Notes on a new subspecies of *Euploea phaenareta* (Schaller, 1785) (Lepidoptera: Nymphalidae) from Papua, Indonesia

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Abstract: A new subspecies of *Euploea phaenareta* (Schaller, 1785) is described from the islands Biak and Supiori, Papua Province, Indonesia. Details pertaining to the general ecology and taxonomy of the new taxon are discussed.

Rangkuman: Subspesies baru dari *Euploea phaenareta* (Schaller, 1785) dipertelakan dari pulau-pulau Biak dan Supiori, Provinsi Papua, Indonesia. Data terinci menyangkut ekologi umum dan taksonomi takson baru ini didiskusi.

Key-words: Apocynaceae, Biak, Chalcosiinae, *Hypolimnas*, Supiori, Zygaenidae.

Introduction

The nymphalid butterfly genus *Euploea* Fabricius, 1807 is widely distributed within the Indo-Australian region, and westernmost to the Seychelles and Mascarenes (Ackery & Vane-Wright, 1984), with the eastern limits of its distribution terminating within the island groups of the central Pacific. *Euploea* contains approximately sixty stable species, and expresses remarkable geographical phenotypic variability.

Adults of *Euploea* commonly exhibit marked sexual dimorphism with respect to wing patterning; most species within the genus are patterned with white, bluish or purplish-blue spotting upon a velvet black or dark brown background colour. *Euploea* species constitute a highly conspicuous element of the insect fauna present within their habitats, which include rainforests, areas of secondary growth and adjacent open spaces from sea level to 1,200 m or more in elevation. Small

and relatively isolated tropical islands may be colonised by *Euploea*; in such situations, distinctive and highly specialised phenotypes frequently develop. *Euploea* also prosper within habitats which have been disturbed as a result of human activity, and regularly breed upon plants which are grown for ornamental purposes within urban gardens. Plant species recorded as being utilised by *Euploea* to complete larval development fall principally within the families Apocynaceae, Asclepiadacaeae and Moraceae.

Euploea appears to express model species around which often widely extensive Batesian mimicry complexes revolve; such mimetic associations regularly include representative taxa comprised of several non-related families and subfamilies of rhopalocera. Heterocera also appear within mimetic associations with *Euploea*, particularly species of Zygaenidae within the chalcosiine genera *Amesia* Duncan & Westwood, 1841, *Cyclosia* Hübner, 1820, and *Pompelon* Walker, 1854; the latter genera frequently exhibit adult sexual dimorphism which closely mirrors that of sympatrically distributed taxa of *Euploea*.

Euploea phaenareta (Schaller, 1785) was originally described from the southern Moluccas, most likely the island of Ambon.
Fruhstorfer (1910) recognised *E. callithoe* as a separate species for Papua, being somewhat smaller than *E. phaenareta*. However, Carver (1979) demonstrated from his breeding experiments with various forms of *phaenareta/callithoe* that the two taxa were actually conspecific.

This species (*E. phaenareta* including *callithoe*) is the most widely distributed *Euploea*, occurring with 61 taxon names from Sri Lanka, Burma, southern Indo-China, the Malay Peninsula, Sumatra, Java and the Lesser Sunda Islands to Flores, northward into Borneo, the Philippines and Taiwan, eastward through Sulawesi, the Moluccas, New Guinea to the Bismarck Archipelago, Admiralty Islands and Solomons (Ackery, 1984). One subspecies, *Euploea phaenareta juvia* Fruhstorfer, 1908, which was endemic to the island of Taiwan, has apparently become extinct; some taxon names were synonymised.

Within the broader context of its distribution, *E. phaenareta* is typically uncommon to rare, or present in low population densities. Contrary to the habits of the majority of *Euploea* species, *E. phaenareta* is usually encountered as single individuals, and is not confirmed as participating in communal roosting behaviour in which other *Euploea* species have been observed to engage (Parsons, 1999). On the island of New Guinea, *E. phaenareta* is recorded from sea level to 1,200 m in elevation (Parsons, 1999), whereas in the Philippines, the species is observed from sea level to 500 metres (Treadaway, 2012). The life histories of several subspecies of *E. phaenareta* have been recorded (Carver, 1979); the preferred larval food plants are within the Apocynaceae, including several species of *Cerbera*, of which *Cerbera floribunda* is noted as being utilised

by the species in Papua New Guinea (Parsons, 1999), in addition to *Plumeria* (Ackery & Vane-Wright, 1984).
Dependent upon the subspecies in question, the respective sexes of *E. phaenareta* exhibit limited or marked sexual dimorphism with respect to wing patterning and colouration. The male forewings of *E. phaenareta* are more acutely triangular in shape than those of the female; the inner margins of the male forewings are curved outward in order to make effective contact with the prominent androconical scaling which is present upon the recto surfaces of the hindwing cells.

E. phaenareta represents the largest species within both its genus and the Danaiinae; populations of *E. phaenareta* occurring within the northern Philippines, including *Euploea phaenareta lornae* Schröder & Treadaway, 1979, and *Euploea phaenareta margaretae* Schröder & Treadaway, 1988 represent the largest recorded subspecies. With reference to phenotypic stability, *Euploea phaenareta callithoe* Boisduval, 1832 (Figs 5-7) which is a resident on New Guinea and several of its larger satellite islands, represents an interesting exception within the species with respect to the variability of colouration and wing patterning; males of *E. p. callithoe* are patterned with variable amounts of bluish-purple, with females expressing distinctive polymorphic forms, some of which are frequently infused with white wing scaling.

The author recently examined specimens of *E. phaenareta* which were collected on the island of Biak, within Indonesian Papua. Biak forms part of the Schouten Archipelago, which also includes Supiori Island, separated from Biak via a narrow channel, Numfor Island, in addition to several smaller islands. Biak is relatively small in area and situated adjacent to the north-west coast of the island of New Guinea, approximately 50 kilometres north-west of Japen Island. The Schouten Islands express a high level of endemic fauna and flora, particularly with respect to the avifauna, with the latter group interestingly lacking species of Birds of Paradise (Paradisaeidae). Biak and Supiori islands host several endemic species of rhopalocera, including the nymphalid *Cirrochroa imperatrix* Grose-Smith, 1894, the papilionid *Graphium* (*Paranticopsis*) *felixi* Joicey & Noakes, 1915, the danaid *Ideopsis hewitsonii* Kirsch, 1877 and several Pieridae of the genus *Delias* Hü'9fbner, 1819 including *Delias biaka* Joicey & Noakes, 1915, *Delias bosnikiana* Joicey & Talbot, 1915, *Delias euphemia* Grose-Smith , 1894. *Delias maudei* Joicey & Noakes, 1915, and *Delias talboti* Joicey & Noakes, 1915.

Specimens of *E. phaenareta* from Biak Island held in the collection from the author, in addition to examples from Supiori Island contained in the KSP (Jayapura, Indonesia) were carefully examined and positively confirmed as being consistently distinctive from examples of *E. p. callithoe*, mentioned above, in addition to *Euploea phaenareta sacerdotalis* Fruhstorfer, 1910 (Fig. 8) which inhabits the island of Yapen.

The population of *E. phaenareta* resident to Biak and Supiori Islands is described herein as *Euploea phaenareta caeruleoreducta* **subsp. nov**.

Depositories

BMNH - Natural History Museum (NHM), London, United Kingdom.
KSP - Koleksi Serangga Papua (Collection of Papuan Insects), Jayapura, Indonesia.
MG` - Collection of Mark Goode, Tettenhall, United Kingdom.

Euploea phaenareta caeruleoreducta subsp. nov.

(Figs 1-4)

Type material: Holotype ♂: "Biak Island, Schouten Islands, Papua Province, Indonesia, x-2013", BMNH. Paratypes (1 ♂, 6 ♀♀): Pulau Supiori, Korido 10-120m, 3-21.iv.2004, 1 ♂, 3 ♀♀, Mah. UNCEN; Supiori Utara, 135°38.576' E; 0° 41.211' S, 24.viii-1.ix.2006, 2 ♀♀, KEP/UNCEN; Supiori Utara, Kamp Yenggarbun, 22.ix.2006, Rinto Mambrasar, 1 ♀, (all KSP).

Diagnosis: *Euploea phaenareta caeruleoreducta* is clearly divergent in appearance from both of its closest geographical counterparts, *E. p. callithoe* and *E. p. sacerdotalis*. The purplish-blue forewing spotting of *E. p. caeruleoreducta* is consistently reduced in extent when compared with the latter two taxa, with the said patterning displayed prominently within the sepia-brown background colour of the recto wing surfaces; the effect of the reduction of blue spotting is further enhanced by the characteristic purplish bloom present within the recto wing surfaces of both sexes *E. phaenareta* being somewhat deeper in iridescence than expressed in *E. p. callithoe* and particularly *E. p. sacerdotalis*. *E. p. caeruleoreducta* also differs with respect to the shape of the male forewings, the outer margins of which are straighter in the male in contrast to the more outwardly curved forewing margins which are typical of both *E. p. callithoe* and *E. p. sacerdotalis*.

In general appearance, the male of *E. p. caeruleoreducta* most closely resembles *Euploea phaenareta admiralia* Strand, 1914 (♂ figured in Parsons, 1999) which occurs within the Admiralty Islands of the Bismarck Archipelago in Papua New Guinea. However, the female of *E. p. admiralia* is strongly dimorphic from the male, being liberally marked with white and bluish-white spotting; the male of *E. p. admiralia* expresses a similarly modified wingshape to that of *E. p. caeruleoreducta*, with the outer margins of the male forewings being straighter, and the forewings more strongly triangular in comparison to males of both *E. p. callithoe* and *E. p. sacerdotalis*. The latter two subspecies express wing patterning which varies within each sex, in addition to presenting variable sexual dimorphism; however, *E. p. caeruleoreducta* retains consistent elements of wing patterning and colouration within both sexes, and does not appear to convey sexual

dimorphism. As is consistent with all subspecies of *E. phaenareta*, the adult morphology of *E. p. caeruleoreducta* differs between the sexes with reference to the enlarged structure of the inner margins of the male forewings.

Description: Male. Length of forewing 56 mm. The antennae and eyes are black; colouration of the head, thorax and abdomen is blackish-brown, as are the legs, with the lateral thorax and dorsal thoracic area of the head speckled with small, clear white spots. Background colour of the upper surfaces of both pairs of wings is sepia with a deep brown tint. Rows of iridescent deep purplish-blue spotting is present on the recto forewing surfaces in marginal, submarginal and postmedian rows; the spotting increases in extent and size as the patterning progresses inward from the wing margins, with the purplish-blue postmedian and submarginal spots in space 3 are fused together. A small patch of purplish colouration is located within the far discoidal region of each forewing cell. Irridescent purplish spotting is present on the recto hindwing surfaces as very faint points running along the marginal area; a large single bluish spot is present between the submarginal and postmedian areas in spaces 2 to 5 inclusive. The apical and costal area of the recto hindwing surfaces are a satin tone of greyish-brown. A beige coloured androconial patch is present within each hindwing cell, intruding slightly into space 5 and spreading somewhat upward into the subcostal area. Both pairs of wings are infused with a deep, electric purplish bloom; the purplish iridescence reaches its greatest intensity within the postmedian and submarginal areas of the forewings, and the marginal to postmedian areas of the hindwings. Outer margins of both pairs of wings are finely edged with clear white.

The background colour of the verso wing surfaces of both pairs of wings is rich chocolate brown, with the colour becoming infused with a blackish tint within forewing cells. Small bluish-white spots, single or paired are present within the marginal spaces of the forewings, and a small row of single, slightly larger white spots placed submarginally in spaces 8 to 4 inclusive and space 2. Single and more prominent oval white spots are present in the postmedian area of the forewings in spaces 2 to 5 inclusive; a tiny oval, whitish-blue spot is located in each forewing cell, adjacent to wing spaces 3 and 4. Small whitish-blue spots, single or paired, are present within the marginal spaces of the hindwings, and small row of slightly larger whitish-blue spots, single or paired in spaces 7 to 1a. Slightly larger and more bluish spots are present singly within the postmedian area in spaces 7 to 2 inclusive, with the most prominent in spaces 6, 5. Female. Forewing length 56-60 (57.7) mm. The antennae and eyes are black; colouration of the head, thorax and abdomen is blackish- brown, as are the legs, with the lateral thorax and dorsal thoracic area of the head speckled with small, clear white spots. Background colour of the upper surfaces of both pairs of wings is sepia, tinted with dark brown. Rows of iridescent deep purplish-blue spotting are present upon the recto forewing surfaces in marginal, submarginal and postmedian areas. As in the male, the spots increase in size as the patterning progresses inward from the wing margins. A

patch of purplish-blue colouration is located within the far discoidal region of each forewing cell. Iridescent purplish spotting is present on the recto hindwing surfaces a very faint points within the marginal area, larger spots within spaces 5 and 4 and pairs of spots in spaces 3 and 2 and 1b; a single larger light purple patch which is infused with whitish scaling is present in the subapical area of space 6. The apical and costal area of the recto hindwing surfaces are a satin tone of greyish-brown. Both pairs of wings are infused with a deep, purplish bloom, which reaches its greatest intensity within the postmedian and submarginal areas.

The background colour of the verso wing surfaces of both pairs of wings is rich chocolate brown, but lighter in tone than that present in the male, with the colour becoming infused with a blackish tint within forewing cells and adjacent submedian areas. Small bluish-white spots, single or paired are present within the marginal spaces of the forewings, and a small row of single, slightly larger white spots placed submarginally in spaces 8 to 4 inclusive and spaces 1 and 2. Single and more prominent oval white spots are present in the postmedian area of the forewings in spaces 2 to 5 inclusive, with tiny portions of the same colour present in spaces 6 and 8; a tiny oval, whitish-blue spot is located in each forewing cell, adjacent to wing spaces 3 and 4. Small whitish-blue spots, single or paired, are present within the marginal spaces of the hindwings, and small row of slightly larger whitish-blue spots, single or paired in spaces 7 to 1a. Slightly larger sized and more bluish spots are present singly within the postmedian area in spaces 7 to 1a inclusive, with the most prominent in spaces 6 to 4 inclusive.

Distribution: Recorded from Supiori and Biak Islands (Schouten Islands), Papua Province, Indonesia.

Etymology: The subspecific name *caeruleoreducta* is selected in recognition of the consistently reduced blue wing patterning of this subspecies in comparison to the two more substantially patterned regional subspecies, *E. p. callithoe* and *E. p. sacerdotalis*.

Discussion

E. p. caeruleoreducta constitutes an interesting new addition to the taxonomic understanding of *E. phaenareta*, and fits comfortably within the Müllerian and Batesian butterfly mimicry rings of the Biak butterfly fauna. Species of strong visual similarity to *E. p. caeruleoreducta* include the nymphalid *Hypolimnas pithoeka fumosus* Joicey & Noakes, 1915 (Fig. 6) and the satyrid *Elymnias cybele umbratilis* Joicey & Noakes, 1915 (Fig. 7), with the patterning of both conforming closely to that of *E. p. caeruleoreducta*. Although *H. p. fumosus* and *E. c. umbratilis* lack purplish-blue recto wing patterning, both species retain prominent bluish white spotting as a pattern element of their verso wing surfaces which is strongly reminiscent of

that present in *E. p. caeruleoreducta*. Indeed, the said patterning is likely to be more prominently displayed by *E. p. caeruleoreducta*, as the species tends to keep its wings firmly closed whilst resting or feeding at flowers, resulting in the prominent purplish-blue recto wing patterning being concealed unless observed in flight. In comparison to the individual variability present in both sexes of *E. p. callithoe*, and to a lesser degree *E. p. sacerdotalis*, *E. p. caeruleoreducta* is phenotypically stable, with examples of the new subspecies retaining similar, consistent wing patterning and colouration in both sexes.

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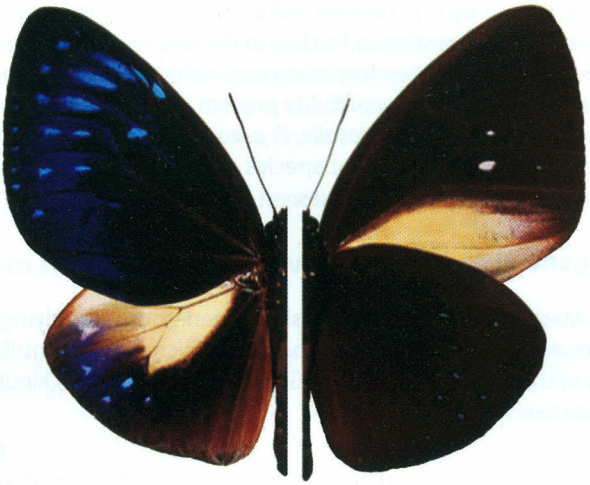

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Figs 1-2. Upperside and underside of *Euploea phaenareta caeruleoreducta* **ssp. nov.:** 1.♂ (holotype) Biak Island, Papua, Indonesia, (BMNH); 2.♀ (paratype) Supiori island, Papua, Indonesia, (KSP 15105)

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Figs 3-4. Upperside and underside of *Euploea phaenareta caeruleoreducta* **ssp. nov.:** 3. ♂ (paratype) Korido, Supiori, Papua, Indonesia, (KSP 15104); 4. ♀ (paratype) Supiori Utara, Papua, Indonesia, (KSP 46768).

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Figs 5-6. Upperside and underside of *Euploea phaenareta callithoe* ♂: 5. from Topo, Nabire, Papua, Indonesia (KSP 15062); 6. from Nuta Uti, Kepulauan Moor, Nabire, Papua, Indonesia (KSP 15075).

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Figs 7-8. Upperside and underside of *Euploea phaenareta* ssp.: 7. Ssp. *callithoe* ♂ from Pulau Mioswaar, Kab. Wondama, Papua Barat. (KSP 62843). 8. Ssp. *sacerdotalis* ♂ from Yapen Island, Indonesia (MG).

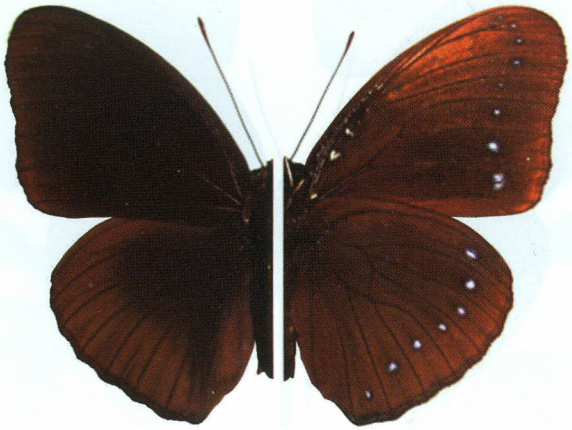

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Fig. 9. Upperside and underside of *Hypolimnas pithoeka fumosus* ♂, Biak Island, Indonesia (MG).
Fig. 10. Upperside and underside of *Elymnias cybele umbratilis* ♂, Biak Island, Indonesia (MG).