

A review of the Lepidostomatidae (Trichoptera) of Borneo

J.S. Weaver III & J. Huisman

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A review of the Lepidostomatidae of Borneo is provided with descriptions and illustrations of 19 species, including 14 new species: *Dinarthrum bidentatum*, *D. kellyi*, *D. tridentatum*, *Lepidostoma biscullum*, *L. corollatum*, *L. cratis*, *L. curtispiculum*, *L. erectum*, *L. octolobium*, *L. oreion*, *L. pendulum*, *L. quaternarium*, *L. tenellum*, and *L. uncinatum*.

The five lepidostomatid species previously known from Borneo are removed from the genus *Goerodes*: four species, *G. conjunctus* (Banks), *G. grandis* (Banks), *G. medius* (Banks) and *G. dulitensis* Mosely, are transferred to the genus *Lepidostoma*, and one species, *Goerodes capreolus* Ito is transferred to *Dinarthrum*. *Goerodes pendleburyi* Weaver is recognized as a junior synonym of *Lepidostoma dulitense* (Mosely). One new species group for *Dinarthrum* and three new species groups for *Lepidostoma* are proposed. Keys to species for adult males are provided.

John S. Weaver III, Dept. Entomology, Nesmith Hall, Univ. of New Hampshire, Durham, NH 03824, U.S.A.

Jolanda Huisman, Dept. Entomology, Hodson Hall, Univ. of Minnesota, St. Paul, MN 55108, U.S.A.

Introduction

Little research has been done on the Lepidostomatidae of Borneo. Banks (1931) described the first lepidostomatid from Borneo, *Goerinella grandis* Banks, and shortly thereafter he (1934) described two more species, *G. conjuncta* Banks and *G. media* Banks; all three species were collected at Mt Kinabalu, Sabah. These species were assigned to the genus *Goerodes* Ulmer by default, when the genus *Goerinella* Ulmer, 1915, was recognized by Ulmer (1951) as a junior synonymy of *Goerodes*. Lectotypes and redescriptions of these species were later provided by Weaver (1985). The fourth species, *Goerodes dulitensis* Mosely, 1951, was collected at Mt Dulit, Sarawak. For 41 years these four species were the only lepidostomatids known from Borneo. However, recently an additional species, *Goerodes capreolus* Ito, 1992, was described from Mt Kinabalu. All of these species are removed from the genus *Goerodes* and are now recognized as *Lepidostoma grande* (Banks), *L. conjunctum* (Banks), *L. medium* (Banks), *L. dulitense* (Mosely), and *Dinarthrum capreolum* (Ito).

Examination of recent collections from expeditions by members of the Nationaal Natuurhistorisch Museum, Leiden, and the Smithsonian Institution, U. S. National Museum of Natural History, Washington, has revealed 14 new species of Lepidostomatidae from Borneo: 13 from Sabah and 1 from Sarawak, bringing the present total number of lepidostomatids from Borneo to 19. Only one of these species, *L. dulitense*, has a distribution which includes Borneo, i.e. Sarawak, and other regions of the Malay Archipelago, i.e. Sumatra, and the Malay Peninsula. The other 18 species appear to be restricted to Borneo; only one of these species, *L. curtispiculum* spec. nov., is known from Sarawak, and the remaining 17 species are known only from

Sabah, with most of these collected in the Mt Kinabalu area. The majority of Trichoptera known from Borneo have also been collected in Sabah. Thus, too little is presently known to estimate the species richness of the island's lepidostomatid fauna. This is a disturbing fact, since most of the forests are being cut at an alarming rate, and undoubtedly decimating much of Borneo's undescribed fauna.

Compared with the caddisfly faunas of neighbouring islands (the Greater Sunda Islands), the lepidostomatid fauna of Borneo is especially rich in species, i.e. 11 lepidostomatids are known from Sumatra (Weaver, 1989), 7 from Sulawesi (Neboiss, 1991; Weaver and Huisman, 1992, and 3 from Java (Ulmer, 1951, 1957).

The abbreviations of collections for the material examined: British Museum of Natural History, BMNH; Bernice P. Bishop Museum, Honolulu, BPBM; Canadian National Collection, Ottawa, CNC; Nationaal Natuurhistorisch Museum, Leiden, RMNH; Smithsonian Institution, National Museum of Natural History, Washington, DC, USNM; collection of the first author, JSW; and of the second author, JH. Names of collectors are abbreviated as follows: C. van Achterberg, CvA; Jolanda Huisman, JH. Collections by J. Huisman were made using a light trap, and those by C. van Achterberg were made with a malaise trap.

The terminology follows that of Weaver (1988) with roman numerals referring to abdominal segments. The species synonymies are complete.

Collection sites

Habitat descriptions are provided for the following collection localities, with conditions observed at time of collection. Malaysian words in the locality data are as follows: *sungai* (abbreviated sg.), river, stream; *ulu*, tributary, headwaters.

Carsons camp.— 2621 m, no streams nearby, vegetation dominated by stunted *Leptospermum* and grass, on ultrabasic rock.

Danum Valley Field Center.— 210 m, lowland dipterocarpaceous forest, near brooklet 1 m wide.

Kinabalu Nat. Pk.— 1600-1500 m, terrain wet submontane oak forest with tree ferns; area with Sg. Silau-Silau flowing through and Sg. Liwagu forming its eastern border. Other sites at 1750 m, 1850 m, and 1900 m, wet submontane oak forest with tree-ferns, shallow soil, and steep terrain.

Marei Parei.— 1670 m, trickle, in a steep twisted riverbed, 5 m wide, H₂O temperature 23°C, having terrain with basic soil, and vegetation with low *Leptospermum* and grass, on ultrabasic rock.

Sg. Dapur.— 1200 m, stream 15 m wide, 1-2 m deep, fast-flowing over pebbles and sand, with water turbid and H₂O temperature 23°C; vegetation is wet open forest with high bamboo along river, with podsolic soil and stagnant pond nearby.

Sg. Kepungit.— 550 and 700 m, clear stream 7 m wide, fast-flowing over boulders and leaf litter, with H₂O temperature 20-22°C; hilly terrain with wet dipterocarpaceous forest with bamboo.

Sg. Kijuhutan.— 1350 m, stream 5 m wide, water clear, fast-flowing over boulders, H₂O temperature 23°C; terrain with low, wet submontane forest.

Sg. Kolopis (Pakka cave).— 2960 m, clear stream 7 m wide, flowing through a narrow gorge and over huge boulders, with H₂O temperature 10°C and flow varying

from a trickle in January to a torrent in August; terrain with sparse vegetation, dominated by *Leptospermum recurvum* and *Dacridium gibbsiae*, and tree line at 3300 m.

Sg. Liwagu.— 1185 m, clear stream 10 m wide, flowing quietly over small boulders, with H₂O temperature 21°C, northern banks with oak forest, southern banks with riverine forest and pastures. Other sites at 1450-1650 m, clear stream 10 m wide, flowing quickly over mossy boulders, pebbles and leaf litter, with H₂O temperature 16-19°C; terrain steep with wet submontane forest of oak and tree ferns.

Sg. Malabit.— 1180 m, clear stream 10 m wide, fast-flowing over huge boulders and pebbles (flood once observed), with tea-brown colour and H₂O temperature 19°C; terrain varying from steep banks with riverine forest to sandy beaches with ferns.

Sg. Matang.— 1000-1100 m, clear shallow stream, 7-10 m wide, flowing quietly over pebbles and sand, with tea-brown colour and H₂O temperature 17-22°C; area around Long Pa Sia cultivated with remnants of a riverine forest.

Sg. Mesilau.— 1900 m, clear stream 10 m wide, fast-flowing over boulders and pebbles, with H₂O temperature 19°C; terrain with submontane oak forest.

Sg. Montokungun.— 450 m, stream 3 m wide, water clear, flowing quietly over boulders and leaf litter, H₂O temperature 22°C; terrain with disturbed riverine forest with bamboo.

Sg. Ritan.— 1150 m, clear stream 3 m wide, flowing quietly over pebbles and boulders, with H₂O temperature 19°C; terrain with vegetation wet, submontane forest, rather open with bamboo.

Sg. Silau Silau.— 1600-1450 m, clear stream 2-5 m wide, fast-flowing over boulders and pebbles, with H₂O temperature 17-20°C.

Sg. Tananansad.— 560 m, clear brooklet 1 m wide, flowing quietly over leaf litter and mossy boulders, with H₂O temperature 22°C; terrain hilly, with wet dipterocarpaceous forest with bamboo.

Sg. Tawubang.— 1030 m, clear stream 15 m wide, flowing quietly over mossy boulders, with H₂O temperature 23°C; terrain with wet submontane forest.

Sg. Tibabar.— 1750m, clear braided stream 4 m wide, flowing quietly over pebbles and leaf litter, with H₂O temperature 15-21°C.

Ulu Kolopis.—3200 m, several clear streams flowing over flat granite rocks, with H₂O temperature 11°C and flow varying from a trickle in January to a torrent in August.

Ulu Liwagu.— 2550 m, clear streamlet 2 m wide, flowing quietly over pebbles and leaf litter, with H₂O temperature 10°C; narrow valley with steep terrain, with wet submontane oak forest with bamboo.

Ulu Noloyan.— 1010 m, clear brooklet 2 m wide, flowing quietly over pebbles and leaf litter, with H₂O temperature 20°C; terrain steep, forest with red laterite soil.

Ulu Rurun.— 1400 m, clear streamlet 3 m wide, flowing gently over mossy boulders, with tea-brown colour and H₂O temperature 20°C; terrain steep with undisturbed open riverine forest.

Systematics
Lepidostomatidae Ulmer, 1903

Key to genera
(males only)

1. Hindwing with anal region reduced, apical portions of M and Cu curved anteriad, nearly parallel to posterior margin, with fork II narrowed distally (figs. 2, 6, 9); phallus with parameres (figs. 3D, 4D, 7D, 10D) *Dinarthrum* McLachlan, p. 532
- Hindwing with M and Cu nearly straight, not curved and parallel with posterior margin, with fork II not narrowed distally; phallus without parameres (figs. 41D, 45D) *Lepidostoma* Rambur, p. 539

Dinarthrum McLachlan, 1871

Members of this genus generally have secondary sexual modifications exhibited in the male forewing. Hence, it was unique to find a new group of species from Borneo having venation of the hindwing more highly modified than in the forewing.

D. tridentatum group.— This new species group includes all of the species of *Dinarthrum* known from Borneo, *D. bidentatum* spec. nov., *D. kellyi* spec. nov., *D. capreolum* (Ito) and *D. tridentatum* spec. nov. Monophyly of this group is suggested by the following synapomorphies: 1) Male hindwings (figs. 2, 6, 9) modified with apical portions of M and Cu₁ curved anteriad, and with subapical portions parallel with posterior apical margin. 2) Male maxillary palpi (figs. 1, 8) with apical portion of first segment bearing dense brush of long setae recurved apically. 3) Female (figs. 5, 11) segment IX in lateral view nearly rectangular, dorsal margin nearly straight and lacking typical subapical lateral humps (female only known for *D. capreolum* and *D. tridentatum*). All of the species in this group, except *D. bidentatum*, have parameres bearing apical patches of spines. 4) male segment X with unbranched middorsal process (figs. 3, 4, 7, 10). However, the latter characteristic is similarly exhibited by one other lepidostomatid, *Ulmerodes armata* (Ulmer).

Key to species of *Dinarthrum*
(males only)

1. Segment X of genitalia with short middorsal process, less than $\frac{1}{3}$ length of inferior appendage in lateral view (figs. 3A, 4A) 2
- Segment X with long middorsal process, greater than $\frac{1}{3}$ length of inferior appendage (figs. 7A, 10A) 3
2. Inferior appendage in lateral view with main article long, fingerlike and bearing a pair of subapical mesal lobes (fig. 3A) *D. bidentatum* Weaver and Huisman, p. 533
- Inferior appendage in lateral view with main article stout, truncate, and bearing three long apical processes (fig. 4A) *D. capreolum* (Ito), p. 534

3. Segment IX broad in lateral view; segment X with mesoventral blades long, extended ventroposteriad below inferior appendages, nearly equal to length of inferior appendage *D. kellyi* Weaver and Huisman, p. 536
- Segment IX narrow in lateral view; segment X with mesoventral blades short, extended ventrad and $\frac{1}{3}$ as long as inferior appendage (fig. 10A)
..... *D. tridentatum* Weaver and Huisman, p. 536

***Dinarthrum bidentatum* spec. nov.**
(figs. 1, 2, 3)

Material.— **Sabah:** Holotype: ♂, (RMNH), 10 km SW of Long Pa Sia, Ulu Rurun, 4°22'N 115°40'30"E, 1400 m, 21.xii.1986, JH.

Male.— Head (fig. 1): modifications similar to those of *D. tridentatum*, dorsum with large posterior and small anterior pair of setaceous warts, frons with large lateral pair of warts, vertex with minute bump. Scape 1.8 mm, nearly straight, cylindrical, except with striated concavity along basal $\frac{2}{3}$ of mesal surface bearing brush of long setae. Maxillary palpi with first segment 2.0 mm, irregular sinuate, having basal $\frac{1}{2}$ broad, straight at base and apical portion curved dorsad and bearing dense brush of long setae, and having distal $\frac{1}{2}$ flexible, slenderer, and bent anteriorly; apical segment minute, lobiform, 0.3 mm long. Forewing 9.7 mm long, mostly dark brown except light anal margin, with numerous slender scales and setae, anterior margin fringed, anal region with long stout setae and jugal pocket. Hindwing (fig. 2) light brown with setose anal groove, *M* unbranched, *Cu*₁ gradually curved, following posterior margin and bearing many fine setae, anal region bearing many long stout setae. Genitalia (fig. 3): Segment IX broad and annular. Segment X bearing single middorsal process and pair of ventrolateral processes; middorsal process slender, straight, slightly shorter than ventrolateral processes; ventrolateral processes bifid, each with mesal broader and 3 × longer than lateral branch, in lateral view mesal branch claw-shaped with apex slightly hooked and pointed ventrad, lateral branch more slender, acuminate and directed ventroposteriad; in dorsal view mesal branch sickle-shaped, with basal portion curved mesad and apical portion strongly curved outward and pointed laterally. Phallus with phallicata curved ventrad, having parameres similar to those of *D. tridentatum* with subapical dorsal tuft of spines and a few apical spines. Inferior appendages each in lateral view nearly fingerlike, directed dorsoposteriad, slightly broadened at attachment of mesal processes and second article; main article broader than in *D. tridentatum*, but second article slenderer in ventral view; basodorsal process in lateral view slightly clavate with basal $\frac{1}{2}$ curved posteriorly and apical $\frac{1}{2}$ nearly straight and directed dorsoposteriad; two short subapicomeral lobes, thumblike, originate together with ventral lobe slightly smaller than dorsal lobe; Female.— Unknown.

Etymology.— Latin *bi-* twice; *dentatus* toothed, after the ventrolateral processes of segment X of the male genitalia.

Remarks.— This species is placed in the *tridentatum* group. It is closely related to the *D. tridentatum*, but differs by having segment IX broader in lateral view, segment X with bifid ventrolateral processes, and inferior appendage with main article broader.

***Dinarthrum capreolum* (Ito, 1992) comb. nov.**
(figs. 4, 5)

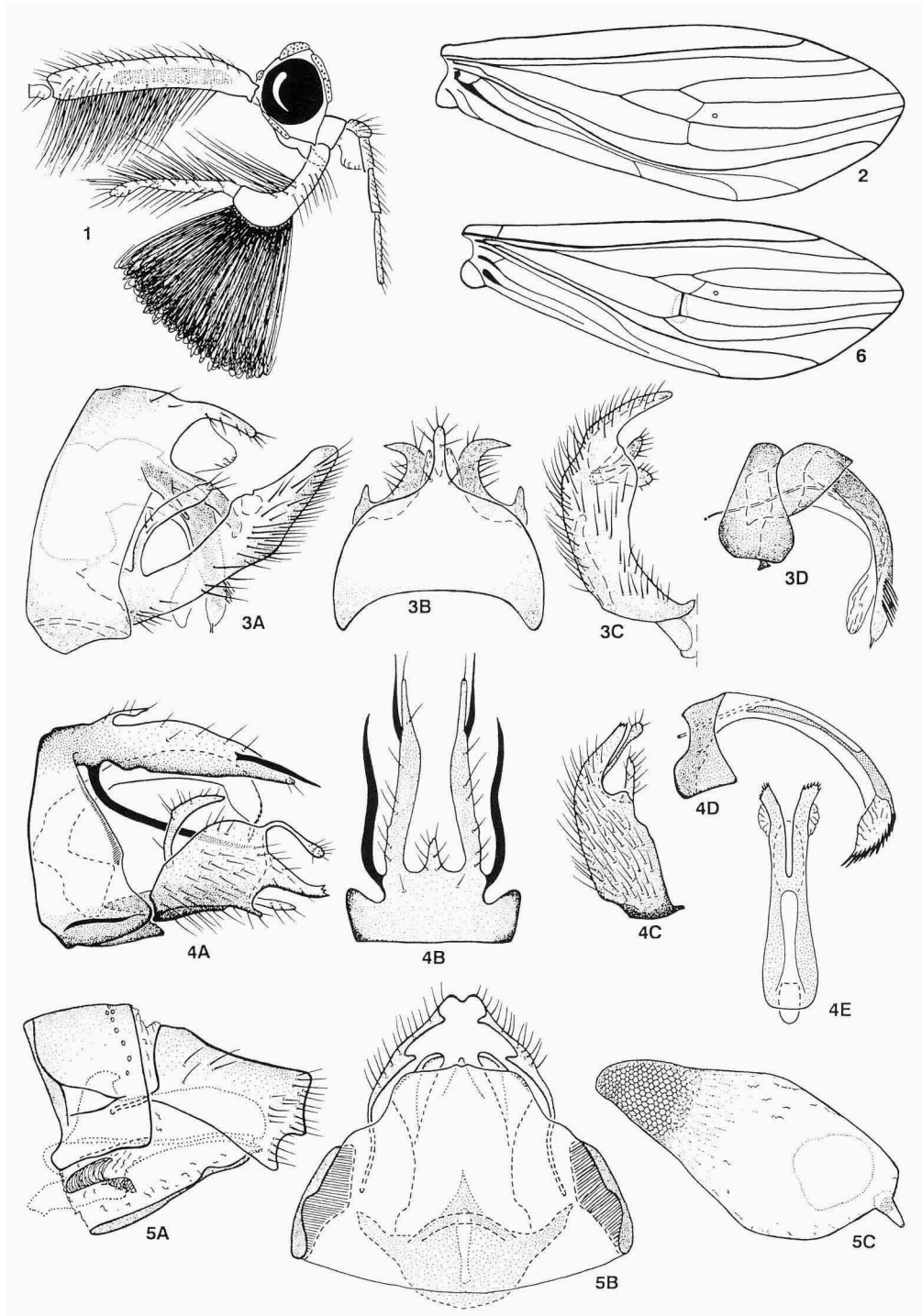
Goerodes capreolus Ito, 1992: 99-100, fig. 1, ♂ larva.

Material.— **Sabah:** 9 ♂♂, 5 ♀♀, (RMNH), Kinabalu Nat. Pk., Sg. Silau-Silau near Bukit Burong trail, 6°00'N 116°32'E, 1490 m, 20.xi.1986, JH; 2 ♂♂, (RMNH), *ibid.*, 21.xi.1986, JH; 1 ♀ (RMNH), *ibid.*, 11.xi.1987, JH; 2 ♂♂, 2 ♀♀, (RMNH), 12 km NNW Kundassang, trickle near Marei-Parei, 6°05'N 116°31'E, 1670 m, 9.iii.1987, JH; 2 ♀♀, (RMNH), Kinabalu Nat. Pk., HQ roadside, 6°00'N 116°32'E, 1500 m, 14.v.1987, JH; 1 ♂ (USNM) Kinabalu Nat. Pk., HQ, 1560 m, 13.ix.1983, GF Hevel & WE Steiner.

Male.— **Head:** Dorsum with posterior pair of setaceous warts, frons with lateral pair of oval warts, vertex with small bump between two minute warts. Scape 1.4 mm, cylindrical, straight with basomesal surface slightly concave. Maxillary palpi with first segment 1.2 mm, elbowed, bent $\frac{3}{5}$ from base with extended ventral lobe, apical part bent dorsad at oblique angle, acuminate and bearing brush of long fine setae; second segment slender, lobiform, 0.3 mm long. Wings (Ito, 1992: fig. 1): Forewing 7.3 mm, brown, oval, venation not highly modified; hindwing 6.2 mm, lanceolate, with long narrow setose pocket along fused anal veins, M_{1+2} and M_{3+4} curved toward apex. Genitalia (fig. 4): Segment IX in lateral view with venter much broader than dorsum, posterior margin inclined. Segment X with minute middorsal process and large pair of branched lateral arms, each arm bearing two heavily sclerotized spinelike lateral rods, one long rod attached at base and a short rod attached to subapex; lateral arms in dorsal view long, slender, with mesal margin slightly sinuate and lateral margin nearly straight, and with apical $\frac{1}{4}$ slenderer; lateral arms in lateral view with ventrobasal rod almost as long as main arm, with basal $\frac{1}{5}$ directed ventrad and bent having apical $\frac{4}{5}$ directed ventroposteriad; subapical rods short, about $\frac{1}{3}$ as long as arm, directed posteriad and extended slightly beyond apex of lateral arm. Phallus long, with base extended dorsoposteriad, endotheca reduced; parameres almost appear to be fused with phallicata, each with brush of apical spines. Inferior appendages each having main article very broad, almost square in lateral view, but with dorsoanterior margin rounded, posterior margin nearly truncate, and with four posterior processes: 1) dorsal process capitate, attenuate and directed ventroposteriad; 2) middle process broadest of four posterior processes, directed ventroposteriad, apex truncate with three minute apical teeth; 3) ventromesal process slender, fingerlike, directed posteriad and $\frac{1}{2}$ as long as midposterior process; and 4) slender extension of ventral ridge, shortest of four posterior processes, directed posteriad.

Female.— **Head:** Dorsum with normal pattern of setaceous warts. Scape 1.3 mm. Forewing 7.9 mm, both wings narrow as in male. Genitalia (fig. 5): VIII having recessed pocket (probably receptacle for male's inferior appendage). Segment IX in lateral view more than twice as long as height, nearly rectangular, posterior margin irregular, having posterior dorsal angle blunt and nearly square; posterior ventral angle with two short blunt points, separated by curved emargination. Vaginal cavity long and well sclerotized. Spermathecal sclerite with lateral processes long, slightly angled posteriad with pointed apices. Spermatheca ovoid, with anterior $\frac{1}{3}$ tapered and conspicuous honeycombed with reticulate pattern.

Remarks.— This species is placed in the *tridentatum* group. Both the male and the female have unusual genitalia. The male having the inferior appendages, broad and



Figs. 1-3, *Dinarthrum bidentatum* spec. nov.; figs. 4-5, *Dinarthrum capreolum* (Ito); fig. 6, *Dinarthrum kellyi* spec. nov. 1, male head, lateral; 2, 6, male hindwing; 3, 4, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 4E, phallus, dorsal; 5, female genitalia: 5A, lateral; 5B, ventral; 5C, spermatheca, lateral.

truncate in lateral view, and the female having segment IX with bilobed posterior margin in lateral view. The larva was described by Ito (1992).

***Dinarthrum kellyi* spec. nov.**

(figs. 6, 7)

Material.— **Sabah:** Holotype: ♂, (RMNH), Crocker Range, 5 km N Tenom, Sg. Noloyan, 1010 m, 5°10'N 115°55'E, 11.x.1986, JH. Paratype 1 ♂, (RMNH), *ibid.*

Male.— **Head:** Vertex without projection, dorsum with large posterior warts and minute anterior warts, and frons with setaceous area below scape. Scape 1.1 mm, nearly cylindrical, mesal surface slightly flattened. Maxillary palpi 1.2 mm, basal segment 1.0 mm, curved anteriad, apical $\frac{2}{3}$ bearing brush of long setae, with apices of setae recurved mesad, apical segment short and flexible. Forewing 6.5 mm, brown, venation of both wings similar as in *D. tridentatum*; hindwing (fig. 6) with anal veins obscured by basoposterior groove bearing many long stout setae. Genitalia (fig. 7): Segment IX broad and annular. Segment X having a single middorsal process, a pair of ventrolateral processes and a pair of ventromesal processes: 1) middorsal process long and slender with base and apex slightly broadened in dorsal view, almost as long as lateral processes, with irregular bilobed apex; 2) ventrolateral processes each with basal $\frac{2}{3}$ broadened gradually, having rounded dorsomesal margin and nearly straight ventral margin, apical $\frac{1}{3}$ tapered abruptly and bifid, having a long point, directed posteriad, and a short subapical point directed ventrad; 3) ventromesal processes each blade-like, slightly curved ventrad, long, 1.7 × as long as ventrolateral processes, extended ventrad beyond ventral margin of inferior appendages. Phallus with parameres flexible, not heavily sclerotized, and with phallicata curved ventrad. Inferior appendages each having dorsal process in lateral view bent at obtuse angle and slightly inclined posteriad; main article in lateral view with basal portion nearly straight and slightly widened toward blunt apex; main article in ventral view with basal $\frac{1}{2}$ semicircular, having apical portion (second article) nearly straight and bearing two subapical mesal lobes.

Female.— Unknown.

Etymology.— This species is named after Matthew Kelly, former student at the University of New Hampshire and illustrator of many of the figures in this work.

Remarks.— This species is placed in the *tridentatum* group, and is closely related to *D. tridentatum*. It differs by having segment X of the male genitalia with long pair of mesoventral blades extending ventroposteriad below the ventral margin of the inferior appendages, and parameres not strongly sclerotized and lacking an apical brush of spines.

***Dinarthrum tridentatum* spec. nov.**

(figs. 8, 9, 10, 11)

Material.— **Sabah:** Holotype: ♂, (RMNH), 12 km NNE Ranau, Poring Hot Springs, Sg. Kepungit, 6°03'N 116°42'E, 550 m, 29.viii.1986, JH. Paratypes: 1 ♀, (RMNH), *ibid.*; 1 ♀, (RMNH), *ibid.*, 24.i.1987, JH.

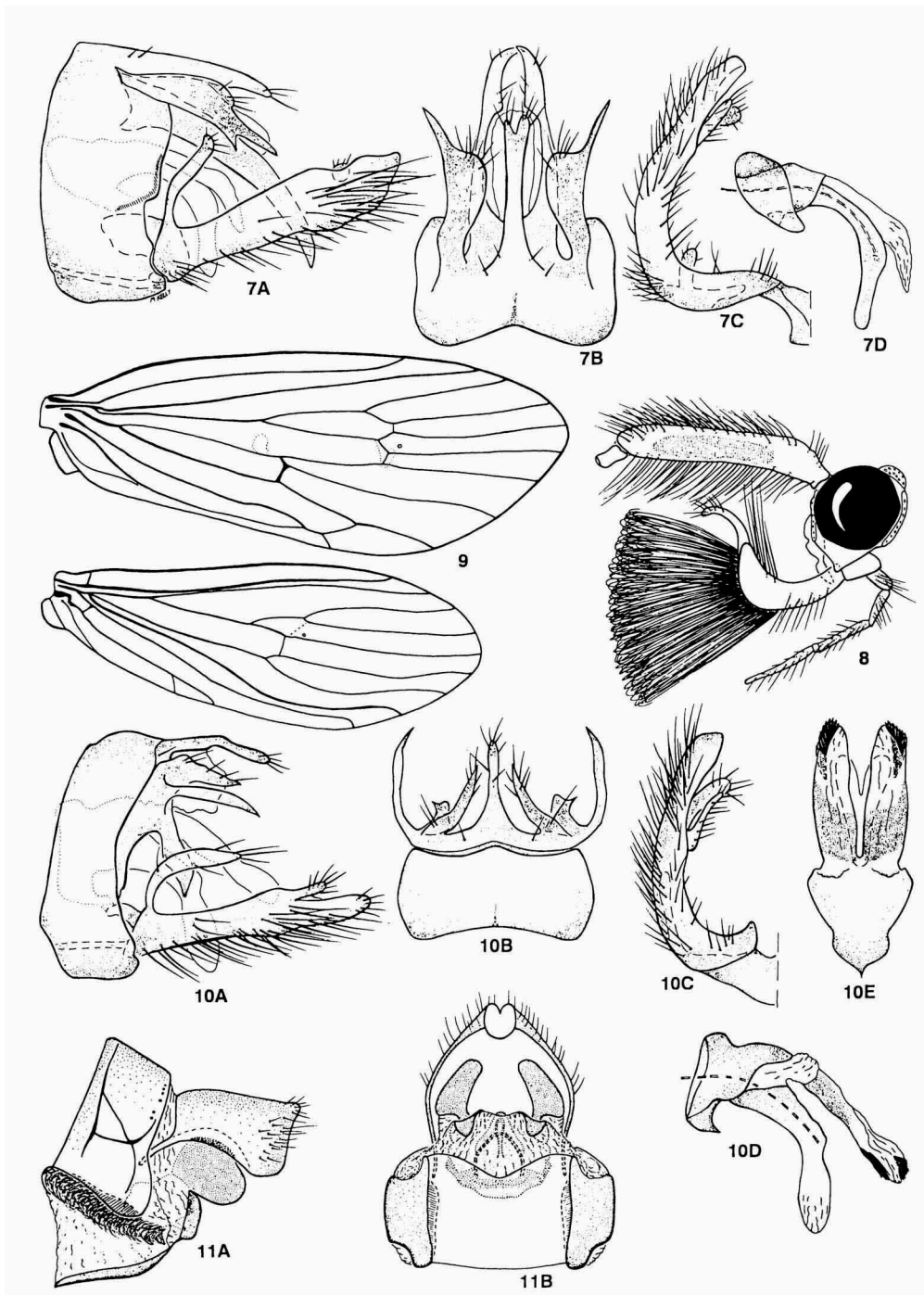


Fig. 7, *Dinarthrum kellyi* spec. nov.; figs. 8-11, *Dinarthrum tridentatum* spec. nov. 7, 10, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 10E, phallus, dorsal; 8, male head, lateral; 9, male wings; 11, female genitalia: 11A, lateral; 11B, ventral.

Male.— Head (fig. 8): Vertex slightly concave, dorsoposterior warts large, dorsoanterior warts absent, frons with lateral setose areas. Scape 1.2 mm, nearly straight, cylindrical, except having shallow mesal concavity, bearing many minute vertical grooves, and with dorsal and ventral margins of concavity bearing many long fine setae. Maxillary palpi 1.1 mm, having basal segment with apical $\frac{1}{2}$ curved dorsad and bearing large mesal brush of fine setae, brush 0.7 mm and with apices of setae recurved mesad; apical segment 0.4-0.6 mm, slenderer than basal segment and curved anteriad. Wings (fig. 9): Forewing 5.8 mm, brown, C bearing short scales forming anterior fringe, anal margin bearing several long stout setae forming posterior fringe, Cu_2 long and continuous. Hindwing with M_{3+4} and apical $\frac{1}{2}$ of Cu_1 and Cu_2 curved and parallel to distal portion of posterior wing margin. Genitalia (fig. 10): Segment IX annular. Segment X with middorsal process and a pair of trifid ventrolateral processes: Middorsal process in dorsal view undivided, straight, narrow, fingerlike and directed posteriad, in lateral view geniculate. Ventrolateral processes each with three pointed processes: 1) Mesosuperior process about $\frac{3}{4}$ as long as of middorsal process, in lateral view acuminate and directed posteriad; in dorsal view with apices converging mesad. 2) Lateral process about as long as middorsal process, in lateral view blade-like having ventral margin straight and dorsal margin gradually curved; in dorsal view base extended from dorsolateral corner of segment X and curved, middle $\frac{3}{4}$ nearly straight, and apex acuminate and curved mesoposteriad. 3) Ventromesal process in lateral view irregular blade-like, directed ventrad, twice as broad as lateral process. Phallus with phallicata bent ventrad, having each paramere with apical portion flexible and bearing dorsal and ventral patches of short spines. Inferior appendages each in lateral view straight, somewhat fingerlike, with basal $\frac{2}{3}$ of dorsal and ventral margins slightly concave; basodorsal process clavate, with basal $\frac{1}{2}$ directed dorsad and curved posteriad, and apical $\frac{1}{2}$ directed posteriad and parallel to main article; main article equally slender in both lateral and ventral views, broadened at attachment of second article and subapicomesal processes, in ventral view having basomesal margin with long curved emargination, second article, nearly straight with rounded apex; main article in lateral view straight, dorsal and ventral margins slightly concave, somewhat fingerlike, broadened at articulation of second article and mesal processes; two subapical mesal lobes with dorsal lobe broader than ventral lobe.

Female.— Head with vertex not concave as in male; scape 1.0 mm. Forewing 6.8 mm, both fore and hindwings with shape similar as in male. Genitalia (fig. 11): VIII with long recessed pocket below tergite. Segment IX in lateral view almost rectangular, with dorsal margin nearly straight and posterior dorsal angle blunt and square, slightly widened posteriad with ventroposterior angle rounded. Vaginal apparatus having short canal, in lateral view with pair of heavily sclerotized posterior valves, obovate, extended below ventral margin of segment IX and almost fully exposed laterally. Spermathecal sclerite triangular, bearing pair of slender lateral processes bent posteriad. Spermatheca without conspicuous pattern.

Etymology.— Latin *tri-* three; *dentatus* toothed, after the ventrolateral processes of segment X of the male genitalia.

Remarks.— This species is placed in the *tridentatum* group. It resembles *D. bidentatum* and *D. kellyi*, but differs from both by having male genitalia with segment IX more slender in lateral view, and with the processes of segment X in lateral view subequal in length, none being more than $1.5 \times$ as long as another.

Lepidostoma Rambur, 1842

There are 15 species of *Lepidostoma* known from Borneo: 11 new species and 4 previously described. The four previously described species are removed from the genus *Goerodes* and transferred to *Lepidostoma* based on having male genitalia lacking phallic parameres, i.e. *L. grande* (Banks), *L. conjunctum* (Banks), *L. medium* (Banks), and *L. dulitense* (Mosely). All species from Borneo, except *L. dulitense* and *L. erectum* spec. nov., are placed in one of the following three new species groups.

Corollatum Group.— Five species from Borneo are placed in this new species group: *L. biscalum* spec. nov., *L. corollatum* spec. nov., *L. quaternarium* spec. nov., *L. tenellum* spec. nov., and *L. uncinatum* spec. nov. Members of this group share the characteristics of having male scape (figs. 12, 18) cylindrical and simple, lacking mesal processes, and male genitalia (figs. 14, 20) with segment X simple, bearing at most only two pairs of processes, usually short (except in *L. tenellum*), phallicata nearly straight, and inferior appendages simple, each having blunt dorsal process and without other major processes.

Grande Group.— Six species from Borneo are placed in this new species group: *L. conjunctum* (Banks), *L. curtispiculum* spec. nov., *L. grande* (Banks), *L. octolobium* spec. nov., *L. oreion* spec. nov., and *L. pendulum* spec. nov. Members of this group share characteristics of having male forewing (fig. 37, 40, 44) relatively long and slender, with Cu_1 , Cu_2 , 1A, and 2A reduced or converging just below $M_{3,4}$. Four species of this group, *L. conjunctum*, *L. curtispiculum*, *L. grande*, and *L. pendulum*, have the male scape modified with the basomesal process bearing a large scale at the apex of the basomesal process (figs. 15, 25). Three of the latter species, *L. conjunctum*, *L. curtispiculum*, and *L. pendulum*, have the male inferior appendages (figs. 16, 26) each with basal $1/3$ directed dorsad in lateral view, then curved with distal $2/3$ directed posteriad.

Medium Group.— Two species from Borneo are placed in this new species group: *L. medium* (Banks), and *L. cratis* spec. nov. Both of these species have male forewing (fig. 22) with posterior margin nearly straight or with slightly recessed curve, 1A thick, straight and parallel with posterior margin, 1A at arculus atrophied and Cu_1 curved posteriad.

Key to species of *Lepidostoma*
(males only)

1. Forewing with broad postcostal cell that folds back reaching R_1 (Mosely, 1951: fig. 1) *L. dulitense* (Mosely), p. 545
- Forewing with postcostal cell either very slender (fig. 29) or absent 2
2. Segment X of genitalia with long slender pair of dorsomesal processes directed dorsad (fig. 30A) *L. erectum* Weaver and Huisman, p. 547
- Segment X without processes directed dorsad 3
3. Forewing without long open anal cell, with some anal veins terminating near the

- middle of posterior margin (fig. 48); *corollatum* group 4
- Forewing with long open anal cell extended from basal fork of anal veins along entire length of posterior margin to arculus, with anal veins either terminating near base or near arculus (figs. 22, 40, 44) 8
4. Segment X with long pair of slender clavate dorsolateral processes, and inferior appendage with long slender basodorsal process (fig. 50)
..... *L. tenellum* Weaver and Huisman, p. 557
- Segment X with lateral processes short or absent, and inferior appendage with short stout basodorsal process (figs. 14, 49, 53) 5
5. Segment X in dorsal view comprising one pair of fused processes and shaped like cloven hoof (fig. 14B) *L. bisculum* Weaver and Huisman, p. 541
- Segment X different from above, in dorsal view with two pairs of short, separate posterior processes (fig. 20B, 49B, 53B) 6
6. Inferior appendage in ventral view with broad bifid apex comprised of broad apical point and rounded mesal margin, and with short rounded subapicomesal flange (fig. 49C) *L. quaternarium* Weaver and Huisman, p. 555
- Inferior appendage with acuminate apex and without subapicomesal flange (fig. 20C, 53C) 7
7. Segment X in lateral view with dorsal process slightly larger than ventral process, and inferior appendage stout with apex wedge-shaped (fig. 20A)
..... *L. corollatum* Weaver and Huisman, p. 542
- Segment X in lateral view with dorsal process much smaller than ventral process, and inferior appendage longer and slenderer, with apex fingerlike (fig. 53A)
..... *L. uncinatum* Weaver and Huisman, p. 558
8. Forewing broad with posterior margin nearly straight or slightly concave, having 1A thick, straight and parallel to posterior margin (fig. 22); *medium* group 9
- Forewing narrow with posterior margin curved, having coalesced veins including 1A either not parallel with hind margin (fig. 37, 40), or curved slightly anteriorly with hind margin (fig. 44); *grande* group 10
9. Basodorsal process of inferior appendage in lateral view clavate, and slightly broadened apically (fig. 23A); segment X with bifid dorsomesal process, and long pair of lateral rods with apices curved ventrad and extended below subapex of inferior appendage *L. cratis* Weaver and Huisman, p. 544
- Basodorsal process capitate with large apical knob extended posteriad (fig. 35A); segment X with dorsomesal process absent, and lateral rods shorter with apices directed posteriad *L. medium* (Banks), p. 550
10. Scape simple, cylindrical and without mesal lobes (fig. 39) 11
- Scape complex, with two or three mesal lobes (fig. 15, 25, 32, 43) 12
11. Inferior appendage with uniquely large subapicolateral spinelike seta, and segment X in lateral view with ventromesal pair of twisted geniculate rods, each having apical $\frac{1}{2}$, hooked ventrad, and longer than lateral processes (fig. 41A)
..... *L. oreion* Weaver and Huisman, p. 553
- Inferior appendage without spinelike seta, and segment X in lateral view with ventromesal pair of processes irregular thumblike, and shorter than lateral processes (fig. 40A) *L. octolobium* Weaver and Huisman, p. 551
12. Ventromesal processes of segment X capitate in lateral view (figs. 26A, 45A) 13
- Ventromesal processes either absent, or not capitate (figs. 16A, 33A) 14

13. Ventromesal processes of segment X each with large apical knob (fig. 45A)
 *L. pendulum* Weaver and Huisman, p. 554
 - Ventromesal processes each with small apical knob (fig. 26A)
 *L. curtipendulum* Weaver and Huisman, p. 545
 14. Segment X with two mesal pairs of processes nearly equal in length, and inferior
 appendage in lateral view with basal $\frac{1}{3}$ extended dorsad and distal portion
 curved and directed posteriad (fig. 16A) *L. conjunctum* (Banks), p. 541
 - Segment X with ventromesal pair of processes 2 × as long as dorsomesal pair, and
 inferior appendage in lateral view nearly straight and directed posteriad (fig.
 33A) *L. grande* (Banks), p. 548

***Lepidostoma bisculum* spec. nov.**
 (figs. 12, 13, 14)

Material.— Sabah: Holotype: ♂, (RMNH), Poring Hot Springs, Sg. Tananansad, 560 m, 6°03'N
 116°42'E, 9.xii.1986, JH.

Male.— Head (fig. 12) very setaceous with full complement of setal warts; frons
 mostly flat with raised area just above labrum. Scape 0.65 mm, nearly cylindrical.
 Maxillary palpi with basal segment 0.5 mm, setaceous, straight and fingerlike, apical
 segment similar as in *L. corollatum*, minute flexible lobe about $\frac{1}{8}$ as long as first seg-
 ment. Forewing (fig. 13): 6.3 mm, brown, with short membranous groove in anal
 loop. Genitalia (fig. 14): Segment IX in lateral view with posterior margin concave;
 dorsum extending well above segment X, and with short flexible posterior extension
 that projects above base of segment X. Segment X simple, in dorsal view shaped like
 cloven hoof with median fissure, and apex with short shallow narrow notch; in later-
 al view shaped liked an irregular thumblike lobe extended posteriad, and $\frac{2}{3}$ as long
 as inferior appendages. Phallus with phallicata nearly straight, having base bent
 slightly ventrad. Inferior appendages simple, each in lateral view straight slender
 and acuminate, with blunt triangular basodorsal lobe, and slender apex; in ventral
 view apex with broad rounded subapical mesal flange, and ventromesal ridge with
 long gradually curved margin.

Female.— Unknown.

Etymology.— Latin *bisulcus*, cloven, as characteristic of segment X of the male genitalia.

Remarks.— This species is included in the *corollatum* group, and is similar to other
 species of this group, but differs by having segment X of the male genitalia shaped
 like a cloven hoof in dorsal view, and lacking ventrolateral processes.

***Lepidostoma conjunctum* (Banks, 1934) comb. nov.**
 (figs. 15, 16, 17)

Goerinema conjuncta Banks, 1934: 574-5, figs. 10, 20, ♂ ♀.

Goerodes conjuncta; Ulmer, 1951: 30, 31, 502, 509-10, pl. 27: figs. 820-23, ♂ ♀; Kimmins, 1955: 402.

"*Goerinema*" *conjuncta*; Ulmer, 1957: 452.

Goerodes conjunctus; Fischer, 1970: 18-9; Weaver, 1985: 240, figs. 6-8, lectotype, ♂, ♀.

Material.— Sabah: Lectotype: ♂, (BMNH), Mt Kinabalu, Lumu Lumu, 5000', 16.iv, HM Pendlebury;
 "allotype" ♀, (BMNH), ibid. 5500', 16.iv.1929 HM Pendlebury.

Male.— Scape (fig. 15): 1.7 mm, with setose mesal concavity and three basomesal lobes, largest lobe bearing large lanceolate scale. Maxillary palpi having basal segment curved and apical segment short flexible and setose. Forewing (Weaver, 1985: fig. 6A): 9.2 mm, brown, venation similar as in *L. pendulum* (fig. 44). Genitalia (fig. 16): Segment IX in lateral view tapered toward dorsum. Segment X in dorsal view with two pairs of slender fingerlike processes extended posteriad, and with short lobes at apicolateral corners, in lateral view with slender fingerlike dorsal lobes extended posteriad and broad oval ventral mass. Phallus simple and short. Inferior appendages each about $3 \times$ as long as segment X, having main article with basal $\frac{1}{3}$ directed dorsad, then curved with posterior $\frac{2}{3}$ directed posteriad; basodorsal process slender, straight, clavate, and extended dorsad, all except apex obscured by main article in lateral view; second article in lateral view more slender with apex trapezoidal and bearing two short stout apical setae; main article bearing three other processes: 1) dorsomesal subapical process bilobed, with both lobes slender and fingerlike; 2) ventromesal subapical process slightly basad of bilobed dorsomesal process, irregular capitate and directed ventroanteriorly; and 3) basoventral process long and slender, about $\frac{1}{3}$ as long as main article.

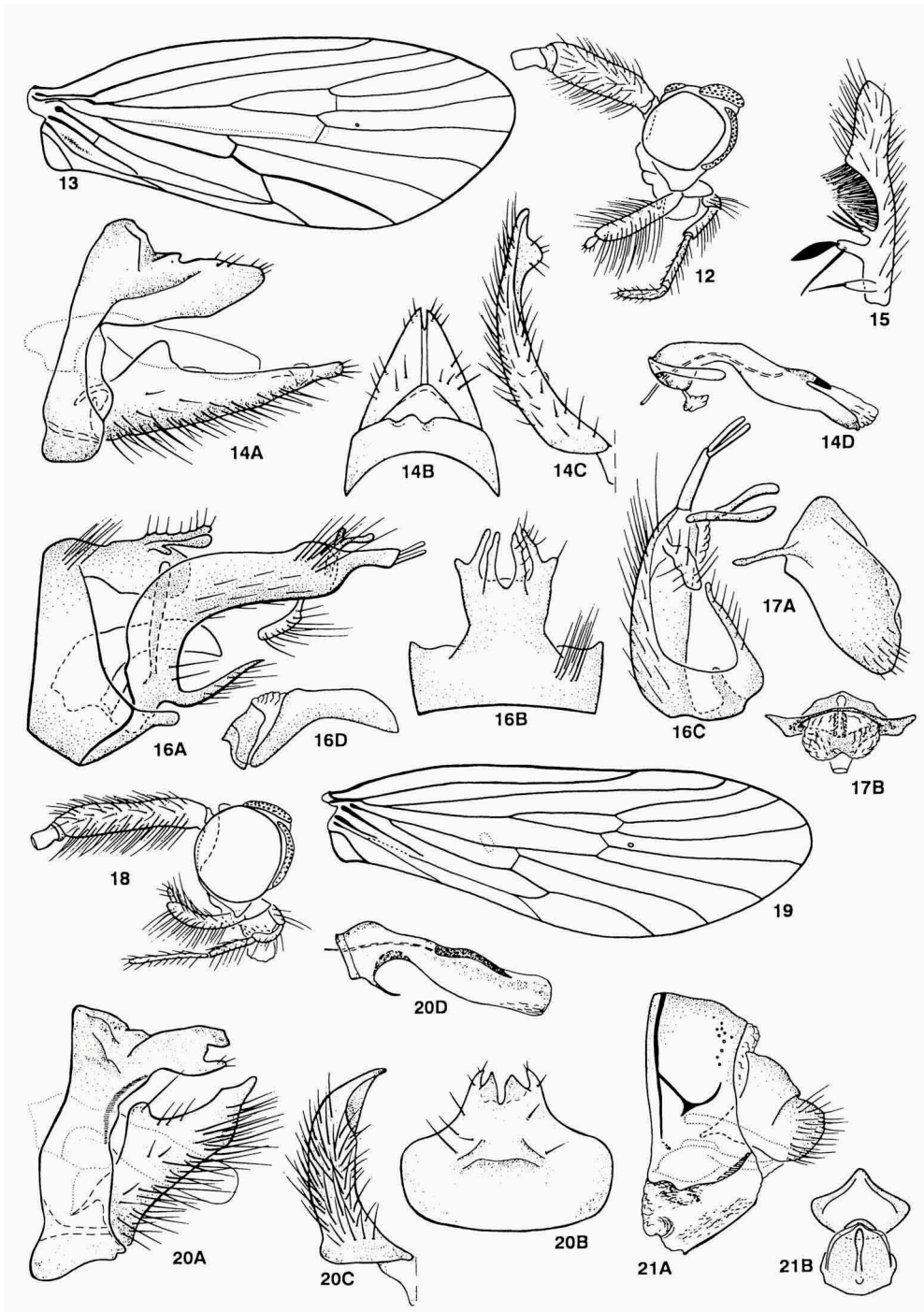
Female.— Scape 1.2 mm. Forewing 8.6 mm. Genitalia (fig. 17): Segment IX in lateral view about twice as long as high, with slender anterior arm. Spermathecal sclerite about twice as broad as long, bearing pair of lateral processes, each process trapezoidal with acute distal posterior angle and obtuse anterior angle.

Remarks.— This species is included in the *grande* group, it is similar to *L. curtipendulum* and *L. pendulum*, but differs by characteristics of the male genitalia. This species is known only from the type series; the lectotype was designated by Weaver (1985).

***Lepidostoma corollatum* spec. nov.**
(figs. 18, 19, 20, 21)

Material.— Sabah: Holotype σ , (RMNH), Kinabalu Nat. Pk., summit trail near Liwagu trail, 6°02'N 116°33'E, 1850 m, 17.vii.1986, JH. Paratypes: 2 ♀♀ , (RMNH), *ibid.*; 3 ♂♂ , (RMNH), Kinabalu Nat. Pk., Sg. Tibabar, 6°02'N 116°33'E, 1750 m, 11.viii.1986, JH; 1 σ 3 ♀♀ , (RMNH), Kinabalu Nat. Pk., power station, 1900 m, 8-11.iii.1987, CvA.

Male.— Head (fig. 18): Dorsum with large posterior warts; frons with narrow pair of lateral warts; vertex concave, without frontal projection. Scape cylindrical, 0.7 mm. Maxillary palpi with basal segment 0.45 mm, fingerlike and slightly curved, with apical segment 0.10 mm and lobiform. Forewing (fig. 19) 7.2 mm, brown, not highly modified. Genitalia (fig. 20): Segment IX irregular and annular. Segment X simple, with main body projecting posteriad and with two pairs of short apical processes; in lateral view main body about twice as long as its height, imarginate oval-shaped, with square apical notch separating dorsomesal and ventrolateral processes, dorsal process short and trapezoidal, ventral process short and lobiform; in dorsal view about as wide as long, bearing two pairs of apical teeth pointed posteriad, dorsomesal teeth about twice as broad as ventrolateral teeth. Phallus nearly straight with base slightly curved ventrad. Inferior appendages each in lateral view broad and irregularly wedge-shaped; ventral and dorsal margins slightly concave and slightly widened at subapex, apical $\frac{1}{4}$ broadly acuminate having triangular lobe directed



Figs. 12-14, *Lepidostoma bisculum* spec. nov.; figs. 15-17, *Lepidostoma conjunctum* (Banks), lectotype; figs. 18-21, *Lepidostoma corollatum* spec. nov. 12, 18, male head, lateral; 13, 19, male forewing; 14, 16, 20, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 15, male right scape, dorsal; 17, 21, female genitalia: 17A, IX, lateral; 21A, lateral; B, spermathecal sclerite, ventral.

posteriad, basodorsal process short broad and lobiform; in ventral view mesal ridge without basoventral angle, mesal margin with curved emargination, width almost uniform and tapered only at apex, lateral margin gradually curved with apex directed mesad.

Female.— Head with vertex not concave as in male. Scape 0.95 mm. Forewing 7.2 mm. Genitalia (fig. 21): VIII with recessed pocket below tergite. Segment IX short, in lateral view about as long as broad, anteriolateral arm short and triangular, dorsal margin curved and interrupted by fine lateral ridge. Spermathecal sclerite nearly round, but anterior portion slightly broader, without lateral processes. Spermatheca ovoid and without conspicuous pattern of mictotrichia.

Etymology.— Latin *corolla*, diminutive for crown, after the shape of segment X of the male genitalia in dorsal view.

Remarks.— This species is similar to *L. quaternarium* and *L. uncinatum*, but differ by having segment X of the male genitalia in lateral view with a square notch between the dorsal and ventral processes, and inferior appendage broad and somewhat wedge-shaped.

Lepidostoma cratis spec. nov.

(figs. 22, 23, 24)

Material.— Sabah: Holotype: ♂, (RMNH), 12 km NNE Ranau, Poring Hot Springs, Sg. Montokungon, 6°02'30"N 116°43'E, 450 m, 28.i.1987, JH. Paratypes: 4 ♂♂, 2 ♀♀, (RMNH), Long Pa Sia, Sg. Matang, 4°24'N 115°43'E, 1000 m, 6.xii.1987, JH & CvA; 3 ♀♀, (RMNH), E of Long Pa Sia, 1050 m, 25.xi-8.xii.1987, CvA; 2 ♀♀, (RMNH), W of Long Pa Sia, 1050 m, 25.xi-8.xii.1987, CvA; 5 ♂♂, (RMNH), Long Pa Sia, Sg. Pa Sia, 4°25'N 115°43'E, 1090 m, 14-28.x.1986 JH; 2 ♀♀, (RMNH), 10 km S Long Pa Sia, Sg. Malabit, 4°21'N 115°41'E, 1180 m, 2.xii.1987, JH & CvA.

Male.— Head: Vertex with minute point along anterior margin in dorsal view, frons lacking well defined setaceous warts but with lateral and dorsolateral setose areas. Scape 0.8 mm and cylindrical. Maxillary palpi with basal segment 0.3 mm; second segment about $\frac{1}{3}$ as long as basal segment, bearing thick brush of scales. Forewing (fig. 22): 6.0 mm, light brown, venation similar as in *L. medium*. Genitalia (fig. 23): Segment IX broad and annular in lateral view. Segment X bearing dorsomesal and ventrolateral pairs of processes; ventrolateral processes long slender rods, well set into dorsum of segment IX, about $1.5 \times$ as long as dorsomesal processes, in lateral view basal $\frac{3}{4}$ slanted ventroposteriad and apical $\frac{1}{4}$ curved sharply ventrad and with acute apical point, in dorsal view each process saber-like and crossing each other apically; dorsomesal process in lateral view saber-like with slender base slightly dorsad of lateral rods, dorsal and ventral margins curved ventrad apex extended below midsection of lateral rods; in dorsal view with basal $\frac{3}{4}$ fused and rectangular, bifid with apical $\frac{1}{4}$ bearing two triangles pointed posteriad and separated by posterior mesal triangular notch. Phallus having phallicata short, asymmetrical with left side bulbous, and at midlength bent ventrad at right angle. Inferior appendages each having basodorsal process in lateral view slender clavate and extended dorsad, almost straight but bent slightly posteriad; main article in lateral view rectangular, but slightly widened distally and then tapered at attachment of second article; second article in lateral view shaped like irregular oval lobe projecting posteriad, attached to apicodorsal margin of main article; main article in ventral view rectangle,

ventromesal ridge straight with short apical lobe projected posteriad, second article slender and slanted mesad with trapezoidal apex, having acute apical angle and obtuse mesal angle.

Female.— Scape 9.5 mm. Forewing 6.8 mm. Genitalia (fig. 24): VIII pleuron with noticeable recessed pocket below tergite. Segment IX about twice as long as broad in lateral view, dorsum curving ventrad with small subapical hump. Spermathecal sclerite in ventral view irregular broad triangle, with lateral processes broad truncate and extended anterolaterally. Spermatheca having midsection with numerous fine microtrichia, and anterior portion with dense strong reticulate pattern.

Etymology.— Latin *cratis*, rake, after the configuration of segment X of the male genitalia.

Remarks.— This species is placed in the *medium* group. It is closely related to *Goerodes malickyi* Weaver, but differs by having segment X of the male genitalia with longer lateral rods and with middorsal process having shallower apicomesal notch.

Lepidostoma curtispiculum spec. nov.

(figs. 25, 26)

Material.— Sarawak: Holotype: ♂, (RMNH), 16 km N Bario, Long Rapun, Sg. Dapur, 3°53'N 115°35'E, 1200 m, 20.ii.1987, JH.

Male.— Head (fig. 25): Vertex and setaceous warts similar as in *L. pendulum*; scape also similar except slightly shorter, 1.25 mm long, more nearly straight in lateral view, and with mesal cavity having minute distal tubercle and larger basal tubercle, basal tubercle bearing two apical lanceolate scales and distal tubercle with one. Maxillary palpi similar as in *L. pendulum* (fig. 43B), 0.8 mm, setose with many ventral setae and short mesal scales. Forewing 6.5 mm, brown, venation similar as in *L. pendulum* (fig. 44). Genitalia (fig. 26): Segment X with dorsal and ventral pairs of arms; in lateral view dorsal arm straight, horizontal, about 3 × as long as its basal width, $\frac{2}{3}$ as long as ventral arm; in lateral view ventral arm capitate, not extending below venter of inferior appendage, and with apical knob about twice as broad as its petiole. Inferior appendages each in lateral view slender, and with basomesal ventral process extended well beyond ventral margin of main article.

Female.— Unknown.

Etymology.— Latin, *curtus*, short and, *pendulus*, hanging; after the ventral processes of segment X of the male genitalia.

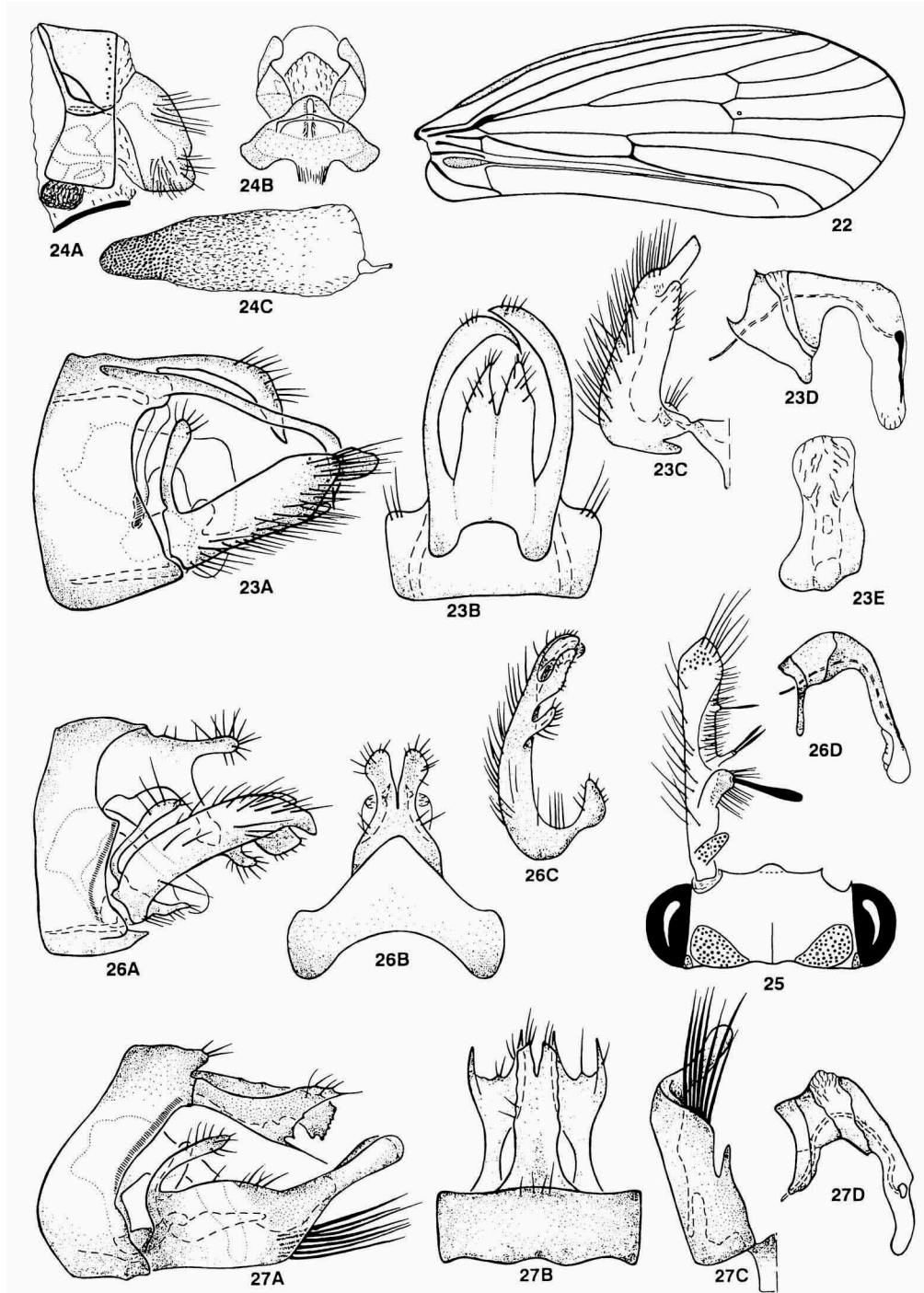
Remarks.— This species is included in the *L. grande* group, and is closely related to *L. pendulum*. It differs by having male with scape slightly shorter and not as curved in lateral view, and segment X having ventromesal capitate processes with smaller apical knob.

Lepidostoma dulitense (Mosely, 1951) comb. nov.

(fig. 27)

Goerodes dulitensis Mosely, 1951: 481-483, figs. 1-4, ♂ ♀; Kimmins, 1955: 397-8, 402; Ulmer, 1957: 452; Fischer, 1970: 19.

Goerodes pendleburyi Weaver, 1989: 58-9, fig. 14. *Syn. nov.*



Figs. 22-24, *Lepidostoma cratis* spec. nov.; figs. 25-26, *Lepidostoma curtipendulum* spec. nov.; fig. 27, *Lepidostoma dulitense* (Mosely), type. 22, male forewing; 23, 26, 27, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 23E, phallus, dorsal; 24, female genitalia: 24A, lateral; 24B, spermathecal sclerite, ventral; 24C, spermatheca, lateral; 25, male head, dorsal.

Material.— Sarawak: Type: ♂, (BMNH), foot of Mt Dulit, junction of rivers Tinjar & Lejok, 17.ix.1932, Oxford Univ. Exp., BM Hobby & AW Moore. Note: The type was remounted and placed in the pinned type collection.

Male.— Head with two pairs of dorsal warts and frons with pair of lateral setose areas. Scape 0.8-1.1 mm, cylindrical, mesal surface not concave. Maxillary palpi with first segment 0.6 mm, second segment 0.15 mm, apices of both segments setose. Wings (Mosely, 1951: fig. 1): Forewing 5.5-5.8 mm, brown, with postcostal cell bearing many scales and overlapping Sc and R₁; hindwing 4.3 mm. Genitalia (fig. 27): Segment IX annular, in lateral view with ventral 1/2 curved anteriorly. Segment X symmetrical, with dorsomesal process and ventrolateral pair of processes; dorsomesal process in dorsal view long slender rectangular, bifid with short narrow V-shaped apicommesal notch; lateral processes each with basal 1/3 narrow and distal portion broadened, in dorsal view chalice-shaped slightly longer than dorsomesal process, bifid with two slender apical points, in lateral view dorsal margin sinuate and ventral margin nearly straight, with dorsal and ventral apical points continuous with their respective margins. Phallus with phallicata inclined ventrad. Inferior appendages each having main article in lateral view rectangular, broad, and about 2/3 as high as long; basodorsal process slender, with base curved dorsoposteriorly; main article tapered apically at articulation of second article; second article in lateral view thumblike and extended dorsoposteriorly, in ventral view with short ventromesal point directed posteriorly.

Female.— Described briefly by Mosely (1951). We have not examined any female specimens.

Remarks.— In a comparison of *L. dulitensis* and *L. pendleburyi* Weaver (1989) mentioned that the latter "differs by having male with a very small notch in the middorsal process of segment X, the apex of the phallicata bent anteroventral, and the apices of the inferior appendages not curved dorsad." Examination of the male type of *L. dulitensis* has revealed these differences are due to natural variation of segment X and the tendency for the second article of the inferior appendage to bend dorsomesad. Hence, *L. pendleburyi* is recognized as a junior synonym. Figure 27 of the male genitalia is based on the type of *L. dulitensis*.

Distribution — Sarawak, Selangor, and Sumatra.

***Lepidostoma erectum* spec. nov.**

(figs. 28, 29, 30, 31)

Material.— Sabah: Holotype: ♂, (RMNH), W of Long Pa Sia, 1050 m, 25.xi-8.xii.1987, CvA. Paratypes: 44 ♂♂, 18 ♀♀, (RMNH), *ibid.*; 1 ♂, (RMNH), 12 km NNE Ranau, Poring Hot Springs, Sg. Kepungit, 6°04'N 116°41'E, 700 m, 26.i.1987 JH; 1 ♀, (RMNH), 12 km NNE Ranau, Poring Hot Springs, Sg. Tananasad, 6°03'N 116°42'E, 560 m, 31.i.1987, JH.

Male.— Head (fig. 28): Vertex with blunt mesal projection, dorsum with posterior pair of large triangular warts, anterior warts small and round, frons with large round lateral pair of warts bearing scales and each wart 0.3 mm in diameter. Scape 1.2 mm with slender basomesal process 0.5 mm, in lateral view slightly sinuate with obtuse ventromesal angle 2/3 length from base. Maxillary palpi with basal segment 1.0 mm, bearing basomesal brush of long scales and apical 1/4 bent dorsad; distal segment

about 0.5 mm, having basal $\frac{1}{4}$ with long brush of thick setae set in mesal pocket, and apical $\frac{3}{4}$ slender fingerlike and curved ventrad. Forewing (fig. 29): 7.3 mm, brown, with setose basal pocket and narrow anterior marginal fold about as long as Sc, and with anal groove running from base to arculus. Genitalia (fig. 30): Segment IX having dorsum with mesal pair of oval setose areas. Segment X in lateral view with dorsomesal processes slender and long, about $\frac{2}{3}$ as long as inferior appendages, and extended dorsad at 45° angle; with ventrolateral flanges in dorsal view short and triangular, bearing three points, in lateral view with lowest apical point directed ventrad and two other smaller points above it directed posteriad. Phallus nearly straight, but apex curved slightly ventrad. Inferior appendages each having main article in lateral view nearly straight and slightly widened apically, bearing several long thick apical setae; second article in ventral view bent slightly mesad and with apex truncate; basodorsal process in lateral view clavate, curved slightly anteriad, and short, about $\frac{1}{4}$ as long as inferior appendage; main article in ventral view with lateral margin nearly straight and mesal margin slightly concave, apex of ventromesal ridge with short fingertip-shaped lobe parallel to base of second article.

Female.— Head having vertex without mesal projection. Scape 1.3 mm. Forewing 7.2 mm. Genitalia (fig. 31): VIII pleuron with two pairs of recessed pockets, one pair just below tergite and another adjacent to vaginal opening. Segment IX long, in lateral view dorsal margin with basal $\frac{2}{3}$ nearly straight, apical $\frac{1}{3}$ irregular with minute bump adjacent to subapical indentation. Spermathecal sclerite in ventral view, slightly wider than long, anterior portion semicircular, posterior portion triangular, with short lateral processes having anterior corners blunt and curved. Spermatheca similar to that of *L. pendulum* but with less distinct pattern of microtrichia, having anterior $\frac{1}{4}$ with ring of fine horizontal striations.

Etymology.— Latin *erectus*, upright, after the dorsal processes of segment X of the male genitalia.

Remarks.— This species is not assigned to a species group. It is unique among the Asian Lepidostomatidae having segment X of the male genitalia with long slender dorsomesal processes extended dorsoposteriad.

Lepidostoma grande (Banks, 1931) comb. nov.

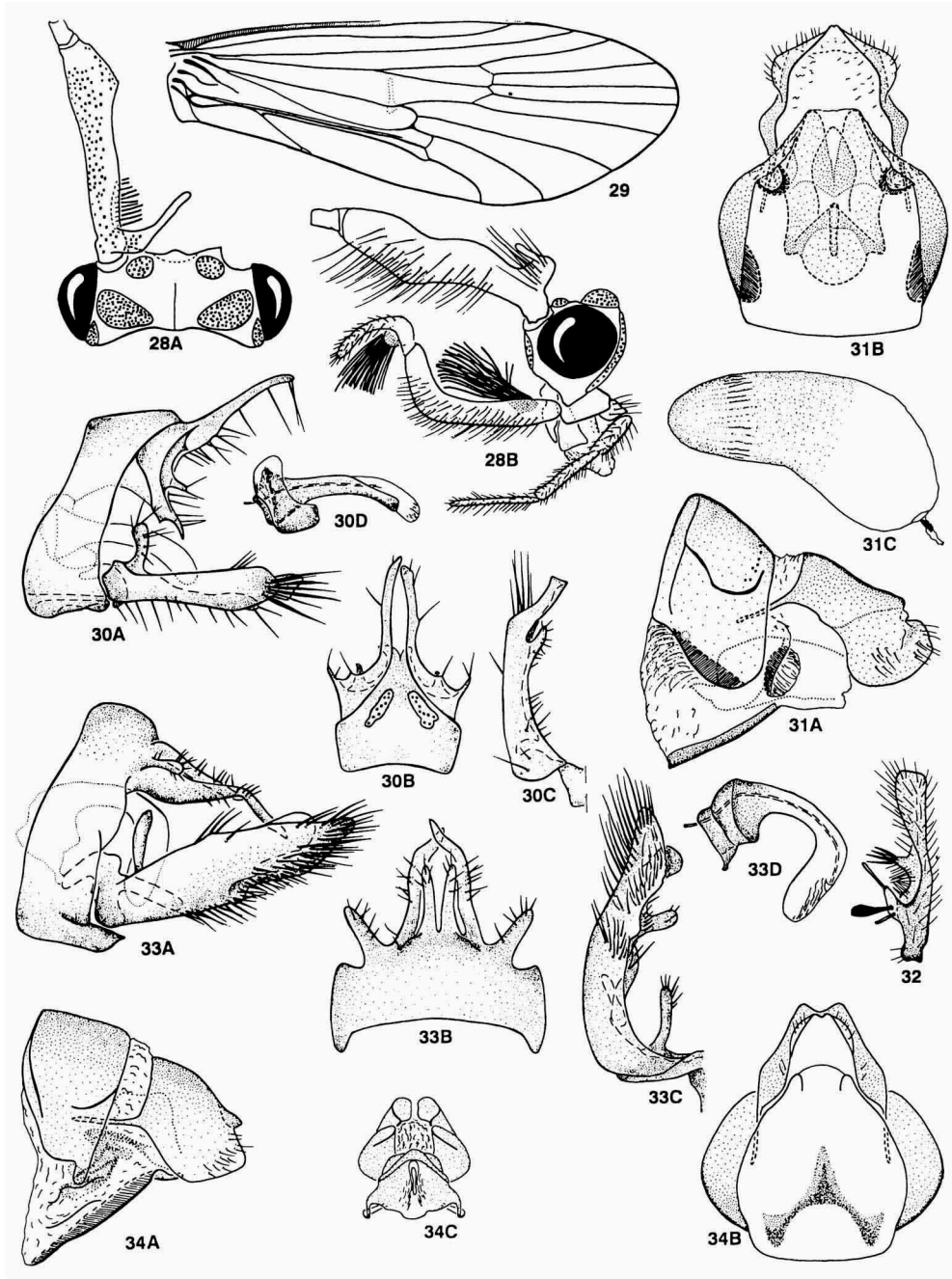
(figs. 32, 33, 34)

Goerinella grandis Banks, 1931: 420, figs. 1, 3, 4, 9, ♂ ♀; Banks, 1934: 574.

Goerodes grandis; Ulmer, 1951: 25, 31, 502, 507-9, pl. 27: figs. 815-8, ♂ ♀; Kimmins: 1955: 402; Fischer, 1970: 20-21; Weaver, 1985: 240, ♂, ♀, figs. 9-11, lectotype.

"*Goerinella*" *grandis*; Ulmer, 1957: 452.

Material.— Sabah: Paratype: ♂, (CNC 12359), Mt Kinabalu, Pakka 10,000', 20.iii.1929, at light, HM Pendlebury. Other material: 2 ♂♂, (BPBM), Mt Kinabalu, 3650-3960 m, 27.x.1958, LW Quate; 14 ♂♂, 21 ♀♀, (RMNH), Kinabalu Nat. Pk., Gunting Lagadan, Ulu Kolopis, 6°04'N 116°34'E, 3200 m, 13.i.1987, JH; 2 ♂♂, 1 ♀, (RMNH), *ibid.*, 15.xii.1989, HA in den Bosch; 1 ♀, (RMNH), Kinabalu Nat. Pk., summit trail, Pondok Pakka, 6°04'N 116°34'E, 2950 m, 4.viii.1986, JH; 2 ♂♂, 5 ♀♀, (RMNH), Kinabalu Nat. Pk., Pakka cave, Sg. Kolopis, 6°04'N 116°34'E, 2960 m, 5.viii.1986, JH; 63 ♂♂, (RMNH), *ibid.*, 14.i.1987, JH; 1 ♂, 2 ♀♀, (RMNH), Kinabalu Nat. Pk., Carsons Camp, 6°02'N 116°33'E, 2621 m, 28.vii.1986, JH; 1 ♂, (RMNH), Kinabalu Nat. Pk., Ulu Liwagu below Carsons Camp, 6°02'N 116°33'E, 2550 m, 5.x.1987, JH; 1 ♀, (RMNH), *ibid.*, 12.x.1987, JH.



Figs. 28-31, *Lepidostoma erectum* spec. nov.; figs. 32-34, *Lepidostoma grande* (Banks), syntype. 28A, male head, dorsal; 28B, male head, lateral; 29, male forewing; 30, 33, male genitalia: A, lateral; B, IX and X dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 31, 34, female genitalia: A, lateral; B, ventral; 31C, spermatheca, lateral, 34C, spermathecal sclerite, ventral; 32, male right scape, dorsal.

Male.— Head: Vertex without frontal projection. Scape (fig. 32) 2.0 mm, similar as in *L. conjunctum* but with only two mesal lobes. Maxillary palpi 2.0 mm, similar as in *L. conjunctum*. Forewing (Weaver, 1985: fig. 9A): 13.5 mm, brown, venation similar as in *L. oreion*, but C without short anterior marginal fold, anal region modified with reduction in venation, M branching only once, and Cu_1 unbranched, distal $\frac{1}{2}$ of Cu_1 close to anal groove and coalesced sections of $Cu_2 + 1A + 2A$; 3A running into hind margin. Hindwing with discal cell closed. Genitalia (fig. 33): Segment IX annular. Segment X bearing three pairs of processes: 1) dorsomesal processes fingerlike, in lateral view straight with apices directed posteriad and slightly inclined ventrad, in dorsal view directed posteriad and separated by long narrow notch. 2) ventromesal processes asymmetrical, about $1.5 \times$ as long as dorsomesal processes, strongly sclerotized and geniculate, in lateral view apical $\frac{1}{3}$ of left process bent ventroposteriad at obtuse angle, and right process with apical $\frac{1}{3}$ bent directly ventrad at right angle. 3) lateral processes lobiform, each about $\frac{1}{2}$ as long as dorsomesal processes, in dorsal view short, fingerlike, nearly straight and diverging laterally. Phallus with phallicata short and stout, with apical $\frac{1}{2}$ curved abruptly ventrad. Inferior appendages each in lateral view about $4 \times$ as long as mean height, with basal $\frac{1}{2}$ slightly widened distally and apical $\frac{1}{2}$ having ventral margin with slightly recessed curve, and with apical $\frac{1}{4}$ acuminate having rounded apex; basodorsal process slender, straight, and clavate; basoventral process in ventral view slender, fingerlike and extended posteriad; with two short subapicomesal processes, the more distal lobe broader.

Female.— Scape 1.45 mm cylindrical. Forewing 14.5 mm. Genitalia (fig. 34): VIII sternite with Y-shaped heavily sclerotized pattern, with bottom of "Y" directed posteriad. Spermathecal sclerite in ventral view about as long as wide, triangular, tapering toward rounded posterior corner, having anterolateral corners with minute twisted flanges. Spermatheca nearly transparent, anterior portion with faint reticulate pattern. Remarks.— Based on the material examined this species appears to be one of the most common lepidostomatids (almost as common as *L. oreion*) and the largest in size known from Borneo. *L. grande* is closely related to *L. octolobium* and *L. oreion*, however it differs from both by having male scape highly modified. The figure of the male genitalia of the lectotype by Weaver (1985: fig. 10) is not accurate, as it does not depict the dorsomesal processes of segment X. Examination of additional material has revealed that these processes were damaged and not present in the lectotype. The specimen illustrated in fig. 33 is a male syntype from the CNC.

***Lepidostoma medium* (Banks) comb. nov.**
(figs. 35, 36)

Goerinnella media Banks, 1934: 574-5, figs. 11, 17, 18, 22, σ ♀.

Goerodes media; Ulmer, 1951: 31, 502, 506-7, pl. 27: figs. 813-4, σ ♀; Kimmins, 1955: 402; Ulmer, 1957: 452; Weaver, 1985: 240-1, σ , ♀, figs. 12-14, lectotype.

Goerodes medius; Fischer, 1970: 21-2.

Material.— Sabah: Lectotype σ (BMNH), Mt Kinabalu, Lumu Lumu, ca. 5500 ft., HM Pendlebury; lectotype designated by Weaver (1985).

Male.— Scape 0.9 mm, not highly modified. Maxillary palpi 0.5 mm, curved anteri-

ad. Forewing (Weaver, 1985: fig. 12): 8.0 mm, brown, venation similar as in *L. cratis* but without long narrow postcostal cell. Genitalia (fig. 35): Segment IX in lateral view with dorsum tapered. Segment X mostly comprised of a long pair of asymmetrical pointed rods; in lateral view each rod with basal $\frac{1}{2}$ nearly straight and directed posteriad, distal $\frac{1}{2}$ sinuate, being curved ventrad and then curved posteriad, having right rod with apex curved dorsad; in dorsal view shaped like pair on tongs, having basal $\frac{3}{4}$ nearly straight and directed posteriad, and apical $\frac{1}{4}$ converging mesad with apices crossing. Phallus short with phallicata curved ventrad. Inferior appendages each having main article in lateral view about $3 \times$ as long as its mean height, dorsal and ventral margins nearly straight, and broadened slightly posteriad, broadest at attachment of second article; second article slender fingerlike lobe with short subapicomeresal lobe, about $\frac{2}{5}$ as long as main article; basoventral lobe short, fingerlike and directed posteriad; ventromesal ridge of main article with obtuse triangular flange at midlength.

Female.— Scape 1.0 mm. Forewing 6.5-7.5 mm. Genitalia (fig. 36): Segment IX in lateral view about $2 \times$ as long as its mean height. Spermathecal sclerite nearly round in ventral view, each anterolateral corner bearing a short lobe. Spermatheca with anterior $\frac{1}{3}$ having dense pattern of short stout microtrichia.

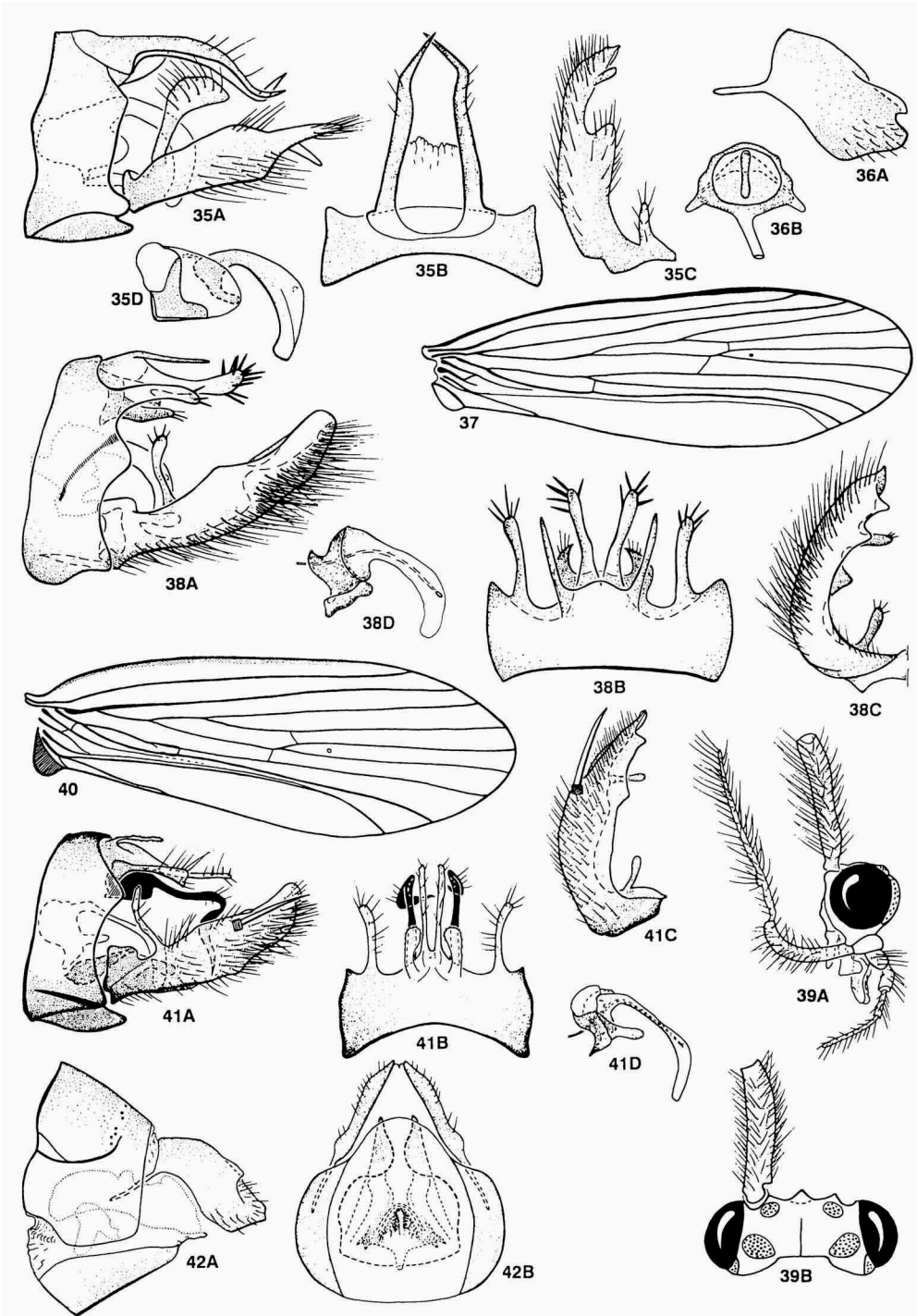
Remarks.— This species is similar to *L. cratis*; it differs by having segment X of the male genitalia with a pair of lateral processes and without a middorsal process.

Lepidostoma octolobium spec. nov.

(figs. 37, 38)

Material.— Sabah: Holotype: σ , (RMNH), 10 km S Long Pa Sia, Sg. Malabit, 4°21'N 115°41'E, 1180 m, 2.xii.1987, JH & CvA.

Male.— Head: Dorsum with anterior and posterior pair of setaceous warts, frons with large pair of lateral warts, vertex with small triangular projection, similar as in *L. oreion*. Scape cylindrical, 1.2 mm. Maxillary palpi having basal segment 1.2 mm with apical $\frac{1}{4}$ tapered and curved dorsad; apical segment 0.4 mm, setose and tapered distad. Forewing (fig. 37) 8.9 mm long, 2.8 mm wide, brown, venation as in *L. grande*. Genitalia (fig. 38): Segment IX annular, in lateral view with dorsum about $\frac{1}{2}$ as wide as venter. Segment X bearing four pairs of processes directed posteriorly: 1) superior dorsomesal processes slender, straight, and in dorsal view diverging slightly laterally, with bases widely separated, and subequal in length to lateral processes; 2) mesosuperior mesal processes fingerlike, diverging laterally from adjacent bases and in dorsal view separated by V-shaped notch, slightly longer than lateral processes, and with large apical spinelike setae; 3) inferior ventromesal processes short, about $\frac{1}{2}$ as long as lateral processes, in dorsal view asymmetrical and shaped like broad mandibles; 4) lateral processes fingerlike, with short apical spinelike setae. Phallus with phallicata curved ventrally. Inferior appendages each in lateral view long and fingerlike, slightly curved dorsad toward apex, and dorsal margin with obtuse point at midlength; basodorsal process clavate, slender, long, and directed dorsad with apical $\frac{1}{3}$ bent slightly posteriad; basoventral process slender, fingerlike, and directed posteriad; ventromesal margin with recessed rounded curve and two



Figs. 35-36, *Lepidostoma medium* (Banks), lectotype; figs. 37-38, *Lepidostoma octolobium* spec. nov.; figs. 39-42, *Lepidostoma oreion* spec. nov. 35, 38, 41, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 36, 42, female genitalia: 36A, IX, lateral; 36B, spermathecal sclerite, ventral; 42A, lateral; 42B, ventral; 37, 40, male forewing; 39A, male head, lateral; 39B, male head, dorsal.

short subapical mesal triangles; apex triangular and pointed posteriad; lateral margin broadly curved.

Female.— Unknown.

Etymology.— Latin *octo* eight, *lobion* lobe, after segment X of the male.

Remarks.— This species is similar to *L. grande*, and *L. oreion*. It differs from *L. grande* by having male with scape simple and cylindrical, and segment X bearing four pairs of processes. It differs from *L. oreion* by having male with ventromesal processes of segment X short, not long and geniculate, and with inferior appendage without unique long lateral spinelike seta.

Distribution.— Malaysia: Sabah.

Lepidostoma oreion spec. nov.

(figs. 39, 40, 41, 42)

Material.— Sabah: Holotype: ♂, (USNM), Kinabalu Nat. Pk., HQ, 1560 m, 6-13.ix.1983, GF Hevel & WE Steiner. Paratypes: 10♀♀, (USNM), *ibid.*; 1 ♂, 1 ♀, (RMNH), Kinabalu Nat. Pk., HQ, Sg. Silau Silau, old bridge, 6°00'N 116°33'E, 1480 m, 9.ii.1987, JH; 1 ♂, (RMNH), Kinabalu Nat. Pk., HQ, 6°00'N 116°33'E, 1500 m, 4.x.1986, JH; 1 ♂, 3 ♀♀, (RMNH), Mt Kinabalu, Sg. Liwagu, near Kundassang bridge, 6°00'N 116°34'E, 1185 m, 23.xi.1986, JH; 1 ♂, 1 ♀, (RMNH), Kinabalu Nat. Pk., Sg. Liwagu nr JPT, 6°01'N 116°33'E, 1650 m, 30.ix.1986, JH; 11 ♀♀, (RMNH), *ibid.*, 18.xi.1986, JH; 1 ♀, (RMNH), Kinabalu Nat. Pk., Sg. Tibabar, 6°02'N 116°33'E, 1800 m, 11.viii.1986, JH; 3 ♂♂, 8 ♀♀, (RMNH), *ibid.*, 2.x.1986, JH; 1 ♀, (RMNH), 9.5 km NNW of Kundassang, Sg. Tawubang, 6°04'N 116°30'E, 1030 m, 11.iii.1987, JH; 4 ♂♂, 5 ♀♀, (RMNH), 10 km NNE Kundassang, Sg. Mesilau E, 6°02'N 116°36'E, 1900 m, 11.xi.1986, JH; 1 ♀, (RMNH), 10.5 km NNW of Kundassang, Sg. Kijuhutan, 6°04'30"N 116°30'30"E, 1350 m, 10.iii.1987, JH; 1 ♀, (RMNH), 12 km NNW Kundassang, trickle near Marei-Parei, 1670 m, 6°05'N 116°31'E, 9.iii.1987, JH; 3 ♀♀, (RMNH), Kinabalu Nat. Pk., Sg. Silau-Silau nr Bukit Burong trail, 6°00'N 116°33'E, 1490 m, 20.xi.1986, JH; 3 ♀♀, (RMNH), *ibid.*, 16.i.1987, JH; 2 ♀♀, (RMNH), *ibid.*, 6.x.1987, JH; 1 ♀, (RMNH), Kinabalu Nat. Pk., HQ, Liwagu + Silau-S trail, 6°00'N 116°33'E, 1470 m, 15.viii.1986, JH; 1 ♀, (RMNH), *ibid.*, 26-30.ix.1986, JH; 1 ♀, (RMNH), *ibid.*, 1.x.1986, JH; 8 ♀♀, (RMNH), *ibid.*, 22.i.1987, JH; 3 ♀♀, (RMNH), *ibid.*, 10.ii.1987, JH; 3 ♀♀, (RMNH), Kinabalu Nat. Pk., Sg. Liwagu, 6°01'N 116°32'E, 1500 m, 11.ii.1987, JH.

Male.— Head (fig. 39): Dorsum with anterior pair of setaceous warts about 1/2 diameter of posterior pair; frons with large oval pair of setaceous lateral areas; vertex with small triangular process directed anteriorly. Scape 1.1 mm, simple and cylindrical. Maxillary palpi 2.0 mm, first segment 0.4 mm with apex curved dorsad, second segment 0.8-1.6 mm, expandable and slender. Forewing (fig. 40): 9.6 mm, brown, narrow, venation as in *L. grande*, but with narrow anterior marginal fold extended almost to apex of *Sc*, anal region modified with reduction in venation, both *M* and *Cu*₁ unbranched, middle section of *Cu*₁ adjacent to anal groove comprised of coalesced *Cu*₂ + 1*A* + 2*A*. Hindwing with discal cell open. Genitalia (fig. 41): Segment IX dorsoposterior margin with slightly recessed curve. Segment X bearing four pairs of processes: 1) superior dorsomesal processes bearing minute pointed tubercles, clavate and thumblike in dorsal view, but slender in lateral view; 2) mesosuperior mesal processes 2 × as long as superior dorsomesal processes, straight slender and directed posteriad in both dorsal and lateral view; 3) inferior ventromesal processes asymmetrical, heavily sclerotized, irregularly twisted rods, in lateral view basal portion slightly bowed ventrad and extended posteriad about as far as mesosuperior processes, then curved strongly anteriorly in hairpin turn and with apex twisted and

pointed ventrad; 4) lateral processes about $1.5 \times$ as long as superior processes, in lateral view clavate with apicoventral point, in dorsal view slender clavate and directed posteriad, with apices diverging slightly laterally. Phallus with phallicata slender, having long narrow petiole and broadened apical knob. Inferior appendages similar as in *L. octolobium*, each in lateral view curved slightly dorsad, irregular fingerlike, $1.5 \times$ as long as mesosuperior processes of segment X, bearing unique large lateral subapical spinelike seta, extended to apex; basodorsal process slender with basal portion slightly curved anteriorly and apical part directed dorsad; ventromesal basal process in ventral view short, fingerlike, slender, and directed posteriad; subapico-mesal process fingerlike, slender, and directed mesad.

Female.— Head with vertex bearing small triangular process as in male. Scape 1.15 mm. Forewing 9.2 mm. Genitalia (fig. 42): VIII sternite with Y-shaped pattern as in *L. grande*. Segment IX similar as in *L. grande* but slenderer in lateral view. Vaginal canal longer than in *L. grande*, having heavily sclerotized posterior valves with mesal margins curved and lateral margins straight. Spermathecal sclerite with anterolateral corners each bearing two short teeth. Spermatheca having anterior portion with faint inconspicuous microtrichia.

Etymology.— Greek *oreios*, of the mountain.

Remarks.— This species is included in the *grande* group, and it is similar to *L. grande* and *L. octolobium*. It differs from *L. grande* by having segment X of the male genitalia with four pairs of processes and having male scape cylindrical and not highly modified. It differs from *L. octolobium* by having segment X with inferior ventromesal processes shaped like long irregularly twisted rods. The long lateral subapical spinelike seta of each inferior appendage is an unusual characteristic only observed in one other lepidostomatid, *Goerodes subanganus* (Ulmer).

Lepidostoma pendulum spec. nov.

(figs. 43, 44, 45, 46)

Material.— Sabah: Holotype: ♂, (RMNH), Long Pa Sia, Ritan River, 1150 m, 8-10.iv.1987, CvA. Paratypes: 1 ♀, (RMNH), *ibid.*; 1 ♀, (RMNH), near Danum Valley Field Centre, 210 m, 14-26.iii.1987, CvA.

Male.— Head (fig. 43): Vertex with short rounded projection; dorsum with posterior pair of setal warts and without anterior warts; frons with lateral setous areas having ventrolateral corners with long brush, and with triangular hump above labrum. Scape 1.65 mm with apical portion curved dorsad, broadened and truncate in lateral view, and with three mesal processes: 1) shorter basodorsal lobe closest to base simple and setose; 2) larger basodorsal lobe $\frac{1}{4}$ length from base and complex, having basal $\frac{1}{2}$ directed dorsad and apical $\frac{1}{2}$ curved mesad and bearing large spatulate scale; 3) ventromesal lobe at midlength, short and slender, bearing pair of apical lanceolate scales; mesal concavity long, setose, just distal to ventromesal process. Maxillary palpi 1.0 mm, basal segment uniformly curved and tapered toward apex, with rounded apical knob curved anteriorly, bearing many short mesal scales, second segment minute membranous subapical ventral lobe. Forewing (fig. 44): 7.5 mm, brown, M_{1+2} and M_{3+4} merge distally forming a closed cell distal to thyridial cell, Cu_1 atrophied below nygma, Cu_2 atrophied below thyridial cell, anal veins appear to con-

verge forming long setose fold parallel to posterior margin and extended to apical margin just below apex of *M. Genitalia* (fig. 45): Segment X with two pairs of mesal processes: 1) dorsomesal processes fingerlike, in dorsal view separated by V-shaped notch, directed posteriad but slightly diverged laterally, in lateral view straight, clavate and nearly horizontal; 2) ventromesal processes about 1.5 × as long as dorsomesal processes, capitate, in lateral view directed ventroposteriad, with large apical knob about 4 × as broad as its petiole, in dorsal view obscured by dorsomesal processes. Phallus with phallicata curved strongly ventrad at its base, having distal part straight, long and directed ventrad. Inferior appendages similar as in *L. curtispindulum* but broader in lateral aspect, each having main article in lateral view with basal $\frac{1}{3}$ directed dorsad, distal $\frac{2}{3}$ curved posteriad, ventral margin with ventral lobe protruding posteriad at $\frac{2}{3}$ length from base; apex with two subapical mesal lobes: 1) ventral lobe short, broad and geniculate in lateral view, having short base extended posteriad and apical obovate portion bent dorsad; 2) dorsal lobe slender, extended posteriad just above dorsal margin of inferior appendage in lateral view; basodorsal process clavate with slender petiole, basal portion of petiole directed anterodorsad and curved with distal portion of petiole and apical knob directed dorsoposteriad; ventral basomesal process in lateral view short, directed ventroposteriad.

Female.— Head having vertex with minute bump. Scape 1.4 mm. Forewing 7.5 mm. Genitalia (fig. 46): VIII pleuron with recessed pocked below tergite. Segment IX long and narrow with dorsum curved ventrad. Spermathecal sclerite in ventral view about twice as broad as long, having broad trapezoid lateral processes, each with posterior angle acute and anterior angle obtuse. Spermatheca having anterior $\frac{1}{4}$ with annular constriction of dense fine longitudinal striations.

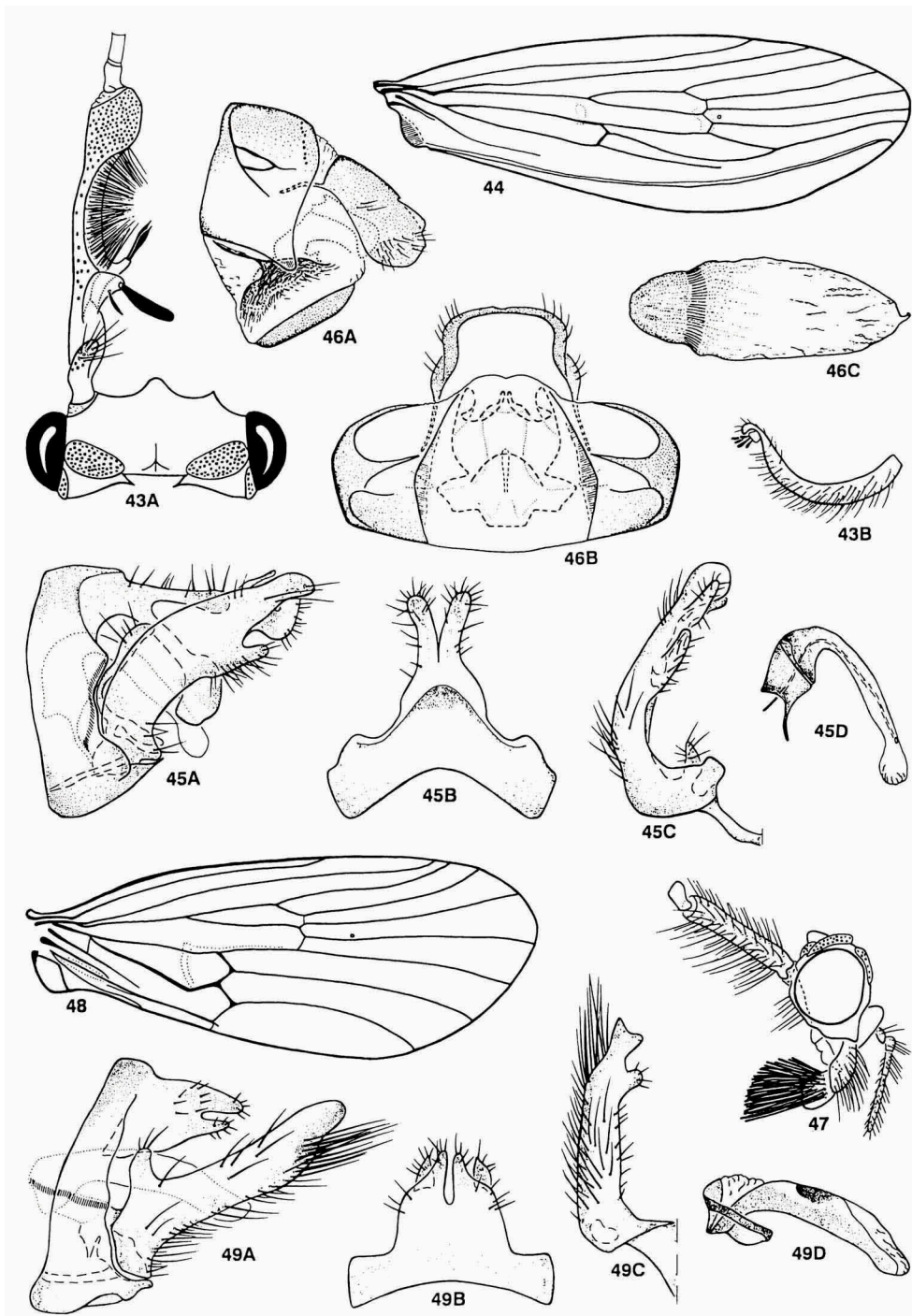
Etymology.— Latin *pendulus*, hanging, after the ventral process of segment X of the male genitalia.

Remarks.— This species is included in the *grande* group and is closely related to *L. curtispindulum*. It differs from *L. curtispindulum* by having male scape longer and more curved in lateral view, and having segment X of the male genitalia with larger capitate ventromesal pair of processes in lateral view.

***Lepidostoma quaternarium* spec. nov.**
(figs. 47, 48, 49)

Material.— Sabah: Holotype: ♂, (RMNH), Kinabalu Nat. Pk., Sg. Tibabar, 6°02'N 116°33'E, 1750 m, 11.viii.1986, JH. Paratypes: 3 ♂♂, (RMNH), *ibid.*

Male.— Head (fig. 47): Dorsum with posterior pair of setous warts large and triangular, anterior warts smaller and oval, frons slightly concave with lateral pair of warts long and oval, vertex with small dorsal hump. Scape 0.7 mm, cylindrical. Maxillary palpi short and stout, first segment 0.3 mm, bearing thick brush of long slender scales, second segment 0.2 mm. Forewing (fig. 48): 6.1 mm, brown, oval with short anal setose groove at base of 1A + 2A. Hindwing broad with apex truncate. Genitalia (fig. 49): Segment IX slender and annular, broadened toward venter. Segment X simple, with dorsal and ventral pairs of apicomesal processes; in lateral view acuminate with apical notch separating dorsal and ventral lobes, 1.5 × as long as basal height, dorsal margin slanted ventrad apically and ventral margin inclined dorsad; dor-



Figs. 43-46, *Lepidostoma pendulum* spec. nov.; figs. 47-49, *Lepidostoma quaternarium* spec. nov. 43A, male head, dorsal; 43B, male left maxillary palp, lateral; 44, 48, male forewing; 45, 49, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 46, female genitalia: 46A, lateral; 46B, ventral; 46C, spermatheca; 47, male head, lateral.

somesal lobes in dorsal view triangular, directed posteriad and separated by deep slender U-shaped notch, each having lateral margin with recessed curve and slender apical lobe; ventrolateral lobes in dorsal view acuminate, slightly shorter and narrower than dorsal lobes, with apices pointed posteriad. Phallus with phallicata nearly straight. Inferior appendages each in lateral view inclined dorsad, about 1.5 × as long as segment X, nearly straight and fingerlike with venter slightly incised near apex; basodorsal process short, thumblike and extended dorsad; and apex broadly rounded; in ventral view ventromesal margin straight except for short, stout subapical mesal knob; apex bent slightly mesad, broadened, almost truncate, bilobed with two short projections: an acute posterior point, and a rounded mesal point.

Female.— Unknown.

Etymology.— Latin *quaternarius*, divided into four parts, referring to segment X of the male genitalia.

Remarks.— This species is included in the *corollatum* group and is similar to *L. uncinatum* and *L. corollatum*. It differs from both by having inferior appendages of the male genitalia, each with apex broadened, almost truncate, having a short rounded subapicommesal flange, and not acuminate.

Lepidostoma tenellum spec. nov.

(fig. 50)

Material.— Sabah: Type: ♂ pupa, (RMNH), Kinabalu Nat. Pk., HQ, upper Silau-Silau, 6°01'N 116°32'E, 1600 m, 15.vii.1986, JH.

Male (based on pupa).— Head: Dorsum with two pairs of round warts bearing light brown scales. Scape 0.7 mm, cylindrical, bearing many stout setae. Maxillary palpi 0.7 mm, basal $\frac{1}{2}$ bearing long stout light brown setae, apical $\frac{1}{2}$ bearing short oval dark brown scales. Forewing 8.0 mm, dark brown, brushes of stout setae at base of C and M, dark scales along anterior margin, strip of light brown scales between Sc and R, and below discal cell. Genitalia (fig. 50): Segment IX annular with ventral portion about twice as wide as dorsum. Segment X with slender pair of dorsolateral processes and a large mesal process; dorsolateral processes straight, slender and clavate, about $\frac{3}{4}$ as long as mesal process, in dorsal view extended posteriad, in lateral view diverging slightly laterally; mesal process in dorsal view bifid and trapezoidal, with base attached broadly to Segment IX, length about equal to basal width, lateral margins with shallow recessed curve, tapered posteriad, apices separated by slender V-shaped mesal notch, each trapezoidal with acute mesal angle and obtuse lateral angle; in lateral view mesal process oval and directed posteriad. Phallus having short membranous dorsal lobes, phallicata slightly curved ventrally and with apex bearing pair of short ventral barbs. Inferior appendages each in lateral view tapered just beyond base and remaining uniformly slender, basal $\frac{2}{3}$ nearly straight and directed dorsoposteriad, with obtuse flange extended above dorsal margin at midlength, and apical $\frac{1}{3}$ curved dorsad; basodorsal process slender and clavate; apex pointed dorsad in lateral view but fingerlike and bent slightly mesad in ventral view.

Female.— Unknown.

Etymology.— Latin *tenellus*, diminutive for tender, after the pupal type.

Remarks.— This species is included in the *corollatum* group. In comparison to other members of this group it differs by having male genitalia with inferior appendages

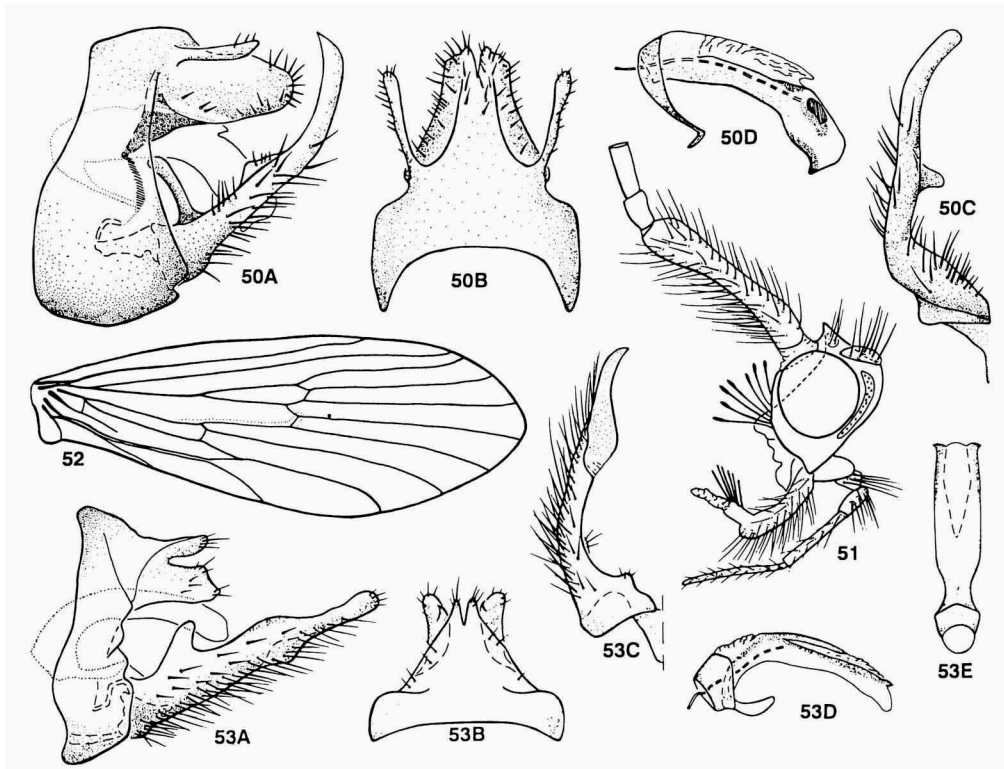


Fig. 50, *Lepidostoma tenellum* spec. nov.; figs. 51-53, *Lepidostoma uncinatum* spec. nov. 50, 53, male genitalia: A, lateral; B, IX and X, dorsal; C, left inferior appendage, ventral; D, phallus, lateral; 51, male head, lateral; 52, male forewing.

longer and slenderer, and segment X with mesal process larger and lateral processes longer.

***Lepidostoma uncinatum* spec. nov.**
(figs. 51, 52, 53)

Material.— **Sabah:** Holotype: ♂, (RMNH), Kinabalu Nat. Pk., Gunting Lagadan, Ulu Kolopis, 6°02'N 116°34'E, 3200 m, 13.i.1987, JH.

Male.— Head (fig. 51): Frons concave almost glabrous with dorsal and ventral carinae; dorsal carina setose in lateral view projecting dorsoanteriorly; ventral carina with long slender petiolate scales; vertex with short triangular dorsal point, bearing tufts of long slender scales. Scape 0.9 mm, simple and nearly cylindrical. Maxillary palpi with basal segment 0.5 mm, cylindrical; apical segment about 0.2 mm, with brush of scales at base and apical portion flexible. Forewing (fig. 52): 10.3 mm, brown with several small light spots, with short anal pocket, and without basal pocket. Genitalia (fig. 53): Segment IX sclerotized and annular. Segment X with dorsal and ventral pair of processes directed posteriorly; in dorsal view shaped like equilateral triangle, with posterior apex divided into pair of small lobes, and bearing pair of thumblike ventral

lobes, each with minute subapicomesal tooth; in lateral view, dorsal processes lobi-form, ventral processes trapezoid with apicodorsal angle oblique and apicoventral angle acute. Phallus with phallicata in lateral view slightly curved ventrad and having heavily sclerotized apicodorsal ridge, in dorsal view with minute apicolateral barbs. Inferior appendages slender and long, each in lateral view slightly over 3 × as long as segment X, without mesal or ventral processes, with ventral margin nearly straight, broadened slightly at point of articulation with second article; basodorsal process in lateral view short, fingertip-like, extended dorsoposteriad; second article in lateral view slender and $\frac{1}{2}$ as long as main article, in ventral view shaped like slightly curved claw with apical point directed mesad.

Female.— Unknown.

Etymology.— Latin *uncinatus*, barbed, as characteristic of the phallicata.

Remarks.— This species is included in the *corollatum* group. Based on the male genitalia it is similar to *L. corollatum* and *L. quaternarium*, but differ from both by having segment X in lateral view with ventral processes more than twice as large as the dorsal processes, and by having the inferior appendages long and slender, each in lateral view with apical $\frac{1}{3}$ more slender, and phallus with apicolateral barbs.

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