

Bonn zoological Bulletin	Volume 57	Issue 1	pp. 75–83	Bonn, April 2010
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## Two new species of the *Plutodes costatus*-group from the Philippines and Indonesia (Lepidoptera, Geometridae, Ennominae)

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**Abstract.** Two new species, *Plutodes magdelinae* sp. n. from Mindanao Island, the Philippines, and *P. thorbeni* sp. n. from Sulawesi, Indonesia, are described. Pattern and coloration clearly indicate that they are members of the *P. costatus*-group. Besides the well-known, wide-spread and often abundant *P. costatus* Butler, 1886, other members of this species-group are *P. warreni* Prout, 1923, and *P. moultoni* Prout, 1923. The latter species, described from Peninsular Malaysia, is redescribed. It is very similar externally to *P. magdelinae* sp. n., but clearly different in the genitalia morphology. Its known range of distribution is fairly extended, based on new records. *P. hermanowskii* Stüning, 2005 (Luzon, Philippines) is the most recently described species in this group. DNA barcoding of all involved taxa revealed that they are well differentiated also on the genetic level.

**Key words.** *Plutodes*, new species, *P. magdelinae* sp. n., *P. thorbeni* sp. n., Philippines, Indonesia, DNA barcoding.

### INTRODUCTION

Species of the genus *Plutodes* Guenée [1858] are characterized by broadly unipectinate antennae in both, males and females, and their striking wing-pattern of yellow ground colour with bands and patches in reddish-brown or grey, the latter often highlighted by margins of iridescent scales. Parsons et al. (1999) listed 27 species as a whole, distributed from the NW Himalayas (Sabathu, type-locality of *P. warreni*) and Nepal (Yazaki, 1992, 1993, 1994: eight species) to tropical Australia (*P. signifera* Warren, 1896; cf. McQuillan & Edwards, 1996). Holloway [1994] redescribed the genus and recorded seven species from Borneo. He also provided a definition for the tribe Plutodini.

Species of the *P. costatus*-group are distinguished from the typical species of *Plutodes* (like the type-species *P. cyclaria* Guenée and its relatives) externally by larger size and by the hind wings coloured brown with only some remnants of the yellow ground colour. Also in the forewings the range of brown colour is enlarged, most definitely so in *P. costatus* and *P. warreni*. *P. moultoni* has the yellow areas of the forewings more extended, but has the apical patch, which is very conspicuous in the two species mentioned before, reduced to minor orange-coloured remnants. Instead, the apical region is marked by a pair of black, outwardly pointed spots. *P. hermanowskii* is transitional to the core-group in having oval apical patches to the forewings, similar to the majority of species related to *P. cyclaria*.

The two new species described herein clearly belong to the *P. costatus*-group, the one from Mindanao being strikingly similar externally to *P. moultoni*, but clearly different in male genitalia. *P. thorbeni* from Sulawesi is also distinctive in its habitual features, but closer to *P. costatus* externally.

DNA barcodes were obtained at the Canadian Centre for DNA Barcoding, University of Guelph, Canada, in the course of a project called ‘All Leps’ (cf. <http://www.lep-barcoding.org>).

### MATERIAL AND METHODS

This study is based mainly on material of the Lepidoptera collection of the Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK). In addition, the collections of the Zoologische Staatssammlung, Munich (ZSM), including the collection Claude Herbulot, and two important private collections (coll. M. D. Sommerer, Munich, and coll. M. Schaarschmidt, Leipzig) were studied. The relevant material housed at The Natural History Museum, London (NHM), has been checked by J. D. Holloway, and images of the holotype of *P. moultoni* Prout and its labels were provided by the collection manager at the NHM Lepidoptera department.



Figs 1–15. Adults of *Plutodes* spp. 1–4. *Plutodes moultoni* Prout, 1: ♂, N. Thailand, 2: underside; 3: ♂, Sumatra, 4: underside of 3; 5–6. *Plutodes magdelinae* sp. nov., holotype ♂, Mindanao; 5: upper side, 6: underside; 7–12. *Plutodes thorbeni* sp. nov., Sulawesi, 7–8: holotype ♂, 9–12: ♂ paratypes (8, 10, 12: underside); 13–15. *Plutodes costatus* Butler; 13: ♂, Sumatra; 14: ♀, Sumatra; 15: underside of ♀.



External features and genitalia of all species were examined. The illustrations of whole moths (upper side and underside) and moth genitalia were prepared from digital images, and were subsequently edited in Adobe Photoshop. The terminology of the genitalia largely follows that of Klots (1956).

A total of 38 specimens of the “*Plutodes costatus* species-group” has been processed at the Canadian Centre for DNA Barcoding (CCDB) in order to obtain DNA barcode sequences (COI, 5', barcode fragment, 658 bp.), most of them successfully, though partly 15 years old (for details of the procedure see Ivanova et al., 2006).

**Abbreviations.** NHM: The Natural History Museum, London; ZFMK: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; ZSM: Zoologische Staatssammlung, Munich, Germany.

## TAXONOMY

### Redescription of *Plutodes moultoni* Prout (Figs 1–4, 16–18, 19, 20)

*Plutodes moultoni* Prout, 1923, Annals and Magazine of Natural History (9) 11: 321.

**Type locality.** [Peninsular Malaysia] Selangor, Bukit Kutu, 3457 ft.

Holotype ♂. NHM, London.

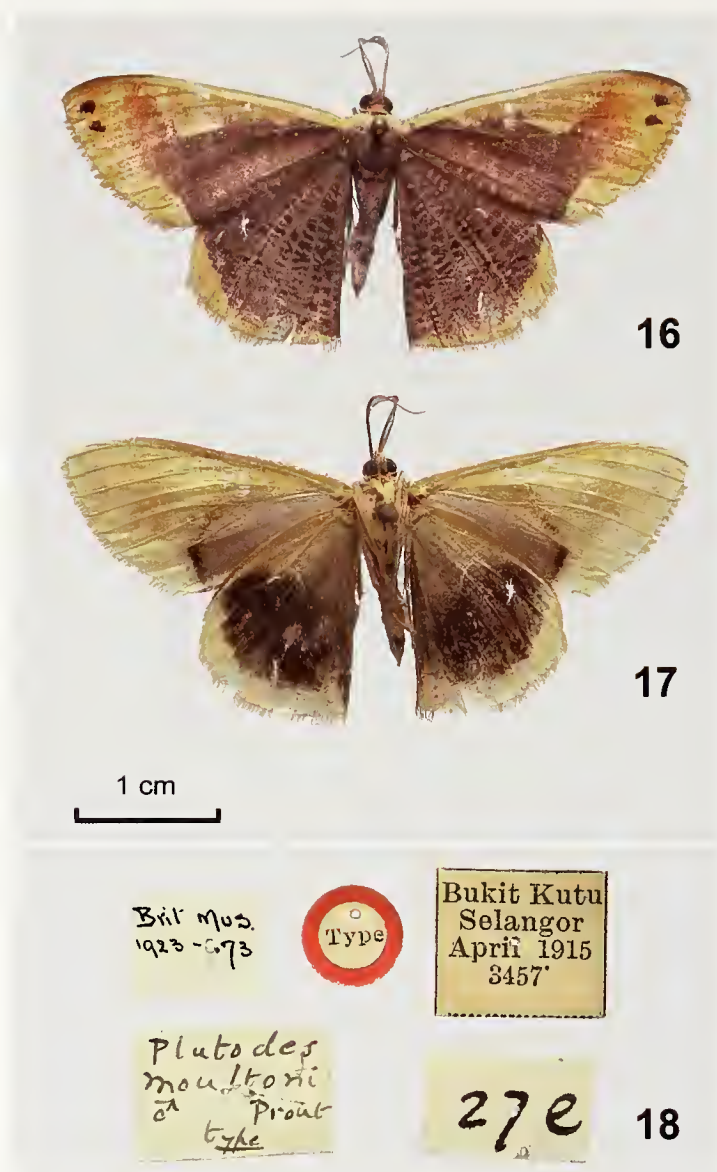
**Male** (Figs 1–4). Wingspan 31–38mm, length of forewing 17–20mm. Apex rounded, termen evenly curved, tornus rounded. Fovea lacking. Vein  $R_1$  of forewing arising from cell close to the common stem of  $R_{2-5}$ , anastomosing with Sc at varying length.  $R_2$  branching off from the middle of the common stem of  $R_{3+4}$ . Forewings yellow, with a greyish-brown basal area and a distal, indistinct, orange patch, both parts broadly connected. The connecting band is always present, the orange patch may be more or less distinctly developed. Distal to and rarely connected with the orange patch are two blackish-brown, subapical, irregularly triangular spots, their tips pointing towards the termen. Basal area with an ill-defined anterior margin, reaching well into the discal cell, an acute protuberance at the position of the discal vein and a short concavity prior to the connection with the apical patch. Posterior half with indistinct, transverse, greyish striation. Iridescent scales are found along basal two-thirds of costa, anterior margin of basal greyish-brown area, around orange patch and densely covering the triangular spots. Fringe of termen yellow, that of hind-margin brown.

Hind wings with margin evenly rounded, fringe yellow. A narrow yellow marginal band from apex to tornus, slightly broader at apical half. Remaining part of hind wing dark blackish or greyish brown, with extensive transverse striation. Distal margin of dark area lined with iridescent scales. Discal spot or streak not visible. In some specimens a postmedial, double, indistinct zigzag-line present.

Underside of both wings lighter yellow, forewings with a transverse, slightly curved, blackish bar from tornus towards middle of costa, but not reaching the latter, less strongly developed or absent in Malaysian (including the type) and Sumatran specimens (see Figs 2, 4). A band proximal to this bar rather greyish-brown than yellow. Hind wings on underside with a large, blackish, oval patch, touching or almost reaching the anterior margin near apex. Basal area of wings light yellow or suffused with darker scales (the latter character found again in specimens from Malaysia and Sumatra). Distally a broad, light yellow marginal band of even width. Fringe yellow.

Head with frons distinctly narrower than eye-diameter, smoothly scaled, greyish-brown, but with groups of upright, narrow scales at dorsal margin. Vertex with larger, yellow scales and white scales between the antennal bases, basal segments and dorsal side of lower part of antennae also white. Palps slightly up-curved, of a light greyish-brown colour, the third segment small, tapering. Proboscis well developed. Antennae unipectinate, with longest branches about 7.5 times as long as the diameter of the flagellum shaft. Terminal one third of antennae simple. Patagia and anterior parts of tegulae yellow, posterior part of tegulae, thorax and abdomen greyish brown. Tibiae of hindlegs not dilated, thus without hair-pencil. Setal comb on third abdominal sternite as well as sterno-tympanal spine lacking. Tympanal organ without lacinia.

**Male genitalia** (Figs 19, 20). Valves elongate, weakly sclerotized, apex rounded, lamina internally densely setose. Valve costa, like the whole genitalia capsule, weakly sclerotized, the sacculus being the only strongly sclerotized part. It reaches a little more than half the length of the ventral valve margin, bearing an acute distal tooth-like process with a second tip at some distance pointing basally. A strong basal process with a more rounded tip is directed dorsally. There is also a roundly protruding area opposite to the sacculus on the external surface of the valve. Uncus broad, dorso-ventrally flattened, dorsally setose, with a dense group of stiff, narrow, upright scales near base, slightly curved ventrad, with pointed tip. Socii present, small, but with long setae. Gnathos with narrow lateral arms, central part a broad plate at right angles towards the lateral arms, without medial process. Transtil-



**Figs 16–18.** Holotype ♂ of *Plutodes moultoni* Prout, 1923. 16: upper side; 17: underside, 18: labels. Images reproduced by kind permission of the Trustees of the Natural History Museum, London.

la a triangular, curved, cap-like plate, its tip pointing distally, with a pair of short, narrow processes arising from the proximal corners and directed caudally. Juxta a round plate, with a v-shaped incision with irregular margins dorsally. Saccus narrow, strongly elongate, rounded distally. The aedeagus straight, club-shaped, with a stout proximal and a narrow distal half, the vesica with an elongate, semi-cylindrical sclerotization and a small group of cornuti, a long, curved, distal one and 3–4 distinctly smaller ones, arising from a common base. Bulbus ejaculatorius moderately large, about half the length of the aedeagus.

Male genitalia of specimens from N Thailand a little smaller and slightly differing to those from Sumatra in the length-proportions of the saccular processes (Fig. 20).

Female similar to male, wingspan 35–37 mm, length of forewing 19–21 mm, with forewings a little broader and termen more strongly curved. Pectinations of antennae about one fifth shorter than in males and a little narrower.

**Material studied.** Type material. Holotype, ♂, [Peninsular Malaysia], Bukit Kutu, Selangor, April 1915, 3457'; coll. NHM (see Figs 16–18). J. D. Holloway (London, pers. comm.) mentioned two more specimens from Peninsular Malaysia in coll. NHM, but Prout (1923) obviously only had one specimen at hand when he described this species (i.e. the holotype).

**Further material.** 1♀, [Peninsular] Malaysia, Taiping [~4°51'N 100°46'E], May [19]79;

4♂, N. Sumatra, vic. Tiga-Dolock, 18., 25.v.1972, leg. Roessler & Küppers; coll. ZFMK; 1♂, N. Sumatra, Dolok Merangir, 21.ix.–5.x.1967, leg. Dr. E. Diehl, ex coll. Dr. R. Bender, coll. ZSM. (more specimens from N. Sumatra in coll. M. D. Sommerer, Munich).

2♂, Borneo, Sabah, route Keningau-Kimanis PK 28.5, 1300m, 8., 11.viii.1991, leg. Haxaire. Herbulot collection in coll. ZSM;

1♂, S. Vietnam, Prov. Quang Tri, Partung, Da Krong, 1.–3.vi.2005; coll. ZFMK;

1♂, SE Thailand, Prov. Trat, Kho Chang, 0m, 25.–30.xi.2004, leg. T. Ihle; coll. ZFMK;

8♂, N. Thailand, Chiang Mai Prov., Doi Suthep, 1050m, 25.xi.2000, leg. D. Stünig; 4♂, same locality, 1100m, 15.–19.i.2008, leg. T. Ihle; 1♂, N. Thailand, Chiang Mai Prov., Doi Angkhang, W Fang, 1600m, 21.v.2004; 1♀, N. Thailand, Chiang Mai Prov., Doi Inthanon, 1500m, 28.–30.iv.2006, leg. T. Ihle; 1♀, N. Thailand, Mae Hong Son Prov., ca. 30km E Khun Yuam, 950m, 1.v.2006, leg. T. Ihle; coll. ZFMK;

16 specimens from Doi Suthep, Chiang Mai Prov., are kept in the collection of Bro. Amnuay Pinratana, St. Gabriel's College, Bangkok.

1♂, S. China, S. Yunnan Prov., Mangxi Ba Mts., Simao distr., 18km S Simao city, 1280m, 16.iii.–10.iv.2000, ex coll. Dr. R. Brechlin. Coll. ZFMK.

**Distribution and bionomics.** Peninsular Malaysia (type-locality), Borneo, Sumatra; Vietnam, SE & N. Thailand, S. China (first record for all localities except Peninsular Malaysia). Specimens have been collected in January, March–April, May, June, Sept.–October, November; at el-



evations between 0 and 1600m. The immature stages are unknown.

*Plutodes magdelinae* sp. nov. (Figs 5, 6, 21)

**Male** (Figs 5–6). Wingspan 37–38mm, length of forewing 21–22mm. Apex rounded, termen evenly curved, tornus rounded. Fovea lacking. Vein  $R_1$  of forewing arising from anterior vein of cell close to the common stem of  $R_{2-5}$  – both at rather large distance from upper corner of cell –, anastomosing with Sc at varying length.  $R_2$  branching off from the middle of the common stem of  $R_{3+4}$ . Forewings yellow, with a greyish-brown basal area and a distal, indistinct, orange patch, both parts narrowly connected. The connecting band is always present, the orange patch may be more or less distinctly developed. Distal to the orange patch are two blackish-brown, subapical, elongate triangular spots, their tips pointing towards the termen. Basal area with an ill-defined anterior margin, reaching just a little beyond the posterior margin of the discal cell. Posterior half with indistinct, transverse, greyish striation. Iridescent scales are not very obvious, weakly covering basal two-thirds of costa, anterior margin of basal greyish-brown area, orange patch and the submarginal area near the triangular spots. Fringe of termen yellow, that of hind-margin brown.

Hind wings with margin evenly rounded, fringe yellow. A narrow yellow marginal band from apex to tornus, distinctly broader at apical half. Remaining part of hind wing dark blackish or greyish brown, with extensive transverse striation. Distal margin of dark area lined with iridescent scales. Discal spot visible as a short, curved, white streak. Postmedial ziczac-line absent.

Underside of both wings (Fig. 6) lighter yellow, forewings with a broad, posterior, greyish-brown band between hind margin and posterior vein of cell, but not reaching termen. Hind wings on underside with a large, blackish-brown, oval patch, almost reaching the anterior margin near apex. Basal area of wings strongly suffused with darker scales. Distally a rather broad, light yellow marginal band of even width. Fringe yellow.

Head with frons distinctly narrower than eye-diameter, smoothly scaled, greyish-brown, with thin white lateral margins, but with groups of upright, narrow scales at dorsal margin. Vertex with larger, yellow scales and white scales between the antennal bases, basal segments and dorsal side of lower part of antennae also white. Palps slightly up-curved, basal segment predominantly white, second and third of a light greyish-brown colour, the third segment small, tapering, with a white tip. Proboscis well developed. Antennae unipectinate, with longest branches

about 8,5 times as long as the diameter of the flagellum shaft. Terminal one third of antennae simple. Patagia and anterior parts of tegulae yellow, posterior part of tegulae, thorax and abdomen greyish brown. Tibiae of hindlegs not dilated, thus without hair-pencil. Setal comb on third abdominal sternite as well as sterno-tympanal spine lacking. Tympanal organ without lacinia.

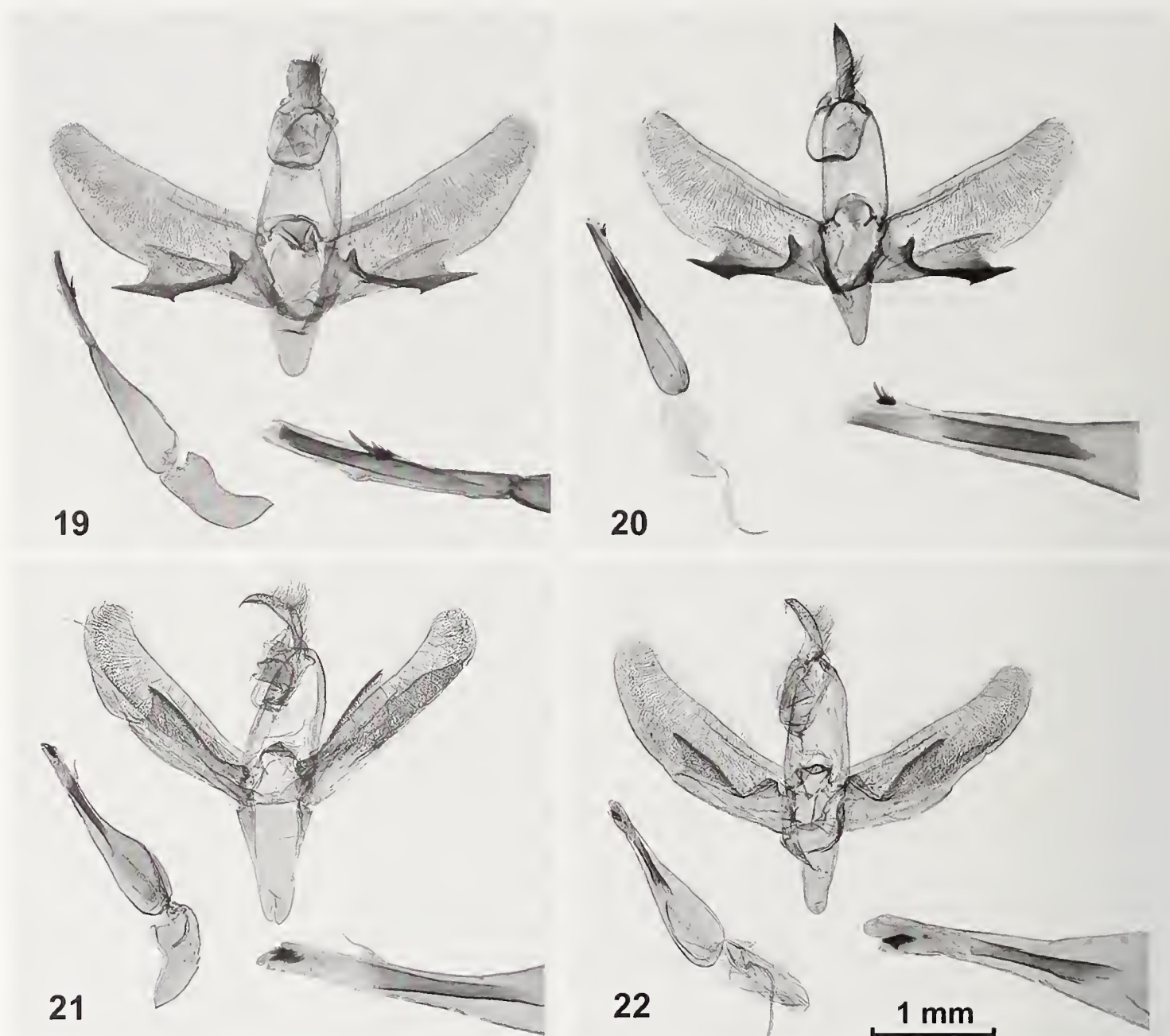
**Male genitalia** (Fig. 21). Valves elongate, weakly sclerotized, apex rounded, lamina internally densely setose. Valve costa, like the whole genitalia capsule, weakly sclerotized, but sacculus with a prominent and strongly sclerotized, plate-like process, inserting in an upright position close to the ventral margin of the saccular region. It is getting broader distally, with an acute tip, narrower basally, with a rounded, very short, dorsal bulb. Outer margin of the plate densely covered with short, appressed setae. Length a little more than half the length of the ventral valve margin. Uncus broad, dorso-ventrally flattened, dorsally setose, with a dense group of stiff, narrow, upright scales near base, slightly curved ventrad, with pointed tip. Socii very small, marked by a few long setae only. Gnathos with narrow lateral arms, central part a broad plate at right angles towards the lateral arms, without medial process. Transtilla a triangular, curved, cap-like plate, its tip pointing distally, with a pair of short, narrow processes arising from the proximal corners and directed caudally. Juxta a narrow plate, with a deep, v-shaped incision dorsally. Saccus narrow, strongly elongate, rounded distally.

The aedeagus almost straight, club-shaped, with a stout proximal and a narrow distal half, the vesica with an elongate, semi-cylindrical sclerotization and a small group of 5–6 cornuti, not much differing in size. Bulbus ejaculatorius moderately large, about half the length of the aedeagus.

**Diagnosis.** *P. magdelinae* is distinguished from the externally very similar *P. moultoni* by slightly larger size, the wing-shape (forewings more elongate with more strongly oblique termen), a narrower greyish-brown basal area (anterior margin just reaching the posterior vein of discal cell, distal margin more strongly concave). The subapical, black, triangular spots are larger and more distinctly acute towards the termen. In the hind wings, the yellow marginal band is much narrower at tornal half. On underside, the oblique bar on forewing from tornus to costa is absent, the basal area of hind wing is much darker.

In the male genitalia, the elongate, simple plate on sacculus without a separate basal process is distinctive.

Female unknown.



**Figs 19–22.** ♂-genitalia of *Phytodes* spp. 19: *P. moultoni* Prout, Sumatra (vesica partly everted); 20: *P. moultoni* Prout, N. Thailand; 21: *P. magdelinae* sp. nov., paratype, coll. no. LEP 2010/ 469-2; 22: *P. thorbeni* sp. nov., paratype, coll. no. LEP 2010/ 472-3. (bottom left: aedeagus, bottom right: enlarged apical part of aedeagus).

**Type-material.** Holotype, ♂, “Philippinen, Mindanao (Prov. Davao del Sur), Mt. Apo, SE-route via Kapatagan, 1570m, 10.–12.July 1996, prim. forest, leg./ ex coll. Dr. Ronald Brechlin. Coll. ZFMK, coll. no. LEP 2010/468 (Biodat).

**Paratypes.** 2♂, same data as holotype, coll. nos. LEP 2010/469-1, 469-2; 1♂, Philippinen, Mindanao, Mt. Kitanglad, Intavas, 600m, 8° 10'N 124°56'E, 23.–24. ii. 2009, leg. J. H. Lourens & K. Knoblich, coll. ZFMK, coll. no. Lep 2010/470;

1♂, Philippinen, Mindanao, Mt. Dalongdong, 9.–17. viii.1999. Coll. M. Schaarschmidt, Leipzig. [“Dalongdong” correctly is named Dolongdong and is a village on a high plateau at the western slopes of Mt. Kalatungan, 45km SW Talakag, 40km W Maramag, 07°53'N 124°40'E; J.H. Lourens, Luzon, in litt.]

**Distribution and bionomics.** Probably endemic to Mindanao Island, the Philippines, only known from Mt. Apo, Mt. Kitanglad and the Dolongdong high plateau near Mt. Kalatungan. Specimens have been collected in February, July and August at 600m and 1570m a.s.l. The immature stages are unknown.



**Etymology.** The present new species is dedicated to Magdeline Camille Vlasimsky (formerly Frankfurt a. M., Germany, now Dallas/ Texas), in recognition of her and her parents' Lezlie and Stan valuable contribution to the taxonomic research of the author and to conservation of biodiversity.

***Plutodes thorbeni* sp. n.** (Figs 7–12, 22)

**Male** (Figs 7–12). Wingspan 34–39mm, length of forewing 19–23mm. Apex slightly acute, termen evenly curved, tornus rounded. Fovea lacking. Vein  $R_1$  of forewing arising from anterior vein of cell close to the common stem of  $R_{2+5}$  – both at rather large distance from upper corner of cell-, anastomosing with Sc at varying length.  $R_2$  branching off from the middle of the common stem of  $R_{3+4}$ . Forewings yellow, with a greyish-brown basal area and a distal, more or less distinct, irregularly quadrangular, dark brown to orange-brown, rarely light orange patch, both parts broadly or narrowly, sometimes not connected. Internal surface of the patch with a dark, wavy line. Apical corner of the patch forming an elongate, black spot, its tip connected with the apex of the forewings. The spot is most distinctive in specimens with a reduced, orange, apical patch. Basal area with an ill-defined anterior margin, reaching well beyond the posterior margin of the discal cell, with an acutely triangular protuberance at the position of the discal vein and a broad concavity prior to the connection with the apical patch. Posterior half with indistinct, transverse, greyish striation. A margin of iridescent, leaden-grey scales along the anterior margin and around the apical patch, including the black apical streak, but not along distal margin. Fringe of termen yellow, that of hind-margin brown.

Hind wings with margin evenly rounded, fringe yellow, a narrow yellow marginal band from apex to middle of termen, with rather straight internal border. Larger part of hind wing dark blackish or greyish brown, with extensive transverse striation. Distal margin of dark area lined with iridescent scales. Discal spot weak, visible as a short, curved, white streak. Indistinct postmedial double wavy or zigzag-line present in most specimens.

Underside of both wings (Figs 8, 10, 12) yellow, forewings with a tiny, black, apical spot and a short, transverse, almost straight, blackish bar from tornus towards the centre of the wing. There is a greyish-brown band between hind margin and posterior vein of cell, more or less agreeing with the dark basal area of the upper side and also a dark patch representing the apical patch of upper side. Hind wings on underside with a large, blackish-brown, oval patch, broadly touching the anterior margin near apex. Basal area of wings yellow, often suffused with darker

scales. Distally a narrow, light yellow marginal band from apex to the middle of termen, basal half represented by the yellow fringe scales only.

Head with frons distinctly narrower than eye-diameter, smoothly scaled, greyish-brown, with thin white ventral margin, but with groups of upright, narrow scales at dorsal margin. Vertex with larger, yellow scales and white scales between the antennal bases, basal segments and dorsal side of lower part of antennae also white. Palps slightly up-curved, basal segment predominantly white, second and third of a light greyish-brown colour, the second edged white distally, the third segment small, tapering, with a white tip. Proboscis well developed. Antennae unipectinate, with longest branches about 8.5 times as long as the diameter of the flagellum shaft. Terminal one third of antennae simple. Patagia and anterior parts of tegulae yellow, posterior part of tegulae, thorax and abdomen greyish brown. Tibiae of hindlegs not dilated, thus without hair-pencil. Setal comb on third abdominal sternite as well as sterno-tympanal spine lacking. Tympanal organ without lacinia.

**Male genitalia** (Fig. 22). Valves elongate, weakly sclerotized, apex rounded, lamina internally densely setose. Valve costa, like the whole genitalia capsule, weakly sclerotized, but sacculus with a prominent and strongly sclerotized, triangular plate with an acute tip distally, inserting in an upright position close to the ventral margin of the saccular region. Basally, it is getting narrow and widens again to a rounded, dorsal bulb. Outer margin of plate and bulb scobinate and slightly setose. Length of sacculus and its process a little more than half the length of the ventral valve margin. Uncus broad, dorsally rounded, ventrally flattened, dorsally setose, slightly curved ventrad, with pointed tip, with a dense group of stiff setae near base. Socii very small, marked by a few long setae only. Gnathos with narrow lateral arms, central part a broad plate at right angles towards the lateral arms, without medial process. Transtilla a triangular, curved, cap-like plate, its tip pointing distally, with a pair of short, narrow processes arising from the proximal corners and directed caudally. Juxta a narrow plate, with a deep, v-shaped incision dorsally. Saccus narrow, strongly elongate, rounded distally.

The aedeagus club-shaped, with a stout proximal and a narrow, slightly curved distal half, the vesica with an elongate, semi-cylindrical sclerotization and a small group of 5–6 cornuti, not much differing in size. Bulbus ejaculatorius moderately large, about half the length of the aedeagus.

**Diagnosis.** *P. thorbeni* is in no way similar to *P. moultoni* or *P. magdelinae*, but externally quite close to *P. costa-*

*tus*, the type of this species-group (Figs 13–15). Both are of the same size and the arrangement of yellow and brown pattern elements is very similar. In detail, *P. thorbeni* is distinguished from *P. costatus* in the apical forewing patch being smaller, darker and more strongly irregular. *P. costatus* has the internal surface of this patch rather grey instead of brown. *P. thorbeni* has a black, acute apical spot or streak, best seen in specimens with a reduced apical patch (Figs 9, 11). It is strongly highlighted by iridescent scales and absent in *P. costatus*. There is a curved, blackish antemedial line in *P. costatus*, absent in *P. thorbeni*.

Fringe of termen of forewings is completely yellow in *P. thorbeni* (partly grey in *P. costatus*) and there is more of the yellow ground colour distal to the brown pattern elements. In the hind wing, the tornal half is narrowly yellow in *P. thorbeni*, but brown – including fringe – in *P. costatus*. The underside is very different in both species, i.e. the large black patch of the hind wing seen in *P. thorbeni* is absent in *P. costatus*, the surface being light grey instead in the latter (Fig 15). The underside of *P. thorbeni* is much more similar to *P. magdelinae* and *P. moultoni*.

Also the male genitalia are strongly different, especially in the shape of the sacculus process, which is also more similar to *P. magdelinae* (Fig 21), and cannot be mistaken.

Female unknown.

**Type material.** Holotype, ♂, “Indonesia, C. Sulawesi, Tambusisi mts., 1800m, 1° 45’S 121° 27’E, ii. 1996, native collector”. Coll. ZFMK, coll. no. LEP 2010/471.

**Paratypes.** 6♂, same data as holotype; 2♂, South Sulawesi, Quarles Mountains, ca. 30km N Rantepao, Polo Polo, 2200m, 26.–28.ix.1995, leg. H. Schnitzler; 3♂, Central Sulawesi, Sempuraga (=Sampuraga), 1500–1700m, vi. 1996, G. Lecourt & J. Martin leg.; 2♂, C. Sulawesi, vic. Mamasa, 2° 57’S 119° 24’E, 17.–18.x.1995, leg. local collector (Gala); 1♂, S. Sulawesi, Puncak Palopo, 900–1300m, x.1997, leg. local collector, ex coll. Dr. R. Brechlin. Coll. ZFMK, coll. nos LEP 2010/472–476.

2♂, S. Sulawesi, Puncak Palopo, 900–1300m, ii.1998, leg. local collector, coll. M. Schaarschmidt, Leipzig, Germany.

2♂, C. Sulawesi, Mt. Tambusisi, x. 1195, native collector; 7♂, same locality, ii. 1996; 2♂, same locality, iii. 1996. Coll. K. Yazaki, Tokyo.

**Further material studied.** J. D. Holloway sent images of three male specimens, collected by him during the “Project Wallace” of the Royal Entomological Society. Col-

lecting site: “Sulawesi Utara, Dumoga Bone N.P., Site 15, 1140m, 6.–8. viii.1985”. According to his recommendation, these three undissected males which also show slight external differences compared to the paratypes mentioned above and which come from a locality in Northern Sulawesi rather far away from the type locality are not recorded as paratypes.

**Distribution and bionomics.** Probably endemic to Sulawesi, but widely distributed on the island. Specimens have been collected in February, June, September and October at elevations between 900m and 2200m a.s.l. The immature stages are unknown.

**Etymology.** The present new species is dedicated to Thorben Briese (Lippstadt, Germany), in recognition of his and his parents’ Dr. Anette Meyer-Briese and Dr. Harald Briese valuable contribution to the taxonomic research of the author and to conservation of biodiversity.

#### DNA BARCODING RESULTS

Results obtained from the Canadian Centre for DNA Barcoding (CCDB) revealed clear specific distances between all species involved: pairwise distances are between 3.13% and 7.25% in the *P. costatus*-group. Of the species treated in the present paper, *P. moultoni* and *P. thorbeni* exhibit the closest relationship (medial pairwise distance 3.54%).

In addition, an unusually deep divergence was found among the analysed specimens of *P. warreni* Prout, indicating a cryptic new taxon within material from Laos, Vietnam and Thailand. Morphological studies on this group are carried out at present and will be published in near future, together with a more comprehensive account on the barcoding results of the whole group. Preliminary results can be viewed under [www.boldsystems.org/Plutodes](http://www.boldsystems.org/Plutodes).

**Acknowledgements.** Thanks are due to A. Schintlmeister, Dresden, for presenting Geometridae material from the Philippines collected by Karel Cerny, Victor Sinjaev and himself to the Lepidoptera & Trichoptera Section of ZFMK. I also thank Jan Lourens, Lucena City, Luzon, the Philippines, for presenting valuable specimens of *Plutodes*, including one paratype of a species described herein. I am thankful to J. D. Holloway, NHM London, and M. Sommerer, Munich, for various data and information about species of *Plutodes* in the collections under their care. The latter also checked, besides his private collection, the Herbulot collection now housed at the ZSM. K. Yazaki, Tokyo, and M. Schaarschmidt, Leipzig, provided data and sent images of specimens in their private collection. I am also very thankful to Mrs. Ulla Kreutz, Meckenheim, for preparing the figures and plates presented in this article. The careful processing of the material by the CCDB team (University of Guelph) is gratefully acknowledged as well.



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Received: 10.12.2009

Accepted: 30.01.2010

Corresponding editor: F. Herder

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Jahr/Year: 2010

Band/Volume: [57](#)

Autor(en)/Author(s): Stüning Dieter

Artikel/Article: [Two new species of the \*Plutodes costatus\*-group from the Philippines and Indonesia \(Lepidoptera, Geometridae, Ennominae\) 75-83](#)