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Are hind coxal knobs a synapomorphy for therevids? An unusual new species of *Anabarhynchus* Macquart from Australia (Diptera: Therevidae: Therevinae)

SHAUN L. WINTERTON

Department of Entomology, North Carolina State University, Box 7613 Raleigh, North Carolina, 27695, USA; email: wintertonshaun@netscape.net

Abstract

A new species of *Anabarhynchus* Macquart is described and figured from south-eastern Queensland, Australia. *Anabarhynchus oblongicornus* sp. nov. adults are active in coastal heath and beach fore-dune habitats. This species is notable because of its greatly elongate antennae, and absence of hind coxal knob, which easily differentiates *A. oblongicornus* sp. nov. from other species in this endemic Australasian genus. The presence of the hind coxal knob has previously been considered synapomorphic for Therevidae+Apsilocephalidae. A review of the presence of this structure in the therevoid clade (Apsilocephalidae+Scenopinidae+Therevidae+Ocoidae) indicates that it is actually plesiomorphic for the entire group, with various examples of secondary reduction or absence in all higher scenopinids and some therevids.

Key words: Therevidae, Diptera, Stiletto-fly, Asiloidea

Introduction

Stiletto-flies (family Therevidae) are found in a variety of habitats ranging from rainforest to desert, but are generally most diverse in arid regions where the sandy, friable soils provide a suitable habitat for their fossorial larvae. The preference for sandy soils has meant that not only desert regions, but also coastal dune systems and fore-shores are inhabited by therevids, especially by certain species of the endemic and species-rich Australasian genus *Anabarhynchus* Macquart. Adults are nectar feeders, while the larvae are voracious predators of soil arthropods, and are characterised by a secondarily segmented abdomen and an apically spatulate tentorial rod (Irwin & Lyneborg 1981).

The Australasian therevid fauna is represented by two of the three currently recognised subfamilies: Therevinae and Agapophytinae. Therevinae are a diverse, cosmopolitan

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group of therevids represented in Australasia (i.e. Australia, New Zealand, Papua New Guinea and far eastern Indonesian Archipelago) only by *Anabarhynchus*, *Megathereva* Lyneborg and *Irwiniella* Lyneborg (Irwin & Lyneborg 1989, Lyneborg 1992, 2001). Agapophytinae comprise ten genera of brightly coloured flies endemic to Australia, Papua New Guinea and Indonesia. (Winterton *et al.* 2001). A third informal grouping closely related to the agapophytines, the *Taenogera* genus-group, are very diverse in Australia, New Zealand and Papua New Guinea, with representatives also in New Caledonia and the Neotropics (Winterton *et al.* 1999b). While being found in all other biogeographical regions, the subfamily Phycinae are not represented in Australasia.

Diverse and species-rich, the distinctive genus *Anabarhynchus* was first described by Macquart (1848). Originally very broadly defined, it subsequently became a holding genus for numerous therevids described from Australasia, Africa and the Neotropics. Recent revisions of *Anabarhynchus* from New Zealand (Lyneborg 1992) and Australia (Lyneborg 2001) have greatly expanded the known fauna of *Anabarhynchus* to a total of 155 species, 93 species from Australia and 62 species from New Zealand, with at least one undescribed species from Papua New Guinea represented in collections (unpublished data). Three additional species of *Anabarhynchus* have been described from Chile, but are likely to be removed to *Peralia* Malloch later as *Anabarynchus sensu stricto* does not occur outside of Australasia.

A new species of *Anabarhynchus* is described and figured here from material collected in south-eastern Queensland, Australia. *Anabarhynchus oblongicornus* sp. nov. adults are active in coastal heath and beach fore-dunes in spring. This species is the first *Anabarhynchus* with greatly elongate antennae similar to that found in species of *Agapophytus* Guérin and *Phycus* Walker. Characteristics that support the inclusion of this new species in *Anabarhynchus* include: black macrosetae present on the fore femur, wing cell m_3 open, apical seta present on anterodorsal surface of hind femur, multiple rows of post ocular setae in both sexes, two spermathecae, ventral apodeme of aedeagus simple and not fused to gonocoxites ventrally. Apparently unique among Australian therevids, *Anabarhynchus oblongicornus* sp. nov. lacks rounded projections on the anterior surface of the hind coxae (hind coxal knobs). This character has been used as a synapomorphy for Therevidae+Apsilocephalidae by Yeates (2002), but it has been found in some basal Scenopinidae (Metz 2003) and it is lacking in some therevids. This distribution of the hind coxal knobs in the therevoid clade is discussed.

Materials and Methods

Genitalia were macerated in 10% KOH at 40-50^{o}C for one hour to remove soft tissue, then rinsed and dissected in 80% ethanol. Female reproductive organs were stained with a saturated solution of Chlorazol Black in 40% ethanol. Preparations were then placed into glyc-

erine gel and figures were drawn with the aid of a camera lucida mounted on a Zeiss Stemi SV-6 stereo-microscope. Internal membranous structures of the female reproductive system were figured while still in ethanol as they collapse and distort when placed into glycerine or glycerine gel. Genitalia preparations are stored in glycerine in a genitalia vial mounted on the pin underneath the specimen. Specimens examined are given a unique MEI number (yellow label on specimen pin). These numbers are quoted in parentheses in the material examined list for future reference for specimen database entry, identification and location. MEI numbers have been entered into a web-based specimen database (MANDALA) (http://pherocera.inhs.uiuc.edu/index.htm) held at the University of Illinois, Champaign. Terminology essentially follows Irwin & Lyneborg (1981) but is modified according to Winterton *et al.* (1999a). Abbreviations: *dc*, dorso-central setae; *np*, notopleural setae; *pa*, post-alar setae; *sa*, supra-alar setae; *sc*, scutellar setae; *d*, distiphallus; *da*, dorsal apodeme of parameral sheath; *ea*, ejaculatory apodeme; *ga*, gonocoxal apodeme; *gs*, gonostylus; *igp*, inner gonocoxal process; *lea*, lateral ejaculatory apodeme; *va*, ventral apodeme of parameral sheath; *ac*, accessory gland; *f*, furca; *ss*, spermathecal sac; *ssd*, spermathecal sac duct; *s*, spermatheca; *sd*, spermathecal duct. Types are deposited in the Australian National Insect Collection (ANIC), CSIRO Entomology, Canberra (Australia), and Queensland Museum Collection (QMBA), Brisbane, Queensland (Australia).

Taxonomy

Anabarhynchus oblongicornus sp. nov.

(Figs 1, 2)

Holotype male, AUSTRALIA: Queensland: Great Sandy National Park, Cooloola Section, 25° 57 15 S 153° 06 27E, 1-5.x.1996, D. Yeates, C. Lambkin, S. Winterton (MEI#091215) (ANIC).

Paratypes: AUSTRALIA: Queensland: 2 males, 2 females, same data as holotype (MEI#091212-14, 091216) (ANIC); 1 female, same data has holotype except: 25° 53 31 S 153° 05 06E (MEI#091210) (ANIC); 1 male, 1 female, same data as holotype except: 25° 53 31 S 153° 05 06E (MEI#091209, 091211) (QMBA); 1 female, same data as holotype except: 26° 01 37 S 153° 05 33E, malaise trap (MEI#091208) (QMBA); 1 female, Rainbow Beach, 05.x.1996, on fore dune, S. Winterton, hand collected (MEI#091217) (QMBA).

Etymology. The specific epithet is derived from the Latin: *oblongus*, longer than broad, and *cornu*, horn; referring to the distinctively elongate antennae found in this species. Gender is neuter.

Diagnosis. *Autapomorphies*: scape longer than head, flagellum elongate, hind coxal knob absent, apex of distiphallus with large articulated spines. *Shared characters* (with some *Anabarhynchus* species): costal setae arranged in two rows, prosternal pile absent,

hypopleural pile absent, fore femur with 1-2 posterodorsal setae, epandrium narrowed posteriorly.

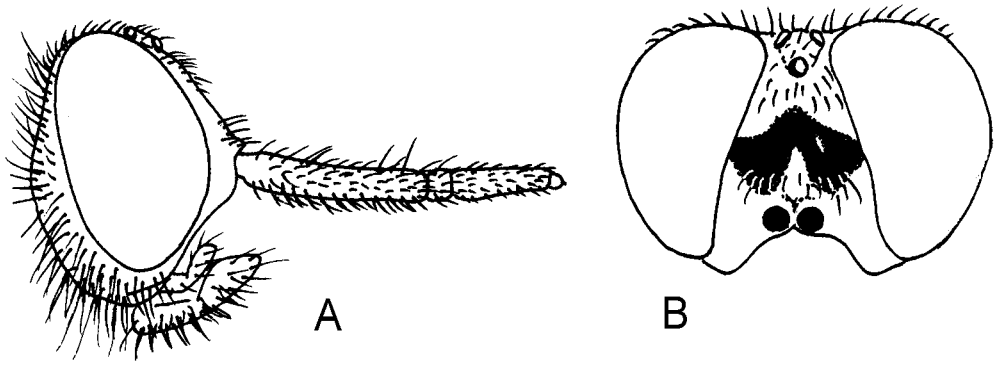

FIGURE 1. *Anabarhynchus oblongicornus* sp. nov., A, male head, lateral; B, frontal. Scale line= 0.5 mm.

Description: *Male.* Body length: *ca.* 6-8 mm. *Head.* Frons wider than ocellar tubercle at narrowest point, antennal base positioned low on frons; frons flat, glossy black, overlain with silver-grey velutum pruinescence pattern as in figure 1B; lower frons and face overlain with silver pruinescence; ocellar tubercle black with sparse grey pruinescence; occiput convex, covered with dense silver-white velutum pruinescence, when viewed from non-reflective angle velutum pruinescence is black to bronze laterally on medial occipital sclerite above occipital foramen, occiput with broad margin of silver velutum; 2-3 poorly defined rows of black postocular setae; gena black, densely overlain with silver-white velutum pruinescence admixed with long, pale setae; palp and labellum dark yellow with scattered pale setae; antennae elongate (Fig. 1A), longer than head, short, dark setae on all segments; scape length equal to head, dark yellow basally to brown distally; pedicel and flagellum black or dark brown; flagellum elongate, approximately half length of scape. *Thorax*. Scutum glossy black, overlain with alternating stripes of gold-brown and white-grey pruinescence sparsely admixed with short, pale setae; scutellum glossy black and overlain with grey pruinescence, scutal macrosetae (bristles) dark; pleuron and coxae glossy dark brown-black, overlain with sparse to dense silver velutum pruinescence except on anterior surface of anepisternum, hypopleural pile absent; pale setae on anterior surfaces of fore and mid coxae and on posterolateral surface of hind coxa, macrosetae pale; legs yellow, fore tibia, fore tarsi and apex of fore femur darkened, fore femur with one to two dark posterodorsal setae, hind femur with single dark seta apically; wing hyaline, tinted uniformly brown, venation dark; halter yellow, stem darkened; scutal chaetotaxy

(pairs): np, 3-5; sa, 2; pa, 1; dc, 3; sc, 2. *Abdomen*. Black with scattered pale setae, longer laterally, posterior margins with white band; bright silver velutum pruinescence on segments 1-5, extensive on segments 1-3 and present laterally on segments 4-5 posteriorly; tergites 2-6 overlain with thin silver-grey velutum; tergites 2-3 with bronze velutum dorsally. *Genitalia.* Epandrium (Figs 2A-B) slightly longer than wide, narrowed posteriorly; tergite 8 band like, only slightly expanded laterally (Fig. 2D), irregular row of dark elongate setae along entire posterior margin, spiracular pore near anterior margin; hypandrium apparently absent; gonocoxites (Figs 2C, E-F) semi-spherical, separate ventrally, extended slightly into rounded processes posteroventrally [? = outer gonocoxal process], numerous elongate setae along posterior surface, darker laterally; gonocoxal apodeme reduced, weakly sclerotised; inner gonocoxal process shorter than gonostylus, apex bilobate; gonostylus elongate, as long as gonocoxite, rounded process midway along dorsolateral surface, apex truncated, slightly reflexed dorsally, numerous pale elongate setae on medial surface; ventral lobe absent; parameral sheath dark sclerotised (Figs 2G-H), distiphallus strongly curved ventrally at base, rounded bulbs on either side of base, distiphallus expanded slightly apically, apex open, ringed with strong setae, aedeagus evident internally, narrow, extending beyond end of distiphallus; dorsal apodeme of parameral sheath triangular, covering ejaculatory apodeme dorsally; ventral apodeme quadrangular, lateral ejaculatory apodeme narrow, band-like, ejaculatory apodeme narrow, barely extending beyond dorsal apodeme.

Female. Similar to male except: Uppers frons with bronze velutum pruinescence; abdomen without silver velutum pruinescence. *Genitalia.* Tergite 8 with narrow anterior marginal process; sternite 8 (Fig. 2I) emarginate posterolaterally, inverted melanised chevron posteriorly; spermathecal sac elongate (Fig. 2J), narrowed distally; spermathecal sac duct relatively short, spermathecal duct joined to spermathecal sac duct proximal to furca; accessory gland elongate, two spermathecae, non-spherical.

Comments. *Anabarhynchus oblongicornus* sp. nov. is closely related to *A. maritimus* Hardy. Both species are the only members of *Anabarhynchus* that lack hypopleural pile, and both are beach fore-dune inhabitants. *Anabarhynchus oblongicornus* sp. nov. keys out to *A. maritimus* in the key presented in Lyneborg (2001), and can be quickly separated from *A. maritimus* by the presence of elongate antennae, hyaline wings and white-grey stripes on the scutum of *A. oblongicornus*. *Anabarhynchus oblongicornus* is known from a single series of specimens collected near Rainbow Beach, Great Sandy National Park, southeastern Queensland, Australia.

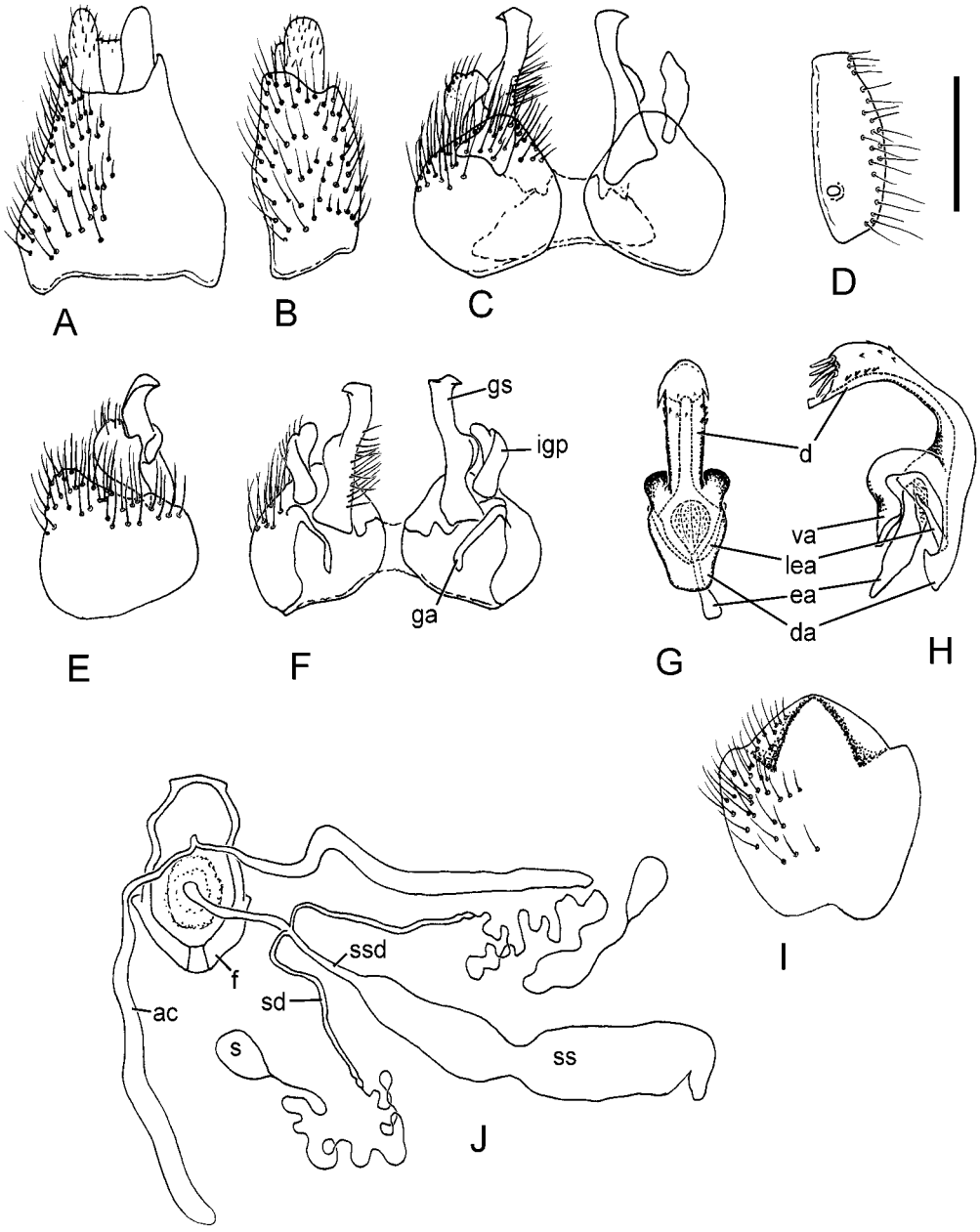

FIGURE 2. *Anabarhynchus oblongicornus* sp. nov., terminalia. Male: A, epandrium; B, same lateral; C, gonocoxites, ventral; D, tergite 8, lateral; E, gonocoxites, lateral; F, same, dorsal; G, aedeagus, dorsal; H, same, lateral. Female: I, sternite 8, ventral; J, distal reproductive complex. Scale line= 0.2 mm.

The elongate antennae and lack of hind coxal knob quickly differentiates *A. oblongicornus* sp. nov. from all other *Anabarhynchus* species. The absence of a hind coxal knob is rare in therevids. The hind coxal knob is always present in Agapophytinae and the *Taenogera* genus-group, but appears to be secondarily reduced or absent in certain therevine and phycine genera. The hind coxal knob is missing in all species of the genus *Actorthia* Kröber (Phycinae), a genus found from North Africa to Central Asia. Within Therevinae, the hind coxal knob is completely absent in the genera *Ammonaios* Irwin and Lyneborg and *Arenigena* Irwin and Lyneborg (both southwestern Nearctic) and is reduced in *Pseudothereva parviseta* Lyneborg (South Africa) and some species of *Ammothereva* Lyneborg (Asia) (Anon. pers com., M. Metz pers. com.). Yeates (1994) used the presence of the hind coxal knob as a synapomorphy for Therevidae, and later (Yeates 2002) as a synapomorphy for Therevidae+Apsilocephalidae, but as more genera are surveyed it appears that the hind coxal knob is absent in some therevids. Moreover, Metz (2003) found the hind coxal knob is present in the basal scenopinid genus *Caenotus* Cole (Metz 2003). Rather than apomorphic for Therevidae+Apsilocephalidae, the hind coxal knob appears to be plesiomorphic for the entire therevoid clade (Apsilocephalidae+Scenopinidae+Therevidae) and secondarily reduced or absent in all higher scenopinids (i.e. Proratinae+Scenopininae) and several distantly related species of Therevidae.

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