

Revision of *Delias mysis* (Fabricius, 1775) and closely related species (Lepidoptera: Pieridae)

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Abstract: Because of sympatry of *Delias lara* and *D. mysis nemea* at Sota, in the Merauke area of Papua, a division of *Delias mysis* in two species is proposed: *D. mysis* with four subspecies and *D. lara* **stat. nov.** with five subspecies, including four **comb. nov.** Four subspecies are regarded synonyms (**syn. nov.**). The closely related species *D. euphemia* from the islands of Supiori and Biak and *D. doylei* from the Central Mountain Range in PNG are compared and illustrated.

Ikhtisar: Karena ditemukan *Delias lara* dan *D. mysis nemea* di Sota, wilayah Merauke, Papua, maka suatu pembagian *Delias mysis* diusulkan menjadi dua spesies: *D. mysis* dengan empat subspecies dan *Delias lara* **stat. nov.** dengan lima subspecies, termasuk empat kombinasi baru (**comb. nov.**). Empat subspecies dinyatakan sinonim (**syn. nov.**). Dua spesies yang dekat, yaitu *D. euphemia* dari pulau Supiori dan Biak dan *D. doylei* dari pegunungan tengah di PNG dibandingkan dan diilustrasi.

Keywords: *Delias lara*, Merauke, Papua, Indonesia, PNG.

Introduction

Sixteen taxon names have been proposed for the *Delias mysis* complex from New Guinea and its surrounding islands and from the northern coast of Australia. Since Fabricius in 1775 described *Papilio mysis* (now *Delias mysis*) debate has continued about the classification of various newly described taxa.

Pieris lara (Boisduval, 1836) was originally described as separate species. However, since Vollenhoven (1865) and Fruhstorfer (1910), it has been treated as a subspecies of *Delias mysis*. The remaining taxa were described as subspecies of *D. mysis*. Several, because of their close relationship with *D. lara*, have been synonymised with, or treated as forms of *D. mysis lara*. Only *D. euphemia* Grose-Smith, 1894, from

the islands Supiori and Biak and *D. doylei* Sanford & Bennet, 1955 from the central highlands of Papua New Guinea are currently recognised as separate species.

Following the discovery that *Delias mysis nemea* and *D. mysis lara* are sympatric in Sota, Merauke district, S.E. Papua, the need for a review of the *D. mysis* species group has become evident.

Depositories

The abbreviations given below have been used throughout the text.

- AT - Allotype
- BMNH - British Museum Natural History, London, UK
- HT - Holotype
- KSP - Koleksi Serangga Papua
- PNG - Papua New Guinea
- PT - Paratype
- NG - New Guinea

Taxonomic History

In 1775 Fabricius described *Papilio mysis* from Australia. Godart (1819) renamed the species as *Pieris mysis*. Wallace (1867) mentioned it as *Thyca mysis*. Since Mitis (1893) it is named as *Delias mysis* and, after publications of subspecies, as *Delias mysis mysis*.

Boisduval (1836) described *Pieris lara* from Nouvelle-Guinée, without further explanation of the locality. This taxon was placed as subspecies of *mysis* by Vollenhoven (1865). Wallace (1867), Mitis (1893), Staudinger (1894) and Butler (1897) mentioned it as *Delias lara*. However, since Fruhstorfer (1910) it has continuously been treated as a subspecies of *mysis*. Grose-Smith (1894) erroneously mentioned this taxon as *D. cruentata*.

Butler (1865) described *D. mysis cruentata* from Mysol. Mitis (1893) described *Delias mysis aruensis*, renaming *Thyca bagoe* Wallace, 1867 from Aru, and *D. lara* var. *intermedia* from N. E. British New Guinea, which was followed by Fruhstorfer (1910), R'ber (1919) and Talbot (1928a). Grose-Smith (1894) described the closely related *Delias euphemia* from Biak, which he compared with *T. bagoe* Wallace.

Butler (1897) described *D. aestiva* (or *oestiva*) from N.W. Australia, now accepted as *D. mysis aestiva*. The confusion about the correct spelling of the name is caused

by the font used in the original publication, which did not distinguish between diphthongs ae and oe, e.g. see *Delias hae[oe]morrhoe[ae]a* on p. 145; subsequent authors have interpreted the original spelling as either *oestiva* or *aestiva*; the first subsequent author was Fruhstorfer (1910) in *Macrolepidoptera of the World*, where *aestiva* is used; the next was Waterhouse & Lyell (1914), where *oestiva* was used.

Grose-Smith (1897) described *D. maga* from Sud Est Island, and treated *D. mysis*, *D. lara* and *D. cruentata* as separate species. Fruhstorfer (1910) added *D. mysis onca* from the Milne Bay, *D. mysis oisyme* from Waigeu and *D. mysis nemea* from the Merauke area and included *maga* as subspecies of *mysis*. Talbot (1937) erroneously mentioned South-West Dutch New Guinea as the habitat of *D. mysis nemea*, rather than the south-east where it actually occurs.

Rothschild (1915) described three new subspecies: *D. mysis maforensis* from Mafor Island, now called Numfor, *D. mysis goodenovii* from Goodenough Island and *D. mysis rosselliana* from Rossell Island.

Talbot (1939) described *D. mysis adelphoí* from Yule Island, which has subsequently been spelled without diaeresis as *D. mysis adelphoe*

Roepke (1955) recorded *Delias mysis lara* Boisduval, 1836 and further mentioned *D. mysis nemea*, *D. mysis intermedia* and *D. mysis onca* as subspecies from the mainland of New Guinea. In the same year Sanford & Bennett described *D. doylei* from the Central Mountain range in PNG, a species which is closely related to *mysis*.

D'Abrera (1971, 1977 and 1990) mentioned all of the above taxa. However he treated *intermedia* and *oisyme* as synonyms of *lara*, and considered *cruentata* and *onca* to be very doubtful subspecies which probably belong to *lara*.

Nakano (1993) followed the arrangement of D'Abrera mentioning thirteen subspecies and synonymising *intermedia* and *oisyme* with *lara*. Nakano's illustrations of *Delias mysis maforensis*, do not agree with the description by Rothschild (1915) and probably belong to *aruensis*. Nakano (1995) described *Delias mysis hideyoeae* from the Island of Japen, based on a single male and female.

Tuzov, V. K. (1995) in his checklist of the genus mentioned thirteen subspecies of *mysis*, treating *intermedia* and *oisyme* as forms of *lara*. He also mentioned *cruentata* Fruhstorfer, 1910 as synonym of *cruentata* and misspelled *rosselliana* (sic.).

Parsons (1999) mentioned six subspecies in PNG from the 13 listed by D'Abrera: *lara*, *onca*, *adelphoe*, *rosselliana*, *maga* and *goodenovii*. In his comment on *mysis*

Parsons quoted Talbot (1928-37) in saying that the described races of *mysis* are "not entirely constant, one race occurring with another as an individual form. The chief variation occurs on the hind wing below, the red band being the most variable element" and added that D'Abrera's comments throughout his text on *mysis* support this opinion. Parsons further states that "as would be expected from their isolation, only the island races in PNG exhibit more obvious and consistent differences from the mainland 'subspecies'. The reasonably distinctive taxon *euphemia* Grose-Smith, 1894, from Biak Island in Irian Jaya, which was credited with species rank by Talbot (1937) and D'Abrera (1978), is probably only a specialized race of *mysis* as those authors pointed out."

Nakano in Yagishita, Nakano & Morita (1993) recognized thirteen subspecies of *D. mysis*, omitting the taxa *intermedia* and *oisyme*.

Braby (2000) recognised the occurrence of three subspecies in Australia; *D. mysis mysis* (northern and north-eastern mainland), *D. mysis aestiva* (northern and north-western mainland Australia) and *D. mysis onca* (mainland of NG extending to Torres Strait Islands) Braby mentions that "specimens from the Cape York peninsula assigned to *D. mysis waterhousei* appear to show little consistent difference from those further south assigned to *D. m. mysis*... The distribution in north eastern Queensland is continuous and clinal variation may be involved in some of the characters."

Discussion

In the Merauke district of Papua two supposed subspecies of *D. mysis* have been found to occur in sympatry: subspecies *nemea* and subspecies *lara*, the commonest form found throughout mainland New Guinea.

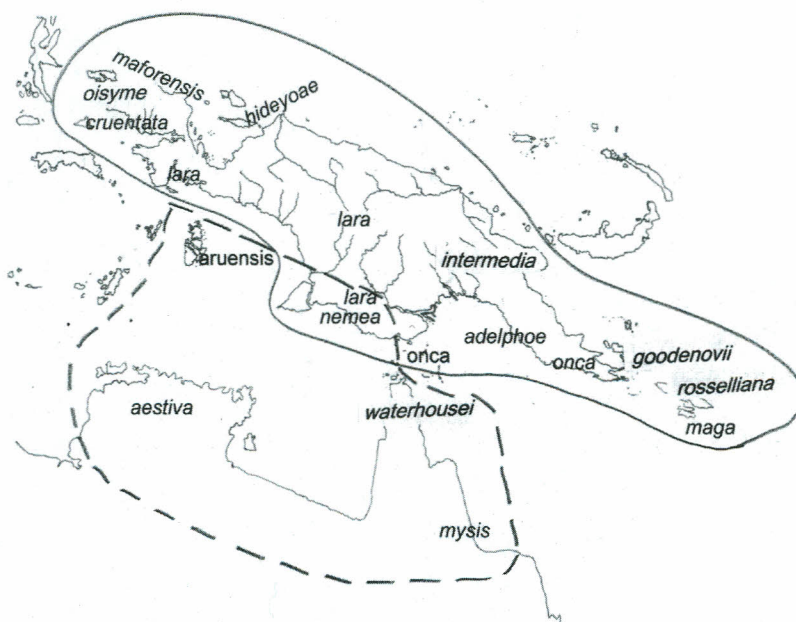
The relative width of the red band on the underside of the hindwing is not a reliable feature to separate subspecies, being variable among individual specimens from the same locality, as already pointed out by D'Abrera (1971, 1977 and 1990) and Parsons (1999). A more constant and useful diagnostic feature is the row of subapical spots on upper - and underside of forewing.

In *nemea* and its relatives, *mysis* (including *waterhousei*), *aestiva*, *aruensis*, the subapical spots on upperside of forewing are well developed and look like streaks which form a white band with black veins; the streaks in the males are white, in the females sometimes yellow. The subapical spots on the underside of forewing are generally white with variable amounts of yellow suffusion.

In *lara* ssp. - *lara* (including *cruentata*, *maforensis*, *onca* and *adelphoe*), *hideyoae*, *goodenovii*, *rosselliana* and *maga* - the subapical spots on upperside of forewing are white, quite poor developed and even sometimes absent; the subapical spots on the underside of forewing are yellow and somewhat larger.

D. lara occurs throughout mainland NG. Coastal populations are often larger and more heavily marked than those from montane areas. There is slight west to east clinal increase in the average width of the black and red hindwing bands, but these characters are highly variable among individuals from a single population. Due to this variability, we can identify no constant features to separate ssp *cruentata*, *maforensis*, *onca* and *adelphoe* from the variable *D. lara lara* and therefore treat them as synonyms.

The taxon *euphemia* is closely related to *mysis*, however the significant differences, particularly the presence of a row of pale orange submarginal spots on the upperside hindwing of the female, justify retention of this taxon as a separate species in our opinion.



Map 1. Distribution of *Delias lara* ssp. (uninterrupted line) and *D. mysis* ssp. (interrupted line), including synonyms

Conclusion

Based on these findings, the *mysis* complex is considered to consist of three species, two of which occur on mainland of New Guinea.

Delias lara occurs all over NG, including *onca* **syn. nov.** from the Milne Bay. Outside the mainland of NG *lara* is found on Waigeu (*oisyme* **syn.**), Mysol (*ssp. cruentata* **syn. nov.**), Numfor (*ssp. maforensis* **syn. nov.**), Japen (*ssp. hideyoae*), at Yule Island (*ssp. adelphoe* **syn. nov.**), at Goodenough & Fergusson Islands (*ssp. goodenovii*), at Rossel Islands (*ssp. rosselliana*) and at Tagula [= Sudest Island] (*ssp. maga*).

Delias mysis is distributed from Australia, *ssp. mysis*, to the Aru islands, *ssp. aruensis*, and the southern part New Guinea where *D. mysis nemea*, occurs in the Merauke area and is sympatric with *Delias lara*.

D. euphemia occurs only on the islands of Biak and Supiori.

The following classification is proposed:

Delias mysis (Fabricius, 1775) with subspecies

- *mysis* (Fabricius, 1775) from north east Australia
 - *waterhousei* Talbot, 1937 from Cape York Peninsula
- *aestiva* Butler, 1897 from north west Australia
- *aruensis* Mitis, 1893 from Aru Islands
- *nemea* Fruhstorfer, 1910 from Merauke District

Delias lara (Boisduval, 1836) **stat. nov.** with subspecies

- *lara* (Boisduval, 1836) from Waigeu, Japen and NG, including
 - *intermediata* Mitis, 1983 from north-east British NG
 - *oisyme* Fruhstorfer, 1910 from Waigeu
 - *cruentata* Butler, 1865 **syn. nov.** from Mysol Island
 - *onca* Fruhstorfer, 1910 **syn. nov.** from Milne Bay area
 - *maforensis* Rothschild, 1915 **syn. nov.** from Numfor Island
 - *adelphoe* Talbot, 1939 **syn. nov.** from Yule Island
- *hideyoae* Nakano, 1995 **comb. nov.** from Japen Island
- *goodenovii* Rothschild, 1915 **comb. nov.** from Goodenough Islands
- *rosselliana* Rothschild, 1915 **comb. nov.** from Rossel Islands
- *maga* Grose-Smith, 1897 **comb. nov.** from Sud-Est Island

Delias euphemia Grose-Smith, 1894 from Biak, without subspecies.

Delias doylei Sanford & Bennett, 1955 from Kup, Central Mountain Range, PNG, without subspecies.

The recognition of *D. lara* as a separate species from *mysis* is not in fact a new position but a return to the original status, as this taxon was described by Boisduval (1836) as *Pieris lara*. Mitis (1893), Staudinger (1894) and Butler (1897) treated *lara* as separate species from *mysis*. Since Fruhstorfer (1910) *lara* was been consequently treated as subspecies of *mysis*, following Vollenhoven (1865) and Wallace (1867).

Acknowledgements

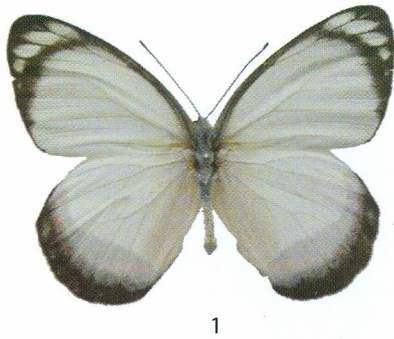
We are very thankful to the indigenous people of Papua who provided the opportunity to Henk to survey so many localities and to increase our understanding of Lepidoptera in Papua, especially the genus *Delias*. Many thanks we express to teachers and students of the Cenderawasih University (UNCEN) at Jayapura, the State University of Papua (UNIPA) at Manokwari and the Christian University (UKIP) at Sorong, and to the members of KEP for their company and cooperation during the various surveys, including their reports, especially to Edy Rosariyanto, Beatrix Wanma, Rinto Mambrasar and John Kaize, who were members of the team to the Merauke area. Thanks once more to Rinto H. Mambrasar for his assistance in preparing this publication, especially for preparing photographs. We are grateful to John Chainey at the BMNH London for enabling photography of type material and other specimens. Finally, we would like to thank Fred Gerrits in Brisbane, Australia for his corrections and suggestions.

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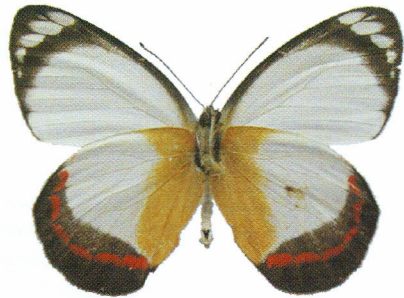
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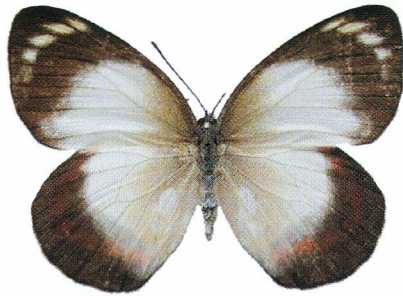
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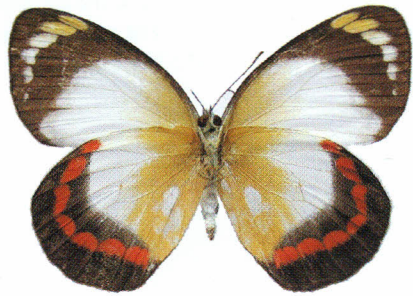
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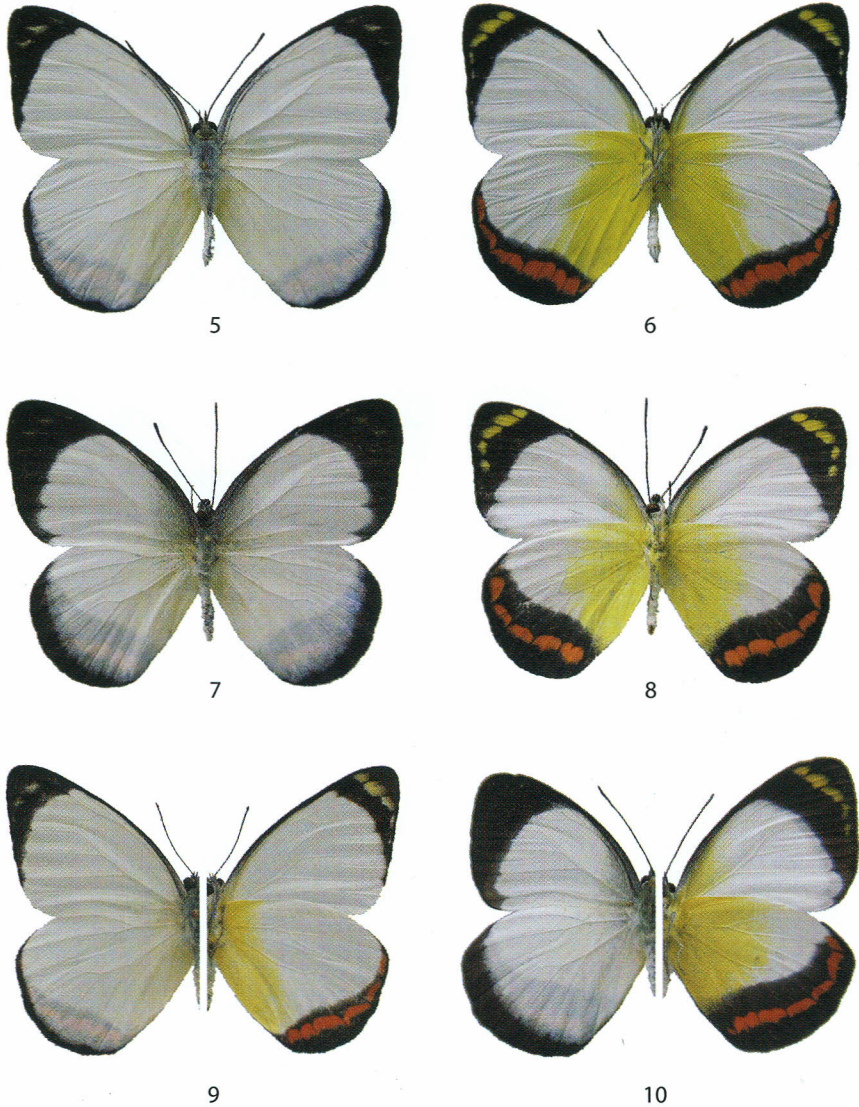


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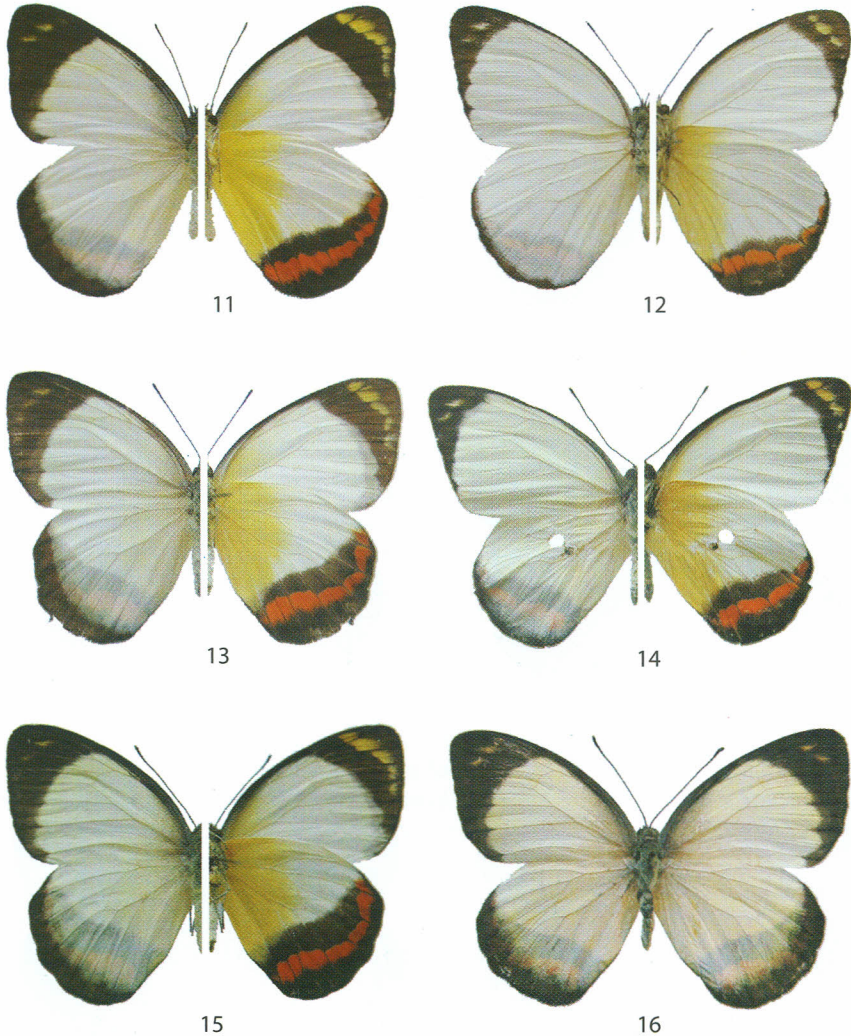


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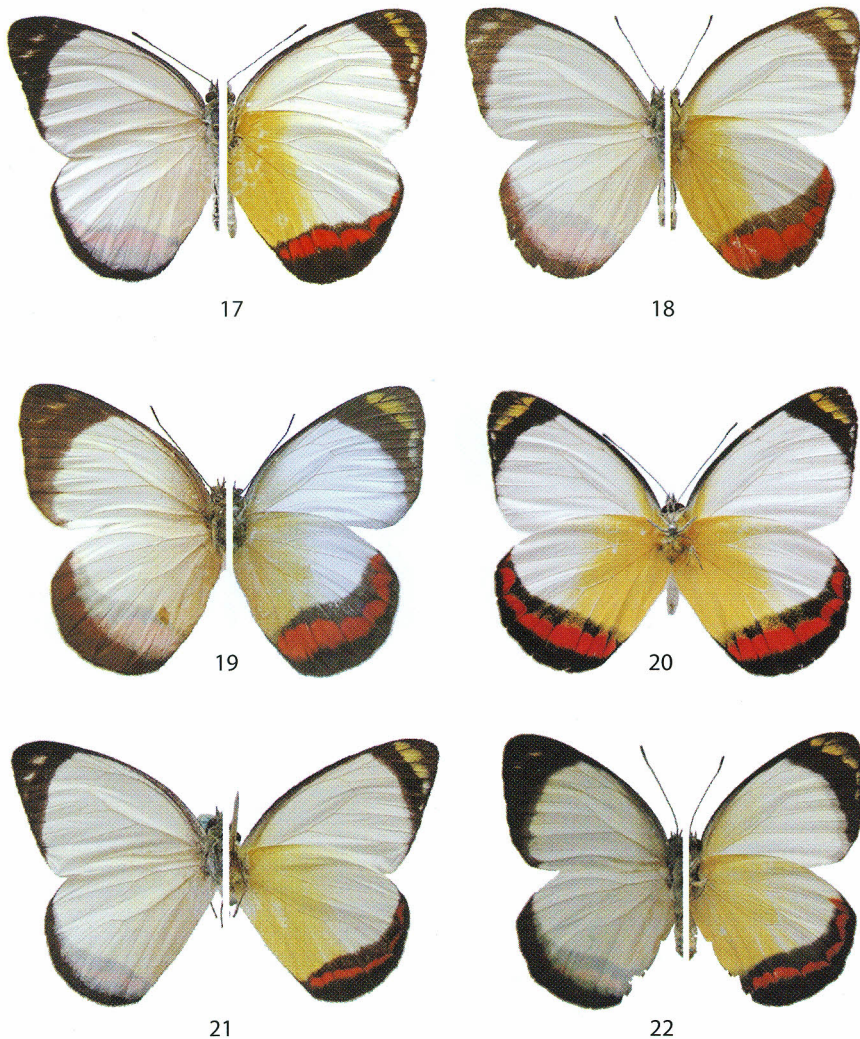
Figs. 1-4. *Delias mysis nemea*. 1. HT ♂ upperside; 2. idem underside; 3. AT ♀ upperside. 4. idem underside.



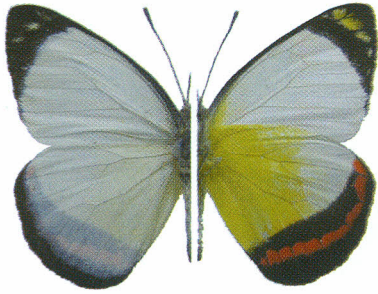
Figs. 5-10. *Delias lara lara* stat. nov. 5. ♂ (Merauke) upperside; 6. idem underside; 7. ♀ (Merauke) upperside; 8. idem underside; 9. ♂ (Sentani, Pos 7) upperside; 10. ♀ idem underside (Modio).



Figs. 11-16. *Delias lara lara* **stat. nov.** 11. ♀ upperside/underside (Mimika);
 12. ♂ TYPE (Waigeu, *oisyme* syn.) upperside/underside;
 13. ♀ TYPE (Waigeu, *oisyme* syn.) upperside/underside;
 14. ♂ (Numfor, *maforensis* **syn. nov.**) upperside/underside;
 15. ♀ TYPE (Numfor, *maforensis* **syn. nov.**) upperside/underside;
 16. ♂ (Numfor, aberration: yellow dusting) upperside.



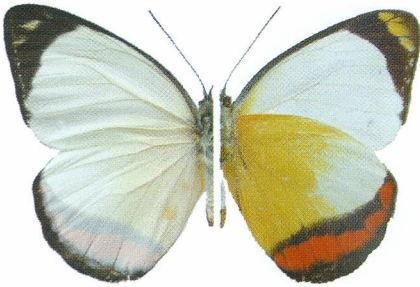
Figs. 17-22. *Delias lara lara* stat. nov. 17. HT ♂ (Yule Island, *adelphoe* **syn. nov.**) upperside/underside; 18. ♂ TYPE (Milne Bay, PNG, *onca* **syn. nov.**) upperside/underside; 19. AT (Milne Bay, PNG, *onca* **syn. nov.**) upperside/underside; 20. aberration (Milne Bay, PNG, *onca* **syn. nov.**) upperside; 21. ♂ HT (Mysol, *cruentata* **syn. nov.**) upperside/underside; 22. ♀ (Mysol, *cruentata* **syn. nov.**) upperside/underside.



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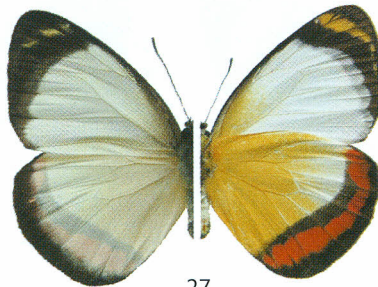
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Figs. 23-24. *Delias lara hideyoae* comb. nov.

23. ♂ upperside/underside; 24. ♀ upperside/underside.

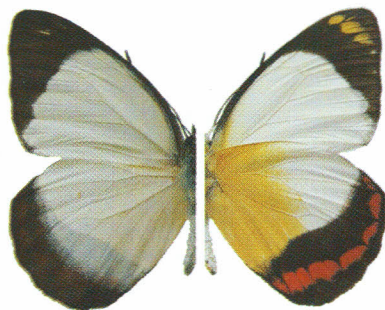
Figs. 25-27. *Delias lara goodenovii* comb. nov. 25. ♂ TYPE upperside/underside;

26. typical female upperside/underside;

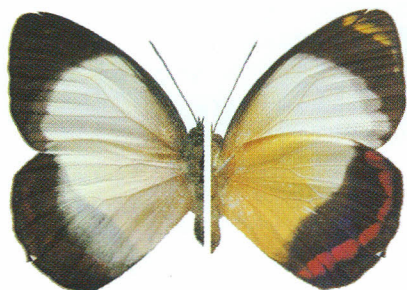
27. ♀-form (with reduced black band) upperside/underside.



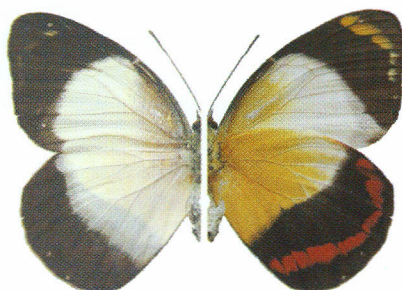
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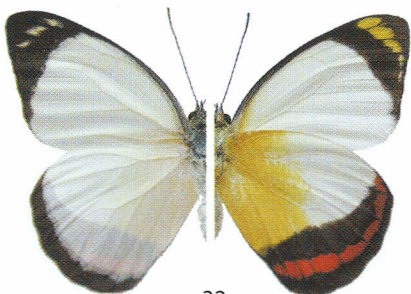
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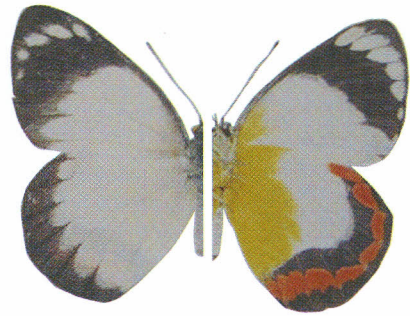
33

Figs. 28-31. *Delias lara maga* **comb. nov.** 28. ♂ TYPE upperside/underside; 29. ♂ form with extended black markings upperside/underside; 30. ♀ without apical spots upperside/underside; 31. ♀ with apical spots upperside/underside.

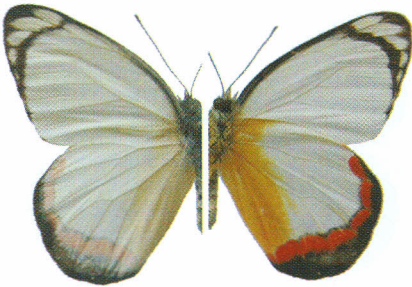
Figs. 32-33. *Delias lara rosselliana* **comb. nov.** 32. ♂ TYPE upperside/underside; 33. ♀ TYPE upperside/underside.



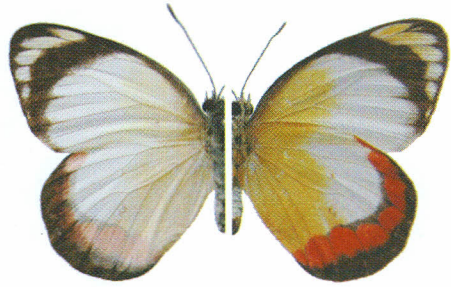
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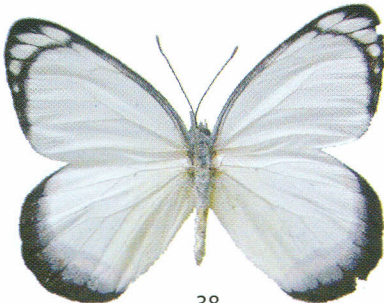
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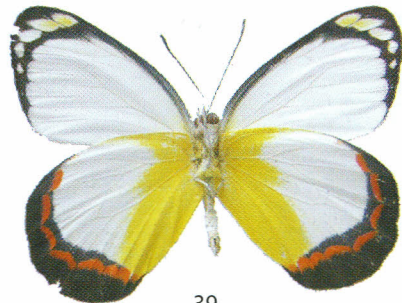
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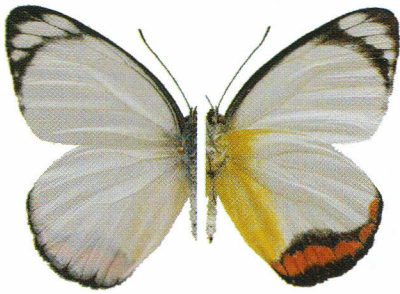


39

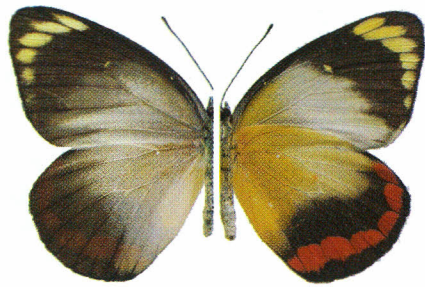
Figs. 34-35. *Delias mysis mysis*. 34. ♂ upperside/underside;
35. ♀ upperside/underside (pictures ex Braby, 2000).

Figs. 36-37. *Delias mysis waterhousei*. 36. HT ♂ upperside/underside;
37. AL ♀ upperside/underside.

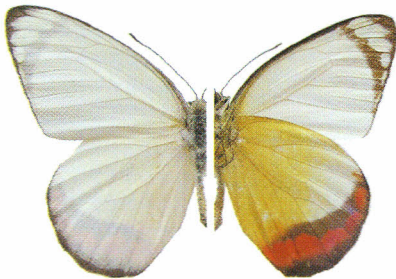
Figs. 38-39. *Delias mysis aestiva*. 38. ♂ upperside; 39 idem underside.



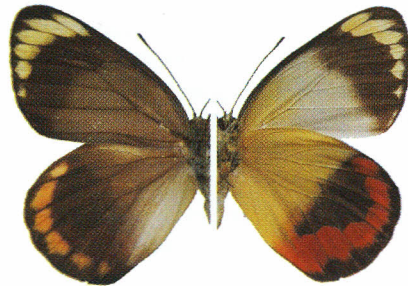
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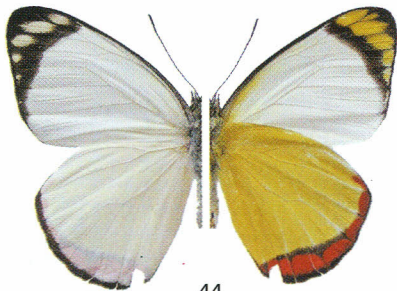
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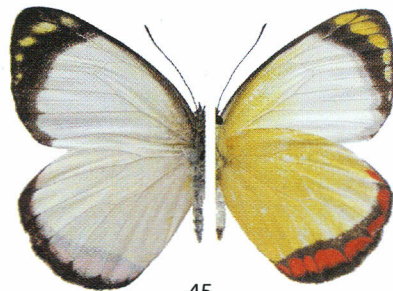
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45

Figs. 40-41. *Delias mysis aruensis*. 40. ♂ upperside/underside;
41. ♀ upperside/underside.

Figs. 42-43. *Delias euphemia*. 42. TYPE ♀ upperside/underside;
43. TYPE ♂ upperside/underside.

Figs. 44-45. *Delias doylei*. 44. PT ♂ upperside/underside;
45. PT ♀ upperside/underside.