

A New Species of *Cethosia* and a New Subspecies of *Delias* (Lepidoptera: Nymphalidae and Pieridae) from New Ireland, Papua New Guinea

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ABSTRACT. Two butterflies *Cethosia vasalia* n.sp. (Nymphalidae) and *Delias messalina lizae* n.subsp. (Pieridae) are described and figured from mid to high montane New Ireland. *Cethosia vasalia* n.sp. and *C. obscura* Guérin-Méneville are parapatric locally within the Bismarck Archipelago. These two species and their subspecies are compared in detail.

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This paper is the second describing new butterflies from montane forests of New Ireland; geographic and locality information is given in the first (Müller & Tennent, 1999). The genus *Cethosia* Fabricius, which occurs from Sri Lanka and India, in the Andamans and Nicobars, through Southeast Asia to eastern Papua New Guinea and northern Queensland, is represented by about ten species. Parsons (1989b, 1998) provided keys to the New Guinean genera of Heliconiinae, one of which is *Cethosia*. A new species, *Cethosia vasalia* n.sp., is described here from New Ireland. It superficially resembles *C. obscura* Guérin-Méneville, which occurs generally throughout the Bismarck Archipelago and together, these species are the most melanic in the genus.

All stages of *Cethosia* species may be unpalatable to predators (see Parsons, 1998). Evidence of this is provided by the bright colouration of adults and larvae, the latter, where known, also being gregarious. Larvae of *Cethosia*

are capable of moving very quickly and this may be a means of escaping from green tree ants (*Smaragdina* sp.) which frequent the fresh tips of their vine foodplants (Passifloraceae).

Butterflies belonging to the genus *Delias* Hübner are commonly known as “jezebels” and are popular with enthusiasts worldwide, owing to their generally bright ventral surfaces. To date there are 236 species described (G.J.M. Gerrits, pers. comm., 1998); the majority occur within mainland New Guinea where there appears to have been explosive speciation in the Tertiary, possibly due to a complex geological evolution of that island. Elsewhere, members of this genus are distributed from the Himalayas through Southeast Asia to New Guinea, Solomon Islands, Vanuatu, New Caledonia and Australia. Numerous taxa exist to the west of New Guinea, whilst in the Bismarck Archipelago eight species are recorded and in the Solomon Islands only four species (Arora, 1983).

Most larval foodplants recorded for *Delias* butterflies are mistletoes (Loranthaceae), although many remain undocumented. A revision by Talbot (1928–1937) remains the principal work on this genus. Talbot's primary division was based on androconial form and wing pattern similarities and an extensive key was presented.

Materials and methods. This study was based on material borrowed from the following institutions.

AM	Australian Museum, Sydney
ANIC	Australian National Insect Collection, CSIRO, Canberra
BPBM	Bernice P. Bishop Museum, Honolulu
BMNH	British Museum (Natural History), London
CJMC	private collection of C.J. Müller
GJMGC	private collection of Fred Gerrits, Buderim, Australia
RGC	private collection of Robert Gotts, Winmalee, Australia
SGC	private collection of S.G. Ginn, Sydney

Morphological terms and their abbreviations applied here conform with those used by Common & Waterhouse (1981).

Taxonomy

Cethosia vasalia n.sp.

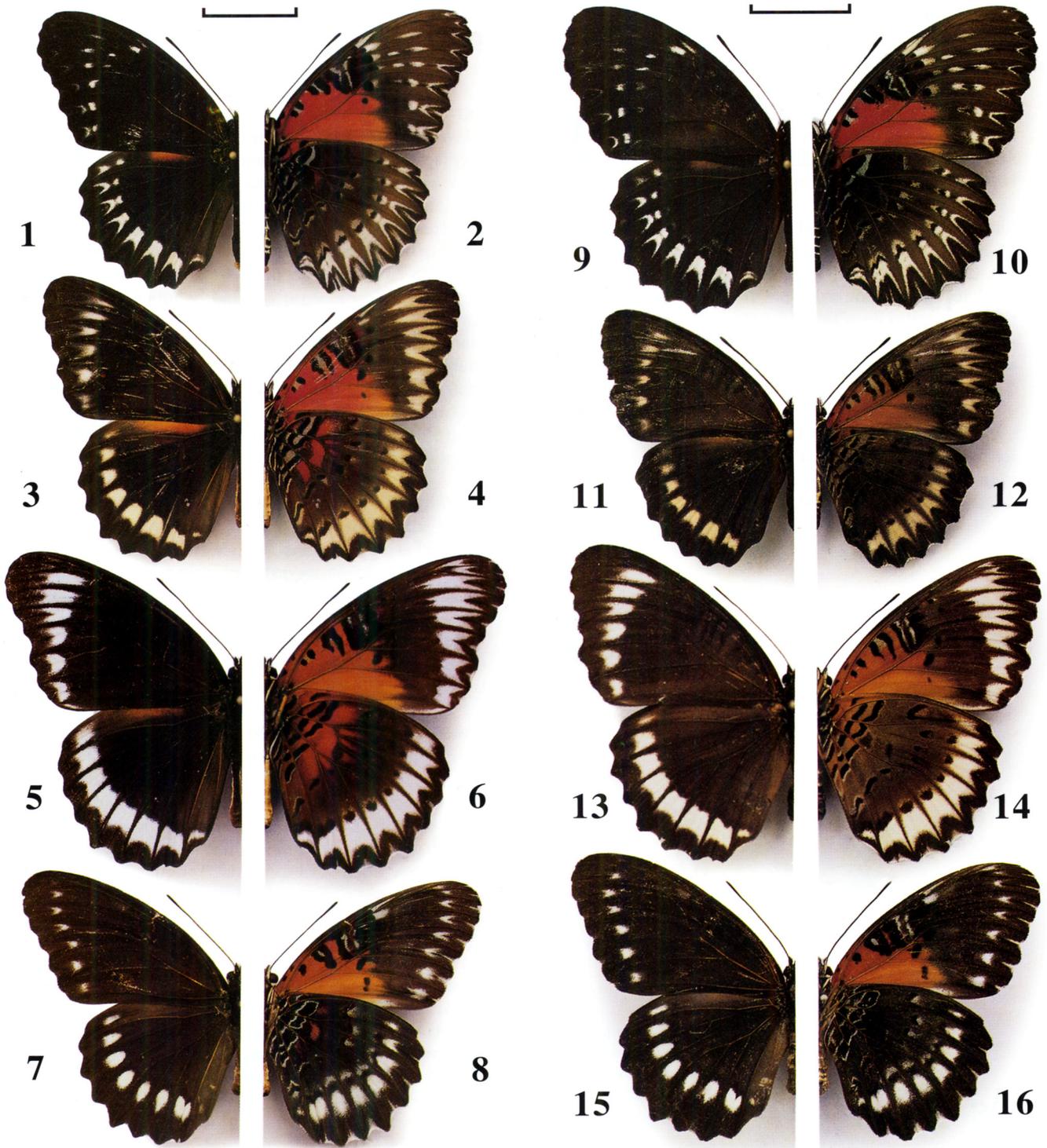
Figs. 1, 2, 9, 10, 17–19, 23, 27, 29

Type material. HOLOTYPE ♂, "Schleinitz Mts., Central New Ireland, 990 m, 26 July 1998, C.J. Müller" AM K111544, genitalia dissected and attached to specimen. PARATYPES (5 ♂♂, 4 ♀♀): 1 ♂ same data as holotype, genitalia slide No. 13097, ANIC; 1 ♂ same data as holotype, genitalia dissected and attached to specimen, BMNH; 2 ♀♀ labelled "New Ireland, Lelet Plateau, 1000 m, 2 Oct–18 Dec, 1963, W.W. Brandt, Sir E. Hallstrom", ANIC; 1 ♀ "New Ireland, December 1923 (A.F. Eichhorn)", BMNH; 1 ♂ same data as holotype, SGC; 2 ♂♂ same data as holotype except dated 23 July 1998, CJMC; 1 ♀ labelled "Hans Meyer Ra., S. New Ireland, 2300 m, 22 Aug. 1998, C.J. Müller", CJMC.

Diagnosis. Thorax and abdomen black. Mid-tibia with fine spines and narrow spurs, distally. Antennal clubs reaching well beyond discocellulars. Fore wings with four predominantly vestigial median to submarginal bands, pure white on upperside and extending conspicuously into hind wing as cusps, broken proximally toward the costa. Underside of hindwing, with mauve markings within the cell and between veins 1A+2A and Sc+R1, in median area. Genitalia with valvae closely spaced, sclerotised posterior hooks blunt and parallel, sociuncus anteriorly/laterally square-shaped with dorsoanterior process, strongly dipping, phallus blunt.

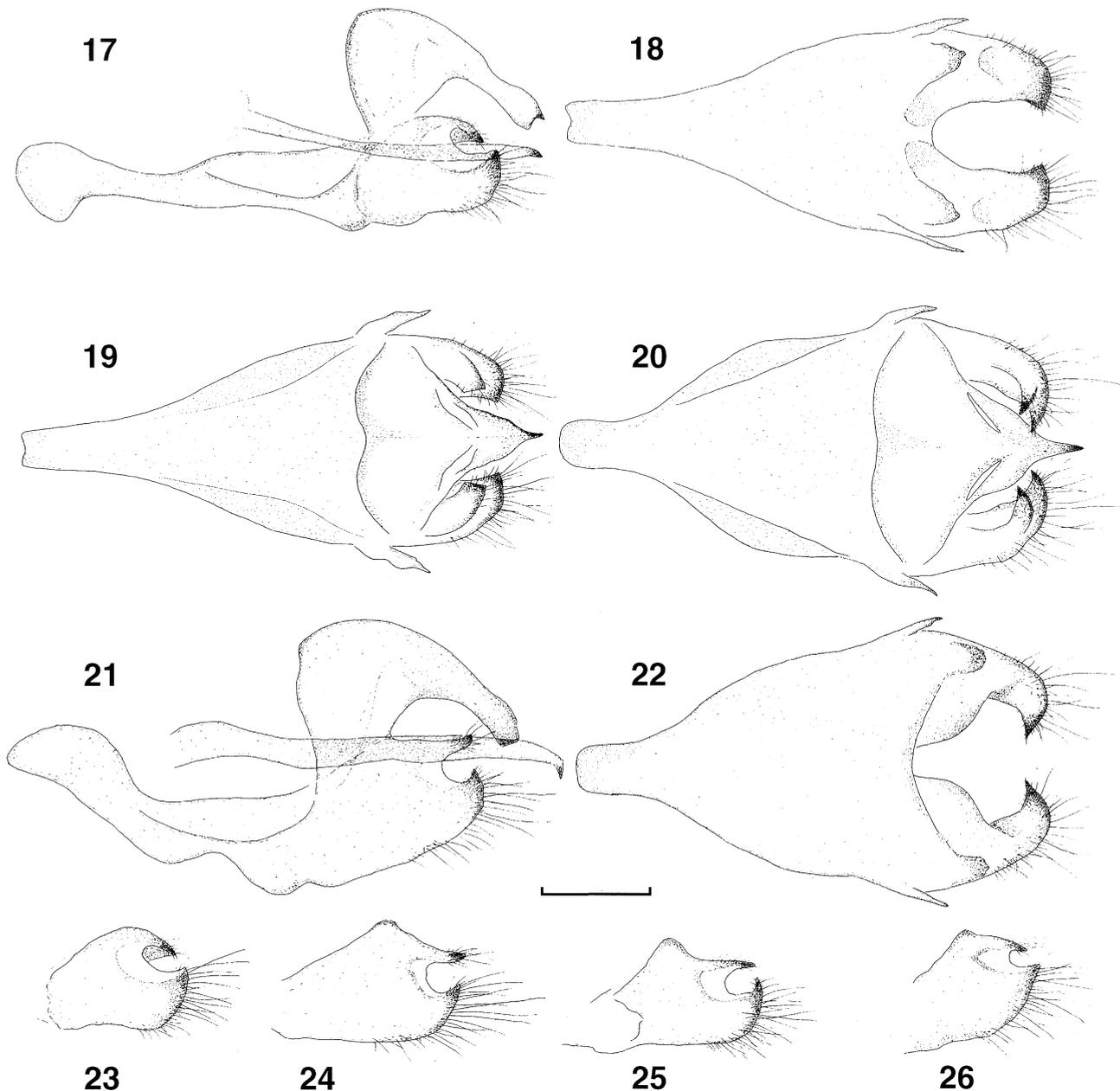
Description. Male. (Figs. 1, 2). Head black, with two pairs of white spots, adjacent to eye, dorsally and anteriorly; antennae long, black with deep brownish orange-tipped clubs, ventrally; labial palpus black with brown-black hair-tufts, beneath white, tending grey anteriorly. Thorax above black with fine brown-black hairs, beneath grey-black; legs deep grey, tending brown towards base, white posteriorly, mid-tibial spurs black, narrow. Abdomen black, beneath broadly segmented with white. Forewing with costa slightly bowed, termen conspicuously serrated between veins, slightly concave between veins M3 and tornus; above black with purple gloss from base to submarginal area; a series of white submarginal spots, cusp-shaped proximally, becoming vestigial towards apex; a band of irregularly shaped postmedian white spots, tending arcuate proximally towards costa; a pair of elongate white spots in postmedian and median area near costa; cilia broad, black at vein ends and white between; beneath with ground colour deep nut brown, basal area red, becoming orange near dorsum, forming an arcuate shape from inner margin about quarter of distance from tornus to distal part of cell to third distance along costa; a series of V-shaped white submarginal spots, becoming smaller towards apex; a further band of elongated, white postmedian spots, curving towards base near apex; two pairs of median spots between costa and vein Cu A1; vein M3 considerably bowed in median area beyond cell, inner row of white spots proximally bordered with elongate black spots, lowest reaching past vein Cu A1; two broad, irregular black bars either side of discocellulars, separated by grey-blue congruent but less extensive bars; two pairs of short, broad bars in upper one third of cell, each pair separated by grey-blue, short white bars between veins from termen to submarginal area; cilia as above. Hindwing, with termen indented between veins as in forewing, giving serrated appearance; above black with deep purple gloss from base to submarginal area; a series of crescent-shaped pure white submarginal spots, approximately congruent with termen, becoming smaller and divided towards costa; a restricted, subcostal purple-orange spot elongate between vein Rs and costa; inner margin grey; cilia as in dorsal surface of forewing; beneath, ground colour rich brown, deepening proximally; a series of white V-shaped submarginal markings, reaching to and slightly beyond row of irregular black markings in postmedian area, congruent with termen; a row of small black spots in median area, ringed narrowly with blue-grey, beyond bottom of cell only distally; a straight broad black bar near and normal to costa in median area; a series of three alternating pairs of black and blue-grey bars in basal area, basal of vein Sc+R1 black; a number of variable mauve spots in submedian area between veins 1A+2A and Sc+R1; broad white bars reaching between veins from termen to submarginal area; cilia as above.

Female. (Figs. 9, 10). As in male but both wings broader with termen much more rounded; above with olive sheen replacing purple gloss in male; subcostal orange spot in hindwing very reduced and obscure; ground colour ventrally much greyer than in male; V-shaped markings with intracusp very dark and bisected by only narrow white lines, tapering basally; mauve median markings absent, replaced by broad black bars.



Figures 1–8. Adult males of *Cethosia* taxa from the Bismarck Archipelago. 1, *C. vassalia* n.sp., upperside (AM) (New Ireland); 2, *C. vassalia* n.sp., underside; 3, *C. obscura obscura* Guérin-Méneville, 1831, upperside (CJMC) (New Ireland); 4, *C. obscura obscura*, underside; 5, *C. obscura antippe* Grose-Smith & Kirby, 1889, upperside (CJMC) (New Britain); 6, *C. obscura antippe*, underside; 7, *C. obscura gabrielis* Rothschild, 1898, upperside (CJMC) (Manus Island); 8, *C. obscura gabrielis*, underside. Scale = 20 mm.

Figures 9–16. Adult females of *Cethosia* taxa from the Bismarck Archipelago. 9, *C. vassalia* n.sp., upperside (New Ireland); 10, *C. vassalia* n.sp., underside; 11, *C. obscura obscura*, upperside (New Ireland); 12, *C. obscura obscura*, underside; 13, *C. obscura antippe*, upperside (New Britain); 14, *C. obscura antippe*, underside; 15, *C. obscura gabrielis*, upperside (Manus Island); 16, *C. obscura gabrielis*, underside; all CJMC. Scale = 20 mm.



Figures 17–26. Male genitalia of *Cethosia* taxa from the Bismarck Archipelago. 17, *C. vasalia* n.sp., lateral view; 18, *C. vasalia* n.sp., ventral view; 19, *C. vasalia* n.sp., dorsal view; 20, *C. obscura obscura*, dorsal view; 21, *C. obscura obscura*, lateral view; 22, *C. obscura obscura*, ventral view; 23, *C. vasalia* n.sp., lateral view of right valva; 24, *C. obscura obscura*, lateral view of right valva; 25, *C. obscura antippe*, lateral view of right valva; 26, *C. obscura gabrielis*, lateral view of right valva. Scale = 1.0 mm.

Genitalia. (Figs. 17–19, 23). Uncus/tegumen rather narrow, uncus essentially square anteriorly but with sharp protrusion dorsally, dorsolateral flanges short and tapered, directed anteriorly, posteriorly concave in centre and bowed outwards dorsolaterally, laterally with deep, broad channels oval in shape; valva short and broad, sclerotised anteriorly with upper accessory dipping downward, dorsally parallel; vinculum saddle-shaped posteriorly; juxta short and blunt.

Early stages. Unknown.

Measurements. Male forewing length 44 mm, antenna 23 mm; female forewing length 48 mm, antenna 24 mm.

Remarks. *Cethosia vasalia* n.sp. is typical of the genus as shown by its characteristic terminal wing shape, serrated subterminal pattern on the underside of both wings and by the structure of the tarsal claws, which are long and simple (Figs. 27, 29) (see Parsons, 1998). The new species is superficially similar to *C. obscura* Guérin-Méneville (Figs.

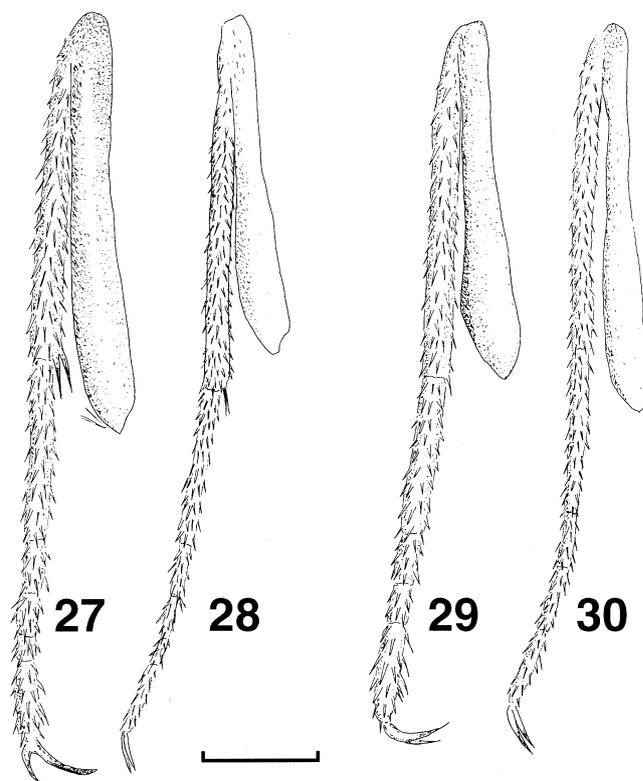
3–8, 11–16, 20–22, 24–26, 28, 30), although displays several differences to that species. The antennae of *C. obscura* reach only barely beyond the distal part of the forewing cell whereas those of *C. vassalia* extend well past the discocellulars. The abdomen is orange-brown in *C. obscura* yet is always black in *C. vassalia*. Additionally, the legs in *C. vassalia* are much more robust and with well-developed tarsal spurs by comparison to *C. obscura* (Figs. 27–30). The patterns of both wings in *C. vassalia* are very distinctive, bearing four, mostly vestigial pure white, not dirty white to cream as in *C. obscura*, bands on both surfaces of the forewing and a costally bisected band on the hindwing, whilst in the various subspecies of *C. obscura*, only one well-developed band is present on both wings. Parsons (1998) figured a female from the W. Brandt collection held in ANIC (see Type material) as a “rare female form” of *C. obscura*. He separated this based on its pure white markings which are V-shaped and the overall dark appearance of the female. *Cethosia vassalia* is the darkest member of the genus. With no male material available until now, the species was considered a female form of the former species.

The male genitalia in the subspecies of *C. obscura* vary only slightly from one another in the shape of the valva (Figs. 24–26). In *C. vassalia*, the sociuncus apex is laterally square-shaped with a prominent upper spike, whilst in *C. obscura* it is saddle-shaped. The male valva in the latter species are widely spaced, unlike those in *C. vassalia* and possess long, tapering sclerotised hooks which are blunt and dorsally parallel in the new species. The vinculum is indented in *C. vassalia*, posteriorly, whilst in *C. obscura* it is rounded.

The parapatric distributions of *Cethosia vassalia* n.sp. and *C. obscura* Ribbe, on New Ireland is intriguing, considering the close affinities between the two taxa. Their occurrence in differing habitats with no obvious physical barriers has implications as to their possible evolution. Perhaps their separation may be postulated in a fashion similar to that for *Hypochrysops geminatus* Sands and its sister species, *H. pythias* (Lycaenidae) in mainland New Guinea. The former species does not occur below 1100 m although it is widely distributed on that island (Sands, 1986). *Hypochrysops pythias* is widespread in lowland regions from the Moluccas in eastern Indonesia to eastern mainland Papua and also in northern Queensland. Similarly, the highland species *C. vassalia* appears to exhibit a much more restricted distribution than the low altitude *C. obscura*, which occurs widely in the Bismarck Archipelago. Mainland New Guinea has experienced a structurally similar, although temporally distinct, geological evolution to that of New Ireland, the former being obducted above sea level fairly early in the Tertiary, c. 45 million years ago, whilst New Ireland became subaerial in the Miocene period, approximately 25 million years ago (Davies, 1990). Perhaps early influxes of each ancestral pair of species, here mentioned, became temporally isolated and fixed to the continual orogenesis, raising land in both islands. Subsequent waves possibly inhabited lower elevations and were adapted to different host plants at that stage. Sands (1986) records the larvae of *H. geminatus* on a *Commersonia* sp., different to the lowland

and ubiquitous *C. bartramia* (L.) Merr., upon which the larvae of *H. pythias* feed (Common & Waterhouse, 1981; Sands, 1986). Parsons (1998) records *Adenia heterophylla* (Passifloraceae) as a host for *C. obscura* and the author observed females of *C. obscura* ovipositing on that plant at several locations in lowland New Ireland. Conversely, no plants of *A. heterophylla* were observed in the areas where *C. vassalia* was collected. It is possible that the larvae of *C. vassalia* feed on a species endemic to upland areas in New Ireland.

In central and southern New Ireland, *C. obscura* is not known to occur above approximately 500 m, while *C. vassalia* has been collected between 990 m and 2300 m. South of Malum Village, central New Ireland, adults of both species were collected within 2 km of each other. *Cethosia o. obscura* is fairly common in lowland rainforest where it flies directly and quite rapidly, males within their territories often circle close to a vantage perch where they settle 2–6 m above the ground. Adults of *C. vassalia* were noted to fly rather more slowly than those of *C. obscura* and to settle frequently on the ground or on low vegetation. A further female specimen of *C. vassalia* was collected by the author in the Schleinitz Mountains at 990 m but was released, owing to its very poor condition.



Figures 27–30. Mid- and hind-legs of *C. vassalia* n.sp. and *C. obscura obscura*. 27, *C. vassalia* n.sp., mid-leg; 28, *C. obscura obscura*, mid-leg; 29, *C. vassalia* n.sp., hind-leg; 30, *C. obscura obscura*, hind-leg. Scale = 2.0 mm.

Delias messalina vigasa Parsons*Delias messalina naokomoritae* Morita, 1995: 5, fig. 3, **n.syn.**

Delias messalina Arora, is a recently described species from the Solomon Islands. Arora (1983) described two subspecies, designating those from Bougainville (Papua New Guinea) as nominotypical; the other subspecies from Santa Isabel and Guadalcanal was named *orientalis*. Parsons (1989a) described *D. messalina vigasa* from eastern New Britain. *Delias m. naokomoritae* Morita, 1995 is clearly synonymous with *D. m. vigasa*. Both Parsons (1989a) and Morita (1995) described *D. m. vigasa* and *D. m. naokomoritae*, respectively, from two specimens. The holotype male of *vigasa* (BPBM) was used again for the description of *naokomoritae* and the names are therefore objective synonyms. Few specimens of *D. messalina* are known, in particular there are very few from the Bismarck Archipelago.

Arora (1983) suggested that *D. messalina* is closely related to *D. nigrina* (Fabricius) from eastern mainland Australia, although Parsons (1998) considered *D. messalina* to be more closely related to *D. weiskei* Ribbe from mainland New Guinea. Certainly, *D. nigrina* and *D. messalina* exhibit structural and behavioural similarities.

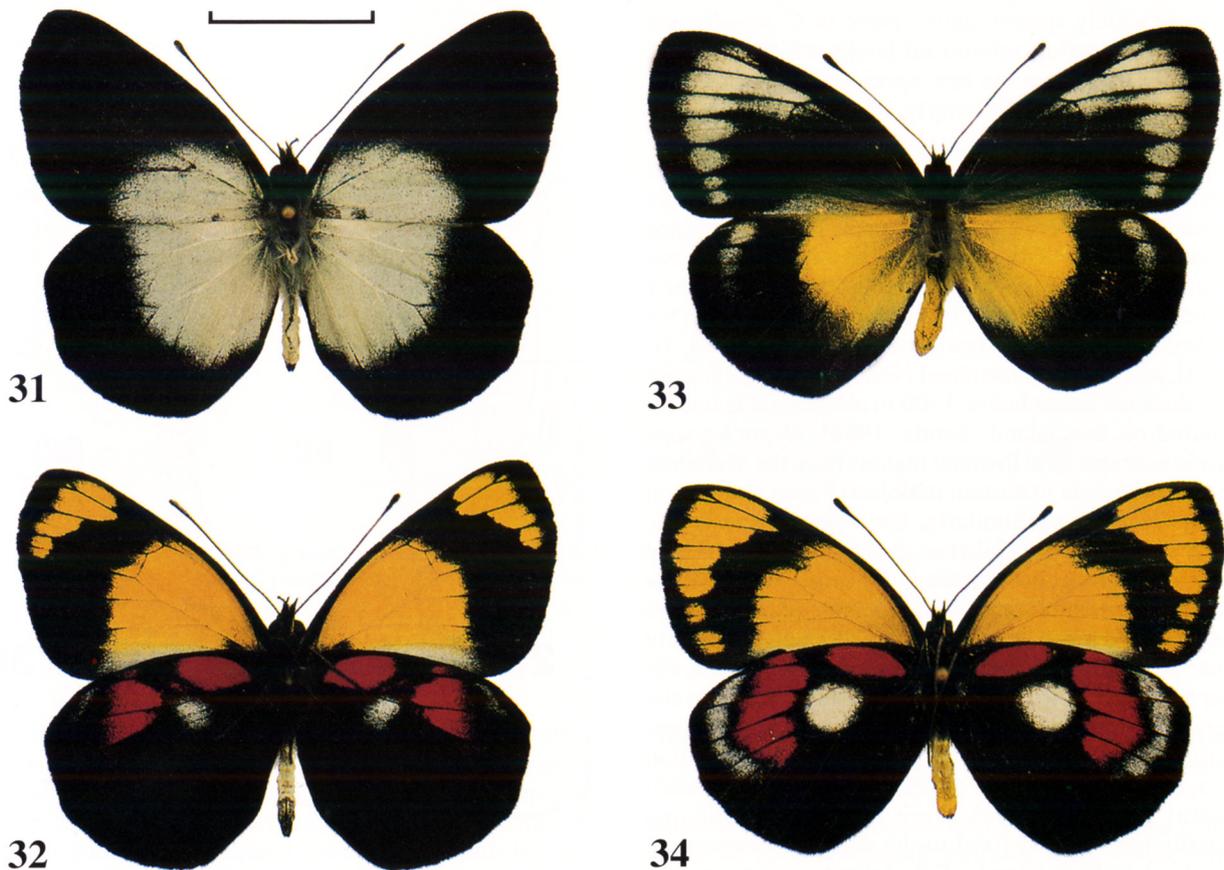
Delias messalina lizae n.subsp.

Figs. 31–38

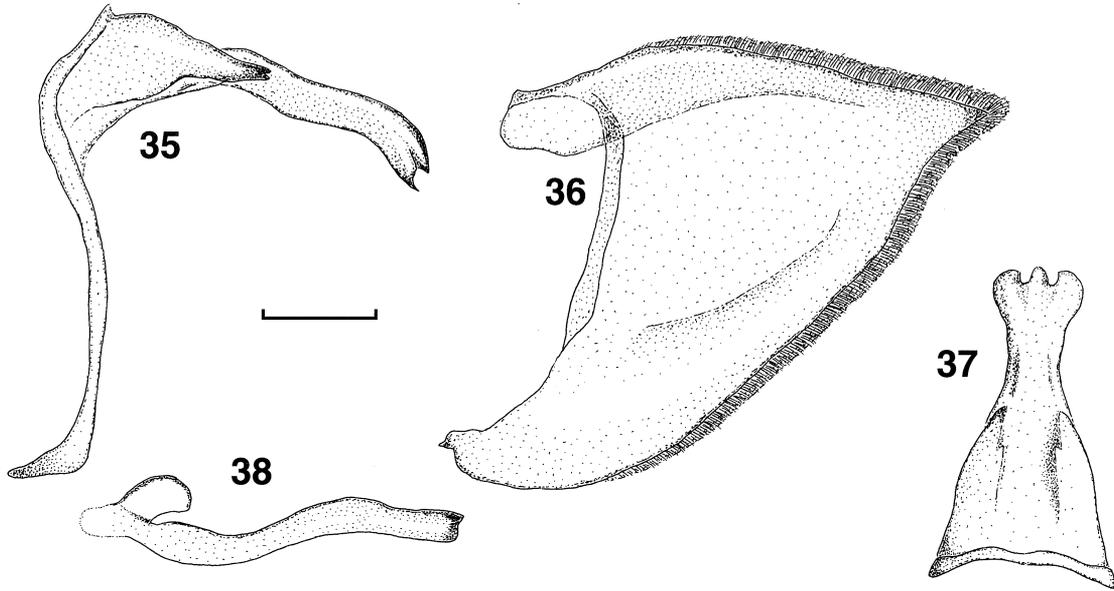
Type material. HOLOTYPE ♂, “Lak district, Hans Meyer Ra., S. New Ireland, 2400 m, 22 Aug. 1998, C.J. Müller” AM K111545, genitalia dissected and attached to specimen. PARATYPES: 5 ♀♀, all with same data as holotype, 1 in RGC, 2 in GJMGC and 2 in CJMC.

Diagnosis. Thorax beneath black. Abdomen white in male, yellow in female. Male fore and hind wings somewhat pronounced at veins M2 and apex, respectively, ground colour above with greenish sheen. Female with forewing submarginal band extending to dorsum on both surfaces and often reaching cell on upperside. Vestigial pale spots also present at apex of hindwing. Underside of hindwing in both sexes with scarlet markings very broad, circular spot in cell pure white. Genitalia with median lobe of uncus, dorsally spaced from lateral lobes which are flattened anteriorly, valva narrow, with ventrum nearly straight.

Description. Male. (Figs. 31, 32). Head black, clothed with dense deep grey hairs; labial palpus black, eye ringed with pale yellow anteriorly; antenna black, tipped white ventrally.



Figures 31–34. Adults of *Delias messalina lizae* n.subsp. 31, holotype ♂, upperside; 32, holotype ♂, underside; 33, paratype ♀ (CJMC), upperside; 34, paratype ♀ (CJMC), underside. Scale = 20 mm.



Figures 35–38. Male genitalia of *Delias messalina lizae* n.subsp. 35, lateral view of genitalic ring; 36, lateral view of left valva; 37, dorsal view of uncus; 38, lateral view of phallus. Scale = 0.5 mm.



Figure 39. Hans Meyer Range, 2,000 m, southern New Ireland.



Figure 40. Hans Meyer Range, 1,700 m, southern New Ireland.

Thorax black with long grey hairs dorsally, beneath black, legs black. Abdomen white, narrow black dorsal ridge, tapered posteriorly, claspers grey. Forewing with termen somewhat convex at vein M2; above with ground colour black with greenish sheen; basally light grey in an arcuate manner from approximately 1/8 along costa to junction of veins CuA1 and cell and to dorsum 1/4 of distance from apex; beneath black with bright yellow subapical band from costa to vein M3, vestigial between veins R3 and R4+5 and intruding abruptly between veins R3 and M2; base to postmedian area brilliant yellow, abruptly changing to white below vein 1A+2A; costa broadly black to vein Sc, black patch at base between cell and vein 1A+2A. Hindwing above with ground colours in dorsal surface of forewing; a large basal to median/postmedian light grey area extending from costa near apex to end of cell and to dorsum, about 2/3 of distance towards tornus, congruent with termen; beneath with ground colour black, an irregular small pure white spot in cell, approximately 2/3 distally; a large basal scarlet patch extending to vein Rs, rounded distally; a scattering of scarlet scales between veins Rs and M1; one vestigial and two large scarlet markings in median area between costa and M2, becoming irregular distally; a vestigial band of light grey scales near apex between veins Rs and M1.

Female. (Figs. 33, 34). Head, antennae, legs and labial palpus as in male. Thorax grey with dense yellow-grey hairs; beneath black. Abdomen yellow, with narrow black dorsal line, tapering posteriorly, beneath cream. Forewing, with costa and termen slightly bowed; dorsum straight; black above with deep greenish basal area, progressively becoming light grey and extending to postmedian area at dorsum; a well-developed series of white submarginal spots, elongate, especially between veins R4+5 and M3 and reaching into cell between veins M1 and M2, vestigial between veins R3 and costa, rounded distally; beneath black with pure white, circular spot in cell and reaching beyond intersections of veins Rs and M1; a large scarlet basal spot above cell and reaching vein Rs, a broad, conspicuous band of scarlet spots between costa and M3, in postmedian area; a band of silvery-grey markings from Sc+R1 to M3, elongate, approximately congruent with termen but running obliquely towards dorsum.

Genitalia. (Figs. 35–38). Uncus dorsally with median lobe separated from lateral lobes which are straight anteriorly, laterally with lower lobe downward dipping and tapered to a sharp point; valva fairly narrow and tapered to apex, ventrum nearly straight; ring concave ventrolaterally; juxta irregular and tapered ventrally.

Early stages. Unknown.

Measurements. Male forewing length 32 mm, antenna 17 mm; female forewing length 33 mm, antenna 18 mm.

Remarks. *Delias messalina lizae* is a most striking member of the large genus *Delias* Hübner. The male of *D. m. lizae* may be separated from those of other subspecies particularly by its rather acute wing shape and greenish gloss on the upperside of both wings. In addition, the pale basal area in both wings above is far more restricted than in other

subspecies and is greyish in colour. Beneath, the hindwing bears large, bright red markings that are confined between the costa and vein M1. The male most closely resembles that of *D. m. vigasa* Parsons, ventrally. The female above is superficially most similar to *D. m. orientalis* Arora, although the white submarginal markings in the forewing of the former are very extensive and there is a greenish basal area. The hindwing above is bright yellow in the basal to median area and the subterminal spots near the apex are well developed. Beneath, the submarginal spots on the forewing are large and extend to the dorsum. The hindwing beneath bears a large pure white spot in the cell and the scarlet basal and median spots are very large.

The male genitalia of the new taxon are closer to *D. nigrina* than to the other subspecies of *D. messalina*, although the wing pattern is closer to *D. messalina*. In particular, the median lobe of the uncus is well separated from the lateral lobes and the valvae are much narrower with an almost straight ventrum.

Both sexes of the new taxon were observed and/or collected between 1400 m and 2400 m elevation, in the Hans Meyer Range, southern New Ireland. The biome here is one of high montane moss forest (Figs. 39, 40) and heathland, the latter is apparently peculiar to the upper peaks and ridges. Specimens of *D. m. lizae* were collected above the canopy as they sailed with prevalent wind and were observed to fly as high as 60 m above the ground. Two females were observed flying high in the canopy (c. 30 m) at 1400 m apparently in search of oviposition sites. The type series of *D. m. vigasa* were collected between 1100 m and 1300 m in far eastern New Britain, although a further specimen in BPBM is labelled "New Britain Gazelle Pen. Talliligap, 300 m, 17–18.XII.1962"; "J. Sedlaceck Collector BISHOP" (Parsons, 1989a). The type series of *D. m. messalina* were collected by W.M. Brandt at Guava, Bougainville, at c. 1300 m and in Guadalcanal specimens of *D. m. orientalis* were collected at the summit of Mount Popomanaseu at 2327 m (Tennent, 1997).

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