

**REGIONS OF TAXONOMIC DISJUNCTION IN AUSTRALIAN
ODONATA AND OTHER FRESHWATER INSECTS:
SECOND ADDENDUM, WITH THE DESCRIPTION OF
AUSTROAESCHNA UNICORNIS PINHEYI SSP. NOV.
(ANISOPTERA: AESHNIDAE)**

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The information on taxonomic disjunction at the gap between the Paluma Range (ca 19°S) and Eugella (ca 21°S) of mostly species pairs of Odonata is updated and discussed. The holotype ♂ of *A. u. pinheyi* ssp. n. comes from Queensland, Carnarvon Gorge (18/21-II-1990), deposited in ANIC, Canberra. *A. u. coloola* Theischinger and *A. u. speciosa* Sjöstedt are appraised, respectively re-appraised, as distinct species.

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). The information on the odonate taxa listed as having limits of distribution at or near the Hunter Valley (New South Wales) was updated and discussed by THEISCHINGER (1999b). This paper is an attempt to update WATSON & THEISCHINGER's (1984) list of odonates with distributional limits lying on one or the other side of the Paluma-Eungella gap. In this context a new subspecies is described and a change of status for two other taxa is suggested.

GENERAL ABBREVIATIONS:

E final instar exuviae
N. P. National Park
S. F. State Forest
s. l. same locality
vs versus

GENERAL ACRONYMS:

ANIC Australian National Insect Collection,
CSIRO Canberra
GTS Collection G. Theischinger, Sydney

DISCUSSIONS

EPISYNLESTES CRISTATUS WATSON & MOULDS
vs *EPISYNLESTES* SP. near *E. CRISTATUS*

Episynlestes sp. near *E. cristatus* has since been described from Eungella as *E. intermedius* THEISCHINGER & WATSON, 1985, but has not yet been found elsewhere (THEISCHINGER, WATSON & ROWE, 1993). *E. cristatus* is now known to be fairly widely distributed along rainforest streams of northeastern Queensland.

SYNLESTES TROPICUS TILLYARD vs *SYNLESTES SELYSI* TILLYARD

S. tropicus is known to occur North of the Paluma-Eungella gap including Paluma, *S. selysi* South of the gap including Eungella.

ARGIOLESTES AUREUS TILLYARD / *ARGIOLESTES* SP.
near *A. CALCARIS* FRASER

Argiolestes sp. near *A. calcaris* has since been described as *Austroargiolestes elke* THEISCHINGER & O'FARRELL, 1986. It is my opinion that *A. elke* is the northernmost member of a species group of *Austroargiolestes* (including *A. calcaris* (Fraser), *A. isabellae* Theischinger & O'Farrell, *A. christine* Theischinger & O'Farrell and *A. elke*), ranging from southern Victoria to Eungella. *A. chrysoides* Tillyard (known only from 24°22'S and further South) is now considered the possible sister species of *A. aureus* on the other side of the gap (see also below).

DIPHLEBIA EUPHAEOIDES TILLYARD vs *DIPHLEBIA COERULESCENS* TILLYARD

D. euphaeoides is known to occur North of the Paluma-Eungella gap including Paluma, *D. coerulescens* South of the gap including Eungella.

PETALURA INGENTISSIMA TILLYARD

According to WATSON & THEISCHINGER (1984) *P. ingentissima* has a close relative (*P. pulcherrima* Tillyard) only in the northern rainforests. Since then, considerable doubt was cast about the specific distinctness of *P. ingentissima* and *P. pulcherrima*, and the southeastern *P. gigantea* Leach was found to be complex (THEISCHINGER, 1999). *P. gigantea* is now known to reach North as far as Boonoo Boonoo (ca 28°50'S), close to the border between Queensland and New South Wales, whereas *P. litorea* Theischinger has not only been found to reach well into New South Wales (S of Brooms Head, 29°37'S) but also to exist as far North as Byfield (22°50'S) in Queensland. Considering that Byfield is not necessarily the northernmost point of

P. litorea's distribution and the close similarity of *P. ingentissima* and *P. litorea* in slenderness, structure of frons and male superior appendages, these two species may qualify as a possible species pair astride the gap.

AUSTROAESCHNA FORCIPATA TILLYARD / *AUSTROAESCHNA SIGMA* THEISCHINGER;
AUSTROAESCHNA WEISKEI (FÖRSTER) / *AUSTROAESCHNA PULCHRA* TILLYARD

Both, *A. pulchra* and *A. sigma*, were listed by WATSON & THEISCHINGER (1984) on the evidence of larvae from Eungella. These were later (THEISCHINGER, 1993) found to belong to *A. eungella* Theischinger and *A. christine* Theischinger. However, also those two species do not seem to be any closer to their northern congeners, *A. forcipata* and *A. weiskei*, than *A. pulchra* and *A. sigma*.

AUSTROPHLEBIA SUBCOSTALIS THEISCHINGER vs *AUSTROPHLEBIA COSTALIS*
(TILLYARD)

According to THEISCHINGER (1996), a definite species pair with *A. subcostalis* now known to range from Paluma to Cape Tribulation and *A. costalis* from Buckenbowra River (36°36'S) to Eungella.

TELEPHLEBIA CYCLOPS TILLYARD

T. cyclops Tillyard, known from South of the gap, including Eungella, has, like *Austroaeschna christine* and *A. eungella*, no closely related counterpart North of the Paluma-Eungella gap.

AUSTROGOMPHUS DODDI TILLYARD

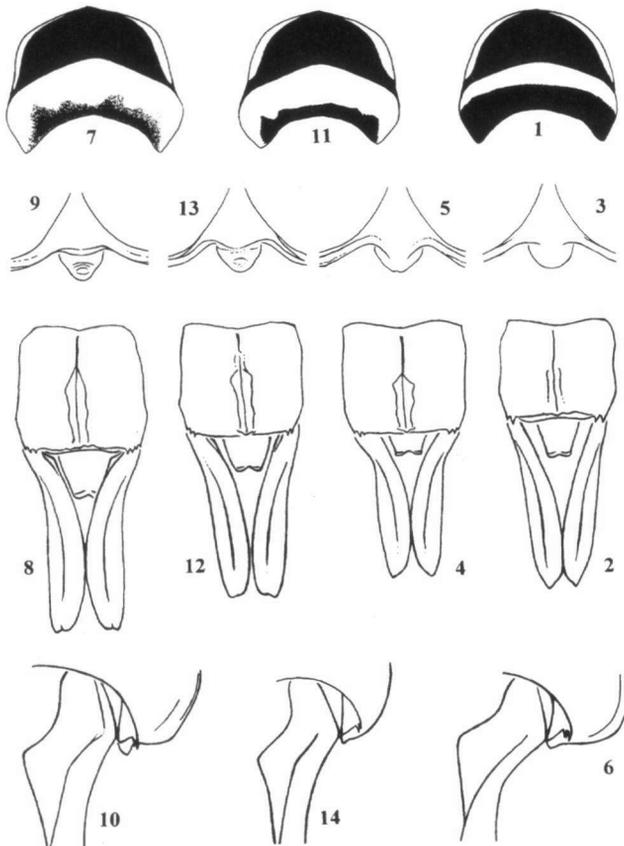
According to WATSON & THEISCHINGER (1984), the tropical *A. doddi* is closely related to *A. sp. "c"* (= now *A. cornutus* Watson) from southeastern Queensland (and eastern New South Wales and Victoria). Since then, however, we have found *A. cornutus* not only in the Eungella area but also at Porcupine Gorge near Hughenden, inland of the coastal mountains, and beyond the Paluma-Eungella gap (WATSON, 1991). WATSON (1991) also recorded *Austrogomphus* males, collected between Mt Molloy and Maryfarms North of the Paluma-Eungella gap, as appearing intermediate between *A. doddi* and *A. cornutus*. Near Atherton, Sid Dunkle has since 1999 collected three females and a male corresponding well with the "intermediate" males I collected. After a thorough check of all this material, particularly the occiputs, and comparison with both *A. doddi* and *A. cornutus*, it is my opinion that it should – at least at this stage – be included in *A. doddi*. *A. cornutus* and *A. doddi* can be identified reasonably safely and without great difficulties only by the structure of the female occiput rather than by colour pattern.

ARCHAEOPHYA MAGNIFICA THEISCHINGER & WATSON

Additional information is not available (see below).

PSEUDOCORDULIA ELLIPTICA TILLYARD

According to WATSON & THEISCHINGER (1984), *P. elliptica* has a close relative only in the northern rainforests. Both *P. elliptica* and *P. circularis* Tillyard occur at Paluma but apparently not at Eungella. A monotypic family, Pseudocorduliidae, has since been erected for *Pseudocordulia* Tillyard (LOHMANN, 1996).



Figs 1-3: *Austroaeschna cooloola* Theischinger; - Figs 4-6: *A. speciosa* Sjöstedt; - Figs 7-10: *A. u. unicornis* (Martin); - Figs 11-14: *A. u. pinheyi* ssp. n. - (1, 7, 11) anterior frons and postclypeus, frontal view; - (2, 4, 8, 12) male anal appendages, dorsal view; - (3, 5, 9, 13) female occiput, dorsal view; - (6, 10, 14) base of left superior anal appendage of male, lateral view.

EUSYNTHEMIS N. NIGRA (TILLYARD) vs *EUSYNTHEMIS N. XANTHOSTICTA* TILLYARD

A definite pair with *E. n. nigra* quite common at Paluma and further North, and what we call now *E. n. xanthosticta*, at Eungella and further South. More work, however, is needed to assess complexity and status of typical *E. nigra*, but particularly of *E. n. xanthosticta*.

CORDULEPHYA BIDENS SJÖSTEDT vs *CORDULEPHYA ?PYGMAEA* SELYS

A definite species-pair. However, only larval material and a single female of supposedly *C. pygmaea* have hitherto been collected at Eungella. Material of *C. bidens* is now available from Paluma and further North.

OTHER SPECIES PAIRS

Besides *Austrogomphus doddi* Tillyard / *A. sp. "c"* (= *A. cornutus* Watson) (see above), WATSON & THEISCHINGER (1984) listed *Argiolestes aureus* Tillyard / *A. chrysoides* Tillyard (see also above), and *Archaeophya magnifica* Theischinger & Watson / *A. adamsi* Fraser as pairs with one species known from Paluma or close by and another closely related species from southern Queensland or northeastern New South Wales. To these at least the following pairs should be added:

- *Griseargiolestes metallicus* (Sjöstedt) / *G. fontanus* (Tillyard)
- *Neosticta fraseri* Watson / *N. canescens* Tillyard
- *Austroaeschna unicornis* (Martin) / *A. speciosa* Sjöstedt (see below, under *A. unicornis* (Martin))
- *Spinaeschna watsoni* Theischinger / *S. tripunctata* (Martin)
- *Telephlebia tillyardi* Campion / *T. tryoni* Tillyard
- *Tonyosynthemis claviculata* (Tillyard) / *T. ofarrelli* (Theischinger & Watson).

"AUSTROAESCHNA UNICORNIS (MARTIN)"

Up to now *A. unicornis* appeared to differ from numerous species of southern origin which are restricted South of the Paluma-Eungella gap and have either no closely related or a closely related distinct species North of the gap. Re-examination of adults and larvae from numerous populations of *A. unicornis* has changed this picture.

THEISCHINGER (1982), under *Austroaeschna unicornis*, listed two subspecies, *A. u. unicornis* and *A. u. speciosa* Sjöstedt, illustrating *A. u. unicornis* from New South Wales and Stradbroke Island (southeastern Queensland) and *A. u. speciosa* from northeastern and southeastern Queensland. Theischinger in WATSON et al. (1991) described *A. unicornis* from Stradbroke Island (and from the Cooloola area, with records also from Fraser Island) as *A. u. cooloola*. On the evidence presented

earlier (THEISCHINGER, 1982; WATSON et al., 1991), the distinct structure and pattern of the adult face and on larval characters like the shape of labial palps and thoracic and abdominal armature (being described elsewhere) and on ecological grounds (small sand-bottomed streams as opposed to rather rocky streams and rivers), *A. u. cooloola* is now considered as a distinct species *Austroaeschna cooloola* Theischinger stat. nov. (Figs 1-3). It appears to be an endemic element, mainly associated with sandy streams and dune situations, where other endemic species are known in the Megapodagrionidae, Lestidae, Gomphidae and Libellulidae.

The differences between *A. u. speciosa* from northeastern and from southern Queensland, were recognised already by THEISCHINGER & WATSON (1979) and illustrated in detail by THEISCHINGER (1982). In the meantime additional material and field information from southern Queensland have been accumulated, and material from close to the Queensland / New South Wales border has been found to include specimens corresponding closely to *A. u. speciosa* from southern Queensland (Figs 11-15) along such corresponding closely to *A. u. unicornis* (Figs 7-10, 16). This indicates that these two forms which have male anal appendages of similar size and shape are not geographically isolated from each other. As it is not yet clear if they intergrade or not, they continue to be regarded as subspecies of *A. unicornis*. The marked differences in size and shape of male anal appendages and female occiput between northeastern Queensland populations on one side and southern Queensland populations on the other, of what was hitherto regarded as *A. u. speciosa*, however, are now considered as an indication of their potential reproductive isolation and distinctness at specific level. The northern Queensland populations (known only N of 18°S) originally described as a distinct species, *A. speciosa* Sjöstedt (Figs 4-6), are re-elevated to that rank. Consequently the southeastern populations (known only S of 23°30'S) are described as a new subspecies of *A. unicornis*.

AUSTROAESCHNA UNICORNIS PINHEYI SSP. NOV.

Figures 11-15

M a t e r i a l. – **H o l o t y p e** ♂: Australia, Queensland, Carnarvon Gorge, 18/21-II-1990, G. Theischinger & L. Müller (ANIC). Paratypes: Queensland: 38 ♂, 7 ♀, same data as holotype; 4 ♂, 2 ♀, s. l., 1/2-XII-1976; 4 ♂, 1 E, s. l., 11/14-X-1980; 5 E, s. l., 11/14-X-1980; 5 E, s. l., 1/3-XII-1982; 4 ♂, 1 E, s. l., 17/18-III-1992; 8 ♂, 1 ♀, 4 E, s. l., 26/29-IV-1995; 1 ♂, 1 ♀, s. l., 11/13-II-1997, G. Theischinger & L. Müller (ANIC, GTS); 5 E, Blackdown Tableland, XI-1982; 3 E, s. l., Mimosa Ck area, 14-II-1997, G. Theischinger & L. Müller (GTS); 1 ♂, 1 ♀, Crows Nest Falls, 17-I-1986, G. Theischinger & L. Müller (ANIC); 6 E, Emu Ck S. F., 15/16-I-1986, G. Theischinger & L. Müller (GTS); 1 ♂, Goomburra S. F., 20-I-1986, G. Theischinger & L. Müller (ANIC); 1 ♂, Mount Moffat, May 1990, G. Theischinger & L. Müller (ANIC); 7 ♂, 3 ♀, Salvator Rosa N. P., XI-1990, G. Theischinger & L. Müller (ANIC).

E t y m o l o g y. – Dedicated to the memory of our great colleague, Dr Elliot P i n h e y.

MALE. – Head. – Labium including lobes largely yellowish green merging into pale reddish brown; mandibles greenish yellow basally, otherwise reddish brown with apex black; labrum largely pale yellowish- to bluish green with broad reddish- to dark greyish brown anterior margin; anteclypeus largely dark reddish- to greyish- and blackish brown; postclypeus yellowish- to pale bluish green with anterior margin reddish- to greyish- and blackish brown; genae reddish- to greyish brown; epistomal suture rather evenly curved; anterior frons dark reddish grey to brownish black, top of frons black at base, along midline and adjoining anterior frons, forming T-mark, remainder of top and sides of frons yellowish- to very pale bluish green; vertex black with pale greyish green mark in front and on top of median cone; antennae brownish black; occiput a wide flat yellow cone, brownish black adjacent to eyes; postgenae brownish black next to occiput, otherwise pale brownish- to greyish green along the eye margin, blackish brown elsewhere.

Thorax. – Cervix and prothorax. – Cervical sclerites pale yellowish brown; pronotum largely yellowish- to reddish- and blackish brown, anterior margin of anterior lobe, lateral margins of median lobe and posterior margin of posterior lobe yellow; episternum, epimeron and coxa yellowish- to pale reddish- and greyish brown; trochanter largely dark brown to black; femur brown above and, basally, at sides, distally black, entirely pale green to pale cream-coloured below; tibia, tarsus and claws black.

Synthorax. – Spiracular dorsum and collar brownish black to black dorsally, brown laterally; mesostigmatic lamina brown; dorsal carina and antealar ridge reddish- to brownish black; antealar sinus pale bluish green; front of synthorax dark reddish- to blackish brown with two yellowish- to pale bluish green stripes each side, one narrower and almost C-shaped near dorsal carina, the other broader and slightly bowed, adjoining mesopleural suture, and a subtriangular pale bluish green spot in outer angle of antealar ridge; mesepimeron brownish black with two pale green marks, one near metastigma, the other close to black subalar ridge; mesokatepisternum brown to black with greenish yellow oval mark; metanepisternum brownish black with almost straight, yellowish- to pale bluish green stripe over entire length; metakatepisternum brownish- to greyish black; metepimeron blackish brown with substantial ill-defined pale bluish green patch, often somewhat L-shaped, in posterior half; metapostepimeron greyish brown; mesoscutum, mesopostscutellum and two irregular spots on metascutum yellowish- to bluish green, other tergal surfaces brown to black; poststernum greyish brown; coxae yellowish- to reddish brown; trochanters reddish brown to black; basal 2/3-4/5 of femora brown, remainder black; tibiae, tarsi and claws black.

Wings. – Humeral plates dark reddish brown with two small pale greenish yellow marks; axillary plates blackish brown with one larger, yellowish green mark; intermediary pieces dark reddish- to blackish brown; venation largely black, ray of costa pale yellow; membrane hyaline; antenodals 16-19/12-15, postnodals 12-15/12-15 Ax1 and Ax4 or Ax5 thickened in both wings; pterostigma reddish- to

greyish black, 2.6-3.2 mm long and overlying 3-4 cells in both wings; anal loop made up of 4-8 cells, 2-4 cells wide and 2-3 cells deep; membranules greyish white.

A b d o m e n. – Segments 1 and 2 swollen, 3 constricted near base, remainder of 3 and 4-6 slightly increasing in width from anterior to posterior, 7-10 almost parallel sided. Terga predominantly dark reddish brown to black with pale greenish blue markings as follows: tergum 1 with large patch along ventral margin; tergum 2 with narrow midline, interrupted at about half length, and on each side a large, mediodorsal mark just behind supplementary transverse carina, a patch above auricle and a larger and longer patch along ventral margin; tergum 3 with anterolateral spot each side, extending into stripe along ventral margin, and two narrowly separated, mediodorsal spots posterior to supplementary carina; terga 4-7 each with narrow anterolateral line on each side, connecting with ventral patch that extends just beyond supplementary transverse carina, and a pair of subpentagonal mediodorsal spots on supplementary carina, narrowly separated above and narrowly isolated from lateroventral patches; tergum 8 similar to 4-7 but the two patches made up of anterolateral line and mediodorsal spot slightly more widely separated above, larger than on preceding terga and usually broadly confluent also with lateroventral patch; tergum 9 with two widely separated anterolateral marks and a small apical mid-dorsal spot; segment 10 with conspicuous apical patch over entire width; sternum 1 yellowish- to greyish brown; secondary genitalia greyish yellow to black; sterna 3-9 greyish brown to black; bipartite sternum 11 yellowish- to reddish- and blackish brown.

Anal appendages. – Superior appendages black, about 1.5 times as long as segment 10, slightly and evenly arched in lateral aspect; moderately thick and slightly convergent in basal fourth and with ventrobasal angulation, almost straight for the rest and with apex rather truncate; inferior appendage brownish yellow to dark brown, truncate, trapezoid-shaped, slightly arched and emarginate.

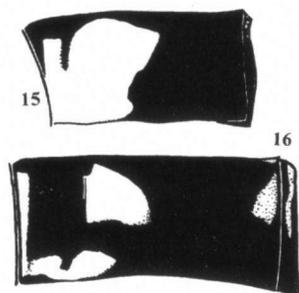
M e a s u r e m e n t s (in mm). – Hindwing 38.0-44.0; abdomen 46.0-54.0.

FEMALE. – **H e a d.** – Colouration much as in male but somewhat duller; occiput a bulky but slightly to moderately defined and generally slightly up-turned cone.

C e r v i x a n d t h o r a x. – Colouration duller than in male.

Wings. – Much as in male but pterostigma 2.8-3.5 mm long and yellowish- to reddish brown.

A b d o m e n. – Segments 1, 2 and 8, 9 swollen, other segments almost cylindrical, abdomen as a whole somewhat stouter than in male; colouration generally similar to male with dull yellow replacing



Figs 15-16. Segment 8 of male, lateral view: (15) *Austroaeschna unicornis pinheyi* ssp. n.; – (16) *A. u. unicornis* (Martin).

greenish blue; tergum 8 with two variably widely separated patches taking almost $\frac{1}{2}$ length of tergum, composed of anterolateral line, trapezoid-shaped mediodorsal patch and ventrolateral patch; segment 9 with middorsal spot in apical third only; segment 10 with or without pale middorsal patch of variable size, shape and definition. Anal appendages about as long as segment 10, black; supra-anal plate brown.

Genitalia. – Dentigerous plate brown to black, slightly tapered, generally with 3-4 teeth on each side; valves and styli brownish black; terebra reaching close to end of segment 10.

M e a s u r e m e n t s (in mm). – Hindwing 41.0-46.0; abdomen 42.0-50.0.

LARVA. – Typical *Austroaeschna* larva; mesothorax and metathorax each with 1 pair of lateral spines, as described for *A. unicornis speciosa* by THEISCHINGER (1982) or for *A. unicornis* by HAWKING & THEISCHINGER (1998); overall appearance much as described for *A. u. speciosa* by THEISCHINGER (1982) but: pronotal lobes variously, generally not sharply, angulated; backwardly directed lateral spines on abdominal segments 6-9 rather long, those on 9 reaching well beyond the middle of segment 10.

AFFINITIES AND DIAGNOSIS. – *Austroaeschna unicornis pinheyi* is now known from a wide range of locations in Queensland between 23°30'S and 28°S and East of 147°10'E. It usually inhabits streams in sclerophyll forest. In the South of its range it apparently has contact with *A. u. unicornis*, a longer-bodied reddish to dark brown form with sparse yellowish green to pale blue pattern, also mainly associated with sclerophyll forests. Whereas the relatively long, slightly and evenly curved and truncate male superior anal appendages of *A. u. pinheyi* closely correspond to *A. u. unicornis*, its markedly richer, more distinctly pale blue pattern on black background is very similar to that of *A. speciosa* Sjöstedt, a species with short, more distinctly bent and pointed male superior anal appendages and a less differentiated female occiput and occurring in the tropical forests more than 550 km further north.

Little geographical variability was found in the known material of *A. speciosa* (Figs 4-6) as well as that of *A. u. unicornis* from between 29°S and 42°S (Figs 7-10, 16) and of *A. u. pinheyi* from between 23°30'S and 28°S (Figs 11-15). However, the morphological range of *A. unicornis* between 28°S and 29°S appears rather significant, even in single populations. A confident assessment of this material is not yet possible.

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