

**REGIONS OF TAXONOMIC DISJUNCTION IN AUSTRALIAN
ODONATA AND OTHER FRESHWATER INSECTS:
FIRST ADDENDUM, WITH THE DESCRIPTION OF
AUSTROCORDULIA REFRACTA JURZITZAI SSP. NOV.
(ANISOPTERA: CORDULIIDAE)**

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The information on taxonomic disjunction along the Hunter Valley (New South Wales) of mostly species-pairs of Odonata is updated and discussed. The holotype ♂ of *A. refracta jurzitzai* ssp. n. comes from New South Wales, Heathcote (bred 21-XI-1916), deposited in ANIC, Canberra.

INTRODUCTION

Based on then available information on Australian Odonata and other freshwater insects, regions of taxonomic disjunction were pointed out and discussed by WATSON & THEISCHINGER (1984). More distributional information, particularly on Odonata, has since been accumulated, and the effect of these ecological and physiographic boundaries on possible former taxonomic continuities have been found variable. In the following, the information given on the odonate taxa listed by WATSON & THEISCHINGER (1984) as having limits of distribution at or near the Hunter Valley (New South Wales) is updated and discussed. A new subspecies is described.

GENERAL ABBREVIATIONS:

ck creek
c.u. collector unknown
E final instar exuviae
L larva

COLLECTION ACRONYMS:

AM Australian Museum, Sydney
ANIC Australian National Insect Collection,
CSIRO Canberra
EPA Environment Protection Authority
New South Wales, Sydney
GT Gunther Theischinger, Sydney

DISCUSSIONS

ARGIOLESTES SP. near *A. ALPINUS* TILLYARD vs *ARGIOLESTES* SP. "i"

Argiolestes sp. near *A. alpinus* Till. and *Argiolestes* sp. "i" have since been described as *Austroargiolestes brookhousei* Thei. & O'Farrell and *Austroargiolestes isabellae* Thei. & O'Farrell (THEISCHINGER & O'FARRELL, 1986). *A. brookhousei* and *A. alpinus* form a well defined species group of *Austroargiolestes* which seems to be restricted to streams and boggy seepages in the high country of New South Wales north of the Hunter, whereas *A. isabellae* belongs to another species group of *Austroargiolestes* which includes *A. calcaris* Fraser, *A. isabellae*, *A. christine* Thei. & O'Farrell, *A. elke* Thei. & O'Farrell and possibly *A. aureus* (Tillyard), a mixed bag of bog and stream dwellers distributed across some of the montane areas of coastal eastern Australia. *A. brookhousei* and *A. isabellae* are not longer considered a pair sensu WATSON & THEISCHINGER (1984), even though *A. brookhousei* is still known only from north of the Hunter and *A. isabellae* only from south of the Hunter.

ARGIOLESTES SP. near *A. CALCARIS* FRASER vs *ARGIOLESTES CALCARIS* FRASER

Argiolestes sp. near *A. calcaris* Fraser has since been described as *Austroargiolestes christine* Thei. & O'Farrell (THEISCHINGER & O'FARRELL, 1986). *A. christine* and *A. calcaris* are a typical species-pair sensu WATSON & THEISCHINGER (1984). Both species inhabit high altitude streams and boggy seepages, *A. christine* north, *A. calcaris* south of the Hunter; neither of them has been found to have crossed the Hunter gap.

SYNLESTES TILLYARDI FRASER (hornless larvae) vs *SYNLESTES TILLYARDI* FRASER (horned larvae)

Synlestes tillyardi Fraser is now (WATSON et al., 1991) considered to be a subspecies of *Synlestes weyersii* (*S. w. tillyardi* Fraser). It has also since been found that at least some larval instars of both forms listed by WATSON & THEISCHINGER (1984) have larvae with lateral postocular horns. More work is needed to assess status and validity of the two forms and their distributions.

DIPHLEBIA LESTOIDES TILLYARDI FRASER vs *DIPHLEBIA L. LESTOIDES* (SELYS)

Additional information is not available.

AUSTROAESCHNA SIGMA THEISCHINGER vs *AUSTROAESCHNA OBSCURA* THEISCHINGER

Definitely a species pair sensu WATSON & THEISCHINGER (1984). Both spe-

cies are mainly small stream dwellers with a total altitudinal range from 100 to 1500 m. It is not surprising that at least one of them has crossed the Hunter gap. Both species now coexist at least at Watagan Mountains, south of the Hunter (THEISCHINGER, 1982) where even a case of interspecific mating was observed (THEISCHINGER, 1997).

AUSTROAESCHNA SUBAPICALIS THEISCHINGER (northern form) vs *AUSTROAESCHNA SUBAPICALIS* THEISCHINGER (southern form)

Austroaeschna subapicalis Thei. was considered a variable species which may include discrete subspecies (THEISCHINGER, 1982). Generally there is a morphological north of the Hunter/south of the Hunter trend as pointed out and illustrated by THEISCHINGER (1982). *A. subapicalis* is confined to fast flowing medium-sized to large high altitude (>600 m) streams and rather high rainfall areas. There is a wide gap along the Hunter Valley lacking such conditions. However, there are also numerous smaller gaps between smaller areas with such conditions and populations of *A. subapicalis*, particularly north of the Hunter. On one hand, the more or less isolated populations often differ somewhat from each other, on the other hand some individuals do not differ significantly from some individuals from the opposite side of the Hunter. None of the hitherto known small populations and none of the two groups of populations south, respectively north of the Hunter, can be considered discrete subspecies.

NOTOAESCHNA GEMINATA THEISCHINGER vs *NOTOAESCHNA SAGITTATA* (MARTIN)

Definitely a species-pair sensu WATSON & THEISCHINGER (1984). Both species inhabit fast sections of medium-sized to large streams and are not known from low altitude or coastal areas. There are clear differences between the two species in the structure of terminal abdominal segment and anal appendages of the male. Crossing of the Hunter gap by either species has not yet been recorded.

EUSYNTHEMIS GUTTATA "AUROLINEATA" (TILLYARD) vs *EUSYNTHEMIS GUTTATA* (SELYS) s. str.

Eusynthemis guttata "aurolineata" (Till.) sensu WATSON & THEISCHINGER (1984) has since been found to include at least 2 species, namely *E. aurolineata* (Till.) (= senior synonym of *melanosoma* Till.), a very variable species, possibly a species complex, known from swampy high mountain streams and mostly small rainforest streams of various altitudes, and *E. rentziana* Thei. which has been recorded from rainforest streams between 300 and 700 m (THEISCHINGER, 1998). *E. guttata* (Sel.) s. str. sensu WATSON & THEISCHINGER (1984) has since been found to include *E. guttata*, a species known only from south of latitude 35°30'S, and the apparently circumalpine species *E. tillyardi* Thei. (THEISCHINGER, 1995,

1998). The total altitudinal range of these two species is from 100 to 1500 m. *E. tillyardi* and of course *E. guttata* have never been recorded from north of the Hunter, whereas there are no records of *E. aurolineata* and only a single record of *E. rentziana* from south of the Hunter. It appears that a species giving rise to *E. guttata* and *E. tillyardi* was separated early by the Hunter gap from a species giving rise to *E. aurolineata* and *E. rentziana*. Whereas now both, *E. aurolineata* and *E. rentziana*, come close to the Hunter gap from the north, only *E. tillyardi* occurs close to the Hunter gap in the south. At present *Eusynthemis aurolineata* (Till.) + *E. rentziana* Thei. vs *Eusynthemis tillyardi* Thei. is considered to be a pair sensu WATSON & THEISCHINGER (1984).

EUSYNTHEMIS BREVISTYLA "SUBJUNCTA" (TILLYARD) vs *EUSYNTHEMIS BREVISTYLA* (SELYS) s. str.

Eusynthemis brevistyla "subjuncta" (Till.) and *E. b. brevistyla* (Sel.) were distinguished by differences in thoracic pattern (TILLYARD, 1913; FRASER, 1960; WATSON et al., 1991). Populations of *E. brevistyla* from south of the Hunter have since been found to include individuals with typical *brevistyla* pattern and individuals with *subjuncta* pattern but without any indication of specific distinctness of the two forms. It is possible that there are other characters separating the two forms, but more work is needed to confirm their status as different subspecies.

AUSTROCORDULIA REFRACTA TILLYARD (short spine larvae) vs *AUSTROCORDULIA REFRACTA* TILLYARD (long spine larvae)

Only insufficient information on the distribution led to the inclusion of these two forms by WATSON & THEISCHINGER (1984). The Hunter Valley is not separating these two forms. Short spine larvae have since been found as far south as Taree region, and long spine larvae are now available from as far north as the Bellinger River. There appears to be a small distributional overlap of the two different larval forms and they can be associated with two different adult forms. However, as differences of the adults have hitherto been detected only in the males, the two forms are treated as subspecies of one and the same species. *A. refracta* was originally described from Cooktown on Cape York Peninsula where the larvae have short lateral abdominal spines and adult males have long anal appendages. The southern form (long spine larvae, short male anal appendages) is described as a new subspecies below.

AUSTROCORDULIA REFRACTA JURZITZAI SSP. NOV.

Figures 1-3

Material. – **Holotype** ♂ + E: Australia, New South Wales, Heathcote, bred, 21-XI-1916, R.J. Tillyard (ANIC). **Paratypes:** New South Wales: 1 ♂, Allen Ck nr Wilton, 3-XII-1979, G. Theischinger & L. Mueller (ANIC); 1 ♂, Berowra, 9-XII-1973, L. Mueller (ANIC); 1 ♀ + E, Engadine, emerged

24-IX-1980, J.A.L. Watson (ANIC); 1 ♀ + E, Heathcote, bred, 14-XI-1912, 1 ♂, same locality, bred, 30-XII-1916, R.J. Tillyard (ANIC); 1 ♀ + E, Heathcote, bred, 29-X-1912, 1 ♂ + E, same locality, bred, 26-XI-1912, 1 ♀ + E, same locality, 8-XII-1912, R.J. Tillyard (AM); 1 ♂, Heathcote Brook, 28-XI-1980, G. Theischinger (ANIC); 1 ♀, Kingfisher Ck, nr Heathcote, X-1997, G. Theischinger & L. Mueller (GT); 1 ♀, Nepean R., nr Maldon Bridge, 3-XII-1979, 1 ♀ (in cop. with *A. leonardi* Thei.), same locality, 14-XI-1983, G. Theischinger & L. Mueller (ANIC); 1 ♀, Stanwell Park, Bulli, 11-XI-1952, R. Dobson (ANIC). — *Other material*: New South Wales: 5 E, Berowra Ck, 11-XII-1976, G. Theischinger (ANIC); 2 L, Cabbage Tree Ck, Clyde Mt, 28-II-1966, E.F. Riek (ANIC); 1 E, Engadine, 24-IX-1980, J.A.L. Watson (ANIC); 1 L, Galston, 2-II-1936, C. Davis (ANIC); 25 E, Hackling R., nr Bola Ck, 8-I-1999, G. Theischinger & L. Mueller (GT); 1 E, Heathcote, 29-XI-1916, R.J. Tillyard (ANIC); 11 E, Hungry Way Ck, 8-III-1996, G. Theischinger (GT); 1 E, Illawara, 10-X-1908, R.J. Tillyard (ANIC); 1 L, Kalang R., nr Rose Ck, 8-V-1998, J. Potts (EPA); 3 E, Karloo Pool, I-1980, G. Theischinger (ANIC); 17 E, Kangaroo Ck, nr Audley, 10-XI-1995, 1 E, same locality, 15-III-1996, G. Theischinger (GT); 4 E, Kangaroo Ck, S of Grays Point, 12-XII-1998, D. Paulson & N. Smith (GT); 10 E, Kingfisher Pool, 25-XII-1993, G. Theischinger (GT); 1 L, Margaret Ck, Bournda National Park, 4-VI-1998, E. Turak (EPA); 6 E, Mogo Ck, nr Popran Ck, 16-IV-1979, G. Theischinger (ANIC); 2 E, Mt White, 8-XI-1995, G. Theischinger (GT); 2 E, Nepean R., Maldon Bridge, 3-XII-1979, G. Theischinger (ANIC); 1 E, S of Nowra, IV-1980, G. Theischinger (GT); 1 E, Ourimbah Ck, 30-III-1979, G. Theischinger (ANIC); 6 E, Popran Ck, 3-III-1979, G. Theischinger (GT), 1 E, same locality, 15-IV-1979, G. Theischinger (ANIC); 4 E, Shellbrook, foot of Barrington Tops, 10-X-1976, G. Theischinger (GT); 1 E, Somersby Falls, II-1980, G. Theischinger (ANIC); 1 E, Somersby Falls, Floods Ck, Gosford, 15-XII-1976, G. Theischinger (ANIC); 3 E, St Albans, McDonald R., 16-X-1976, G. Theischinger (ANIC); 4 E, Stanwell Park, Bulli, 3-XII-1961, R. Dobson (ANIC); 1 E, nr Waragamba Dam, 1-I-1980, G. Theischinger (GT), 4 E, same locality, 17-I-1980, G. Theischinger (ANIC); 1 E, Woronora Dam, 17-IV-1979, G. Theischinger (ANIC); 2 E, Woronora R., G. Theischinger (GT); 3 E, Woronora R., nr Engadine, 2 E, same locality, XI-1979, G. Theischinger (ANIC); 1 E, Woronora R., nr Heathcote, 9-XI-1979, J.A.L. Watson & G. Theischinger (ANIC).

Etymology. — Dedication to Professor Dr Gerhard J u r z i t z a who acted incredibly fast and unselfish when the undescribed larval material of *Gomphomacromia* Brauer was needed for a study of the Australian Gomphomacromiinae (THEISCHINGER & WATSON, 1984).

ADULT. — **H e a d.** — Shiny greenish- to greyish- and blackish brown, top of frons, vertex and occiput darkest, labrum and labium palest.

T h o r a x. — Largely shiny greyish-to blackish brown, with front of synthorax darkest; dorsal carina bright yellow; postscutella greyish yellow. Legs brown to black.

W i n g s. — Veins brown to black; membrane hyaline; costal and subcostal spaces variably suffused with brown at base; pterostigma orange brown; membranule white. Venation as described in the generic diagnosis by TILLYARD (1908) and by THEISCHINGER & WATSON (1978). Anal loop starting with single cell.

A b d o m e n. — Subcylindrical; dark reddish- to greyish- and blackish brown. Secondary genitalia with inner lobe of hamule longer than outer and ending in a slim hook. Female valves trifold, each with large horn-like outer tooth bent mediad, small tooth in the middle, and inner horn-like tooth, intermediate in size.

Anal appendages. — Brown; superiors long, slender, very slightly curved laterally, basal 1/3 with curved lateral keel terminating in a ventral denticle; inferior rather narrow, subtriangular slightly curved, dorsally.

Measurements (in mm).
 – Hindwing, male 27.0-31.0, female 31.0-36.0; abdomen, male 33.0-39.0, female 33.0-40.0.

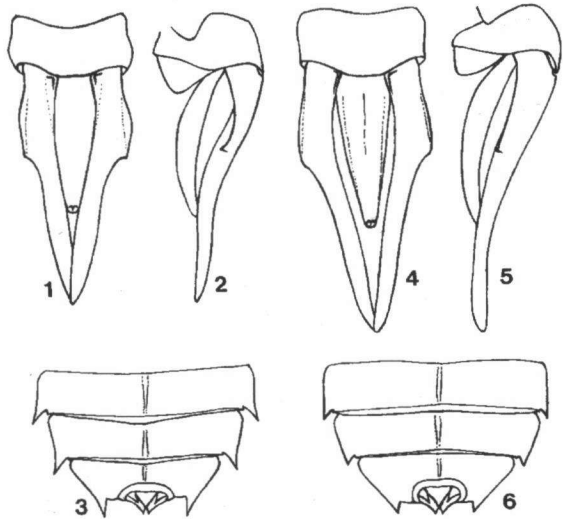
LARVA. – As described for *Austrocordulia refracta* Till. (southern form) by THEISCHINGER & WATSON (1982).

DISCUSSION. – In general appearance both sexes of adult *A. r. juritzai* agree with the description of *A. r. refracta* (Figs 4-6) presented by TILLYARD (1908) and complemented by THEISCHINGER (1973) and THEISCHINGER & WATSON (1978).

There are, however, consistent differences between the two subspecies in the male anal appendages. *A. r. juritzai* has shorter, slightly straighter, superior appendages with a more strongly curved lateral keel in basal 1/3, making the subsequent ventral denticle appear larger, and a shorter and stouter inferior appendage.

Diagnostic characters of the female are not available at present. The larva of *A. r. juritzai* has much larger and more sharply pointed lateral spines on abdominal segments 7-9 than the larva of typical *A. refracta*. There is evidence at present, based on larvae only, of a geographical overlap of the two subspecies of *A. refracta*. Typical *A. refracta* has been collected as far south as the area around Taree (Manning catchment), *A. r. juritzai* as far north as the Bellinger catchment.

Material of *Austrocordulia refracta* Till. examined for comparison: New South Wales: 1 ♂, Boonoo Boonoo Swamp, ca 1000 m, XI-1992, G. Theischinger (ANIC); 2 E, Cangai Ck, 11-X-1979, 1 ♀, same locality, 15-I-1985, G. Theischinger (ANIC), 1 E, same locality, 13-XI-1983, G. Theischinger (GT); 1 E, Coombadja Ck, Washpool N.P., 5/6-I-1986, G. Theischinger (GT); 1 E, Forbes R., 2-XII-1998, G. Theischinger (GT); 1 E, Landsdowne, nr Taree, G. Theischinger (GT); 2 E, Middle Brother State Forest, 15/17-I-1999, G. Theischinger (GT); 1 E, Nymboida R., 7-XII-1998, G. Theischinger (GT); 1 E, Washpool N.P., 5-I-1986, G. Theischinger (GT); 2 E, Wattui Falls, 17-I-1999, G. Theischinger & L. Mueller (GT); 2 E, Wilson R., Wild Bull Park, 2-XII-1998, 9 E, same locality, 15/17-I-1999, G. Theischinger (GT). Queensland: 1 E, northern tributary of Apis Ck, nr Marlborough, 12/13-XII-1976, G. Theischinger (ANIC); 1 ♀, Atherton, I-1963, C. Vallis (ANIC); 1 L, Behana Gorge, S of Gordonvale, 29-VI-1971, E.F. Riek (ANIC); 1 E, Blencoe Falls (swamp), 19-X-1980, G. Theischinger & L. Mueller (ANIC); 1 ♀, Bluff Range, 17-XII-1970, 1 ♂, same locality, 25-XII-1970, H. Frauca (ANIC); 1 ♂,



Figs 1-3. *Austrocordulia refracta juritzai* ssp. n.: (1, 2) male anal appendages: – (1) dorsal view; – (2) lateral view; – (3) larva, abdomen from segment 7, dorsal view. – Figs 4-6. *Austrocordulia r. refracta* Till.: (4, 5) male anal appendages: – (4) dorsal view; – (5) lateral view; – (6) larva, abdomen from segment 7, dorsal view.

NW section of Bluff Range, 11-I-1972, H. Frauca (ANIC); 18 L, Bluff Range, Biggenden, VIII-1971, H. Frauca (ANIC); 1 ♂, Brisbane, 8-I-1986, G. Theischinger (ANIC); 1 E, Cania Gorge, 31-XII-1980, G. Theischinger & L. Mueller (ANIC); 2 E, Cape Tribulation, 23/26-X-1980, G. Theischinger & L. Mueller (ANIC); 2 E, Carnarvon Gorge, 3 E, same locality, 1/3-XII-1986, 2 ♀, same locality, XI-1990, G. Theischinger, 1 ♂, 1 ♀, same locality, 17/18-III-1992, G. Theischinger & L. Mueller (ANIC, GT); 1 ♂, Coast Range, S of Biggenden, 16-I-1977, H. Frauca (ANIC); 1 ♂, 3 ♀, 1 E, Crows Nest Falls National Park, 17/18-I-1986, G. Theischinger & L. Mueller (ANIC, GT); 4 E, Dalrymple Ck, nr Mackay, 14-XI-1976, G. Theischinger (ANIC); 9 E, Elaman Ck and Little Yabba Ck, nr Kenilworth, 9-XI-1976, G. Theischinger (ANIC); 2 E, Emu Ck State Forest, 15/16-I-1986, G. Theischinger (GT); 1 ♂, Gap Ck, Mt Finleyson Range, S of Cooktown, 2-I-1981, M.S. & B.J. Moulds (AM); 1 E, Hartley's Ck, 25 mi. N Cairns, 10-XI-1951, R. Dobson (ANIC); 1 ♂, Kiamba, Blackall Range, 18-I-1981, c.u. (ANIC); 1 ♂, Kirrama Range, W of Kennedy, 12-I-1990, M.S. & B.J. Moulds (AM); 1 E, Kroombit Tops, 14-X-1983, G. Theischinger (GT); 1 ♂, Kuranda, 3-X-1952, R. Dobson (ANIC); 4 E, Lake Freshwater, 12-XI-1982, G. Theischinger (GT); 1 L, Leo Ck Rd, ca 500 m, McIlwraith Range, 30 km NE of Coen, 29-VI/7-VII-1976, G.B. & S.R. Monteith (ANIC); 2 E, Little Yabba Ck, nr Kenilworth, 11/12-I-1984, G. Theischinger (GT); 5 E, Lobster Ck, nr Kenilworth, 14-I-1986, G. Theischinger (GT); 2 E, Millstream Falls, Ravenshoe, 18/19-XI-1976, G. Theischinger (ANIC); 1 E, NW of Mt Molloy, 23-XI-1976, G. Theischinger (ANIC); 1 E, Mt Tamborine, 8-IX-1976, G. Theischinger (ANIC); 1 L, Mt Tozzer area, Iron Ra., 23-IV/1-V-1973, S.R. Monteith (ANIC); 1 ♂, Mt Walsh National Park, Biggenden, 10-II-1978, H. Frauca (ANIC); 4 E, Nerang R./Cave Ck, 7-XII-1976, G. Theischinger (ANIC); 1 ♂, Stoney Ck, Byfield, Rockhampton, 16-X-1955, R. Dobson (ANIC); 1 ♂, Stoney Ck, nr Kilcoy, 26-I-1986, c.u. (ANIC); 1 L, Wangoolba Ck at Central Station, Frazer Island, 24-XII-1996, E. Tsyrlin (GT).

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