

Linzer biol. Beitr.	28/1	305-314	20.8.1996
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The species of *Austrophlebia* TILLYARD (Odonata: Anisoptera: Aeshnidae: Brachytroninae)

G. THEISCHINGER

Abstract: Larvae and adults of *Austrophlebia* TILLYARD are analysed, resulting in the description of a second species.

Key words: *Austrophlebia*, revision, Australia.

Introduction

During recent studies towards a key to the last instar larvae and exuviae of the Australian dragonflies, the larvae of *Austrophlebia* TILLYARD, supposedly a monotypic genus, were found to be heterogeneous.

Differences exist particularly in the shape of the prementum, generally the most useful character for identifying closely allied species in many aeshnid genera, most notably in *Austroaeschna* SELYS, the genus considered closest to *Austrophlebia*. Whereas marked differences were found between populations from south of latitude 21°S and populations from north of latitude 18°S, no major morphological differences were detected between single populations from inside the two regions.

Further study, involving also adults of *Austrophlebia*, finally revealed that the two morphologically distinct groups of larvae also produce two types of adults. The differences between the two groups of populations of *Austrophlebia* in colouration of adults and in adult and larval morphology are of a magnitude which indicates distinctness at species level.

A second species of *Austrophlebia* is, therefore, described below and compared with *A. costalis* (TILLYARD).

The terminology used in the description of the adult follows CHAO (1953) and WATSON & O'FARRELL (1991).

The material referred to is held in the Australian Museum, Sydney (AM), 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
E(E)	exuviae
em.	emerged
ft	feet
L(L)	larva(e)
mi.	miles
Mt(s)	Mountains
N. P.	National Park
nr	near
R.	River
S. F.	State Forest
s. l.	same locality
trib.	tributary

Austrophlebia costalis (TILLYARD) (Figs 1, 2, 5-7, 11)

Planaeschna costalis TILLYARD 1907: 724.

Telephlebia racleayi MARTIN 1909: 142.

Telephlebia macleay MARTIN 1911: 22 (?misspelling).

Austrophlebia costalis (TILLYARD); TILLYARD 1916: 22 (part); FRASER 1960: 32 (part); HOUSTON & WATSON 1988: 87 (part); WATSON et al. 1991: 186 (part); WATSON & HOUSTON 1994: 27 (part).

Primary types: Holotype ♀ of *Planaeschna costalis* TILLYARD and *Telephlebia racleayi* MARTIN: New South Wales (type data: holotype, AM K13579 F., from N.S.W.) (AM); seen.

Diagnostic characters: Adults with the dark fasciae of wings extensive and very intensively reddish brown, very similar in both sexes. Anal appendages of male (Fig. 1) rather short, superiors convergent, markedly narrower in basal 1/3 than more distally, their outer margins slightly angulated near midlength, inferior appendage rather shallow, with apex very narrow. Female with dentigerous plate of ovipositor moderately wide and bearing 8-12 teeth; anal appendages of female (Fig. 2) not particularly pointed. Larvae (Figs 5-7, 11) with length/width ratio of prementum approximately 1.5.

Material examined: Queensland: 1♂, Brisbane, 28.12.1941, C.F. Ashby (ANIC); 1♂, 1♀, Cameron Ck, Mt Tamborine, 30.12.1954, R. Dobson (ANIC); 1♀, Cedar Ck, Mt Tamborine, 30.12.1954, R. Dobson (ANIC); 2 EE, Elaman Ck and Little Yabba Ck, Kenilworth, 9.11.1976, G. Theischinger (ANIC); 1 E, Finch Hatton Gorge, nr Mackay, 10.10.1980, G. Theischinger (AM), 2 EE, s. l., 16.10.1980, G. Theischinger and L. Müller (AM); 5 EE, Finch Hatton Gorge, Nov. 1982, G. Theischinger and L. Müller (ANIC), 6 EE, s. l., Dec. 1982, G. Theischinger (AM), 1♀, s. l., Nov. 1992, G. Theischinger (GT); 1♂, Goomburra S. F., 20.1.1986, G. Theischinger and L. Müller (GT); 1♂, 1 E, Horse Gully, Bunya Mts, 4.12.1976, G. Theischinger (GT); 1♂, Killamey, 18.1.1914, E.J. Dumigan (AM); 2 EE, Mt Dalrymple, Nov. 1982, G. Theischinger (AM); 3 EE, Mt Tamborine, 8-9.11.1976, G. Theischinger (ANIC); 1♂, Tambourine, 22.12.1912, R. J. Tillyard (AM), 1♀, s. l., 28.12.1912, R.J. Tillyard (ANIC), 1♀, s. l., 29.12.1912, R.J. Tillyard (AM), 1E, s. l., 31.12.1912, R.J. Tillyard (ANIC). New South Wales: 1♂, Audley, Royal N. P., 14.11.1960, D.H. Colless (ANIC); 1♂, Berowra, 2.2.1995, L. Müller (GT); 1 E, Bundanoon Ck, 8.2.1996, G. Theischinger and L. Müller (GT); 1 E, Coombadja Ck, Washpool N. P., 5-6.1.1986, G. Theischinger (AM); 1♂, 2♀♀, Upper

Coombadjah Ck, Gibraltar Ra. N. P., em. Dec. 1975, 1♂, s. l. em. Dec. 1976, W. Stewart (ANIC); 1♀, Dorrigo, 16.11.1911, R.J. Tillyard (ANIC); 1♂, Honey Gully, Big Hill area, 45 mi. E of Armidale, 16.1.1965, J. Overell (ANIC); 1♂, 1♀, Kangaroo Valley, 18.12.1949, 3♂♂, s. l., 21.12.1949, 1♀, s. l., 23.12.1949, R. Dobson (ANIC); 1 E, Little Georges Ck (Macleay R. trib.), G. Theischinger (ANIC); 1♂, Mt Keira, nr Wollongong, 13.1.1980, G.A. Holloway, at light (AM); 1♀, Muogammara, open stream, 16.1.1974, C.N. Smithers (AM); 1♀, National Park, 27.1.1934, A. Musgrave (AM); 1♂, Shaws Ck, Springwood, 15.3.1964, Gail Williams (ANIC); 15 EE, Somersby Falls (Floods Ck), nr Gosford, 15.11.1976, G. Theischinger (ANIC); 2 EE, Somersby Falls, 30.3.1979, L. Müller & G. Theischinger (ANIC); 1♂ Stanwell Park, 8.2.1913, G. Goldfinch, 1 E, s. l., 22.2.1913, G.A. Waterhouse, 1 E, s. l., 18.2.1913, R.J. Tillyard (ANIC); 4 EE, Stanwell Park, Bulli, 3.12.1951, R. Dobson (ANIC); 1♀, Timmsvale, 22.11.1938, A.J. Meany (AM); 5 EE, nr Warragamba Dam, 17.1.1980, G. Theischinger (ANIC); 5 EE, Watagan Forest, Jan. 1980, G. Theischinger (ANIC); 1♀, Watagan S. F., 14.10.1949, E. Edwards (ANIC), 1 E, s. l., 2.4.1979, G. Theischinger (ANIC); 1 E, Wilson R., G. Theischinger (AM).

Austrophlebia subcostalis spec. nov. (Figs 3, 4, 8-11)

Austrophlebia costalis (TILLYARD); TILLYARD 1916: 22 (part); FRASER 1960: 32 (part); HOUSTON & WATSON 1988: 87 (part); WATSON et al. 1991: 186 (part); WATSON & HOUSTON 1994: 27 (part).

Diagnostic characters: Adults with dark fasciae of wings more restricted than in *A. costalis*, dark but not very intensively olive brown, in female less strongly defined than in male. Male anal appendages (Fig. 3) slightly longer than in *A. costalis*, superiors of approximately the same width from base to apex, their outer margins widely and evenly curved without any angulation; inferior appendage deeper than in *A. costalis* and with apex wider. Female with dentigerous plate of ovipositor rather narrow and with apex truncate and bearing 6 teeth; anal appendages of female (Fig. 4) sharply pointed. Larvae (Figs 8-11) with length/width ratio of prementum 1.25-1.38.

Types: Holotype ♂: Queensland, Leichhardt Creek, S Mount Lewis, at road, 30-31.10.1966, J.A.L. Watson (ANIC). **Paratypes:** Queensland: 1 E, 2 km on Mount Edith Road, Tinaroo Dam, 23.6.1971 (ANIC); 1♀, Herberton, 26.1.1911, F.P. Dodd (ANIC); 1♂, Lock Creek, Davies Creek road, Lamb Range, Mareeba District, 25.12.1976, M.S. and B.J. Moulds (AM); 4 EE, creeks from Mount Haig into Tinaroo Dam, G. Theischinger (GT); 1 L, Mount Lewis, 13.6.1971, E.F. Riek (ANIC); 1♂, Star Valley Lookout, Paluma, 18.1.1969, E.E. Adams, J.G. Brooks (ANIC); 1 L, Thornton Peak, 1100-1300 m, via Daintree, 24-27.9.1984, G.B. and S.R. Monteith (QM); 1 L, Upper Millstream, 3500 ft, 26.6.1971, E.F. Riek (ANIC); 2 LL, Vision Falls, Wright Creek, Lake Eacham, 11.10.1967, R. Dobson (ANIC).

Name: To express the close affinity with *A. costalis* (TILLYARD) as well as to indicate that the brown fasciae of the wings are less extensive than in *A. costalis* in costal field but at least equally extensive in subcostal field.

Male (Fig. 3)

Dimensions: Hindwing 60.7-63.0 mm; abdomen 67.5-72.7 mm (N = 3).

Head: Labium yellowish- to greyish brown, lobes reddish- to blackish brown; mandibles largely ochreous with apices reddish brown to black; labrum, anteclypeus, postclypeus and genae ochreous; anterior frons ochreous, with dorsal and lateral margins black; top of frons largely brown to black, greyish yellow adjacent to the eyes; vertex black; antennae with scape and pedicel brown and flagellum dark brown to black; occiput brown; postgenae greyish- to brownish yellow.

Cervix and prothorax: Cervical sclerites yellowish- to greyish brown; pronotum pale greyish- to blackish brown; episternum, epimeron and coxa pale yellowish- to greyish brown; trochanter brown; femur and tibia dark reddish brown with tip blackened; tarsus black, claws blackish brown.

Synthorax: Spiracular dorsum, mesostigmatic lamina, collar, dorsal carina and antealar ridge dark greyish brown, antealar sinus yellowish white; front of synthorax dark greyish brown with yellowish white humeral stripes; mesokatepisternum largely yellowish white, posteroventral portion brownish black; mesepimeron, anterior portion of metanepisternum, posteroventral portion of metakatepisternum, and metepimeron dark greyish brown, metapostepimeron blackish brown; posterior portion of metanepisternum and most of metakatepisternum yellowish white; the pale humeral stripe with narrow greyish black wedge in dorsal half, the pale metathoracic stripe margined with greyish black; terga greyish- to blackish brown, only mesopostscutellum markedly paler, almost yellow; poststernum dark greyish brown, paler along lateral margins; coxae brownish grey, somewhat paler anteriorly; trochanters brown; femora and tibiae dark reddish brown, with tips blackened; tarsi brownish black, claws dark brown to black.

Wings: Humeral and axillary plates and intermediary pieces reddish- to blackish brown; membrane largely hyaline; a small portion at base of antenodal section of costal field, the entire postnodal section of costal field, field R1 from arculus to wing apex and an anterobasal wedge of basal space strongly suffused with greyish- to blackish brown; venation brown to blackish brown, some of the more basal antenodals partly or entirely yellow; membranules greyish white; antenodals 31-33/22-23; postnodals 23-27/27-31; Ax1 and Ax5 or Ax6 of forewing and Ax1 and Ax4 or Ax5 of hindwing thickened; pterostigma reddish brown to brownish black, 4.3-5.5 mm long, overlying 4-7 cells; hypertriangle crossed by 6-10/5-8 veins; triangle 7-9/6-8 celled; 7-9/5-7 crossveins in cubital space including subtriangle; anal loop made up of 10-20 cells; anal triangle 3- or 4-celled.

Abdomen: Segments 1 and 2 swollen, 3 constricted near base, posterior portion of segment 3 and segments 4-10 slightly increasing in width from anterior to posterior; segment 10 with low, wide, obtuse dorsal cone showing indications of 5 longitudinal ridges; all segments blackish brown except for a large greyish yellow ventral wedge on both sides of tergum 1 and a small greyish yellow patch each, anterodorsal and ventral to auricle.

Anal appendages (Fig. 3): Superiors blackish brown, moderately long, forcipate, of about the same thickness throughout their length, evenly curved without any indication of an angulation (as seen in dorsal aspect), obtusely angulated near mid-length as seen in lateral aspect; inferior appendage brown, deep, narrowly subtriangular, with apex truncate and slightly bilobed.

Female (Fig. 4)

Dimensions: Hindwing 64.0 mm; abdomen 67.5 mm (N = 1).

Head, cervix and thorax: Much as in male.

Wings: Much as in male; dark fasciae along anterior margins paler and less clearly defined; pterostigma 5.1-5.5 mm long, blackish brown; antenodals 31/22-25; postnodals 26/29-31; Ax1 and Ax5 of both wings thickened; hypertriangle crossed by 7-8 veins; triangle 8-9/7-8 celled; cubital space crossed by 5-7/6 veins; anal loop made up of 11-13 cells; no anal triangle.

Abdomen: Much as in male but markedly narrower, without auricles and without dorsal cone of segment 10.

Genitalia: Dentigerous plate brown, rather narrow, with apex bearing 6 teeth (3 on each side); valves blackish brown; supra-anal plate blackish brown, subtriangular; anal appendages (Fig. 4) blackish brown, conical, sharply pointed.

Larva (Figs 8-11) (described from final instar larvae and exuviae)

Total length 45.0-48.0 mm; width of head including eyes 10.0-10.6 mm; length of metafemur 8.3-8.9 mm; length of abdomen 28.0-32.0 mm, greatest width 9.8-10.5 mm.

Colouration yellowish- to greyish brown with small darker and lighter markings; femora and tibiae banded with dull yellow. Labium (Fig. 8) extending posteriorly slightly beyond mesocoxae; length of prementum 9.0-10.1 mm, width at distal end 6.9-7.7 mm, width at base 3.6-3.9 mm; ligula with very short median cleft. Prothorax with slim horn-like anterior process and more extensive, mostly slightly rounded, posterior lobe; notal lobes short, obtuse; mesothorax with small tooth at base of postcoxale. Abdomen with all terga well arched and with slim and rather long lateral spines on segments 5-9; female gonapophyses reaching beyond end of segment 10; basal projection of male larva (Fig. 9) slightly longer than cerci and somewhat constricted immediately before tip; cerci of female larva (Fig. 10) narrowly conical, distinctly curved inward and sharply pointed.

Discussion

Austrophlebia subcostalis sp. n. is very closely related to *A. costalis* (TILLYARD). The two species can be considered as a species pair. The adults of *A. subcostalis* have a shorter and less acutely pointed frons, less extensive and less intensively but darker coloured fasciae along the anterior wing margins, male superior anal appendages of more even thickness and curvature, the appendix inferior wider at apex, the female dentigerous plate narrower and bearing fewer teeth and the female anal appendages more acutely pointed than have adults of *A. costalis*. The larva of *A. subcostalis* has a

length/width index of prementum of 1.25-1.38 as opposed to approximately 1.5 in *A. costalis*. Generally the larvae of *A. subcostalis* appear larger and bulkier than those of *A. costalis*, whereas adults of *A. costalis* seem to be slightly larger than *A. subcostalis*. It is not clear if this is only a reflection of the availability of limited adult material of *A. subcostalis*, or if there is a more substantial loss in mass from larval to adult stage in this species. It has to be left to future collecting to decide if *A. subcostalis* is the second or third largest of the Australian dragonflies.

Zoogeography

The gap between the Paluma Range and Eungella is known as a region where ecological and physiographic boundaries coincide with taxonomic discontinuities in Odonata and other fresh-water insects (WATSON & THEISCHINGER 1984). Apart from "*Austrophlebia costalis*", only a single species (*Austroaeschna unicornis speciosa*) of the Australian brachytronine aeshnid genera *Acanthaeschna* SELYS (1 species [WATSON et al. 1991]), *Antipodophlebia* FRASER (1 species [WATSON et al. 1991]), *Austroaeschna* SELYS (18 species [THEISCHINGER 1982, WATSON et al. 1991, THEISCHINGER 1993]), *Dendroaeschna* TILLYARD (1 species [WATSON et al. 1991]), *Notoaeschna* TILLYARD (2 species [THEISCHINGER 1982, WATSON et al. 1991]), *Spinaeschna* THEISCHINGER (2 species [THEISCHINGER 1982, WATSON et al. 1991]) and *Telephlebia* SELYS (6 species [THEISCHINGER 1985, WATSON et al. 1991]) was hitherto recorded from north as well as from south of the Paluma-Eungella gap. The distinctness on species level of *Austrophlebia* from north and *Austrophlebia* from south of the Paluma-Eungella gap is therefore hardly a surprise. The taxonomic disjunction probably results from pleistocene climatic fluctuations. The strong flight and sometimes seemingly vagrant behaviour of *Austrophlebia costalis*, however, and records of larvae even from intermittent streams, suggest not to exclude a priori sympatrical existence of the two *Austrophlebia* species but rather to take particular care when identifying adults and larvae of *Austrophlebia* from the Paluma-Eungella gap area.

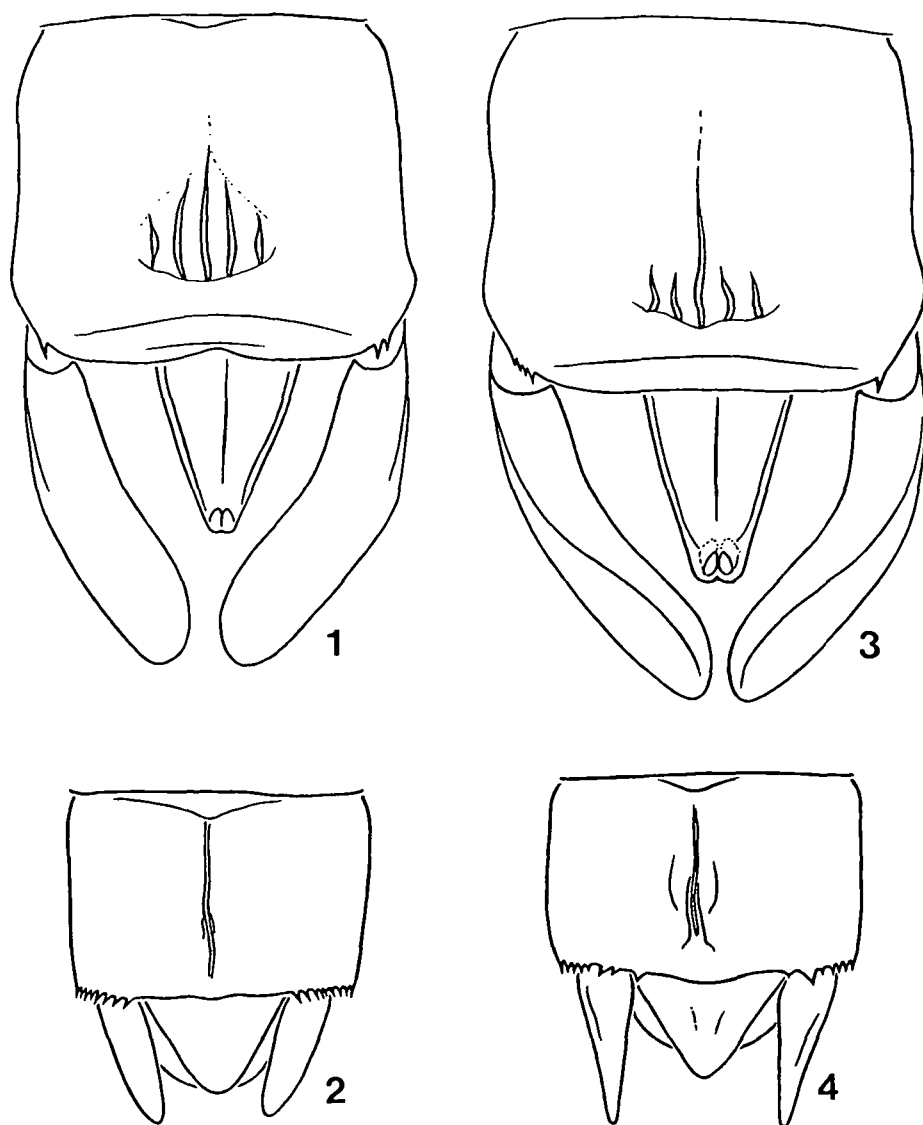
Acknowledgements

I wish to thank Mr L. Müller (Berowra) for support in the field and for helpful discussions. I also wish to express gratitude to Mrs H.M. Abbey (Canberra), Dr. G. Monteith (Brisbane) and Mr M.S. Moulds (Sydney) for giving me access to material in their care.

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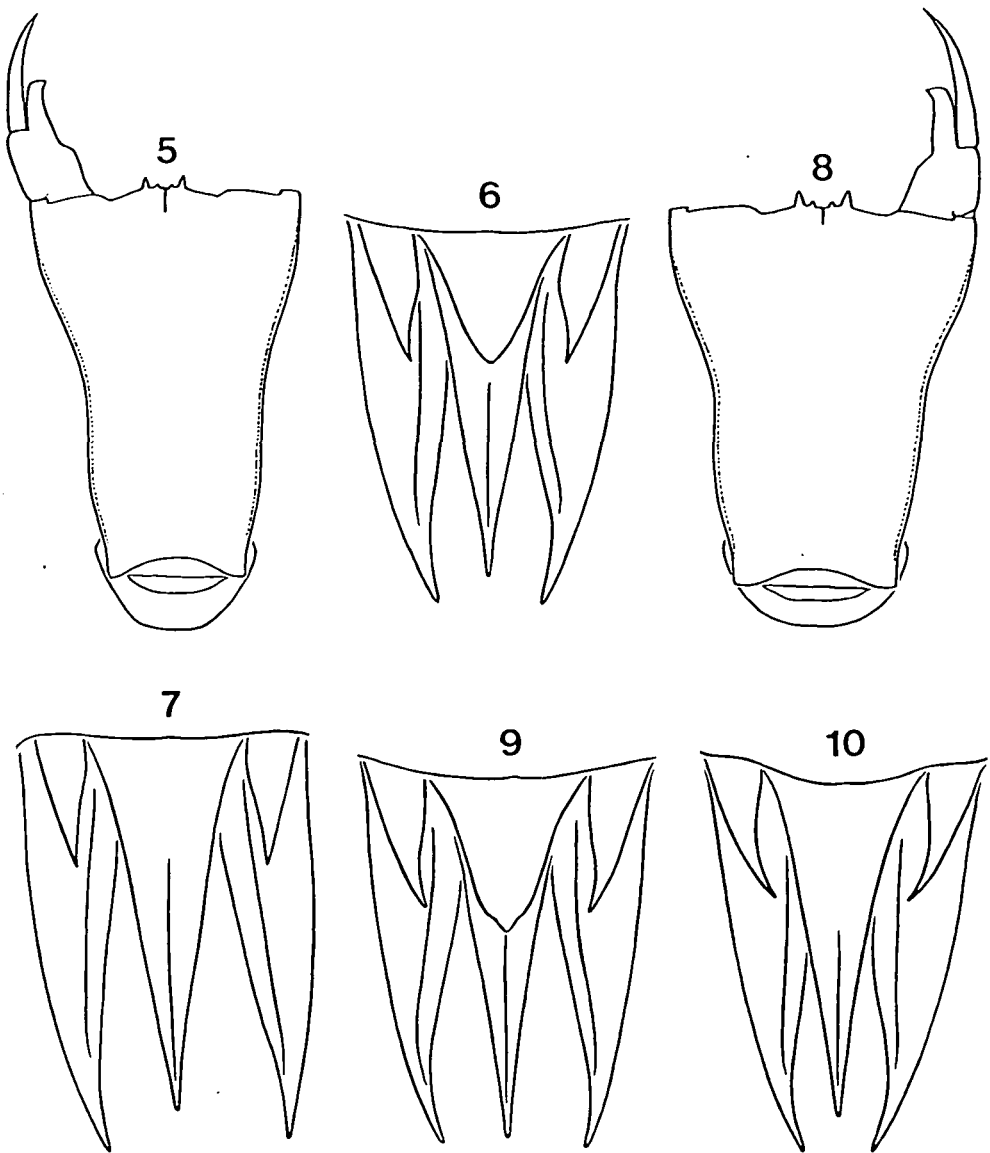
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Address of the author: Günther THEISCHINGER;
20 Leawarra Street, Engadine, N.S.W. 2233, Australia.



Figs 1, 2: *Austrophlebia costalis* (TILLYARD), adult, dorsal aspect: 1: male anal appendages; - 2: female anal appendages.

Figs 3, 4: *Austrophlebia subcostalis* sp. n., adult, dorsal aspect: 3: male anal appendages; - 4: female anal appendages.



Figs 5-7: *Austrophlebia costalis* (TILLYARD), final instar larva: 5: labium, ventral aspect; - 6, 7: anal pyramid, dorsal aspect: 6: male; - 7: female.

Figs 8-10: *Austrophlebia subcostalis* sp. n., final instar larva: 8: labium, ventral aspect; - 9, 10: anal pyramid, dorsal aspect: 9: male; - 10: female.



Fig. 11: Comparison of *Austrophlebia* larval exuviae (female): *A. costalis* (TILLYARD) = exuviae with narrow labium; - *A. subcostalis* sp. n. = exuviae with wide labium.

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Band/Volume: [0028_1](#)

Autor(en)/Author(s): Theischinger Günther

Artikel/Article: [The species of Austrophlebia TILLYARD \(Odonata: Anisoptra: Aeshnidae: Brachytroninae\). 305-314](#)