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**Autor:** New, T. R.

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## Notes on the complex of species allied to *Psococerastis taprobanes* (Hagen) (Psocoptera, Psocidae)

By T.R. New

Abstract: Thirty-two nominal taxa (22 Oriental, 3 African, 7 S. American) are included in the 'taprobanes-complex'. *P. taprobanes* is redescribed from Sri Lankan specimens, and illustrated. Comparative notes are given on *P. cosmopterus* (McLachlan) and *P. bengalensis* (Kolbe), and a new species (*P. rhondae*) is described from Bhutan. A female of *P. callanganus* Enderlein (Peru) is figured, and the integrity of the taxa in the complex briefly discussed. Figures of forewings of many species are given to facilitate diagnosis, and it is concluded that the nominal taxa should be provisionally retained as separate species.

Since HAGEN (1858) described '*Psocus*' *taprobanes* from Sri Lanka, a number of other 'species', 'forms' or 'varieties' allied to it have been raised. Most of these are from the Oriental region but a smaller number of Neotropical and African taxa are clearly referable to the same complex. These, characterised by strongly contrasted brown forewing markings forming a defined pattern of a transverse band and darkening of much of the apical region of the wing, are now placed in *Psococerastis* PEARMAN (1934). Differences between the taxa have been based largely on details of forewing pigmentation but, as the extent of individual variation is generally unknown and the earliest-described species has not been illustrated, interpretation of many of these is difficult. KOLBE (1883a) based his interpretations of *taprobanes* and *cosmopterus* (McLachlan (1866—later (McLACHLAN 1872) considered as a slight local modification of *taprobanes*) on specimens sent to him by McLachlan, and raised a third from (*bengalensis*) on forewing pigmentation and venational differences (in particular the form of the  $R_s$ -M fusion). Later (KOLBE, 1885) he raised the form *flavistigma*, differentiated from those earlier described by having a paler pterostigma. Differences in forewing pattern of the four forms indicated by KOLBE are in table p.236.

ENDERLEIN (1903) reassessed these four forms (treated as varieties of *taprobanes*) after examining Hagen's reputed types of *taprobanes*. He noted that cell  $R_5$  of the *taprobanes* types contained three hyaline spots, and illustrated forms purported to be *cosmopterus* and *bengalensis* — the

	taprobanes	cosmopterus	bengalensis	flavistigma
Cell R <sub>3</sub>	Three equally spaced hyaline spots	No hyaline spots	Two hyaline spots	Hyaline spots (♂: 1, ♀: 2)
Cell R <sub>5</sub>	Two obscure hyaline spots	No hyaline spots	One hyaline area	No hyaline spots
Basal transverse band	Narrow, anteriorly pointed	Broad behind, tapered anteriorly	Rather broad, not tapered anteriorly	Broad behind, tapered anteriorly

first published figures of any member of the group. More recently, allied species have been described from many parts of the Orient and elsewhere, and the following names are now available for members of the 'taprobanes-group': *bakeri* (Banks 1913, Philippines), *bengalensis* (Kolbe 1883a, North India) *capitatus* (Okamoto 1907, Japan), *cosmopterus* (McLachlan 1866, Malacca), *discalis* (Navas 1920, Tonkin), *ficcivorella* (Okamoto 1907, Japan), *flavistigma* (Kolbe 1885, Borneo), *grandis* (Okamoto 1907, Japan), *joannisi* (Navas 1934, China), *kurokiana* (Enderlein 1906, Japan), *lombokensis* (Navas, 1927, Indonesia), *luroris* Soehardjan and Hamann (1959, Indonesia), *luzonensis* (Banks 1916, Philippines), *murudensis* (Karny 1925, Sarawak), *nubila* (Enderlein 1906-Japan), *orientalis* (Navas 1931-China), *parasinensis* New (1975, Malaysia), *ryukyuensis* Tsutsumi (1964a, Japan), *sinensis* Thornton (1960, Hong Kong), *taprobanes* (Hagen 1858, Sri Lanka), *tokyoensis* (Enderlein 1906, Japan), *yuwan* Tsutsumi (1964b, Japan); Africa: *fuelleborni* (Enderlein 1902), *ghesquieri* Badonnel (1949), *thomasseti* Pearman (1934); S. America: *callanganus* (Enderlein 1900), *hageni* New (1972), *interrupta* New (1972), *opulentus* (Navas 1930), *pyralinus* (Kolbe 1883b), *paraguayensis* (Ribaga 1908), *sticticus* (Banks 1920). Thus, 32 described forms are referable to the complex, 22 of which are Oriental. With the exception of the African forms these are mainly inadequately known, and genitalic features of Oriental species have been described only for the four species described since 1960 (in their original descriptions) and a purported female of *bengalensis* (by NEW 1971). In some of the species for which both sexes are known, there is a tendency for the male forewing to be less heavily marked than that of the female, a feature which provides an additional complication in attempting to interpret earlier descriptions or figures of

specimens of unknown sex. It has not yet been possible to examine many of the described forms, but copies of forewing figures from many of original description are given here as a synoptic aid to their identification. These have been redrawn to a standard scale to emphasise differences in pigment distribution and small differences in venation have been ignored. The diagrams and other forewing depicted here indicate the difficulty of assessing the validity of these forms and show the superficial close similarity between species. (Figs.1–38).

The following brief description of *taprobanes* is based on specimens from Sri Lanka, in which the forewing corresponds closely to earlier interpretations. No other similar taxa have been recorded from Sri Lanka. Specimens tentatively referred to *bengalensis* and *cosmopterus* are also noted and a new species from Bhutan described. In addition an augmented description of the female of the Peruvian *callanganus* is given to indicate the close resemblance of extra-Oriental forms to the earliest-described members of the complex.

#### 1. *Psococerastis taprobanes* (Hagen 1858) (Figs. 11, 12, 39–44)

*Psocus taprobanes* HAGEN, 1858, Ver. zool. bot. Ges. Wien 8: 473.

*Psococerastis taprobanes* (Hagen), THORNTON, 1960, Trans. R. ent. Soc. Lond. 112: 250.

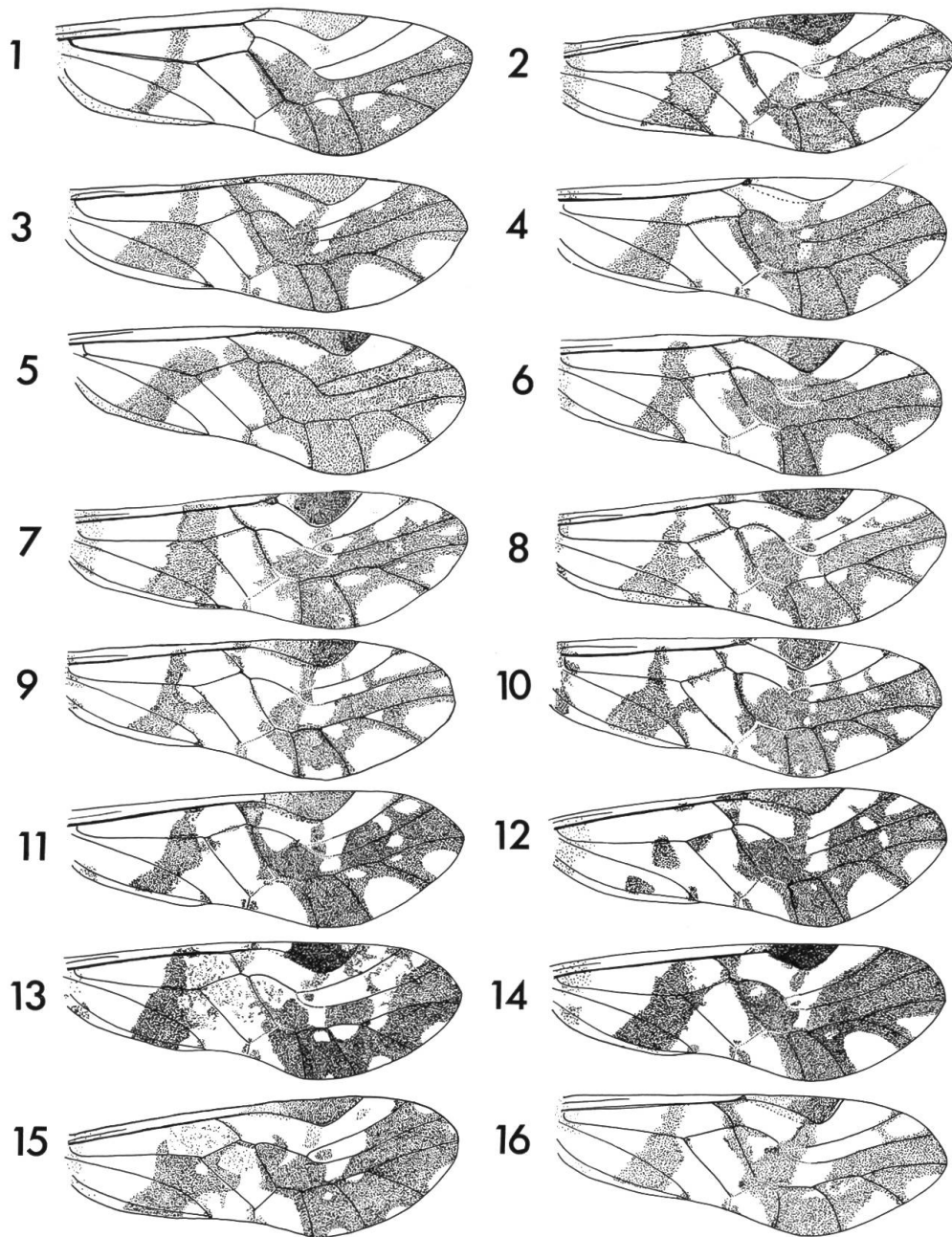
Female. Coloration dark brown: few markings discernible. Eyes black. Forewing marked with dark brown as in Fig. 11.

Morphology. Forewing as in Fig. 11. Subgenital plate (Fig. 39) with small narrow median lobe and anterior transverse sclerotised ridge. Gonapophyses (Fig. 40): dorsal valve relatively narrow; external valve tapered ventrally, with short posterior lobe. Epiproct (Fig. 41) broadly triangular. Paraproct (Fig. 41) with field of about 45 small trichobothria.

Dimensions: B 5.50, FW 7.90, HW 5.51,  $f_1$  1.820,  $f_2$  2.108,  $f_1/f_2$  0.863, hind leg missing.

Male. Coloration as female. Forewing markings as in Fig. 12.

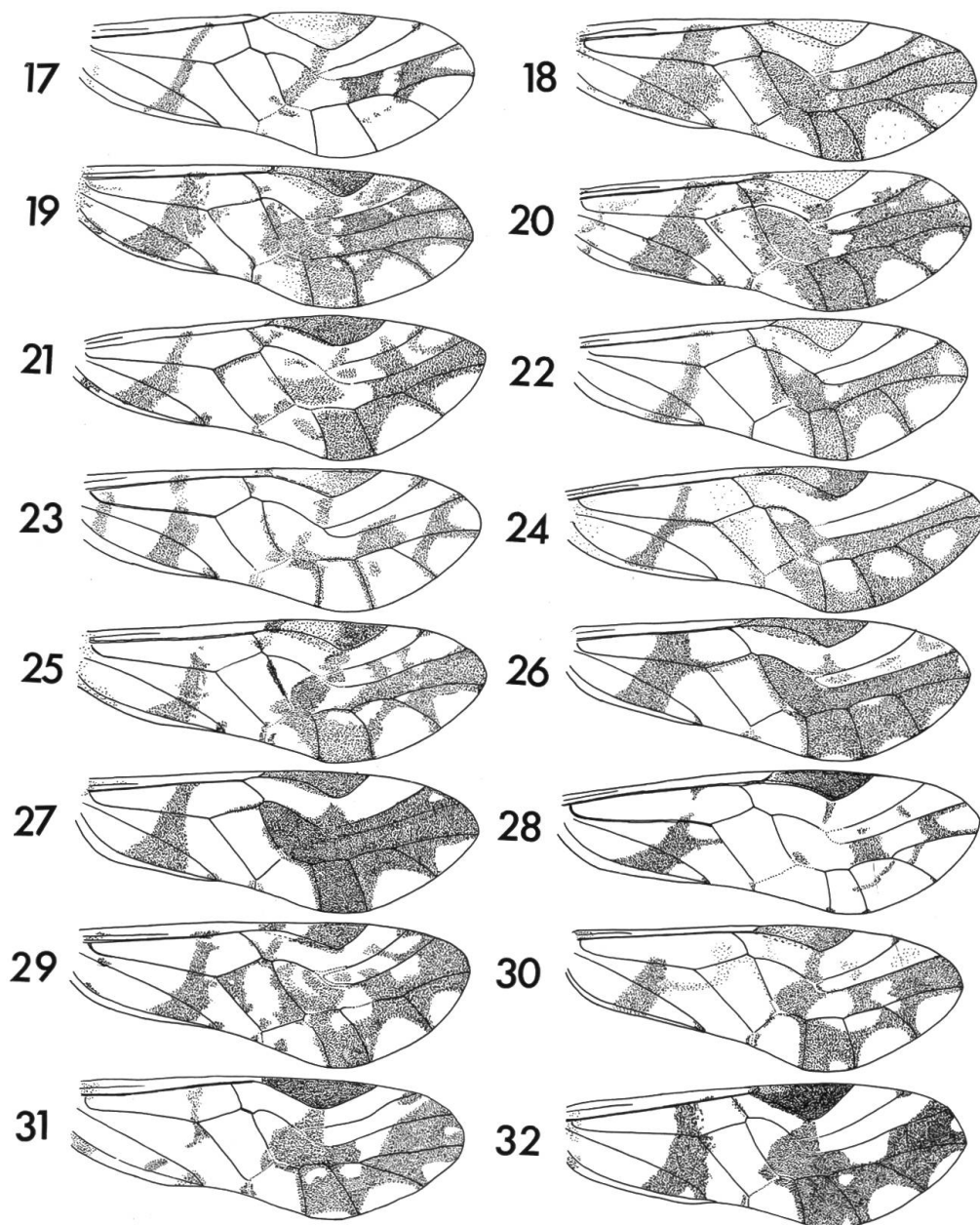
Morphology. Forewing as in Fig. 12. Hypandrium (Fig. 42) symmetrical, with broad membranous laterodorsal lobes and a posterior lobe bearing row of about six peg-like 'teeth' each side of midline. Phallosome (Fig. 43) tapered posteriorly, transverse anteriorly, with slight lateral flanges. Clunium (Fig. 44) expanded, with border heavily sclerotised. Epiproct (Fig. 44) truncated, with numerous short setae and anteriorly-extended lateral arms. Paraproct (Fig. 44) with narrow basal stem, short curved apical spine and a field of about 40 small trichobothria. Hind tarsal segments with 24 and 5 ctenidia.



Figs. 1–16. Schematic representation of forewings of members of the '*Psococerastis taprobanes* group', to show differences in pigmentation. These, and Figs. 17–35 are, unless stated, copied from original descriptions but changed slightly to fit a similar size scheme and to emphasise pattern distribution: not to scale. — 1, *nubila* (Enderlein); 2, *opulentus* (Navás); 3, *lombokensis* (Navás); 4, *flavistigma* (Kolbe) (reconstruction from unillustrated description and based partially on a damaged, supposed specimen of this taxon); 5, *cosmopterus* (McLachlan), sensu ENDERLEIN 1903; 6, *hageni* New; 7, *interrupta* New; 8, *thomasseti* Pearman; 9, *fuelleborni* (Enderlein); 10, *ghesquieri* Badonnel; 11, *taprobanes* (Hagen), ♀; 12, *taprobanes* (Hagen), ♂; 13, ? *bengalensis* (Kolbe), ♀; 14, ? *cosmopterus* (McLachlan), ♂ (all from specimens — see text); 15, *bengalensis* (Kolbe) sensu Enderlein 1903; 16, *yuwan* Tsutsumi.

Dimensions: B 5.20, FW 6.42. HW 4.65,  $f_1$  1.964,  $f_2$  2.108,  $f_1/f_2$  0.932, F 1.410, T 2.805,  $t_1$  0.705,  $t_2$  0.300,  $t_1/t_2$  2.350.

Material examined. 1 ♂, 1 ♀: CEYLON, Green, ex McLachlan



Figs. 17–32. Forewing representations of: 17, *joannisi* (Navás); 18, *parasinensis* New; 19, *sinensis* Thornton; 20, *luroris* Soehardjan and Hamann; 21, *ficivorella* (Okamoto); 22, *tokyoensis* (Enderlein); 23, *kurokiana* (Enderlein); 24, *grandis* (Okamoto); 25, *ryukyuensis* Tsutsumi; 26, *luzonensis* (Banks); 27, *bakeri* (Banks); *murudensis* (Karny); 29, *capitatus* (Okamoto); 30, *discalis* (Navás); 31, *callanganus* (Enderlein); 32, *callanganus* ♀, specimen from Peru.

Coll. and determined by McLachlan as '*Psocus taprobanes* Hagen'. (in BMNH).

As noted above, these specimens correspond to earlier concepts of the species and there is little doubt that they are referable to *taprobanes* s.str. It is, then, possible to attempt comparative assessment of other, later-described, taxa.

## 2. *Psococerastis* ? *cosmopterus* (McLachlan 1866). (Fig. 14).

*Psocus cosmopterus* MCLACHLAN, 1866, Trans. ent. Soc. Lond. (3) 5: 350.

*P. taprobanes* var *cosmopterus* (McLachlan), MCLACHLAN 1872, Ent. mon. Mag. 9: 76.

A male from Thailand (Bangkok) (in BMNH) apparently referable to this species has been examined; and the forewing of this specimen is shown in Fig. 14. Genitalia are very similar to those of *taprobanes* except (1) hypandrium with posterior tooth rows not as pronounced, (2) phallosome with lateral flanges scarcely evident and (3) clunial expansion slightly deeper, with apical lateral borders scarcely expanded, resulting in epiproct having a smaller portion projecting beyond clunium.

Dimensions. B 3.80, FW 4.65, HW 3.35,  $f_1$  1.485,  $f_2$  1.724,  $f_1/f_2$  0.861, F 1.050, T 1.980, hind tarsus missing.

This specimen differs from that of *cosmopterus* figured by Enderlein (Fig. 35) in that cells  $R_3$  and  $R_5$  do have small hyaline areas: however cell  $M_3$  is wholly dark and cells  $M_1$  and  $M_2$  both have large marginal lunules. The specimen is clearly most similar to *cosmopterus*. *P. bakeri* (Fig. 27) also has the radial cells and cell  $M_3$  almost wholly dark, but the transverse band is narrower.

## 3. *Psococerastis* ? *bengalensis* (Kolbe 1883) (Figs. 13, 45)

*Psocus taprobanes* var *bengalensis* KOLBE, 1883, Ent. Nachrbl. 9: 153.

A single female closely similar to this form (MALAYA, Kuala Lumpur, 13.7.1929, H.M. Pendlebury, in BMNH) has been examined. Forewing as in Fig. 13. Genitalia are closely similar to those of *taprobanes* except for the subgenital plate (Fig. 45) having the apical lobe rather broader and the anterior sclerotised bar more pronounced.

Dimensions: B 4.20, FW 4.55, HW 3.26,  $f_1$  1.437,  $f_2$  1.533,  $f_1/f_2$  0.937, F 0.930, T 1.785,  $t_1$  0.435,  $t_2$  0.195,  $t_1/t_2$  2.231, ct 21.2.

Genitalia differ from a female earlier referred to '*bengalensis*' by NEW (1971) which on wing characters is intermediate between the specimens here designated as *bengalensis* and '*cosmopterus*': it may represent an undescribed form but, in the absence of a male and of

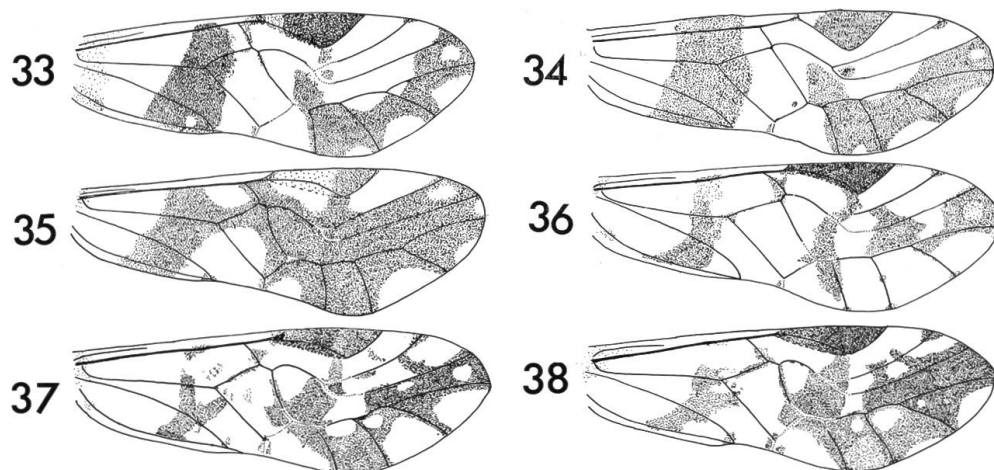
examination of type material of *bengalensis* it is preferable not to name it at present.

The present specimen differs somewhat from Enderlein's figure (Fig. 15) but shares with that specimen the diffuse nature of the anterior region of the transverse band, and its considerable intrusion into the basal region of the discoidal cell. As with the specimen referred to *cosmopterus* below, there are slight differences from earlier concepts of the species but it is clearly far more similar to *bengalensis* than to any other described taxon.

#### 4. *Psococerastis rhondae* sp. nov. (Figs. 36–38, 46–50)

Female. Coloration. Brown. Eyes black. Antennae basally pale brown; apex of  $f_1$  and whole of remainder of flagellum dark brown. Vertex strongly marked with 7 lines of elongate dark brown spots, the 2 inner lines being more or less coalescent to form broad 'X' mark across vertex, and additional spots behind the eyes. Genae dark brown. Frons with dark 'V' in central region and lateral regions darkened to form parts of anterior arms of 'X' on vertex. Postclypeus with about 7 narrow dark brown striae each side of midline. Anteclypeus and labrum dark brown. Apical 2 segments of maxillary palp dark brown.

Thorax predominantly dark brown; a broad pale sinuous band across mesonotum; pleura dark. Legs with coxae dark brown, femora pale except for apical darkening, tibiae darker, apex of  $t_1$  and whole of  $t_2$  dark brown. Forewing with pale to mid brown markings as in Figs 37,

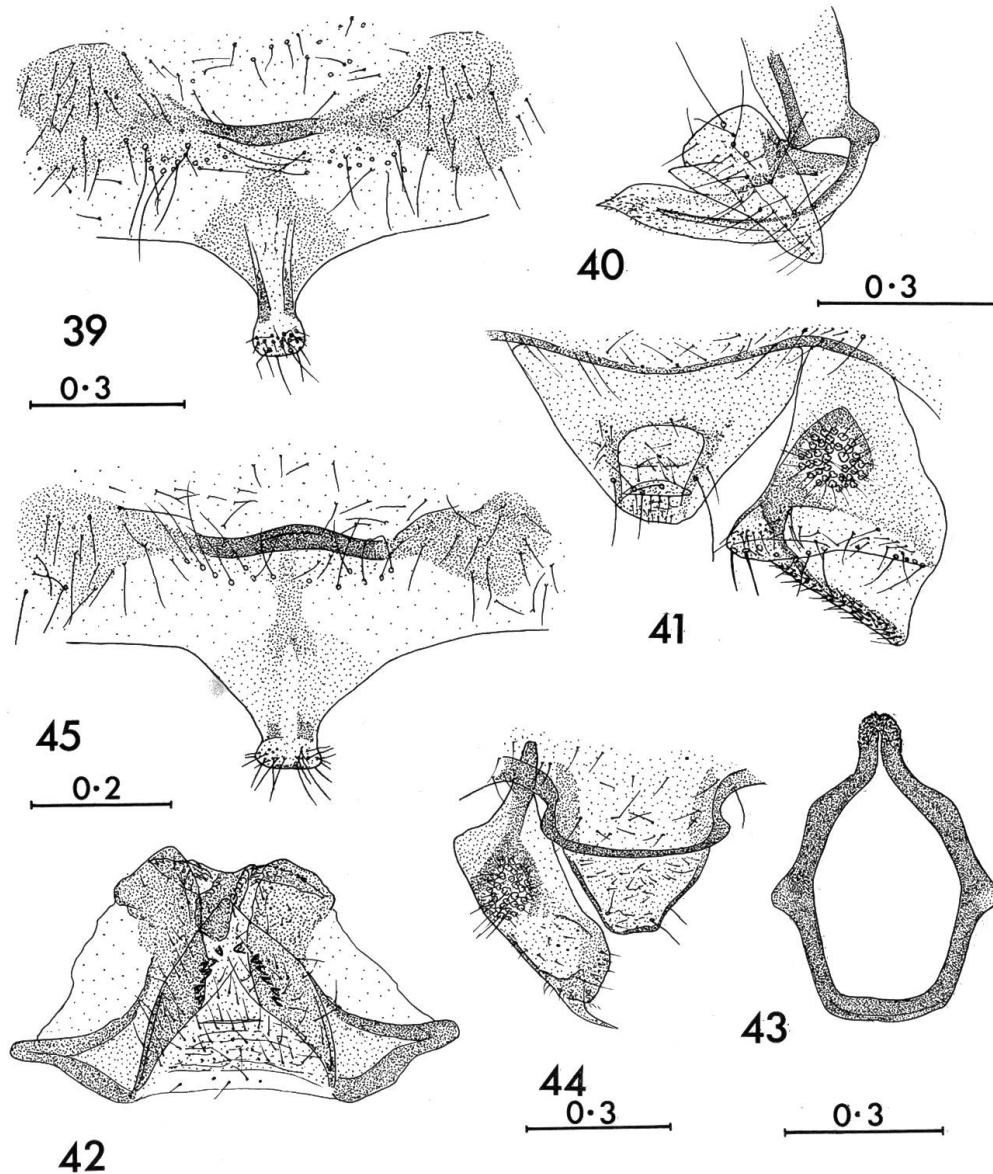


Figs. 33–38. Forewing representations of : 33, *callanganus*, ♀, specimen from Brazil (see text); 34, *pyralinus* 'var' *paraguayensis* (Ribaga); 35, *sticticus* (Banks); *Psococerastis rhondae* sp. nov: forewing of (36) male and (37, 38) females.



38; pterostigma pinkish brown, darker brown in distal half. Hindwing hyaline. Abdomen with granular dark brown pigment dorsally.

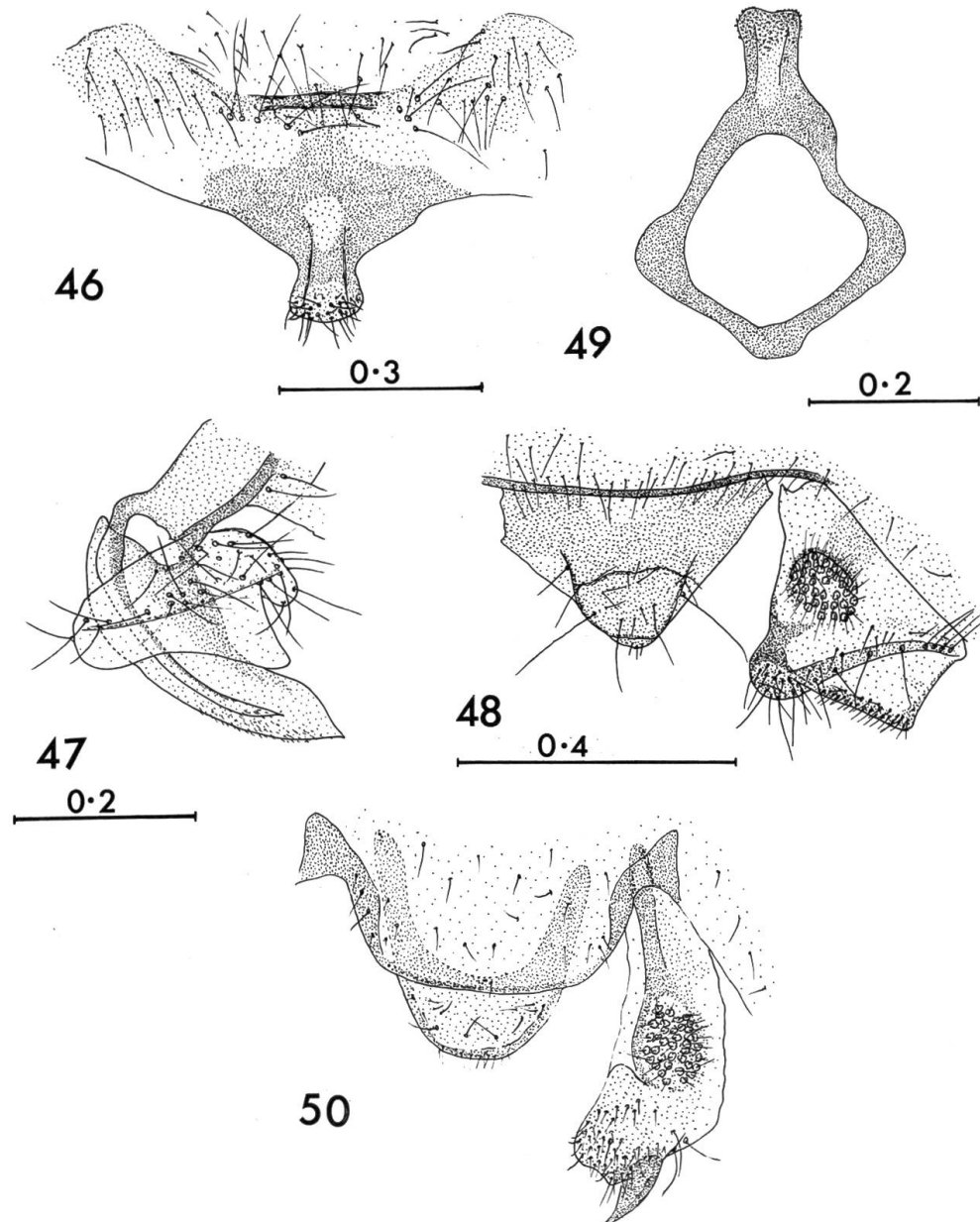
Morphology. Forewing as in Figs. 37, 38. Subgenital plate (Fig. 46) with short broad median lobe; a broad posterior sclerotised region and a central anterior transverse ridge linking lateral sclerotised areas. Gonapophyses (Fig. 47): external valve with short broad posterior lobe. Epiproct (Fig. 48) triangular with setae on inset apical lobe. Paraproct



Figs. 39–45. 39–44, *Psococerastis taprobanes*: 39, subgenital plate; 40, gonapophyses; 41, female epiproct and paraproct; 42, hypandrium; 43, phallosome; 44, male clunium, epiproct and paraproct. 45 *P. bengalensis*, subgenital plate. (Scales in mm; 40, 41 to same scale; 42, 43 to same scale).

(Fig. 48) with field of about 40 trichobothria. Hind tarsal segments with 24 or 25 and 4–7 ctenidia.

Dimensions. B 5.65, FW 5.98–6.61, HW 4.22–4.60,  $f_1$  1.620–1.916,  $f_2$  1.916–1.950,  $f_1/f_2$  0.831–1.000, F 1.050–1.290, T 1.985–2.640,  $t_1$  0.555–0.690,  $t_2$  0.240–0.360,  $t_1/t_2$  1.917–2.412.



Figs. 46–50. *Psococerastis rhondae* sp. nov.: 46, subgenital plate; 47, gonapophyses; 48, female epiproct and paraproct, 49, phallosome; 50, male clunium, epiproct and paraproct (Scales in mm; 49, 50 to same scale).

Male. As female, but rather paler. Vertex buff with dark markings indistinct; genae only slightly darkened. Thorax dorsally pale. Forewing marked with brown as in Fig. 36.

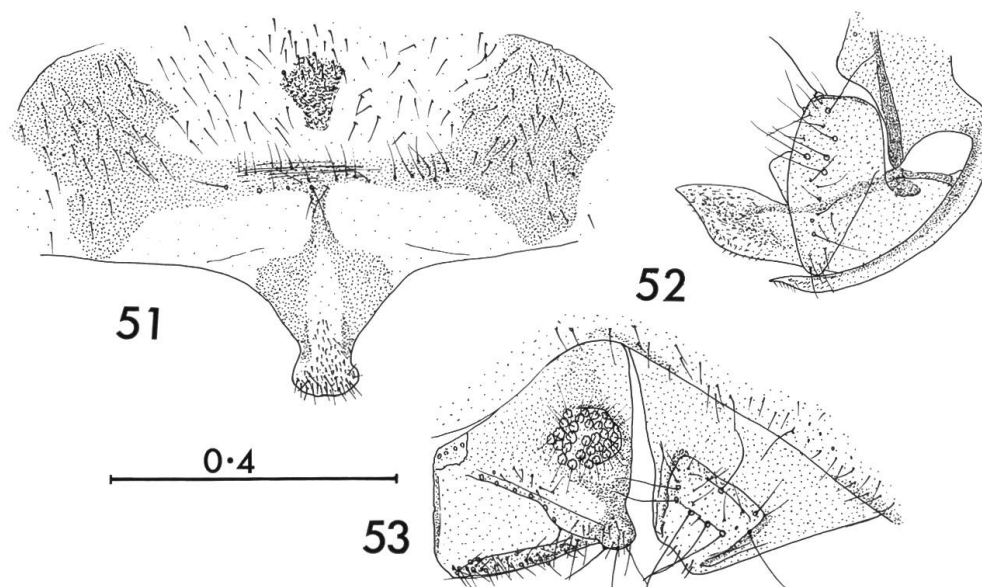
Morphology. Forewing as in Fig. 36. Hypandrium symmetrical, very similar to that of *taprobanes* (Fig. 42) except posterior tooth rows not evident. Phallosome (Fig. 49) with elongate spiculate apex; very broad across central region, with lateral flanges and anteriorly tapered. Clunium (Fig. 50) extended and broadly rounded, with strongly sclerotised laterobasal areas. Epiproct (Fig. 50) simple, rounded, with row of short preapical setae, scattered longer setae and lateral arms strongly produced anteriorly. Paraproct (Fig. 50) elongate, with narrow basal stem, short broad apical spine, and a field of about 38 trichobothria. Hind tarsal segments with 25 and 4 ctenidia.

Dimensions. B 4.35, FW 4.89, HW 3.54,  $f_1$  1.425,  $t_2$  1.560,  $f_1/f_2$  0.913, F 0.960, T 1.905,  $t_1$  0.655,  $t_2$  0.225,  $t_1/t_2$  2.911.

Holotype, ♀ BHUTAN, 21 km O Wangdi Phodrang, 1700–2000 m, 15.6.1972. Naturhistorisches Museum Basel.

Paratypes, 1 ♂, data as holotype; 1 ♀, same locality but 25.6.1972; 1 ♀ Bhutan, Thimpu river 29.4.1972. Naturhistorisches Museum, Basel.

This species is named for Mrs Rhonda McLauchlan, in gratitude for her careful secretarial assistance over several years. Forewings of the



Figs. 51–53. *Psococerastis callanganus* (Enderlein), ♀: 51, subgenital plate; 52, gonapophyses; 53, epiproct and paraproct (Scale in mm, to same scale).

three specimens illustrated here are shown also in NEW (1978), where they were considered to represent separate forms of the complex. However, despite differences in wing pattern and sexual differences in body pigmentation, it appears likely that only one species is represented.

Although, as indicated above, the genitalia of many of the complex are not known, this species differs in forewing features, from descriptions of all described forms and genitalia of both sexes differ from those known in other species. In particular the form of the male clunium and phallosome frame appear to be distinctive: the clunium is most similar to that of *ryukyuensis*, but the phallosome differs considerably in its more elongate apex and very broad mid-region. The forewing markings of *rhondae* most resemble that of *thomasetti* and *fuelleborni*, but both these African species differ clearly on genital features.

5. *Psococerastis callanganus* (Enderlein 1900) comb.nov. (Figs.32, 51–53).

*Neopsocus callanganus* ENDERLEIN, 1900, Zool. Jb. Abt. Syst. 14: 147.

*Psocus callanganus* (Enderlein), ENDERLEIN, 1925, Konowia 4: 100.

*Psocidus callanganus* (Enderlein), SMITHERS, 1967. Aust. Zool. 14: 107.

Female. Coloration as in original description. Forewing marked with dark brown as in Fig.32.

Morphology. Forewing as in Fig.32. Subgenital plate (Fig.51) broad, with lateral patches of anterior sclerotised region linked by narrow transverse sclerotised band which is slightly thickened near midline; a small median sclerotised patch anterior to this band. Gonapophyses (Fig.52): external valve tapered ventrally and with small posterior lobe. Epiproct (Fig.53) trapezoidal, with short preapical setae and longer setae on central region. Paraproct (Fig.53) with field of about 34 trichobothria. Hind tarsal segments with 19 and 5 ctenidia.

Dimensions. B 3.85, FW 4.60, HW 3.07,  $f_1$  1.110,  $f_2$  1.320,  $f_1/f_2$  0.841, F 0.900, T 1.710,  $t_1$  0.405,  $t_2$  0.195,  $t_1/t_2$  2.077.

Material examined. 1 ♀, PERU, Callanga, ex McLachlan Coll., bearing label '*Neopsocus callanganus* End. det. D.E.Kimmins', in BMNH.

A second female (BRAZIL, Itaituba, ex McLachlan Coll., in BMNH) has the forewing pattern (Fig.33) rather different from the above specimen: the transverse band is more pronounced and pigment is less extreme in the region of cell  $R_5$  near the radial fork. However, genitalia of the two specimens are identical and the Brazilian specimen is consequently referred to *callanganus*. The forewing of the Callanga

female has the transverse band more evident than the specimen depicted by Enderlein (Fig. 31): this could be a sexual difference.

No Oriental species are known to possess a subgenital plate with the anterior sclerotised patch.

The above notes and figures enable some interpretation of the value of genitalic features in the group. In males there appear to be specific characters in the shape of the phallosome, details of ornamentation of the hypandrium, the extent of expansion of the clunium, and the shape of the paraproct. Females appear to show specific differences the subgenital plate (details of the sclerotisation pattern and shape of the apical lobe) and the shape of the gonapophyses, especially of the external valve.

Currently, much of the basis for maintenance of many of the taxa as distinct species rests on geographical separation, but it now appears that (in addition) a range of genitalic features (that is, of specific characters) occurs in the Oriental members of the group. It appears wise to retain as distinct species all named forms, as no firm synonymy has been established — including all those conventionally treated as varieties or synonyms of *taprobanes* and of *tokyoensis*. Several of the former are now shown (if tentative identifications given above are correct) to differ in genitalic features, and the Japanese species described by Enderlein and Okamoto have not yet been examined in detail. As determination must be based to some extent on genitalic information, a key to species is premature. The forewing figures given above indicate possible differences between closely related species, but the extent of sexual/individual variation has not been established for most of the taxa. However, it appears that the form of the transverse band, although lighter in some males than in some females (*taprobanes*, *sinensis*, *rhondae* — Figs. 11, 12, 19, 36–38, respectively), has some taxonomic significance. The gross intensity of pigment may also be useful. There appears to be a range of forms from very lightly marked species (*joannisi*, *kurokiana*, *murudensis* — Figs. 17, 23, 28) to those in which cell  $R_5$  and all medial cells are predominantly dark (*bengalensis*, *luzonensis* — Figs. 13, 26).

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Author's address:

Dr. T. R. New  
Zoology Department, La Trobe University  
Bundoora, Victoria 3083, Australia