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## REVISIONAL NOTES ON THE DANAINAE (LEPIDOPTERA)

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This paper consists primarily of a classification of the true Danaids, which I hope may give a clearer idea of their internal relationships and phylogeny. I have also included keys to the genera and to what I believe are the true species (save in the very large Old World genus *Euploea*, where the material in American collections is insufficient);—further, to the subspecies and leading forms in the New World fauna.

Hulstaert's revision in the *Genera Insectorum*, fasc. 193, 1931, is considered basic; and commentary, whether modifications or opinions, may be referred to it as a standard.

In the New World fauna, almost all the recognized forms have been examined, but only about a third of those in the Old World; I believe, however, that these are sufficient to validate the generic descriptions and general groupings.

### SUBFAMILIES

The primary character for the Danaids has been generally taken to be the preservation of 3rd A in the fore wing as a small but tubular vein. This is shared by the *Pierella* group of the Satyrinae, so that the character "subcosta not strongly swollen" must be added. I should consider personally the Danaids and Satyrids alike as groups of less than family value, rather subfamilies of the large family



Nymphalidae. Other useful characters are the naked shaft of the antenna and the pair of pencils at the apex of the male abdomen, but the former is shared by a few other Nymphalid genera (particularly the Acraeinae) and the latter is inconspicuous and confined to the male sex. The larva of the restricted Danainae is always naked with paired subdorsal filaments (save in *Clothilda*, apparently) and the pupa is stout, with the middle of the abdomen much swollen and terminal segments shortened.

On this definition the subfamily must include *Clothilda* (*Anelia*), a genus in fact close to *Lycorea* and *Ituna*, though not yet modified by mimicry (Bates, Bull. Mus. Comp. Zool. 78: 148, 1935). With it are universally associated two other subfamilies, which have the tubular 3rd A, though not the anal pencils,—the Ithomiinae and Tellervinae. Of the characters usually given to separate them the position of  $R_2$  is inconstant in both directions, the palpal differences are intangible, and the others are sexual; so I should prefer to make primary a neglected character of the middle and hind legs, and would offer the following

# KEY

1. Middle and hind tarsi, and less conspicuously hind tibiae, densely clothed with fine spines (among the scales) above as well as below, the tarsal spines below not ordered, or in vague transverse series; male abdomen without pencils ..... 2
- Tibiae and tarsi unarmed *above* or with a few irregularly scattered and much heavier spines on both tibiae (*Clothilda*) or hind ones only (*Danaus*, *Ideopsis*), spines of tarsi below in four longitudinal rows, male sex-scaling when present of dense mealy areas on hind wing, or inner area of fore wing below, without pencils;  $R_2$  generally free in fore wing; abdomen generally falling short of margin of hind wing; first segment of palpus moderate (variable); admarginal spots of hind wing two to an interspace (absent in *C. cubana*). Male abdomen with a pair of retractile terminal pencils.

## *Danainae*

2. Male sex-scaling obscure, on upper side of fore wing;  $R_2$  arising well before end of cell; first segment of palpus minute; fore wing broad with costal veins widely spaced; admarginal white spots one to an interspace. (Old World.)

## *Tellervinae*<sup>1</sup>

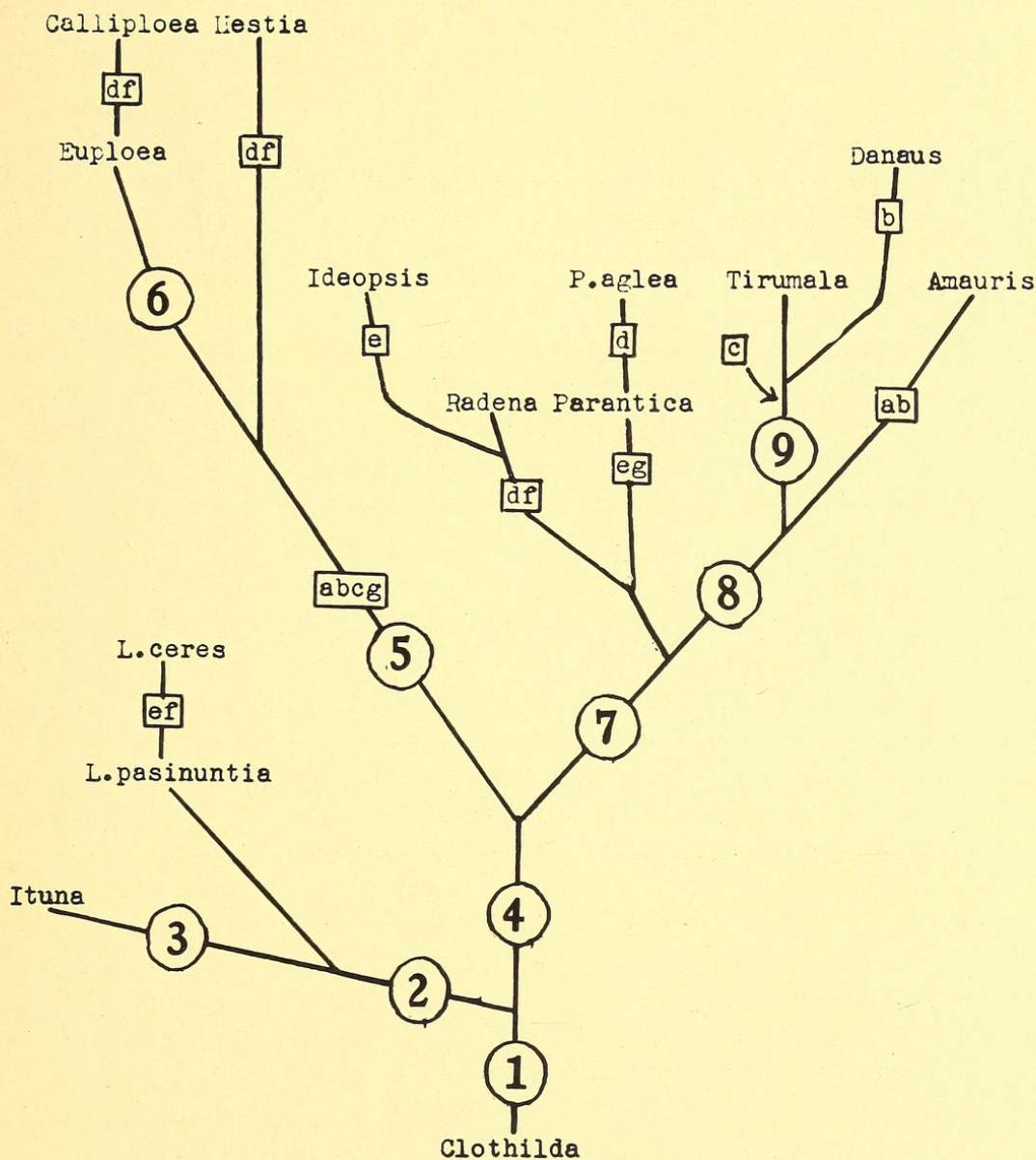
- Male with modified sex-scaling on costal area of hind wing above and also one or two hair-pencils; first segment of palpus moderate, reaching forward to middle of loop of tongue;



admarginal spots various; costal area with more crowded venation;  $R_2$  stalked, except occasionally in the more primitive genera. (New World) ..... *Ithomiinae*<sup>1</sup>

## SUBDIVISION OF THE DANAINAE

Adding *Clothilda*, we find eight genera almost universally accepted in this subfamily, and these eight are clearly homogeneous and on the whole well defined. Only in England (following Moore) and by a few American workers (following Scudder) are the two large and varied genera *Danaus* and *Euploea* subdivided. *Ideopsis* also,



<sup>1</sup> Not discussed further.



while doubtless homogeneous, is too close to *Danaus*, subgenus *Radena*, and should probably be reduced to a subgenus. *Amauris*, while equally close to *Danaus* in the imago, has a distinct larva.

The separation into a *Danaus* group, an *Euploea* group and an American group is also generally accepted. They may be treated as tribes: Danaini, Euploeini, Lycoreini. The accompanying diagram indicates what I believe to be their true relationships, and the characters by which they are generally distinguished. I have divided the

#### GENEALOGY OF THE DANAINAE

The height of the name indicates the degree of divergence from *Clothilda*, which is considered the most primitive surviving genus.

#### *Changes which take place only once*

1. Larva develops filaments on mesothorax; pattern of imago becomes simple.
2. Abdomen becomes fully as long as hind wing; pattern converges with Ithomiine type.
3.  $M_3$  and  $Cu_1$  of hind wing become approximate and ldev. of hind wing becomes vertical.
4. Larva develops filaments on 8th segment of abdomen; lower discocellular of hind wing becomes nearly straight.
5. Hind wing loses humeral cell, and humeral vein migrates out on Sc.
6. Sex-scaling developed on costal area of hind wing above and inner area of fore wing below.
7. Sex-scaling develops toward inner margin of hind wing above; tarsal claws enlarged and pulvilli vestigial.
8. Cells  $M_3$  and  $Cu_1$  of fore wing develop paired subterminal dots, as on hind wing.
9. Male with sex-pocket below  $Cu_2$  of hind wing.

#### *Changes which develop more than once*

- a. Larva develops filaments on metathorax.
- b. Larva develops filaments on 2d segment of abdomen (not yet in *Danaus erippus*).
- c. Hair in cell of fore wing below lost (also a few *Parantica*).
- d. Fore wing with Sc and  $R_1$  anastomosing.
- e.  $R_2$  arising well back from end of cell.
- f. Hind wing with udev. longest and nearly longitudinal.
- g. Hind wing with ldev. much the shortest and vertical.



latter into two categories, those which have developed once only (numbered) and those which have appeared repeatedly (letters). For theoretical reasons it would seem better to consider the larva with many subequal pairs of filaments primitive (*Amauris* with five pairs) but it seems impossible to draw up a reasonably consistent tree on this basis. In every other way *Amauris* is as advanced as *D.* (*Parantica*) or more.

For the separation of the genera the characters are also generally agreed on, but there are some exceptional species that will give trouble in Hulstaert's key. We must allow for *Lycorea pasinuntia*, which has his key character for *Ituna*, for the species of *Euploea* and *Danaus* with Sc and R<sub>1</sub> anastomosing and the Asiatic species of *Danaus* with R<sub>2</sub> arising well back from the end of the cell, as in *Amauris*. Also *Clothilda* must be added, the long wings of a few *Danaus* (the Monarch and the Celebesian species, *e.g.*) must be allowed for; and the very gradual change of shape of the antennal club reduces its value. I prefer, therefore the following

## KEY

1. Middle and hind tarsi with large pulvilli and paronychia, and short, sharply curved claws ..... 2
- Middle and hind tarsi with long straight claws, curved only near the tip, and rudimentary pulvilli and paronychia ..... 6
2. Abdomen (in the spread butterfly) extending beyond hind margin of hind wings ..... 3
- Abdomen falling short of hind wings ..... 4
3. Hind wing with m-cu very short or absent; udev. also very short, and mdev. and ldev. continuing their general direction, much longer and subequal; scaling of light markings reduced, spaced and semierect; R<sub>2</sub> normally arising very close to end of cell ..... *Ituna*
- Hind wing with m-cu and udev. about as long as mdev. and ldev., the two latter set at a decided angle; scaling all similar and dense; R<sub>2</sub> normally arising about half the length of mdev. back from end of cell ..... *Lycorea*
4. Humeral cell of hind wing minute or slender, but present, humeral arising from its outer end practically opposite the forking of Sc and R; pattern of cell below complex, with wavy transverse bands, etc.; club of antenna strong (Central America).  
*Clothilda*
- Humeral cell absent; humeral vein arising from Sc well beyond its separation from R; cell of fore wing with a simple pattern of a few streaks or spots, or none (Old World) ..... 5



5. Large species, expanding well over 100 mm. (4 in.), Sc and R<sub>1</sub> of fore wing connected or anastomosing; hind wing with costal cell narrow, humeral vein turning sharply outward; ground white, the pm. spots when present rounded and separate.

*Hestia*

- Sc and R<sub>1</sub> of fore wing separate except in one or two species expanding less than 75 mm. (*Calliploea*); hind wing with humeral cell broad, humeral vein transverse more than half its length, and then forked or turning abruptly out; ground almost always dark, with light markings, when light with the pm. area heavily blackish ..... *Euploea*

6. Hind wing with the upper discocellular longest, the middle shorter and curved, lower not extremely short, though straight; fore wing with Sc and R<sub>1</sub> anastomosing. (Larva with two pair of filaments) ..... 7

- Upper discocellular shorter, sometimes much shorter than middle or lower or both; Sc very rarely anastomosing with R<sub>1</sub> (*aglea*) ..... 8

7. Fore wing with R<sub>2</sub> more than half length of mdev. back from end of cell<sup>2</sup> ..... *Ideopsis*

- Fore wing with R<sub>2</sub> close to end of cell or even stalked.

*Danaus* (*Radena*)

8. Hind wing with lower discocellular long, Cu<sub>2</sub> arising opposite M<sub>1</sub>; cell of fore wing hairy below. (Africa) (Larva with 4 or 5 pair of filaments) ..... *Amauris*

- Hind wing with lower discocellular much shorter than middle one or else without hair on cell of fore wing below; Cu<sub>2</sub> opposite R in the primitive species that have hair in the cell and lack the sex-pocket; none of the latter African. (Larva with 2 or 3 pair of filaments) ..... *Danaus* (residue)

#### *Clothilda* Blanchard

This genus is one of the curious types common to the Greater Antilles and Central America without close relatives elsewhere in the world. It stands apart from the rest of the Danainae and yet does not really approach any other subfamily of the Nymphalidae, the complex pattern being merely primitive, and not distinctively Nymphaline. The larva (as quoted by Gundlach and Bates from Poey) is without filaments, white, with black head, and it would seem, with the usual transverse stripes reduced to two on the prothorax. The pupa is Danaoid.

<sup>2</sup> Fails in *I. endora*, which has large round black spotting.



By good fortune all the forms have been examined, even the exceedingly rare *C. jaegeri* from the north coast of Haiti, in the Museum of Comparative Zoology. The key is fundamentally that of Salvin (Trans. Ent. Soc. London, 1869, 391-397) supplemented by Hall (Ent. 58: 161, 1925; 63: 13, 1930) and Bates (Bull. M.C.Z. 78: 148, 1935), but has been checked, modified and expanded.

## KEY

1. Fore wing with crimson at least below. Ground of upper side and outer half of fore wing below dark with pale post-medial spots down to  $M_2$ , then apparently joining the st. series,—the true lower pm. spots being red or partly pale and incorporated with the crimson base, and the true st. spots being minute above. Hind wing with pm. series mostly close to cell, with a small one in base of cell  $M_3$ , and st. series mostly diffuse (*Synalpe* Boisduval) ..... 2
- Ground tawny, without any crimson, the pm. and st. spots dark, not abruptly changing their character; hind wing below with pm. series far beyond cell, a large spot in  $M_3$ , and outlined with white, doubly on the pm. series (*Clothilda*) ..... 5
2. Under side with blurred bands, the postmedial slightly darker and slightly oblique in cells  $Cu_1$  and  $Cu_2$  when visible, hardly defined with slightly paler; black postmedial spots on the crimson of fore wing rounded or fusing, st. spots rounded, short and completely defined, terminals short and single on fore wing, diffuse or absent on hind wing (*Antilles*) ..... 3
- Pm. spots narrow, blackish, contrastingly defined with whitish, the bar in  $Cu_1$  and  $_2$  if visible strongly oblique; pm. spots L-shaped, extending out above  $Cu_1$  and  $Cu_2$ , st. spots extending out at least in cells  $M_3$ — $Cu_2$ , fusing with the double terminal spots, which are also double, yellow, and elongate on hind wing (Mainland) ..... 4
3. Postmedial and subterminal bands above white, continuous except for the black veins, the st. spot in cell  $M_2$  small, outside the band. St. of hind wing broad, continuous above, absent below, no crimson subcostal spot below (Cuba) ..... *cubana*
- Pm. and st. bands of fore wing yellow, more or less suffused; of small separate spots, the two spots in cell  $M_2$  equal; sub-terminal of hind wing absent above. Base of fore wing dull crimson with distinct black pm. spots. Terminal spots distinct (Haiti) ..... *jaegeri*



4. Hind wing with pm. lunules in cells R, M<sub>1</sub> and less definitely in M<sub>2</sub> above, also in M<sub>3</sub> and Cu<sub>1</sub> below; the wing above gradually paler toward outer margin, but dark on dorsal half. (northern Central America) ..... *t. thirza*
- Hind wing with a broad whitish postmedial patch on dorsal half, formed by the suffusion of the pm. lunules (Costa Rica and western Panama) ..... *t. insignis*
5. Hind wing with three series of black spots between the cell and the black border, the inner series incomplete (*numidia*) ..... 6
- Hind wing with only two series (the inner incomplete) the inner st. series being absent (*pantherata*) ..... 7
6. Inner series of spots on hind wing with a large spot in cell Cu<sub>1</sub>, terminal spots cream, large; chestnut shade on under side of fore wing in cell and below, contrasting (Haiti).  
..... *n. numidia*
- Inner series with the spot in cell Cu<sub>1</sub> usually minute; terminal lunules tawny and usually small, dark shading on under side of fore wing more diffuse (Cuba) ..... *n. briarea*
7. Inner row on hind wing of four distinct spots, the terminal spots distinct, pale tawny (Haiti & S. Domingo) ..... *p. pantherata*
- Inner row with distinct spots only in cells M<sub>1</sub> and M<sub>3</sub>, only a couple of tawny marginal spots toward costa (*numida* in error of Seitz 83: e4) (Cuba) ..... *p. clarescens*

*C. jaegeri*. I have only seen the series collected by Darlington in extreme northern Haiti, now in the M.C.Z. This species, *cubana* and the mainland types represent each other locally but are doubtless good species.

*C. thirza*. I have seen the type form only from Guatemala and Honduras, the variety from Costa Rica and Chiriquí, Nicaragua doubtless shows the intermediate conditions.

*C. numidia* and *pantherata*. These have been much confused, but can be easily separated by the presence of one or two rows of subterminal black spots. The respective races in Cuba and Haiti vary in the same way, so probably some form of Mullerian mimicry is involved.

#### *Ituna* Doubleday & Hewitson

This genus and the following are very close, and probably differ mainly because they have entered different mimicry groups (*Dir-cenna* and *Melinaea* respectively). They are frequently made a separate tribe or even subfamily, but in fact are very close to *Clothilda* except for the mimetic features. The key-character used by Hul-



staert fails in *L. pasinuntia*, but can be used in the modified form given in the key. The larva is about like that of *Lycorea*.<sup>3</sup>

The slight difference in venation makes us recognize two species, but they represent each other locally. The distinction of northern races marked with tawny, and southern ones which are black and translucent yellow only, is repeated in *Dircenna*, *Olyras*, *Eutresis* and *Aprotopus*. I recognize the following forms:

1. Hind wing with  $M_3$  and  $Cu_1$  almost invariably short-stalked; antenna with base of club as well as whole shaft black; light parts honey yellow (Brazil and Paraguay) ..... *ilione*
- Hind wing with  $M_3$  and  $Cu_1$  a little separated; antenna with the whole club yellow (*phenarete*) ..... 2
2. More than half of antennal shaft black; ground generally all honey yellow; hind wing with  $M_3$  and  $Cu_1$  arising extremely close together ..... 3
- More than half of antennal shaft yellow; ground of wings usually shaded with tawny;  $M_3$  and  $Cu_1$  generally a little further apart ..... 5
3. Basal half of fore wing solid blackish or only with narrow fully scaled reddish streaks ..... *l. lamirus (completa)*<sup>4</sup>
- Fore wing with a broad translucent whitish streak in basal part of cell, at least ..... 4
4. Fore wing streaky looking, like *Dircenna klugi*; a continuous translucent stripe from base of cell below  $Cu_2$  to near margin, the dark on Cu being linear and the st. spot practically absorbed in the stripe by the loss of the st. bar. Hind wing about  $\frac{3}{4}$  yellow in the specimen examined ..... *albescens*
- Fore wing much less streaky, the streak which starts from base of cell cut by black bars just beyond cell, subterminally, or both ..... *fenestrata*
5. Fore wing with a brown streak and hind wing with a brown triangular patch near inner margin; yellow on antenna tending to extend down to middle (E. Peru and Bolivia).

*l. lanassa*

<sup>3</sup> Hempel, Chacaras e Quintaes 21 (4) : 373; Monte, Bull. agr. zoo. vet. Bello Horizonte 7 : 3–12;—summarized by Costa Lima in his Terceiro Cat. Ins. que vivem nos Plantas do Brasil, 206, Rio Janeiro, 1936. It feeds on *Ficus* like *Lycorea*.

<sup>4</sup> This analysis follows Haensch in Seitz ix, 116. Original descriptions are vague and types have not been examined. The forms are only partly local, and doubtless controlled by Mendelian factors.



- Fore wing with markings wholly black ..... 6
- 6. Bands more sharply defined, outer margin of hind wing more dentate; postmedial black band strong; about a third of antennae yellow (Eastern Peru to Bolivia) ..... *l. phenarete*
- Bands less sharply defined, outer margin of hind wing less dentate; postmedial band running out below; toward half of antenna yellow (western Ecuador) ..... *l. decolorata*

*Lycorea* Doubleday and Hewitson

There are two structurally distinct species, in fact *L. pasinuntia* will not run to *Lycorea* in Hulstaert's key, the cell of hind wing being too short. I must leave Fabricius' name *eva* uncertain, it is certainly not the *eva* of authors (*pasinuntia*), but might be an extreme form of *L. p. brunnea*. I have seen nothing at all like it. I believe the forms with normal structure (long cell) are all forms of a single species. *L. demeter* differs in the smoky cryptically colored under side, whereas all the other forms, even the Haitian, are colored about the same above and below. Curiously Hulstaert does not make much of *demeter*. The other forms of *ceres* merely ring the changes on the following characters: ground tawny or chestnut, median area of hind wing concolorous or yellow, band and border of hind wing separate or fused, fore wing with 3 or 4 apical spots (the fourth sometimes fused with the corresponding postmedial one), postmedial fascia continuous, only cut by the fine black veins, or separated into three spots by heavy black bars (rarely suffused with black). The black markings are narrower below than above, save in Haitian *cleobaea* and (faintly) in Cuban *demeter*.

Cornell has a striking aberration from the upper Cauca Valley, Colombia, with the black areas much reduced, mostly represented by heavy bars on the veins, and the rest of the postmedial black replaced by tawny. It is dwarfed but not as much as one normally marked specimen.

The following key will allocate the named varieties in the traditional way, but does not allow for many transitions and recombinations of characters. The forms of *ceres* are only partially racial: *demeter* from Cuba only; *cleobaea*, Hispaniola (though similar more lightly colored specimens occur on the mainland); *halia*, S. Brazil; *cinnamomea*, Teffe, Upper Amazons; but the Amazons also have *fasciata*, *ceres* and *referrens*; Obidos on the middle Amazons shares *referrens* with Bolivia; *ceres* is found on the lower Amazons, as well as Guiana, *fasciata* from the upper Cauca, Colombia, as well as the lower Amazons, and *discreta* from both Pará and southern Brazil;—



but *pales* may really be limited to S. E. Peru, Bolivia and the upper Juruá region. *L. c. atergatis* is found everywhere, and the few specimens I have seen labelled "Florida" (none very authentic) are of this form.

## KEY

1. Lower discocellular vein of hind wing nearly vertical, angled above its middle; fore wing above with the yellow or tawny medial area as much beyond the cell as in it (*pasinuntia*) ..... 2
- Lower discocellular longer and strongly oblique inward; the yellow or tawny medial spots or fascia not extending beyond the cell on costal part of wing (*ceres*) ..... 5
2. Hind wing with a discal black loop, separate from the black border ..... 3
- Hind wing with the black discal loop and border fused into a large dorsal patch ..... 4
3. Medial fascia of fore wing yellow ..... (*p. eva* of authors)
- Medial area of fore wing tawny, concolorous ..... *p. concolor*
4. Medial fascia of fore wing yellow ..... *p. pasinuntia*
- Medial area concolorous tawny ..... *p. brunnea*
- Medial area black, the tawny limited to two basal streaks and two submarginal patches (according to original description,—not seen) ..... *p. eva* Fabricius
5. Under side of hind wing suffused with blackish, much darker than upper side, which is also rather dark (Cuba).  
..... *c. demeter*
- Under side of hind wing like upper side or with ground a little paler, the markings sharply defined and black ..... 6
6. Fore wing with a continuous median fascia, cut only by the fine black veins ..... 7
- Fore wing with three yellow spots (rarely tawny) separated by heavy black bars ..... 10
7. Middle part of hind wing, inside the black loop, yellow; three apical spots ..... *c. halia*
- Ground of hind wing all reddish ..... 8
8. Ground light mahogany brown; hind wing with separate loop and border (Lower Madeira) (not seen) ..... *c. transiens*
- Ground tawny ..... 9
9. Fore wing with three apical yellow spots, making a band; hind wing with black border and loop separate ..... *c. referrens*
- Fore wing with four apical spots; hind wing with border and loop separate ..... *c. fasciata*



- Fore wing with four spots; hind wing black, with reddish submarginal streak and streak in cell only ..... *c. ceres*
- 10. Ground mahogany brown, sometimes almost black, the black loop and border tending to be suffused at least above; fore wing with four large yellow subapical spots, the lower sometimes connected with the corresponding postmedial spot.  
*c. cinnamomea*<sup>5</sup>
- Ground tawny ..... 11
- 11. Apical part of fore wing almost wholly black, with small yellow spots (but the one in cell  $M_3$  almost always distinct); the spot in end of cell also almost obliterated in the black area; black of hind wing on the contrary reduced and loop frequently broken ..... *c. pales*
- Fore wing with strongly developed yellow spots, including a large squarish spot in end of cell; loop of hind wing stronger ..... 12
- 12. Medial area of hind wing bright yellow, contrasting; four well developed subapical yellow spots; under side of hind wing with black banding rather heavier than upper side (Haiti).  
*c. cleobaea*
- Medial area of hind wing frequently tawny or shaded with tawny; black banding on under side of hind wing weaker than on upper side ..... 13
- 13. Medial area of hind wing concolorous tawny; four well developed subapical spots ..... *c. atergatis*
- Medial area of hind wing somewhat yellowish, the subterminal spot of cell  $M_3$  of fore wing usually absent ..... *c. discreta*<sup>6</sup>

*L. pasinuntia* Dru. This is commonly called *eva* F., but the original description of *eva* is like nothing I ever saw, and may perhaps not even be a *Lycorea*. The forms are not local to any extent, though the specimens I have seen without yellow (concolor) are from the southwest of the area of distribution,—eastern Peru to Matto Grosso. Most specimens come from the Amazons and Guiana. *L. p. brunnescens* Tess. was based on a strain of concolor with the black markings on base of fore wing and disc of hind wing reduced, and may be compared with *L. c. pales*. The uncertain use of the name

<sup>5</sup> Two of the three specimens examined from Teffé are light mahogany, and would be transitional to *c. transiens*.

<sup>6</sup> Mainland specimens occasionally have the yellow in the loop of hind wing as light as in *c. cleobaea*, but the black banding of the under side is lighter and there are as often 3 as 4 subapical spots.



*eva* has caused a snarl in the Lep. Cat. *L. eva* of that work is made up mainly of *pasinuntia* ("eva" so far as not based merely on Fabricius' original description, *concolor*, *brunnescens*, etc.) but also of the original indeterminate "eva" of Fabricius and even *ceres* (the *ceres* of D. & H. being merely a catalogue citation of *ceres* Cr.)

*L. ceres* Cr. This species is more often called *cleobaea* Gdt., but *ceres* has many years priority and is definitely a race, no mere aberration. Hulstaert, and also Bryk in the Lep. Cat. 80, divide this into several species: *ceres*, *cleobaea*, *halia*; and have gone wrong on the localities of the few varieties that are really locally limited, giving Haiti as well as Cuba for *demeter* and Central America instead of Haiti for typical *cleobaea*. They also assign forms somewhat at random to their three "species," e.g., *discreta*, which is superficially almost like true *cleobaea*, and *domingensis* which is a strict synonym of *cleobaea*, to *halia*. It is a little curious that forms with a complete fascia on the fore wing (*demeter*, *referrens*, *fasciata*, *ceres*, *halia*) or with yellow band on hind wing (*cleobaea*, *discreta*, *halia*) occupy the extremes of distribution, but not in a strictly parallel way.

### *Euploea* Fabricius

I make no attempt at a full analysis of this large genus. The forms are innumerable, there is no obvious clue to indicate which are true species, and less than half are available. As compared with typical *Danaus* it is about equally advanced on a different line, as shown by the primitive feet but more specialized humeral arrangement of hind wing and distinctive sex-scaling. As filaments of the larva increased it is evidently the one on metathorax that appeared before the one on A2, since the latter is still missing in the type group of *Euploea*. Presumably this increase in number of filaments is an orthogenetic tendency in the Danainae, for everything shows it took place independently in *Euploea*, *Danaus* and *Amauris*.

The pupa of *Euploea* lacks the sharp abdominal keel of typical *Danaus*, but too few of the more primitive *Danaus* are clearly figured to indicate if this is a tribal character or one that has arisen in the *Danaus* stock itself.

I repeat the subgenera recognized by Hulstaert in tabular form. They seem to be the most distinctive of the many "genera" proposed by Moore on details of male wing form and coloring.

### KEY

1. No special sex-patch on hind wing (though usually a diffuse silky area) ..... 2



- Costal part of hind wing with a large area of velvety scales, with a yellowish androconial patch in center ..... 3
- 2. No sex-scaling on fore wing above; cell with a recurrent vein; a single simple pair of short anal pencils ..... (*Vonona*) Moore
- Fore wing with one bar of sex-scaling (sometimes indicated more by change of color than any distinctive change in structure. (*Crastia*) Hübner
- Fore wing with two bars of sex-scaling ..... (*Stictoploea*) Hübner
- 3. Fore wing without sex-scaling above ..... 4
- Fore wing with a bar of sex-scaling below  $Cu_2$  (hardly more than a change of color in *E. leucostictos*); hind wing with androconial patch extending above cell; anal pencils complex. (*Salpinx*) Hübner
- 4. Androconial patch in center of sex-area of hind wing small, in cell; anal pencils simple ..... (*Trepsichrois*) Hübner
- Androconial patch large, extending in front of cell; four anal pencils ..... 5
- 5. Sc and  $R_1$  of fore wing separate; a short M-spur in cell. (*Euploea*)
- Sc and  $R_1$  anastomosing; no M-spur ..... (*Calliploea*) Butler
- (*Vonona*)

The distribution of this subgenus covers the range of the genus. The reports of *Euploea* from the Ethiopian region appear to be incorrect, since while a few species are found in the isolated islands of the Indian Ocean—the Seychelles, Mauritius, Rodriguez and Bourbon,—none of them is authentically known from Madagascar.

About a third of the 45 species have been examined. They divide primarily into two groups, a primitive one with inner margin of fore wing straight (*helcita*) or nearly so, and one with the inner margin arched, and a distinct sex-patch on the under side. In each group we have species with well marked st. spots on the upper side in outlying areas, in the first group *goudoti* from Bourbon (Réunion), *euphon* from Mauritius and *desjardinsi* from Rodriguez, in the second *eichhorni* from Australia, *alecto* from New Guinea and their relatives.

The residue of the first group divide into species with the st. spots (beneath) in a regular series, so far as preserved, including *climene*, *obscura*, *batesi* and *wallacei*, with decreasing development of the st. spots; the others, typified by *helcita* and *cratis*, with the spot at  $M_2$  or  $M_3$  deeply offset inward. The second group contains three types: 1, *eichhorni* and *alecto* with a very large though obscure



patch of sex-scaling, covering the cell (best visible at 15 U 0; 30 U 0<sup>7</sup>), and well developed or even enormous st. spots on hind wing; 2, with the st. spot on the fore wing in cell R<sub>5</sub> (sometimes M<sub>1</sub> also) noticeably enlarged,—such as *moorei* and *crameri*; 3, without either of these features. This group includes *cameralzeman* with both wings blue, *modesta* with fore wing blue and hind wing bronze, and such species as *cerberus* and *malayica* with no distinct iridescence.

(*Crastia*)

A further specialization of the second group of *Vonona*, with a distinct spot of more or less specialized scales on the upper as well as under side of fore wing. It extends even further east, to Fiji, Tahiti and Samoa, but is represented in the Indian Ocean only by *rogeri* Geyer from the Seychelles, of which I have only the ancient record. Color forms parallel those of the other groups, as often noted, e.g., *eichhorni* and *eleutho* in north Queensland. The species may be divided into three groups; 1, those with the st. series of spots offset out at M<sub>2</sub>, the spot above it weak or absent and outer margin concave or notched at middle. (This includes *schmeltzi*, *eleutho* and *baudiniana*); 2, those with st. series even and strong blue iridescence,—*amymone* and part of *deione*, and 3, those with st. spots regular when distinct and no iridescent blue or violet (though *diana* has some matt violet on the dorsal area). In the latter group a few of the species have distinctive marks, e.g., *eurianassa*, with a continuous white st. band, cut only by the black veins; *tobleri* with under side of hind wing white, marked with black spots and veins, like *Hestia*; *abjecta* with subterminal spots in M<sub>3</sub> of both wings lengthened, dagger-like, but the pm. spots absent; *diana* with the pm. spots in cells M<sub>3</sub> and Cu<sub>1</sub> of fore wing much enlarged and conspicuous; *morosa* with stigma of fore wing far out toward margin (beneath farther out than the dot in cell Cu<sub>1</sub>); *alcathoe* with the st. spots of hind wing largely fused into a patch which reaches almost in to the cell; *andamanensis*, with ground clay color and white markings enlarged; *nechos* with enormous stigma on fore wing.

More than half of the 41 species listed by Hulstaert have been examined.

(*Stictoploea*)

I believe this subgenus is formed merely of the local races of a single plastic species, except for *E. martini*, in which the upper scent stripe is much smaller than the lower one. This species should be

<sup>7</sup> See Ent. News XL: 40–44, 1939.



transferred here from *Salpinx*. Hulstaert lists over 60 races and forms; the following key to his "species" will fairly represent the main racial types (exerges of Verity).

KEY

1. Upper scent stripe (♂) much smaller than lower one; sex-patch of hind wing velvety brown; st. spots conspicuous, more or less fused with the terminals, on a velvety black ground (Sumatra) ..... *martini*
- Upper scent stripe but little smaller than lower one ..... 2
2. Ground blue (N. India to Wetter and Japan) ..... *dufresne*
- Ground not blue, dull ..... 3
3. Fore wing dark brownish, with no trace of purple; hind wing with strong st. and terminal dots (S. India and Ceylon) .... *coreta*
- Both wings dark, very faintly purple in the best light; st. and t. dots absent or present only toward apex of fore wing (Moluccas and New Guinea) *melina* (with *immaculata*).
- With a complete series of st. dots, and with minute terminal dots below ..... 4
- St. series of one spot to a cell, broad and continuous on hind wing but spot M<sub>2</sub> of fore wing skipped (Wetter to Australia).  
..... *sylvester*
4. Larger, less spotted below; st. series on hind wing closer to outer margin (1/6 way in) (Aru) ..... *palla*
- Smaller, more spotted below on disc, but st. spots sometimes reduced; st. spots on hind wing farther from margin (New Hebrides) ..... *tristis*

(*Trepsichrois*)

This also comes pretty close to being a single species with local forms, but the different populations, while still almost wholly local, differ in their sex-scaling, and must be considered true species.

KEY

1. Border of hind wing blue, with pale blue st. spots, like fore wing; stigma of hind wing large, extending half way across cell and connected with a pale patch to base, the remaining sex-scaling obscure (Celebes) ..... *euctemon*
- Hind wing wholly dull, the fore wing often blue and contrasting; stigma smaller, extending about 1/3 way across cell and completely surrounded with black; sex-scaling (except perhaps in *cordelia*) thick and velvety ..... 2



2. Dull brown-black, without purple; sex-patch round, not extending to fork of R (Celebes, not seen) ..... *cordelia*
- Fore wing blue (except *M. semperi* from Philippines, which is large with a triangular sex-spot), larger ..... 3
3. Stigmal velvety scaling extending down into costal edge of cell  $M_3$  and sometimes even base of  $Cu_1$ ; stigma proper shorter, thicker and yellower (Lombok to Flores) ..... *gelderi*
- Stigmal scaling less extensive; stigma proper triangular, wedge-like or wing-like (India to Formosa and Java) ..... *mulciber*

## (Calliploea)

This group is also composed of recent segregates, and no doubt was a single species not too long since, but the forms can now coexist, and therefore are fully established species. How many is not yet certain. The following key will separate most of the species, but the status of the forms on the islands between the Lesser Sundas and New Guinea is confused by the report of three on the small island of Babber. Possibly *hyems* and *visenda* are merely series of races, and the three colorings on Babber indicate the blend zone.

## KEY

1. Fore wing with white pm. band, hind wing with white disc, both cut by broad black vein-lines (Celebes) ..... *hyacinthus*
- No portion of fore wing ground white; with small light spots only or white border ..... 2
2. Both wings with large white st. spots, one to an interspace, or suffused with white to border ..... 3
- White st. spots when present smaller, and two to an interspace, at least on dorsal half of hind wing ..... 5
3. Spots suffused into a very broad white border, but leaving some trace of large white st. spots in cells R and  $M_1$  of hind wing below (Key & Banda Ids.) ..... *hopfferi*
- Spots distinct or the lower ones suffused to margin by a narrower white border ..... 4
4. Fore wing with slight violet iridescence (Timor to Babber Ids.).  
*hyems*<sup>s</sup> and *menamoides*
- Fore wing without iridescence (Babber to Key Ids.) ..... *visenda*

<sup>s</sup> The forms with the white suffusing out toward the margin occupy the smaller islands in the middle of the range, well separated from the range of *hopfferi*.



5. White postmedial dashes on both wings below; st. spots of fore wing with the one at anal angle largest (Solomon Ids.). *pyres*
- No white pm. dashes below; st. series strongest toward costa of fore wing, often lost on hind wing ..... 6
6. Blue and white st. spots elongate, pointed at their outer ends (Saleyer, near Celebes) ..... *nautilus*
- Blue and white or white st. spots squarely or roundly cut off at outer ends, often small ..... 7
7. St. spots emphasized toward costa of fore wing above, often white overlaid with blue iridescence (widespread) ..... *tulliolus*
- St. spots not noticeably larger toward costa of fore wing, but tending to disappear toward inner margin of hind wing ..... 8
8. St. series complete on under side of hind wing (Moluccas). *trimenii*
- St. series with only the first four spots on hind wing below; abdomen beneath contrastingly striped with black and white ..... *salabanda* (Moluccas)
- ..... *pumila* (New Guinea, etc.)
- ..... *vulcania* (Vulcan Id. off New Guinea)

(*Euploea*)

As noted by Hulstaert, the nearly 50 forms probably represent only a single species, varying locally. They may be grouped in the following series (nominal species) :

KEY

1. Ground generally light; pm. and st. spots generally small, the former practically lost in *c. celebica*, the latter in *c. corus* (India to Celebes) ..... *corus*
- Pm. spots larger than half the width of a cell, typically largest in cell  $Cu_1$ ; ground nearly black, the spots partly blue (Formosa and Mindanao) ..... *althaea*
- Pm. spots large and blue on costal half of wing, broken off and continued by the enlarged blue st. spots below (Sumbawa to Flores) ..... *eucala*
- Brown-black, the spots much reduced and blue, frequently only 2 or 3 st. spots (Moluccas) ..... *phaenarete*
- Fore wing heavily shaded with bright iridescent blue in pm. area, hind wing brown and spotted like typical *corus* (New Guinea and smaller islands) ..... *callithoe*
- All spots obsolescent or lost, ground brown-black, without blue,



or violet black with brown veins (*browni*) or heavily blue over disc of wing (*barippa*) (Bismarcks and Solomons).  
*unibrunnea*

(*Salpinx*)

This is the third large and varied group of *Euploea*, the color forms running in general parallel to those of *Vonona* and *Crastia*. The distinguishing character is supposed to be the presence of both a patch of highly modified sex-scales on the hind wing and a bar on the upper side of the fore wing, but the latter in several species is hardly developed, being really only a discolored patch in such species as *leucostictos*. In contrast *E. midamus* has definitely developed special scales. A few of the species have striking special characters, such as the white patch in end of cell of *diocletianus* or the large buff discal patch of *usipetes*, but most need further study, not only to bring out the distinctions of superficially very similar species, but to determine even what are species.

*Hestia* Hübner

This genus needs little discussion, being easy to recognize, well defined structurally and universally accepted. The resemblance to *Ideopsis*, as now generally realized, is purely superficial, since *Hestia* shows all the special characters of *Euploea* except the sex-scaling, while *Ideopsis* is almost identical with the primitive *Radena* group of *Danaus*. It also has a weaker club to the antenna than any other Danaine, and narrower costal area of the hind wing. The larva is as in *Euploea*, with pencils on metathorax as well as 2d and 8th segments of the abdomen.

The genus is usually divided into two subgenera (*Hestia* and *Nectaria*) on the position of  $R_2$ , but *H. hypermnestra* is transitional, with the broad wings of *Nectaria* but the exact pattern of *Hestia*;  $R_2$  is most often as in *Nectaria* but individually variable. In both sections the base of  $M_1$  in cell of hind wing is marked with black, as in no other Danaine. The following key is intended to separate the recognized species. There is some instability in the characters for *idea*, *aza* and *urvillei*, but these represent each other locally, and are probably no more than subspecies.

KEY

1. Hind wing with two postmedial spots in cell  $Cu_1$ , and a spot in outer part of discal cell; cell Sc with 2 or 3 spots, the second always free from R;  $R_2$  arising well before apex of cell (ex-



- cept sometimes in *hypermnestra*) ; ldev. of hind wing short (*Hestia*) ..... 2
- Hind wing with only a single pm. spot in cell Cu<sub>1</sub> or none, and no spot in cell; cell Sc without spots, or if with two, the second farther out and in contact with the stem of R (*Nectaria*) ..... 4
2. Hind wing with only 2 spots in cell Sc ..... *hypermnestra*
- Hind wing with a third spot, sometimes small, resting on free part of R; fore wing with outer margin concave ..... 3
3. Outer margin not strongly concave; hind wing with ldev. about as long as m-cu and over half as long as mdev.; fore wing with inner black spot in fold much larger than outer, bar in cell a heavy oblique splash, except in very light specimens; both spots in cell Sc of hind wing below free from veins ..... *jasonia*
- Outer margin strongly concave and sinuous; ldev. of hind wing much shorter than m-cu and less than half as long as mdev.; fore wing with spots in fold subequal, spot in cell rounded and not oblique; basal spot in cell; Sc of hind wing resting on R except in very light specimens ..... *lynceus (logani)*<sup>9</sup>
4. Hind wing with regular rounded postmedial black spots (frequently connected in a zigzag band in Philippine specimens), and two rounded spots in cell Sc below<sup>10</sup> ..... 5
- Hind wing with streaks running in from border to postmedial region, without separate pm. spots, the spots in cell Sc almost always absent, but in typical *idea* small and on under side only ..... 6
5. Outer margin of fore wing strongly sinuate in male, distinctly concave at middle in female (E. Mindanao)<sup>11</sup> (not seen).  
*electra*
- Fore wing with outer margin convex in general course (Japan to Java) ..... *leuconoe*

<sup>9</sup> Fruhstorfer separates specimens with white ground color and small black spots as *logani* and Hulstaert follows him. Corbet and Pendlebury feel doubtful. Perhaps Fruhstorfer's earlier opinion that they represent wet and dry forms is correct, but only local study can determine.

<sup>10</sup> All the *Nectarias* represent each other locally and are doubtless recent segregates.

<sup>11</sup> As shown by the studies of the Rehns, based on the Orthoptera, eastern Mindanao has strong traces of a special fauna and was obviously a separate island in the not too distant past.



6. Hind wing without marginal chain-pattern, at most with slight dashes leading off from the vein-streaks; the border frequently fuscous or even black (Celebes, etc.) ..... *blanchardi*
- Hind wing with a marginal chain, composed of streaks on and between veins, crossed by a black st. line ..... 7
7. A continuous black band across fore wing; marginal chain usually continuous to anal angle (New Guinea, etc.) ..... *urvillei*
- Separate black spots across middle of fore wing, or a narrow and constricted band not reaching anal angle ..... 8
8. Subterminal line broken up on dorsal part of hind wing, only the more costal white spots completely enclosed (southern Moluccas) ..... *idea*
- Subterminal line continuous to anal angle, cutting off a complete series of white marginal spots (northern Moluccas) ..... *aza*

### *Ideopsis*

This is hardly more than a plastic species, since all the forms represent each other locally. The character of  $R_2$  becomes intangible in the western part of the range, leaving it separated from *Radena* by hardly more than habitus, but it is these western forms that are most modified in pattern by convergence with *Hestia*.

I cannot see the grouping advanced by Hulstaert, but am much more impressed by the distinctness of the eastern "exerge" typified by *vitrea*. The residue are more closely related, but the development of the pm. and st. spots suggests a grouping into three rather than two species, making a distinct group of the Javan *gaura* and the Eastern Mindanao *glaphyra* and *messala*, and possibly adding *costalis* from Nias.

### KEY

1. Postmedial line on hind wing continuous, strongest toward costa and far in toward cell, frequently ending abruptly at or just above  $Cu_2$ ; ground generally shaded with yellow but more strongly in the subterminal than the basal area, when there is any difference;  $R_2$  well back from angle of cell,  $M_1$  sometimes connate (Celebes to New Guinea, etc.) ..... *vitrea*
- Postmedial series of spots more or less distinct and rounded, at least on hind wing, not joining end of cell but frequently joined to the marginal pattern; yellow shading when present strongest toward base of wing;  $R_2$  usually nearer end of cell and  $M_1$  stalked ..... 2
2. Discal dots large and almost round, the one on hind wing extending down to base of  $Cu_1$ , postmedial spots rounded in both



- wings; st. dots in hind wing pear-shaped, joining the terminal dots in middle of each cell, on fore wing minute or obscure.  $M_1$  decidedly stalked (Indomalayan) ..... *endora*
- Discal spots smaller, oblong or irregular and tending to be less well set off from the venation; postmedial spots on fore wing arrow-head shaped, their tips connected to border; st. spots at least on hind wing triangular or mushroom shaped, the lateral ends with a strong tendency to connect to the black vein-stripes and thus to the margin, in dark forms producing a heavy black border with two small white spots to an interspace ..... 3
3. Pm. spots of fore wing very large in three lower interspaces, enclosing large white spots, small in cell  $M_2$ , and above that minute or indistinguishably incorporated in border; discal bar of fore wing elongate or suffused, connected with the first of the large pm. spots or running out on  $Cu_1$ ; male usually white, with lemon yellow basal shading, female more buffy;  $R_2$  usually well back from end of cell (Philippine Ids.) ..... *anapis*
- Pm. spots more regularly decreasing in size on fore wing, the discal bar not enlarged; marginal chain of hind wing usually with elements pretty completely fused (at least in male)  $R_2$  usually close to end of cell and  $M_1$  stalked (Java and Mindanao) ..... *gaura*

*I. anapis* Felder. Forms *glaphyra* and *messala* show neither the exaggeration of the discal dash nor the weakening of the margin of the hind wing of the other Philippine races, and should be rejected.

*I. gaura* Horsf. True *gaura* does not show  $R_2$  arising from the end of cell, as stated in Hulstaert's definition of sg. *Ideopsis*, and thus differs from *endora*, which has been confused with it. Using the characters here given *gaura* is much closer to *anapis* than to *endora* (*daos*). I should list as races of it only *glaphyra* and *messala* from Mindanao. *I. costalis* from Nias is somewhat transitional, and it is most probable that all are a single species, in spite of the differences of  $R_2$  and pattern. This is obviously the primitive stock from which the other three types are derived.

*L. endora* Gray. I should use this name to include the strikingly spotted species from the whole Indomalayan region except the Philippines and Java. *Daos*, *perakana*, *ardana*, *sonia*, *endora*, *nigrocostalis* and *costalis* have been examined, and only the latter is transitional to *gaura*. The pm. spots differ in position as well as form, being definitely farther from the margin.



*L. vitrea* Blanchard. In this complex Hulstaert separates off *ribbei* and *inuncta* as species, but their range is included in that of *vitrea* and they differ only by the lack of yellow in the ground. *Ribbei* is from the islands off Celebes, *inuncta* from those off New Guinea. Fruhstorfer would also separate *klassika* Mart. from Ceram as a species. In it the fore wing is black except for limited yellow markings. The rest of the Moluccas have fairly normal *vitrea* races.

### *Danaus* Linnaeus

Regardless of technical rules this name was proposed by Linnaeus, in a sense inclusive of the present one, was definitely characterized as a major subdivision of a genus, and since then has been continuously in use, with only minor variations of spelling (*Danais*, *Danaida*). Those who follow a recent decision of the Commission must forget this use and credit the name to Kluk, as Hemming has done.

Of the numerous subdivisions proposed, four are sharply definable on characters of both sexes, and I believe it will give a much clearer idea of the genus to treat only these four as subgenera. They are: *Danaus* (*Anosia*, *Limnas*, *Tasitia*, *Nasuma*), *Tirumala* (*Melinda*), *Parantica* (*Ravadeba*, *Chittira*) and *Radena*. The first two and last two each make a pair, and may possibly be separately derived from their common ancestor (which would also be that of *Amauris*) since the first two agree against the last two in having two subterminal dots to each interspace in both wings, and having developed the sex-pocket. The subgenera may be keyed as follows.

### KEY

1. Hind wing with either upper discocellular very long or lower very short, the middle and lower meeting at a distinct angle; fore wing beneath with much loose hair in base of cell Sc and costal part of discal cell (except *pumila* and *melusine*); st. spots one to a cell at least on fore wing, lying in the center of each cell (lost by fusion with terminals in *pumila*); male sex-scaling diffuse or concentrated along veins. (Larva spotted as far as known; pupa with a rounded keel on abdomen or none) ..... 2
- Hind wing with upper discocellular vein shortest, middle in line with lower (except *chrysippus*), the lower at least twice as long; subcostal area and cell of fore wing on under side closely scaled (except on veins); male with a sex-pocket below Cu<sub>2</sub>; fore wing with two st. spots to a cell in both



- parts of both wings (rarely with a single spot far above the center of the cell by the loss of lower one). (Larva transversely striped; pupa with a sharp abdominal keel) ... 3
2. Cell of hind wing with udev. much lengthened, longer than either mdev. or ldev. which are not far from equal and bent at a moderate angle; mdev. moderately bent near middle; fore wing with Sc and R anastomosing. Postmedial light spots in cells  $M_3$  and  $Cu_1$  simple. Male with a diffuse mealy area wholly below the fold ..... (*Radena*)
    - Cell of hind wing with ldev. less than half as long as mdev. as a rule, vertical and meeting it at a sharp angle; udev. variable, rarely as long as mdev. (very short in *melusine*); mdev. bent well above middle; fore wing with Sc and  $R_1$  approximate, but anastomosing only in *aglea* (s.l.); postmedial spots in cells  $M_3$  and  $Cu_1$  more or less distinctly divided (very rarely lost in the light ground). Male with areas of highly specialized sex-scaling, usually across  $Cu_2$ , if lower very conspicuous ..... (*Parantica*)
  3. Fore wing with Sc and  $R_1$  well separated and parallel; subterminal spots close to margin on both wings, pm. spots simple when distinct; male sex-pocket close to  $Cu_2$ , not more conspicuous below than above. (Larva except *erippus* s.l. with 6 filaments) ..... (*Danaus*)
    - Fore wing with Sc and  $R_1$  approximate; st. spots far back from margin in both wings, in the fore wing so far back as to eliminate the spot in cell  $R_4$ ; sex-pocket far from  $Cu_2$  and surrounded by an area of special scaling above. (Larva with 4 filaments) ..... (*Tirumala*)

(*Radena*) Moore

The key defines this group adequately. The three nominal species are extremely close but overlap widely in distribution. Hulstaert is inclined to transfer several of the "races" of *juventa* which coexist with more ordinary forms to *oberthurii*, but gives no tangible characters. The following key makes the conventional separation.

#### KEY

1. Basal part of wings with an extended white area, in strong contrast with the almost wholly blackish outer third ..... 2
  - Basal part with heavy veins, the outer part with extensive light markings, not contrasting ..... *similis*
2. Fore wing with a transverse pm. white band, cut off from the



- inner marginal area by a heavy black bar on  $Cu_1$ , a similar bar also on  $Cu_2$ ; terminal spots very weak or absent, but inner st. spots well developed and outer pm. again absent (Sumba and Sumbava) ..... *oberthuri*
- White area not so distributed, being continuous to near apex or more or less limited to dorsal part of wing; terminal dots normal, conspicuous ..... *juventa*

## (Parantica) Moore

In the more normal species of *Parantica* the postmedial area of the fore wing is crossed by a black bar, cutting the pm. spots into two series, at least in cells  $M_3$  and  $Cu_1$ . In *Radena* there is always a single long spot in each of these cells. But this character often fails, e.g., in *pumila*, and males of *vitrina*, *gloriola*, *periphas* and *schenki*.

I should make two principal divisions of *Parantica*, rather than three, basing them on the position of the sex-patch, whether or not there is a conspicuous oval patch bisected by  $Cu_2$ . The true *Paranticas* have the patch, and also the majority of species put by Fruhstorfer in *Ravadeba*; but in *Chittira*, and the curious *melusine* and *pumila* (placed by Fruhstorfer in *Ravadeba*) the sex-scaling is almost wholly below the fold. The latter are also queer in losing the hair on the under side of the fore wing, and most of the smaller markings.

## KEY

1. Fore wing with Sc and  $R_1$  anastomosing; pattern much like *D. albata* ..... *aglea*
- Fore wing with Sc and  $R_1$  merely approximate ..... 2
2. General color of hind wing pattern brown, much warmer than fore wing; sex patch variable in different races, sometimes almost wholly below  $Cu_2$  (tytioides) ..... *sita*
- Dark pattern of fore and hind wings the same color ..... 3
3. Outer part of hind wing and border of fore wing mostly black above, the cell  $M_3$  of fore wing in particular almost wholly black (the hind wing may be lighter when the fore wing is almost wholly black) ..... 4
- Border of hind wing narrower, usually with white terminal and subterminal spots; cell  $M_3$  of fore wing usually with two good sized spots of the light ground (white, green, yellow or hyaline) ..... 7
4. Cell  $Cu_1$  light for at least the basal  $2/5$ , not even with suffused dark veins, the border broader below  $Cu_2$ ; no hair in cell of fore wing below ..... 5



- Cell  $Cu_1$  also mainly black, with two small white spots, the border narrow below  $Cu_2$ ; cell of fore wing below hairy ..... 6
- 5. Ground transparent white; st. white spots conspicuous above (New Guinea, etc.) ..... *melusine*
- Ground transparent yellow; st. spots invisible above on both wings, but some of them present below (New Caledonia to New Hebrides) ..... *pumila*
- 6. Wings squarish; hind wing white with spotted black border (not seen) ..... *weiskei*
- Wings elongate, sinuate; hind wing blackish, except for white cell, a ray beyond it and st. white spots ..... *fumata*
- 7. Subterminal spots on upper half of hind wing double (at least with the one in cell  $M_2$  almost wholly and that in  $M_1$  partly divided) ..... 8
- St. spots in upper half of hind wing single, at least the one in  $M_1$ , that in  $M_2$  sometimes partly divided ..... 11
- 8. Ground of hind wing at least bright yellow ..... 9
- Ground of both wings white, greenish or bluish ..... 10
- 9. Postmedial area in cells  $M_3$  and  $Cu_1$  of hind wing also divided in two ..... *aspasia*
- Post medial areas simple, but black border much widened, reaching  $2/3$  way in to cell in female and further in male ..... *cleona*
- 10. Sex-patch astride of  $Cu_2$ ; fore wing shorter; white streaks in cells  $R_5$  and  $M_3$  broadly separate; at least traces of black streaking in cells and fold ..... *eryx*<sup>12</sup>
- Sex-patch in anal area; white in cells  $R_5$  and  $M_1$  separated from each other and the neighboring areas by the black veins only. Wings dominantly white ..... *albata*
- 11. Ground of wings yellow or heavily shaded with yellow toward base ..... 12
- Ground of wings not yellowish ..... 13
- 12. Hind wings of male with cell reaching  $2/3$  way to margin, ground transparent bright yellow; cell  $Cu_1$  of fore wing mostly of the light ground ..... *schenkii*<sup>13</sup>
- Cell of hind wing normal, scaling dense, buffy; cell  $Cu_1$  of fore wing mainly dark ..... *menadensis*<sup>14</sup>

<sup>12</sup> If correctly determined in our collection, *D. maghaba* agrees with *eryx*, in the characters given above, but with as much white as most *albata*.

<sup>13</sup> Apparently the more eastern representative of *vitrina*.

<sup>14</sup> Perhaps a local representative of *luzonensis*.



13. Dominantly black, even in basal part of wings (sex-patch astride of  $Cu_2$ ) ..... 14
  - Cells in basal part of wing dominantly of the ground color, though the discal cell is often invaded with black from the costal side ..... 15
14. Large, with two postmedial spots or dots each in cells  $M_3$  and  $Cu_1$  of hind wing ..... *crowleyi*
  - Small, only the basal of these two spots preserved, the rest of the cell very heavily black ..... *nilghiriensis*
15. Border of hind wing not wider than distance between it and end of cell; markings of under side of hind wing dead black.
  - ..... *vitrina* group
  - Border of hind wing extending far in toward cell; markings of under side with a distinct brown tint ..... 16
16. Body blackish, under side grayish with a slight olive tint; spot in cell  $M_1$  of fore wing short and broad, 4 or 5 times as long as wide, less than twice as long as the rounded spot in cell  $M_2$ , and filling the width of its cell; st. spot in  $M_2$  minute or absent; separate pm. spots in cells  $M_3$  and  $Cu_1$  of hind wing. Sex-patch astride  $Cu_2$  ..... *phyle*
  - Body tawny; spot in cell  $M_1$  of fore wing about 3 times as long as spot in  $M_2$ , slender, not filling its cell, and defined by wide dark stripes above and below; st. spot in cell  $M_2$  normal ... 17
17. Chestnut below; fore wing sinuate with extended apex, streak in cell  $M_1$  extending  $2/3$  way to margin; sex-patch large, astride  $Cu_2$  ..... *melaneus*
  - Deep umber below, almost as dark as upper side; fore wing hardly sinuate, the streak in  $M_1$  only extending  $3/5$  way to margin; sex-patch on 2d A ..... *luzonensis*

*D. (P.) aspasia* F. The yellow and white races do not seem to be consistently distributed. I have seen white ones from Sumatra, Borneo and Celebes; yellow ones from Java, Engano and Nias.

*D. (P.) vitrina* Fld. This appears to me a good species as against the preceding, to which Hulstaert sinks it. Of the numerous forms, typical *vitrina* from the Philippines is transparent white, while *gloriola*, *citrina*, *periphas* and *schenki* are yellow.

*D. (P.) gloriola* Butler, which is at hand, should be a distinct species from *vitrina*, as indicated by the extremely large cell in hind wing of male. *Talboti* Huls. certainly goes with it, to judge by the figure in Gen. Ins. (1: 7), but I cannot say how many other of the “*schenki*” forms.

*D. (P.) cleona* Stoll. The different wing-form, heavier scaling



and coarser pattern indicate this is also a good species from the Moluccas and Celebes. If National Museum determinations are correct *luciplena*, *tigrana* and *lutescens* belong to it.

*D. (P.) melusine* Bdv. This species and *pumila*, which is obviously related, are the only exception found to the rule that all *Danaus* species without scent pockets have hair on the under side of the fore wing near the base. *Marcia* of Joicey and Talbot differs so much from *melusine* that I should be inclined to rate it as a species. It will tend to run out of the key and go down to 15, but shows its relation to *melusine* in the large single st. spots (on hind wing as well as fore wing) and contrast between the nearly black filled cell  $M_3$  and largely transparent cell  $Cu_1$ ;  $Cu_2$  is again dark, as in *pumila*, but the veins are heavily black-lined.

*D. (P.) maghaba* Fruh. looks almost exactly like *aglea*, and may be an *aglea* form, as generally placed, but it has Sc and  $R_1$  separate, and as I have drafted the key will run to *eryx*. The two species are much closer in pattern than they look.

*D. (P.) melaneus* Cr. and *luzonensis* Fld. The key characters here used would redistribute the forms of this group, but in a way I believe more natural than those of Fruhstorfer and Hulstaert. As determined in the National Museum, *banksii*, *praemacaristus*, *panaitius* and *larissa* belong to *luzonensis*, also I believe the "*aglea*" of Piepers and Snellen's Rhopalocera of Java, pl. 13: fig. 20. On the other hand his fig. 19 ("*larisca*") is a pretty obvious *melaneus*. The different sex spots show that two real species are involved.

In sum this subgenus needs drastic revision, as to subdivision, species boundaries and species content; or else a very high proportion of records, both published and unpublished, are based on misdeterminations.

(*Tirumala*) Moore

The survival of an area of sex-scaling about the pocket and the position of the pocket in line with the fold are primitive characters; the exaggerated form of the pocket, curved  $R_1$  of fore wing and migration inward of the st. spots are specializations, as compared with typical *Danaus*. The few species divide into an African group (*Melinda*) and an Asiatic group which has secondarily invaded Africa (*petiveranus*) but all are closely related.

#### KEY

1. Submedian area of fore wing solid color, except for a subterminal



and one or two marginal spots; fore wing with outer margin more sinuous and apex extended (*Melinda*) (Africa).

*formosa*

- Submedian area with a large median pale spot at least; outer margin less sinuous and apex blunter (*Tirumala*) ..... 2
- 2. Cell of hind wing wholly of the pale ground, without black central streak or wedge; basal part of submedian area also clear except in very dark specimens; abdomen mostly white.

*choaspes*

- Cell of hind wing with a central black streak, often forked; submedian area with a heavy black streak; abdomen red-brown or black ..... 3

- 3. Postmedial spots in cells  $R_5$  and  $M_1$  and subterminal in  $M_2$  rounded, roughly twice as long as wide ..... 4

- Pm. spots in  $R_5$  and  $M_1$  and subterminal in  $M_2$  streak-like, three or four times as long as wide (Asia) ..... 5

- 4. Ground decidedly green; submedian area of fore wing with a single green spot above fold, or with a slender separate sub-basal streak below fold also (Africa) ..... *petiverana*

- Ground white, usually with very faint or no green tinge; submedian area with a large double spot, composed of an oval spot above, and a longer streak below the fold (Asia and Islands) ..... *limniace*

- 5. A pale species; cell as well as interspaces about it dominantly light green and marginal pattern well developed; or if darkened with outer part of cell divided into three green stripes by two black stripes (Indochina and Nicobars) ..... *gautama*

- Basal half of wings dominantly light green, save that the cell of the fore wing is dominantly blackish; outer half mostly blackish, contrasting; body redder (Philippines and Celebes) ..... *ishmoides*

- Markings about evenly developed, the marginal pattern usually complete; cell of fore wing dominantly black, the outer green spot single, or once emarginate on outer side; submedian area darker, its two green antemedial streaks separate or connected by both joining the postmedial spot (wide-spread) ..... *melissa*

*D. (T.) formosa* Godm. This still stands in our lists as three species. I think in fact few would deny it is made up of four local forms of one; the fore wing darkening and hind wing becoming duller from *formosa*, through *neumannii* and *mercedonia* to *morgenii*; but *formosa* and *mercedonia* overlap, so perhaps two species are present,—*formosa* with more spotting on hind wing and brighter base of



fore wing, *mercedonia* with no pm. yellow spots on hind wing and dark brown on fore wing.

*D. (T.) petiverana*, etc. If Martin is right there are four species in this group in Asia, all existing together in the Celebes. Determinations are confused, partly through failure to realize the wide range of *melissa* forms, but I think the characters given in the key will usually work. *D. petiverana* is evidently not quite a modern immigrant to Africa, since it combines features of both the commoner Asiatic species, e.g., the green color of *melissa* with the shorter thicker spots of ground, of *limniace*.

(*Danaus*) Linnaeus

This group is commonly divided into five, but three of these are composed of a single aberrant and variable species each (*Anosia* with *erippus*, *Nasuma* with *ismare* and *Limnas* with *chrysippus*). The other two names merely represent the Old World and American members of a single homogeneous series, which show no differences of structure, pattern or larva. The following key separates what I consider to be distinct species. I believe my analysis of the American forms is correct, but am not quite so sure in the case of the Old World *lotis* group. The chief divergences from Hulstaert are the reallocation of the American normal series to three names only instead of six or seven; the combining of the northern Monarch with *erippus* (whose distribution is quite incorrectly given) associating *cleophile* with the *gilippus* rather than the *erippus* subgroup, and the realignment of the Old World species which have both tawny and white in the patterns of the under side as discrete elements.

KEY

1. Cell of hind wing lengthened, by the lengthening of the lower halves of mdcv. and ldcv., extending more than  $\frac{3}{5}$  way to margin; fore wing long, with sinuate outer margin. Tawny, with black border and veins and white spotting; rarely with a white spot in cell  $M_1$  (Larva with 4 filaments) (*Anosia*) 2
- Cell of hind wing not extending  $\frac{3}{5}$  way to margin, the outer part not lengthened ..... 3
2. Inner margin of fore wing tawny, or somewhat darkened in females with very dark ground, never much darker than ground ..... *erippus*<sup>15</sup>
- Inner margin of fore wing black below A, strongly contrasting ..... *megalippe*<sup>15</sup>
3. Fore wing elongate and outer margin sinuate; white postmedial

<sup>15</sup> Probably conspecific.



- spots beyond cell formed of two similar series of streaks, the one in cell  $Cu_1$  small, all diffuse and concolorous with the whitish ground; a conspicuous white apical spot. No brown or tawny (*Nasuma*) ..... *ismare*
- Fore wing short and blunt, white postmedial spots beyond cell and in cell  $Cu_1$  sharply defined when distinct, frequently contrasting with a tawny ground; apical white spot less conspicuous (Old World) or absent (New World) (Larva with 6 filaments) ..... 4
4. Mdev. of hind wing sharply angulated above middle and marked by a conspicuous black spot; veins not marked with black (*Limnas*) ..... *chrysippus*
- Mdev. of hind wing moderately bent about middle and not marked with a black spot; veins of Old World species conspicuously striped with black (*Danaus*) ..... 5
5. White postmedial spots in cells  $M_1$  and  $M_2$  of the shape of longitudinal oblongs, commonly only separated by the fine black veins, much larger than the white spots just beyond the cell, and forming part of a conspicuous oblique fascia (Old World) ..... 6
- White pm. spots in cells  $M_1$  and  $M_2$  rounded, always well separated, and similar to the ones just beyond cell (mostly New World) ..... 11
6. Under side of hind wing with a series of tawny postmedial spots, largely enclosed in black, and contrasting with the white or whitish ground; the terminal area brown; veins of hind wing above thin ..... *affinis*
- Ground of under side of hind wing more often tawny, never with a series of definite discolorous tawny spots, though sometimes shading imperceptibly from white into tawny; ground of terminal stripe black; veins of upper side heavily black .. 7
7. Fascia pointing at the pm. spot in cell  $M_3$ ; the latter opposite the outer end of the spot in cell  $M_2$  when that spot is long (as usual) ..... *genutia*
- Fascia further out, the pm. spot in cell  $M_2$  opposite its inner end, or obliquely in from it when small;—its *outer* end continuous with the upper st. spot ..... 8
8. Under side nearly evenly deep chestnut brown (with the usual white spots) the terminal area concolorous, the upper side almost as even (New Guinea) ..... *molyssa*<sup>16</sup>

<sup>16</sup> The National Museum has a race or closely related species from Sumbava, intermediate to *haruhasa*; under a ms. name of Neumoegen's.



- Terminal stripe of hind wing below black, contrasting with disc ..... 9
- 9. Veins of hind wing above broadly black, much broader than on fore wing; under side with broad shades of tawny, as in some *genutia* forms ..... 10
- Veins of hind wing above thinner than on fore wing, linear in center of wing. All specimens seen with deep mahogany ground, and mostly with sharply defined white spots and rays about end of cell below ..... *philene*
- 10. Ground at least of fore wing tawny or brown ..... *melanippus*
- Ground of both wings white ..... *lotis*
- 11. Body black above with yellow rings. Fore wing with white spotting reduced, the pm. with 4 dots (in cells  $M_1$ - $Cu_1$ ) only, and the st. and t. dots also obsolete, except for a strong apical dot below; ground fuscous shading into dull clay. .... *haruhasa*
- Body even or broadly shaded, usually red-brown, rarely black (*cleophile*), or white when the hind wings are white; markings of fore wing as strong as on hind wing; the st. and t. dots numerous ..... 12
- 12. Old World. Apical white dot much more conspicuous than the others; ground dark red-brown, evenly laid on ..... *mytilene*
- New World. Apical white dot not or scarcely enlarged, not at all distinctive; ground of fore wing light enough so that the blackish border contrasts decidedly ..... 13
- 13. Ground of abdomen and inner margin of fore wing black. .... *cleophile*
- Abdomen and inner margin of fore wing tawny or brown, concolorous ..... 14
- 14. Under side of hind wing with a series of small contrasting white postmedial spots ..... *plexaure*
- Under side with a series of very large, faintly paler spots. .... *eresimus*
- Under side with no trace of *postmedial* markings, sometimes with white spots grouped about end of cell ..... *gilippus*

*D. erippus* Cramer. The famous milkweed butterfly, or Monarch, is in a complete state of nomenclatorial snarl, since the oldest references to it were invariably confused with other related or similar species. Linnaeus included it in *plexippus*, but that name is claimed by the Old World *genutia* with at least equal right. I am inclined to drop it as of hopelessly uncertain identity; whatever the name may



have meant to Linnaeus it is certainly a composite. Next we have *erippus* of Cramer, an undisputed name, but belonging to the extreme southern representative of the group generally treated as a distinct species. Then comes *archippus*, but this was intended for the Viceroy, and its use for the Monarch must be treated as a homonym, or more probably a misdetermination. Next comes Hübner's "Verzeichniss." He proposes the name of *menippe*, including in it the North American race of the Monarch, but unfortunately his first citation under it is Cramer's figure of *erippus*;—he transfers the name *erippus* to *berenice*. If we accept Kirby's restriction (in Hübner's Samml. Exot. Schm. ed. ii, vol. 3, p. 4) this is the name we must use for the northern Monarch, otherwise it is nameless. On a later plate (ii, pl. 220, 1826) Hübner proposes the name *megalippe* for the race from northern South America.

The following key brings out the normal differences between the three chief races, but they intergrade completely. The northern one is well known to be a migrant, but the central one varies so much from place to place that it is evidently sedentary as a rule. Austin Clark reports (in lit.) that race *megalippe* exists in a definite colony in eastern Virginia. If so its failure to be lost among the normal Monarchs shows it must be sedentary here.

Of the minor names, *fumosus* Hulst. was intended for an aberration of the North American race; in fact it is the dominant female also in the races from Lima, Peru, and Vieques Id. and St. Thomas. From the latter island Butler gave it the name of *leucogyne*. In Porto Rico only a few miles away, the female is normal. The name *americanus* Gund. was given to a suffused aberration, *nivosus* Gund. (not *nivosus* G. & S.) to one with white ground.

Haensch overlooked the name *megalippe*, and renamed it *nigripus*. Hulstaert also failed to recognize the synonymy, and besides gives Central and South America and the Antilles wrongly for *erippus*, which seems in fact to occur only south of the Amazon.

#### KEY

1. Inner margin of fore wing concolorous, or somewhat suffused with darker brown (South America from Pará south) .....*erippus*
- Inner margin of fore wing black ..... 2
2. Postmedial spots of fore wing light tawny, but little paler than ground (U. S.; Cuba and Mexico—with the following; introduced widely in Old World) .....*e. menippe*
- Postmedial spots of fore wing cream or white; the border more solidly black (West Indies to Amazons and Peru, perhaps sporadic colonies in U. S.—Virginia) .....*e. megalippe*



*D. cleophile* Godart. This species has always been compared with the preceding, on account of the black body and inner margin of the fore wing, but in wing-form, venation and presence of a postmedial white spot in cell  $M_1$  of fore wing it agrees with the following. The latter spot is absent in a single specimen seen and minute in two more. The species differs from all the other *Danai* known to me in having a large contrasting pale patch in the fork of Sc below, though *D. affinis* has a white splash at the same place. Hulstaert gives the locality as "Antilles" but all the specimens I have seen with authentic locality are from Haiti and San Domingo. A stray female labelled "Jamaica, Thaxter" looks exactly like normal Haiti specimens and is doubtless the victim of an accident in labelling.

*D. gilippus* Cramer. As Bates notes (The Butterflies of Cuba, Bull. M.C.Z. 78 (2): 146, 1935) this is certainly a single locally variable species, covering the *gilippus*, *berenice*, *hermippus*, *xanthippus* and *cleothera* of Hulstaert and others. M. LeCerf has kindly lent me an authentic *cleothera* from the Paris Museum, and it is plainly this species, not *eresimus* as apparently assumed by Hall in describing *kaempfferi*. The distribution of the races is erratic, especially in the Antilles, where the Haitian *cleothera* has nothing special in common with the Cuban *berenice* or Jamaican *jamaicensis*, and these latter represent the two extremes of the *berenice* "exerge."

There are three main groups of races; the *berenice* group, rather evenly Indian red, with weak veins and little white spotting; the true *gilippus*, with similar ground color, but much white spotting about end of cell, and the *cleothera* types with more orange-tinted ground and heavy dark veins. The first two occupy the ends of the distribution area, while the third is typical of the middle, but areas interlock, and there is a good deal of blending of the two northern types in the Andean region. Hall gives the absence of the lower discal spots on under side of fore wing as a point to distinguish *kaempfferi* (i.e., typical *cleothera*) from the other races; the difference holds normally but not strictly, like so many racial differences.

#### KEY

1. Hind wing above with a group of 3 to 6 white spots about discocellulars. Ground pale Indian red with narrow but distinct black veins (Brazil, from Pará south) ..... *gilippus*
- Hind wing above without white spots at end of cell, below at most with weak spots, or with white streaks along the veins<sup>17</sup> ..... 2

<sup>17</sup> The National Museum has a female from Loja, Ecuador, and one without locality that are transitional, with the group of white



2. Ground color mostly orange-ochre to tawny, the apex and costa contrasting dark red-brown; veins heavily dark ..... 3
- Ground color rather Indian red, without orange tint, varying from light leather color to deep mahogany, the costa as a rule not noticeably darker ..... 4
3. Fore wing at least on under side, with white pm. spots in cells  $Cu_1$  and  $Cu_2$  (Colombia to Trinidad)<sup>18</sup> ..... *xanthippus*
- Fore wing without these two spots (Haiti) *cleothera (kaempfferi)*
4. Hind wing with black veins thickened, strongly contrasting, the white edging when present suffused ..... 5
- Hind wing with black veins linear, not at all contrasting, the accompanying white lines when present, also linear ..... 6
5. White spotting on fore wing moderate (Colombia) *hermippus*<sup>19</sup>
- White spotting of fore wing very large, the pm. spots larger than the space between them, the st. dots also enlarged at middle of wing (W. Colombia to N. Peru) ..... *nivosus*<sup>19</sup>
6. Ground deep mahogany red (Fla., Cuba, Bahamas, and Isle of Pines; Costa Rica and Panama)<sup>20</sup> ..... *berenice*
- Ground pale Indian red, the veins of hind wing normally edged with white (Arizona to Costa Rica)<sup>20</sup> ..... *strigosa*
- Ground evenly pale leather brown, the black border frequently obsolete; generally small (Jamaica) ..... *jamaicensis*

I judge *thersippus* Bts., from Panama to be merely the normal dark *berenice* like the Costa Rica specimens examined. If there is any difference it will serve for the Costa-Rican subrace, *berenice* for that from Florida and the Antilles. I take *centralis* J. & T. to be

spots, but a still paler color, approaching *nivosus*. They probably represent a case of parallel variation, not continuous with the general area of *g. gilippus*.

<sup>18</sup> Omitted from Kaye's list, but in the Hope Museum from La Brea, Trinidad; also reported by Joicey and Talbot, as *centralis* J. & T.

<sup>19</sup> These forms intergrade and interlock in distribution and also interlock with *g. xanthippus*; but any one block of specimens runs relatively constant. The National Museum also has an ultra-form of *nivosus* from Cuzco, Peru, with the ground almost wholly white except the cell of the fore wing, and the st. and t. spots also much enlarged.

<sup>20</sup> The difference in color is more striking when viewed in an extremely dim light, then the ground of *berenice* goes black, while *strigosa* seems even paler.



merely *xanthippus*, since my specimen from Pitotán, Venezuela, not too far from the type locality, is as light as normal *xanthippus*.

*D. plexaure* Gdt. This species replaces *eresimus* locally, but the difference is so striking that I treat it as a good species. The Tring Museum reports a specimen transitional to *gilippus*, but I have never seen one. Pará to Corrientes, Argentina.

*D. eresimus* Cramer. The color forms of this show a distinct tendency to parallel those of *gilippus*,—except its type race, which matches the range of *D. plexaure*. While the key difference is clean-cut, and almost always easy to see, it is frequently overlooked (I suppose because it is visible only below) and few collections show pure series. The series that I treat as *e. eresimus* can be further divided, especially in the shade of brown ground, for instance Cuban specimens are much darker than those from Haiti and Jamaica. These lighter ones are perhaps *kaempfferi* Hall, but he does not mention the spots below, and the description suggests *cleothera* rather than *eresimus*. The new race from the Middle Amazon is the most distinct of all. Most of the specimens seen may belong to a single collection (they were distributed through dealers) but very few have locality labels of any value.

#### KEY

1. Wings above heavily shaded with black between the two series of marginal spots and along border, at least; hind wing below warmly colored, tawny to red-brown ..... 2
- Wings above with black shading confined to extreme margin and costa; hind wing above with outer part noticeably lighter tawny, below leather brown without orange or red tint; white markings conspicuous, sometimes with the st. and t. dots on fore wing partly fused (Amazons).....**dilucida**, n. ssp.
2. Hind wing with subterminal as well as terminal white dots conspicuous, apex of fore wing more black, hind wing more tawny (arid West Peru and West Ecuador) .....*erginus*
- Hind wing with subterminal dots largely lost, terminal series sometimes incomplete; ground usually even brown, with less black in apical area (Florida to Amazons) ..... *eresimus*

*Danaus eresimus dilucida* (Stgr. ms.), new race.

Ground mahogany brown, shading into bright tawny toward anal angle of fore wing and on outer third of hind wing; apex of fore wing also lightened. White spots in the usual positions, pure white, large and strongly contrasting, the ground about



them somewhat darkened toward costa but not black; st. and t. series fairly complete on fore wing, the middle st. ones somewhat enlarged, and occasionally joining the corresponding terminal ones; outer margin shading into dark brown. Hind wing with the pm. spots of under side repeated as vague pale shades, and also sometimes with similar pale shades about end of cell; st. dots mostly faint or obsolete in the tawny ground, but terminals more distinct, usually a complete series but not really white. Beneath, fore wing except apex as above, but with even less dark shading; apex and hind wings pale dull brown, with fine black veins; the st. and t. spots in a complete series and white on both wings, the ground not at all darkened around them. Postmedial patches on hind wing pale dirty buff, not at all shaded with paler or defined with darker, sometimes with smaller similar spots grouped at end of cell. Expanse 60–80 mm.

Type male and 3 paratypes, Santarem, Amazons, Brazil (F. Knab) in U. S. National Museum; 12 other paratypes without authentic localities in U. S. National Museum, Museum of Comparative Zoology and Cornell University Collection. One is labelled "Amazon" one "Brazil" and two bear the determination "*dilucida*."

Cornell has one specimen of *eresimus* from Bocas, Panama, with the ground evenly as dark as the local *berenice*, and the usual white pm. spots in cells  $M_3$  and  $Cu_1$  lost. It may possibly represent a fourth distinct race. From Godman and Salvin's remark in the Biologia they probably included such specimens in "*cleothera*."

The Old World species of true *Danaus* appear to be a homogeneous group, though hardly worth a subgenus (*Danaus* against *Tasitia*) as the only tangible difference is the emphasized apical dot on the fore wing. The key separates most of the species along the lines recognized by Hulstaert, except in the case of *genutia* (*plexippus*). This is certainly two species, marked by the different relation of the white fascia and the spot in  $M_3$ , the fascia being continued by the postmedian spot in *genutia*, the subterminal in *philene*. I have entered the names of *molyssa* and *mytilene* in the key, but believe them only rather divergent pattern-types of *philene*. *D. ismare kotoshonis* Mats. (*kotoshoensis* on the plate) in Ins. Mats. iii 4: 1, is obviously not a form of *ismare* but a normal *Danaus*. I believe it is *affinis*, though the under side is neither described nor figured.

*D. genutia* Cr. Normal forms of this species run as far east as Tenimber in the Lesser Sunda Ids., but stop short of the Celebes, which have a couple of large races with the pm. fascia more erect than the others (though the spot in  $M_3$  is in line) and the cell of the



hind wing white. From the Moluccas and east the *philene* group of forms come in.

*D. philene* Cr. Fruhstorfer makes three species out of this complex, Hulstaert combines all three with *genutia*, as *plexippus*. While Fruhstorfer gives genitalic differences in "Seitz" he sometimes allowed too little for individual variation and the characters should be checked. Typical *philene* is Moluccan, but *philene*-like forms reappear in eastern New Guinea; the intervening strains, mainly from Dutch New Guinea, tend to be darker. For analysis see Fruhstorfer in Berl. Ent. Zeit. 44: 64-83, 1899; Iris 19: 161-202, 1906; Seitz' Macrolep. World 9: 197-199, 1910.

*D. melanippus* Cr. and *lotis* Cr. are hardly more than representative species, but the distributions interlock, and Fruhstorfer reports both from the Natuna Ids. In some strains of *lotis* the veins are no darker on the hind wing than the fore wing, but only when both are very heavily shaded.

*D. affinis* F. Hulstaert questions the distinctness of this species from *philene*. I believe the latter is rather the representative of *genutia*, while *affinis* overlaps the distribution area of both and remains distinct. The orange spotting on the border below varies in extent, but so far as I have seen is always separated either by a black line or a sharp change of color from the paler areas of ground color. Many of the races have been assigned without any note of this character, and I suspect some of the names should be interchanged between *affinis* and *genutia-philene*.

*D. haruhasa* Doh. A very distinct species from *melanippus* and *lotis*, between which it now stands. The wings are lengthened and coloring dull. It plainly belongs to the Celebesian fauna in characters, but instead is found in the Lesser Sunda Ids., which generally when they have special forms vary in the opposite direction. Note *Cethosia myrina* and *lamarecki justa*.

*D. (Limnas) chrysippus* L. This species needs no comment.

*D. (Nasuma) ismare* Stoll. The usual exaggerated type to be expected in the Celebes. Matsumura's race *kotoshonis* must be excluded, being a normal *D. (Danaus)*. The wing form suggests *Anosia*, but the more important characters do not, and I fully believe the larva will be found similar to *genutia*, with 6 filaments.

#### *Amauris* Hübner

A slight variant of *Danaus*, intermediate in most characters between *D. (Danaus)* and *D. (Parantica)*. It would hardly have



been held so long were it not for the different caterpillar and the fact that no primitive *Danaus* are found in Africa to make the connection. — Of the four main subgroups it comes nearest to typical *Danaus*, though it lacks any trace of the pocket, and therefore cannot be derived from it.

Aurivillius' analysis in the *Rhopalocera Aethiopica* 34–40, and in Seitz 13: 73–78, is so complete that further comment would be out of place.

## PLATE XII

*Explanation of Symbols**Danaus erippus*

Dotted	<i>menippe</i> (Monarch)	} <i>megalippe</i> exerge
Vertical ruling	<i>megalippe</i>	
Horizontal ruling	<i>erippus</i>	<i>erippus</i> exerge

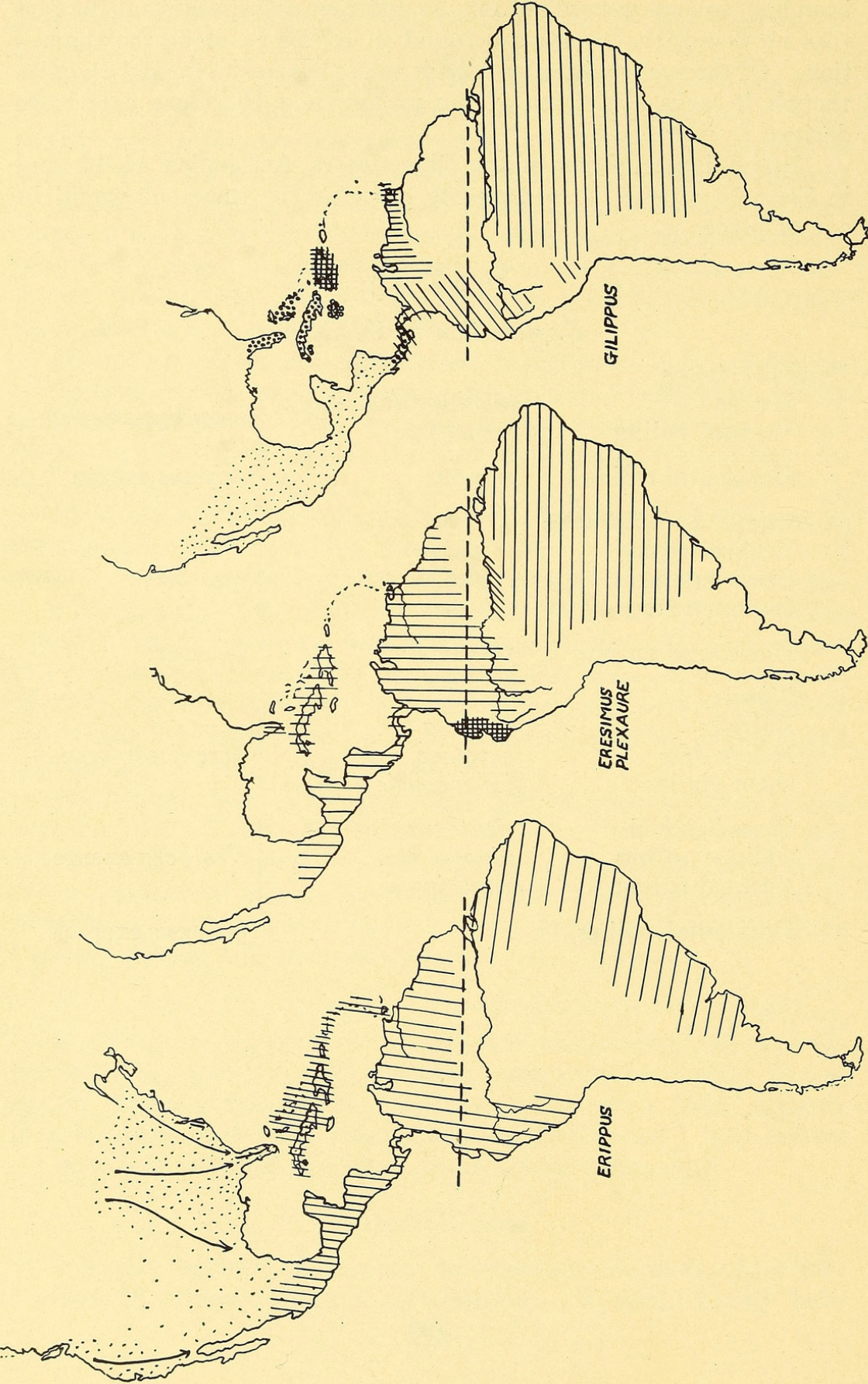
*D. eresimus* and *plexaure*

Vertical ruling	<i>eresimus</i>	} <i>eresimus</i>
Cross-hatched	<i>erginus</i>	
Oblique ruling	<i>dilucida</i>	
Horizontal ruling	<i>plexaure</i>	<i>plexaure</i>

*D. gilippus*

Dotted	<i>strigosa</i>	} <i>berenice</i> exerge
Heavy dots	<i>berenice</i>	
Open circles	<i>jamaicensis</i>	
Cross-hatched	<i>cleothera</i>	} <i>cleothera</i> exerge
Oblique ruling	<i>nivosus</i> etc.	
Vertical ruling	<i>xanthippus</i>	
Horizontal ruling		<i>gilippus</i> exerge









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