# THE PSYCHODIDAE OF BATU CAVES, MALAYA $(Diptera)^1$

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#### ABSTRACT

Twenty-two species of psychodid flies were taken in Batu Caves, near Kuala Lumpur, Malaya during an ecological study in 1959-60 by the U. S. Army Medical Research Unit. The species belong to six genera in three subfamilies as follows: Trichomyinae-Sycorax, 1 n. sp.; *Trichomyia*, 2 n. spp.; Phlebotominae-Phlebotomus, 4 spp.; Psychodinae-Telmatoscopus, 3 spp. (2 new); *Brunettia*, 1 sp.; *Psychoda*, 11 spp. (3 new). The most abundant species were *Telmatoscopus albipunctatus* (Williston), *Psychoda malayica*, n. sp., and *P. lutea*, n. sp. This is the first record of *Sycorax* in the Oriental Region.

Batu Caves, located in a great limestone bluff northeast of Kuala Lumpur, Malaya, has attracted a number of naturalists interested in biospeleology and several studies have been made of the fauna. The latest and most intensive is that of the U. S. Army Medical Research Unit, Kuala Lumpur, under the direction of H. E. McClure. Over a two year period extensive collections were made in the caves. The invertebrate specimens were sorted at Bishop Museum and loaned to various specialists for their identifications. A series of papers is planned to describe the new species and make the names available for the final report.

This paper treats the psychodid flies taken in Batu Caves. Descriptions and illustrations are given of the new species and keys provided. Primary types are deposited in Bishop Museum (BISHOP); paratypes will be sent to the U. S. National Museum, Washington, D. C. (USNM); the California Academy of Sciences, San Francisco, (CAS); and the British Museum (Natural History), London (BMNH).

A detailed analysis of the Batu Caves fauna will be published at a later date by Dr. McClure. For this paper it is sufficient to point out that many of the psychodids taken in the caves are represented by only a few specimens and are probably there merely by accident ("accidental trogloxenes"). Three species, *Telmatoscopus albipunctatus*, *Psychoda malayica* and *P. lutea*, were extremely abundant during certain seasons, larvae of at least the first were found, and all three undoubtedly passed their complete life cycle in the cave. *T. albipunctatus* is a widely distributed tropicopolitan species and breeds under a wide variety of conditions; the other two probably will be found to occur elsewhere than Batu

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Caves. The three species, then, may be classified as "troglophiles," those which complete their life cycles in the cave but may also be found outside.

## KEY TO PSYCHODIDAE GENERA IN BATU CAVES

1.	Eyes hemispherical, not extended towards midline above antennae2
	Eyes with definite bridges, extensions 2 to 5 facets wide above antennae 4
2.	Wing with 1 vein between radial and medial forks; palpus 3- or 4-segmented; pro-
	boscis not fitted for bloodsucking
	Wing with 2 veins between radial and medial forks; palpus 5-segmented; proboscis
	long, slender and ♀ fitted for bloodsucking; yellowish, narrow-winged, long-leg-
	ged species Phlebotomus
3.	Scape very small, much smaller than pedicel; antennal segment 3 one and one-
	half times length of 4; Cu very short, not attaining wing margin, ending far be-
	fore level of medial fork Sycorax
	Scape as large as or larger than pedicel; antennal segment 3 subequal to 4; Cu
	long, attaining margin ending near or beyond level of medial fork Trichomyia
4.	Vertex (anterior surface of head above eyes) on midline much longer than width
	of eye bridge; palpal segment 2 about $2 \times$ length of 1; labellum bulbous api-
	cally; terminal antennal segments not reduced 5
	Vertex shorter than width of eye bridge; palpal segment 2 subequal to 1; labellum
	flattened apically; antennal segments beyond 13 reduced and much smaller than
	preceding flagellar segments Psychoda
5.	Palpal segment 2 about $2 \times$ length of 1, palpus about as long as head height; as-
	coids forked or many on each segment (figs. 4c, 5a); tenacula of $\mathcal{F}$ surstyle
	without bell-shaped tips Telmatoscopus
	Palpal segment 2 more than $3 \times$ length of 1, palpus longer than head height; a
	pair of simple, long, unbranched ascoids on each flagellar segment; tenacula of
	$\mathcal{J}$ surstyle with bell-shaped tips

## Subfamily TRICHOMYIINAE

#### Genus Sycorax Curtis, 1839

The finding of this genus in Malaya is the first record in the Oriental Region. Sycorax is widespread, but with few species. There are now known 1 Ethiopian species, 6 Palaearctic, 4 Australasian (all from New Zealand), 3 Neotropical and 1 fossil from Baltic amber. The distribution and morphological characteristics indicate Sycorax is an archaic genus.

Although the antennae of *Sycorax* are usually described as 15-segmented, the Malayan species is 16-segmented. The terminal is very small, but nevertheless distinct when seen under high magnification. Perhaps, a similar condition exists in other species of the genus.

The head and mouth parts seem similar to that of *Phlebotomus*. The scales on the 2nd palpal segment appear homologous to the "Newstead scales" of *Phlebotomus* and have been so designated in this paper. The cibarium and pharynx are described, since they are

different from those in *Trichomyia* and the Psychodinae and, as in *Phlebotomus*, may prove to have interspecific variation. The spermatheca are fragile sac-like structures much like that of *Phlebotomus*. They probably are best examined in a temporary phenol mount after the whole specimen is cleared in lacto-phenol and before being treated with KOH, but this wasn't done with the specimens studied due to lack of experience with the group.

## Sycorax malayensis Quate, n. sp. Fig. 1.

*Male*: Body integument brown. Proboscis extending to palpal segment 3; palpus 4segmented, segment 1 cylindrical, remaining subglobular, 2 with circular patch of Newstead scales (fig. 1c) on anteriomedian margin, ratio of segments = 14 : 11 : 10 : 9. Cibarium with dome-like apex; pharynx slender. Antenna 16-segmented; flagellar segment 1 about 1-1/3 length of 2; terminal segment very small but distinct; ascoids simple, rodlike, those on segments 7-14 very small, about 1/3 size of those on 3-6.

Wing short and broad; base of  $M_3$  and junction with  $M_{4+5}$  weak or obliterated. Genitalia as figured.

Antenna 0.7 mm; wing length 1.1 mm; wing width 0.5 mm.

*Female*: Similar to  $\mathcal{F}$ , but larger; sternite 2 as figured; pair of spermathecae membranous, globular and simple without visible setae or other adornment; sternite 7 narrowed in center to thin band, wider on sides; external genitalia as figured.

Antenna 0.9 mm; wing length 1.4 mm; wing width 0.6 mm.

Holotype 3, allotype  $\Im$  (BISHOP 3151), Batu Caves, Malaya, 12-XII-1959, McClure. Paratypes (USNM, CAS, BMNH): 29  $\Im$   $\Im$ , 36  $\Im$   $\Im$ , same locality, VII, VIII, IX, XI, XII-1959 and II, V-1960. About 50 other specimens collected in same places on same dates.

#### Genus Trichomyia Curtis, 1839

## KEY TO BATU CAVES SPECIES OF TRICHOMYIA

- Radial fork distad of center of wing and Cu apex; flagellar segment 1 clearly longer than pedicel;  $\mathcal{P}$  ovipositor (cercus) elongate, nearly  $3 \times$  as long as wide; spermathecal duct very short, shorter than stem of furca; palpus 3-segmented ..... malaya
- Radial fork basad of center of wing and Cu apex; flagellar segment 1 and pedicel subequal in length; ♀ ovipositor circular, about as long as wide; spermathecal duct long, about 2× length of stem of furca; palpus 4-segmented ...... batu

## Trichomyia malaya Quate, n. sp. Fig. 2.

*Male*: Integument pale brown. Head with single row of large sockets along upper eye margin; palpus 3-segmented, thick patch of Newstead scales in circular pit at apicolateral margin of palpal segment 1, ratio of segments=24:14:14; cibarium with margins weak, concave at base of posterior arms, pharynx slender with number of longitudinal ridges. Antenna 15-segmented; flagellar segments elongate pyriform, eccentric, segment 1 twice as long as pedicel, terminal with thick apiculis; ascoids simple.

Wing membrane very light brown; radial and medial forks beyond Cu apex, radial beyond center, medial about at center. Hairs on abdominal sternites on posterior 2/3 of



Fig. 1. Sycorax malayensis. a, antenna base,  $\mathcal{J}$ ; b, antenna tip,  $\mathcal{J}$ ; c, palpus,  $\mathcal{J}$ ; d, cibarium and pharynx,  $\mathcal{J}$ ; e, head,  $\mathcal{J}$ ; f, wing,  $\mathcal{P}$ ; g, wing,  $\mathcal{J}$ ; h, apex of abdomen, ventral view,  $\mathcal{P}$ ; i, sternite 2,  $\mathcal{P}$ ; j, sternites 7 and 8,  $\mathcal{P}$ ; k,  $\mathcal{J}$  genitalia, lateral view; l,  $\mathcal{J}$  genitalia, dorsal view.



Fig. 2. *Trichomyia malaya*. a, antenna tip,  $\Im$ ; b, palpus,  $\Im$ ; c, head,  $\Im$ ; d, cibarium and pharynx,  $\Im$ ; e, wing,  $\Im$ ; f, wing,  $\Im$ ; g,  $\Im$  cercus; h,  $\Im$  genitalia, internal view; i,  $\Im$  genitalia, dorsal view, right coxite not shown; j,  $\Im$  genitalia, lateral view.

each segment and gradually become denser on hind margin, without a single definite row on margin. Genitalia as figured; parameres thickly combed, aedeagus furcate with pair of strong subapical spurs and terminating in arrowhead-like apex; surstyle triangular with upturned lateral margins.

Antenna (1.0)-1.2 mm, holotype 1.2; wing length 1.0-1.2 mm, holotype 1.2; wing width 0.4-0.5 mm, holotype 0.5.

• *Female*: Similar to  $\mathcal{F}$ ; flagellar segments smaller and not eccentric; ratio of palpal segments=20: 14: 14, segment 1 smaller; wing longer and more slender; genitalia as figured, subgenital plate acutely pointed; spermathecal duct very short; cercus elongate,

## paddle-shaped.

Antenna 1.0-1.1 mm, allotype 1.0; wing length 1.2-1.4 mm, allotype 1.3; wing width 0.4-0.5 mm, allotype 0.5.

Holotype  $3^{\circ}$ , allotype  $2^{\circ}$  (BISHOP 3152), Batu Caves, 22–II–1960 and 8–III–1960. Paratypes (USNM, CAS, BMNH):  $6 3^{\circ} 3^{\circ}$ ,  $11 2^{\circ} 2^{\circ}$ , same locality, VIII, IX, XII–1959 and II to IV–1960.

Trichomyia batu Quate, n. sp. Fig. 3.

Male: Unknown.

*Female*: Integument brown. Head with patch of large hair sockets between upper part of antennal bases and along upper eye margin; palpus 4-segmented, basal segment incompletely divided; patch of Newstead scales on center of median margin of segment 2, segment 4 long and slender, ratio of segments=10: 10: 14: 30; cibarium with margins strong,



Fig. 3. Trichomyia batu,  $\varphi$ . a, head; b, antenna tip; c, cibarium and pharynx; d, palpus; e, wing; f, cercus; g, genitalia, internal view.

straight and a little divergent, posterior arms short, pharynx slender. Antenna 15-segmented; flagellar segments pyriform, segment 1 subequal to length of pedicel and more nearly cylindrical than others, terminal with small, round apiculis; ascoids simple.

Wing membrane very light brown; radial and medial forks well before center of wing and Cu apex, radial fork distad of medial. Abdominal sternites sparsely covered with spatulate, striate hairs and a definite row of close-set, stiff hairs on hind margin. Genitalia as figured; subgenital plate truncate, weakly trilobed; spermathecal duct very long, strongly and finely annulate; cercus nearly circular in profile.

Antenna 0.8-1.0 mm, holotype 0.8; wing length 1.1-1.4 mm, holotype 1.1; wing width 0.4-0.6 mm, holotype 0.4.

Holotype P (BISHOP 3153), Batu Caves, 7–XII–1959, light trap. Paratypes (USNM, CAS, BMNH): 14 PP, same locality, IX, XII–1959 and III, V, VII, X–1960.

## Genus Phlebotomus (Rondani), 1840

KEY TO BATU CAVES SPECIES OF PHLEBOTOMUS

- tubular, not annulate and not differentiated from duct ...... anodontis 3. Male with 5 spines on dististyle, 3 of which are median, nondeciduous hairs on

Phlebotomus (Idiophlebotomus) asperulus Quate and Fairchild, 1961, Pac. Ins. 3: 208. DISTRIBUTION: Malaya.

MALAYA. Batu Caves, VIII, IX, XII–1959; 6  $\partial \partial$ , 4  $\varphi \varphi$ .

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- Phlebotomus (Phlebotomus) argentipes Annandale and Brunetti, 1908, Rec. Ind. Mus. 2: 101. DISTRIBUTION: Borneo to India. MALAYA. Batu Caves, IX, XII-1959 and II-1960; 4 ♀ ♀.
- Phlebotomus (Phlebotomus) stantoni Newstead, 1914, Bull. Ent. Res. 5: 190. DISTRIBUTION: Malaya to India, Hainan, South China. MALAYA. Batu Caves, XII-1959; 1 ♀.
- Phlebotomus (Sergentomyia) anodontis Quate and Fairchild, 1961, Pac. Ins. 3: 220. DISTRIBUTION: Malaya. MALAYA. Batu Caves, VIII, IX, XII-1959 and II to V-1960; 10 みよ, 37 우우.

#### Genus Telmatoscopus Eaton, 1904

KEY TO BATU CAVES SPECIES OF TELMATOSCOPUS

## Telmatoscopus kulas Quate, n. sp. Fig. 4.

Male: Unknown.

*Female*: Body integument brown. Eyes contiguous, eye bridge with 3 rows of facets; frons with hairs nearly divided into 2 patches; cibarium with margins moderately strong, concave apically, pharynx very slender; palpus with segments 2 and 3 a little inflated, ratio of segments=4:6:6:11. Antenna 16-segmented, segment 14 with very short internode, 15 spherical without internode, 16 with stout apiculis; ascoids slender, V-shaped.

Wing slender, acutely pointed; membrane light brown and a little darker along margin; vein  $R_5$ , distal part of  $R_2$ , and  $M_4$  thickened; base of  $M_2$  lacking. Ratio of fore leg (femur: tibia: basitarsus: remaining tarsal segments) = 5:4:2:3, mid leg=5:7:4:4, hind leg=5:9:3:4. Genitalia as figured.

Antenna 0.6 mm; wing length 1.4 mm; wing width 0.5 mm.

Holotype ♀ (BISHOP 3154), Batu Caves, 3-IX-1959, H. E. McClure.

Of hundreds of psychodids collected in the caves, there was only the single female of this species. Perhaps its usual environment is the forest near the caves.



Fig. 4. *Telmatoscopus kulas*,  $\varphi$ . a, cibarium and pharynx; b, head; c, antenna tip; d, wing; e, genitalia, left external view, right internal.

## Telmatoscopus mcclurei Quate, n. sp. Fig. 5.

*Male*: Body integument brown; frons and palpus with slender, spatulate hairs. Eyes contiguous, eye bridge with 4 rows of facets; vertex prolonged and indented at apex; frons with quadrate patch of hairs without posterior extension; cibarium very long, with strong, nearly straight margins, pharynx slender, nearly parallel-sided; ratio of palpal segments = 6: 11: 12: 16. Antenna 16-segmented; flagellar segment 1 with cylindrical node and small internode, following nodes cubical in outline with short nodes in basal segments and lengthening distally, terminal segment elongate with slender, eccentric apiculis; ascoids small, rod-like, 30–50 on each segment arranged in 2 rings.

Thorax without patagia. Wing with rounded apex; membrane light brown and much darker basally and in costal cell; radial and medial forks on same level well before Cu apex. Ratio of fore leg=8:10:6:6, mid leg=10:13:7:6, hind leg=10:16:6:6. Genitalia as figured, dististyle very long, finger-like, with slenderly pointed appendage on inner base; surstyle very long, cluster of tenacula near center.

Antenna 1.2-1.3 mm, holotype 1.3; wing length 2.0-2.1 mm, holotype 2.0; wing width 0.9-1.0 mm, holotype 1.0.

*Female*: Similar to  $\mathcal{F}$ ; flagellar segments smaller, ascoids 2- or 3-branched pair on each segment; genitalia as figured, subgenital plate strongly bulging ventrally on disc (not shown in illustration); cercus short and acute.

Antenna 1.1–1.2 mm, allotype 1.1; wing length 1.9–2.1 mm, allotype 1.9; wing width 0.8–0.9 mm, allotype 0.8.

Holotype 3, allotype  $\Im$  (BISHOP 3155), 3-V-1960, light trap and 24-III-1960. Paratypes (USNM, BMNH): 6 3 3, 13  $\Im$   $\Im$ , 13  $\Im$   $\Im$ , XII-1959 and II, V-1960.



Fig. 5. *Telmatoscopus mcclurei*. a, antennal segments 3-6,  $\mathcal{O}$ ; b, antenna tip,  $\mathcal{O}$ ; c, cibarium and pharynx,  $\mathcal{O}$ ; d, head,  $\mathcal{O}$ ; e,  $\mathcal{O}$  genitalia, dorsal view; f,  $\mathcal{O}$  surstyle; g, lobe of tergite 9 (between surstyli),  $\mathcal{O}$ ; h,  $\mathcal{Q}$  cercus; i,  $\mathcal{Q}$  genitalia, left external view, right internal; j, wing,  $\mathcal{O}$ .

A feature of this species is the contiguous eyes in both sexes. One female, however, has the eyes separated by about one facet and the eyes are joined by a strong suture. Otherwise, it is the same as other specimens of *mcclurei*.

This species is named after Dr. H. E. McClure in recognition of his intensive study of Batu Caves and the contribution made to the cave ecology.

Telmatoscopus albipunctatus (Williston), 1893, Ent. News 4: 113.

DISTRIBUTION: Tropicopolitan.

MALAYA. Batu Caves, VII to IX, XI, XII-1959, I to VI-1960; 260 spec. incl. larvae and pupae.

## Genus Brunettia Annandale, 1910

# Brunettia sp.

Two  $2^{\circ}$  of *Brunettia* were taken in the Caves in V-1960. They probably belong to an undescribed species of the *biformis* group, but without  $3^{\circ}3^{\circ}$  little is to be gained from naming them.

## Genus Psychoda Latreille, 1796

## Key to Batu Caves species of Psychoda

1.	Wing forks incomplete (fig. 6c) 2
	Wing forks complete (fig. 7c)
2(1).	Antenna 16-segmented
	Antenna 15-segmented; 3 dististyle rather broad and suddenly tapering to apex,
	paramere a prominent, bilobed shelf below aedeagus; 2 unknown (but see
	discussion of species) pellucida
3 (2).	Male genitalia with lateral shaft of aedeagus straight or lacking; $\mathcal{P}$ subgenital
	plate quadrate with small apical lobes 4
	Lateral shaft of $\mathcal{J}$ aedeagus twice curved, S-shaped; $\mathcal{P}$ subgenital plate elongate
	with sides divergent posteriorly makati
4 (3).	Male dististyle with large, sac-like lobe attached to base; digit of $P$ subgenital
	plate arises from level of base of lobes malleola
	Male dististyle without sac-like lobe; digit of subgenital plate arises near center
	clearly cephalad of level of base of apical lobeslutea
5(1).	Wing veins with brown spots at tips; antenna 15-segmented, terminal 2 seg-
	ments reduced, terminal smallest, button-like
	Wing veins without brown spots at tips; terminal antennal segment not button-
	like
6 (5).	Radial fork little distad of medial, nearly on same level; $\mathcal{P}$ subgenital plate
	not V-shaped7
	Radial fork distad of medial by $2-3 \times$ width of cell R <sub>3</sub> ; subgenital plate con-
	sisting only of V-shaped piece alternata
7 (6).	Female subgenital plate with deep apical concavity, deeper than $1/2$ length of
	plate; 3 <sup>th</sup> dististyle short, clavate with sharp, spur-like apex and bearing

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about 15 strong setae on distal 1/2 of inner face acanthostyla
Subgenital plate rectangular with V-shaped apical notch, notch less than $1/2$
length of plate; 👌 unknown
8 (5). Eye bridge with 4 rows of facets; eyes separated by 1.5 facets at most; an-
tenna 16- or apparently 14-segmented
Eye bridge with 2 or 3 rows of facets; eyes separated by 2 facets or more;
antenna 15-segmented, terminal 2 segments equal and separated; ascoids of
both sexes 4-branched; wing length 1.2-1.9 mm malayica
9 (8). Antenna 16-segmented with terminal 3, reduced segments subequal in size 10
Antenna apparently 14-segmented (actually 15-segmented but segment 14 very
small and fused to 13); $\Im$ antennal ascoids 4-branched, $\Im$ ascoids 3-branch-
ed; small species, wing length 1.0-1.5 mm savaiiensis
10 (9). Wing veins $R_1$ , $R_5$ , and $M_4$ much thicker than others; palpal segments unequal,
ratio=8:11:13:15; ♂ aedeagus ending as 2 straight rods; ♀ subgenital
plate with sides subparallel or convergent posteriorly aponesos
Vein $R_5$ little thicker than others, but $R_1$ and $M_4$ as others; ratio of palpal
segments = 8 : 8 : 8 : 10; $\Im$ aedeagus ending in strongly recurved, beak-like
point; $\varphi$ subgenital plate with sides of apical part divergent posteriorly
and basal piece widely expanded flap-like

## Psychoda pellucida Quate, n. sp. Fig. 6 a-e.

*Male*: Body integument brown. Eyes separated by about 1/2 facet at narrowest point, interocular suture absent; bridge with 4 rows of facets; frons thickly covered with hairs and dense band extending posteriorly between eyes; palpus with first 3 segments equal, ratio of segments=6:6:6:8; labellum with 2 setae. Antenna 15-segmented; terminal 2 reduced, subequal, well separated, 14 partly fused to 13; ascoids Y-shaped, not dimorphic.

Wing broad, forks incomplete; vein tips without spots. Ratio of fore leg=20: 18: 8: 12, mid leg=22: 22: 8: 12, hind leg=22: 24: 8: 12. Genitalia as figured; dististyle rather broad and suddenly tapering to apex, aedeagus simple without lateral shaft, paramere a conspicuous, bilobed shelf under aedeagus, surstyle of usual elongate *Psychoda* shape with single tenaculum.

Antenna 0.7 mm; wing length 1.0 mm; wing width 0.4 mm.

Female: Unknown (see discussion below).

Holotype & (BISHOP 3156), Batu Caves, 1-IX-1959, H. E. McClure. Paratypes (USNM, BMNH): 3 & &, same locality, IX-1959 and II-1960.

There are three females associated by date and location with the above males. They have similar size, antennal structure and wing venation as the males, but differ in the less dense vestiture on the frons, wider eye separation and dimorphic antennal ascoids. That may be sexual variance, but on the other hand might indicate the females are not conspecific with the males. Further specimens are needed from different localities to confirm the association of sexes for this species.

The females are the same as described by Tokunaga (1957, Sci. Rpt. Saikyo Univ. Agric. 9: 64) from Taiwan and designated as the female of *P. alabangensis* del Rosario, a species described from the Philippines on the male sex only. There is some question if



Fig. 6. a-e. *Psychoda pellucida*,  $\mathcal{J}$ . a, head; b, antenna tip; c, wing; d, surstyle; e, genitalia, dorsal view. f-k. *Psychoda lutea*. f, head,  $\mathcal{J}$ ; g, wing;  $\mathcal{J}$ ; h, antenna tip,  $\mathcal{J}$ ; i,  $\mathcal{P}$  genitalia, left external view, right internal; j,  $\mathcal{J}$  genitalia, dorsal view; k,  $\mathcal{J}$  surstyle.

Tokunaga's identification is correct. The above association would indicate this female is not that of *alabangensis* and, furthermore, the male genitalia of *alabangensis* illustrated by Tokunaga (*loc. cit.*) differs markedly from that described by del Rosario (1936, Phil. Jour. Sci. **59**: 566). Only additional specimens can settle the question and clarify the identity of *alabangensis*.

Psychoda makati del Rosario, 1936, Phil. Jour. Sci. 59: 568.

DISTRIBUTION: Polynesia, Australia, Borneo, Philippines, Taiwan, Malaya. MALAYA. Batu Caves, 1-IX-1959; 2  $\vec{\sigma}$ , 5  $\vec{\gamma}$ , 2 Psychoda malleola Tokunaga and Komyo, 1954, Phil. Jour. Sci. 83 : 310.
DISTRIBUTION : Japan, Borneo, Malaya.
MALAYA. Batu Caves, 12–1V–1960; 2 ♀♀.

Fig. 6 f-k.

Psychoda lutea Quate, n. sp.

Male: Body integument pale brown. Eyes separated by 1 facet, interocular suture absent; bridge with 4 rows of facets, rounded on median margin; frons with wide, thick band of hairs extending posteriorly on midline and joining hairs on vertex; palpus extending to node of antennal segment 6, ratio of segments=20:18:18:26; labellum with 2 setae and 4 teeth. Antenna 16-segmented, segments 13, 14, 15 partly fused, 16 separate; ascoids Y-shaped.

Wing with forks incomplete; vein tips with outspots. Ratio of fore leg=20:20:8: 12, mid leg=24:26:8:14, hind leg=26:26:8:15. Genitalia as figured, basistyle inflated laterally, dististyle tapering to sharp, slightly hooked apex, surstyle of usual elongate *Psychoda* shape with single spatulate tenaculum.

Antenna 0.8-1.0 mm, holotype 0.9; wing length 0.9-1.2 mm, holotype 1.2; wing width 0.4-0.5 mm, holotype 0.5.

*Female*: Similar to  $\mathcal{J}$ ; genitalia as figured, subgenital plate with small apical lobes, genital digit arising near center of plate well before base of lobes.

Antenna 0.7-1.0 mm, allotype 0.8; wing length 1.1-1.5 mm, allotype 1.2; wing width 0.4-0.6 mm, allotype 0.5.

Holotype  $3^{\circ}$ , allotype  $9^{\circ}$  (BISHOP 3157), Batu Caves, 7-XII-1959 and 19-IV-1960, light trap, McClure. Paratypes (USNM, CAS, BMNH): 28  $3^{\circ}3^{\circ}$ , 58  $9^{\circ}9^{\circ}$ , same locality, II, III, IV, V-1960 and VIII, IX, XII-1959. More than 600 other specimens collected at same places on same dates.

In antennal characters, wing venation and appearance of the female genitalia, *lutea* resembles *malleola* Tokunaga. The male of *lutea*, however, lacks the sac-like appendage of the dististyle which is such a distinctive feature of *malleola*. Details of the female genitalia of the two species also differ; in *lutea* the genital digit arises near the center of the plate clearly cephalad of the base of the apical lobes and there isn't the reticulated shelf from the spermatheca to the plate, while in *malleola* the genital digit originates on the level of the base of the apical lobes and there is a reticulation from the spermatheca to the center of *lutea* are larger than those of *malleola* in relation to the rest of the plate.

Psychoda alternata Say, 1824; Quate, 1959, Ins. Micronesia, Bishop Mus. 12 (4): 469.
DISTRIBUTION: Cosmopolitan.
MALAYA. Batu Caves, II-1960; 3 ♀♀.

Psychoda vagabunda Quate, 1962, Pac. Ins. 4 (1): 61. DISTRIBUTION: Borneo, Malaya, Ceylon. MALAYA. Batu Caves, 3-IX-1959; 1 ♀. Psychoda acanthostyla Tokunaga, 1957, Saikyo Univ. Agric., Sci. Rpt. 9: 53.
DISTRIBUTION: Micronesia, Taiwan, Borneo, Malaya.
MALAYA. Batu Caves, 16-VIII-1960: 1 φ.

#### Psychoda malayica Quate, n. sp. Fig. 7.

*Male*: Body integument pale brown. Eyes separated by 2 facets, interocular suture present but weakened in center; bridge with 3 rows of facets but narrowing to 2 rows on median edge; frons with thick, quadrate patch of hairs anteriorly and narrow band extending posteriorly on midline to suture; palpus with segment 3 smallest, ratio of segment = 24:20:18:28; labellum with 4 teeth and 2 setae, few specimens with 3 setae on one side. Antenna 15-segmented, terminal 2 reduced, of equal size, well separated, 13 and 14 with apicolateral spinose tubercles; ascoids 4-branched.

Wing with forks complete, but  $M_2$  weakened at base; vein tips without spots. Ratio of fore leg=30: 30: 10: 18, mid leg=30: 40: 10: 20, hind leg=35: 40: 10: 20. Geni-



Fig. 7. *Psychoda malayica*. a, antenna tip,  $\mathcal{J}$ ; b, head,  $\mathcal{J}$ ; c, wing,  $\mathcal{J}$ ; d,  $\mathcal{L}$  genitalia, left external view, right internal; e,  $\mathcal{J}$  surstyle; f,  $\mathcal{J}$  genitalia, dorsal view.

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talia as figured, basistyle rather inflated laterally, dististyle evenly tapering to acute apex, lateral shaft slender and extending to tip of main shaft; surstyle of moderate length.

Antenna 1.0–1.3 mm, holotype 1.1; wing length 1.2–1.5 mm, holotype 1.2; wing width 0.5–0.6 mm, holotype 0.5.

*Female*: Similar to  $\mathcal{J}$ ; eyes separated by little more than 2 facets; genitalia as figured, subgenital plate weakly bilobed, genital digit with single apical spine.

Antenna 0.9–1.2 mm, allotype 1.1; wing length 1.4–1.9 mm, allotype 1.8; wing width 0.5–0.7 mm, allotype 0.7.

Holotype  $3^{\circ}$ , allotype  $9^{\circ}$  (BISHOP 3158), Batu Caves, 5-I-1960, and 22-XI-1960, H. E. McClure. Paratypes (USNM, CAS, BMNH): 54  $3^{\circ}3^{\circ}$ , 40  $9^{\circ}9^{\circ}$ , same locality, VIII, IX, X, XI, XII-1959 and I, XI, XII-1960. More than 600 other specimens collected at same places on same dates.

Psychoda savaiiensis Edwards, 1928, Ins. Samoa (Brit. Mus., Nat. Hist.), Pt. 6, Fasc. 2: 74. *Psychoda rarotongensis* Satchell, 1953, Roy. Ent. Soc. London, Proc., ser. B, 22: 183.

DISTRIBUTION: Tropicopolitan, except Ethiopian Region.

Malaya. Batu Caves, I, II, III, V-1960; 2 ♂♂, 23 ♀♀.

**Psychoda aponesos** Quate, 1959, Ins. Micronesia, Bishop Mus. **12** (4): 465. DISTRIBUTION: Micronesia, Borneo, Malaya.

MALAYA. Batu Caves, 1-IX-1959; 1 ♀.

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