

MECOPTERA FROM BORNEO AND TIOMAN ISLAND^{1,2}

By George W. Byers

Abstract: Three species of the genus *Neopanorpa* from Borneo and Tioman Island are described as new, and *Neopanorpa flavicauda* Banks is briefly described and discussed.

Accumulation of Mecoptera from various parts of southeastern Asia in connection with my recent study of the Mecoptera of mainland Indo-China yielded a few undescribed species from outside that region. Those from insular areas are dealt with below. One species, *Neopanorpa flavicauda* Banks (1931b), has already been described from North Borneo. I have been able to examine most or all of the type series of this species and have here illustrated and briefly described certain details of the male genital bulb, etc., for purposes of comparison with the other species.

***Neopanorpa flavicauda* Banks**

Neopanorpa flavicauda Banks, 1931b: 419-20, figs. 6, 8.

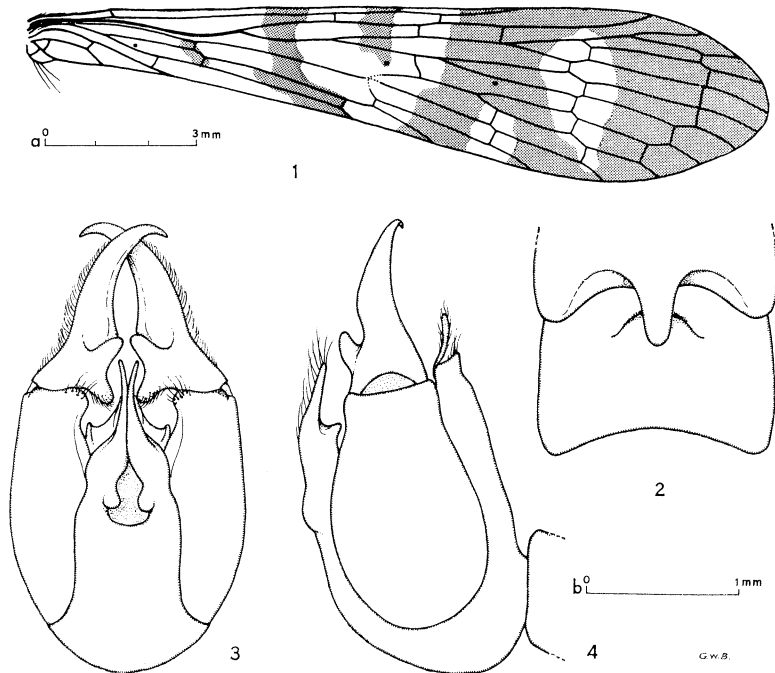
Fore wing (fig. 1) with apical band entire, the pterostigmal band entire and forked posteriorly, with distal fork joined to apical band at margin in some specimens (not in lectotype). Marginal spot conspicuous, and basal band entire, somewhat spurred proximad between veins Cu_1 and Cu_2 . A small spot is present near mid-width of wing before basal band in most specimens.

Posterior process of abdominal tergum 3 linguiform in some ♂♂ (fig. 2), somewhat longer and more slender in the lectotype than in the ♂ illustrated here.

Banks overlooked a number of details of the ♂ genital bulb, and his figures of it, especially the ventral aspect, can scarcely be regarded as accurate. The dististyles, for example, are much thicker and more sharply curved than shown by Banks, and the basal lobe of each is conspicuously divided into a proximal and a distal protuberance, the distal one only slightly the larger. Each hypovalve of sternum 9 is expanded basally and attenuate at apex (fig. 3), with a rounded basal lobe on mesal margin and a blunt dorso-lateral tooth near mid-length.

In the collection of the British Museum (Natural History) there is a ♂ labelled "Type" (the word within a red circle), "B. N. Borneo, Mt Kinabalu, Kenokok, 3300 ft., 26th Apr. 1929", and "*Neopanorpa flavicauda* Bks., type." It also bears an accession label: "Ex F.

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Figs. 1-4. *Neopanorpa flavicauda* Banks, ♂ paralectotype. 1, right fore wing; 2, abdominal terga 3 and 4, dorsal aspect; 3, genital bulb, ventral aspect. 4, same, right lateral aspect. Scale a-fig. 1, b-figs. 2-4.

M. S. Museum, B. M. 1955-354," indicating it is from the collection of the Federated Malay States Museum, where the types were originally deposited. This ♂ is hereby designated lectotype of *Neopanorpa flavicauda* Banks. The lectotype is intact except for lacking the left antennal flagellum and about half the right flagellum. In addition to the lectotype, there are, in the British Museum, 4 ♂♂ and 4 ♀♀ labelled as "paratypes" (although they were not so indicated by Banks), bearing collection dates of 22, 23 and 26. IV.1929 but otherwise with the same collection label as the lectotype. One further ♂, labelled "Type" but here regarded as only a paralectotype, is in the Esben-Petersen collection in the Zoological Museum, Copenhagen. There are 2 ♂♂ and 2 ♀♀ paralectotypes and 1 ♂ not labelled as a type, all with the same data as the holotype, in the Museum of Comparative Zoology, Harvard University.

The probable relationships of this species are discussed under the heading of *Neopanorpa borneensis*, below.

Neopanorpa spicata Byers, n. sp.

Description based on 11 ♂♂ and 4 ♀♀, pinned.

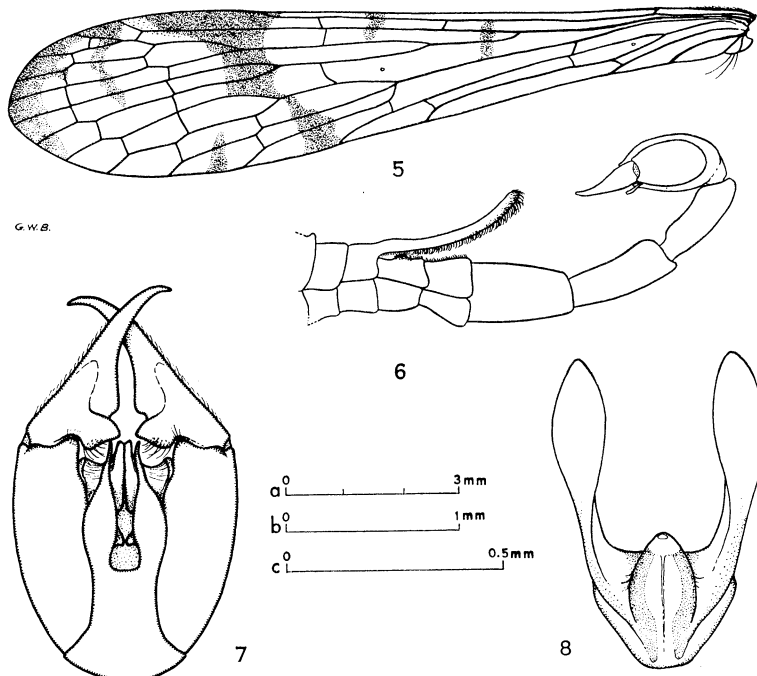
Head: Dorsum of head shining black; frons below antennal sockets dark brown; rostrum brown anteriorly, yellowish brown at sides; mouthparts yellowish brown. Antennal scape yellowish brown, pedicel brown; flagellum (both incomplete in holotype) black,

with 40 to 42 segments.

Thorax: Pronotum black, with 4 or 5 short bristles at each side on anterior margin. Mesonotum and metanotum chiefly dark brownish black, each with poorly defined, pale yellowish brown areas on postero-lateral shoulders of scutum near wing bases. Pleura sordid yellowish brown. Femora, tibiae and basitarsi sordid yellowish brown, apical tarsal segments brown.

Wings (fig. 5) slightly iridescent, faintly tinged with grayish brown, bands and spots smoky brown. Apical band in fore wings weakly indicated in holotype, allotype and 7 paratypes, broader but deeply indented or including variously shaped clear areas in other paratypes. Pterostigmal band complete, constricted and almost broken near mid-length, forked posteriorly in some specimens. Marginal spot small, opposite first fork of media. Basal band short, not darkly colored (holotype) to complete but slender. A small basal spot in cell 1st Cu_1 in one paratype.

Abdomen of ♂: Terga 1-3 dark brown with pale pubescence, longest on tergum 3; terga 4-5 dark yellowish brown, hairs mostly pale except black along mid-dorsal area; sterna 2-5 dark yellowish brown. Segment 6 yellowish brown, segments 7-8 pale yellowish brown, segment 9 dark yellowish brown. Posterior process of tergum 3 long, stout, curved upward, densely set with black hairs especially on underside, extending to or slightly past mid-length of segment 6 (fig. 6). Hypovalves of sternum 9 not darkened,



Figs. 5-8. *Neopanorpa spicata* n. sp. 5, left fore wing, ♂ holotype; 6, abdomen, ♂ holotype, left lateral aspect; 7, genital bulb, ♂ holotype, ventral aspect; 8, genital plates, ♀ allotype, ventral aspect. Scale a-figs. 5-6, b-fig. 7, c-fig. 8.

separated throughout their length, widened near mid-length and tapered to acuminate tips (fig. 7). Tergum 9 slightly narrowed toward truncate apex, with subapical lateral extension on each side bent around segment 10. Dististyles long, slender, each with median basal lobe strongly sclerotized mesally, shallowly excavated below. Ventral valves of aedeagus sclerotized, projecting posteriorly and ventrally (backward) between hypovalves; bases of ventral parameres in form of narrow, blunt-tipped blades projecting backward.

Abdomen of ♀: Terga 1-4 and about basal half of 5th brownish black; corresponding sterna pale yellowish brown; segments 6-10 dark yellowish brown; cerci black. Subgenital plate of sternum 8 apically notched with 2 thick, finger-like lobes above gonopore on dorsal surface. Axis of genital plates ovoid, without conspicuous lateral lobes (fig. 8); arms of distal plate spatulate, somewhat twisted near base.

Body length, ♂, about 11-13 mm (holotype 12 mm); ♀, about 9-11 mm (allotype 10 mm). Length of fore wing, ♂, 12.2-13.2 mm (holotype 13.2 mm); ♀, 13.1-13.6 mm (allotype 13.6 mm).

Holotype ♂ (BISHOP 6959), Tenempok, 48 km E of Jesselton, British North Borneo, 1460 m, 17-21.X.1958, T. C. Maa. Allotopotype ♀ (BISHOP), same data as holotype. Paratopotypes: 2♀♀, 17-21.X.1958, L. W. Quate; 2♂♂, 20.X.1958, Quate; 3♂♂, 1♀, 26-31.I.1959, T. C. Maa; 1♂, 2-4.II.1959, Maa; 3♂♂ (2 in capsule on same pin as 3rd specimen), 10-19.II.1959, Maa. One additional paratype, ♂, Singkor, British North Borneo, 19.I.1959, Maa. The holotype is pinned together with a small ichneumonid wasp on which it was feeding at the time of capture. Holotype, allotopotype and 10 paratypes in Bishop Museum, Honolulu, 2♂♂ and 1♀ paratypes in Snow Entomological Museum, The University of Kansas.

The general shape of the hypovalves and aedeagus of the male show the relationship of *Neopanorpa spicata* to *N. flavicauda* Banks and *N. borneensis* n. sp., the only other species known from the island of Borneo. The wing pattern, however, is very different from that of either of those species, and structural details such as the posterior process of abdominal tergum 3, the basal lobes of the dististyles, and the shape of the aedeagus will easily differentiate the males. Females of *spicata* and *borneensis* may be distinguished by their wing pattern, coloration, subgenital plate and shape of genital plates. The female of *flavicauda* is as yet undescribed. The specific name (Latin *spicata*=sharpened to a point) pertains to the acuminate tips of the hypovalves.

***Neopanorpa borneensis* Byers, n. sp.**

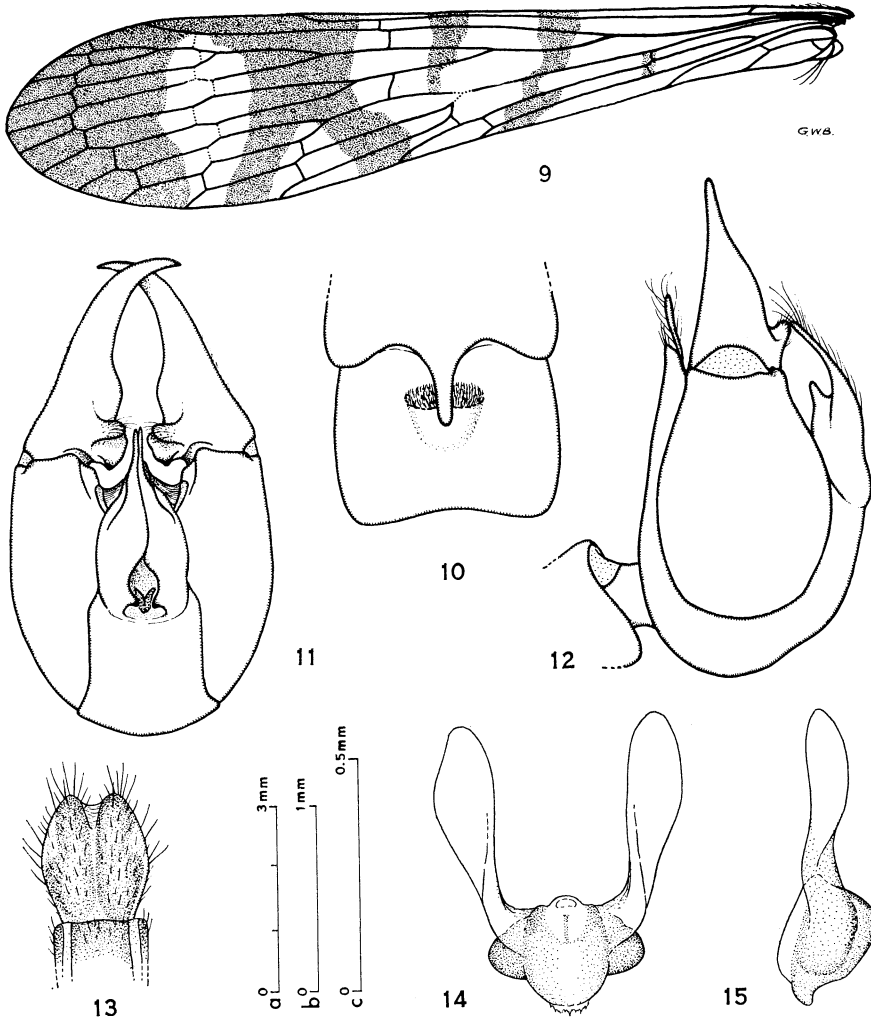
Description based on 2♂♂ and 6♀♀, pinned.

Head: Dorsum of head glossy black; frons below antennal sockets dark brown; genae below antennal sockets light yellowish brown; rostrum dark brown anteriorly, yellowish brown laterally, especially near base, except for thin line of brown along edge of eye; margin of labrum black. Antennal scape dark yellowish brown, pedicel brown; flagellum dark brown basally grading into black, comprising 41 segments in both sexes.

Thorax: Pronotum black, with 3 shorter bristles at each side on anterior margin. Mesonotum and metanotum almost wholly black, each with small, poorly defined, yellowish brown areas on posterolateral shoulders of scutum near wing bases. Pleura dark yellowish brown.

lowish brown. Femora yellowish brown, tibiae darker yellowish brown, tarsi brown, darkest apically.

Wings (fig. 9) lightly tinged with brown, markings dark brown. Apical band entire, somewhat faded posteriorly in both ♂♂, with included pale spot posteriorly in 2♀♀. Pterostigmal band entire, forked posteriorly, connected along costal margin to apical band. Cross-veins in area between apical and pterostigmal bands pale. Marginal spot extending from costa to M_{1+2} or farther. Basal band entire, strongly constricted near mid-length



Figs. 9-15, *Neopanorpa borneensis* n. sp. 9, left fore wing, ♂ holotype; 10, abdominal terga 3 and 4, ♂ holotype, dorsal aspect; 11, genital bulb, ♂ holotype, ventral aspect; 12, same, left lateral aspect; 13, subgenital plate, ♀ allotype, ventral aspect; 14, genital plates, ♀ allotype, ventral aspect; 15, same, right lateral aspect. Scale a-fig. 9, b-figs. 10-13, c-figs. 14-15.

in ♂, not in ♀. Basal spot present over cross-veins 1st m-cu and 1st cu.

Abdomen of ♂: Terga 1-4 black, tergum 5 dark brown; corresponding sterna sordid yellowish brown mottled with brown. Segment 6 dark brown with yellowish brown apex; segments 7-8 yellowish brown; segment 9 dark yellowish brown, except tips of dististyles brown. Posterior process of tergum 3 narrow, a little widened at base (fig. 10), set in shallow emargination of tergum, extending about half-way across tergum 4. Prominence on tergum 4 rounded and smooth posteriorly, flattened and hairy anteriorly. Hypo valves (fig. 11) not darkened, widened near mid-length, acuminate in apical half, each with a stout, strongly sclerotized dorsal tooth, partially concealed in ventral aspect but readily seen from side (fig. 12). Tergum 9 evenly tapered toward apex, with truncate apical margin; subapical lateral extensions, one from each side, encircling base of proctiger. Dististyles stout, darkly sclerotized beyond mid-length; outer margins slightly concave and covered with fine hairs on basal half; inner basal lobe of dististyle comprising an elongate, hairy, ventral projection and a more dorsal, thickened, less hairy portion sclerotized on lower, mesal margin (fig. 11). Ventral lobes of aedeagus sclerotized, rounded in lateral profile, not projecting between hypo valves; bases of ventral parameres in form of narrow, acutely tipped blades projecting backward (ventrad) (shown as shaded V-shaped structure between bases of hypo valves, in fig. 11).

Abdomen of ♀: All terga brownish black, sterna mottled, sordid brown; cerci black. Subgenital plate of sternum 8 broadly and shallowly notched at apex, with a small cluster of bristles on each apical lobe; pigmentation of plate in definite bilateral pattern (fig. 13) with pale median streak. Axial portion of genital plates broadly oval, with wide, rounded, dorso-ventrally thickened lateral lobes (figs. 14, 15); distal arms broadly spatulate.

Body length, ♂, about 12-13 mm (holotype 13 mm); ♀, about 10-14 mm (allotype 14 mm). Length of fore wing, ♂, 13.6-14.4 mm (holotype 13.6 mm); ♀, 13.8-14.8 mm (allotype 14.6 mm).

Holotype (BISHOP 6960) ♂, Tenompok, 48 km E of Jesselton, British North Borneo, 1460 m, 26-31.I.1959, T. C. Maa collector. Allotype ♀ (BISHOP), Keningau, British North Borneo, 12-17.I.1959, Maa. Paratypes: 1♂, 5♀, Bundu Tukan, British North Borneo, 18. II.1959, Maa. Holotype, allotype and 4 paratypes in collection of Bishop Museum; 1♂, 1♀ paratypes in Snow Museum. There is also a teneral ♂ apparently of this species but lacking abdominal segments beyond the 6th, from Kiam Base, north of Mt. Kinabalu, 4.II.1959; it has not been made a paratype.

Neopanorpa borneensis is clearly a close relative of *N. flavicauda* Banks. In fact, the original description of *flavicauda* (Banks 1931: 419-20), concerned mostly with color pattern, fits *borneensis* just as well. In wing markings and general coloration, the two species are so alike as to be easily confused when seen without magnification. Abdominal tergum 3 is emarginate at either side of the posterior process, in both species, but the process itself is somewhat more slender in *borneensis*. Comparison of figures 3 and 11 shows several genitalial differences, most notably the shape of the basal lobe of the dististyle, which in *borneensis* has markedly unequal ventral and dorsal protuberances instead of the proximal and distal protuberances, roughly equal in size, seen in *flavicauda*. The small basal lobe on the mesal margin of each hypo valve is subacute in *borneensis*, rounded in *flavicauda*; and the dorsolateral tooth of the hypo valve is more prolonged and

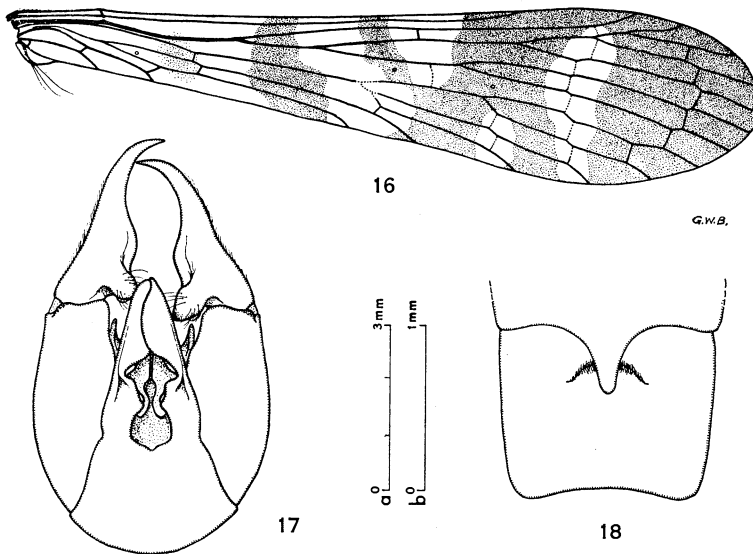
distinct in *borneensis* (cf. figs. 4 and 12). Since the genital plates of *flavicauda* have not been examined, the females of that species and *borneensis* cannot be compared. Figures 8 and 14 show striking differences in shape of the axial portions of the genital plates of females of *borneensis* and *spicata*. The subgenital plate in *borneensis* possesses one feature seen only uncommonly in species of Panorpidae, namely, a longitudinal separation of the sclerotized areas (fig. 13), suggesting that this plate may be formed by the nearly complete fusion of two backward prolongations of the 8th sternum (cf. Byers 1954: 486).

***Neopanorpa tiomanensis* Byers, n. sp.**

Description based on 3♂♂ and 2♀♀, pinned.

Head: Eyes dark brown; occiput, vertex and frons to antennal sockets brownish black; ocelli pale; rostrum, antennal bases and mouthparts reddish brown. Antennal flagella dark brown, comprising 41 segments.

Thorax: Pronotum black, with 3 or 4 weak setae at each side along anterior margin; mesonotum black on anterior half, with broad black median band separating 2 dull yellowish brown areas adjacent to wing bases and including scutellum in posterior half; metanotum narrowly blackened anteriorly and along mid-line to and including scutellum, leaving subcircular paler areas adjacent to wing bases. Pleural surfaces yellowish brown with a few sparse, soft hairs, most numerous on coxae. Legs yellowish brown, the tarsi only slightly darker; claws long-pectinate.



Figs. 16-18, *Neopanorpa tiomanensis* new species. 16, right fore wing, ♂ paratype (Snow Museum); 17, genital bulb, ♂ holotype, ventral aspect; 18, abdominal terga 3 and 4, ♂ holotype, dorsal aspect. Scale a—fig. 16, b—figs. 17-18.

Wings lightly tinged with yellowish brown, heavily marked with bands and spots of dark smoky brown. Apical band in fore wing broad, including a small clear spot near proximal posterior margin. Pterostigmal band entire, forked posteriorly, narrowly connected to apical band along costal margin at stigma. Basal band entire. An intermediate spot (small in one paratype of each sex) adjoining costal margin about halfway between basal and pterostigmal bands, deflected toward middle of pterostigmal band.

Abdomen of ♂: Terga 1-5 blackish brown, paler at posterior margins; sterna of these segments yellowish brown; segment 6 blackish brown throughout; segments 7, 8 and 9 yellowish brown. Posterior process of tergum 3 (fig. 18) extending about halfway across 4th. Hypovalves of sternum 9 (fig. 17) similar to those of *N. angustipennis* (cf. Byers 1965) but not as closely approximated in basal half and with lateral surface of each sharply delimited from ventral surface by an angular, longitudinal bend; lateral portions of hypovalves not as strongly infolded as in *angustipennis*. Tergum 9 slightly narrowed near apex, the apical margin truncate, thin and, in holotype but not in other males, shallowly impressed dorsally. Dististyles with a thick inner basal lobe bearing pale hairs, a somewhat flattened, mesal blackened point and a more dorsal (anterior) rounded, projection.

Abdomen of ♀: First 4 terga blackish brown, succeeding terga brown; sterna sordid yellowish brown; cerci black. Genital plates similar to those of *N. angustipennis*.

Body length, ♂, about 12-14 mm; ♀, about 12 mm. Length of fore wing, ♂, 13.8-14.0 mm (holotype 14.0 mm); ♀, 12.0-13.5 mm (allotype 13.5 mm).

Holotype ♂, Sedagong, Tioman Island (Pulau Tioman), South China Sea, off southern Pahang, Malaya, about 176 km NNE of Singapore, V. 1927, N. Smedly collector. Allotype has same data as holotype except elevation 900 feet added. Two ♂ paratypes with label data as allotype; 1 ♀ paratype labelled as others except "G. Rakam, 2000" instead of Sedagong. All types in the collection of the British Museum (Natural History), London, except one ♂ paratype in Snow Entomological Museum.

Neopanorpa tiomanensis very closely resembles *N. angustipennis* Westwood, and Banks (1931a: 391) included these specimens in that species, calling attention to the much more darkly patterned wings of the island form. The wing markings in *tiomanensis* are more extensive than in the most heavily patterned individuals of *angustipennis*; and the differences in male genitalia described above are consistent within the limits of the sample available.

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