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AUSTRALIAN GLOW-WORMS OF THE GENUS ARACHNOCAMPA EDWARDS (Diptera: Mycetophilidae)

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Abstract: Cave-dwelling mycetophilids of the genus *Arachnocampa* are treated and keyed. Two new species, *richardsae* and *flava*, are described.

The most recent taxonomic work on *Arachnocampa* is that by me (1961) redescribing the New Zealand species *A. luminosa* (Skuse). Since then, interest in Australian glow-worms has grown and it has become desirable to re-examine the Australian fauna taxonomically. One species has been described from Australia viz. *A. tasmaniensis* Ferguson, and I (1961) indicated that it was close to *A. luminosa* but that a larger series was needed for a satisfactory examination of the fauna.

Several collections of adults and larvae have now been gathered together and, as a result of the study of them it has been possible to formulate some ideas on the species in existence and of their relationships. This paper gives results of such study.

Acknowledgment for help in locating collections and for loaning specimens is grate-

fully given to: Dr Aola M. Richards, University of New South Wales; Dr D. E. Colless, CSIRO, Canberra; E. Hamilton-Smith, Victoria; and Dr Elizabeth Marks, University of Queensland. Thanks are also given to A. N. McFarland, South Australian Museum for examining types and elucidating specific points.

Genus *Arachnocampa* Edwards

Arachnocampa Edwards, 1924, Ann. Mag. Nat. Hist. ser. 9, 14: 177.—Harrison, 1961, Trans. Roy. Soc. N.Z. Zool. 1: 197-201.

Empodium and pulville absent. Radial sector originating far before middle of wing and far before tip of costa. R_4 absent. Larval head capsule as long as broad. Labrum hood-like. Mandibles longer than broad with prominent teeth. Antennae vestigial. Posterior segment with papillae. Pupation takes place in larval web. Pupa inactive.

Remarks: The above description is based on Edward's original description (Edwards 1924). It serves to characterize the genus satisfactorily and to separate it clearly from *Bolitophila* Meigen. It does not clarify the subfamily position of the genus any further than I (1961) indicated. This problem awaits a future study of the family Mycetophilidae as a whole and the genus should be tentatively allied to the Ceratoplatinae.

As a result of the study of the collections of Australian specimens on hand, it has been discovered that there are several species involved and that supraspecific differences exist. As indicated below the major difference is concerned with the venation and in particular with the relative position of the cross veins. If one is influenced by authorities in the family such as Edwards (1924) and Tonnoir & Edwards (1927) and the many workers who have followed their ideas of separating subfamilies, eg. Shaw & Fisher (1952), then this difference would, at first sight, appear to be very important and might even be considered of subfamily significance. Other basic morphological and behavioral characters of adults and larvae of the specimens from both Australia and New Zealand are generally so similar that it is considered their relationship is very much closer than would be indicated by placing them into different subfamilies. They are kept in the one genus and their distinctness is indicated at subgeneric levels. There appears no reason to suspect that similarity between subgenera is due to convergent evolution.

Larvae have been examined in numbers but are so similar in all species where available that they have turned out to be much less important than was anticipated.

KEY TO SUBGENERA OF ARACHNOCAMPA EDWARDS

m-cu cross vein before r-m cross vein *Arachnocampa*
m-cu cross vein beyond r-m cross vein.....*Campara*

Subgenus *Arachnocampa* Edwards

Wings shaded with brown at least on apical half; m-cu cross vein before r-m cross vein. Body length of adults usually much greater than 10 mm.

This is the nominate subgenus and is readily distinguished by the key character.

Type species: *Arachnocampa* (*Arachnocampa*) *luminosa* (Skuse).

KEY TO SPECIES OF SUBGENUS ARACHNOCAMPA

Basal segment of fore tarsus equal to or up to $1.3\times$ length of fore tibia.....**luminosa**
 Basal segment of fore tarsus $1.75-2.0\times$ length of fore tibia **tasmaniensis**

Arachnocampa (Arachnocampa) luminosa (Skuse)

Bolitophila luminosa Skuse, 1891, Trans. N.Z. Inst. **23**: 48.

Arachnocampa luminosa: Edwards, 1924, Ann. Mag. Nat. Hist. ser. 9, **14**: 175.—Harrison, 1961, Trans. Roy. Soc. N.Z. Zool. **1**: 199-201.

This species appears to be confined to New Zealand. The most recent redescription (Harrison 1961) is adequate and it is not considered necessary to repeat it here.

Arachnocampa (Arachnocampa) tasmaniensis Ferguson

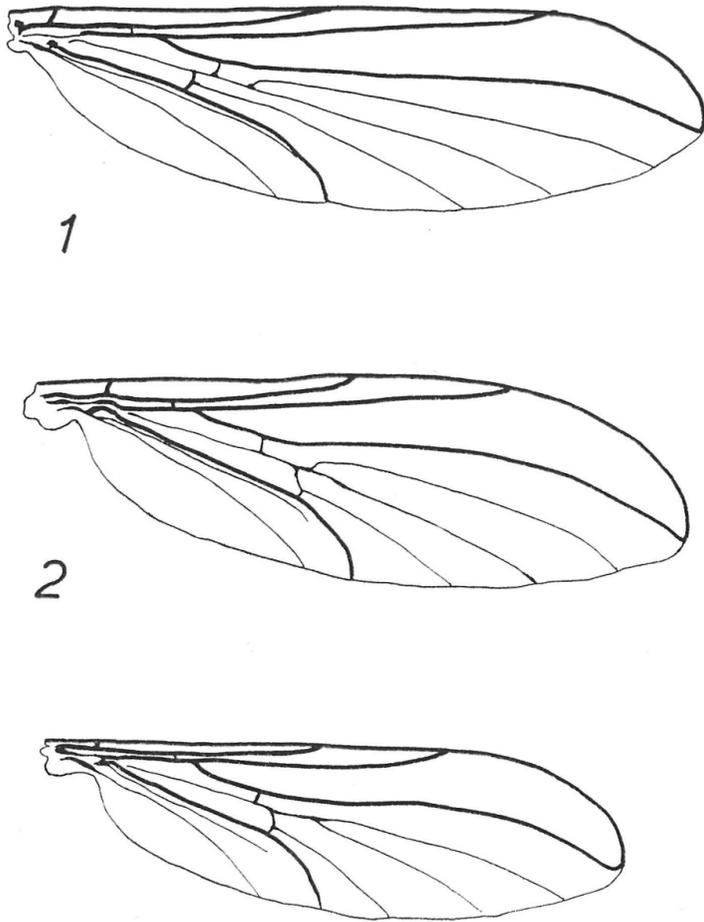
Arachnocampa tasmaniensis Ferguson, 1925, Proc. Linn. Soc. N.S.W. **50**: 487-88.

In order to indicate the differences between this species and the previous one and for the sake of uniformity and completeness a redescription is given here.

Adults (σ and ρ). Body length 12-14 mm ($\sigma\sigma$), 12-15 mm ($\rho\rho$); wing length 7-9 mm ($\sigma\sigma$), 8-10 mm ($\rho\rho$).

Head: Antenna brown, scape and base of 1st flagellar segment often paler brown in $\sigma\sigma$. Diameter of scape $2\times$ diameter of basal flagellar segment. Apical segment of flagellum noticeably narrowed at apex. Vertex and occiput blackish brown, frontal triangle reddish brown with median cleft but without any noticeable raised ridges from eyes to antennal bases. Ocelli distinctly raised above level of vertex. Face pale brown dorsally beneath antennae, dark brown on ventral half and with thick cluster of hairs over whole of this dark area. Palpi pale yellowish brown, basal segment a shade darker, apex of terminal segment slightly swollen and pale brown. Proboscis yellowish brown. Eyes dark reddish black and covered with distinct matt of hairs. *Thorax*: Mesonotum pale brown with indefinite darker brown areas laterally and on supra alar area. Scutellum dark brown at apex, postscutellum mostly dark brown, paler at edges. Pleurites dark brown with distinct dark brown edges. Cluster of strong hairs on supra alar region; smaller cluster at post alar area; propleuron haired and humeral area with clusters of small fine hairs; metapleuron bare or with 1 or 2 hairs; 2 strong and other small hairs in small cluster posterior to base of haltere; other pleurites bare. *Legs*: Coxae pale yellow with brown areas apically, at tip only in fore coxa but extensive in others to extent of about apical $1/3$ in hind coxa. Trochanters dark brown. Femora, tibiae and tarsi brown, hind femur darker than others and all legs darker towards apical segments. Fore tibia with 1 ventral apical, other tibiae with 2 apicals. Basal segment of fore tarsus about $1.75-2.0\times$ length of fore tibia; basal segment of mid tarsus equal to mid tibia; basal segment of hind tarsus about $0.75\times$ length of hind tibia. *Wing* (Fig. 1): Clear, apical $3/5$ shaded pale brown and shaded along anterior margin. Veins dark brown. Subcosta reaching costa well beyond median fork. Haltere with light yellow stem, dark brown capitellum. *Abdomen*: All segments dark brown with segments 2-7 inclusive distinctly yellowish brown on basal thirds. External σ genitalia dark brown. External ρ genitalia pale brown. Papillae yellowish brown and slightly divergent.

Pupa: Dark brown. Length about 12 mm, wing length 4-5 mm.



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Figs. 1-3. 1, wing of *Arachnocampa* (*Arachnocampa*) *tasmaniensis*; 2, wing of *Arachnocampa* (*Campara*) *richardsae*; 3, wing of *Arachnocampa* (*Campara*) *flava*.

Larva: Length up to 30 mm when mature. Creamy white, head dark brown. Antenna vestigial. Mandible with 4 apical teeth and 1 median tooth on inner surface; 2 of the apicals strong. Maxilla large and with row of about 10 conical marginal teeth. Pair of distinct anal papillae.

Eggs: Not seen.

Holotype ♂ (South Australian Museum), Tasmania: Ida Bay Caves, in total darkness fully 1/4 mile from entrance, X. 1909, Arthur M. Lea.

NEW RECORDS: TASMANIA: 1♂, 1♀, Ida Bay, entrance cave, 15.XI.1963, (BS 0451); 1♂, 1♀, (BS 0542); 1♂, 1♀, (BS 0453); 2♂♂, (BS 0454); 2♂♂, (BS 0455); 2♂♂, (BS 0456); collected by E. Hamilton-Smith (South Australian Museum). LARVAE. TASMANIA: 21, Cashion Creek Cave, 29.XII.1964, A. Goede; 3, Ida Bay, Exit Cave, I.1965, Goede; 30, Ida Bay, Entrance Cave, 22.XII.1964, Goede, (Australian Museum). PUPAE. TASMANIA: 2, Ida Bay, Entrance Cave, 22.XII.1964, Goede (Australian Museum)

Remarks: Very closely related to *A. luminosa*. Separated by several characters which together make it apparent that two species are in existence. From the large series available in perfect preservation, it has been possible to redescribe this species with some confidence. The relative lengths of segments of the fore leg are, as Ferguson (1925) indicated, a useful character and others have been discovered and are given in the description. The most important of these are the color of abdominal segments and the differences in venation.

Subgenus *Campara* Harrison, n. subgen.

Wings faintly shaded with brown; m-cu cross vein beyond r-m cross vein. Body length of adults usually under 10 mm.

The new subgenus is most readily separated and distinguished from the other subgenus by the cross veins.

Type species: *Arachnocampa* (*Campara*) *richardsae* Harrison, n. sp.

KEY TO SPECIES OF SUBGENUS CAMPARA

Body colors brown and dark brown **richardsae**
Body colors shining yellow and pale brown **flava**

Arachnocampa (Campara) richardsae Harrison, n. sp.

Adults (♂ and ♀). Body length 8.0–9.0 mm (♂♂), 8.5–10.0 mm (♀♀); wing length 6.0–6.5 mm (♂♂), 7.0–7.5 mm (♀♀).

Head: Antenna brown; scape paler brown, flagellum covered with dense mat of white hairs. Diameter of scape segments about 1.5× diameter of basal flagellar segment. Apical segment of flagellum noticeably pointed at apex. Front dark reddish black, raised slightly on lateral margins about the antennal fossae and with distinct median cleft. Vertex and occiput black, ocelli raised well above general level of vertex. Face brown and with cluster of some hairs ventrally. Palpi pale brown, apex of terminal segment slightly swollen and a shade darker. Proboscis pale brown. Eyes reddish black in pinned specimens and with distinct mat of hairs. *Thorax*: Mesonotum yellowish brown with large areas of brown of varying degrees of darkening on lateral 1/3. Scutellum dark brown with lateral areas narrowly paler brown; postscutellum brown or dark brown. Pleurites brown. Large cluster of strong hairs on supra alar region, smaller cluster of much shorter hairs on post alar area; few hairs on propleuron and humeral area; metapleuron haired on ventral half; a strong hair posterior to base of haltere; other pleurites bare. *Legs*: Coxae pale yellow, fore coxa at apex, mid on apical 1/4 and hind on apical half or 2/3 shaded brown or dark brown. Trochanters dark brown. Remaining segments of legs brown, with apical segments and hind leg being somewhat darker brown. Fore tibia with one small ventral apical; mid tibia with 2 stronger and hind tibia with 2 weak ventral apicals. Basal segment of fore tarsus about 1.4× length of fore tibia; basal segment of mid tarsus about 0.9× length of mid tibia; basal segment of hind tarsus about 2/3 length of hind tibia. *Wing*: Clear, slightly shaded on apical half. Veins brown. Subcosta reaching costa beyond line of median fork, across vein m-cu beyond cross vein r-m and close to median fork or to r-m or any position between these 2 points. Haltere light brown basally and darker brown apically. *Abdomen*: Brown or dark brown with segments 2–7 inclusive pale brown or yellowish brown on basal 2/5 or 1/2. External ♂ genitalia brown. External ♀ genitalia dark brown. Papillae dark brown and slightly divergent.

Pupa: Not seen.

Larva: (White Horse Mine specimens) Length up to about 30 mm when fully mature. Creamy white, head brown or dark brown. Antenna vestigial and in form of low pale yellow protuberance. Mandible with 4 apical teeth (2 strong and 2 weak) and 1 median tooth on inner surface. Labial maxilla almost as large as mandible and with row of about 10 stumpy conical teeth along margin. Pair of distinct anal papillae.

Eggs: Not seen.

Holotype ♂ (Australian Museum), New South Wales: Newnes, ex railway tunnel, collected as pupa 21.I.1962, emerged as adult 27.I.1962, A.M. Richards. Paratopotypes: Same data as holotype: 1♂, collected as pupa 15.X.1961, emerged as adult 18.X.1961; 1♂, collected as pupa 15.X.1961, emerged as adult 20.X.1961; 1♀, collected as pupa 15.X.1961, emerged as adult 21.XI.1961; 1♀, collected as pupa 21.I.1962, 1♀ collected as pupa 21.I.1962, emerged as pupa 21.I.1962, emerged as adult 23.I.1962; A. M. Richards, collector. NEW SOUTH WALES: 1♂, Blue Mountains, Hazelbrook, 26.XI.1962, D. K. McAlpine.

OTHER SPECIMENS EXAMINED: Same data as holotype: 1♂, adult emerging from pupa, 21.

I.1962,; 1♂ adult on wall, 21.I.1962; 1♂ (spirit); 1, collected as pupa 15.X.1961, emerged as adult, 20.X.1961. NEW SOUTH WALES: 1♀, Gloucester, ex limestone cave, collected as larva, 19.VIII.1961, emerged as adult, 3.IX.1961, A. M. Richards.

Remarks: Named for Dr Aola M. Richards whose enduring enthusiasm for all things speleological has resulted in the assemblage of the collections from which this study has been made.

Superficially this species is like *A. luminosa* and *A. tasmaniensis* but it can be distinguished easily by the keys. The distribution of the species is probably incompletely known and there is a possibility that it may include Victoria. E. Hamilton-Smith has collected larvae. They are specimens of *Arachnocampa* which are tentatively assigned to this species. VICTORIA: 4, Walhalla, Happy-go-lucky, White Horse Mine, 17.X.1965, E. Hamilton-Smith (South Australian Museum: BS 1103).

***Arachnocampa (Campara) flava* Harrison, n. sp.**

Adults (♂ and ♀). Body length 8.0 mm (♂), 9.5–10.0 mm (♀♀); wing length, 5.0 mm (♂), 6.5–7.0 mm (♀♀).

Head: Antenna pale brown; scape pale yellow, flagellum with dense mat of pale brown hairs. Diameter of scape segments 2× diameter of basal flagellar segment. Apical segment of flagellum pointed at apex. Front reddish brown, ridge at dorsal corner of eye fading out before reaching center of front, longitudinal deep sulcus above base of antennae. Vertex and occiput blackish brown. Ocelli on prominent raised areas. Face brown in middle and this area supporting cluster of fine brown hairs, elsewhere pale yellow and bare. Palpi pale yellow, apical segment slightly dilated but not darkened. Proboscis yellowish brown. Eyes silvery in pinned specimens, covered with mat of hairs. *Thorax:* Shining pale brown or yellowish brown. Mesonotum yellowish brown with 2 narrow pale brown longitudinal vittae on posterior 2/3 at about 1/3 distance to lateral margins; pale brown areas on supra alar and post alar regions. Scutellum mostly pale brown, yellowish brown at margins; postscutellum mostly pale brown. Pleurites pale brown. Hairs along lateral margins of mesonotum, in supra alar region usually a few of these hairs stronger; hairs in post alar region as for supra alar region and usually without the stronger hairs; few small propleural hairs and small fine hairs on humeral area; metapleuron with one or 2 or few hairs about middle of area; 2 short but fairly stout hairs posterior to base of haltere; other pleurites bare. *Legs:* Coxae yellowish brown, faint trace of darkening at apices, more extensively so on hind coxa. Remaining segments of legs pale brown merging to darker brown towards apical segments. Fore tibia with one small ventral apical, other tibia with 2 larger apicals. Basal segment of fore tarsus 1.5× length of fore tibia; basal segment of mid tarsus equal to length of mid tibia; basal segment of hind tarsus about 2/3 length of hind tibia. *Wing* (Fig. 3): Clear, shining slightly shaded on apical half. Veins brown. Subcosta reaching costa just before level of median fork. Cross vein m-cu beyond cross vein r-m and usually arising closer to r-m than median fork. Haltere light yellow basally, brown apically. *Abdomen:* Shining brown more so in ♂♂. Segments 2 to 7 inclusive yellow on basal 2/5 or 1/2. External ♂ genitalia brown with dorsal papillae yellow. External ♀ genitalia brown, papillae brown with darker brown margins, lightly divergent.

Pupa: Not seen.

Larva: Length up to about 18 mm when mature. Creamy white, head pale brown. Antenna vestigial and in form of low hemispherical pale yellow protuberance. Mandible with 4 apical teeth, 2 strong and 2 weak and 1 median tooth on inner surface. Labial maxilla almost as large as mandible and with row of about 10 stumpy conical teeth along margin. Pair of large anal papillae.

Eggs: Not seen.

Holotype ♂ (Queensland Museum No. T 6430), Queensland: Numinbah, 21.IV.1935, F. A. Perkins. Paratopotype: 1♀, same data as holotype; 1♀, 20.II.1963; B. V. Timms, collector.

OTHER SPECIMENS EXAMINED: QUEENSLAND: 1, Benowa, 30.III.1945, R. Simms.

Larvae: 1 ex, same data as holotype, 5 ex. Springbrook, IV.1955 (Anon).

Remarks: Separated most readily from *A. richardsae* by the shining pale yellow color. The supra alar hair cluster appears to be a useful character but there is variation in this character and some specimens of this species have many of the hairs in the cluster stronger than elsewhere on the mesonotum rather than just the few as described. The sparse brown areas on the mesonotum is a character separating this species from all others which have extensive brown areas on this plate.

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