

A REVISION OF THE GENUS *Puranoides* MOULTON AND DESCRIPTION OF TWO NEW SPECIES FROM MALAYSIA

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ABSTRACT

Puranoides klossi and *Puranoides sphinx* were reexamined and redescribed in this paper. A revision of the genus *Puranoides* from Malaysia has led to the discovery of two new species that need to be described as new to science namely *Puranoides ismaili* sp. nov. from Sabah and *Puranoides schouteni* sp. nov. from Johor and Pahang. Both species are differed from each other and located under the same species group.

Keywords: Cicadidae, Sundaland, *Puranoides*, new species

ABSTRAK

Puranoides klossi dan *Puranoides sphinx* telah diperiksa dan diperihalkan semula. Semakan ke atas genus *Puranoides* dari Malaysia telah membawa kepada penemuan dua spesies baru yang perlu diperihalkan kepada sains iaitu *Puranoides ismaili* sp. nov. dari Sabah dan *Puranoides schouteni* sp. nov. dari Johor dan Pahang. Kedua-dua spesies berbeza antara satu sama lain dan terletak di bawah kumpulan spesies yang sama.

Kata kunci: Cicadidae, Sundaland, *Puranoides*, spesies baru

INTRODUCTION

The genus *Puranoides* was described by Moulton (1917) based on a type specimen of *Puranoides klossi* Moulton (1917), a species that was newly described and designated as a type species at the same time. According to him, *Puranoides* was related to *Purana*, *Leptopsaltria* and *Maua* but differed by lack of lateral tubercles on sternites II and III. Moulton (1923) indicated that *Puranoides* is distinguished from *Pomponia* by the lateral margins of a pronotal collar which are not toothed-like and a black median longitudinal fascia down the postclypeus is the main prominent feature. This genus was erected to accommodate the smallest species of *Pomponia* which bears these two main characters.

This revision has successfully examined the holotype specimens of four described species, *Puranooides klossi* and *Puranooides sphinx* that were deposited in the British Museum of Natural History (BMNH) (Metcalf 1963; Moulton 1917), while *Puranooides jaafari* and *Puranooides abdullahi* were deposited in Centre for Insect Systematics (CIS, UKM) (Azman & Zaidi 2002). The first two species herewith revised, illustrated and redescribed while another two species deposited in UKM were already revised and illustrated for the first time in science (Azman & Zaidi 2002). However, none of the *Puranooides geomensi* Lee (2009) specimens are available, hence it is only listed in the species checklist without any revision or redescription.

Examination of the type specimen of *Pomponia thalia*, the current smallest species of *Pomponia* deposited in BMNH, shows that this species belongs to the genus *Puranooides*. However, it is not revised nor redescribed, since their distribution is confined in India. However, this indicates that the species distribution for *Puranooides* is not limited to South East Asia.

A revision of the genus *Puranooides* from Malaysia has led to the discovery of two new species that need to be described as new to science namely *Puranooides ismaili* sp. nov. from Kinabalu Park and Crocker Range Park in Sabah, and *Puranooides schouteni* sp. nov. from Endau Rompin National Park Johor and Rompin Endau State Park Pahang.

MATERIALS AND METHOD

Specimens Collection

The materials of this study were collections of cicada specimens of the genus *Puranooides* from Sundaland. Specimens deposited in a total of seven museums and/ or institutions as abbreviated below have been examined (Table 1). Visit trip to BMNH, Nationaal Natuurhistorisch Museum (former Rijksmuseum voor Natuurlijke Historie), Leiden, The Netherlands (RMNH), and Zoologische Staatssammlung, München (Munich), Germany (ZMAN) have successfully examined the type materials of known described species and possible new species.

Table 1. List of repositories or institutions of studied materials

| No. | Abbreviation | Repositories/ Institutions |
|-----|--------------|---|
| 1. | BMNH | British Museum of Natural History, London |
| 2. | FRCS | Forest Research Centre, Sepilok, Sabah |
| 3. | MNM | Museum Negara Malaysia, Kuala Lumpur |
| 4. | MZB | The Museum Zoologicum Bogoriense, Bogor, Indonesia |
| 5. | RMNH | Nationaal Natuurhistorisch Museum (former Rijksmuseum voor Natuurlijke Historie), Leiden, The Netherlands |
| 6. | UKM | Centre for Insect Systematics, Universiti Kebangsaan Malaysia |
| 7. | ZSM | Zoologische Staatssammlung, München (Munich), Germany |
| 8. | ZMAN | The Zoologisch Museum, Universiteit van Amsterdam, The Netherlands |

Species Illustrations

Illustrations of the external morphology of male genitalia were done using a Stereo microscope, Zeiss Stemi SV11, x6-x66, equipped with camera lucida. The morphological characters of the head, thorax, abdomen, wing and venations, operculum, tymbal cover and male genitalia have

been illustrated. The male genitalia illustration is the most important being produced for species identification and grouping since this character is species specific.

Distribution Mapping

An online Google Earth program was used for tracing the coordinates of localities for every specimen referred to in this study. The traced coordinates were placed and saved on Google Maps. A high-quality outline map of South East Asia was obtained online from the internet address [http://d-maps.com/csrtc.php?num_car=5267 &lang=en](http://d-maps.com/csrtc.php?num_car=5267&lang=en). The map of the species distributions were constructed by tracing the saved coordinates on Google Maps onto the outline map following the species.

RESULTS AND DISCUSSION

Puranoides ismaili sp. nov. is similar to *P. klossi* in term of marking on tegmina while *P. schtouteni* sp. nov. is similar to *P. jaafari* in term of longer body and marking on the sternit but a little bit lighter in colour.

Puranoides klossi Moulton, 1917

(Figures 1a, 3a–g)

Puranoides klossii Moulton 1917: 1-2. Male holotype: ‘Sumatra, Korinchi’ / ‘*Puranoides klossi*’, ‘type’ [hand written with red label], (BMNH); Moulton 1923: 115; Metcalf 1963: 524; Azman et al. 2010: 90, 95.

Redescription of male. Head, thorax and abdomen (Figures 1a, 3a), with greenish to greenish ochraceous ground colour for life specimens, greenish ochraceous to ochraceous and sometimes castaneous for old specimens. Markings on head and thorax blackish to black; markings on abdomen dark ochraceous to fuscous and blackish. Ratio of body length to pronotum width about 3.23 (2.93–3.46).

Ratio of head width to pronotum width about 0.96, and to mesonotum width about 1.05. Dorsal part (Figure 3a), with the following black markings: median marking enclosing ocelli with its anterior ends reaching frontoclypeal suture and posterior ends bifurcate to reach posterior margin of head; a pair of transverse fasciae on posterior margin, fused with bifurcated medial longitudinal fasciae; a pair of short oblique fasciae about half between postclypeus and eyes; a pair of short and transverse fasciae on anterior angle of vertex; a pair of spots on supra-antennal plate; a pair of very small spots near eye about one-fifth between ocelli and eyes; a pair of spots behind the eyes. Postclypeus swollen and anterioventral part of head (Figure 3c), with black markings as follows: median longitudinal fasciae on postclypeus with greenish ochraceous spot anteriorly, bifurcated become five pairs of fasciae along transverse groove anteriorly, and extending posteriorly to reach posterior margin; the second pair of transverse fasciae extending to lateral margin of postclypeus, fused with spots on supra-antennal plate, and the third to fifth pairs gradually shortened.

Anteclypeus with a broad median longitudinal fasciae enclosing an ochraceous tiny spot at about middle, extending to posterior and anterior margin, and combined with median fasciae of postclypeus anteriorly. Gena with black transverse fascia between postclypeus and eye, nearly reaching inner margin of eyes. Lorum black except about one-fifth of anterior part and marginal area. Rostrum black apically; reaching and just passing the hind coxae.

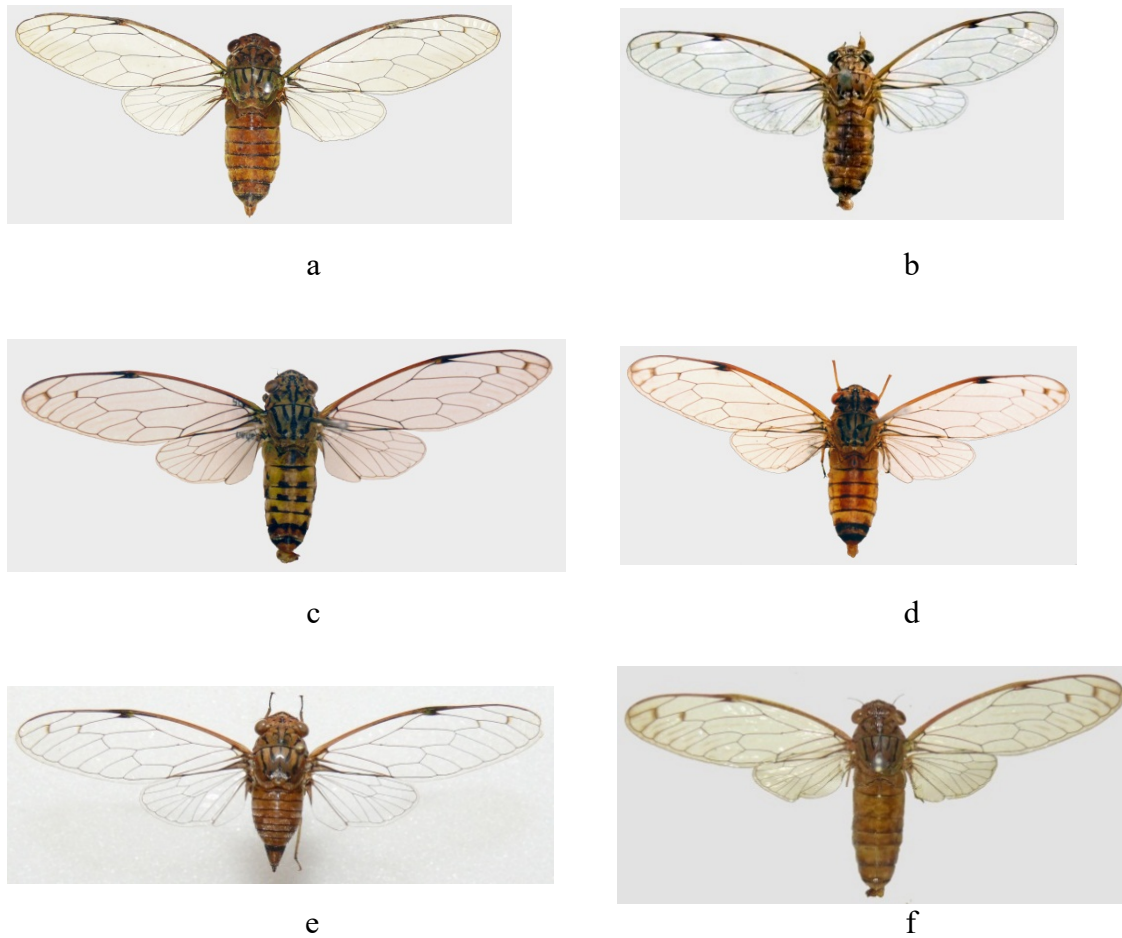


Figure 1. *Puranoides* spp. (scale, x1.0); a, *Pu. klossi*, male, Bukit Kutu, Selangor; b, *Pu. sphinx*, male, Cibodas, Java; c, *Pu. jaafari*, male, holotype, Mt. Ledang, Malacca; d, *Pu. abdullahi*, male, holotype, Selangor; e, *Pu. ismaili* sp. nov., female, paratype, Sayap, Mt. Kinabalu; f, *Pu. schouteni* sp. nov., male, holotype, Lubuk Tapah, Johore

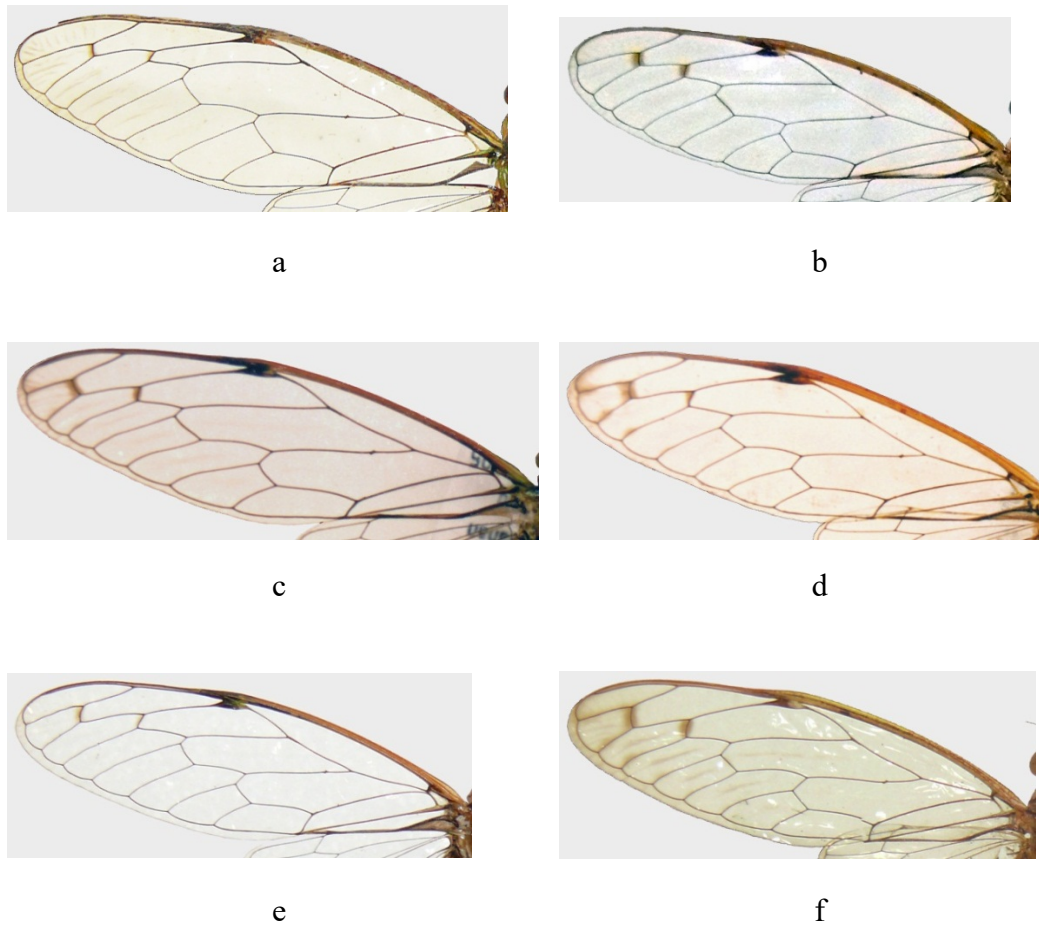


Figure 2. Left tegmina of *Puranoides* spp (scale, x2.25); a, *Pu. klossi*; b, *Pu. sphinx*; c, *Pu. jaafari*; d, *Pu. abduhlahi*; e, *Pu. ismaili* sp. nov. h, *Pu. schouteni* sp. nov.

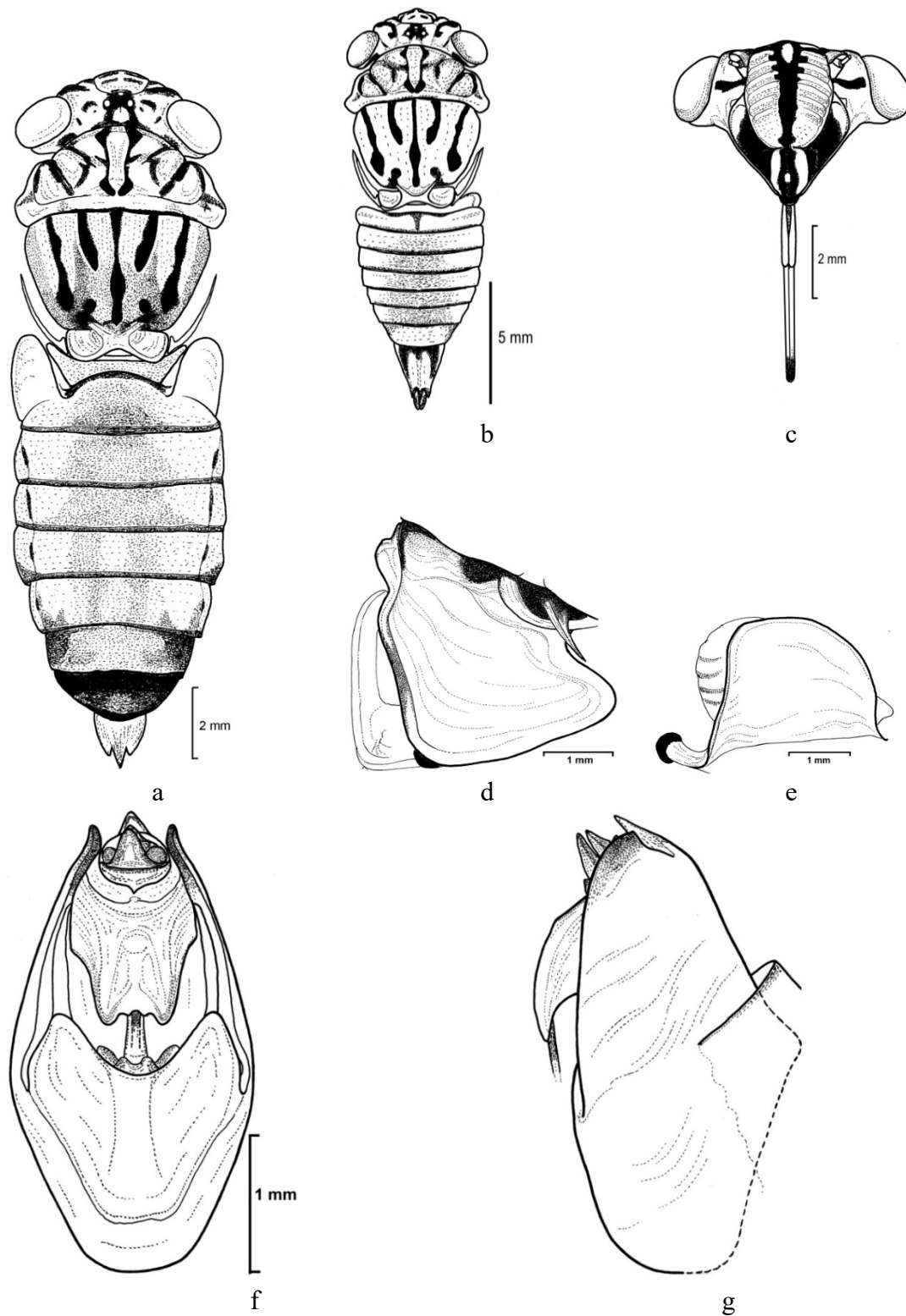


Figure 3. *Puranoides klossi* Moulton, male, Bukit Kutu, Selangor. a, body from dorsal view; b, female body from dorsal view; c, head from anteroventral view; d, left operculum from lateroventral view; e, right tymbal cover from dorsolateral view; f, pygofer from posteroventral view; g, pygofer from lateroventral view

Thorax (Figures 1a, 3a). Pronotum with the following black markings: a pair of median longitudinal fasciae, broadened anteriorly, and closed posteriorly; a pair of short oblique branches from middle of median longitudinal fasciae, fused with a pair of small oblique fasciae along first half of paramedian fissures; a pair of obliquely longitudinal small fasciae between median parts of paramedian fissures and posterior ends of lateral fissures; a pair of oblique fasciae along lateral fissures, extending to ambient fissures; and a pair of lateral spots behind the eyes. Pronotal collar with a narrow transverse fasciae along posterior margin; and a pair of fuscous spots at lateral corners, combined with spots behind the eyes.

Mesonotum with the following black markings: a median longitudinal fascia, broadened posteriorly to reach anterior margin of cruciform elevation; a pair of paramedian fasciae inwardly curved, along parapsidal sutures; a pair of longitudinal fasciae on lateral sigilla; and a pair of roundish spots enclosing scutal depressions, extending posteriorly to posterior margin of mesonotum, forming a pair of oblique fasciae. Legs greenish ochraceous to ochraceous with black spots at the bases of coxae; fore, middle and hind tarsus, blackish at the basal and apical parts.

Tegmina and wings (Figures 1a, 2a) hyaline with greyish basal membranes. Tegmina with vein R + Sc greenish for life specimens, and become ochraceous to reddish ochraceous for old specimens; venation redish ochraceous to fuscous towards apex; basal cell longer than broad; transverse veins at the bases of second and third apical cells with indistinct infuscation; median area of first to fifth apical cell, area of tegmen apex to about one-third of marginal area, with pale brownish tinge or sometimes indistinct. Wings with greenish to dark ochraceous venation.

Operculum (Figure 3d) greenish to greenish ochraceous; short but longer than broad about 1.15x, just reaching the base of abdominal sternite 2; medial margin concave about one-third from the bases, mediobasal corner subangulate; distal margin weakly convex or almost straight; distal corner subangulate, lateral margin weakly concave with fuscous fascia. Base of meracanthus, a spot at the middle of basal part, and obconical fascia at the bases of lateral area, black.

Abdomen (Figures 1a, 3a) about 1.23 (1.06–1.37) longer than the length of head and thorax combined; with narrowly fuscous to blackish posterior margin on each tergite; medial longitudinal broad dark ochraceous markings, broadened at posterior margin of tergite 3 and 4, and bifurcated on tergite 5 and 6; a pair of dark ochraceous submarginal triangular spots at posterior margin of tergite 6; a pair of narrow fuscous submarginal spots on tergite 3, 4, 5 and 6, forming a pair of submarginal narrow lines. Tergite 7 with a pair of large fuscous spots laterally; tergite 8 fuscous with a transverse broad irregular blackish patch anteriorly. Tymbal cover (Figure 4.63e) greenish to greenish ochraceous, broader than long, with subangulated outer corner. Ventral part of abdomen: with dark ochraceous posterior margin of sternite II–VI; area on sternite VII and VIII dark ochraceous to fuscous; and distinct medial longitudinal fuscous fascia of sternite VIII.

Male genitalia (Figures 3f, 3g): Pygofer, greenish ochraceous to ochraceous; length include dorsal beak, less than twice of width about 1.9x; considerably narrowed posteriorly and semicircular anteriorly. Pygofer basal lobe absent, secondary basal lobe semicircular and well separated from lateral margin; pygofer upper lobe, small with subangulated marginal part. Dorsal beak, long, slender and pointed apically, with the tip passing the apex of anal styles. Anal styles projected towards posteroventral. Uncus simple and wide; uncus lobes, broad and

short, slightly tapering towards anterior, with distal margin strongly curved, forming a pair of blunt bicuspid apex in ventral view. Aedaegus, long and narrowed, flatten with pointed apex.

Redescription of female (Figure 3b). Ratio of body length to pronotum width about 2.77 (2.63–2.87). Markings on head, pronotum, mesonotum, legs, tegmina and wings, identical to male. Operculum triangular with colours and markings, identical to male; distal margin not reaching posterior margin of sternite II. Abdomen as long as the length of head and thorax combined. Dorsal part of abdomen with borag longitudinal dark ochraceous marking. Tergite 8 with dark ochraceous spots laterally. Abdominal segment 9 dark ochraceous dorsally with fuscous anterior margin, and a pair of longitudinal fuscous lateral fasciae. Ventral part of abdomen: sternite VII median dark ochraceous spot, connected with transverse dark ochraceous on posterior margin of the same sternite; median part of sternite VII strongly concave posteriorly. Ovipositor, fuscous and toothed apically. Ovipositor's sheath fuscous, darker towards apex, and pilose.

Measurements (mm). Males (n=10). Body length 19.86 (17.60-21.81); abdomen length 10.96 (9.50-12.51); head width 5.92 (5.35-6.15); pronotum width 6.14 (5.80-6.30); mesonotum width 5.66 (5.10-6.00); tegmen length 25.80 (22.80-27.96); expanded tegmina 57.73 (51.75-62.22). Females (n=4). Body length 16.82 (15.80-18.05); abdomen length 8.12 (7.60-8.53); head width 5.84 (5.70-6.19); pronotum width 6.07 (5.85-6.30); mesonotum width 5.63 (5.50-5.98); tegmen length 25.31 (24.61-26.13); expanded tegmina 56.69 (55.10-58.56).

Materials examined. – 26 males, 24 females. INDONESIA: SUMATRA, Korinchi, Sungei Kumbang, 4700ft., no date, R.K., *Puranoides klossi* Moulton, n.gen, n.sp, Type male, E.J.C. Moulton 4.ix.1914 (Moulton's handwriting), 1916-229, male, (BMNH); same data except female, (BMNH); same data except, no date, H.C.R. & C.B.K., *P. klossi*, co-type female, (moulton's hand writing), Ex F.M.S.Museum, B.M.1955-354, female, (MNM); no date, H.C.R. & C.B.K., Ex F.M.S.Museum, B.M.1955-354, female, (MNM); no date, H.C.R. & C.B.K., Ex F.M.S.Museum, B.M.1955-354, female, (MNM); Near Prapat LF, HW Ila 02°46'13"N 098°58'57"E, 1000m, 13.ii.1999, leg. U.Buchsbaum, 7 males, 5 females, (ZSM); 10km north Bukit Tinggi, 830m, Batang Balupuh, LF 00°14'34"S/ 100°09'13"E, 21.ii.2002, leg. T. Kohte, 3 females, (ZSM); no locality, no date, *P. klossi* (moulton's hand writing), male, (MNM); MALAYSIA: KELANTAN: Lojing Highlands, 2-10.vi.2008, Azman, Badrol & Nordin, male, (UKM); NEGERI SEMBILAN: Negeri Sembilan, K.Pilah, Ulu Bendul, 4.vii.2007, Badrol, Zainudin, 2 females, (UKM); PAHANG: Bukit Fraser, light, 21-22.iv.2001, 1100m, Noramly Muslim & Bakri, male, (UKM); same data except, Sri Bakti, 15-16.iv.2000, 1100m, light, Noramly Muslim, male, female, (UKM); Bukit tinggi, 3.ix.2001, Nurul, M.Zaidi, female, (UKM); Ekspedisi Bukit Fraser, 12.xi.2000, CIS group, male, (UKM); same data except, 14.xi.2000, male, 2 females, (UKM); 15.xi.2000, male, (UKM); Fraser Hill, 7-8.iv.2001, Noramly Muslim, female, (UKM); Kem Bakti, 13.ii.2000, Noramly Muslim, male, (UKM); PERAK: Taiping, Bukit Larut, 5-7.ii.2000, 1100m, Noramly Muslim, male, 2 females, (UKM); same data except, 21-22.iv.2000, 1050m, light, Noramly Muslim, 2 males, (UKM); 2-4.vi.2001, 1113m, Noramly & Neoh K.H., 2 males, female, (UKM); SELANGOR, Bukit Kutu, 3500ft., 19.iv.1926. H.M. Pendlebury, female, (MNM); same data except, at light, 18.iii.1931, male, (MNM); 19.iv.1926, Ex. F.M.S. Museum, B.M.1955-354, male, (MNM); at light, 18.iii.1926, Ex. F.M.S. Museum, B.M.1955-354, male, (MNM); THAILAND: Nakon Sri Tamarat, Khao Luang, at light, 2000ft, 23.iii.1922, H.M.Pendlebury, Ex. F.M.S. Museum, B.M.1955-354, male, (MNM); same data except, 1.iv.1922, male, (MNM); 4000ft, 24.iii.1922, female, (MNM).

Distribution (Figure 7). Sumatra (Korinchi, Prapat, Bukit Tinggi), Peninsular Malaysia and Thailand (Nakhon Sri Tamarat).

Remarks. *Puranoides klossi*, a type species of the genus is distinguished from other described species by its ‘square-like’ operculum. This species is similar to *P. abdullahi* and the differences with its related species are discussed under *P. abdullahi*.

***Puranoides sphinx* (Walker), 1850**

(Figures 1b, 4a–f)

Cicada sphinx Walker, 1850: 164. Female holotype: no locality & date ‘*C.sphinx* Walker’, ‘type’ [green round label], (BMNH).

Pomponia horsfieldi Distant 1893: 77. Male holotype: ‘Java, Seawoo’ / ‘*horsfieldi* Dist’, ‘type’ [hand written, red round label], (BMNH).

Pomponia thalia Distant 1906 (partim): 68 (Java); Distant 1913: 42 (Java).

Puranoides sphinx Moulton 1923: 115; Metcalf 1963:524.

Redescription of male. Head, thorax and abdomen (Figures 1b, 4a), with ochraceous ground colour. Markings on head and thorax blackish to black. Ratio of body length to pronotum width about 3.22 (3.10-3.37).

Ratio of head width to pronotum width about 0.95 (0.94–0.97) and to mesonotum with about 1.06 (1.02–1.10). Dorsal part of head, with the following blackish to black markings: median marking enclosing ocelli with its anterior ends reaching frontoclypeal suture and posterior ends bifurcate but not reaching posterior margin; a pair of spots on anterior margin of vertex; two pairs of small spots on the centre of vertex between ocelli and eyes with anterior pair bigger than the posterior pair; a pair of small spots near the inner margin of eyes; a pair of spots at supra-antennal plate; and a pair of median fused transverse fasciae on posterior margin of head. Postclypeus swollen and anterioventral part of head (Figure 4b), with fuscous to black markings as follow: median longitudinal fasciae on postclypeus enclosing ochraceous spot anteriorly, bifurcates forming five pairs of fasciae along transverse groove, with the first, second and third pairs extending to lateral margin of postclypeus, while the fourth and fifth pairs gradually shorten, and posterior ends bifurcated to reach posterior margin. Anteclypeus fuscous almost two-third of the area apically, enclosing an ochraceous spot at about the middle. Gena with blackish transverse fascia between postclypeus and eyes, extending to lateral margin of postclypeus and inner margin of eyes. Lorum fuscous about two-third of inner part. Rostrum black apically; long, reaching and passing the hind coxae.

Thorax (Figures 1b, 4a). Pronotum, with the following fuscous to blackish markings: a pair of thin medial longitudinal fasciae, slightly oblique, sometimes interrupted about two-third apically, broadened and bifurcated anteriorly, extending to anterior margin and fused in the middle with median transverse fasciae of head, rounded and closed posteriorly; a pair of oblique branches from middle of median longitudinal fasciae, along paramedian fissures, extending anteriorly and bifurcated along anterior margin, reaching bases of lateral fissures; a pair of obliquely longitudinal short fasciae between median parts of paramedian fissures and half way to lateral fissures; a pair of oblique fasciae along lateral fissures and a pair of spots behind the eyes at ambient fissures, both extending and fused anteriorly. Pronotal collar with a narrow transverse fasciae along posterior margin.

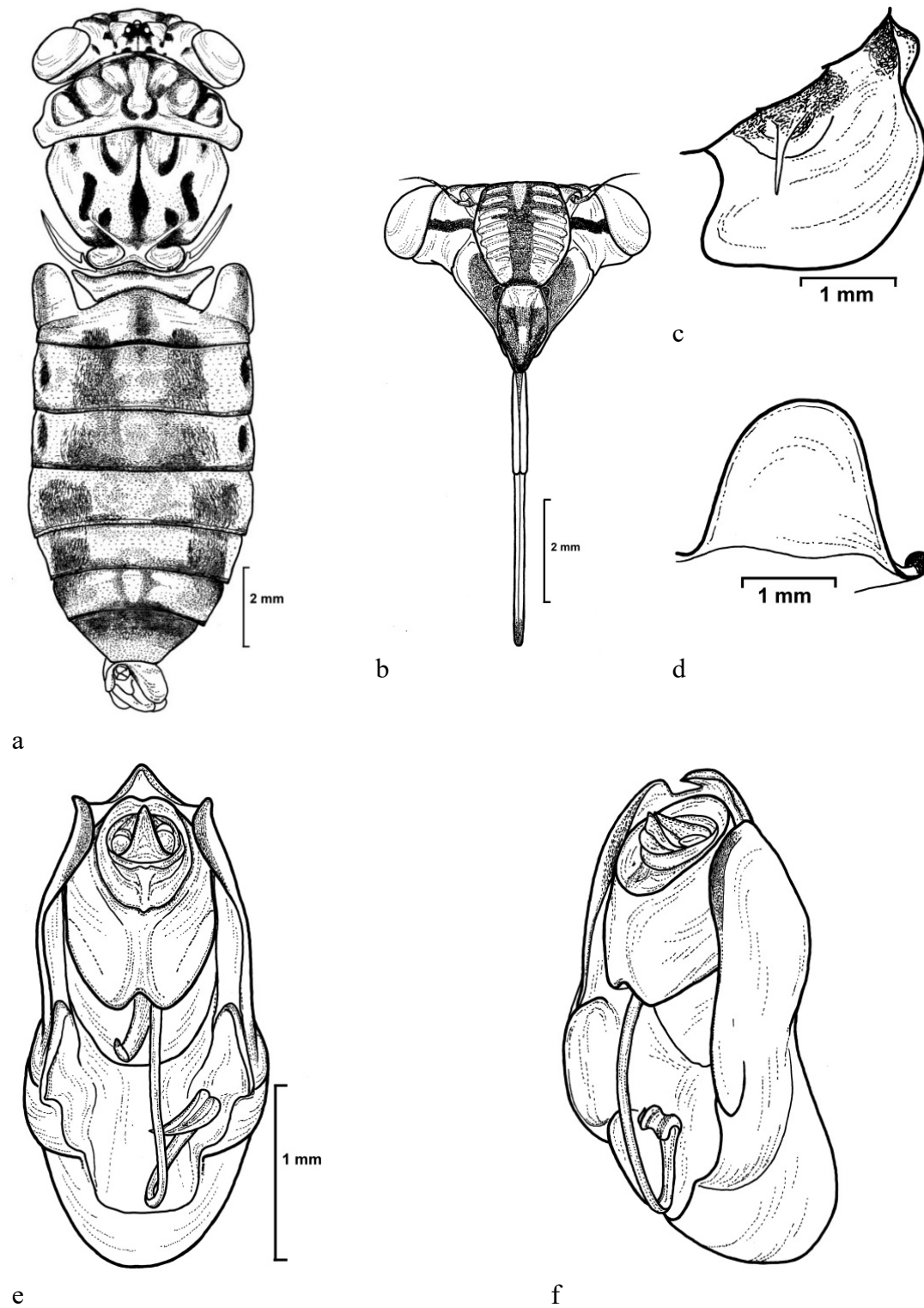


Figure 4. *Puranoides sphinx* (Walker), male, Cibodas, Java. a, body from dorsal view; b, head from anteroventral view; c, left operculum from lateroventral view; d, right tymbal cover from dorsolateral view; e, pygofer from posteroventral view; f, pygofer from lateroventral view

Mesonotum, with the following blackish markings: a median longitudinal fascia, broadened posteriorly to reach anterior margin of cruciform elevation; a pair of paramedian fasciae inwardly curved, along parapsidal sutures; an interrupted pair of lateral longitudinal fasciae on lateral sigilla, forming a pair of spots anteriorly and a pair of shortened longitudinal fasciae posteriorly; and a pair of roundish spots enclosing scutal depressions. Legs with blackish spots at the bases of coxae; dark ochraceous ring marks at apical parts of tibiae; and tarsus, fuscous at one-third of bases and apical parts.

Tegmina (Figures 1b, 2b) with vein R + Sc ochraceous; venation ochraceous to fuscous towards apex; basal cell longer than broad; transverse veins at the bases of second and third apical cells with distinctly infuscated. Wings with dark ochraceous venation. Operculum (Figure 4c) ochraceous; as long as broad and not reaching the base of abdominal sternite 2; medial margin concave about one-third from the bases, mediiodistal corner subangulate; distal margin weakly convex or almost straight; distal corner strongly convex, lateral margin convex. Base of meracanthus and obconical fascia at the bases of lateral area, fuscous.

Abdomen (Figure 1b 4a) about 1.35x longer than the length of head and thorax combined; with narrowly fuscous to blackish posterior margin on each tergite; a pair of small submarginal blackish spots on tergite 2 and 3. A medial longitudinal broad dark ochraceous fasciae comprises of markings as follows: tergite 2 with a median longitudinal fuscous fasciae enclosed by a large semicircular dark ochraceous mark, with a pair of paramedian semicircular fuscous spots at posterior margin; tergite 3 with a pair of paramedian longitudinal fuscous fasciae fused with fuscous spots on tergite 2; tergite 4 with pair of paramedian large fuscous spots in line with fasciae on tergite 3; tergite 5 and 6 with a pair of submarginal large fuscous spots posteriorly; tergite 7 with a pair of marginal triangle fuscous spots anteriorly, fused with spots on tergite 6; and a pair of medial very narrow longitudinal fasciae. Tergite 8 fuscous with a transverse broad irregular blackish patch anteriorly. Tymbal cover (Figure 4d) ochraceous, normal shape, broader than long, semicircular distal margin, with longitudinal fuscous fascia near lateral margin. Ventral part of abdomen: with dark ochraceous posterior margin of sternite II–VI; area on sternite VII fuscous with distinct blackish fascia along posterior margin; sternite VIII ochraceous with distinct medial longitudinal dark ochraceous fascia.

Male genitalia (Figures 4e, f): Pygofer, ochraceous; length include dorsal beak, more than twice of width about 2.08x; narrowed posteriorly only at upper lobes and semicircular anteriorly. Pygofer basal lobe absent, secondary basal lobe semicircular and well separated from lateral margin; pygofer upper lobe, small with semicircular marginal part. Dorsal beak, long, slender and pointed apically, with the tip passing the apex of anal styles. Anal styles projected towards posteroventral. Uncus simple and wide; uncus lobes, broad and short, slightly tapering towards anterior, with distal margin strongly curved, forming a pair of blunt bicuspid apex in ventral view. Aedeagus, long and thin, apical area broadened and dented medially with pointed apex.

Redescription of female. Ratio of body length to pronotum width about 2.74 (2.65–2.83). Markings on head, pronotum, mesonotum, legs, tegmina and wings, identical to male. Operculum triangular with colours and markings, identical to male, distal corner semicircular as male; distal margin not reaching posterior margin of sternite II. Abdomen shorter than length of head and thorax combined. Dorsal part of abdomen with markings identical to male, but a pair of submarginal spots on tergite 5 and 6, and a pair of marginal spots on tergite 7, forming a pair of large triangular lateromarginal spots. Abdominal segment 9 ochraceous dorsally with dark ochraceous anterior margin and a pair of longitudinal dark ochraceous lateral fasciae and

medial small dark ochraceous patch posteriorly. Ventral part of abdomen: sternite VII with median dark ochraceous spot, connected with transverse dark ochraceous on posterior margin of the same sternite; median part of sternite VII concave posteriorly. Ovipositor, fuscous and toothed apically; ovipositor sheath fuscous, darker towards apex.

Measurements (mm). Males (n=4): body length 16.93 (16.10–18.20); abdomen length 9.72 (8.90–10.95); head width 4.99 (4.76–5.17); pronotum width 5.25 (5.06–5.40); mesonotum width 4.71 (4.45–4.90); tegmen length 2.33 (2.30–2.53); expanded tegmina 51.92 (49.80–56.00). Females (n=4): body length 14.42 (13.80–15.09); abdomen length 7.23 (6.52–7.80); head width 4.95 (4.70–5.18); pronotum width 5.26 (5.10–5.44); mesonotum width 4.73 (4.45–4.91); tegmen length 22.64 (21.80–23.40); expanded tegmina 50.54 (48.70–52.24).

Materials examined. – 12 males, 7 females. INDONESIA, JAVA, Seawoo, no date, *horsfieldi* Dist, male Type (red round label), Distant coll. 1911-383, male, (BMNH); no date, *C. sphinx* Walker, Type (green round label), female, (BMNH); Java, 1800', Z.W. Priangan, 4-12.xi.1941, J.M.A. van Groenendael, 2 males, female, (ZMAN); Tjimjiroean, Mt. Malabar, 1700ft., no date, 4104, *Pomponia thalia* det Distant, male, (RMNH); West Java, Tjibodas, 1500m, 13.viii.1920, MZB.HEMI.17736, male, (MZB); Gedeh, Tjisaroea Z. 1200m, 8.ix.1935, M.A. Lieftinck, MZB.HEMI.17750, male, (MZB); Tjibodas, Mt.Gedek, 1400m, 12.v.1954, Minscharto, MZB.HEMI.17759, male, (MZB); Tjibodas, 1400m, 30.iii.1940, L.J. Toxopeus, MZB.HEMI.17755, female, (MZB); same data except, 29.iii.1940, MZB.HEMI.17754, female, (MZB); Soekanegara, 6-700m, ii.1940, Native coll. MZB.HEMI.17753, female, (MZB); TNGHS, Bogor, Ciapus, Citis, G. Salak, ±600m asl, 6.vii.2007, Darmawan, Gianto, L.T., male, (MZB); Cikanniki, TNGH, alt. 960m, 13-14.iv.2001, Makihara, Woro A.N. & E.Cholik, Beating tray, male, female, (MZB); no date, V. Lansbery, *Pomponia tigroides* Walk, male, (RMNH). SUMATRA: Muker, no date, male, female, (RMNH); No locality, no date, male, (RMNH);

Distribution (Figure 7). Java, Sumatra (new record but in doubt).

***Puranoides ismaili* sp. nov.**

(Figures 1e, 5a–f)

Puranoides sp Zaidi and Azman 2003: 99, 105.

Puranoides sp2 Nurulaida and Azman 2007: 46, 59.

Type Materials. – Holotype: male; MALAYSIA: 'SABAH / Gunung Kinabalu / Sayap / 3-8.vi.1992 / Zaidi / Ismail / Ruslan' / (UKM). – Paratypes: 6 males, 8 females; SABAH: same data as holotype, 2 males, 2 females, (UKM); same data except, 1000m, 06°10'N/ 116°34'E, ranger house edge of primary forest, 12-15.iii.2001, J.P. & M.J. Duffels, 2 males, 2 females, (ZMAN); Tambunan, VJR Rafflesia, iv.1994, Ento staff, male, 2 females, (FRCS); Sayap, Alt:948-956m, 18.iii.2005, Pete, Ali, T.Wan, Johnny, female, (MNM); 19.iii.2005, Aida, Tun, Azman, Sinail, male, (MNM); 19.iii.2005, Pete, Ali, T.Wan, Johnny, female, (MNM).

Holotype and paratype specimens are deposited in the depository as mentioned in the list of type materials examined.

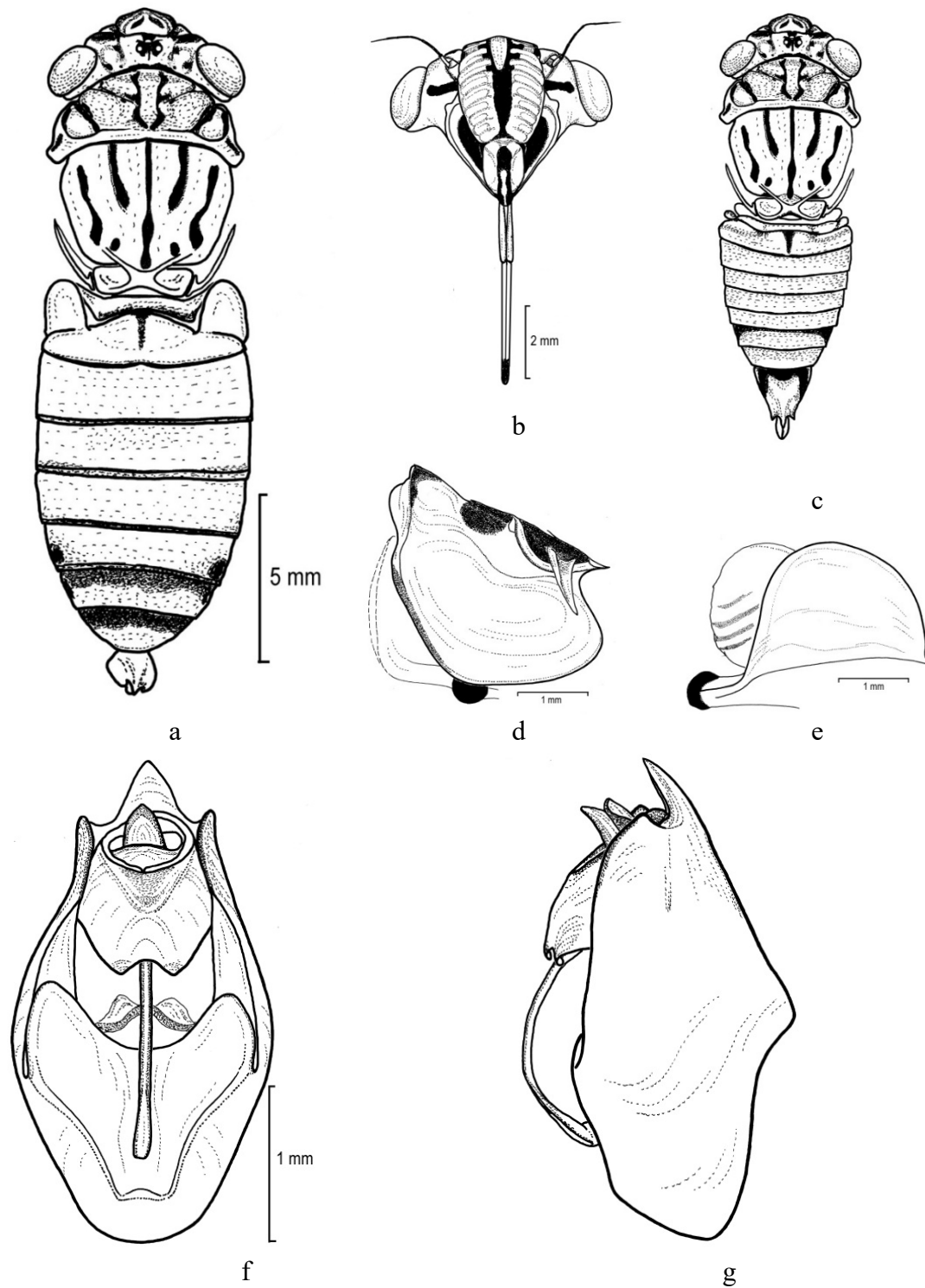


Figure 5. *Puranoides ismaili* sp. nov., male, holotype, Sayap, Mt. Kinabalu. a, male body from dorsal view; b, head from anteroventral view; c, female body from dorsal view; d, right operculum from lateroventral view; e, right tymbal cover from dorsolateral view; f, pygofer from posteroventral view; g, pygofer from lateral view

Etymology. The species is named after the late Mr. Ismail Salleh, one of the collectors of the holotype specimen, a colleague and ex-staff of Centre for Insect Systematics, Universiti Kebangsaan Malaysia, for his more than 30 years of contributions in the study of Malaysian insects. He retired in 2006.

Diagnosis. The tegmina of this species is similar to *P. klossi*. *Puranoides ismaili* has incomplete lateral longitudinal fasciae on lateral sigilla of mesonotum which is not reaching the anterior margin of mesonotum (Nurulaida & Azman 2007). This species also characterised by short operculum, tymbal cover, pygofer, uncus and uncus lobes.

Description of male. Head, thorax and abdomen (Figures 1e, 5a), with greenish to greenish ochraceous ground colour for new specimens, greenish ochraceous to ochraceous for old specimens. Markings on head and thorax, black. Ratio of body length to pronotum width about 3.33 (3.19–3.43).

Ratio of head width to pronotum and mesonotum width about 0.95 (0.93–0.96) and 1.12 (1.06–1.23), respectively. Dorsal part, with the following black markings: median marking in front of middle ocelli with its anterior end reaching frontoclypeal suture; a pair of median spots on ocular tubercle between epicranial suture and lateral ocelli; a pair of transverse fasciae on anterior margin of vertex; a pair of spots on the centre of vertex, between lateral ocelli and anterior margin of eyes; a pair of small spots between anterior margin of pronotum and eyes; and a pair of fused transverse fasciae on posterior margin of head. Postclypeus swollen and anteroventral part of head (Figure 5b), with black markings as follow: median longitudinal fasciae on postclypeus enclosing greenish ochraceous spot anteriorly, bifurcates forming five pairs of fasciae along transverse groove, with the second pairs extending to lateral margin of postclypeus, fused with transverse fasciae at anterior margin of vertex, the third, fourth and fifth pairs gradually shortened, and posterior end bifurcates to reach posterior margin. Anteclypeus with a medial longitudinal fasciae enclosing an ochraceous longitudinal tiny spot at about half to the tip, and only extending to posterior margin. Gena with black transverse fascia between postclypeus and eye but not extending to the margin of eye. Lorum black about one-third of inner part. Rostrum black apically; long, reaching and passing the hind coxae.

Thorax (Figures 1e, 5a). Pronotum, with the following black markings: a pair of medial longitudinal fasciae, oblique and broadened anteriorly, not reaching anterior margin, broadened and closed posteriorly; a pair of short oblique branches from middle of median longitudinal fasciae, along paramedian fissures; a pair of obliquely longitudinal fasciae along lateral fissures, extending to ambient fasciae along posterior margin; a pair of spots at lateral angles, combined with spots behind the eyes.

Mesonotum (Figure 5a), with the following black markings: a median longitudinal fascia, broadened posteriorly to reach anterior margin of cruciform elevation; a pair of paramedian fasciae inwardly curved, along parapsidal sutures; a pair of longitudinal fasciae on lateral sigilla; and a pair of roundish spots enclosing scutal depressions. Legs greenish ochraceous to ochraceous with black spots at the bases of fore coxae; fore, middle and hind tarsus, fuscous at one-fourth of apical parts.

Tegmina and wings (Figures 1e, 2e) hyaline with greyish basal membranes. Tegmina with vein R + Sc greenish for life specimens, and become ochraceous to reddish ochraceous; venation ochraceous; basal cell longer than broad; transverse veins at the bases of second and third apical cells, indistinctly infuscated; apical area of first and second apical cell, and tegmen apex with pale brownish tinge or sometimes indistinct. Wings with fuscous venation.

Operculum (Figure 5d) greenish ochraceous to ochraceous with blackish markings as follows: basal area of meracanthus; fasciae at median part of basal area; fasciae at basal part of lateral area, and narrow fasciae at obliquely lateral margin; as long as broad with the apical part not reaching the base of second abdominal sternite; distal part weakly convex. Medial margin strongly concave about first quarter from the bases, with semicircular distomedial corner, distomedial margin convex, and distomedial corner strongly convex.

Abdomen (Figures 1e, 5a) about 1.33 times longer than the length of head and thorax combined; with narrowly dark ochraceous to fuscous posterior margin on each tergite; medial longitudinal broad dark ochraceous markings on tergite 2, 3 and 4, and bifurcated at tergite 5 and 6; narrow medial longitudinal fasciae on tergite 2; tergite 6 with a pair lateral roundish fuscous spots near posterior margin. Tergite 7 and 8 each with a transverse irregular fuscous to dark fuscous patch anteriorly. Tymbal cover (Figure 5e) greenish to greenish ochraceous, broader than long, normal shape with semicircular distal margin. Ventral part of abdomen: with dark ochraceous posterior margin of sternite II–VI, darker on sternite VII; indistinct medial longitudinal fuscous fascia of sternite VIII; and a pair of paramedian fuscous to blackish spots on sternite III.

Male genitalia (Figures 5f, 5g): Pygofer, greenish-ochraceous to ochraceous with length include dorsal beak about 1.84x than width; considerably narrowed posteriorly and semicircular anteriorly. Pygofer basal lobe absent, secondary basal lobe semicircular and well separated from lateral margin; pygofer upper lobe, small with subangulated marginal part. Dorsal beak, long, slender and pointed apically, with the tip passing the apex of anal styles. Anal styles projected towards posteroventral. Uncus simple and wide; uncus lobes, broad and short, slightly tapering towards anterior, with distal margin strongly curved, forming a pair of blunt bicuspid apex in ventral view. Aedeagus, short, thin, broadened near apex and tapering with pointed apex.

Description of female (Figure 5c). Ratio of body length to pronotum width about 2.83 (2.66–3.00). Markings on head, pronotum, mesonotum, legs, tegmina and wings, identical to male. Operculum triangular with colours and markings, identical to male; distal margin not reaching posterior margin of sternite II. Abdomen about 0.94x shorter than length of head and thorax combined. Dorsal part of abdomen with markings identical to male, but smaller in size, and paler in colour. Abdominal segment 9 ochraceous dorsally with fuscous anterior margin and a pair of longitudinal fuscous lateral fasciae and medial large dark ochraceous patch posteriorly. Ventral part of abdomen: sternite VII median fuscous spot, connected with transverse fuscous fasciae on posterior margin of the same sternite. Ovipositor, fuscous and toothed apically; ovipositor sheath fuscous, darker towards apex, and pilose.

Measurements (mm). Males (n=3). Body length 18.62 (17.90-19.20); abdomen length 10.62 (10.00-11.10); head width 5.33 (5.10-5.48); pronotum width 5.59 (5.30-5.88); mesonotum width 4.78 (4.44-5.10); tegmen length 24.27 (23.11-25.40); expanded tegmina 54.13 (52.10-56.40). Females (n=5). Body length 16.24 (15.40-17.30); abdomen length 7.85 (7.10-8.80); head width 5.51 (5.10-5.80); pronotum width 5.74 (5.20-6.00); mesonotum width 4.75 (4.40-5.20); tegmen length 24.66 (23.30-26.20); expanded tegmina 55.07 (51.80-58.20).

Distribution (Figure 7). Endemic to Sabah (Sayap, Mount Kinabalu and VJR Raffelsia, Tambunan).

***Puranoides schouteni*, sp. nov.**

(Figures 1f, 6a-f)

Puranoides sp. Azman and Zaidi 2004: 168, 175 (possibly new species).*Puranoides* cf *klossi* Schouten et al. 2004: 373, 378.

Type materials. – Holotype: male. ‘PENINSULAR MALAYSIA / JOHOR / TNER / Lubuk Tapah / 1-3.iv.2002 / CIS Group’ (UKM). – Paratypes: 25 males, 26 females. JOHOR, Bekuk, TN Endau Rompin, Selai, 24-26.ii.2006, Azman & Badrol, male, female (UKM); Endau Rompin N.P., Janing Ridge, 20 min, 02°31’19”N/ 103°23’59”E, at light, 27.iii.2001, primary lowland rainforest, Transect primary 4, M.A. Schouten, A. Majanil & M. reinganathan, male, (ZMAN); same data except, Transect primary 8, M.A. Schouten, 2 males, (ZMAN); Endau Rompin N.P., Janing Ridge, 5 min, 02°31’33”N/ 103°24’03”E, at light, Disturbed forest, Transect disturbed 1, 21.ii.2001, M.A. Schouten, male, (ZMAN); same data except, 25.iii.2001, male, (ZMAN); Endau Rompin N.P., Janing Ridge, Junction Logging rd/ Access rd, 02°31’35”N/ 103°23’58”E, at light, 18.iv.2001, forest edge, Transect edge 9, M.A. Schouten, male, (ZMAN); No label, no date, 2 males, (ZMAN); Taman Negara Endau Rompin, Lubuk Tapah, 1-3.iv.2002, 5 female, (UKM); same data except, 10.v.2002, 2 males, female, (UKM); 5.v.2002, 2 males, 5 females, (UKM); 6.v.2002, male, 3 females, (UKM); 9.v.2002, male, female, (UKM); 12-15.vi.2002, 7 males, 8 females, (UKM); 25-28.vii.2002, male, female, (UKM); PAHANG, Taman Negeri Endau Rompin, 17-20.vi.2002, Azman, Shahmi, Saiful, Badrul, male, female, (UKM); same data except, 4.iii.2003, Zaidi, Azman, Badrul, male, (UKM).

Holotype and paratype specimens are deposited in the depository as mentioned in the list of type materials examined.

Etymology. The species is named after Dr. Marieke A. Schouten, a colleague from Nederlands Centrum voor Biodiversiteit (NBC-Naturalis), for her contributions as a cicada researcher and collector for the first batch of specimens.

Diagnosis. This species is almost similar to *Puranoides jaafari* but can be distinguished by the following characters: a pair of median longitudinal fasciae on pronotum is very thin, not reaching anterior margin, and not fused with a pair of median markings behind ocelli; less prominent or indistinct markings on the dorsal part of abdomen, not as blackish markings as *P. jaafari*; infuscations on tegmina are more prominent with distinct infuscation on apices of longitudinal veins to first, second, third and fourth apical cells; and all markings on head and thorax area thinner than *P. jaafari* (Schouten et al. 2004; Azman & Zaidi 2004).

Description of male. Head, thorax and abdomen (Figures 1f, 6a), with greenish to greenish ochraceous ground colour for life specimens, greenish ochraceous to ochraceous for old specimens. Markings on head and thorax blackish to black. Ratio of body length to pronotum width about 3.57 (3.21–3.76).

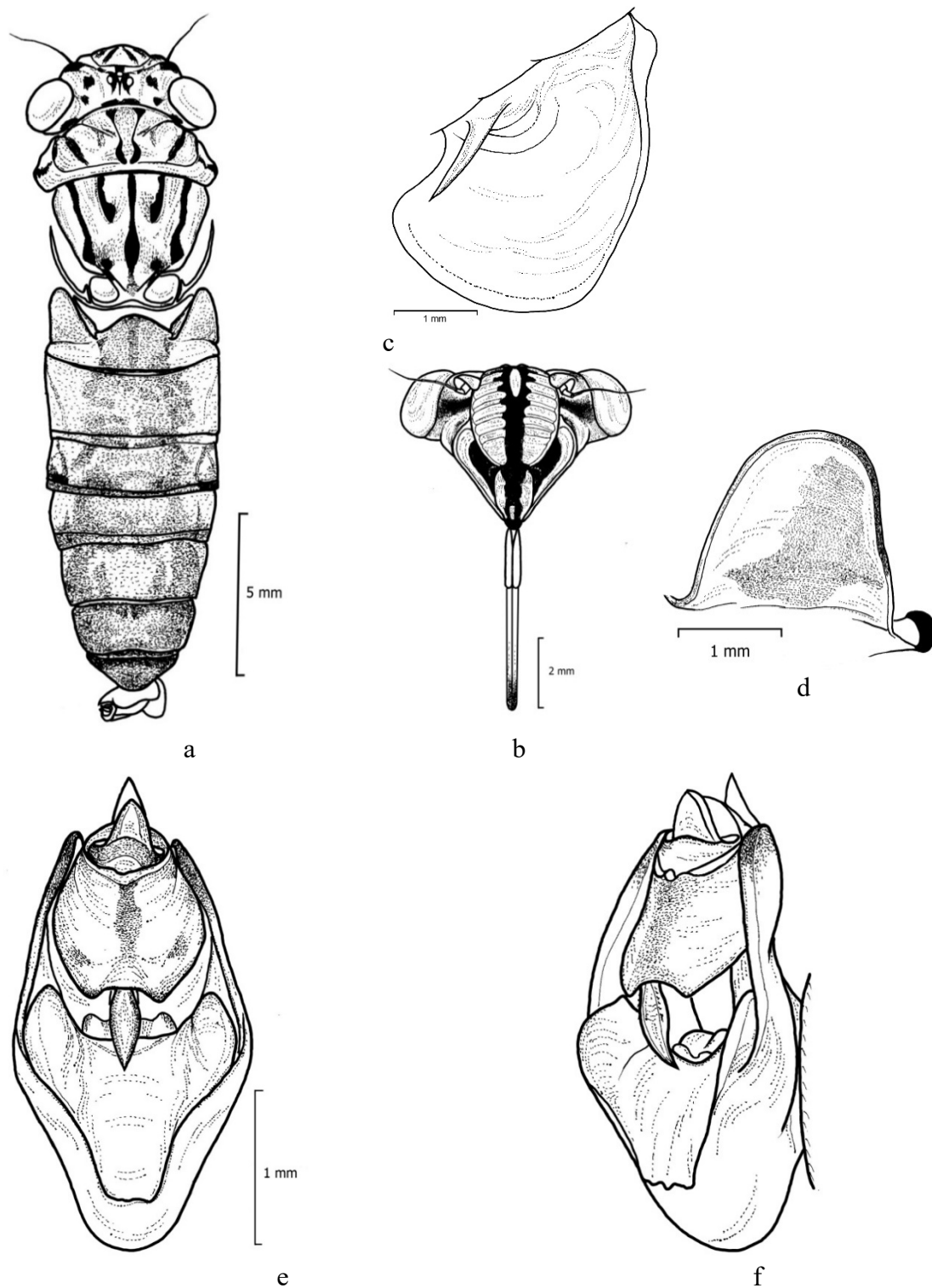


Figure 6. *Puranoides schouteni* sp. nov., male, holotype, Lubuk Tapah, Johor. a, body from dorsal view; b, head from anteroventral view; c, left operculum from lateroventral view; d, right tymbal cover from dorsolateral view; e, pygofer from posteroventral view; f, pygofer from lateroventral view

Head slightly wider than pronotum and mesonotum, with ratio about 1.03 (1.01–1.05) and 1.17 (1.14–1.23), respectively. Dorsal part, with the following black markings: median marking in front of middle ocelli with its anterior end reaching frontoclypeal suture; a pair of median spots on ocular tubercle between epicranial suture and lateral ocelli; a pair of bigger spots on anterior angle of vertex; a pair of spots on the centre of vertex; a pair of spots behind the eyes; a pair of small spots on the vertex, behind the central spots; and a pair of fused transverse fasciae on posterior margin of head. Postclypeus swollen and anterioventral part of head (Figure 6b), with black markings as follow: median longitudinal fasciae on postclypeus enclosing greenish ochraceous spot anteriorly, bifurcates forming five pairs of fasciae along transverse groove, with the second and third pairs extending to lateral margin of postclypeus, while the fourth and fifth pairs gradually shortened, and posterior end bifurcates to reach posterior margin. Anteclypeus with a broad median longitudinal fasciae enclosing an ochraceous tiny spot at about one-fourth of the tip, extending to posterior and anterior margin, fused with median fasciae of postclypeus anteriorly. Gena with black transverse fascia between postclypeus and eye but not extending to the margin of eye. Lorum black about one-third of inner part. Rostrum black apically; short, just reaching but not passing the hind coxae.

Thorax (Figures 1f, 6a). Pronotum, with the following black markings: a pair of very thin median longitudinal fasciae, oblique and broadened anteriorly, not reaching anterior margin, broadened and closed posteriorly; a pair of short oblique branches from middle of median longitudinal fasciae, along paramedian fissures; a pair of obliquely longitudinal fasciae along lateral fissures, extending to ambient fissures; and a pair of lateral spots behind the eyes. Pronotal collar with a narrow transverse fasciae along posterior margin; a pair of spots at lateral angles, combined with spots behind the eyes, extending to lateral margin of lateral angle.

Mesonotum, with the following black markings: a median longitudinal fascia, broadened posteriorly to reach anterior margin of cruciform elevation; a pair of paramedian fasciae inwardly curved, along parapsidal sutures; a pair of longitudinal fasciae on lateral sigilla; and a pair of roundish spots enclosing scutal depressions. Legs greenish ochraceous to ochraceous with black spots at the bases of fore coxae; fore, middle and hind tarsus, fuscous at one-fourth of apical parts.

Tegmina and wings (Figures 1f, 2f) hyaline with greyish basal membranes. Tegmina with vein R + Sc greenish for fresh specimens, and become ochraceous to reddish ochraceous; venation ochraceous; basal cell longer than broad; transverse veins at the bases of second and third apical cells, distinctly infuscated; apices of longitudinal veins to first, second and third apical cells, infuscated, and indistinct at fourth vein; apical area of first apical cell, median area of second to sixth apical cell, area of tegmen apex to about half of marginal area, with pale brownish tinge or sometimes indistinct. Wings with fuscous venation.

Operculum (Figure 6c) greenish ochraceous to ochraceous without any blackish marks; longer than broad with the apical part reaching the base of second abdominal sternite; distal part weakly convex. Medial margin concave with semicircular distomedial corner, distomedial margin convex, distomedial corner rounded, and distal margin slightly convex. Abdomen (Figure 6a) about 1.43 (1.25– 1.53) times longer than the length of head and thorax combined; with narrowly dark ochraceous posterior margin on each tergite; medial longitudinal broad dark ochraceous markings; a pair of dark ochraceous submarginal spots at posterior margin of tergite 2, 3 and 4; a pair of irregular blackish marginal spots on tergite 2 and 4. Tergites 3 and 4 each with a pair of dark ochraceous paramedian short transverse fasciae on posterior margin. Tergite 5 and 6 with a pair of almost lateral roundish dark ochraceous spots near posterior margin.

Tergite 7 and 8 each with a transverse irregular dark ochraceous to fuscous patch anteriorly. Tymbal cover (Figure 6d) greenish to greenish ochraceous, almost as broad as long, with outer corner more angulated than inner corner; fuscous fascia on lateral margin to outer corner; and almost half of surface area dark ochraceous laterally. Ventral part of abdomen: with dark ochraceous posterior margin of sternite II–VI, darker on sternite VII; indistinct medial longitudinal fuscous fascia of sternite VIII; and a pair of paramedian fuscous to blackish spots on sternite III.

Male genitalia (Figures 6e, f): Pygofer, greenish-ochraceous to ochraceous, darker at upper lobe area; length include dorsal beak as twice as width about 2.03x; considerably narrowed posteriorly and rounded anteriorly. Pygofer basal lobe absent, secondary basal lobe semicircular and well separated from lateral margin; pygofer upper lobe, small with semicircular marginal part. Dorsal beak, long, slender and pointed apically, with the tip passing the apex of anal styles. Anal styles projected towards posteroventral. Uncus simple and wide; uncus lobes, broad and short, slightly tapering towards anterior, with distal margin strongly curved, forming a pair of blunt bicuspid apex in ventral view. Aedeagus, short, thin, broadened near apex and tapering with pointed apex.

Description of female. Ratio of body length to pronotum width about 2.76 (2.53–2.91). Markings on head, pronotum, mesonotum, legs, tegmina and wings, identical to male. Operculum triangular with colours and markings, identical to male; distal margin not reaching posterior margin of sternite II. Abdomen shorter than length of head and thorax combined. Dorsal part of abdomen with markings identical to male, but smaller in size, and paler in colour. Abdominal segment 9 ochraceous dorsally with dark ochraceous anterior margin and a pair of longitudinal dark ochraceous lateral fasciae and medial large dark ochraceous patch posteriorly. Ventral part of abdomen: sternite VII median dark ochraceous spot, connected with transverse dark ochraceous on posterior margin of the same sternite; median part of sternite VII strongly concave posteriorly. Ovipositor, fuscous and toothed apically. Ovipositor's sheath fuscous, darker towards apex, and pilose.

Measurements (mm). Males (n=4). Body length 20.21 (17.64-21.73); abdomen length 11.89 (9.79-12.86); head width 5.83 (5.53-6.06); pronotum width 5.67 (5.49-5.90); mesonotum width 4.99 (4.78-5.26); tegmen length 24.26 (23.52-24.71); expanded tegmina 54.18 (52.53-55.32). Females (n=4). Body length 15.44 (13.97-16.83); abdomen length 7.29 (6.26-8.27); head width 5.72 (5.45-5.86); pronotum width 5.60 (5.27-5.78); mesonotum width 4.78 (4.42-5.06); tegmen length 24.00 (23.22-24.06); expanded tegmina 53.60 (51.75-55.70).

Distribution (Figure 7). Peninsular Malaysia: endemic to Endau Rompin National Park, Johor and Endau Rompin State Park, Pahang.

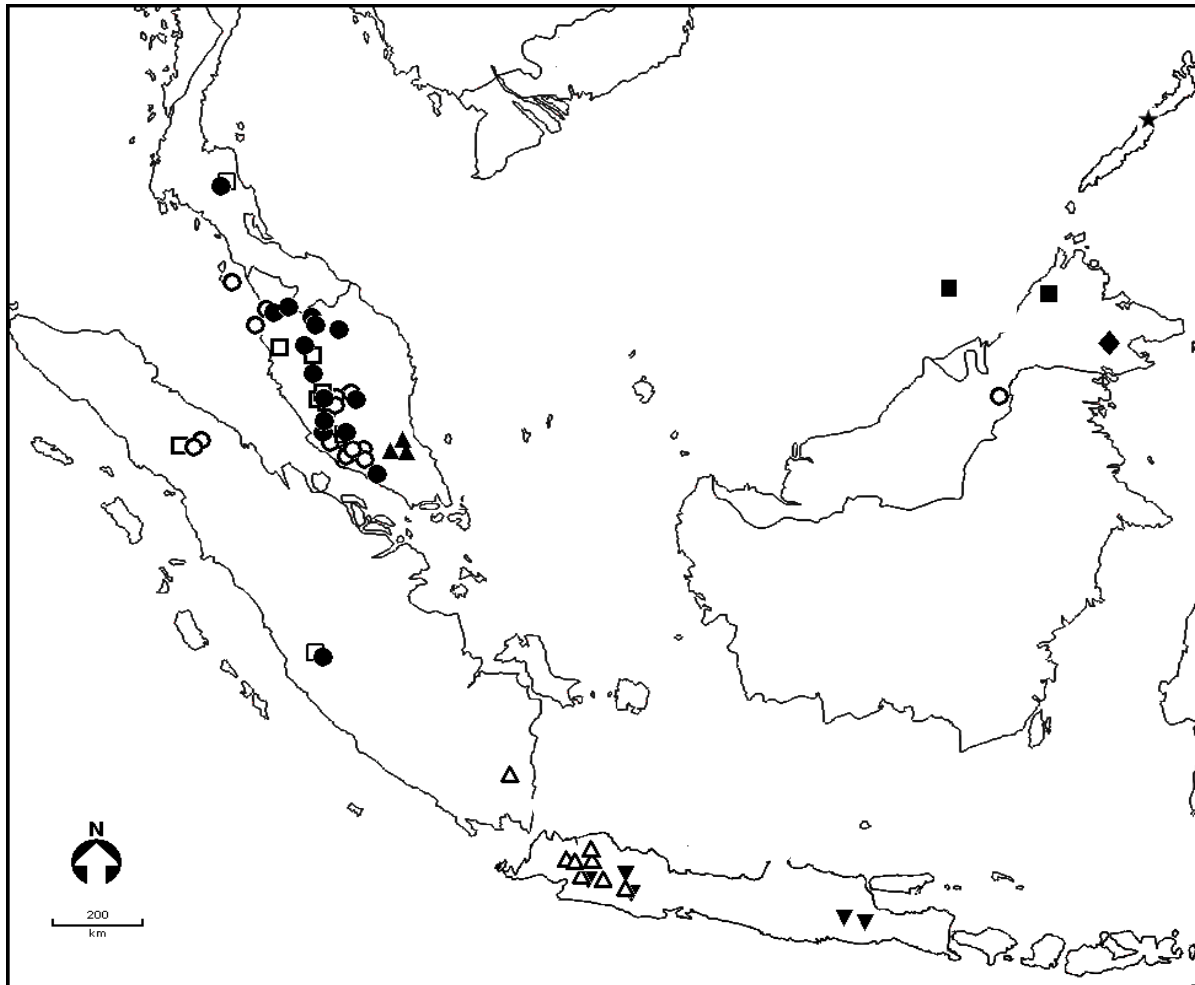


Figure 7. Distribution of *Puranoides* spp. In Sundaland. *P. klossi* (□); *P. sphinx* (△); *P. jaafari* (○); *P. abduhlahi* (●); *P. ismaili* sp.n. (■); *P. schouteni* sp.n. (▲)

CONCLUSION

In conclusion, the geographical distribution of the species of *Puranoides* is limited to Sundaland as shown in Figure 7. It shows that four out of the seven recorded species occur in Peninsular Malaysia. These were followed by Sumatra with three species, Java and Borneo (2), and Palawan Island with one species. Only three species occur in two or more areas namely *P. klossi*, the type species of the genus that originally described from Sumatra, but now also recorded from Peninsular Malaysia. *Puranoides abduhlahi* that firstly described from Peninsular Malaysia was also occurs in Sumatra as a new record, while *P. jaafari*, originally recorded from Peninsular Malaysia and Sarawak, also occur in Sumatra as a new record. The distribution for the other five species in Sundaland is restricted to a single area i.e. *P. sphinx* in Java, *P. geomansi* in Palawan Island, while *P. ismaili* sp. nov. only occurs in Sabah. This result shows that the occurrence of *Puranoides* in Sundaland was found to have a higher affinity with Peninsular Malaysia than Sumatra, Borneo and Java.

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also given to Dr. Rosichon, the Director of the Museum Zoologicum Bogoriense, Bogor, Indonesia and all the staffs.

AUTHORS DECLARATIONS

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics Declarations

No ethical issue is required for this research.

Data Availability Statement

My manuscript has no associated data.

Authors' Contributions

All by single author.

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