MISCELLANEOUS PUBLICATION
OCCASIONAL PAPER NO. 29

Records of the Zoological Survey of India

On the Papilioninae (Papilionidae : Lepidoptera) from Arunachal Pradesh & Adjoining areas of Assam in North-Eastern India

By
G. S. ARORA
and
D. K. MONDAI

Issued by the Director
Zoological Survey of India, Calcutta

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ON THE PAPILIONINAE (PAPILIONIDAE : LEPIDOPTERA) FROM ARUNACHAL PRADESH & ADJOINING AREAS OF ASSAM IN NORTH-EASTERN INDIA

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I. Introduction

The Zoological Survey of India conducted as many as nine faunistic surveys between 1961 and 1973 at different areas, particularly Arunachal Pradesh and Assam, of North-Eastern India. Several parties from the Department were led in these areas by Drs. K. C. Jayaram, S. Biswas, S. K. Bhattacharya, S. K. Tandon, G. S. Arora, A. N. T. Joseph and C. B. Srivastava for continuing works on the general faunistics. Besides, one joint expedition in collaboration with Geological Survey of India was made during the period at Daphabum of the Lohit district in Arunachal Pradesh, when Dr. J. M. Julka and his party from Z. S. I. also participated.

The earlier investigation on the Rhopaloceran families including Papilionidae from North-Eastern India, barring Arunachal Pradesh proper was made by different workers including Atkinson (1873), Butler (1879), De Nicéville (1881, 1882, 1883, 1885, 1890), Wood-Mason & De Nicéville (1887), Elwes (1882, 1891, 1892), Moore (1888, 1901-1906), Watson (1891, 1897), Swinhoe (1893), Fawcett (1904), Jordan (1908-1909, 1928), Tytler (1911-1912, 1914-1915), Evans (1912, 1923) and South (1913). Betts (1950), however, dealt with the fauna for the first time from the areas north of Assam, which are now-a-days considered under the jurisdiction of Arunachal Pradesh. He reported 25 papilionid species and subspecies, of which only *Bhutanitis lidderdalei lidderdalei* (Atkinson), *Graphium agetes* (Westwood) and *Parides latreillei latreillei* (Donovan) do not occur in the present collections. Later, Varshney & Chanda (1971) also studied the material from these areas, and they mentioned mainly from the Tirap district only eight species ; of these, all but *Graphium agetes* (Westwood) are common with the elements under study.

The present paper incorporates 32 species distributed over 18 species-groups in six genera and subgenera under three tribes of the subfamily Papilioninae alone together with certain variations being correlated with geographical and other forms. The system has been principally adopted after Munroe (1961) upto the species level, being supplemented by the infra-specific categories *sensu* Talbot (1939).

II. Systematic Account

Family Papilionidae Leach

1815. Papilionidae Leach, *Edinb. Encycl.*, **9** : 127.

Diagnostic characters.—Fore wing with M_1 arising from the middle

discocellular, M_2 and M_3 from lower discocellular, Cul_a from a little beyond and Cu^1_b from middle of median vein ; hind wing in male with specialised anal fold ; fore tibia with a ventral epiphysis and hind tibia with a pair of mesial spurs.

Distribution.—Cosmopolitan.

Remarks.—The family is represented by two subfamilies, viz., Parnassiinae and Papilioninae, from India. Of these, the former comprises *Bhutanitis lidderdalei* (Atkinson) which was reported by Betts (1950) from Rahung (*c* 2290 m). The latter subfamily is dealt with hereunder.

Subfamily PAPILIONINAE Swainson

1840. Papilioninae Swainson, *Cab. Cycl.*, p. 87.

Diagnostic characters.—Antenna long and slender ; fore wing with median spur well developed and 2A forked with 3A ; hind wing with precostal cell very small, precostal vein curved distad and 1A and 3A rudimentary or absent.

Distribution.—Mainly circum-tropical belts of the world.

Remarks.—The subfamily, which was originally named as "Papilionides (=Swallowtails)" by Latreille (1807), is represented by three tribes, *viz.*, Leptocircini, Papilionini and Troidini. All these tribes are differentiated by the following key.

Key to the tribes of **Papilioninae**

1. Labial palpus usually upturned and short; the tail in hind wing, when present, spatulate ; tibia and tarsus not scaled ... 2

— Labial palpus usually porrect and long ; the tail in hind wing never spatulate ; tibia and tarsus scaled ... ... Leptocircini

2. Tibia and tarsus with rows of spines dorso-ventrally differentiated by a smooth impression ; hind wing in male with anal fold devoid of scent organ ; thorax and abdomen ventrally less often red ... ... Papilionini

— Tibia and tarsus with rows of spines dorso-ventrally not differentiated ; hind wing in male with anal fold provided with scent

organ ; thorax and abdomen ventrally more often red ... ... Troidini

A. Tribe LEPTOCIRCINI

Formerly, this tribe was variously considered as Leptocircinae by Kirby (1896). Teinopalpidae by Grote (1899), Teinopalpini and Graphini by Talbot (1939) and Graphiini by Ford (1944).

The tribe is represented in the world by about 100 species in seven genera, which are mostly intercombined by a total of 22 species-groups, two sections and five subgenera. Of these, about 23 species in 4 genera coupled with the intercombinations of 6 species-groups and 2 subgenera are hitherto known from North-Eastern India. Presently, only two genera are dealt with.

Key to the genera of Leptocircini

Fore wing less than twice as long as antenna, Sc free from R_1 and R_2 stalked with R_4 ; hind wing with scent organ ... ... *Lamproptera* Gray

— Fore wing more than twice as long as antenna ; Sc anastomosed with R_1 and R_2 free from R_4 ; hind wing without scent organ ... ... *Graphium* Scopoli

Genus **Lamproptera** Gray

1832. *Lamproptera* Gray, *In* Griffiths *ed.* Cuvier, *Anim. Kingdom*, **15** : pl. 102, fig. 4.

Type species : *Papilio curius* Fabricius

Diagnostic characters.—*Vide* key.

Distribution.—Sino-Palaearctic and Oriental regions.

Remarks.—The genus, formerly known as *Leptocircus* Swainson, comprises the smallest of all the members in the family Papilionidae. It is allied to *Graphium* Scopoli, with thinly scaled, transparent and banded wings, and greenish legs, but can be readily distinguished from it by the characters cited in the key.

Only two species are known, of which one is presently dealt with.

1. **Lamproptera curius** (Fabricius)

1787. *Papilio curius* Fabricius, *Mant. Ins.*, **2** : 9.

1939. *Lamproptera curius*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 244.

Diagnostic characters.—Fore wing dorsally with a white band constricted near middle ; secondary sexual characters in the form of a long brush of hairs along the anal fold of hind wing in male and a large ventral copulation-groove near the end of abdomen in female.

Distribution.—North-Eastern China. Oriental region.

Remarks.—The species, popularly known as the "White Dragon Tail", is readily distinguished from *Lamproptera meges* (Zinken) from Assam by the foregoing characters. It is not rare in its water-side niches in the open jungle and is attracted by the flowers, but does not rest on them. The flight is very swift like that of dragon-flies with a back and forth darting movement near the ground. The intake and squirting of water rhythmically through the oro-anal passage is peculiar for the species. The ovipositing female is reported to frequent the creeper-species, *Illigera burmanicus* (*N. O.* Combretaceae).

Only the nominal subspecies is presently dealt with.

1(a). **Lamproptera curius curius** (Fabricius)
(Plate I, Fig. 1)

1939. *Lamproptera curius curius*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 244.

Diagnostic characters.—Fore wing with a triangular hyaline area traversed by veins and separated from the semi-hyaline transverse band by black ; hind wing with sinuous transverse line, cilia and tail-end all white.

Distribution.—India (Assam ; Arunachal Pradesh). Burma. Sunda-land. Java. Palawan.

Material examined.—Assam : Likhabali, 1 ♂, 6. x. 1966 (*S. K. Tandon & G. S. Arora* coll.), Charduar Forest, 1 ♂, 24. iii. 1973 (*S. K. Tandon* coll.). Arunachal Pradesh : Siang district, Dali Camp, *c* 300 m, 3 ♂♂, 12. x., Tachi Doni, *c* 400 m, 2 ♂♂, 24. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Tirap district, Deomali

Forest, *c* 250 m, 7 ♂♂, 10-11. xi. 1971 (*G. S. Arora* coll).

Wing expanse.—33-42 mm.

Remarks.—The subspecies, which is a new record for the aforesaid districts of Arunachal Pradesh, shows some interesting variations of characters (*cf.* Talbot, 1939). These include fore wing with the white band not exteriorly oblique, veins traversing the hyaline area pale and the black between this area and the semi-hyaline band posteriorly tapering, and hind wing with the transverse line not reaching the apex and with cilia white along the entire outer margin of tail. The specimens also exhibit the reduced wing expanse as compared to that of 40-50 mm in Talbot (*loc. cit.*).

Genus **Graphium** Scopoli

1777. *Graphium* Scopoli, *Intr. Hist. Nat.*, p. 433.

Type species : *Papilio sarpedon* Linnaeus

Diagnostic characters.—*Vide* Key.

Distribution.—Australasian, Ethiopian and Neotropical regions.

Remarks.—Amongst several synonyms listed by Talbot (1939) under this genus, *Dabasa* Moore, with the type species *D. gyas* (Westwood) from North-Eastern India and *Iphiclides* Hübner, with the type species *I. podalirius* (Linnaeus) from Tibet, were revalidated to their distinct generic status and *Pathysa* Reakirt was considered as subgenus by Munroe (1961). Further, while Talbot (*loc. cit.*) treated four species-groups, Munroe (*loc. cit.*) introduced three more, excluding the *Payeni* - group the members of which have been relegated by him to the genus *Dabasa* Moore.

The species are good fliers and mostly occur in the wooded localities. The males often congregate at swampy substrata including wayside puddles, moist sand along the river banks and other similar niches.

Three subgenera are recognised, of which *Arisbe* (Hübner) is typically African in origin and represented by the superficially varied but structurally homogeneous and intermediate complex between the remaining two which are presenty dealt with.

Key to the subgenera of **Graphium** Scopoli

	Cell of fore wing devoid of bars; antemedial and discal markings ventrally red or yellow; tail shortly toothed or absent and male with scent wool on hind wing ...	*Graphium* Scopoli
—	Cell of fore wing provided with bars; markings as above rarely present; tail long and sworld-like (except in Macareus-group, where tail absent) and male with or without scent wool on hind wing	*Pathysa* Reakirt

Subgenus **Graphium** Scopoli

1961. *Graphium* (*Graphium*), Munroe, *Canad. Ent.*, Suppl. 17 : 19.

Diagnostic characters.— *Vide* key.

Distribution.—Australasian and Neotropical regions.

Remarks.—The subgenus is the most primitive of all its allies. It comprises four species-groups, of which three are known from India. These are presently dealt with.

Key to the species-groups of subgenus **Graphium** Scopoli

1.	Fore wing dorsally without subterminal row of green spots	*Codrus*-group
—	Fore wing dorsally with a subterminal row of green spots	2
2.	Fore wing dorsally with a single spot in cell; hind wing without tail	*Eurypylus*-group
—	Fore wing dorsally with two spots in cell; hind wing with tail	*Agamemnon*-group

(i) **Codrus**-group

Diagnostic characters.—*Vide* key.

Distribution.—Sino-Indo-Palaearctic, Oriental, Australian and Neotropical regions.

Remarks.—The species-group incorporates eight species, of which the two, formerly treated by Talbot (*loc. cit.*) under *Eurypylus*-group (*sensu lato*) are presently dealt with. The group is primitive and

allied to the *Lamproptera-Dabasa* stock with toothed or bifid tarsal claws. Their identifying characters are keyed below.

Key to the species of **Codrus** group

Fore wing dorsally transparent-green and without band ; hind wing with transparent-green subterminal patches ... ... *cloanthus* (Westwood)

— Fore wing dorsally black and with a green band ; hind wing with subterminal lunules ... *sarpedon* (Linnaeus)

2. Graphium (Graphium) cloanthus (Westwood)

1841. *Papilio cloanthus* Westwood, *Arc. Entom.*, **1** : 42, pl. II, fig. 2.
1961. *Graphium (Graphium) cloanthus*, Munroe, *Canad. Ent.*, Suppl. **17** : 19.

Diagnostic characters.—*Vide* key.

Distribution.—South China. Taiwan. India : Kashmir ; Himachal Pradesh ; North-Eastern Himalayas (including Arunachal Pradesh). Burma. Sumatra.

Remarks.—The species, popularly known as the "Glossy Blue-bottle", is locally common, showing rapid flight atop the hill-trees and occasionally settling on the flowers of *Machilus odoratissima* (*N. O.* Lauraceae) or on the swampy patches. This species, recorded by Betts (1950) from Likha, Pite, Apatani and Rahung and also by Varshney & Chanda (1971) from "somewhere in N. E. F. A.", is represented by the only nominal subspecies from India, which is dealt with hereunder.

2 (a). Graphium (Graphium) cloanthus cloanthus (Westwood)
(Plate I, Fig. 2)

1909. *Papilio cloanthus cloanthus*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 94.
1939. *Graphium cloanthus cloanthus*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 218.

Diagnostic characters.—*Vide* key to the species.

Distribution.—Only in the Indian subregion, as for the species.

Material examined.—Arunachal Pradesh : Kameng district, Dirang Road, about 6 kms. west of Raping, *c* 227 m, 1 ♂, 24. iv. 1961 (*K. C. Jayaram* coll.) ; Siang district, Basar, *c* 550 m, 1 ♂, 30. x. 1966 (*S. K. Tandon & G. S. Arora* coll.).

Wing expanse.—70 mm.

Remarks.—Assuming that Betts (1950) refers to this subspecies both from the tropical and temperate elevations of the territory during the monsoon and autumn, its vertical distribution at a fairly lower range during the spring in addition, as presently observed, is interesting. Also, the wing expanse of the specimens is much reduced as compared to that of 85-95 mm in Talbot (1939). The material is not, however, related to the known wet-season form *cloanthulus* Fruhstorfer. The subspecies is a new record at least for the Siang district of Arunachal Pradesh.

3. **Graphium (Graphium) sarpedon** (Linnaeus)

1758. *Papilio sarpedon* Linnaeus, *Syst. Nat.*, ed. **10** : 461.
1961. *Graphium (Graphium) sarpedon*, Munroe, *Canad. Ent.*, Suppl. **17** : 19.

Diagnostic characters.—*Vide* key.

Distribution.—South Japan. China. India : Kashmir ; West Bengal (Kurseong) ; Assam ; Arunachal Pradesh. Burma. Indo-Malayan Islands. Australia. Solomons.

Remarks.—The species, popularly known as the "Common Blue-bottle", is a very strong skipper on sunny meadows. Though it occurs generally at low elevation in the Arunachal Pradesh, it was also reported by Wynter-Blyth (1957) from the temperate zone (*c* 2727 m) in the environs of the North-Eastern Himalayas. The males are gregarious at wet niches often in company with *Graphium* (*G.*) *doson* (C. & R. Felder), and also a few pierids including *Eurema hecabe* (Linnaeus) and *Appias lyncida* (Cramer). The females are mostly found to settle on *Machilus odoratissima, Camphora officinalis* and other plant species of *Alseodaphne* and *Cinnamonum.*

Several subspecies are known, of which only two, excluding the nominal ally from South China (*Vide* Talbot, 1947), occur in the Indian subregion. Presently, a single subspecies is incorporated.

3(a). **Graphium (Graphium) sarpedon luctatius** Fruhstorfer
(Plate I, Fig. 3)

1907. *Graphium sarpedon luctatius* Fruhstorfer, *Ent. Zeit.*, **21** (30) : 183.

Diagnostic characters.—Both fore- and hind wings with broad discal

band which is white across the median vein of the latter.

Distribution.—Vietnam : Tonkin. Hainan. India : Kashmir to North-Eastern Himalayas. Burma. Philippines. Sundaland : Kalimantan (Natuna Island) ; Indonesia. Lesser Sunda Island : Lombok.

Material examined.—Assam : Kaziranga, *c* 100 m, 2 ♂ ♂, 25. ii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Kameng district, Amatulla, *c* 850 m, 3 ♂ ♂, 9. iii., 23. v., bank of the River Norgum, *c* 909 m, 1 ♂, 14. iii. 1961 (*K. C. Jayaram* coll.), Bomdilla, *c* 370 m, 1 ♂, 10. vi. 1961 (*S. Biswas* coll.) ; Siang district, Kambang, around Sirum Bridge, *c* 200 m, 1 ♂, 14. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Tirap district, Deomali-Naharkatiya Road, *c* 250 m, 1 ♀, 11. xi. 1971 (*G. S. Arora* coll.).

Wing expanse.—59-85 mm.

Remarks.—The subspecies shows an interesting aberration in one male, from Kaziranga, with fore wing having an additional small oval greenish-blue spot just above the lower angle of cell. This feature was also noticed by De Nicéville (1896) in a male specimen from Sikkim. However, the characters based on seasonal variations of the spring-form from districts of the North-Eastern Himalayas are not sufficiently clarified by Talbot (1939), since these are rather repetitions of those of the subspecies mentioned above. Also, the characters of the summer-form, called *melas* Fruhstorfer from the identical niches, similarly corroborate with those of the subspecies ; the form is, therefore, proposed to be treated as consubspecific with *Graphium* (*G.*) *sarpedon teredon* (C. & R. Felder) from Peninsular India and Sri Lanka. As a result, no form has been presently considered. The subspecies is a new record for all the districts of Arunachal Pradesh.

(ii) **Eurypylus**-group

Diagnostic characters.—*Vide* key.

Distribution.—Sino-Palaearctic and Indo-Australian regions.

Remarks.—Munroe (1961) established a rather stable homogenity of this species-group and considered it as transitional to the *Agamemnon*-group. At least five species are known from India, all of which possess habits of flight and flower - frequenting almost similar to those

of the *Agamemnon*-group. Presently, only two species are dealt with here.

Key to the species of **Eurypylus**-group

Hind wing ventrally with costo-basal dark bar not continued upto the origin of Rs; discal veins pale ... ... *doson* (C. & R. Felder)

— Hind wing ventrally with costo-basal dark bar continued upto the origin of Rs; discal veins dark ... . *bathycles* (Zinken-Sommer)

4. Graphium (Graphium) doson (C. & R. Felder)

1864. *Papilio doson* C. & R. Felder, *Verh. zool. - bot. Ges. Wien.*, **14** : 305.
1961. *Graphium (Graphium) doson*, Munroe, *Canad. Ent*, Suppl. **17** : 19.

Diagnostic characters.—*Vide* key.

Distribution.—South Japan. South China. India : North-Western (Uttar Pradesh : Kumaon) and North-Eastern Himalayas. Burma. Sri Lanka. Sundaland.

Remarks.—The species, popularly called the "Common Jay", is represented by several subspecies, of which only two occur in the Indian subregion. Presently, only one subspecies is dealt with.

4 (a). Graphium(Graphium) doson axion (C. & R. Felder)
(Plate I, Fig. 4)

1864. *Papilio axion* C. & R. Felder, *Verh. zool. - bot. Ges. Wien*, **14** : 305.
1939. *Graphium doson axion*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 223.

Diagnostic characters.—Fore wing with a subtornal spot; hind wing with broad discal band and large whitish-green spots.

Distribution.—Hainan. Vietnam : Tonkin; Cochin-China; Annam. India : North-Western (Kumaon) to North-Eastern Himalayas, including Arunachal Pradesh. Burma. Thailand.

Material examined.—Arunachal Pradesh : Kameng district, Amatulla, *c* 848 m, 3 ♂♂, 23. v. 1961 (*K. C. Jayaram* coll.), Bhalukpong, *c* 213 m, 1 ♂, 6. v. 1966 (*A. N. T Joseph* coll.), Tippi, 1 ♀, 20. iii. 1973 (*S. K. Tandon* coll.); Siang district, Kambang, around Sirum Bridge, *c* 200 m, 1 ♂, 14. x. 1966 (*S. K. Tandon & G. S. Arora* coll.).

Wing expanse.—67-88 mm.

Remarks.—The subspecies, a new record for the Siang district of Arunachal Pradesh, is commonly found near the moist river banks. The males often congregate amidst the sunny wooded areas. The dry-season variations, as hitherto known for the subspecies, are dealt with here.

d. s. f. *acheron* Moore (1885) : Fore wing with anal vein fairly black-tinged on the discal band; hind wing with median vein also black-tinged and the ventral spots always red ; both wings ventrally with large subterminal spots. Usually found in spring, the form is reported by Talbot (1939) from mountain districts of northern India, and is also presently known by the single female from Kameng district.

d. s. f. *praestabilis* Fruhstorfer (1909) : Fore wing with anal vein hardly black-tinged on the discal band ; hind wing with median vein also hardly black-tinged and the ventral spots either yellow or red; both wings ventrally with small subterminal spots. Usually found in summer or monsoon, the form is presently known by the males from both Kameng and Siang districts.

5. **Graphium (Graphium) bathycles** (Zinken-Sommer)

1831. *Papilio bathycles* Zinken-Sommer, *Nov. Act. Ac. Nat. Cur.*, p. 157, pl. 14, figs. 6-7.
1961. *Graphium (Graphium) bathycles*, Munroe, *Canad. Ent.*, Suppl. **17** : 19.

Diagnostic characters.—*Vide* key.

Distribution.—Oriental region including all its subregions : Indo-Chinese, Indian (North-Eastern Himalayas) and Indo Malayan (Sunda-land : Malay Peninsula ; Sumatra ; Kalimantan ; Java ; Palawan).

Remarks.—The species, popularly called the "Veined Jay", is represented by the single Indian subspecies which is dealt with here.

5 (a). **Graphium (Graphium) bathycles chiron** (Wallace) (Plate I, Fig. 5)

1865. *Papilio chiron* Wallace, *Trans. Linn. Soc. Lond.*, **25** : 66.
1939. *Graphium bathycles chiron*, Talbot, *Fauna Brit India*, Butterflies, **1** : 228.

Diagnostic character.—Hind wing ventrally with a postdiscal white stripe.

Distribution.—Vietnam : Tonkin ; Annam. India : Sikkim ; Arunachal Pradesh. Burma.

Material examined.—Arunachal Pradesh : Kameng district, Amatulla, *c* 848 m, 1 ♂, 23. v. 1961 (*K. C. Jayaram* coll.) ; Siang district, Rimi Bridge, 1 ♂, 11. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Lohit district, Sumbura, *c* 100 m, 1 ♂, 2. iii. 1969, Tezu, 1 ♂, Digam Road, *c* 150 m, 1 ♂, 11 iii. 1969 (*S. K. Tandon* coll.).

Wing expanse.—68-76 mm.

Remarks.—The members of this subspecies, particularly males, frequent the wayside puddles and sandy banks of hillstreams amidst the sunny wooded areas. The wing expanse is fairly reduced as compared to the range of 75-100 mm given by Talbot (1939). Of the two seasonal forms, viz., d. s. f. *ligyra* Jordan and w. s. f. *chiron* (Wallace), as referred to by Talbot (*loc. cit.*) from India, the former is closely allied to some of the present material excepting for the absence of a small discal spot on Cu_{1a} of hind wing, The subspecies is a new record for the Siang and Lohit districts of Arunachal Pradesh.

(iii) **Agamemnon**-group

Diagnostic characters.—*Vide* key.

Distribution.—Oriental, Australian and Neotropical regions.

Remarks.—The species-group, which was earlier treated heterogeneously as *Eurypylus-Agamemnon*-group by Rothschild (1895) and Bingham (1907), and as *Eurypylus*-group by Talbot (1939), is the smallest of all the allies in the subgenus *Graphium* Scopoli. It consists of only one Indian species which is dealt with here.

6. **Graphium (Graphium) agamemnon** (Linnaeus)

1758. *Papilio agamemnon* Linnaeus, *Syst. Nat.*, ed. **10** : 462.

1961. *Graphium (Graphium) agamemnon*, Munroe, *Canad. Ent.*, Suppl. **17** : 19.

Diagnostic characters.—Body dorsally black-brown and ventrally grey with greenish lateral stripes ; fore wing dorsally with a pair of cell spots ; hind wing with the tail slightly longer in female than in male ; both wings clouded with violet grey.

Distribution.—South China. India. North-Western (Uttar Pradesh,

Kumaon) and North-Eastern Himalayas. Queensland. Solomons. Bismarck Islands.

Remarks.—The species, popularly called the "Tailed Jay", shows rapid skipping flight in rainy weather over the flowers of *Anona*, *Saccopetalum*, *Polyalthia*, *Michelia* and other species (*N. O.* Anonaceae), and also *Lantana* (*N. O.* Verbenaceae). It is represented by quite a number of subspecies, of which as many as five occur in the Indian subregion alone. Presently, only the nominal subspecies is dealt with.

6 (a). Graphium (Graphium) agamemnon agamemnon Linnaeus
(Plate I, Figs. 6-7)

1909. *Papilio agamemnon agamemnon*, Jordan, *In* Seitz, *Macrolepidotera of the World*, **9** : 101, pl. 45d.

1939. *Graphium agamemnon agamemnon*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 230.

Diagnostic characters.—Wings dorsally with pale green markings ; hind wings with ventro-discal spots on Rs and M_1 being inwardly marked red, and tail proportionately moderate in size.

Distribution.—India : U. P. (Kumaon) to North-Eastern Himalayas including Arunachal Pradesh. Burma.

Material examined.—Assam : River Likhabali, *c* 50m, 1 ♀, 2. xi. 1966. Arunachal Pradesh : Siang district, Kambang, around Sirum Bridge, *c* 200 m, 1 ♂, 14. x. 1966 (*S. K. Tandon* & *G. S. Arora* coll.).

Wing expanse.—84-88 mm.

Remarks.—The subspecies, which is a new record for the Siang district, Arunachal Pradesh, consists of one male which is referable to the local form given below.

f. *aegisthus*, Linn. (1763) : Tail very short and stumpy.

Subgenus **Pathysa** Reakirt

1864. *Pathysa* Reakirt, *Proc. ent. Soc. Phil.*, **3** : 503.

1961. *Graphium* (*Pathysa*), Munroe, *Canad. Ent.*, Suppl. **17** : 21.

Type species : *Papilio antiphates* Cramer

Diagnostic characters.—*Vide* key.

Distribution.—Mainly Indo-Australian region.

Remarks.—The subgenus is highly evolved of all its allies in the genus *Graphium* Scopoli. The members, like those of the preceding subgenus, are also found on damp patches. All the three Indian species-groups recognised by Munroe (1961), *sensu* Jordan (1900-1909), are included here.

Key to the species-group of subgenus **Pathysa** Reakirt

1. Hind wing without scent wool in male; with long tail in both sexes; ventro-discal spots when present red or yellow ... 2

— Hind wing with scent wool in male; without tail in both sexes; ventro-discal spots always absent ... ... *Macareus*-group

2. Hind wing without ventro-discal spots ... *Antiphates*-group

— Hind wing with red or yellow ventro-discal spots ... ... *Eurous*-group

(i) **Antiphates**-group

Diagnostic characters.—*Vide* key.

Distribution.—As in the subgenus.

Remarks.—Munroe (1961) retained this species-group comprising a total of nine species, of which only four are known from India. He (*loc. cit.*) did not, however, include *Graphium glycerion* Gray and *G. eurous* (Leech) in this species-group but under the *Eurous*-group. One species, *Graphium agetes* (Westwood), which belongs to this group but is not available for study, has already been reported by Betts (1950) from Likha (*c* 1075 m, v.—) and Varshney & Chanda (1971) from Tirap (—x. 1961). Presently, only one species is dealt with.

7. **Graphium (Pathysa) antiphates** (Cramer)

1775. *Papilio antiphates* Cramer, *Pap. Exot.*, **1** : 113, pl. 72, figs. A, B.
1961. *Graphium (Pathysa) antiphates*, Munroe, *Canad. Ent.*, Suppl. **17** : 21.

Diagnostic characters.—Fore wing dorsally with four intra-cellular and a single discocellular transverse bars; hind wing ventrally without red discal spot.

Distribution.—China. India : North-Eastern Himalayas. Sri Lanka.

Sundaland : North Kalimantan. Lesser Sunda Islands.

Remarks.—The species, popularly known as the "Fivebar Swordtail", flies around the tree-tops in a slow, leisurely, erratic and swarming manner. The species was reported by Varshney & Chanda (1971) from Tirap during January. Out of four subspecies, only one from North-Eastern India is presently dealt with.

7 (a). **Graphium (Pathysa) antiphates pompilius** (Fabricius) (Plate I, Figs. 8-9)

1787. *Papilio pompilius* Fabricius, *Mant. Ins.*, **2** : 8.

1939. *Graphium antiphates pompilius*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 215.

Diagnostic characters.—Fore wing with terminal band not reaching dorsum ; hind wing with a small terminal grey patch between Cu_{1b} and M_3 ; both wings with black markings reduced in size and shape.

Distribution.—Hainan. Annam. India : Sikkim ; Assam ; Arunachal Pradesh. Burma. Thailand.

Material examined.—Assam : Terai, 1 ♂, 2. iii. 1973. Arunachal Pradesh : Lohit district, Digam Road, *c* 150 m, 1 ♂, 11. ii. 1969 (*S. K. Tandon* coll.) ; Tirap district, Nampong, 1 ♂, 1. ii. 1962 (*C. B. Srivastava* coll).

Wing expanse.—75 mm.

Remarks.— The members of the subspecies, particularly males, are not rare in status and often observed on profile survey to remain in congregation of the Pierids near the hill streams and glens. None of the specimens is, however, related to the melanic form *nebulosus* (Butler) which was reported by Talbot (1939) from northern India.

(ii) **Eurous**-group

Diagnostic characters.—*Vide* key.

Distribution.—As in the subgenus.

Remarks.—The species-group comprises four species, of which only one from India was earlier considered under the *Antiphates*-group by Talbot (1939). The females are known to be fond of moist patches,

while the males occasionally visit flowers, too. Only one Indian species is presently dealt with.

8. Graphium (Pathysa) eurous (Leech)

1893. *Papilio eurous* Leech, *Butterflies of fr. China*, 521, pl. 32 fig. 3.

1961. *Graphium (Pathysa) eurous*, Munroe, *Canad. Ent.*, Suppl. **17** : 21.

Diagnostic characters.—Fore wing dorsally with four intracellular and two discocellular transverse bars ; hind wing with a row of pale ventro-discal spots.

Distribution.—West, Central and South China. India : North-Eastern Himalayas.

Remarks.—The species, popularly called the "Sixbar Swordtail", is a new record for Arunachal Pradesh and occurs in the vicinity of *Machilus odoratissima* and *M. duthiei* (*N. O.* Lauraceae). The males often exhibit soaring flight overhead the tall trees. The only Indian subspecies is presently dealt with.

8 (a). Graphium (Pathysa) eurous sikkimica (Heron)
(Plate II, Figs. 1-2)

1899. *Papilio sikkimica* Heron, *Ann. Mag. nat. Hist. Soc.*, (7) **3** : 120.

1939. *Graphium eurous sikkimica*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 204.

Diagnostic character.—Fore wing with postdiscal band reaching anal vein.

Distribution.—India : Sikkim to Assam and Arunachal Pradesh.

Material examined.—Arunachal Pradesh : Kameng district, 4-7 kms north of Chug Village, *c* 2121-2424 m, 2 ♂ ♂, 15-16. iv. 1961 (*K. C. Jayaram* coll.).

Wing expanse.—63-67 mm.

Remarks.—This subspecies, which is restricted to the hilly jungles, is known to be locally common between *c* 925-2424 m at their niches of occurrence during the winter and spring seasons.

(iii) Macareus-group

Diagnostic characters.—*Vide* key.

Distribution.—As in the subgenus.

Remarks.—The species-group, comprising a dozen of species, is retained as such by Munroe (1961) after Talbot (1939). Only three Indian species are known, all of which generally mimic their Danaine models. The species, *Graphium (Pathysa) megarus* (Westwood) from North-Eastern India, not presently included, is very much allied to the remaining two species, but can be readily distinguished by the hind wing dorsally with divided discal streaks from Cu_{1a} to M_3 and abdomen without mid-ventral line. The two species are dealt with hereunder.

Key to the species of **Macareus**-group

Hind wing ventrally with very small tornal spots ... ... *macareus* (Godart)

— Hind wing ventrally with very large tornal spots ... ... *xenocles* (Doubleday)

9. **Graphium (Pathysa) macareus** (Godart)

1819. *Papilio macareus* Godart, *Encl. Math.*, **9** : 76.
1961. *Graphium (Pathysa) macareus*, Munroe, *Canad. Ent.*, Suppl. **17** : 21.

Diagnostic characters.—*Vide* key.

Distribution.—Hainan. India : North-Eastern Himalayas. Philippines. Bali.

Remarks.—The species, popularly called the "Lesser Zebra", shows slight sexual dimorphism ; the male is much paler than female particularly from the North-Eastern Himalayas as compared to the material in the National Collections at Z. S. I. Both the sexes, of which the male exhibits gregarious habit preferably in the cloudy weather, are good mimics of *Danaus aglea* (Cramer). The species is a new record for Arunachal Pradesh. Amongst four subspecies, only two, viz., *macareus indicus* and *macareus lioneli*, are known from North-Eastern Himalayas, of which the former is presently dealt with.

9 (a). **Graphium (Pathysa) macareus indicus** (Rothschild) (Plate II, Fig. 3)

1895. *Papilio macareus indicus* Rothschild, *Novit. zool.*, **2** : 457.

1939. *Graphium macareus indicus*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 233, fig. 65.

Diagnostic characters.—Both fore-and hind wings with broad white stripes ; hind wing with cell completely white.

Distribution.—India : Sikkim ; Arunachal Pradesh.

Material examined.—Arunachal Pradesh : Kameng district, Bhalukpong, *c* 213 m, 1 ♂, 6. v. 1966 ; Subansiri district, Pamir, *c* 564 m, 1 ♂, 17. v. 1966 (*A. N. T Joseph* coll.) ; Lohit district, Dambak, 1 ♂, 5. iii. 1969, Tejoo, 1 ♂, 10. iii. 1969 (*S. K. Tandon* coll.).

Wing expanse.—70-85 mm.

Remarks.—The subspecies is very much allied to *Graphium* (*Pathysa*) *macareus lioneli* Fruhstorfer from Assam, but can be distinguished from it by the characters cited above. De Nicéville (1892) referred to a striated aberration in male, which, however, is not presently observed. The expanse of the specimens is fairly reduced as compared to the range of 80-100 mm, as mentioned by Talbot (1939).

10. **Graphium (Pathysa) xenocles** (Doubleday)
(Plate II, Fig. 4)

1842. *Papilio xenocles* Doubleday, *In* Gray, *Zool. Misc.* : 74.
1961. *Graphium* (*Pathysa*) *xenocles*, Munroe, *Canad. Ent.*, Suppl. **17** : 42.

Diagnostic characters.—*Vide* key.

Distribution.—Hainan. India : North-Eastern Himalayas. Burma. Thailand.

Material examined.—Assam : Sadiya, *c* 300m, 1 ♂, 8. iii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Tirap district, Changlong, 1 ♂, Nampong, 1 ♂, 12. i., 3. ii. 1962 (*C. B. Srivastava* coll.).

Wing expanse.—81-90 mm.

Remarks.—The species, popularly called the "Great Zebra", is a new record for Arunachal Pradesh. It is rather common in status during winter. The females are known to mimick *Danaus melaneus* (Cramer). Talbot (1939) referred to three subspecies, viz., *xenocles*

(Doubleday) from Assam, *phrontis* (De Nicéville) from Sikkim and Bhutan and *kephisos* (Fruhstorfer) from Burma and elsewhere, but the present material do not fit properly in any of the above-mentioned subspecies due to their close resemblance of facies with one another. Above all, such overlapping of characters has been observed in the species already present in the National Collections at Z. S. I., too. The specimens are also not referable to any morpho- or seasonal variations under these subspecies, as mentioned by Talbot (*loc. cit.*).

B. Tribe PAPILIONINI

The tribe is represented from both Old and New World by about 205 species in a single genus, being inter-combined by a total of 39 species groups, two series, four subsections and five secions. Of these, about 23 species together with the inter-combinations of 13 species-groups, two series, single subsection and a couple of sections are hitherto known from North-Eastern India. The present account deals with the single known genus, i. e., *Papilio* Linn., as hereunder.

Genus **Papilio** Linnaeus

1758. *Papilio* Linnaeus, *Syst. Nat.*, ed **10** (1) : 458.

Type species : *Papilio machaon* Linnaeus

Diagnostic characters. – As in the key to the tribe Papilionini.

Distribution.—Cosmopolitan.

Remarks.—Linnaeus (1758, 1767) placed under the genus almost all the species of butterflies, many of which were considered by the subsequent workers under different families of the Rhopalocera. Bingham (1907), *sensu* Rothschild (1895), classified the genus into species-groups including those of the next tribe. Besides, Talbot (1939) and Wynter-Blyth (1957) treated *Chilasa* Moore as a valid genus. Later, Talbot (1947) inclined to relegate the members of this genus to the *Clytia*-group of *Papilio* Linnaeus. Munroe (1961) observed that due to the lack of suitable structural difference amidst the abundance of superficial diversity, it is rather difficult to make out phylogenetically the distinguishing features between *Papilio* Linnaeus and *Chilasa* Moore in this tribe, of which the monogeneric status should, therefore, be maintained. It may be noted here that

the genus *Papilio* Linnaeus is allied, mostly due to the convergent mode of adaptation to one of the Troidine genera, i. e., *Battus* Scopoli from America, which is devoid of antennary sense-pits and provided with other characters including the red pigment 'B' (*Vide* Ford, 1941 1944 ; Munroe, 1961).

The genus is notable for certain peculiarities : first, it comprises the members of highest aesthetic value in the whole of Lepidoptera ; secondly, it exhibits extreme degree of polyphenism in one or both sexes of at least two Indian species ; finally, it is very much fond of flowers exclusively of the non-Aristolochiaceous plants. Besides, it shows, in general, highly powerful and variable patterns of flight.

Munroe (1961) subdivided the genus into five sections, of which only two, comprising about 150 species occur mainly in the Old World. The remaining sections are exclusively American in origin. The total number of species from all over India represents about 16.5% of the Old World fauna. The key to the two sections including the species from North-Eastern India is given below.

Key to the sections of **Papilio** Linnaeus

Abdomen with a series of white dots. Mostly mimicking the Danaine or Euploeine model and primarily found in the vicinity of plants of Lauraceae .. .. Section I

— Abdomen without white dots except in *Castor*-group. Mostly mimicking the Troidine model and primarily found in the vicinity of plants of Rutaceae ... ... Section II

Section I

This section, the members of which were erstwhile treated in the genus *Chilasa* Moore by Talbot (1939), is a minor assemblage of nine species distributed over four species-groups from Sino-Indo-Palaearctic, Oriental and Papuan regions. Of these, five species in two species-groups are known from India, including the North-Eastern Himalayas. Munroe (1961), however, doubted the entity of this section, since, with more material available for study, there is every possibility of its merger with the next section. Presently, however, four species are dealt with under two species-groups.

Key to the species-groups of **Section I**

Hind wing with Rs distad to Cu_{1b} at origin and longer than upper discocellular .. *Agestor*-group

— Hind wing with Rs basad to Cu_{1b} at origin and nearly as long as the upper discocellular *Clytia*-group

(i) Agestor-group

Diagnostic characters —*Vide* key.

Distribution.—West, Central and South China. Pakistan. India Both the Himalayas. Burma. Sundaland.

Remarks.—Three exotic species are known to occur in North-Eastern India, of which *Papilio slateri* Hewitson, not presently included, is separable by the fore wing dorsally without bluish-grey or white markings from the remaining two species which are distinguishable by the key given below.

Key to the species of **Agestor**-group

Hind wing chestnut - red with bluish-grey markings ; abdomen with a lateral row of light transverse bars .. .. *agestor* Gray

— Hind wing black with white to greyish-white markings ; abdomen with three lateral rows of white spots ... ... *epycides* Hewitson

11. Papilio agestor Gray

1831. *Papilio agestor* Gray, *In* Gray, *Zool. Misc.*, **1** : 32.

Diagnostic characters.—*Vide* key.

Distribution.—Central and South China. Pakistan. India : North-Western Himalayas ; North-Eastern Himalayas including Arunachal Pradesh. Upto Malaya.

Remarks.—The species, popularly known as the "Tawny Mime", is a sun-lover, occurring mostly on wet river sands. A good mimic of *Danaus sita* (Kollar), it is not known to visit blossoms. Out of five subspecies, as many as three are known from India. Presently, only the nominal subspecies is dealt with here.

11 (a). **Papilio agestor agestor** Gray
(Plate II, Fig. 5)

1895. *Papilio agestor agestor*, Rothschild, *Novit. zool.*, **2** : 360.

Diagnostic characters.—Hind wing dorsally with three postdiscal large spots on Rs, M_1 and M_2 and anterior interspaces markedly pale in contrast to the black ground-colour.

Distribution.—Vietnam : Tonkin. India : Sikkim ; Arunachal Pradesh. Burma : Dawna Range. Malaya.

Material examined.—Arunachal Pradesh : Kameng district, Chug Village, on the bank of the River Dukongko, *c* 1818-2121 m, 4 ♂♂, 3 ♀♀, 14-17. iv., Nyukmadong, *c* 2424 m, 1 ♂, 21. iv., Pobrangchu, *c*, 1818 m, 1 ♂, 22. iv. 1961 (*K. C. Jayaram* coll.), Dun Bridge, Tong Valley, *c* 1524 m, 1 ♂, 21. iv. 1966 (*A. N. T Joseph* coll.).

Wing expanse.—92-116 m.

Remarks.—This locally common subspecies is very much allied to *Papilio agestor govindra* (Moore) from the North-Western Himalayas, but can be readily distinguished from it by the characters as given above. It is mostly found on wing during spring and summer. The specimens are rather smaller as compared to the expanse of 100-120 mm given by Talbot (1939) and constitute a new locality record for the Kameng district of Arunachal Pradesh.

12. **Papilio epycides** Hewitson

1862-1866. *Papilio epycides* Hewitson, *Exot. Butt.*, **3** : pl. 6, fig. 16.

Diagnostic characters.—*Vide* key.

Distribution.—West and South China. India ; North-Eastern Himalayas. Burma.

Remarks.—This univoltine species, popularly known as the "Lesser Mime", exhibits habits almost similar to those of the preceding species, except for its restricted occurrence at much lower elevations. The only Indian nominal subspecies is presently dealt with.

12 (a). **Papilio epycides epycides** Hewitson
(Plate II, Fig. 6)

1895. *Papilio epycides epycides*, Rothschild, *Novit. zool.*, **2** : 361.

Diagnostic characters.—Fore wing with 5 dorsal streaks, of which two longer, diverging distally within the cell and three shorter near the apex, and the ventro-costal margin broadly blackened ; hind wing ventrally with almost complete chestnut tinge, but without discal stripe on Rs.

Distribution.—India : Sikkim ; Assam ; Arunachal Pradesh. North Burma.

Material examined.—Assam : Charduar Forest, *c* 125 m, 1 ♂, 22. ii., Elephant Flat, *c* 400 m, 1 ♂, 24. iii. 1973 (*S. K. Tandon* coll.). Arunachal Pradesh : Kameng district ; Pinjuli, *c* 244 m, 1 ♂, 4. v. 1966 (*A. N. T. Joseph* coll.).

Wing expanse.—76 mm.

Remarks.—This rare subspecies is allied to *Papilio epycides hypochra* Jordan from Shan States of Burma, but can be readily distinguished from it by the above-mentioned characters.

(ii) **Clytia**-group

Diagnostic characters.—*Vide* key.

Distribution.—As in the preceding species-group, but extending, through Philippines and Java, eastward upto as far as the Lesser Sunda Islands and Timor.

Remarks.—The species-group is represented by two species only, both of which are dealt with below.

Key to the species of **Clytia**-group

Hind wing ventrally without terminal yellow spot. Sexes dissimilar : in male, fore wing dorsally dark brown, shot with rich blue throughout and with markings smaller and bluish-white ; head, thorax and abdomen with sparsely oriented white ventral spots ; in female, fore wing dorsally with proximal half pale brown and distal half blue, and markings larger and whiter ; head, thorax and abdomen with regularly oriented white ventral spots	*paradoxa* Zinken-Sommer

— Hind wing ventrally with a terminal row of yellow spots. Sexes alike, with wing dorsally having large terminal spots ; abdomen with white ventral spots either joined with, or separated from longitudinal lines ... *clytia* Linnaeus

13. **Papilio paradoxa** Zinken-Sommer

1832. *Papilio paradoxa* Zinken-Sommer, *Nov. Act. Ac. Nat. Cur.*, **15** : 162, pl. 15, figs. 9, 10.

Diagnostic characters.—*Vide* key.

Distribution.—India : North-Eastern Himalayas. Burma. Upto Malaya. Kalimantan. Java and Palawan.

Remarks.—The species, popularly called the "Great Mime", occurs by the wayside glens amidst forests. It mimicks Euploeine species both in facies and pattern of flight. The sexual variations in females, since not collected in the present surveys, were studied from the material already present in N. Z. C. The species is a new record for Arunachal Pradesh. Amongst six subspecies, *telearchus* (Hewitson) is the largest one known from India and is presently dealt with.

13 (a). **Papilio paradoxa telearchus** (Hewitson)
(Plate II, Fig. 7)

1852. *Papilio telearchus* Hewitson, *Trans. ent. Soc. Lond.* (*N. S.*), **2** : 22, 2 pls.

1907. *Papilio paradoxus telearchus*, Bingham, *Fauna Brit. India*, Butterflies, **2** : 78, pl. xii, fig. 87.

1909. *Papilio paradoxa telearchus*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 44.

Diagnostic characters.— Fore wing with streaks or spots and complete rows of postdiscal and subterminal spots being curved antero-posteriorly ; hind wing with a series of streaks in cell and interspaces, particularly in female.

Distribution.—Vietnam : Tonkin. India : Assam ; Arunachal Pradesn. Burma. Thailand.

Material examined.—Arunachal Pradesh : Kameng district, Den-ling Forest, *c* 229 m, 1 ♂, 5. v. 1966, Bhalukpong, *c* 213 m, 1 ♂, 6. v. 1966 (*A. N. T Joseph* coll.).

Wing expanse.—100-102 mm.

Remarks.—This rare subspecies is known to occur during the spring and summer seasons. It mimicks the Danaine model, *Euploea diocletiana* (Fabricius). The material examined show certain variations in facies (*cf.* Talbot, 1939). These include the size of subterminal series of white markings, when present on the dorsal side of hind wing, being uniform and not increasing anteriorly, and the dark brown colour of cilia on the ventral side of both wings alternating regularly and not sparsely with white. Besides, the wing expanse is also fairly smaller as compared to the earlier known range of 120-150 mm. Amongst four local forms known from the Indian subregion, only one is dealt with hereunder.

f. *danisepa* Jordan (1909) : Wings dorsally velvety-brown with blue irridescence ; fore wing with distal part of cell, four postdiscal streaks and subterminal markings - all bluish-white ; hind wing dorsally with cell white and ventrally without blue shot, but with an almost complete subterminal series of markings. Earlier known from Burma, the form is represented by a single specimen which constitutes a new record for India proper.

14. **Papilio clytia** Linnaeus

1758. *Papilio clytia* Linnaeus, *Syst. Nat.*, ed. **10** : 479.

Diagnostic characters.—*Vide* key.

Distribution.—South China. Vietnam : Tonkin. India. Burma. Sri Lanka. Philippines. Sundaland. Timor.

Remarks.—Popularly called the "Common Mime", the species shows a darting flight well above the tree-tops and is a good mimic of *Danaus limniace* (Cramer). Interestingly enough, the species is not known so far from Arunachal Pradesh, though it was reported by Betts (1950) from Sadiya (200′) in the vicinity of the territory. Of a couple of subspecies from India, only *Papilio clytia flavolimbatus* (Oberthür) hitherto remains endemic in the Andaman Islands. The nominal subspecies is common on the Indian mainland and is dealt with below.

14 (a). **Papilio clytia clytia** Linnaeus

1909. *Papilio clytia clytia*. Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 42.

1939. *Chilasa clytia clytia,* Talbot, *Fauna Brit. India,* Butterflies, **1** : 116, figs. 28, 29.

Diagnostic characters.—Body with small white markings ; both wings with strongly defined cellular streaks ; hind wing with ventro-terminal row of very small and ochreous-yellow spots.

Distribution.—Throughout India. Burma.

Material examined.—Assam : Tezpur, 1 ♂, 3. iii. 1973 (*S. K. Tandon* coll.).

Wing expanse.—94 mm

Remarks.—This very common subspecies exhibits the seasonal occurrence almost identical to that of *Papilio paradoxa telearchus* (Hewitson). Talbot (1939) reported it to be "subject to much variability,....." and referred to as many as six major local forms from the Indian subregion, of which only two are known from the North-Eastern Himalayas. Presently, only one form is incorporated.

f. *dissimillima* (Evans 1923) : Wings densely dusted with black ; discal and inter-nervular streaks prominent, latter shorter in length ; subterminal spots, particularly on fore wing, large. Also found in Burma.

Section II

This is the largest of all the sections treated anonymously by Munroe (1961) under the genus *Papilio* Linnaeus. It comprises about 140 species, distributed almost universally, but predominantly in the Oriental and Ethiopian regions. Quite a many of these, at least from India, exhibit intra-specific variations of facies. It is, in turn, classified into two subsections, of which one consists exclusively of about forty ethiopian species. The other subsection is presently dealt with.

Subsection A

This subsection incorporates about 100 species mainly from Australo-Oriental, occasionally Papuan and rarely Neotropical, Holarctic, Ethiopian and Malagassic regions. Of these, only 35 are known from the Indian subregion. All the species of this subsection are characterised by distal lunule in the cell, particularly of hind wing, entire

and further subgrouped into a couple of series which can be recognised by the characters as keyed below.

Key to the series of **Subsection A**

Wings with non-metallic texture ... Series I

— Wings with metallic texture ... ... Series II

Series I

While Talbot (1939) included 16 species in five species-groups directly under the genus *Papilio* Linnaeus, Munroe (1961) incorporated at least 19 species, known from the Indian subregion in eleven species-groups under this series. Of these, only eight species are presently dealt with under six species-groups which are keyed hereunder.

Key to the species-groups of **Series I**

1. Both wings rarely with ventro-basal red markings ; sexes always dissimilar ... 2

— Both wings never with ventro-basal red markings ; sexes may be alike 4

2. Abdomen dorsally with segmentally arranged rows of white dots ; hind wing in male always tailless ; female mimicking Danaines and not showing polyphenism ... ... *Castor*-group

— Abdomen dorsally without such rows of dots as above ; hind wing in male may be tailed ; female mimicking Troidines, if any ; either of, or both the sexes showing polyphenism 3

3. Hind wing in male tailed and at best dimorphic ; female polyphenic ; both sexes without ventro-basal red marking on wings ... *Polytes*-group

— Hind wing in male tailless ; both sexes polyphenic and with prominent ventro-basal red markings on wings ... ... *Memnon*-group

4. Wings always black ; hind wing with subterminal band obsolescent except for the large white patch on anterior half and tailed *Helenus*-group

— Wings variable in pattern ; hind wing tailless 5

5. Fore wing both dorsally and ventrally with grey adnervular stripes ; hind wing with cell black and not sprinkled with yellow scales ; form mimetic of Troidines ; sexes dissimilar ... ... *Protenor*-group

— Fore wing only ventrally with pale yellow stripes at the base of cell ; hind wing with pale yellow cell ; form non-mimetic ; sexes alike ... ... *Demoleus*-group

(i) **Castor**-group

Diagnostic characters.— *Vide* key.

Distribution.—Oriental region.

Remarks.—On the ground of endemism, the species-group has apparently its smallest range of distribution amidst all the other allies presently considered. Of the two species, one is restricted to Peninsular India, while the other is dealt with hereunder.

15. **Papilio castor** Westwood

1842. *Papilio castor* Westwood, *Ann Mag. nat. Hist.*, **9** : 37.

Diagnostic characters.—Hind wing in male with four to five white discal patches or spots divided by veins, and in female, with a discal band of greyish or yellowish-white streaks and a series of white crescents on the terminal dark border

Distribution.—Taiwan. Hainan. Vietnam : Tonkin ; Annam. India : Sikkim ; Assam ; Arunachal Pradesh. Burma. Malaya Peninsula.

Remarks.—Popularly known as the "Common Raven", the species is a slow flier and drinks on moist sand. The female rather mimicks *Euploea core* (Cramer). Of the two subspecies known from the Indian subregion, only the nominal one is presently dealt with.

15 (a). **Papilio castor castor** Westwood

(Plate III, Figs. 1-2)

1895. *Papilio castor castor*, Rothschild, *Novit. zool.*, **2** : 357.

Diagnostic characters.—Male : Black ; hind wing with terminal tooth at M_3 blunt. Female : Fore wing ventrally with diffused

whitish streaks on Cu_{1b}, 1A and 2A ; hind wing dorsally with a discal series of broadly diffused white streaks extending into the apex of cell and followed by a complete row of subterminal lunules.

Distribution.—India : Assam. North Burma.

Material examined.—Arunachal Pradesh : Kameng district, Tipi, *c* 213 m, 1 ♂ , 1 ♀ , 3. v. 1966 (*A. N. T Joseph* coll.).

Wing expanse.—103 mm.

Remarks.—The subspecies is known to occur mostly during the spring and summer. The present specimens do not belong to the f. *mesites* Jordan, which was mentioned by Talbot (1939) as the connecting link between *Papilio castor mehala* (Grose-Smith) from South Burma and the nominal subspecies.

(ii) **Polytes**-group

Diagnostic characters.—*Vide* key.

Distribution.—Sino-Palaearctic and Indo-Australian regions.

Remarks.—The species-group, comprising a single Indian species along with two others from elsewhere, has been segregated by Munroe (1961) from the *Helenus*-group, which was considered heterogeneously by Talbot (1939). Munroe (*loc. cit.*) also erected separately a few more species-groups including *Fuscus*-group in which he placed two dubious species, viz., *Papilio sakontala* Hewitson and *P. walkeri* Janson. Both these species were earlier treated by Talbot (*loc. cit.*) as distinct male aberrations under *P. polytes romulus* (Cramer). Presently, the Indian species is dealt with.

16. **Papilio polytes** Linnaeus

1758. *Papilio polytes* Linnaeus, *Syst. Nat.*, ed. **10** : 460.

Diagnostic characters.—Fore wing dorsally without a prominent discal band from apex to dorsum. Male less variable ; fore wing with white terminal spots ; hind wing with uniform postdiscal white band. Female highly variable, particularly in the pattern of termen and cilia on fore wing, and colouration of discal markings on hind wing.

Distribution.—West and South China. India. Upto Timor and neighbouring islands except Tenimber.

Remarks.—Popularly known as the "Common Mormon", the species is very common in status and also interesting in so far as their varied geographical forms are concerned. While the flight of male is extremely rapid, that of female is rather equally sluggish. The female is found in company with the Troidine models. Amongst a number of subspecies, only three are known from India, of which two occur in the Andaman and Nicobar Islands. The mainland subspecies is dealt with hereunder.

16 (a). **Papilio polytes romulus** (Cramer)
(Plate III, Figs. 3-6)

1775. *Papilio romulus* Cramer, *Pap. Exot.*, **1** : 67, pl. 43, fig. A.

1895. *Papilio polytes romulus*, Rothschild, *Novit. zool.*, **2** : 347.

Diagnostic characters.—Male : Fore wing with ground colour black ; hind wing dorsally with a discal series of white spots from Rs to anal margin, tornal black spot marked by anterior blue crescent of scales, and ventrally with an incomplete subterminal row of dingy-white lunules. Female either resembling male, or with fore wing black only from base to Cu_{1a} and along the termen ; hind wing with discal markings red.

Distribution.—Vietnam : Tonkin. Throughout India, including the Andaman and Nicobar Islands, and also Assam and Arunachal Pradesh. Sri Lanka. Burma. Malaya Peninsula : Kalimantan ; Natuna Island.

Material examined.—Assam : North Lakhimpur, 1 ♂, 2. x., 1 ♀, 2. xi. 1966 (*S. K. Tandon & G. S. Arora* coll.), Kaziranga, *c* 100 m, 4 ♂ ♂, 1 ♀, 24. ii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Kameng district, Dirang Dzong, *c* 1601 m, 1 ♂, 20. xii. 1961 (*S. Biswas* coll.), Bhalukpong, *c* 213 m, 1 ♀, 6. v. 1966 ; Subansiri district, Sonai Rupai Forest, *c* 79 m, 1 ♂, 28. v. 1966 (*A. N. T Joseph* coll.) ; Siang district, Kambang, *c* 200 m, 1 ♂, 14. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Lohit district, Alubari, *c* 242 m, 1 ♀, 23. xi. 1969 (*J. M. Julka* coll.).

Wing expanse.—76-100 mm.

Remarks.—On the basis of obviously unstable criterion of the relative size of body and of markings on wings, as already pointed out by Evans (1932) and Talbot (1939), it is rather difficult to confirm the identity of this subspecies so as to separate it from remaining allies, viz., *Papilio polytes stichioides* Evans from Andamans and *P. p. nikobarus* (C. & R. Felder) from Nicobars. Moreover, the use of identical nomenclature for the female forms as "*cyrus*" and "*stichius*" of all these three subspecies, being otherwise similar to one another due to their sympatric habits, is not necessarily justified, since it leads to a sort of confusing repetition. The subspecies is a new record at least for the Siang and Lohit districts of Arunachal Pradesh. While no earlier known aberration in male is marked out, only one amongst five female forms, including three major and two minor and a couple of male forms, from North-Eastern India, are dealt with hereunder.

♂ f. *romulus* Cramer (1775) (Figs. 3-4) : This is the normal male which can be readily recognised by the characters, as given for the subspecies (*vide supra*). It is common and represented by five specimens in the lots examined.

♂ f. *cyrus* Fabr. (1793) : Distinguished from the normal male by fore wing dorsally with a large red tornal marking. Rare, being represented by only two specimens for the first time from North-Eastern India and hence of considerable taxonomic interest. Talbot, however, restricted the form only for the females, though he showed its affinities with the male.

♀ f. *stichius* Hübner (1806) (Figs. 5-6) : Fore wing basally and terminally dark, being provided with streaks within the cell ; hind wing velvety in texture, with a varying number of discal elongate white spots, anal area distally red and sprinkled with blue scales, a black tornal spot, subterminal series of red lunules and a terminal series of pale red spots being restricted postero-dorsally and complete ventrally with the anterior spots changed to white. Mimicking *Pachliopta aristolochiae* (Fabricius), this is a major form with status very common, being represented by rest of the specimens.

(iii) **Memnon**-group

Diagnostic characters.— *Vide* key.

Distribution.—Palaearctic and Oriental regions.

Remarks.—The species-group, which was also considered heterogeneously like the preceding one by Talbot (1939), includes, after Munroe (1961), eleven species. Munroe (*loc. cit.*) treated *Papilio bootes* Westwood and *P. janaka* Moore, both from India, under the *Bootes*-group, while he did not refer at all to the other Indian species, *P. rhetenor* Westwood. He, however, dubiously transferred in the *Protenor*-group *P. alcmenor* C. & R. Felder which was earlier synonymised to *P. rhetenor* Westwood by Talbot (*loc. cit.*). Of the four Indian species including *P. rhetenor* Westwood in this group, only two are presently dealt with.

Key to the species of **Memnon**-group

Hind wing in male dorsally without tornal white-edged ocellus ; female, when tailed, without large white discal markings and the red basal markings ventrally never continued along the anal margin ... *memnon* Linnaeus

— Hind wing in male dorsally with a tornal white-edged ocellus ; female always tailed and with large white discal markings supplemented by subterminal lunules and the red basal markings ventrally continued as a broad stripe along the anal margin ... *rhetenor* Westwood

17. **Papilio memnon** Linnaeus

1758. *Papilio memnon* Linnaeus, *Syst. Nat.*, ed. **10** : 460.

Diagnostic characters.—*Vide* key.

Distribution.—South Japan. India : North-Eastern Himalayas ; Eastern Peninsula ; Great Nicobar. Burma. Kalimantan. Lesser Sunda Islands.

Remarks.—The species, popularly called the "Great Mormon", is highly variable both in facies and habits of either sex, as already referred to by Talbot (1939). A new record for Arunachal Pradesh, it seems to be a duplex form of *Papilio polymnestor* Cramer from South India and Sri Lanka, and also of *P. mayo* Atkinson from the Andamans for mutually showing much similar morpho-traits, particularly in female. The single Indian subspecies is dealt with hereunder.

17 (a). **Papilio memnon agenor** (Linnaeus)
(Plate IV, Figs. 1-2)

1758. *Papilio agenor* Linnaeus, *Syst. Nat.*, ed. **10** : 460.
1895. *Papilio memnon agenor*, Rothschild, *Novit. zool.*, **2** : 316.

Diagnostic characters.—Fore wing in male dorsally deep blue with pale internervular streaks ; in female, of sepia colour with greyish-white streaks, cell basally red and distally white-tinged. Hind wing, when tailless, dorsally with discal patches of varying number and colour.

Distribution.—India : West Bengal (Calcutta) ; Sikkim ; Assam ; Arunachal Pradesh ; Nagaland ; Andaman and Car Nicobar Islands (very rare) : Great Nicobar Islands (very common) North and South Burma (Tavoy).

Material examined.—Assam : Sadiya, *c* 300 m, 1 ♂, 8. iii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Siang district, Dali Village, *c* 200 m, 1 ♂, 10. x., Dali Camp, *c* 300 m, 1 ♂, 12. x., Kambang-Perying Road, *c* 200 m, 1 ♀, 15. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Tirap district, Jairampur, *c* 225 m, 1 ♂, 2 ♀ ♀, 25-26. x. 1971 (*G. S. Arora* coll.).

Wing expanse.—Male, 108-145 mm ; female, 133-155 mm.

Remarks.—A large number of variations are on record for this subspecies, since it is so far known to be unique amidst the Indian fauna of the Papilionidae to exhibit extreme degree of polyphenism, particularly in female. With this, it is rather closely related to *Papilio polytes romulus* (Cramer) which, however, possesses comparatively a much lesser number of female forms, as already indicated. Further, the reduced wing-expanse, particularly in male, as compared to that of 120-150 mm. (*vide* Talbot, 1939), is also of interest. Only two of the nine female forms and a single of the four male forms from the Indian subregion are dealt with hereunder.

♂ f. *agenor* Linn. (1758) (Fig. 1) : Both wings dorsally with broad grey-blue stripes. Presently represented by one specimen each from Assam and Tirap, and two from Siang.

♀ f. *alcanor* Cramer (1775) (Fig. 2) : Fore wing brown ; hind wing black with apical half of cell and discal streaks between M_1

and anal area white, and tailed ; abdomen yellow. Earlier recorded from Sikkim to Burma, the form is presently represented by one specimen each from Siang and Tirap.

♀ f. *rhetenorina* Jordan (1909) : Both wings dark sepia ; hind wing dorsally blue-scaled, with a red anal ring, ventrally with a broad white stripe along the anal margin, and tailless ; abdomen black. Originally known from Sikkim, the form is presently represented from Tirap and resembles, at least in respect of the ventro-anal stripe of hind wing and black abdomen, with *P. rhetenor.*

18. **Papilio rhetenor** Westwood

1841. *Papilio rhetenor* Westwood, *Arc. Ent.*, **59** : pl. 16, fig. 1a.

Diagnostic characters.—*Vide* key.

Distribution.—West, Central and South China. India : North-Western to North-Eastern Himalayas (including Arunachal Pradesh). Up to South Burma and Thailand.

Remarks.—Popularly known as the "Red Breast", this locally common species, particularly the female, is a good mimic of the Troidine models like *Parides dasarada* (Moore) and *P. philoxenus* (Gray). Out of a pair of subspecies, *Papilio rhetenor publilius* Fruhstorfer occurs in South Burma and Thailand, while the nominal ally is dealt with hereunder.

18 (a). **Papilio rhetenor rhetenor** Westwood

1909. *Papilio rhetenor rhetenor*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 76, pl. 29b.

Diagnostic characters.—Fore wing dorsally in male with a series of pale streaks up to apical half of cell and ventrally prominent-grey ; hind wing dorsally with distal bluish scaling, an incomplete white tornal ring enclosing a red-bordered black spot, ventrally without subterminal spot in M_3 and in female with extensive red and white markings.

Distribution.—India : North-Western and North-Eastern Himalayas. Up to South Burma (Karen Hills).

Material examined.—Arunachal Pradesh : Kameng district, Dirang-Dzong, 1 ♂, 14. viii. 1961 (*S. Biswas* coll.) ; Siang district, Dali

Camp, *c* 300 m, 1 ♂, 12. x. 1966 (*S. K. Tandon & G. S. Arora* coll.).

Wing expanse.—114-130 mm.

Remarks.—A new record at least for the Siang district of Arunachal Pradesh since Betts (1950) having already recorded it from Kore and Pite of Balipara Frontier Tract, the subspecies is available at low elevations during autumn. It was, however, reported by Talbot (1939) from a maximum altitude of *c* 1818 metres during the monsoon from the other niches of the North-Eastern Himalayas. Talbot (*loc. cit.*) mentioned the male form, *leucocelis* Jordan, from the Karen Hills, as a connecting link between *Papilio rhetenor publilius* Fruhstorfer and the nominal subspecies, but the present material are not referable to this form.

(iv) **Helenus**-group

Diagnostic charcters.—*Vide* key.

Distribution.—Palaearctic and Oriental regions.

Remarks.—Munroe (1961) maintained the homogenity of this species-group and included only seven species. Presently, only two species are dealt with.

Key to the species of **Helenus**-group

Hind wing dorsally with postdiscal white patch extending to M_2 and ventrally with red subterminal lunules ... ... *helenus* Linnaeus

— Hind wing dorsally with the patch extending to M_3 and ventrally with yellow subterminal lunules ... ... *chaon* Westwood

19. **Papilio helenus** Linnaeus

1758. *Papilio helenus* Linnaeus, *Syst. Nat.*, ed. **10** : 459.

Diagnostic characters.—*Vide* key.

Distribution.—South Japan. West and South China. India : North-Western to North-Eastern Himalayas (including Arunachal Pradesh) ; Peninsular areas. Burma. Sri Lanka. Philippines. Thailand. Malay Peninsula. Lesser Sunda Islands (Timor).

Remarks.—Popularly known as the "Red Helen", the species

is fairly common in the evergreen jungles. Amongst three subspecies, two are known from India, of which *Papilio helena daksha* (Hampson) is reported by Talbot (1939) as endemic in the Peninsular belt. The other subspecies is dealt with hereunder.

19 (a). **Papilio helenus helenus** Linnaeus
(Plate IV, Figs. 3-4)

1895. *Papilio helenus helenus*, Rothschild, *Novit. zool.*, **2** : 284.

Diagnostic characters.—Fore wing ventrally with grey, long internervular streaks ; hind wing dorsally with white patch hardly touching the cell and ventrally with a series of subterminal lunules being reduced between Rs and Cula.

Distribution.—India : U. P. (Mussoorie) ; North-Eastern Himalayas. Burma. Thailand. Malay Peninsula.

Material examined.—Arunachal Pradesh : Kameng district, Ankaling, *c* 848 m, 1 ♂, 10. iii., bank of the River Norgnm, *c* 909 m, 1 ♂, 14. iii., bank of the River Dukongko, *c* 1818 m, 1 ♂, 2. v., Denzi, *c* 1227 m, 1 ♂, 15. v., Amatulla, *c* 848 m, 1 ♂, 23. v., bank of the River Norgum, *c* 374 m, 1 ♂, 29. v. 1961 (*K. C. Jayaram* coll.)., Bhalukpong, *c* 213 m, 1 ♀, 6. v. 1966 ; Subansiri district, Pamir, *c* 564 m, 1 ♂, 17. v. 1977 (*A. N. T Joseph* coll.) ; Siang district, Dali Village, 2 ♂ ♂, 12. x., Kambang, *c* 200 m, 1 ♂, 16. x., Tippi, *c* 1600 m, 5 ♂ ♂, 23, 29. x., Basar, *c* 556 m, 1 ♂, 31 x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Tirap district, Changlong Village, *c* 600 m, 1 ♂, 2. xi. 1971 (*G. S. Arora* coll.).

Wing expanse.—87-124 mm.

Remarks.—The subspecies, which is a new record for the Siang and Tirap districts of Arunachal Pradesh, was reported by Talbot (1939) to have a single male morpho-form, *rufatus* Rothschild, to which none of the present specimens, however, is related. Some of the examples exhibit markedly reduced wing-expanse as compared to that of 110-120 mm., as mentioned by Talbot (*loc. cit.*).

20. **Papilio chaon** Westwood

1845. *Papilio chaon* Westwood, *Arc. Ent.*, **2** : 97, pl. 72, fig. 1.

Diagnostic characters.—*Vide* key.

Distribution.—South China. Vietnam. Cambodia. Laos. Nepal. India : North-Eastern Himalayas (including Arunachal Pradesh). North and South Burma. Thailand. Malay Peninsula.

Remarks.—Popularly known as the "Yellow Helen", the species occurs in the wooded hills at low elevations. It is represented in the Indian subregion by two subspecies, of which *Papilio chaon ducenarius* Fruhstorfer is endemic in South Burma. The nominal subspecies is dealt with hereunder.

20 (a). **Papilio chaon chaon** Westwood
(Plate IV, Figs. 5-6)

1909. *Papilio chaon chaon*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, 9 : 53, pl. 22,b,c.

Diagnostic characters.—Fore wing with intra-cellular and distal longitudinal streaks strewn with yellowish-brown scales ; hind wing with white discal spots but without subterminal and tornal markings.

Distribution.—Nepal. India : North-Eastern extra-peninsular belt. North Burma.

Material examined.—Assam : Sadiya, *c* 300 m, 2♂♂, 8. iii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Kameng district, Tipi, *c* 213 m, 1♂, 1♀, 3. v., Bhalukpong, *c* 213 m, 2♂♂, 16. v. 1966 (*A. N. T Joseph* coll.) ; Siang district, Likhabali, *c* 50 m, 1♀, 2. x. 1966 (*S. K. Tandon & G. S. Arora* coll.).

Wing expanse.—97-125 mm.

Remarks.—The subspecies is quite common and variable, particularly in female, with the white spots being approximated to the discocellulars or even extended slightly within the cell of hind wing ; white spots are occasionally present ventro-laterally also on the abdomen. These sexual variations, however, are not stable. None of the examples is referable to any of the local forms, such as, *paryphanta* Jordan or *leucantha* Fruhstorfer, which were mentioned by Talbot (1939). The wing-expanse is also fairly reduced as compared to the range of 115-130 mm, as given by Talbot (*loc. cit.*). The subspecies is a new record for Arunachal Pradesh.

(v) **Protenor**-group

Diagnostic characters.—*Vide* key.

Distribution.—Palaearctic and Oriental regions.

Remarks.—Munroe (1961) incorporated in this group four species, of which three including *Papilio alcmenor* C. & R. Felder are of uncertain systematic position. Presently, only one species is dealt with.

21. **Papilio protenor** Cramer

1775. *Papilio protenor* Cramer, *Pap. Exot.*, **1** : 77, pl. 49, figs. A, B.

Diagnostic characters.—Fore wing dorsally in male with the ground-colour deep velvety blue, paler in female ; hind wing dorsally in male with a broad yellowish subcostal stripe, absent in female, and ventrally with a large red tornal patch in both sexes.

Distribution.—South China. India : North-Western and North-Eastern Himalayas (including Arunachal Pradesh).

Remarks.—Popularly known as the "Spangle", the species shows gregarious habit along the banks of rivers. Out of the two Indian subspecies, the nominal one is restricted to the North-Western Himalayas, while the other one is presently dealt with.

21 (a). **Papilio protenor euprotenor** Fruhstorfer
(Plate V, Fig. 1)

1908. *Papilio protenor euprotenor* Fruhstorfer, *Ent. Zeit. Stutt.*, **22** (11) : 46.

Diagnostic characters.—In both sexes, fore wing ventrally white and hind wing dorsally with extensive blue scaling in the distal area.

Distribution.—Vietnam : Tonkin. India : Sikkim ; Assam ; Arunachal Pradesh. North Burma.

Material examined.—Assam : Sadiya, *c* 300 m, 2 ♂♂, 8. iii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Kameng district, Sangloom Village, 1 ♂, 12. ix. 1961 (*S. Biswas* coll.) ; Subansiri district, Pamir, *c* 564 m, 1 ♂, 17. v., Denling. Forest, *c* 229 m, 1 ♂, 5. v. (*A. N. T Joseph* coll.) ; Siang district, Likha, 1 ♂, 7. x., New Jinning, *c* 200 m. 1 ♀, 19. x., Daporijo, *c* 150 m, 1 ♂, 1 ♀, 28. x. 1966 (*S. K. Tandon* & *G. S. Arora* coll.) ; Lohit district, Dambak, 1 ♂, 5. iii., Manabhum

c 100 m, 1 ♂, 17. iii. 1969 (*S. K. Tandon* coll.).

Wing expanse.—Male, 96-116 mm. ; female, 106-120 mm.

Remarks.—This subspecies was recorded from Balipara Tract by Betts (1950) and also from Tirap by Varshney & Chanda (1971). It does not differ remarkably in facies from the nominal subspecies. Talbot (1939), in the description of the species, referred to the presence of a broad white subcostal stripe on the dorsal side of hind wing in both sexes, whereas in the description of both the subspecies, viz., *protenor* Westwood and *euprotenor* Fruhstorfer, he (*loc. cit.*) mentioned it to be present in male and absent in female. The females in the present material agree with the subspecific description in so far as this character is concerned.

(vi) **Demoleus**-group

Diagnostic characters.—*Vide* key.

Distribution.—Palaearctic, Ethiopian, Malagassic, Oriental, Papuan and Australian regions.

Remarks.—This species-group including five species has its widest range of distribution amongst all its allies under review and was considered by Talbot (1939) to comprise four species from the Indian subregion. Munroe (1961) separated on the basis of genital studies this species-group from two other valid groups. viz., *Machaon*-with eleven Holarctic and Neotropical species and *Xuthus* with only one palaearctic species, all of which were merged together with the present species-group by Talbot (*loc. cit.*). Presently, only one species from India is dealt with.

22. **Papilio demoleus** Linnaeus

1758. *Papilio demoleus* Linnaeus, *Syst. Nat.*, ed. **10** : 464.

Diagnostic characters.—Fore wing dorsally with yellow discal band interrupted by irregular spots ; hind wing with apical blue-black and anal red spots ; both wings with subterminal and terminal series of yellow spots.

Distribution.— Persia Arabia. China. India (including Arunachal Pradesh). Sri Lanka. Burma. Malaya. Lesser Sunda Islands. North Australia. South papua.

Remarks.—Popularly known as the "Lime Butterfly", the species is very common in the plains rather than in the wooded hills of the Oriental region. Fletcher (1925) reported its migration as an agency of serious pest-outbreak on the *Citrus* plantations of India. Out of as many as six subspecies, only the nominal one is known from India and is dealt with hereunder.

22 (a). **Papilio demoleus demoleus** Linnaeus
(Plate V, Figs. 2-3)

1895. *Papilio demoleus demoleus*, Rothschild, *Novit. zool.*, **2** : 279.

Diagnostic characters.—Fore wing dorsally with basal half of cell irrorated with yellow scales and a rather complete but narrow discal band of creamy yellow spots of variable orientation and size.

Distribution.—Persia. Throughout India. Up to North Burma.

Material examined.—Arunachal Pradesh : Subansiri district, Majgaown, *c* 79 m, 1 ♂, 2 ♀ ♀, 30. v. 1966 (*A. N. T Joseph* coll.) ; Siang district, Basar, *c* 550 m, 1 ♂, 31. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Tirap district, Jairampur, *c* 225 m, 2 ♂ ♂, 2 ♀ ♀, 25-26. x. 1971 (*G. S. Arora* coll.).

Wing expanse.—76-99 mm.

Remarks.—The subspecies, which is a new record for the Siang and Tirap districts of Arunachal Pradesh, is closely allied to *Papilio demoleus malayanus* Wallace from South Burma to Malay Peninsula, but can be readily distinguished from it by the above characters. It prefers both sun and flowers particularly of the lemon and mustard plants and remains in congregation near the waterside. In contrast to the Talbot's (1939) observations on variations, all the specimens, presently examined, lack discal spot before M_2 on the dorsal side of fore wing ; there is a pair of small extracellular spots between M_1 and M_3 on the dorsal side of hind wing in as many as six specimens, a feature which was observed by him especially in the specimens from Sri Lanka. The single known local form under the subspecies is given below.

f. *demoleinus* Oberthür (1879) : Hind wing with the red tornal spot anteriorly reduced and separated from the blue lunule by a

black spot, as observed in a few specimens.

Series II

Munroe (1961) erected this series to include four species-groups distributed in the Palaearctic, Oriental and Papuan regions, of which *Paris* and *Palinurus*-groups were earlier considered under the former group by Talbot (1939). The remaining couple of species-groups shows their range from Java to Papua. Presently, only one species-group is dealt with.

(i) Paris-group

Diagnostic characters.—Both wings dorsally shot with blue or green scales distributed either uniformly throughout or localised in a patch, and ventrally dark.

Distribution.—Japan. West, Central and South China. Pakistan : Chitral. Nepal. India : North-Western and North-Eastern Himalayas ; Peninsular belts. Bangladesh. Burma. Sundaland.

Remarks.—This is allied to the *Helenus*-group, but can be readily distinguished from it by the above characters. Out of eight species, only four are known from India. Presently, the account of only a pair of species is given hereunder.

Key to the species of **Paris-group**

	Fore wing in male always with more than one wooly scent-stripes hind ; wing with the proximal edge of discal patch straight and diffused	*polyctor* Boisduval
—	Fore wing in male hardly with wooly scent-stripe along Cu_{1b} ; hind wing with the proximal edge of discal patch curved and sharply defined	*paris* Linnaeus

23. Papilio polyctor Boisduval

1836. *Papilio polyctor* Boisduval, *Spec. Gen. Lep.*, **1** : 205.

Diagnostic characters.—*Vide* key.

Distribution.—Vietnam : Tonkin. Pakistan : Chitral. India : North-Western and North-Eastern Himalayas (including Arunachal Pradesh). Burma. Thailand.

Remarks.—The species, popularly known as the "Common Peacock", is perhaps the most beautiful of all the Indian butterflies. Of the four subspecies from the Indian subregion, the nominal one is confined from Chitral to Kumaon in the North-Western Himalayas, while the other is dealt with hereunder.

23 (a). **Papilio polyctor ganesa** (Doubleday)

1842. *Papilio ganesa* Doubleday, *Zool. Misc.*, p. 73.
1895. *Papilio polyctor ganesa*, Rothschild, *Novit. zool.*, **2** : 383.

Diagnostic characters.—Fore wing dorsally without subtornal spot ; subterminal bright golden-green band very short and extending between subtornus and Cu_{1a} ; ventrally with prominent distal intermediate streaks not reaching termen. Hind wing dorsally with posterior red subterminal lunules and ventrally with irroated yellowish scales.

Distribution.—India : Sikkim ; Arunachal Pradesh. North Burma.

Material examined.—Assam : Sadiya, *c* 300 m, 1 ♂, 8. iii. 1969 (*S. K. Tandon* coll.). Arunachal Pradesh : Siang district, New Jinning, *c* 200 m, 1 ♂, 18. x., Old Jinning, *c* 500 m, 1 ♂, 20. x., Basar, *c* 550 m, 1 ♀, 31. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Lohit district, Tezu, Heyliaung, *c* 700 m, 1 ♂, 12. iii. 1969 (*S. K. Tandon* coll.) ; Tirap district, Khonsa-Deomali Road, *c* 500 m, 1 ♂, 8. xi. 1971 (*G. S. Arora* coll.).

Wing expanse.—96-125 mm.

Remarks.—The subspecies is more closely allied to *Papilio polyctor significans* Fruhstorfer from South Burma than to the nominal ally, but can be readily distinguished from the former by the absence of subtornal spot on forewing and from *polyctor polyctor* Boisduval by the remaining characters as cited above. None of the present specimens, however, fits either in the aberration *porphyira* Jordan or the dry-season form *mai* (Tytler), which were mentioned by Talbot (1939). The subspecies is a new record for most of the districts of Arunachal Pradesh.

24. **Papilio paris** Linnaeus

1758. *Papilio paris* Linnaeus, *Syst. Nat.*, ed. **10** : 459.

Diagnostic characters.—*Vide* key.

Distribution.—West, Central and South China. India : North-Western and North-Eastern Himalayas (including Arunachal Pradesh) ; South and East Peninsula. Burma. Java. Sumatra.

Remarks.—The males belonging to the species popularly known as the "Paris Peacock", are very commonly found at low elevations in the hilly forests and are fond of flowers. While the nominal subspecies was reported by Corbet (1941) and Talbot (1947) from South-East China and elsewhere, two other subspecies are known from India. Presently, only one subspecies is dealt with.

24 (a). Papilio paris decorosa Fruhstorfer

(Plate V, Figs. 4-5)

1909. *Papilio paris decorosa* Fruhstorfer, *Ent. Zeit.*, **23** (No. 25) : 116.

Diagnostic characters.—Sexes dissimilar. Fore wing in male ventrally with a broad post-discal band being rather straight towards costa, and hind wing dorsally with dark green scales not extending to costa, a prominently shiny blue discal patch and a broad post-discal area flanked by a pair of latero-transverse narrow diffused bands ; in female, with green discal patch and red subterminal lunule on Rs.

Distribution.—India : Uttar Pradesh (Kumaon) ; Sikkim ; Terai of Assam (Upto 1525 m.) ; Arunachal Pradesh ; Orissa. Burma (including Tenasserim).

Material examined.—Arunachal Pradesh : Subansiri district, Tamen, *c* 305 m, 1 ♂, 19. v. 1966 (*A. N. T Joseph* coll.) ; Siang district, Likhabali, *c* 50 m, 1 ♂, 1 ♀, 2. x-xi., Siju, *c* 165 m, 1 ♂, 8. x., Dali Camp, *c* 300 m, 2 ♂ ♂, 12. x., Kambang, *c* 200 m, 1 ♂, 15. x., Old Jinning, *c* 500 m, 1 ♂, 20. x., Tachi Doni, *c* 400 m, 1 ♂, 24. x., Daporijo, *c* 150 m, 1 ♂, 3 ♀ ♀, 26-28. x., Bame, *c* 600 m, 1 ♂, 30. x. 1966 (*S. K. Tandon & G. S. Arora* coll.).

Wing expanse.—110-124 mm.

Remarks.—The subspecies, which constitutes a new locality record at least for the Siang district of Arunachal Pradesh, is very much allied to *Papilio paris tamilana* (Moore) from Tamil Nadu, but can be readily distinguished from it by the characters cited above. It

shows very slight seasonal variations in the form which is dealt with below.

Dry-season form *splendorifer* Fruhstorfer (1900) : Very small in size, as observed in a few specimens. Other characters, however, are not enough demarcated from those of the subspecies.

C. Tribe **Troidini**

This tribe, from both the Old and New World, has been considered by Munroe (1961) to include *Parides*- and *Troides*-complexes, *sensu* Zeuner (1943). It is represented by about 140 species in seven genera, four subgenera, 14 species-groups and eight subspecies-groups. Of these, about 22 species in three genera, being intercombined by three species-subgroups, four species-groups and two subgenera, are hitherto known from North-Eastern India. The present account deals with all the three Indian genera, as hereunder.

Key to the genera of the tribe **Troidini**

1. Frons black. Fore wing with R_1 originating from the cell at a point opposite to that of Cu_{1b} ; body particularly in female very large ... ... *Troides* Hübner

— Frons red. Fore wing with R_1 originating from the cell at a point opposite to that of Cu_{1a} ; body in both sexes of medium size 2

2. Hind wing with both scent-fold and wool strongly developed in male ; tail, when present, either shortly pointed or largely spatulate in both sexes ... ... *Parides* Hübner

— Hind wing with scent-fold but without strong scent-wool in male ; tail, when present, never pointed but shortly spatulate in both sexes ... ... *Pachliopta* Reakirt

Genus **Parides** Hübner

1819. *Parides* Hübner, *Verz. bek. Schmett.*, p. 87.

Type species : Princeps echelus Hübner

Diagnostic characters.— Vide key.

Distribution.—Palaearctic, Malagassic, Oriental and Neotropical regions.

Remarks.—This genus, the members of which were formerly treated by Talbot (1939) under *Polydorus* Swainson and later transferred by him (1947) to *Atrophaneura* Reakirt, is recognised by Munroe (1961) as one of the paired components of the *Parides*-complex, the other counterpart being the *Pachliopta*-complex. The genus is represented by two subgenera including *Atrophaneura* Reakirt being dealt with hereunder, while the nominal ally is rather exclusively known from America.

Subgenus **Atrophaneura** Reakirt

1864. *Atrophaneura* Reakirt, *Proc. ent. Soc. Phil.*, **3** : 446.
1961. *Atrophaneura* (*Atrophaneura*) Munroe, *Canad. Ent.*, Suppl. **17** : 34.

Type species : *A. erythrosoma* Reakirt

Diagnostic characters.—Hind wing with tail always well developed except in *Nox*-group and anal region in male having a prominent secondary sexual character except in *Coon*-group.

Distribution.—Palaearctic, Malagassic and Indo-Malayan regions.

Remarks.—The subgenus, which may exhibit variations of the aforesaid characters for the non-Indian members, is represented by four species-groups including one from Malagassy. Of the remaining allies, the *Coon*-group, from Cachar and Andamans to Java, is further distinguished from the others by the tail of hind wing prominently constricted at base. The other two groups are dealt with hereunder.

Key to the species-groups of subgenus **Atrophaneura** Reakirt

The tail in hind wing long and spatulate; anal region in male with a white scent wool — *Latreillei*-group

— The tail in hind wing, when present, short and pointed; anal region in male with white scent scales ... ... *Nox*-group

(i) **Latreillei**-group

Diagnostic characters.— *Vide* key.

Distribution.—Japan. China. Pakistan. India (including only the

Himalayan belts). Burma. Up to Malaya.

Remarks.— Out of 14 species, as many as seven are known from India, mostly from the North-Eastern Himalayas. Presently, only four species are dealt with.

Key to the species of **Latreillei-group**

1. Hind wing dorsally with a subterminal spot in area M_2 ; tail black-tipped 2

— Hind wing dorsally without subterminal spot in area M_2 ; tail red-tipped 3

2. Hind wing with cilia from tornus to Cu_1a black ... ... *latreillei* (Donovan)

— Hind wing with cilia from tornus to Cu_1a red *polla* (De Nicéville)

3. Hind wing dorsally with bright red subterminal spot on M_3 ; tail narrower ... *philoxenus* (Gray)

— Hind wing dorsally with pale red subterminal spot on M_3 ; tail broader ... ... *dasarada* (Moore)

25. Parides (Atrophaneura) latreillei (Donovan)

1826. *Papilio latreillei* Donovan, *Nat. Repos.*, **2** : pl. 140.
1961. *Parides* (*Atrophaneura*) *latreillei*, Munroe, *Canad. Ent*, Suppl. **17** : 46.

Diagnostic characters.— *Vide* key.

Distribution.—India : North-Western and North-Eastern Himalayas. Nepal. Burma.

Remarks.—Popularly known as the "Rose Windmill", the species is represented by two subspecies from India. Of these, the nominal ally was reported from the elevations between *c* 1575-2730 metres of the different belts at Himalayas by Talbot (1939) and also at Arunachal Pradesh (Apa Tani) by Betts (1950). The other subspecies is dealt with hereunder.

25 (a). Parides (Atrophaneura) latreillei kabrua (Tytler)
(Plate VI, Fig. 1)

1915. *Papilio kabrua* Tytler, *J. Bombay nat. Hist. Soc.*, **23** : 513.
1923. *Byasa latreillei kabrua*, Evans, *l. c.*, **29** : 233.

Diagnostic characters.—Hind wing dorsally with an additional white spot between M_1 and M_2 ; subterminal spot absent above M_1.

Distribution.—India : Assam ; Arunachal Pradesh ; Manipur ; Nagaland. North Burma.

Material examined.—Arunachal Pradesh : Kameng district, bank of River Dukongko, 108 kms. from Bomdila, *c* 1818 m, 1 ♂, 2. v., Lower Sigyon Village, *c* 2000 m, 1 ♂, 4. v. 1961 (*K. C. Jayaram* coll.).

Wing expanse.—105-108 mm.

Remarks.—This rare subspecies is very much allied to the nominal ally, but can be readily distinguished from it by the smaller size and other characters, as cited above. It is a new record for the Kameng district of Arunachal Pradesh.

26. **Parides (Atrophaneura) polla** (De Nicéville)
(Plate VI, Figs. 2-3)

1897. *Byasa polla* De Nicéville, *J. Asiat. Soc. Bengal*, **66** (2) : 565, pl. 4, fig. 28.
1961. *Parides* (*Atrophaneura*) *polla*, Munroe, *Canad. Ent.*, Suppl. **17** : 46.

Diagnostic characters.—*Vide* key.

Distribution.—India : Assam ; Arunachal Pradesh ; Manipur ; Nagaland. North Burma.

Material examined.—Arunachal Pradesh : Kameng district, Pura Bridge, *c* 1524 m, 1 ♂, 21. iv. 1966 (*A. N. T Joseph* coll.).

Wing expanse.—124 mm.

Remarks.—Popularly called the "De Nicéville's Windmill", the species is a new record for Arunachal Pradesh, where it seems to occur at a lower elevation than in other niches, as reported (*c* 1818-2424 metres) by Talbot (1939). The species is very rare, being found in the post-winter seasons, and not represented by any subspecies from India.

27. **Parides (Atrophaneura) philoxenus** (Gray)

1831. *Papilio philoxenus* Gray, *Zool. Misc.*, **1** : 32.
1961. *Parides* (*Atrophaneura*) *philoxenus*, Munroe, *Canad. Ent.*, Suppl. **17** : 46.

Diagnostic characters.—*Vide* key.

Distribution.—South China. Pakistan. India : North-Western Himalayas (Kashmir) ; North-Eastern Himalayas (including Arunachal Pradesh). Nepal. Burma. Thailand.

Remarks.—Popularly known as the "Common Windmill" the species is sexually dimorphic. The female is an interesting model of the day-flying moth, *Epicopia polydora* Westwood of the family Epicopiidae, which occurs in the identical niches particularly in India. It shows both the phenomena of Batesian and Mullerian mimicry in that it is mimicked not only by the palatable moth, but also by some distasteful models including *Parides dasarada* (Moore). The species is reported by Wynter-Blyth (1957) as multivoltine in habits, occurring during the monsoon and post-winter seasons. It is also known to be frequenting several plant species of *Nephanthes, Clematis* and *Rhododendron.* Out of four Oriental subspecies hitherto known, only two including the nominal ally occur in India. Presently, only one subspecies is dealt with.

27 (a). **Parides (Atrophaneura) philoxenus polyeuctes** (Doubleday)

(Plate VI, Fig. 4)

1842. *Papilio polyeuctes* Doubleday, *Zool. Misc.*, p. 74.
1909. *Papilio philoxenus polyeuctes*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 32.

Diagnostic characters.—Hind wing dorsally in male without white marking anterior to the quadrate spot on M_2. Frons and abdomen in both sexes ventrally pale.

Distribution.—Yunnan. Vietnam : Annam ; Tonkin. India : Sikkim ; Assam ; Arunachal Pradesh. Up to Thailand.

Material examined.—Assam : Sadiya, *c* 300 m, 2 ♂♂, 8. iii. 1966 (*S. K. Tandon* coll.) Arunachal Pradesh : Kameng district, bank of the River Norgum, *c* 909 m. 1 ♂, 14. iii., Chug Village, 1 ♂, 17. iv., Rahung, 1 ♂, 25. iv., bank of the River Dukongko, *c* 1818 m, 4 ♂♂, 2.v., Lower Sigyon, *c* 2000m, 3 ♂♂, 4.v.,10.vi., Shergaon *c* 1818m, 4 ♂♂, 5, 8. v., Denzi, *c* 1227 m, 2 ♂♂, 16, 29. v. 1961 (*K. C. Jayaram* coll.), Dirang Dzong, *c* 485 m, 2 ♂♂, 19. vii., 1 ♂, 23. vii., Kalaktang, *c* 600 m, 1 ♂, 31 vii., Siggeron, *c* 647 m, 1 ♂, 28. viii. 1961 (*S. Biswas* coll.) ; Siang district, Likha, 1 ♂, 6. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Lohit district, Dambak, 1 ♂,

1 ♀, 5. iii., Bomlung, *c* 3000 m, 1 ♂, 9. iii., Teju, *c* 150 m, 1 ♂, 10. iii. 1969 (*S. K. Tandon* coll.), Gogoi Camp, *c* 242 m (Daphabum Exped.), 1 ♂, 29. vi. 1969 (*J. M. Julka* coll.).

Wing expanse.—98-132 mm.

Remarks.—The subspecies, of which the male in particular is locally very common, is a new record for Arunachal Pradesh. It occurs at the highest ever-known elevation of *c* 3000 metres at Bomlung in the whole of North-Eastern India. It is also interesting to note that some of the specimens examined are provided with a white spot posterior to the quadrate patch on hind wing, while a few others are quite smaller, as compared to 110 mm, the lowest range of wing expanse already mentioned by Talbot (1939) for the subspecies.

28. Parides (Atrophaneura) dasarada (Moore)

1857. *Papilio dasarada* Moore, *Cat. Lep. Mus. E. I. C.*, **1** : 96.
1961. *Parides* (*Atrophaneura*) *dasarada*, Munroe, *Canad. Ent.*, Suppl. **17** : 46.

Diagnostic characters.—*Vide* key.

Distribution.—Hainan. Vietnam (Tonkin). India : Both the belts of the Himalayas. Burma.

Remarks.—Popularly called the "Great Windmill", the species is a new record for Arunachal Pradesh. Of the three subspecies from the Indian subregion, only *Parides (Atrophaneura) dasarada ravana* (Moore) is confined in the North-Western Himalayas, while the other two are dealt with hereunder.

Key to the subspecies of **dasarada** (Moore)

Hind wing ventrally with a spot in area between M_1 - M_2 and a large white discal patch above area M_2 - M_3 ... ... *dasarada* (Moore)

— Hind wing ventrally without such a spot ... *barata* (Rothschild)

28 (a). Parides (Atrophaneura) dasarada dasarada (Moore)
(Plate VI, Fig. 5)

1923. *Byasa dasarada dasarada*, Evans, *J. Bombay nat. Hist. Soc.*, **29** : 233.

Diagnostic characters.—*Vide* key.

Distribution.—India : Sikkim ; Arunachal Pradesh ; Nagaland. Burma.

Material examined.—Arunachal Pradesh : Kameng district, Amatulla, *c* 854 m, 1 ♂, 23. v. 1961 (*K. C. Jayram* coll.) ; Subansiri district, Kimin, *c* 198 m, 1 ♀, 11. v. 1966 (*A. N. T Joseph* coll.) ; Lohit district, Dambak, 1 ♂, 5. iii., Teju, *c* 150 m, 1 ♂, 1 ♀, 10. iii. 1969 (*S. K. Tandon* coll.).

Wing expanse.—108-120 mm.

Remarks.—The specimens, belonging to this endemic subspecies in the North-Eastern Himalayas, are quite smaller as compared to the wing expanse of 120-140 mm in Talbot (1939).

28 (b). Parides (Atrophaneura) dasarada barata (Rothschild)

(Plate VI, Fig. 6)

1895. *Papilio philoxenus* ab. *barata* Rothschild, *Novit. zool.*, **2** : 266 (part.).
1908. *Papilio dasarada barata*, Rothschild, *l. c.*, **15** : 168.

Diagnostic characters.—*Vide* key.

Distribution.—India : Arunachal Pradesh. Vietnam : Tonkin. Burma.

Material examined.—Arunachal Pradesh : Siang district, Kambang, *c* 200 m, 1 ♀, 15. x. 1966 (*S. K. Tandon & G. S. Arora* coll.) ; Tirap district, Jairampur, *c* 225 m, 1 ♂, 27. x. 1971 (*G. S. Arora* coll.).

Wing expanse.—135-145mm.

Remarks.—The subspecies is being recorded from India for the first time.

(ii) **Nox**-group

Diagnostic characters.—*Vide* key.

Distribution.—South China. India : Both the sectors of the Himalayas. Burma. Sulawesi. Thailand. Malay Peninsula. Sumatra.

Remarks.—Out of a dozen species, only four are known from the Indian subregion. Of these, *Parides zaleucus* (Hewitson) was considered by Talbot (1939) as the subspecies of *P. varuna* (White), though he commented, "the subspecies ..... is usually treated as a distinct species" Presently, only two species are dealt with.

Key to the species of **Nox**-group

Male with fore wing entirely bluish-black ; hind wing dorsally with a rounded anal fold, being red or pink on the termen and ventrally without grey spot. Female with fore wing uniformly grey-brown ; hind wing with indistinct sheen ... ... *aidoneus* (Doubleday)

— Male with fore wing bluish-black only on proximal half ; hind wing dorsally with a truncate black-brown anal fold and ventrally with a small pale grey spot. Female with fore wing with a large pale posterior patch ; hind wing a prominent metallic sheen ... *varuna* (White)

29. **Parides (Atrophaneura) aidoneus** (Doubleday)

(Plate VII, Fig. 1)

1845. *Papilio aidoneus* Doubleday, *Ann. Mag. nat. Hist.*, **16** : 178.
1961. *Parides* (*Atrophaneura*) *aidoneus*, Munroe, *Canad Ent.*, Suppl. **17** : 46.

Diagnostic characters.— *Vide* key.

Distribution.— South China. India : Uttar Pradesh ; Sikkim ; Assam ; Arunachal Pradesh. Burma (Shan States).

Material examined.—Arunachal Pradesh : Lohit district, Dambak, *c* 100 m, 1 ♂, 5. iii., Teju, *c* 150, m, 1 ♂ 10. iii., Digaru Road, *c* 150 m, 1 ♂, 1 ♀, 11. iii. 1969 (*S. K. Tandon* coll.).

Wing expanse.— 83-116 mm.

Remarks.—Popularly called the "Lesser Batwing", this sexually dimorphic species is closely allied to *Parides* (*Atrophaneura*) *varuna* (White) with abdomen laterally red or pink in male and broadly white-striped in female, but can be readily distinguished from it by other characters, as cited in the key The species is rare almost everywhere except in Sikkim, where it was reported by Talbot (1939) to be locally common up to *c* 1520 metres during April and November. The specimens at hand are considerably smaller as compared to the expanse of 112-162 mm in Talbot (*loc. cit.*). The species, which has no geographical form, is a new record for the Lohit district of Arunachal Pradesh.

30. Parides (Atrophaneura) varuna (White)

1842. *Papilio varuna* White, *Entom.*, **1** (17) : 280.
1961. *Parides* (*Atrophaneura*) *varuna*, Munroe, *Canad. Ent.*, Suppl. **71** : 46.

Diagnostic characters.—*Vide* key.

Distribution.—Vietnam : Tonkin. India : Sikkim ; Assam ; Arunachal Pradesh. Burma (Mergui Archipelago). Thailand. Malay Peninsula.

Remarks.—Popularly known as the "Common Batwing", the species also exhibits sexual dimorphism like the preceding ally. It is common in status in the niches of its occurrence. Amongst a few subspecies, only one is known from India, and is dealt with hereunder.

30 (a). Parides (Atrophaneura) varuna astorion (Westwood) (Plate VII, Figs. 2-3)

1843. *Papilio astorion* Westwood, *Ann. Mag. nat. Hist.*, **9** : 37.
1909. *Papilio varuna astorion*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 30, pl. 19a.

Diagnostic characters.—Male with fore wing ventro-distally whitish particularly in the area of dorsum ; hind wing dorsally with the cell quite dark. Female with fore wing dorsally with a large diffused grey patch on the dorsum ; hind wing pale and ventrally with a distinct white posterior patch.

Distribution.—India : Uttar Pradesh (Kumaon) ; Sikkim (at low elevation) ; Assam (from Terai, upto *c* 2130 m between March and December) ; Arunachal Pradesh. Up to Burma (Tavoy).

Material examined.—Arunachal Pradesh : Kameng district, Bhalukpong, *c* 213 m, 1 ♀ , 6. v. 1966 (*A. N. T Joseph* coll.) ; Siang district, Likha, 1 ♂ , 1 ♀ , 6, 7-x. 1966 (*S. K. Tandon & G. S. Arora* coll.); Lohit district, bank of the River Bomlung, c 300 m, 1 ♂ , 9. iii., Digaru Road, *c* 150 m, 1 ♂ , 1 ♀ , 11. iii. 1969 (*S. K. Tandon* coll.), Wakro, *c* 515 m, Daphabum Exped., 1 ♀ , 4. xii. 1969 (*J. M. Julka* coll.) ; Tirap district, Jairampur, *c* 225 m, 1 ♀ , 26. x., Pangsau Pass, *c* 1265 m, 1 ♀ , 28. x. 1971 (*G. S. Arora* coll.).

Wing expanse.—84-115 mm.

Remarks.—The subspecies is a good example of sympatric speciation with *Parides zaleucus* (Hewitson) or its local form *punctata* Evans from Burma through the transitional variations of the pattern and colouration of either pair of wings in both sexes, as indicated by Ollenbach (1921) and Talbot (1939), but not observed in the present material. It constitutes a new locality record for Arunachal Pradesh. The males are lover of both sun and flowers particularly of the *Lantana* species and show marked protective resemblance amidst the the jungles. The females, on the contrary, become much abundant at dusk and act as good model for *Papilio memnon agenor* ♀ f. *butlerianus* Rothschild from Sikkim to Burma.

Genus **Pachliopta** Reakirt

1864. *Pachliopta* Reakirt, *Proc. ent. Soc. Phil.*, **3** : 503

Type species : *Papilio diphilus* Esper

Diagnostic characters.— *Vide* key.

Distribution.—Sino-Palaearctic, Oriental and Australian regions.

Remarks.—The genus, of which the incorrect subsequent spelling "*Pachlioptera*" was commented upon by Hemming (1967), is represented by 13 species, of which at least the Indian members were treated by Talbot (1939) under the *Hector*-group of the genus *Polydorus* Swainson. With the revival of the Peninsular subspecies, *pandiyana* (Moore) in Talbot (*loc. cit.*), to the rank of species by Munroe (1961), the overall number of species in the genus *Pachliopta* Reakirt is raised to four from India, of which only one is dealt with hereunder.

31. **Pachliopta aristolochiae** (Fabricius)

1775. *Papilio aristolochiae* Fabricius, *Syst. Ent.* : 443.
1961. *Pachlioptera aristolochiae*, Munroe, *Canad. Ent*, Suppl. **17** : 46.

Diagnostic characters.—Fore wing dorsally with discal area and inter-nervular stripes pale black. Hind wing with white discal and red subterminal spots quite diffused with black. Head and thorax laterally, and abdomen both laterally and terminally red.

Distribution.—West, Central and South China. India. Burma. Sri Lanka. Philippines. Sundaland. Lesser Sunda Islands.

Remarks.—Popularly called the "Common Rose", the species was annotated on nomenclature by Talbot (1947), *sensu* Corbet (1941), as 'this name is strictly preoccupied by *Atrophaneura ascanius* Linn. ..... It is hoped that the priority rule will be suspended in the case' With this, Munroe (1961) is justified in retaining the name "*aristolochiae*", which has also been presently followed. The species is known to emit rosy odour. It exhibits gregarious habit on flowers particularly at dawn during the post-winter seasons, when it is outnumbered by the mimetic members including *Papilio polytes romulus* ♀ f. *stichius* Hübner and the diurnal Zygaenid moth, *Histia flabellicornis* Fabricius, which are mostly known to live on both the wild and cultivated *Citrus*-plantations. The species, which is a new record for Arunachal Pradesh, is known by as many as six subspecies from the Indian subregion. Presently, only the nominal form is dealt with.

31 (a). **Pachliopta aristolochiae aristolochiae** (Fabricius)

(Plate VII, Fig. 4)

1909. *Papilio aristolochiae aristolochiae*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 38, pl. 16a.

Diagnostic characters.—Fore wing black from base to beyond the origin of Cu_{1b}, with shortened stripes in the dorsum ; hind wing dorsally without spots in cell except in the discal area, and ventrally with a red distal spot in the inner area.

Distribution.—Almost throughout the Indian subregion except Burma. Java.

Material examined.—Arunachal Pradesh : Kameng district, Denling, *c* 229 m, 1 ♀, 5. v. 1966 ; Subansiri district, Kimin, *c* 198 m, 1 ♀, 9. v., Sonai Rupai Forest, *c* 79 m, 1 ♀, 28. v. 1966 (*A. N. T Joseph* coll.) ; Lohit district, Lohitpur Road, *c* 150 m, 1 ♀, 13. iii. 1969 (*S. K. Tandon* coll.).

Wing expanse.—79-92 mm.

Remarks.—It is interesting to observe that not a single male of the subspecies, so commonly available for the other forms of the subfamily in question, could be collected during the survey. In continuation with his comments on the nomenclature of the species

concerned, Talbot (1947) further stated, "If the name *ascanius* Linn. (see above) is used to replace *aristolochiae* (Fabr.), the name for the Indian subspecies will be *diphilus* (Esper). The Linnaean *ascanius* came from Java. As already indicated, while the name of the species is retained as "*aristolochiae*", that of "*diphilus*" is presently used for the morpho-form together with its nominal ally under the subspecies after Talbot (1939). Both these forms are dealt with hereunder.

f. *aristolochiae* (Fabr., 1775): Ground-colour pale. Hind wing dorsally with four discal spots, being small in size and mostly apart from cell, as in three specimens from Kameng and Subansiri, one of these spots closely approximated to the cell in two specimens, thus being transitional between this and the second form ; the ventrodiscal spot in the anal area prominent on the right side but reduced to a speck on the left side of another specimen.

f. *diphilus* (Esper, 1792) : Ground-colour dark. Hind wing dorsally with five discal spots, all being large in size and approximated to the cell in the single specimen from Lohit. Closely allied to the subspecies *goniopeltis* (Rothschild) with the reddish subterminal spots on the ventral side of hind wing, but readily distinguishable from it by the absence of dorsal cell spot.

Genus **Troides** Hübner

1819. *Troides* Hübner, *Verz. bek. Schmett.*, p. 88.

Type species : *Papilio helena* Linnaeus

Diagnostic characters.—*Vide* key.

Distribution.—Sino-Palaearctic, Oriental and Australo-Papuan regions.

Remarks.—This is one of the paired components of the second generic group, the *Troides*-complex, the other counterpart of which is known as the genus *Ornithoptera* Boisduval with the type species, *Papilio priamus* Linnaeus exclusively from the Indo-Malayan subregion of the Oriental region. While Bingham (1907) recognised, *sensu* Rothschild (1895), *Ornithoptera* as the species-group of the genus *Papilio* Linnaeus, Talbot (1939) treated the former as con-

generic with *Troides* Hübner, which, however, was not reclassified into species-groups. Munroe (1961) considered, *sensu* Zeuner (1943), the generic status of *Ornithoptera* Boisduval on the basis of angular orientation of discocellulars, reduction or absence of the stalk of R_4-R_5 on fore wing and the genitalia. The members of the *Troides*-complex are rather remarkable for their sexual dimorphism, brilliant irridescence and the largest wing expanse ever known in the whole of Rhopalocera and almost equal to that of the smallest avian form belonging to the *Nectarina* sp., at least from India. Of the two subgenera, *Trogonostera* Rippon with only a couple of species is restricted to the Sundaland, while the nominal subgenus is dealt with hereunder.

Subgenus **Troides** Hübner

1961. *Troides* (*Troides*), Munroe, *Canad. Ent.*, Suppl. **17** : 35.

Diagnostic characters.—Fore wing with dorsum almost equal to termen and ground-colour never green. Hind wing of moderate size and with yellow and black areas well demarcated ; also, never marked green. Gravid female never with sphragis at the end of abdomen.

Distribution.—As in the genus.

Remarks.—The subgenus, according to Munroe (1961), consists of 17 species in three major groups, of which two are known from the Indian subregion. It is rather difficult to distinguish these species-groups from one another by the external facies, though Munroe (*loc. cit.*) attempted to distinguish them on the basis of the male genitalic features. Presently, only one species-group is dealt with.

(i) **Helena**-group

Distribution.—Sino-Palaearctic, Oriental and Papuan regions.

Remarks.—The species-group with a dozen species has been subdivided by Munroe (1961) into three species-subgroups, all of which were earlier recognised as distinct groups by Zeuner (1943) besides two others as considered by Munroe (*loc, cit.*). Munroe (*loc. cit.*) observed that the subgroups can not be differentiated from one another by any suitable morphological character. He, however, erected such groups mainly on the basis of their geographical ranges, which may mutually overlap to some extent, but never become identical.

It may be mentioned here that Munroe (1961) raised the status of the subspecies, *Troides helena darsius* (Gray) from Sri Lanka and *T helena minos* (Cramer) from Peninsular India, and a synonymic species, *rhadamanthus* (Wood-Mason & De Nicéville) of *T aeacus* (C. & R. Felder), (*vide* Talbot, 1939) to species rank. He treated *darsius* under *Haliphron*-subgroup and *minos* and *rhadamanthus* under *Aeacus*-subgroup. Presently, only one species-subgroup is dealt with.

Aeacus-subgroup

Distribution.—Western China. Taiwan. India : Both the Himalayas and Southern Peninsula. Burma (including Mergui). Thailand. Western Malaysia (Malacca).

Remarks.—As compared to the range of distribution of this species-subgroup comprising five species, that of the *Haliphron*-subgroup also with five species is mainly limited to the Indo-Malayan belt and rarely Sri Lanka, while the *Helena*-subgroup with twos pecies, extends from South China to Malaccus and Papua across the Himalayas. Only one species is dealt with hereunder.

32. **Troides (Troides) aeacus** (C. & R. Felder)

1860. *Ornithoptera aeacus* C. & R. Felder, *Wien. Ent. Mon.*, **4** : 225.
1961. *Troides* (*Troides*) *aeacus*, Munroe, *Canad. Ent.*, Suppl. **17** : 46.

Diagnostic characters.—Hind wing in male dorsally with black suffusion before the projections of black terminal border between M_3 and Cu_{1b}, and abdomen yellow-ringed. Fore wing in female with broad inter-nervular stripes extended into the cell and hind wing with wedge-shaped discal spots.

Distribution.—Same as in the species-subgroup, excepting Peninsular India and Thailand.

Remarks.—Popularly called the "Golden Birdwing", the species is crepuscular in habit and comonly found in the heavily forested tropical valleys up to a maximum height of *c* 1000 metres during spring and autumn. It exhibits soaring flight in a slow but majestic manner above tree-tops. The only nominal subspecies from the Indian subregion is presently dealt with.

32 (a). Troides (Troides) aeacus aeacus (C. & R. Felder)
(Plate VII, Figs. 5-6)

1909. *Papilio aeacus aeacus*, Jordan, *In* Seitz, *Macrolepidoptera of the World*, **9** : 25.

1939. *Troides aeacus aeacus*, Talbot, *Fauna Brit. India*, Butterflies, **1** : 68.

Diagnostic characters.—Fore wing in male black-brown and hyaline at veins which are much narrowly striped with grey ; hind wing without discal spot but with black terminal spot posteriorly well suffused around their projections. Fore wing in female entirely black-brown and not hyaline at veins which are much broadly striped with grey ; hind wing with both discal and terminal large black spots, latter not appreciably suffused.

Distribution.—Western China. India : Uttar Pradesh (Garhwal) ; North-Eastern Himalayas (Arunachal Pradesh). Burma (Mergui).

Material examined.—Arunachal Pradesh : Kameng district, Amatulla Village, *c* 848 m, 1 ♂, 9. iii., Ankaling, *c* 606 m, 1 ♂, 24. v. 1961 (*K. C. Jayaram* coll.), Nephra, *c* 369 m, 1 ♀, 3. vii. 1961 (*S. Biswas* coll.) ; Siang district, New Jinning, *c* 200 m, 1 ♀, 18. x., Likhabali, *c* 50 m, 1 ♂, 2 ♀ ♀, 2. xi. 1966 (*S. K. Tandon & G. S.* coll.).

Wing expanse.—119-164 mm.

Remarks.—The subspecies shows some interesting variations of characters (*cf.* Talbot, 1939), *viz.*, hind wing dorsally in male with black suffusion above M_3 rather well contiguous with the corresponding terminal spot ; in female, with subapical yellow spot variable in size or even obsolete and discal elongate black spot below the origin of Cu_{1a} not always interrupted by the golden yellow in the anal area. Besides, one of the males has the right hind wing badly distorted.

III. SUMMARY

The paper sets out to provide rather comprehensively an annotated account on the systematics of the family Papilionidae particularly from Arunachal Pradesh of North-Eastern India. It incorporates 32 species and forms under different supra-taxonomical categories including six genera and three tribes of the single subfamily Papilioninae. Eight species and majority of the subspecies constitute new locality records for almost whole of the territory of Arunachal Pradesh. The presently included subspecies, viz., *Parides dasarada barata* (Rothschild) and *Papilio polytes romulus* ♂ f. *cyrus* Fabricius, were not

reported from India. The study is based on material from the areas presently explored by different scientists including one of the authors, and also those of the adjoining regions, lying identified in the National Collections at Zoological Survey of India, particularly for the sake of confirmation. Finally, a French abstract, plates and references to the original literature are also incorporated in the paper.

RESUME*

L'article s'agit autant concisémént que possible d'un compte rendu annoté sur la systématique des Papilionidae surtout de l'Arunachal Pradesh de l'Inde du Nord-Est. Il s'incorpore à 32 espèces et formes sous les différentes catégories de plus haute taxonomie y compris six genres et trois tribus de la seule sousfamille des Papilioninae. Huit espèces et la plus part des sousespèces forment nouveaux dossiers pour prèsque toute la territoire de l'Arunachal Pradesh. La sousespèce, *Parides dasarada barata* (Rothschild) ainsi que *Papilio polytes romulus* ♂ f. *cyrus* Fabricius, n'étaient pas inclues dans les rapports antérieurs de répartition de l'Inde. Les études sont fondées sur des échantillons recueillies tout à l'heure des endroits par les divers savants y compris l'un des auteurs, et aussi sur ceux des régions voisines, restant identifiés dans les Collections Nationales du Zoological Survey of India, principalement à cause de confirmation. Enfin, un résumé anglais, des planches et des références à litérature originale sont aussi incorporés dans cet article-ci.

IV ACKNOWLEDGEMENTS

The authors are highly grateful to the Director, Zoological Survey of India, for providing the laboratory facilities, critically going through the manuscript and constantly encouraging in their work. Thanks are also due to Dr. A. P. Kapur, the then Director, Zoological Survey of India, for sending one of the authors to survey these areas. They are also thankful to Dr. O. B. Chhotani, superintending Zoologist, Entomology Division, for numerous courtsies and Dr. R. K. Kacker and staff of the Photography Section, for taking photographs.

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* Summary in French has been provided by the second author.

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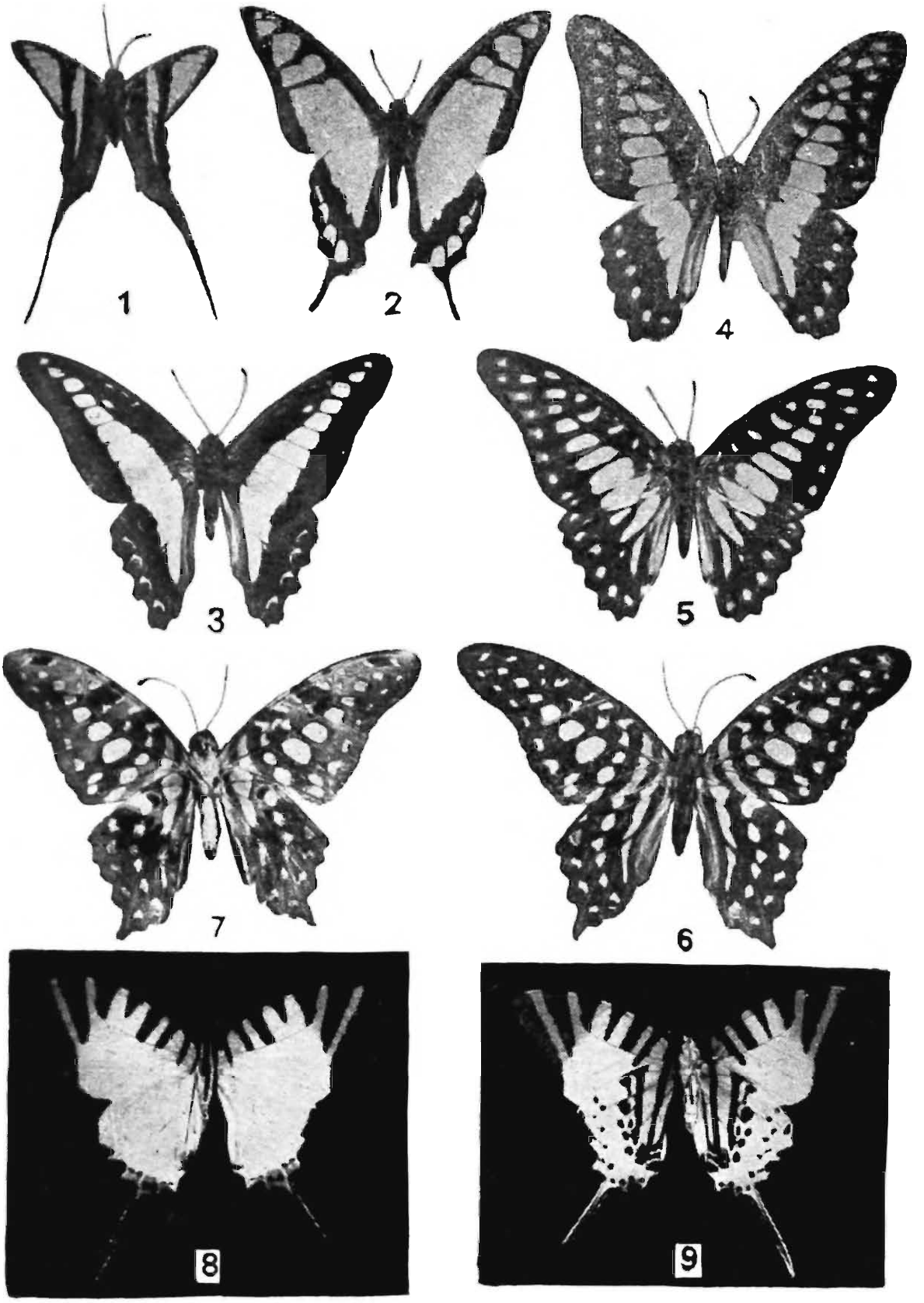
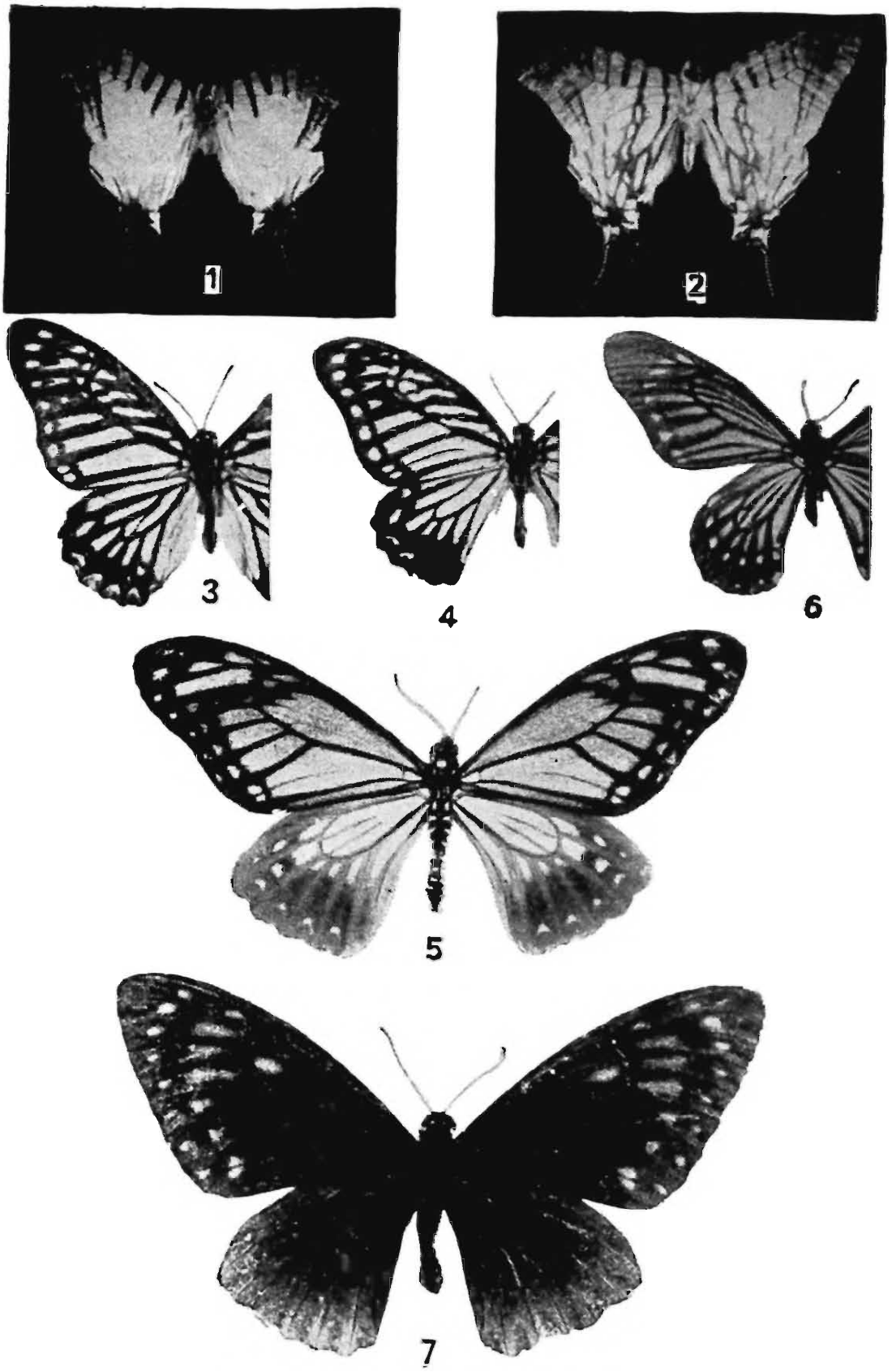
VI. INDEX

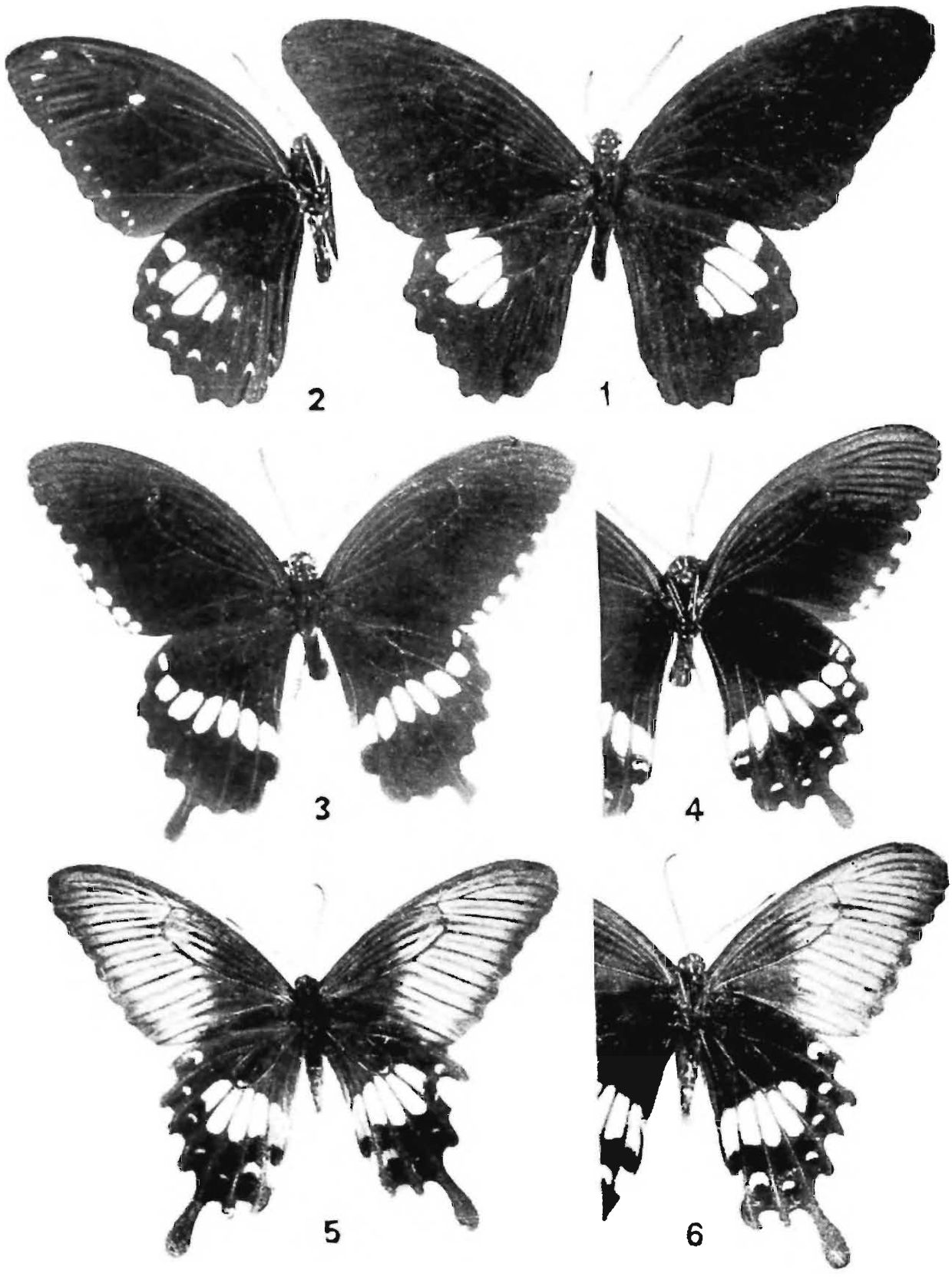
The names of groups and subgroups have been indicated in bold letters, and other names upto the generic level in italics. Only the page dealing with the description of each taxon has been indicated.



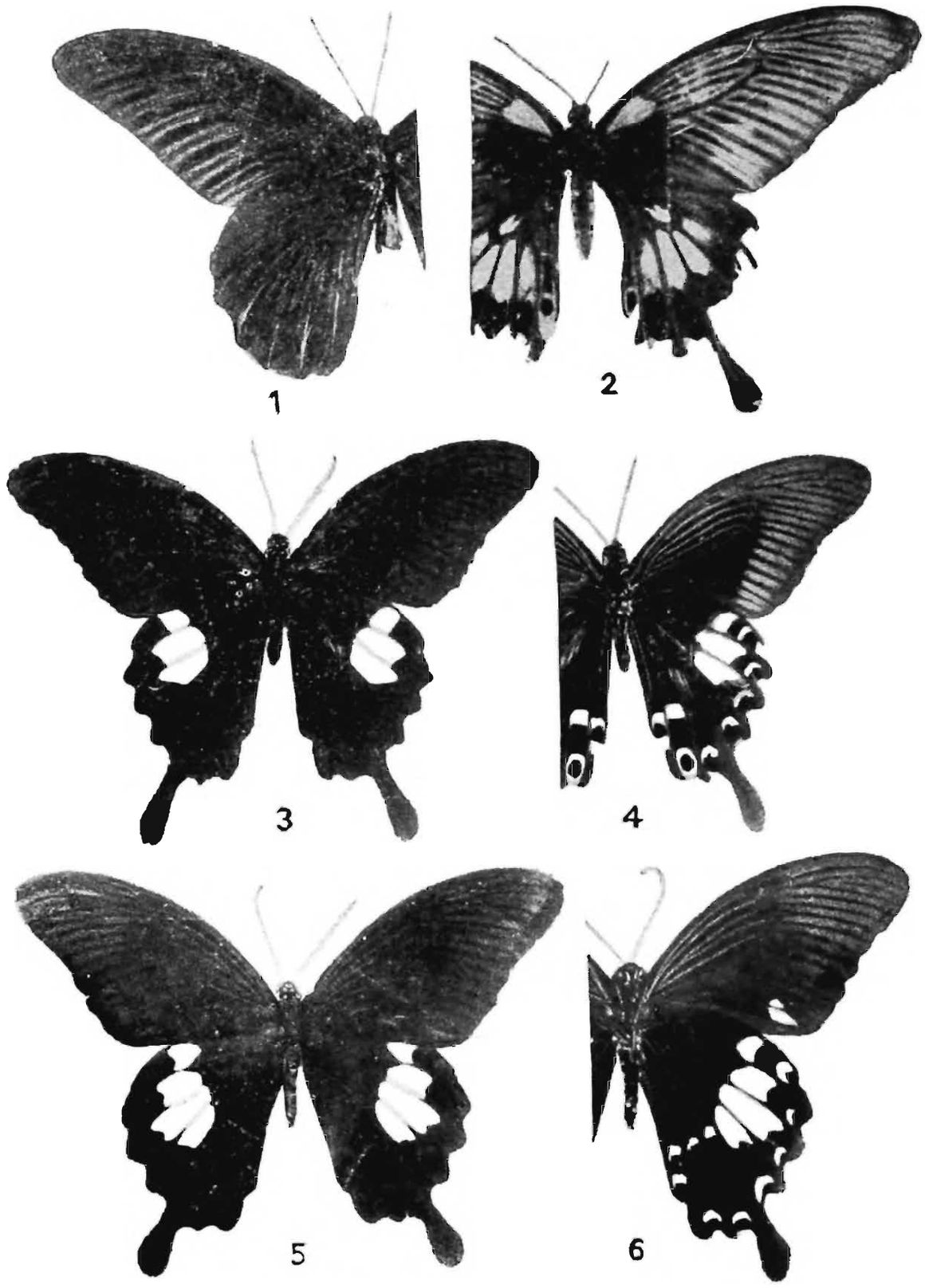
1. *Lamproptera curius curius* (Fabr.), male, Dorsal view. 2. *Graphium* (*Graphium*) *cloanthus cloanthus* (Westwood), male, Dorsal view. 3. *Graphium* (*Graphium*) *sarpedon luctatius* Fruhstorfer, male, Dorsal view. 4. *Graphium* (*Graphium*) *doson axion* (C. & R. Felder), male, Dorsal view. 5. *Graphium* (*Graphium*) *bathycles chiron* (Wallace), male, Dorsal view. 6. *Graphium* (*Graphium*) *agamemnon agamemnon* (Linn.), male, Dorsal view. 7. *Graphium* (*Graphium*) *agamemnon agamemnon* (Linn.), male, Ventral view 8. *Graphium* (*Pathysa*) *antiphates pompilius* (Fabr.), male, Dorsal, view. 9. *Graphium* (*Pathysa*) *antiphates pompilius* Fabr.), male, Ventral view.



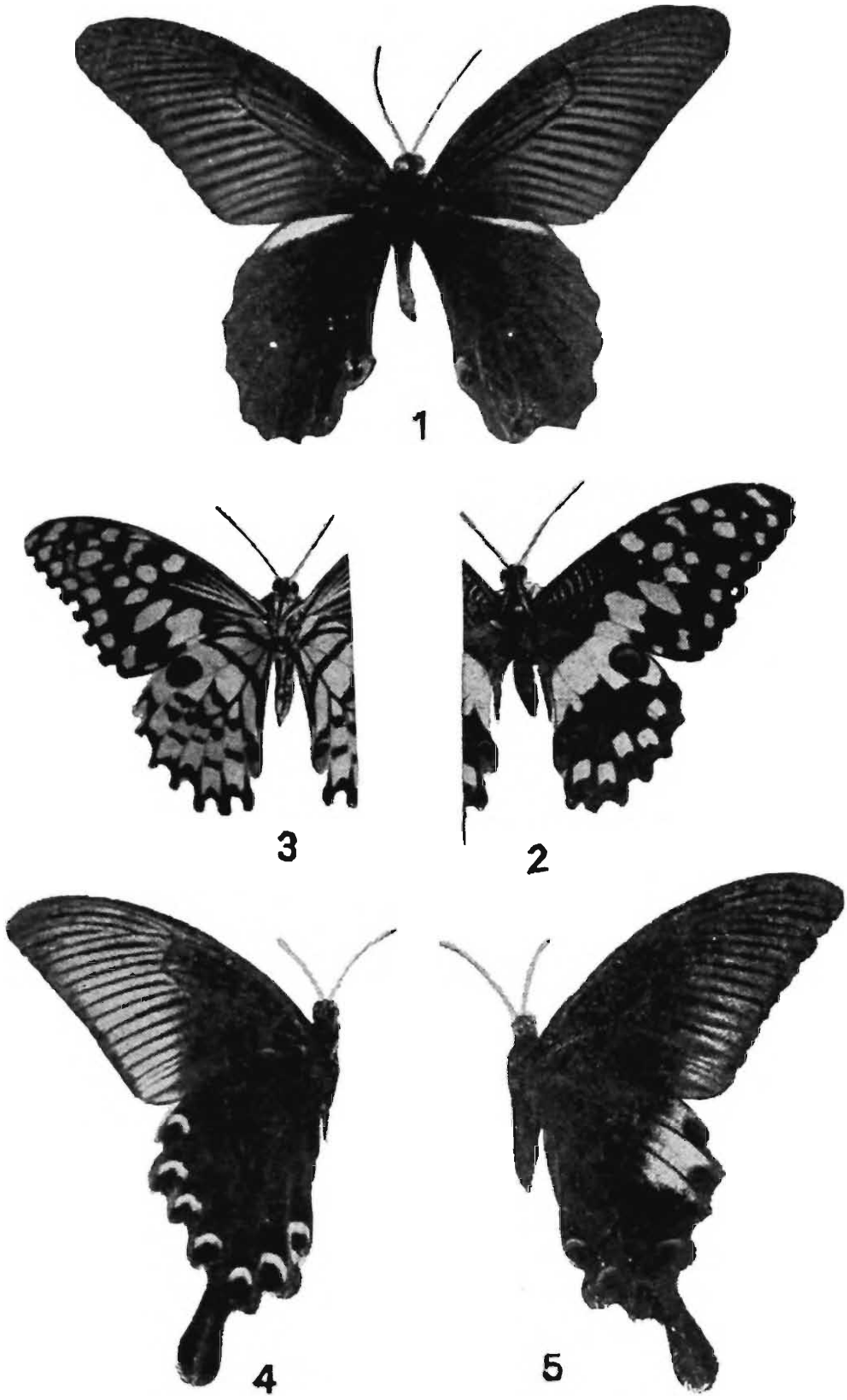
1. *Graphium* (*Pathysa*) *eurous sikkimica* (Heron), male, Dorsal view. 2. *Graphium* (*Pathysa*) *eurous sikkimica* (Heron), male, Ventral view. 3. *Graphium* (*Pathysa*) *macareus indicus* (Rothschild), male, Left side Dorsal view. 4. *Graphium* (*Pathysa*) *xenocles* (Doubleday), male, Left side Dorsal view. 5. *Papilio agestor agestor* Gray, male, Dorsal view. 6. *Papilio epycides epycides* Hewitson, male, Left side Dorsal view. 7. *Papilio paradoxa telearchus* (Hewitson), male, Dorsal view.



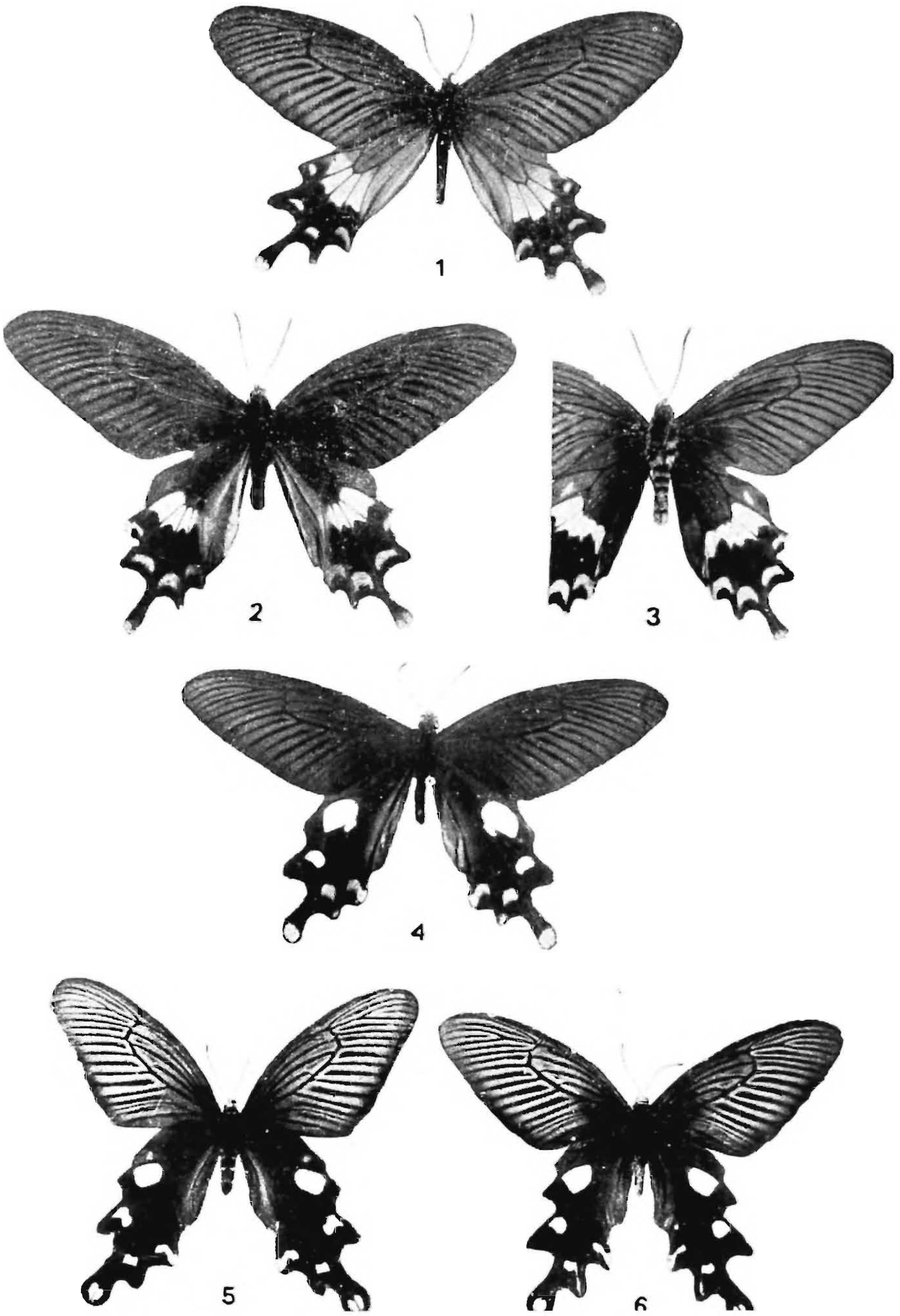
1. *Papilio castor castor* Westwood, male, Dorsal view. 2. *Papilio castor castor* Westwood, male, Right side Ventral view. 3. *Papilio polytes romulus* f. *romulus* (Cramer), male , Dorsal view. 4. *Papilio polytes romulus* f. *romulus* (Cramer), male, Left side Ventral view. 5. *Papilio polytes romulus* f. *stichius* Hübner, female, Dorsal view. 6. *Papilio polytes romulus* f. *stichius* Hübner, female, Left side Ventral view.



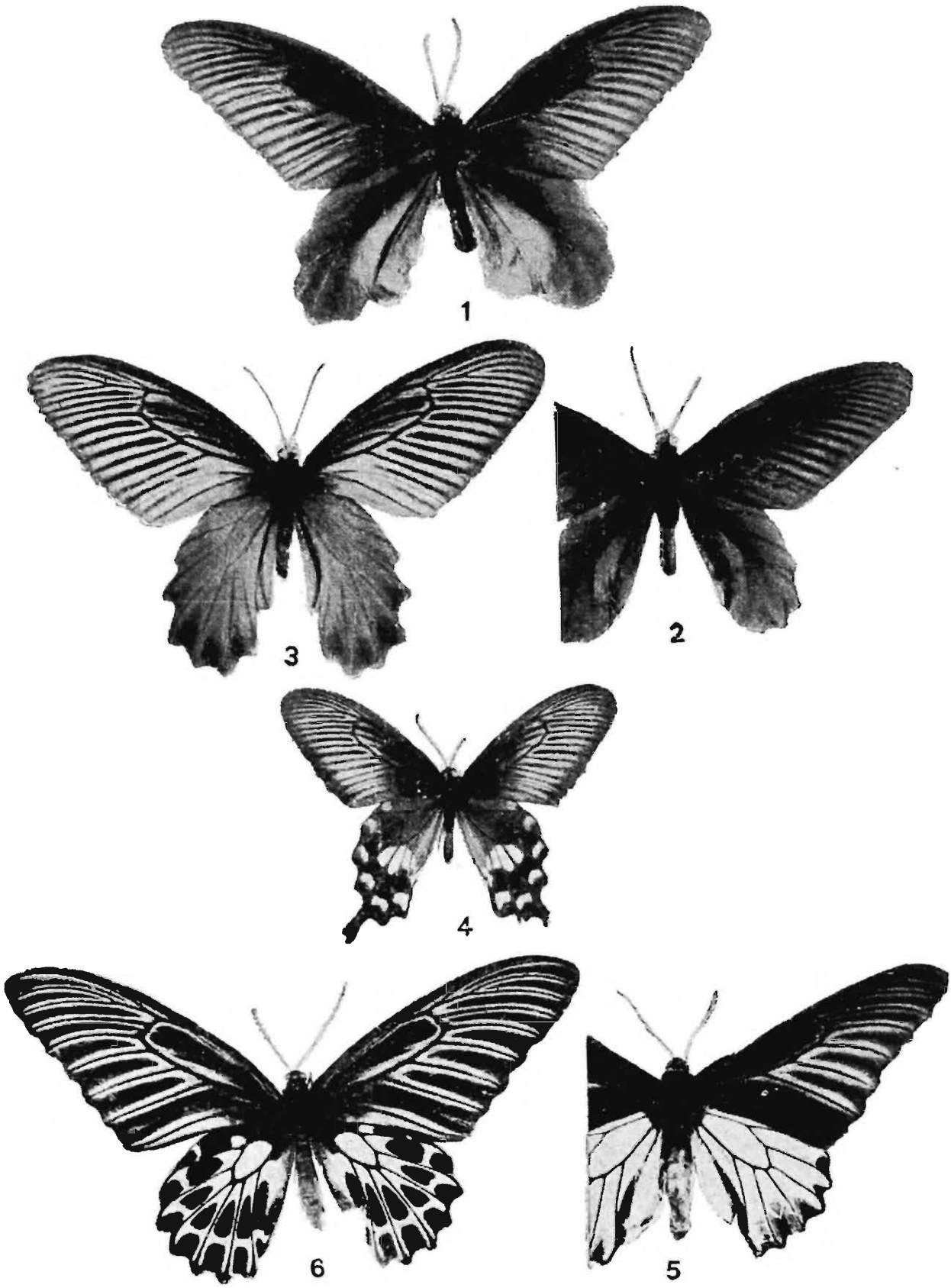
1. *Papilio memnon agenor* (Linn) male, Left side Dorsal view. 2. *Papilio memnon agenor* f. *alcanor* Cramer female, Right side Dorsal view. 3. *Papilio helenus helenus* Linn., male, Dorsal view. 4. *Papilio helenus helenus* Linn., male, Left side Ventral view. 5. *Papilio chaon chaon* Westwood, male, Dorsal view. 6. *Papilio chaon chaon* Westwood, male, Left side Ventral view.



1. *Papilio protenor euprotenor* Fruhstorfer, male, Dorsal view. 2. *Papilio demoleus demoleus* Linn., male, Dorsal view. 3. *Papilio demoleus demoleus* Linn., male, Ventral view. 4. *Papilio paris decorosa* Fruhstorfer, male, Ventral view. 5. *Papilio paris decorosa* Fruhstorfer, male, Dorsal view.



1. *Parides* (*Atrophaneura*) *latreillei kabrua* (Tytler), male, Dorsal view. 2. *Parides* (*Atrophaneura*) *polla* (de Nicéville), male, Dorsal view. 3. *Parides* (*Atrophaneura*) *polla* (de Nicéville), male, Ventral view. 4. *Parides* (*Atrophaneura*) *philoxenus polyeuctes* (Doubleday), male, Dorsal view. 5. *Parides* (*Atrophaneura*) *dasarada dasarada* (Moore), female, Dorsal view. 6. *Parides* (*Atrophaneura*) *dasarada barata* (Rothschild), female, Dorsal view.



1. *Parides* (*Atrophaneura*) *aidoneus* (Rothschild), male, Dorsal view. 2. *Parides* (*Atrophaneura*) *varuna astorion* (Westwood), male, Right side Dorsal view. 3. *Parides* (*Atrophaneura*) *varuna astorion* (Westwood), female, Dorsal view. 4. *Pachliopta aristolochiae aristolochiae* (Fabr.), female, Dorsal view. 5. *Troides* (*Troides*) *aeacus aeacus* (C. & R. Felder), male, Right side Dorsal view. 6. *Troides* (*Troides*) *aeacus aeacus* (C. & R. Felder), female, Dorsal view.