards the sun deliberately, in such a way as to cast no shadow, but this does not necessarily imply that it did so for a purpose. The movement may have been due purely to temperature reaction.

The black and white *Neptis hylas astola* is very inconspicuous when resting on a leaf. It deliberately selects a leaf situated under an overhanging bough, so as to receive the benefit of the shade that is thrown on it. The butterfly rests pressed against

¹ See Eltringham, *Trans. Ent. Soc. Lond.*, 1913, p. 399, and for a description of the scent organs in *Danais chrysippus*, Eltringham, *ibid.*, 1915, pp. 166-168.

the leaf with its wings in line with the body in typical moth-like fashion, and is very difficult to distinguish.

Resistance to pressure on the thorax and to cyanide has been confirmed by us in the case of the Danaines, *Euploea core*, *Danais plexippus* and *D. chrysippus*, *Papilio hector*, *P. aristolochiae* and *P. polytes* have also been noted by us as "tenacious of life." Specimens of these species have not infrequently been found alive in the papers weeks after having been apparently killed.

"Gregariousness" has been noted in *Euploea core*, *Danais chrysippus*, *Hypolimnas bolina* and *H. misippus*. *Papilio polytes* is also a gregarious insect and hundreds of them swarm round their favourite food-plant, *Glycosmis pentaphylla*, in the "rains." Of the Pieridae, the Catopsilias, Ixias, and Terias have been noted as fond of congregating. On a single occasion *Colotis calais amatus* was seen in fairly large numbers round a tree (probably *Salvadora persica*) by the shore, and the little Lycaenid *Chilades laius* was also found congregating in numbers which did not exceed forty, round a low bush. As we have already noted, however, no large flights of any specimens were observed.

OBSERVATIONS ON *Papilio polytes*.

Much has been written on the polymorphism and sexual habits of this butterfly and an excellent summary of the work of previous authors will be found in Punnett's *Mimicry in Butterflies* (Cambridge: 1915). The most detailed investigation is that of Fryer published in the *Phil. Trans. Roy. Soc. Lond.* (ser. B.) Vol. CCIV (1914). Two brief notes have recently been published by P. Susainthan and Bainbrigge-Fletcher in *Bulletin* No. 89, of the *Agricultural Research Institute, Pusa*. Poulton has also published a paper in the *Proc. Third Ent. Meet. Pusa*, III, pp. 903-905 (1920), in which he has recounted the data on the numerical ratio of the female forms which have appeared in the Entomological Society's "Proceedings."¹

We offer no opinion on the origin or function of the mimicry believed to exist in this species, but print our observations for their face value.

In 1919 and 1920, the following observations were made on Barkuda, where this butterfly is probably the most abundant. Its caterpillar feeds there on the leaves of the shrub *Glycosmis pentaphylla* of the family Rutaceae, one of the most abundant plants on the island.

Courtship. In natural conditions the courtship is normally prolonged. In one instance a pair were found *in copula* in which the wings of the female were still damp and flaccid, but this was evidently abnormal as the nuptial flight (in which the male is carried passively, adhering to the female) is as a rule prolonged and vigorous. There is evidence, moreover, that generally some time elapses after the imago emerges before court-

¹ Prof. Poulton will also shortly publish a paper in the *Proc. 4th Ent. Meet.* at Pusa, in 1921.

ship takes place. Large numbers of individuals of both sexes with quite fresh but stiff wings, were often observed feeding on the honey of the flowers of *Vitis vitifolia*, *Zizyphus oenoplia*, *Premna latifolia* and *P. wightiana* without manifesting any sexual attraction to one another, whereas a large proportion of the individuals seen mated had worn wings.

When the female is ripe for mating she sits on a leaf in a conspicuous position, with the wings spread out, but with the forewing turned a little backwards over the hind-wing. If a male approaches she raises and flutters her wings gently. The male flies up to her with a fluttering motion from behind and they often sit together for some time, both waving their wings. They then begin to fly together for short or even for long distances, moving their wings very rapidly but progressing slowly, each occasionally striking the other with the forewings. This process goes on for some time, often as long as half an hour, and the female appears at times to be as ardent as the male. The pair occasionally settle and then flutter away for a short distance before settling again. They often hover vertically in the air for a time without changing their position. While the courtship is in progress a second male often approaches. Sometimes the first suitor gives way to him, and sometimes the new comer flies off himself, after fluttering round the pair for a short while. On more than one occasion a male of *Euploea core* has been observed fluttering round a courting pair but, though evidently attracted, he never stayed for long.¹ Nothing of the nature of a fight ever takes place. The curious thing about the whole affair is that in a very large proportion of cases the male apparently tires of his courtship before mating, and suddenly flies away. Rarely, the female flies after him. A sudden and premature conclusion to the courtship seems to occur more frequently than not. Either the female has the power of repelling the male after a mere flirtation, or else a large proportion of the males are incapable, or not desirous, of mating, though eager for courtship. These facts may express the difficulty experienced by Fryer in getting captive butterflies of this species to mate.²

Numerical ratio of the female forms. All three forms of the female of *P. polytes* were taken on Barkuda and numerous attempts were made to ascertain the proportionate numbers in which they normally occurred. Two facts were clear: that the *polytes*³ form

¹ Ghosh (*Mem. Dept. Agricul. Ind.*, V, No. 1, p. 34) states that he has seen a male of *Papilio demoleus* apparently attempting to mate with a female of *P. polytes* (= *pammon*). On a single occasion this was observed in Calcutta, and *P. demoleus* has also often been seen interrupting a courting pair. Ghosh's paper also contains a good description of the life-history of *P. demoleus* and *P. polytes*, the caterpillars of which often live together.

² Cf. Fryer (*op. cit.*, p. 231). He gives a description of what he calls an absolutely typical mating, but his observations were made on captive butterflies, and the description he gives applies to a case similar to the one cited above as abnormal.

³ We also obtained a variety of this form known as *stichius*, Hub., in which there is no white spot on the cell of the hind wing.

(resembling *P. aristolochiae*) was much the most abundant and that the *cyrus* form (resembling the male of its own species) was extremely rare. Though large numbers of males were caught and examined, only one female of this type was taken in two seasons. We failed to obtain any very exact data as to the relative numbers of the *polytes* and *romulus* forms for three reasons: firstly, because it is often very difficult to distinguish the latter from *P. hector* on the wing in dense thickets when the colour of the body cannot always be seen;¹ secondly, because this form has a stronger and higher flight than the *cyrus* form and is therefore less easily captured; and lastly, because we found very great discrepancy in the numbers taken on different occasions even at the same season. On the whole it seems probable that on Barkuda the *polytes* form is at least three times as abundant as the *romulus* form.

In Calcutta and its environs the *polytes* form is at least twice (if not more) as common as the *romulus* form,² while the *cyrus* form is decidedly rare. *P. hector*, it may be mentioned, appears to be sometimes more abundant here than *P. aristolochiae*, but at one time when a species of *Aristolochia*, was cultivated in the Museum garden, *P. aristolochiae* became very common in the compound. Tytler speaks of the *cyrus* form in Manipur as "decidedly rare" and Bell speaks of this form in similar terms in Bombay. In the Eastern and Western Himalayas this form is also scarce and even in parts of South India (as Bangalore and Madras) it is the rarest of the three female forms. Punnett's remark, "It is generally agreed among observers who have studied this species that of the three forms of female the M [*cyrus*] form is distinctly the most common, while of the other two the H [*romulus*] is rather more numerous than the A [*polytes*]" is therefore not applicable to Barkuda or to the other places mentioned. Indeed, it is probably inapplicable to all parts of continental India.

We give here a tabular *resumé* of what else is known on the proportions of the female forms of *P. polytes* as it is likely to prove an useful addition to the remarks we have made above.

¹ We cannot accept Punnett's statement that to the ordinary man accustomed to use his eyes the *romulus* form is easily distinguishable from *P. hector*. (At any rate it is not my experience after twenty years of the jungle. N. A.)

² Col. Evans reminds us that the *polytes* form may be commoner still as the *romulus* form gradually disappears to the north-east with the disappearance of *P. hector*.

In a fortnight's visit to Chandipore, on the sea-coast of Orissa, neither *Papilio hector* nor *P. aristolochiae* were seen. The proportions of the various forms of female of *P. polytes* were curious. The *romulus* ♀ was the most abundant, while the *polytes* ♀ was extremely rare. The *cyrus* ♀ was never captured. The males, though not as abundant as the *romulus* ♀, were not uncommon and, strangely enough, the majority were the form with reddish markings. This would seem to corroborate Prof. Punnett's theory that these males are in some way connected with the *hector*-like female of the species. C. D.

Locality.	References.	REMARKS
Ashambo Hills, 6 to 40 miles N.W. of Cape Comorin. Bangalore district ...	Pusa, ¹ p. 904 ... J.B.N.H.S. XXI, p. 699, Ent. Month Mag. 1920, p. 201.	The <i>romulus</i> ♀ apparently nearly twice as common as the <i>polytes</i> ♀, and <i>cyrus</i> ♀ extremely rare. The <i>polytes</i> ♀ the prevailing form.
Benares...	J.B.N.H.S. XXVI, p. 690.	The <i>cyrus</i> ♀ and the <i>polytes</i> female not uncommon. Only one damaged <i>romulus</i> ♀ taken.
Burma ...	.....	Col. Evans informs us that the <i>romulus</i> ♀ does not occur in Burma.
Dehra Dun ...	.....	The <i>romulus</i> ♀ not common. The <i>cyrus</i> ♀ is not as common as the <i>polytes</i> ♀.
Hong Kong and Macao districts.	Pusa, p. 905 ...	The male-like ♀ commonest, <i>polytes</i> ♀ rare, <i>romulus</i> ♀ unknown.
Johore, Malay Peninsula.	Pusa, p. 905 ...	The <i>polytes</i> ♀ apparently nearly twice as common as <i>cyrus</i> . Dr. Seitz only remembers the <i>polytes</i> ♀ in this locality.
North Kanara ...	P.E.S. 1914, p. 99 ...	The <i>cyrus</i> ♀ exceedingly rare, <i>polytes</i> and <i>romulus</i> ♀ ♀ about equally common, the latter perhaps slightly the commoner.
The Konkan ...	J.B.N.H.S. XV p. 52.	The commonest female is <i>polytes</i> , <i>romulus</i> ♀ is not rare, and <i>cyrus</i> entirely (?) absent.
Kumaon ...	J.B.N.H.S. XX, p. 361.	The <i>romulus</i> ♀ seems to occur only in the Terai; <i>cyrus</i> ♀ never seen.
Lucknow district ...	J.B.N.H.S. XIV, p. 492.	The <i>cyrus</i> ♀ absent, <i>polytes</i> ♀ common, and <i>romulus</i> ♀ rare. "Its (<i>romulus</i> ♀) appearance is rather surprising as its model is never, as far as I know, found in Upper India."
Madras city ...	P.E.S. 1915, pp. 92-94.	The <i>cyrus</i> ♀ absent, <i>polytes</i> and <i>romulus</i> ♀ ♀ about equally common.
Singapore Island ...	Pusa, p. 905.	The <i>polytes</i> ♀ commoner than <i>cyrus</i> ♀.
Tavoy district ...	J.B.N.H.S. XXVII, p. 895.	Only two forms of ♀ have been taken; the <i>cyrus</i> and <i>stichius</i> .
Tharawaddy and the Pegu Yoma.	J.B.N.H.S. XXV, p. 111.	The <i>aristolochiae</i> like ♀ (<i>polytes</i>) was the only one taken.

Red markings of the male.

In *Spolia Zeylanica*, pp. 21 and 22, Prof. Punnett has suggested that there might be some connection between the amount of red markings and the constitution of the male, and that the "red" males are intimately connected with the *romulus* female, in which the red markings are most developed. With this theory in mind we examined all the males brought from Barkuda with the following results: of 33 individuals

¹ Rep. Proc. 3rd Ent. Meet. Pusa, III, p. 904-905 (1920).

27 were of the variety without red markings, 5 corresponded to Prof. Punnett's "Int. II" series, and a single individual to his "Int. I." Our observations in the field also show that the "no red" males are the most abundant, while the "red" or "Int. I" males are very scarce. The scarcity of males with red markings may be connected to some extent with the comparatively hot and dry climate of Barkuda, but further investigations are necessary.

We obtained no direct evidence as to the utility of mimicry in this species. *Papilio hector* is fairly common but never very abundant on the island, while *P. aristolochiae* is usually rare, although it became common in September and October, 1920. Both species are, however, common in the neighbouring districts; neither breeds habitually on Barkuda, and both are capable of flying over from the mainland. Indeed, even *P. polytes* was frequently observed doing so, though it certainly breeds in considerable numbers in the thickets of *Glycosmis* that cover a large part of the island. In our opinion its abundance is probably due not so much to any special freedom from attack bestowed upon it by its polymorphic and "mimetic" females as to the abundance of its food-plants both as larva and as imago, the scarcity of competitors, and its skill in threading its way through the dense branches and foliage of the shrubs.

The observation that *Euploea core*, which has a distinct resemblance on the wing to the male and *cyrus* form of *P. polytes*, is attracted to apparent but not prolonged rivalry by the courtship of the *Papilio* is not without interest in suggesting speculations as to the role of colouration in the sexual life of butterflies. The female in the instances in which this was noted was of the *romulus* form.¹

LIST OF THE SPECIES OF BARKUDA.

Family NYMPHALIDAE.	<i>Atella phalanta</i> , Drury.
<i>Danais limniace</i> , Cram.	<i>Telchinia violae</i> , Fab.
<i>Danais plexippus</i> , Linn.	Family PAPILIONIDAE.
<i>Danais chrysippus</i> , Linn.	<i>Papilio hector</i> , Linn.
<i>Euploea core</i> , Cram.	<i>Papilio aristolochiae</i> , Fab.
<i>Mycalesis visala</i> , Moore.	<i>Papilio demoleus</i> , Linn.
<i>Melanitis leda ismene</i> , Cram.	<i>Papilio polytes romulus</i> , Cram.
<i>Eulepis athamas</i> , Drury.	<i>Papilio nomius</i> , Esp.
<i>Neptis hylas astola</i> , Moore.	<i>Papilio doson eleius</i> , Fruh.
<i>Junonia lemonias</i> , Linn.	Family PIERIDAE.
<i>Junonia orithyia</i> , Linn.	<i>Leptosia xiphia</i> , Fab.
<i>Junonia almana</i> , Linn.	<i>Anaphaeis mesentina</i> , Cram.
<i>Vanessa cardui</i> , Linn.	<i>Huphina nerissa evagete</i> , Cram.
<i>Hypolimnas bolina</i> , Linn.	<i>Appias libythea</i> , Fab.
<i>Hypolimnas misippus</i> , Linn.	

¹ See Eltringham, *Trans. Ent. Soc. Lond.* 1919, pp. 1-49.

<i>Appias albina confusa</i> , Fruh.	<i>Azanus ubaldus</i> , Cram.
<i>Ixias pyrenè pirenassa</i> , Wall.	<i>Castalius rosimon</i> , Fab.
<i>Ixias marianne</i> , Cram.	<i>Lampides hochus</i> , Cram.
<i>Catopsilia pyranthe</i> , Linn.	<i>Lampides celeno</i> , Cram.
<i>Catopsilia pomona</i> , Fab.	<i>Polyommatus boeticus</i> , Linn.
<i>Terias libythea</i> , Fab.	<i>Curetis thetis</i> , Drury.
<i>Terias hecabe</i> , Linn.	<i>Curetis bulis</i> , Db. and Hew.
<i>Terias silhetana</i> , Wall.	<i>Aphnaeus vulcanus</i> , Fab.
<i>Colotis calais amatus</i> , Fab.	<i>Iraota timoleon</i> , Stoll.
<i>Pareronia valeria hippia</i> , Fab.	<i>Loxura atymnus</i> , Cram.

Family LYCAENIDAE.

<i>Neopithecops zalmora</i> , But.
<i>Chilades leius</i> , Cram.
<i>Zizera lysimon karsandra</i> , Moore
<i>Catachrysops strabo</i> , Fab.
<i>Catachrysops cnejus</i> , Fab.

Family HESPERIIDAE.

<i>Badamia exclamationis</i> , Fab.
<i>Hasora butleri</i> , Aurivill.
<i>Telicota bambusae</i> , Moore.
<i>Parnara bada</i> , Moore.
<i>Parnara colaca</i> , Moore.

ANNOTATED LIST OF THE SPECIES OF BARKUDA.¹

Family NYMPHALIDAE.

Danais limniace, Cram. (560).

1905. *Danais limniace*, Bing., *Faun. Brit. Ind.*, Butt. I, p. 16.
 1910. *Danaida limniace*, Fruh., in Seitz's *Macrolepidop. World*, div. 11, Sect. 11, p. 204.

Barkuda, I-ix-19.

Hab.—India, Burma, Ceylon and the Nicobars. Also Siam and China.

Remarks.—A single female was the only one captured, but the species is not uncommon in thickets in October.

Danais plexippus, Linn. (560).

1905. *Danais plexippus*, Bing., *tom. cit.*, p. 10.
 1910. *Danaida plexippus*, Fruh., *tom. cit.*, p. 194.

Barkuda, II and 24-viii-19; II and 22-iv-20.

Hab.—Throughout our limits, including the Nicobars, and extending to Siam, China and the Malay Peninsula.

Remarks.—Rather scarce, but occurs at all seasons.

Danais chrysippus, Linn. (560).

1905. *Danais chrysippus*, Bing., *tom. cit.*, p. 11, pl. 1, fig. 11.
 1910. *Danaida chrysippus*, Fruh., *tom. cit.*, p. 193.

Barkuda, vii, viii and ix-19; I-29-iv-20; viii-20.

Hab.—A widely distributed species found throughout India, Burma and Ceylon; the Andamans and the Nicobars.

¹ The remarks on distribution are taken mainly from Col. Evans' "List."

Remarks.—One of the commonest butterflies on the island at all seasons. A white pupa was found in October on *Calotropis gigantea*.

***Euploea core*, Cram. (561).**

1905. *Euploea core*, Bing., *tom. cit.*, p. 32, text-fig. 11.

1910. *Euploea core*, Fruh., *tom. cit.*, p. 235.

Barkuda, 10-30-viii-19; 1-6-ix-19; 11-15-xii-19; 9-iv-20.

Hab.—India, Burma and the Andamans.

Remarks.—Fairly common during the "rains," appearing as soon as they commence.

***Mycalesis visala*, Moore (568).**

1905. *Mycalesis visala*, Bing., *tom. cit.*, p. 60.

1911. *Mycalesis visala*, Fruh., *tom. cit.*, p. 346, pl. 91 f.

Barkuda, iv-20.

Hab.—Kumaun to Burma, Central India, Madras.

Remarks.—Occasionally seen among very dense undergrowth in the dry season. The only specimen that was captured flew out into the open at dusk.

***Melanitis leda ismene*, Cram. (570).**

1905. *Melanitis ismene*, Bing., *tom. cit.*, p. 158, text-fig. 36.

1911. *Melanitis leda ismene*, Fruh., *tom. cit.*, p. 362.

Barkuda, 15-xii-19; iv-20.

Hab.—India, Burma and Ceylon.

Remarks.—Also seen occasionally in the dry season. All specimens were of the dry season form.

***Eulepis athamas*, Drury (572).**

1905. *Eulepis athamas*, Bing., *tom. cit.*, p. 220, text-fig. 41.

Barkuda, 18-viii-19.

Hab.—Northern India to Burma.

Remarks.—A single specimen was the only one seen and taken.

***Neptis hylas astola*, Moore (577).**

1905. *Neptis eurynome*, Bing., *tom. cit.*, p. 322, text-fig. 59, pl. ix, fig. 64.

1912. *Neptis hylas astola*, Fruh., *tom. cit.*, p. 602.

Barkuda, 19-viii-20.

Hab.—Himalayas to Upper Burma (hills).

Remarks.—Several individuals were seen in August resting like moths on the leaves of trees in the shade. This species, though mainly a hill species, has also been captured in various localities in the plains.

***Junonia lemonias*, Linn. (579).**

1905. *Junonia lemonias*, Bing., *tom. cit.*, p. 357.

1912. *Precis lemonias*, Fruh., *tom. cit.*, p. 520.

Barkuda, 10-viii-19; 3-ix-19; 1-29-iv-20.

Hab.—India, Burma and Ceylon.

Remarks.—This butterfly was most abundant in April when other butterflies are scarce.

***Junonia orithyia*, Linn. (579).**

1905. *Junonia orithyia*, Bing., *tom. cit.*, p. 358.

1912. *Precis orithyia*, Fruh., *tom. cit.*, p. 522.

Barkuda, 18-viii-19; 3 and 29-ix-19.

Hab.—India, Burma and Ceylon, extending to the Malayan subregion.

Remarks.—Not a common species.

***Junonia almana*, Linn. (579).**

1905. *Junonia almana*, Bing., *tom. cit.*, p. 361.

1912. *Precis almana*, Fruh., *tom. cit.*, p. 519.

Barkuda, 7 and 18-viii-19; 11 and 19-iv-20.

Hab.—India, Burma and Ceylon, extending to China.

Remarks.—Fairly common in August, 1919 and in April, 1920. No specimens were taken in August 1920.

***Vanessa cardui*, Linn. (579).**

1905. *Vanessa cardui*, Bing., *tom. cit.*, p. 365, text-fig. 67.

Hab.—Distributed over the whole world and found in all parts of India, Burma and Ceylon.

Remarks.—Seen once in June, 1920 and in August of the same year.

***Hypolimnas bolina*, Linn. (580).**

1905. *Hypolimnas bolina*, Bing., *tom. cit.*, p. 386, text-fig. 69.

1912. *Hypolimnas bolina*, Fruh., *tom. cit.*, p. 547, pl. 118b.

Barkuda, 10-25-viii-19; 1-4-ix-19, 13-xii-19.

Hab.—India, Burma and Ceylon, extending to the Malayan subregion and China.

Remarks.—Rather common in 1919 in the months stated above but very much scarcer in 1920. The female, which somewhat resembles *Euploea core* on the wing, is approximately twice as common as the male.

The caterpillar was sometimes very abundant in the vicinity of *Justicia diffusa* var. *procumbens*, a plant that exists on dry stony soil. They are black, or very dark rich brown in colour, with nine longitudinal rows of branched spines that extend as far as the 10th segment. The 4th segment has eight spines and the 12th and 13th only two. The head is square in shape and ochraceous or ochraceous-brown in colour, with a pair of branched spines that are rather longer and thicker, and much darker than those on the body.

***Hypolimnas misippus*, Linn. (580).**

1905. *Hypolimnas misippus*, Bing., *tom. cit.*, p. 388.

1912. *Hypolimnas misippus*, Fruh., *tom. cit.*, p. 547.

Barkuda, 27-viii-19 ; 3-6-ix-19 ; 9-iv-20.

Hab.—The same as that of *H. bolina*.

Remarks.—Scarce as compared with the preceding species.

***Atella phalanta*, Drury (581).**

1905. *Atella phalanta*, Bing., *tom. cit.*, p. 412, text-fig. 75.

1912. *Atella phalanta*, Fruh., *tom. cit.*, p. 471.

Hab.—Nearly throughout the Indian Empire extending to China, Japan and the Malayan subregion.

Remarks.—A rather scarce species on Barkuda, occasionally seen during the rains.

***Telchinia violae*, Fab. (384).**

1905. *Telchinia violae*, Bing., *tom. cit.*, p. 471.

Barkuda, 11-18-viii-19 ; iv-20.

Hab.—India and Ceylon.

Remarks.—Usually found, according to Bingham, in regions of heavy rainfall, but on Barkuda commoner in April (when there is practically no rain) than in the "rains." The island is not a region of heavy rainfall.

Family PAPILIONIDAE.

***Papilio hector*, Linn. (969).**

1907. *Papilio hector*, Bing., *Faun. Brit. Ind.*, Butt. II, p. 19, pl. xi, fig. 83.

1909. *Papilio hector*, Jordan. in Seitz's *Macrolepidop. World. div. II*, sect. 11, p. 34, pl. 15a.

Barkuda, 1 and 7-ix-19.

Hab.—Bengal; the southern half of Peninsular India and Ceylon.

Remarks.—A rather scarce species on the island though fairly common on the mainland a few miles away. It flies higher than *P. polytes romulus* and usually frequents more open country. A single full-grown caterpillar was taken on Barkuda in company with one of *P. aristolochiae* on the Sword-Bean (*Canavalia ensiformis*), on the 18th August, 1919. It was of a blackish colour with rather paler processes along each side of the abdomen. Along the anterior half of the body there were a few pale yellow isolated spots of small size. This larva pupated on the 20th of the same month.

The chrysalis was fastened at the tip of the abdomen to the side of the breeding cage, by a number of radiating, strong, black silk threads and supported further by a couple of strings, each double, of similar silk, one extending from the suture between the first and second abdominal sutures to the support, the other from the middle of the ventral surface of the thorax. It was 25 mm. long and 15 mm. wide. The sculpture and colouration was elaborate. The head was produced in front into a broad, flattened,

truncate, somewhat rounded lobe. The anterior end of the thorax was defined by an irregular, semicircular ridge and each side into a prominent, flattened, slightly upturned lobe which was rounded at the apex. Behind the anterior ridge there was a broad ill-defined, transverse groove, and behind this the dorsal surface was produced into a broad protuberance, the anterior part of which was strongly ridged, while the posterior part was obliquely truncate and the whole somewhat compressed. The posterior part (the larger) was flattened above, concave at the sides and produced into a small rounded lobe at the upper anterior angle at each side. The abdomen was strongly curved and bore at each side a series of prominent, rounded, flattened, upwardly directed lobes. The wing cases were produced into strong keels above.

The colouration was still more elaborate. The ground colour was pale lutescent. On the anterior part of the thorax, just behind the anterior ridge were a pair of somewhat elongate, white rimmed black spots, which gave this region a strange resemblance to a caricature of a monkey's face. The concave lateral region of the thorax was variegated with deep chestnut and white, and there was an irregular longitudinal stripe of the former colour running along the variegated area not far from its inner margin. The upper part of the flattened area was clearly chestnut with a small round spot of the same colour on each side in the variegated area above. From the chestnut area a fine stripe of paler tint extended backwards, expanding between the front pairs of abdominal processes. The abdomen was faintly spotted with pale brown.

The butterfly hatched out at about 4 A.M. on the morning of the 7th September. It took much longer in drying than the following species, which began to flutter about two hours after emerging. It began to flutter about four hours after hatching, but its upper wings were still curved down along the upper margin.

Papilio aristolochiae, Fab. (969).¹

1907. *Papilio aristolochiae*, Bing., *tom. cit.*, p. 20, text-figs. 3a and 3c.

1909. *Papilio aristolochiae*, Jordan, *tom. cit.*, p. 38, pl. 16a.

Barkuda, 7-ix-19; 5-vi-20; ix-20.

Hab.—India.

Remarks.—This is usually a very scarce butterfly on the island, but fresh specimens were seen in considerable numbers in September, 1920. A single pair was captured round flowers of *Premna latifolia* in June, 1920 and a single butterfly was reared from the larva in September, 1919. The caterpillar was found with that of *P. hector* on the Sword-Bean (*C. ensiformis*).

It was about half the size of the caterpillar of the preceding species, and was somewhat similar in colour, but the pale yellow spots found on *P. hector* was here replaced by a similarly coloured transverse line. It pupated on the 24th of August and the pupa resembled that of *P. hector* in every respect, except that it was

about $\frac{2}{3}$ of the size of the other and the colours were much deeper. A small female hatched out at about 6 P.M. on the 7th of September. If touched, or otherwise disturbed, as by tapping on the glass of the breeding cage while still in a tender condition, it would emit a few drops of clear fluid from the vent. This was not observed in *P. hector*. The wings as we have already remarked became dry and stiff much quicker than those of the preceding species.

***Papilio demoleus*, Linn. (971).**

1907. *Papilio demoleus*, Bing., *tom. cit.*, p. 39 text-fig. 7.

1909. *Papilio demoleus*, Jordan, *tom. cit.*, p. 48.

Barkuda, 9-29-vii-19; 1-6-ix-19.

Hab.—India, Upper Burma, China and Persia.

Remarks.—Common during the "rains." It disappears almost completely in the dry weather, but fresh specimens appear in large numbers within a day or two of the commencement of the wet season, indicating that the species estivates in the pupal stage.

***Papilio polytes romulus*, Cram. (972).**

1907. *Papilio polytes*, Bing., *tom. cit.*, p. 61, text-fig. 13.

1909. *Papilio polytes romulus*, Jordan, *tom. cit.*, p. 61, pl. 3a and 32a.

Barkuda, viii and ix-19; iv and vi-20.

Hab.—India, Burma and Ceylon.

Remarks.—Jordan confines *P. polytes* to China giving the Indian race as *romulus*, the name under which the *hector*-like female was originally described. Col. Evans writes us that the names of the female forms should stand as follows:—

Papilio polytes romulus, ♀ f. *cyrus*, Fab. (resembling the male of its own species).

Papilio polytes romulus, ♀ f. *polytes*, Linn. (resembling *P. aristolochiae*).

Papilio polytes romulus, ♀ f. *romulus*, Cr. (resembling *P. hector*).

Stichius, Hub. is a variety of the *polytes* ♀ in which there is no white cell spot on the hind wing.¹

Papilio polytes is perhaps the commonest butterfly on the island at all seasons except the end of the dry weather, when only a few battered individuals are to be seen. Its abundance is due to a large extent to the abundance of the favourite food plant of its caterpillar—*Glycosmis pentaphylla*. Unlike *P. demoleus* the young brood of the early part of the "rains" does not appear immediately on their commencement. Numerous young caterpillars were, however, observed on *Glycosmis* a few days after the beginning of the wet weather in June, 1920, and it is probable that the eggs of the winter brood do not hatch until the air becomes damp.

¹ This is somewhat contrary to the views expressed by him in his "List," (p. 972).

Papilio polymnestor, Cram. (972).

1907. *Papilio polymnestor*, Bing., *tom. cit.*, p. 50, pl. xii, fig. 85.
 1909. *Papilio polymnestor*, Jordan, *tom. cit.*, p. 70, pl. 26a.

Hab.—Sikkim, South India and Lower Bengal.

Remarks.—A single individual was seen on several occasions in October, 1919 and another in the same month in 1920.

Papilio nomius, Esp. (973).

1907. *Papilio nomius*, Bing., *tom. cit.*, p. 201, text-figs. 33a and 33b.
 1909. *Papilio nomius*, Jordan, *tom. cit.*, p. 87.

Barkuda, 9-iv-20.

Hab.—Sikkim, Central and Southern India.

Remarks.—A pair taken *in copula* were the only individuals seen and taken on the island.

Papilio doson eleius, Fruh. (973).

1907. *Papilio euryplus*, Bing., *tom. cit.*, p. 106.
 1909. *Papilio doson eleius*, Jordan, *tom. cit.*, p. 97.

Barkuda, 8-15-viii-19; 9-20-iv-20, I-II-vi-20.

Hab.—South India.

Remarks.—The remarkable similarity between *doson* and *euryplus* led Jordan and Rothschild in their revision of the Oriental Papilios, and afterwards Bingham, to unite the two species under the one name *euryplus*. Dr. Jordan in the paper cited in the synonymy separates the two species mainly on the structure of the genitalia. Superficially *doson* differs from *euryplus* in that the short brown-black costal band, which bears the red costal spot on the underside of the hind wing, does not unite with the brown-black sub-basal band, but terminates inside the silver one. In *euryplus* it does unite with the sub-basal band. Our subspecies (*eleius*, Fruh.) differs from typical *doson* in having the green spots in the apical half of the forewing somewhat yellower, and the median band always broader.

The species is as common in April as in the "rains," but is never very abundant on the island. Individuals were somewhat scarcer in 1920 than in 1919.

Family PIERIDAE.

Leptosia xiphia, Fab. (975).

1907. *Leptosia xiphia*, Bing., *tom. cit.*, p. 138, text-fig. 36.
 1910. *Leptosia xiphia*, Fruh., *tom. cit.*, p. 121, pl. 62f.

Barkuda, 12-20-viii-19; 23-x-19; 11-xii-19; 16-20-iv-20.

Hab.—India, Burma and Ceylon, also Siam and Annam.

Remarks.—Common in damp weather in undergrowth, and among vegetation on the shore. A few individuals were seen in April, 1920.

Anaphaeis mesentina, Cram. (975).

1907. *Anaphaeis mesentina*, Bing., *tom. cit.*, p. 155, text.-fig. 39.
1910. *Anaphaeis mesentina*, Fruh., *tom. cit.*, p. 137.

Barkuda, 15-22-vii-16; 9 and 10-iv-20.

Hab.—India and the Nicobars.

Remarks.—Never very common on the island, but less scarce in April and the early part of the “ rains.”

Huphina nerissa evagete, Cram. (977).

- 1780-82. *Papilio evagete et zeuxippe*, Cram., *Pap. Exot.* III, pl. 221, figs. F, G and IV, pl. 362, figs. E, F.
1910. *Huphina nerissa evagete*, Fruh., *tom. cit.*, p. 141.

Barkuda, 9-29-viii-19; 3-6-ix-19; 11-xii-19; 9-19-iv-20.

Hab.—South India and Ceylon.

Remarks.—Fairly common at all seasons, but especially so in August.

Appias libythea, Fab. (977).

1907. *Appias libythea*, Bing., *tom. cit.*, p. 200.
1910. *Appias libythea*, Fruh., *tom. cit.*, p. 148, pl. 58a.

Barkuda, 6-viii-19.

Hab.—Punjab to Sikkim; Southern India and Ceylon.

Remarks.—Rare at all seasons.

Appias albina confusa, Fruh. (977).

1910. *Appias albina confusa*, Fruh., *tom. cit.*, p. 154.

Barkuda, 17-21-iv-20.

Hab.—Sikkim to Burma; Bengal.

Remarks.—A few specimens were obtained for the first time in April, 1920. The species was not seen in July or August of the same year.

Ixias pyrene pirenassa, Wall. (978).

1907. *Ixias pyrene*, var. *pirenassa*, Bing., *tom. cit.*, p. 194, pl. xviii, fig. 120.
1910. *Ixias pyrene pirenassa*, Fruh., *tom. cit.*, p. 159.

Barkuda, 9-19-viii-19; 7-iv-20.

Hab.—Plains of India and Burma.

Remarks.—Very common in August and in the beginning of September, 1919. In August, 1920 it was seen in large numbers, flying high, among species of *Ficus* and *Euphorbia* at the back of a small pond on the island.

Ixias marianne, Cram. (978).

1907. *Ixias marianne*, Bing., *tom. cit.*, p. 196.
1910. *Ixias marianne*, Fruh., *tom. cit.*, p. 159, pl. 72a.

Barkuda, 18-viii-19.

Hab.—Kumaun to South India; Ceylon.

Remarks.—A single male was the only specimen captured. The species was seen occasionally in April. No specimens were seen in August, 1920.

Catopsilia pyranthe, Linn.

1907. *Catopsilia pyranthe*, Bing., *tom. cit.*, p. 221.

1910. *Catopsilia pyranthe*, Fruh., *tom. cit.*, p. 162.

Barkuda, 19-29-viii-19.

Hab.—India, Burma and Ceylon.

Remarks.—Common during the rains.

Catopsilia pomona, Fab. (979).

1907. *Catopsilia crocale*, Bing., *tom. cit.*, p. 219.

1910. *Catopsilia pomona*, Fruh., *tom. cit.*, p. 163. pl. 69b.

Barkuda, 24-viii-19.

Hab.—India, Burma and Ceylon.

Remarks.—Fruhstorfer separates *C. pomona* from *C. crocale* chiefly on the difference in the sexual organs. Superficially the differences are slight. The antennae are red and not black, and white silver dots occur in the disc of the underside of both wings. The females show lesser variability in colour than *crocale*. *C. pomona* is essentially a butterfly of the woods, generally flying high among dense jungle, while *C. crocale* is usually found in open country among flowers. The habits of *C. pyranthe* on Barkuda are similar to those of *C. pomona*.

It is probable that the species of *Catopsilia* do not breed on the island, as they are frequently seen flying over from the mainland. Moreover, there are on Barkuda no plants of the genus *Cassia*, on which their caterpillars are said to feed exclusively, while *Cassias* are abundant on the neighbouring mainland.

Terias libythea, Fab. (980).

1907. *Terias libythea*, Bing., *tom. cit.*, p. 247.

1910. *Terias libythea*, Fruh., *tom. cit.*, p. 166.

Barkuda, 30-viii-6-ix-19.

Hab.—India, Burma and Ceylon.

Remarks.—Not a very common butterfly at any season.

Terias hecabe, Linn. (980).

1907. *Terias hecabe*, Bing., *tom. cit.*, p. 250, text-figs. 60 and 60b; pl. xvi, fig. 106.

1910. *Terias hecabe*, Fruh., *tom. cit.*, p. 166-167, pl. 73f.

Barkuda, 11-18-viii-19; 4-15-ix-19.

Hab.—India, Burma and Ceylon. Also the Andamans and Nicobars.

Remarks.—Common, especially in the latter part of the "rains"; scarce in the latter part of the dry weather.

Terias silhetana, Wall. (980).1907. *Terias silhetana*, Bing., *tom. cit.*, p. 257, text-fig. 65a and 65b.1910. *Terias blanda silhetana*, Fruh., *tom. cit.*, p. 169, pl. 73c.

Barkuda, 29-viii-19; 2-7-ix-19.

Hab.—Sikkim, Burma, South India and the Andamans.

Remarks.—Not so common as the preceding species. The larva of this species is slender, cylindrical and greenish in colour, rather paler towards the anal extremity, and has a pale yellow, ill-defined lateral stripe which is, however, in some individuals absent. It is furnished with very close, rather bristly hairs along the back, and fine, short ones laterally. The head is black, or very dark brown, with fine, pale, in most cases scattered, hairs. In the Cochin States Dr. Gravely found that these caterpillars were eaten by the Reduviid bug, *Panthous bimaculatus*.

Colotis calais amatus, Fab. (980).1907. *Colotis amata*, Bing., *tom. cit.*, p. 261.1910. *Teracolus amata*, Fruh., *tom. cit.*, p. 173.

Barkuda, 6-29-viii-19; 3-29-ix-19; 23-x-19; 15-xii-19; 8-20-iv-20.

Remarks.—“*Amatus* constantly differs from *calais* in that the black spot on the margin near the dorsum is not detached and quadrate.” (*Evans*). The form of female in which the ground-colour ranges from pale primrose-yellow to pure white has been named *albina* by Col. Evans. It is rare on Barkuda. The species was quite common on the island among low herbage from August to October, 1919. In April, 1920 it was abundant on the shore around *Salvadora persica*, but was entirely absent in June and July, and in August was not so plentiful as in 1919. The Chilka Lake represents, according to Col. Evans, the extreme north-eastern limit of the geographical range of this insect.

Hebomoia glaucippe ? australis, Bert. (980).1907. *Hebomoia glaucippe* race *australis*, Bing., *tom. cit.*, p. 275.1910. *Hebomoia glaucippe australis*, Fruh., *tom. cit.*, p. 175.*Hab.*—Southern India and Ceylon.

Remarks.—We have seen this butterfly on several occasions in April, and from August to September, but were unable to capture it on account of its habit of flying very high among dense growths of *Euphorbia* and *Ficus*, chiefly round a small pond on the island. The race *australis* and typical *glaucippe* are so alike that it is impossible to distinguish them on the wing, but the insect we saw is probably *australis* as this is the South Indian race of the species. We cannot, however, be certain as both *glaucippe* and *australis* sometimes fly together in South India.

Pareronia valeria hippia, Fab. (981).1907. *Pareronia hippia*, Bing., *tom. cit.*, p. 278.1910. *Pareronia valeria hippia*, Fruh., *tom. cit.*, p. 178, pl. 66a and 66b.

Barkuda, 24-viii-19, 3-6-ix-19; 11-xii-19, 10-20-iv-20.

Hab.—India and Burma.

Remarks.—Common in the beginning of April and during the “rains.” It generally flies high among dense jungle and somewhat resembles *Danais limniace* on the wing.

Family LYCAENIDAE.

Neopithecops zalmora, But. (981).

1907. *Neopithecops zalmora*, Bing., *tom. cit.*, p. 309.

1905-10. *Neopithecops zalmora*, Swin., *Lep. Ind.* VII, p. 230, pl. 627, figs. 2, ♂, 2a, ♀, 2b, ♂ (*wet-seas. brood*); 2c, ♂, 2d, ♀ (*dry-seas. brood*); 2e, ♂ (*ex-dry-seas. brood*).

Barkuda, 15-xii-19.

Hab.—India, Burma and Ceylon.

Remarks.—Scarce.

Chilades laius, Cram. (984).

1907. *Chilades laius*, Bing., *tom. cit.*, p. 365, pl. xix, fig. 135.

1905-10. *Chilades laius*, Swin., *tom. cit.*, p. 271, pl. 638, figs. 3, ♂, 3a, ♀, 3b, ♀ (*wet-seas. brood*); 3c, ♂, 3d, ♀, 3e, ♂, 3f, ♀ (*dry-seas. brood*).

Barkuda, 15-22-vii-16; 18-viii-19. The specimens captured on other dates have been lost.

Hab.—India, Burma and Ceylon.

Remarks.—One of the commonest Lycaenids on the island at all seasons, generally found in the neighbourhood of *Ficus bengalensis* and *F. infectoria*. Very abundant in the more open parts of the island in the latter part of October, 1920.

Zizera lysimon karsandra, Moore (984).

1907. *Zizera lysimon* var. *karsandra*, Bing., *tom. cit.*, p. 358.

1905-10. *Zizera lysimon karsandra*, Swin., *tom. cit.*, p. 258, pl. 635, figs. 3, ♂, 3a, ♀, 3b, ♂ (*wet-seas. brood*); 3c, ♂, 3d, ♀ (*dry-seas. brood*).

Barkuda, 11-iv-20.

Hab.—India, Burma and Ceylon. The Nicobars?

Remarks.—The two specimens taken on the date given above were the only ones captured. We did not see this butterfly again.

Catachrysops strabo, Fab. (985).

1909. *Catachrysops strabo*, Bing., *tom. cit.*, p. 411, pl. xix, fig. 143.

1907. *Catachrysops strabo*, Swin., *Lep. Ind.* VIII, p. 47, pl. 650, figs. 3, ♂, 3a, ♀, 2b, ♀ (*wet-seas. brood*); 3c, ♂, 3d, ♀ (*dry-seas. brood*).

Barkuda, 30-viii-19, 1-ix-19; 10-21-iv-20.

Hab.—India, Burma, Ceylon, the Andamans and the Nicobars.

Remarks.—Common as compared with most of the other Lycaenids found on the island.

Catachrysops cnejus, Fab. (985).

1907. *Catachrysops cnejus*, Bing., *tom. cit.*, 415.

1910-11. *Euchrysops cnejus*, Swin., *tom. cit.*, p. 40, pl. 649, figs. 2, ♂
2a, ♀ 2b, ♂ (wet-seas. brood); 2c, ♂ 2d, ♀ (dry-seas. brood).

Barkuda, 10-19-viii-19; 16-iv-20.

Hab.—Throughout our limits.

Remarks.—Relatively rare.

Azanus ubaldus, Cram. (985).

1907. *Azanus ubaldus*, Bing., *tom. cit.*, p. 362, pl. xix, fig. 138.

1910-11. *Azanus ubaldus*, Swin., *tom. cit.*, p. 33, pl. 648, figs. 2, 2a, ♀
2b, ♂.

Barkuda, 29-ix-19.

Hab.—India, Burma and Ceylon.

Remarks.—One specimen only has been obtained.

Castalius rosimon, Cram. (985).

1907. *Castalius rosimon*, Bing., *tom. cit.*, p. 424, text-fig. 90.

1905-10. *Castalius rosimon*, Swin., *Lep. Ind.* VII, 239, pl. 630, figs. 1,
♂, 1a, ♀ 1b, ♂ (wet-seas. brood); 1c, ♂, 1d, ♀ (dry-seas.
brood) 1f, ♂, 1g, ♀ (ex-dry-seas. brood).

Barkuda, 6-18-viii-19; 6-29-iv-19; 11-xii-19.

Hab.—India, Burma, Ceylon, the Andamans and the Nicobars.

Remarks.—Probably the commonest Lycaenid on the island at most times.

Lampides bochus, Cram. (987).

1907. *Lampides bochus*, Bing., *tom. cit.*, p. 398.

1910-11. *Famides bochus*, Swin., *Lep. Ind.* VIII, p. 58, pl. 652, figs. 3,
♂, 3a, ♀, 3b, ♀.

Barkuda, 8-20-iv-20 (*W. A. Burns*).

Hab.—India, Burma, Ceylon and the Andamans.

Remarks.—A few specimens were obtained for the first time in April, 1920.

Lampides celeno, Cram. (987).

1907. *Lampides celeno*, Bing., *tom. cit.*, p. 404.

1910-11. *Famides celeno*, Swin., *tom. cit.*, p. 66, pl. 655, figs. 1, ♂, 1a,
♀ 1b, ♂ (wet-seas. brood); 1c, ♂, 1d, ♀ 1e, ♂ (dry-seas.
brood); 1f, larva and pupa.

Barkuda, 2-24-vii-19, 15-xii-19; 11-21-iv-20.

Hab.—India, Burma and Ceylon.

Remarks.—Fairly common at all seasons.

Polyommatus boeticus, Linn. (987).

1907. *Polyommatus boeticus*, Bing., *tom. cit.*, p. 432.

1910-11. *Lampides boeticus*, Swin., *tom. cit.*, p. 44, pl. 650, figs., 2, ♂,
2a, ♀ 2b, ♂.

Barkuda, 8-15-viii-19.

Hab.—Throughout our limits. A very widely distributed species.

Remarks.—Fairly common in August, 1919, but since then it has become rather scarce.

Curetis phaedrus, Fab. (988, as *thetis*).

1907. *Curetis thetis*, Bing., *tom. cit.*, p. 437, text-fig. 93a and 93b.

1910-11. *Curetis thetys*, Swin., *tom. cit.*, p. 239, pl. 698, figs. 1, ♂, 1a, ♀, 1b, ♂, 1c, larva and pupa (nat. size), 1d, larva and pupa, with brush on 12th seg. extruded and enlarged.

1915. *Curetis phaedrus*, Chapman, *Nov. Zool.* XXII, p. 88, pl. 3, and pl. 18, fig. 78, fig. 7; *appendages*, pl. 13, figs. 62-68.

Barkuda, 15-22-vii-16 (*Gravelly*); 9-15-viii-19; 11-xii-19; 11-iv-20.

Hab.—South India, Ceylon, Bombay, Balai, Malabar.

Remarks.—In his analysis of the genus *Curetis* published in *Novitates Zoologicae*, Dr. Chapman separates *thetis* and *phaedrus* mainly on genital differences. The superficial differences are slight and are enumerated by him on page 85 of his paper and by Bingham on page 439 of the "Fauna." It is a fairly common butterfly on the island.

Curetis bulis, Db. and Hew.¹ (988).

1907. *Curetis bulis*, Bing., *tom. cit.*, p. 441, text-fig. 95.

1910-11. *Curetis bulis*, Swin., *tom. cit.*, p. 244, pl. 699, figs. 2. ♂, 2a, ♀, 2b, ♂ (*bulis* form); 3, ♂, 3a, ♀ 3b, ♂ (*discalis* form).

1915. *Curetis brulis*, Chap. *op. cit.*, p. 95, pl. 3, fig. 5; *appendages*, pls. 6 and 7, figs. 31-40.

Barkuda, 15-22-vii-16 (*Gravelly*).

Hab.—India and Upper Burma.

Remarks.—Col. Evans tells us that it is somewhat curious that *bulis* and *phaedrus* were taken together, as they do not fly in company as a rule. In Pachmari only *bulis* is found, in South India only *phaedrus*. The south end of the Chilka Lake probably represents the boundary of the range of these two species. Both are usually found on, or near, the pea *Crotolaria striata*, which grows in cleared land.

Aphnaeus vulcanus, Fab. (989).

1890. *Aphnaeus vulcanus*, De Nic., *Butt. Ind.* III, p. 349.

1911-12. *Aphnaeus vulcanus*, Swin., *Lep. Ind.* IX, p. 158, pl. 733, figs. 1, ♂, 1a, ♀ 1b, ♂, 1c, larva and pupa.

Barkuda, 18-viii-19. 11-iv-20.

Hab.—Sikkim. South India and Ceylon.

Remarks.—Rather scarce.

Iraota timoleon, Stoll. (990).

1890. *Iraota timoleon*, De Nic. *tom. cit.*, p. 213, pl. xxvii, figs. 192 and 193.

¹ Dr. Chapman gives the authors' names as Db. and West., though the species is generally supposed to have been described by Db. and Hew., *Gen. Diurn. Lep.* As we have been unable to verify Dr. Chapman's statements we have followed general opinion and given the authors' names as Db. and Hew.

1910-11. *Iraota timoleon*, Swin., *Lep. Ind.* VIII, p. 132, pl. 669, figs. 3: ♂, 3a, 9, 3b, ♂, 3c, ♀ (*wet-seas. brood*); 3d, ♂ (*dry-seas. brood*)
3c, *larva and pupa*.

Barkuda, 8-10-viii-19. II-iv-20.

Hab.—India and Burma.

Remarks.—Only four specimens have been obtained; all on, or in the neighbourhood of, large fig trees (*Ficus infectoria* or *F. bengalensis*). They resembled moths very closely. Indeed, so close was the resemblance that on two occasions the collector was deceived and labelled them “moth.”

Loxura atymnus, Cram. (996).

1890. *Loxura atymnus*, De Nic., *tom. cit.*, p. 436, pl. xxix, fig. 232.

1911-12. *Loxura atymnus*, Swin., *Lep. Ind.*, IX, p. 213, pl. 744, figs., 1, ♂ 1a, ♀, 1b, ♂, 1c, *larva and pupa*.

Barkuda, 19-viii-20.

Hab.—South India.

Remarks.—A single specimen, probably an immigrant, was the only one obtained.

FAMILY HESPERIIDAE.

Badamia exclamationis, Fab. (1007).

1896. *Badamia exclamationis*, El. and Edw., *Trans. Zool. Soc. Lond.*, XIV, p. 306.

1911-12. *Badamia exclamationis*, Swin., *tom. cit.*, p. 259, pl. 753, figs., 3, ♂, 3a, ♂, 3b, ♂, 3c, ♀ 3d, 3e, 3f, *larva and pupa*.

Barkuda, 18-viii-6-ix-19. viii-20.

Hab.—India, Burma and Ceylon.

Remarks.—Common as compared with the other Hesperiidæ. Often seen round *Pongamia glabra*, flying jerkily from tree to tree.

Hasora butleri, Aurivill. (1007).

1897. *Hasora butleri*, Aurivill. *Ent. Tidskrift*. XVIII, p. 150.

1911-12. *Parata butleri*, Swin., *tom. cit.*, p. 255, pl. 753, figs. 1, ♂, 1a, ♀ 1b, ♂.

Barkuda, 18-30-viii-19. 8-iv-20.

Hab.—India, Burma and Ceylon.

Remarks.—Scarce.

Telicota bambusae, Moore (1004).

1896. *Telicota bambusae*, El. and Edw., *op. cit.*, p. 251, pl. xxv, fig. 63.

1912-13. *Telicota bambusae*, Swin., *Lep. Ind.* X, p. 248, pl. 813, figs., 3, ♂, 3a, ♀ 3b, ♂, 3c, *larva and pupa*.

Barkuda, 3-ix-19.

Hab.—India, Burma and Ceylon.

Remarks.—One specimen only was obtained, probably an immigrant.

Parnara mathias, Fab. (1006).

1896. *Parnara mathias*, El. and Edw., *op. cit.*, p. 275, pl. xxvi, fig. 84.

1912-13. *Chapra mathias*, Swin., *tom. cit.*, p. 320, pl. 831, figs., 3, ♂ 3a, ♀ 3b, ♀ 3c, *larva and pupa*.

Barkuda, 18-viii-19.

Hab.—India, Burma, Ceylon and the Andamans.

Remarks.—A single specimen.

Parnara bada, Moore (1006).

1896. *Parnara guttatus*, El. and Edw., *op. cit.*, p. 283, pl. xxvi, fig. 76.

1912-13. *Parnara bada*, Swin., *tom. cit.*, p. 329, pl. 834, figs., 1, ♂, 1a, ♀ 1b, ♂ 1c, ♀

Barkuda, 18-viii-19.

Hab.—India, Burma and Ceylon.

Remarks.—A single male.

Parnara colaca, Moore (1006).

1896. *Parnara colaca*, El. and Edw., *op. cit.*, p. 283, pl. xxvi, fig. 81.

1912-13. *Caltois colaca*, Swin., *tom. cit.*, p. 316, pl. 831, figs., 1, ♂, 1a, ♀ 1b, ♀ 1c, larva and pupa.

Barkuda, 15-30-viii-19.

Hab.—India, Burma, Ceylon, the Andamans and Nicobars.

Remarks.—Five examples only were captured.

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