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## The species of *Lestoideinae* MUNZ (Insecta: Odonata: Zygoptera: Lestoideidae)

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**Abstract:** The species of *Lestoideinae* are reviewed. Two species are described as new and compared with the two known species. Distributions and zoogeography of the group are discussed.

**Key words:** *Lestoideinae*, revision, Australia.

### Introduction

*Lestoidea* was established by TILLYARD (1913) for his species *conjuncta* from Kuranda, north-eastern Queensland. A second species of *Lestoidea*, *L. barbarae*, was described by WATSON (1967) from Myee Creek, north-eastern Queensland.

Ongoing arguments about taxonomic status and systematic position of *Lestoidea* were recently settled by NOVELO-GUTIERREZ (1995) who retained the genus in the monotypic subfamily *Lestoideinae* and included *Lestoideinae*, together with *Diphlebiinae* (genera *Diphlebia* SELYS and *Philoganga* KIRBY), in the family *Diphlebiidae*. Even more recently VAN TOL (1995) corrected the nomenclature of this classification, showing that *Lestoideidae* MUNZ has priority over *Diphlebiidae* DAVIES & TOBIN and that *Philoganginae* KENNEDY has priority over *Diphlebiinae* DAVIES and TOBIN.

Recent studies of the *Lestoidea* material in the Australian National Insect Collection (ANIC) and in my own collection disclosed remarkable diversity between groups of individuals even in relevant characters like shape of male anal appendages and female prothorax. This came as a surprise but should have been expected if one had carefully studied the illustrations presented under *Lestoidea conjuncta* TILLYARD in the past.

The available illustrations of the male anal appendages of what was thought to be *Lestoidea conjuncta* show rather clear and easily detectable differences which were not picked up by Lieftinck, Watson and myself. TILLYARD (1913), FRASER (1953, 1960) and WATSON et al. (1991) depicted perpendicularly bent, truncate superior appendages and inferiors with a moderately long and slim end lobe. LIEFTINCK (1951)

showed almost perpendicularly bent, less truncate superior appendages and inferiors with a short and stout end lobe. WATSON (1967) finally presented much less strongly bent and less truncate superior appendages and inferiors with relatively long and rather slim end lobe.

The differences of the male anal appendages as described above together with others which will be presented below, the consistency of these relevant characters within series of specimens and the zoogeographical situation appear sufficient reasons to establish a *Lestoidea conjuncta* group of species. This group includes 3 species, 2 of which are described as new in this paper.

In the descriptions below, the terminology is that of CHAO (1953).

The material referred to is held in the Australian National Insect Collection, Canberra (ANIC), and in the collection of the author (GT).

Other non-selfexplanatory abbreviations used in this paper:

Ck	Creek
ft	feet
Hwy	Highway
mi.	miles
N. P.	National Park
nr	near
Ra.	Range(s)
Res.	Reserve
s. l.	same locality

### Genus *Lestoidea* TILLYARD

*Lestoidea* TILLYARD 1913: 428.

Type species: *Lestoidea conjuncta* TILLYARD 1913, by monotypy.

#### *Lestoidea barbarae* WATSON (Figs 1-3, 13, 14)

*Lestoidea barbarae* WATSON 1967: 78.

*Lestoidea barbarae* WATSON; WATSON et al. 1991: 155.

Primary type: Holotype ♂: Queensland, Palmerston National Park, Myee Creek at Palmerston Highway, 5.11.1966, J.A.L. Watson (ANIC); seen.

Diagnostic characters: posterior lobe of female pronotum not differentiated into medial and lateral portions; basal and apical portion of superior anal appendages of male including wide angle (130-150°, as seen in lateral aspect), basal portion without distinct ventral tooth; inferior anal appendages of male with end lobe long, slim and apically rounded.

Material examined: Queensland: 3♂♂ (paratypes), same data as holotype (ANIC); 2♂♂, Myee Ck, at Palmerston Hwy, Palmerston N. P., 2100 ft, 22-28.12.1967, R. Dobson (ANIC); 3♂♂, 2♀♀, Myee Ck, 2100 ft, Palmerston N. P., 2.12.1967, R. Dobson (ANIC); 3♂♂, 2♀♀, Myee Ck, nr Palmerston Hwy, 18.11.1976, 1♂, s. l., 26.11.1976, G. Theischinger and L. Müller (GT).

***Lestoidea conjuncta* group (Figs 4-12, 15-18)**

*Lestoidea conjuncta* TILLYARD; WATSON 1967: 77; WATSON et al. 1991: 155.

**Diagnostic characters:** posterior lobe of female pronotum differentiated into large medial and small lateral portions; basal and apical portion of superior anal appendages of male including almost acute to moderately wide angle (80-130°, as seen in lateral aspect), basal portion with distinct ventral tooth; inferior anal appendages of male with end lobe short to moderately long, apically not rounded.

***Lestoidea conjuncta* TILLYARD (Figs 4-6, 15, 16)**

*Lestoidea conjuncta* TILLYARD 1913: 428.

*Lestoidea conjuncta* TILLYARD; FRASER 1953: 227 (part); FRASER 1956: 287 (part); FRASER 1960: 27 (part); WATSON 1967: 77 (part); WATSON et al. 1991: 155 (part).

**Primary type:** Holotype ♂: Queensland, Kuranda, Jan. 1908, E. Allen (BMNH); not seen.

**Diagnostic characters:** A pale spot at base of each antenna; female prothorax with medial portion of posterior lobe rather narrow, subtriangular to widely rounded, its lateral margins rather narrow and not markedly upturned; superior anal appendages of male perpendicularly bent ventrad, basal portion rather slim and with small ventral tooth, apical portion distinctly truncate; inferior anal appendages of male with end lobe moderately long and slim.

**Material examined:** Queensland: 1♂, Cape Tribulation, creeks nr Daintree, 23-26.10.1980, G. Theischinger and L. Müller (GT); 2♂♂, 1♀, Dowger Ck, Intake, nr Redlynch, 13.1.1955, R. Dobson (ANIC); 4♀♀, ck on Gillies Hwy, 10-12 mi. W Gordonvale, 2.12.1967, R. Dobson (ANIC); 1♂, 1♀, Intake, nr Redlynch, 4.10.1952, 1♀, s. l., 12.1.1955, 2♀♀, s. l., 13.1.1955, 1♀, s. l., 8.-10.10.1967, R. Dobson (ANIC); 1♂, Intake, Redlynch, 7.12.1967, R. Dobson (ANIC); 1♂, The Intake, Redlynch, nr Cairns, 1.12.1967, R. Dobson (ANIC); 1♀, Kirrama, Feb. 1995, S. Richards (GT); 1♀, Kirrama, Bridge 8, 17.11.1993 (GT); 1♂, 1♀, Kirrama, Bridge 10, 27.10.1993, 1♂, s. l., 17.11.1993, S. Richards (GT); 1♂, Kuranda, 17.1.1951, 2♂♂, s. l., 7.1.1957, 2♂♂, s. l., 8.1.1957, R. Dobson, 1♂, 1♀, s. l., 28.2.1956, 1♂, s. l., 18.4.1956, 1♂, s. l., 23.4.1956, 1♀, s. l., 2.5.1956, 1♀, s. l., 23.1.1956, 1♂, s. l., 28.1.1957, 2♂♂, s. l., 17.2.1957, E. Harris (ANIC); 1♂, waterfall on Kuranda Ra., 12 mi. N of Cairns, 24.4.1965, 1♂, 2♀♀, s. l., 26.4.1965, C.W. Frazier (ANIC); 6♂♂, 2♀♀, Mena Ck, nr Mt Utchee, 17.11.1976, G. Theischinger and L. Müller (GT); 14♂♂, 1♀, Mervyn Ck, Kuranda, 1.10.1952, 1♂, s. l., 2.10.1952, 2♂♂, s. l., 6.10.1952, 1♂, s. l., 3.10.1955, 1♂, s. l., 8.1.1967, R. Dobson (ANIC); 5♀♀, Mt Spec, nr Paluma, 15.-16.11.1976, 3♂♂, 1♀, s. l., G. Theischinger and L. Müller (GT); Mt Spec, Townsville, Jan. 1960, C. Vallis (ANIC); 1♂, 2♀♀, Murray Falls, nr Babinda, 23.3.1992, G. Theischinger and L. Müller (GT); 8♂♂, 4♀♀, Myee Ck, at Palmerston Hwy, Palmerston N. P., 2100 ft, 22.-28.12.1967, R. Dobson (ANIC); 7♂♂, 1♀, Myee Ck, 2100 ft, Palmerston N. P., 2.12.1967, R. Dobson (ANIC); 2♂♂, 2♀♀, Myee Ck, nr Palmerston Hwy, 18.11.1976, G. Theischinger and L. Müller (GT); 1♂, Palmerston Hwy, between Myee Ck and Tchooratippa Ck, 26.11.1976, G. Theischinger and L. Müller (GT); 17♂♂, 3♀♀, Palmerston N. P., Tchooratippa Ck, 5.11.1966, J.A.L. Watson (ANIC); 1♀, Paluma, Little Crystal Ck, 22.3.1992, G. Theischinger and L. Müller (GT); 1♀, Rainbow Ck, Kuranda, 8.1.1957, R. Dobson (ANIC); 2♂♂, Tchooratippa Ck, 22.3.1969, J.A.L. Watson (ANIC); 5♂♂, Tchooratippa Ck, nr Palmerston Hwy, 18.11.1976, G. Theischinger and L. Müller (GT); 1♂, Tully, 29.9.1952, 3♀♀, s. l., 1.10.1953, 2♂♂, 3♀♀, s. l., 11.1.1955, 1♂, s. l., 9.10.1955, R. Dobson (ANIC); 2♀♀, Whitfield Ra., Forest Res., Cairns, 19.4.1967, D.H. Colless (ANIC); 1♂, Wright's Ck, Lake Eacham, 24.12.1967, R. Dobson (ANIC).

***Lestoidea brevicauda* spec. nov.** (Figs 7-9, 17, 18)

*Lestoidea conjuncta* TILLYARD; LIEFTINCK 1951: 9 (part); FRASER 1953: 227 (part); FRASER 1956: 287 (part); FRASER 1960: 27 (part); WATSON 1967: 77 (part); WATSON et al. 1991: 155 (part).

**Types:** **Holotype** ♂: Queensland, Cape Tribulation, creeks near Daintree, 23.-26.10.1980, G. Theischinger and L. Müller (ANIC). **Paratypes:** 14♂♂, 3♀♀, same data as holotype (GT); 1♀, Douglas Creek, near Daintree, 22.11.1976, G. Theischinger and L. Müller (GT); 1♂, Josephine Falls, 21.10.1980, G. Theischinger and L. Müller (GT); 1♀, Kirrama S.F., 12 km from Kennedy, Apr. 1993, G. Theischinger (GT); 1♀, Mossman Gorge, 23.4.1967, D.H. Colless, 3♂♂, 1♀, s. l., 8.-9.12.1967, R. Dobson, 1♀, s. l., 28.3.1969, J.A.L. Watson (all ANIC), 3♂♂, 4♀♀, s. l., 9.-25.11.1976, G. Theischinger and L. Müller (GT); 1♂, 1♀, Mossman R. Gorge, 27.10.-1.11.1966, J.A.L. Watson (ANIC); 1♂, Mount Spec, near Paluma, 15.-16.11.1976, G. Theischinger and L. Müller (GT); 1♂, Roaring Meg - CREB track, 27.-28.3.1992, G. Theischinger and L. Müller (GT).

**Diagnostic characters:** A pale spot at the base of each antenna; female prothorax with medial portion of posterior lobe rather wide and widely rounded, the lateral margins broad and markedly upturned; superior anal appendages of male almost perpendicularly bent ventrad, basal portion rather stout and with substantial ventral tooth, apex not distinctly truncate; inferior anal appendages of male with end lobe short, claw-shaped.

**Name:** A combination of the Latin words brevis (= short) and cauda (= tail); refers to the short inferior appendages of the male.

**Male** (Figs 7-9)

**Dimensions:** Forewing 20.2-22.0 mm (N=12); hindwing 19.7-21.3 mm (N=10); abdomen 26.8-28.2 mm (N=10).

**Head:** Labium greyish yellow, the apices of the lateral lobes black; genae and outer face of mandibles dull yellow, remainder of mandibles brownish black; labrum yellow, black along anterior margin; anteclypeus dull yellow, postclypeus black; anterior frons black medially, brownish yellow laterally, or entirely brownish yellow; top of frons, vertex, occiput and postocular area including postgenae black except for ill-defined oval yellowish brown mark lateral to each lateral ocellus; antennae black, a greyish yellow patch at their bases.

**Prothorax:** Anterior lobe of pronotum largely blackish brown, its anterior and lateral margins yellow; median lobe brownish black above, yellow laterally; posterior lobe largely blackish brown, greyish yellow laterally; propleuron greyish- and blackish brown; coxa and inner aspect of trochanter and femur greyish yellow to greyish brown, remainder of leg brownish black.

**Synthorax:** Mesostigmatic lamina and spiracular dorsum black; mesothoracic anepisternum including dorsal carina, antealar ridge and antealar sinus largely black, a narrow, ill-defined, brownish yellow wedge along most of mesopleural suture; mesokatepisternum black with anterodorsal portion greyish yellow; mesepimeron yellowish- to brownish grey with anteroventral corner largely black; metepisternum yellowish grey with posterodorsal portion of katepisternum black and with large

elongate ill-defined black patch dorsally adjacent to metaspiracle hardly separated from a smaller black patch along dorsal 1/4 of metapleural suture and connected with black subalar ridge; metepimeron dark yellowish grey, with elongate blackish brown patch near and along most of posterior margin; metapostepimeron pale greyish yellow with dorsal margin broadly black; terga largely greyish brown to black, scutella and most of mesopostscutellum yellow; poststernum greyish- to brownish yellow, with darker patches along lateral margins; postcoxae greyish yellow; coxae greyish- to brownish yellow; inner and anterior surface of trochanters and femora pale brown, rest of legs brownish black.

**Wings:** Venation as typical for *Lestoidea*; axillary plates and intermediary pieces blackish brown, humeral plates blackish brown with inner margin yellow; venation and pterostigma black; membrane hyaline; very rarely a third, incomplete antenodal; CuP usually subtending only 1 cell beyond quadrilateral; A1 strongly reduced, from clearly separated from wing margin to completely absent; postnodals 11-15/10-15.

**Abdomen:** Segments 1 and 2 wider than segments 3-7, and segments 8-10 wider again; largely black except for greyish yellow patches as follows: lateral portion of segment 1, leaving irregular median stripe, posterior margin and part of the latero-ventral area black; narrow dorsolateral longitudinal stripes on segment 2, extending approximately 2/3 length of segment; small basal spot on each side of segment 3, the spot less clearly defined and often just or hardly indicated on segments 4-6.

**Anal appendages:** Superior appendages basally dark greyish yellow to greyish brown, remainder blackish brown; basal 2/3 rather straight and moderately stout and apical 1/3 almost perpendicularly bowed medioventrally (as seen in lateral aspect); a substantial ventral tooth at the end of basal portion; dorsal margin of apical portion rather evenly rounded; inferior appendages yellowish- to greyish brown, with upper lobe acute and end lobe short, claw-shaped, as seen in lateral aspect.

**Female** (Figs 17, 18)

**Dimensions:** Forewing 22.3-23.7 mm (N=6); hindwing 21.7-23.1 mm (N=6); abdomen 24.3-26.2 mm (N=6).

**Head:** Much as in male.

**Prothorax:** Colouration much as in male; median portion of posterior lobe of pronotum rather wide and widely and evenly rounded, lateral margins broad and markedly upturned.

**Synthorax:** Much as in male.

**Wings:** Much as in male; postnodals 13-16/11-14.

**Abdomen:** Colouration much as in male; terminalia and genitalia blackish brown to black.

***Lestoidea lewisiana* spec. nov. (Figs 10-12)**

*Lestoidea conjuncta* TILLYARD; WATSON 1967: 77 (part); WATSON et al. 1991: 155 (part).

Types: Holotype ♂: Queensland, Leichhardt Creek, just S Mount Lewis, at road, 30.-31.10.1966, J.A.L. Watson (ANIC). Paratypes: Queensland: 1♂, same data as holotype (ANIC); 2♂♂, Mount Lewis, 3-ways, 7.12.1993, S. Richards (GT).

**Diagnostic characters:** Anterior frons medially black, laterally pale; no pale spot at base of antennae; basal portion and apical portion of male superior anal appendages including a moderately wide angle (120-130°, as seen in lateral aspect), basal portion with substantial ventral tooth, apex not distinctly truncate; inferior anal appendages of male with end lobe moderately long and rather slim.

**Name:** Lewisianus 3 = Latinized for „from Mount Lewis“.

**Male (Figs 10-12)**

**Dimensions:** Forewing 25.3-26.8 mm (N=4); hindwing 24.5-25.6 mm (N=4); abdomen 32.0-33.2 mm (N=4).

**Head:** Labium greyish yellow, the apices of all lobes black; genae and outer face of mandibles brown, remainder of mandibles brownish black; labrum pale yellow, broadly black along anterior margin; anteclypeus pale brown, postclypeus black; anterior frons black medially, brown laterally; top of frons, vertex, occiput and postocular area including postgenae black except for elongate yellowish brown mark lateral to each lateral ocellus; antennae black.

**Prothorax:** Anterior lobe of pronotum black, its anterior and lateral margins pale yellow; median lobe black above, greyish yellow laterally; posterior lobe black medially, greyish yellow laterally; propleuron largely black; coxa and inner aspect of trochanter and femur greyish yellow, remainder of leg brownish black.

**Synthorax:** Mesostigmatic lamina and spiracular dorsum black; mesothoracic anepisternum including collar, dorsal carina, antealar ridge and antealar sinus largely black, a greyish yellow wedge along most of mesopleural suture; mesokatepisternum black with anterodorsal corner greyish yellow; mesepimeron yellowish grey with anteroventral portion largely black; metepisternum yellowish grey, with posterodorsal portion of katepisternum black and with large elongate black patch dorsally adjacent to metaspiracle and smaller black patch along dorsal 1/4 of metapleural suture connected with black subalar ridge; metepimeron dark yellowish grey with elongate black patch near and along most of posterior margin; metapostepimeron pale greyish yellow with dorsal margin broadly black; terga largely greyish brown to black, scutella and most of mesopostscutellum yellow; poststernum greyish- to brownish yellow with darker patches along lateral margins; postcoxae greyish yellow; coxae greyish- to brownish yellow; inner and anterior surface of trochanters and femora pale brown, rest of legs black.

**Wings:** Venation as typical for *Lestoidea*; axillary plates and intermediary pieces blackish brown, humeral plates blackish brown with inner margin yellow; rarely a third, incomplete antenodal; CuP subtending 1-3 cells beyond quadrilateral; A1 strongly reduced but clearly separated from wing margin, or completely absent; postnodals 13-18/13-15.

**Abdomen:** Segments 1 and 2 wider than segments 3-7, and segments 8-10 wider again; largely black except for greyish yellow patches as follows: lateral portion of segment 1, leaving irregular median stripe, posterior margin and part of the lateroventral area black; narrow dorsolateral longitudinal stripes on segment 2, extending approximately 2/3 length of segment; small basal spot on each side of segments 3-5; part of sternum 1.

**Anal appendages:** Black; superior appendages with basal 2/3 rather straight and apical 1/3 bowed medioventrally; ventral edges of basal portion and apical portion including an angle of approximately 120-130° as seen in lateral aspect; a substantial ventral tooth at the end of basal portion; dorsal margin of apical portion widely and evenly rounded; inferior appendages with upper lobe acute and end lobe of moderate length and thickness as seen in lateral aspect.

**Female** unknown.

### Zoogeography and distributions

Lestoideinae are restricted to streams in tropical rainforests of north-eastern Queensland. They are known to range from Cape Tribulation in the north to the area around Paluma in the south. *L. barbarae* WATSON, known only from Myee Creek near the Palmerston Highway, and *L. lewisiana* sp. n., known only from Mount Lewis, both larger species, seem to be restricted to small areas near the middle of the total range of the genus. *L. conjuncta* as well as *L. brevicauda*, both smaller species, cover the whole known geographical range of the genus but have rarely been found to occur sympatrically. The hitherto known localities of *L. conjuncta* are predominantly southern and high altitude, those of *L. brevicauda* are predominantly northern and low altitude.

### Acknowledgements

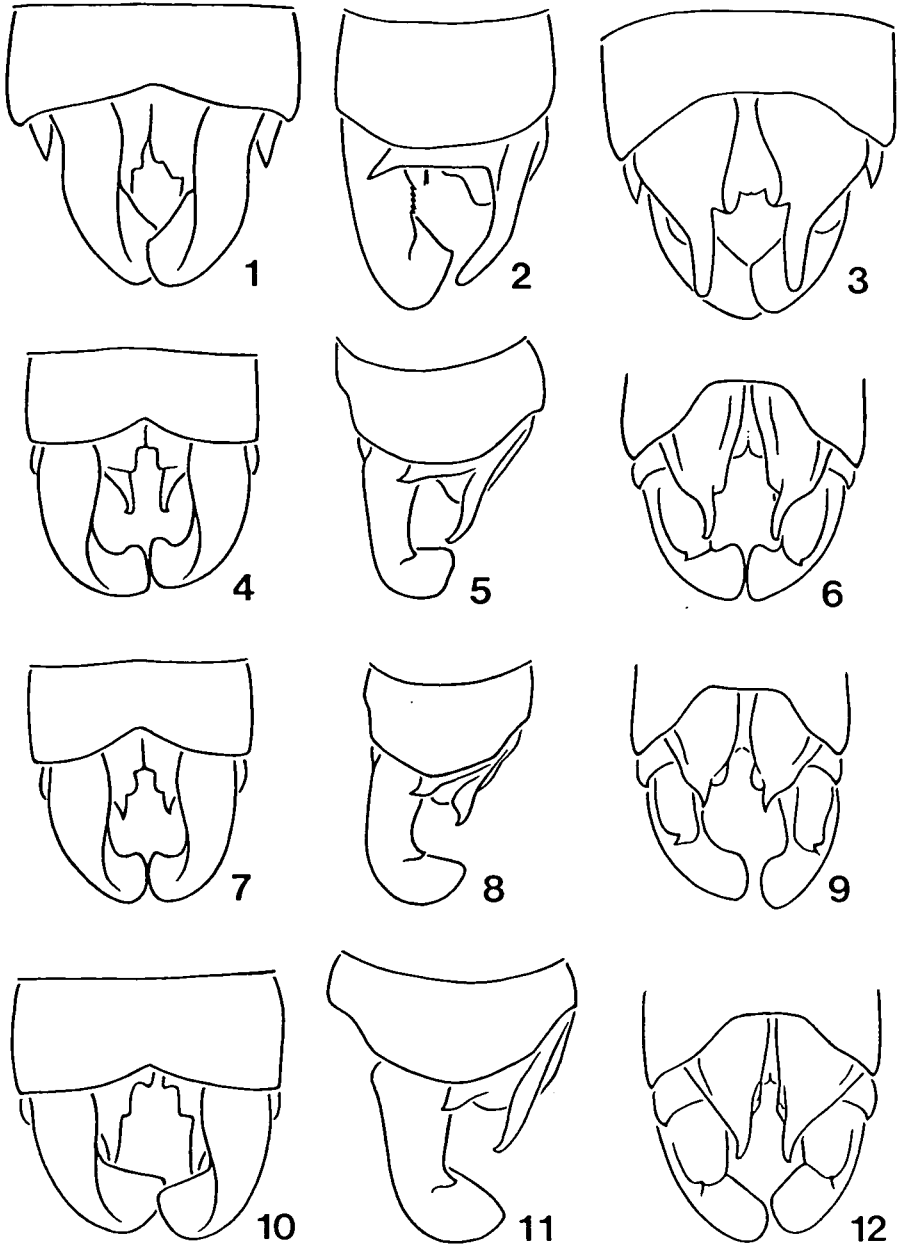
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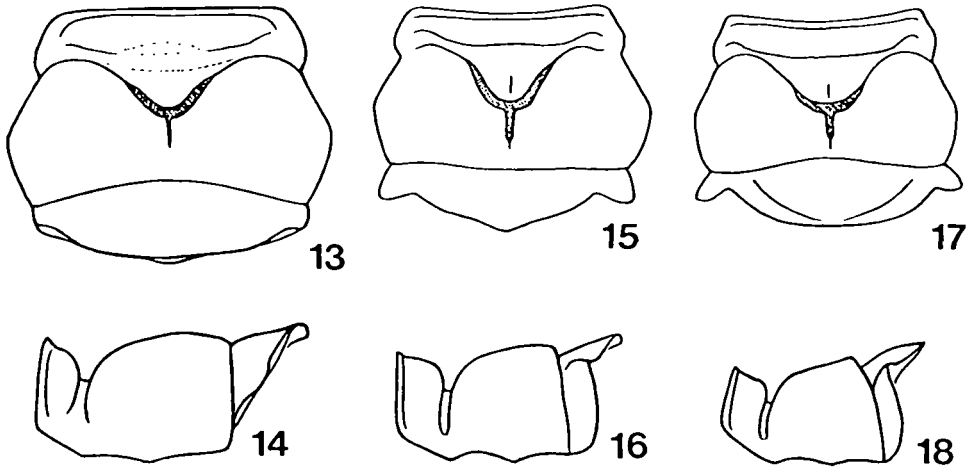
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Figs 1-12: *Lestoidea* spp., male anal appendages, dorsal, lateral and ventral aspect: 1-3: *L. barbarae* WATSON; - 4-6: *L. conjuncta* TILLYARD; - 7-9: *L. brevicauda* sp. n.; - 10-12: *L. lewisiana* sp. n.



Figs 13-18: *Lestoidea* spp., female pronotum, dorsal and lateral aspect: - 13, 14: *L. barbarae* WATSON; - 15, 16: *L. conjuncta* TILLYARD; - 17, 18: *L. brevicauda* sp. n.