

# The ecnomid caddisflies: generic composition and a male-based generic key, with description of *Caledomina noumea* n. g. et n. sp. from New Caledonia (Trichoptera: Ecnomidae)

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**Abstract.** A new ecnomid genus and species, *Caledomina noumea* n. g. et n. sp. is described. The establishment of the new genus is based on its phylogenetic position in relation to other taxa in the family, but is also distinguished from the other genera in the family by several morphological character states in the males. A key to the genera in the family is provided based on males. The phylogenetic position of the new genus is indicated based on previously published analyses of molecular data.

**Résumé.** Les trichoptères ecnomides de Nouvelle-Calédonie: composition générique et clef des mâles, avec la description de *Caledomina noumea* n. g. et n. sp. (Trichoptera : Ecnomidae). Une nouvelle espèce d'un nouveau genre, *Caledomina noumea* n. g. et n. sp., est décrite. L'établissement de ce nouveau genre est basé sur sa position phylogénétique par rapport aux autres taxons de la famille. Il se distingue aussi des autres genres de la famille par plusieurs états de caractères chez les mâles. Une clé des genres de la famille est fournie pour les mâles. La position phylogénétique de ce nouveau genre est précisée grâce à des données moléculaires déjà publiées.

**Keywords:** Systematics, New Caledonia, *Caledomina*, phylogeny.

The Ecnomidae are a family of caddisflies belonging to the suborder Annulipalpia, and is distinguished from related families mainly by synapomorphies found in the larvae, like all thoracic segments having sclerotized dorsum; larval head being oblong and strongly depressed dorsoventrally; and long and narrow larval mandibles (Weaver 1984, Lepneva 1964). In addition, the coin-shaped phallic parameres were proposed as a synapomorphy by Li & Morse (1997).

Until now, the family Ecnomidae comprises about 375 described extant species in seven genera. In addition, Navás (1934) described the monotypic genus *Chilocentropus*, presently considered a *nomen dubium* (Holzenthal *et al.* 2007b). The family name was first mentioned in literature as the subfamily Ecnominae Ulmer, 1903 within Hydropsychidae, and subsequently transferred to the Polycentropodidae by Ulmer (1907), and to the Psychomyiidae by Ulmer (1910). It received family rank by Lepneva (1970). The Ecnomidae also includes one genus of exclusively extinct species, the *Archaeotinodes* Ulmer 1912 that contains fourteen species from Baltic Amber. The type genus of the family is *Ecnomus* McLachlan 1864, that was first erected as a monotypic genus for the species *Philopotamus tenellus* Rambur 1842 described from

France. This genus is now the largest in the family by number of species, and is represented in all faunal regions except in the New World. Of the about 275 species presently classified as *Ecnomus*, 68 are described from the Afrotropical Region, 61 from Oceania, 135 from the Oriental Region, and fifteen species have been described from the Palearctic Region. The genus *Psychomyiellodes* Mosely 1931 is endemic to the Afrotropical Region and includes eight species. The genus *Ecnomina* Kimmins in Mosely & Kimmins 1953 was erected to hold three Australian species and now comprises 11 species and is also known from New Zealand (Wise 1958), and New Caledonia (Ward & Scheffer 2000). The genus *Austrotinodes* Schmid 1955 was described to include the two species *A. latior* Schmid 1955 and *A. angustior* Schmid 1955 from Chile, the former subsequently synonymised with *A. talcanus* (Navás 1934). About 35 species have been described in *Austrotinodes* and has been recorded from most parts of the Neotropical region as far north as Mexico (Flint & Denning 1989), Australia (Cartwright 2009), and is also known from Dominican Amber (15–20 m. y. a.) by Wichard (2007). The genus *Parecnomina* Kimmins 1957 is widely recorded from the Afrotropical region, and includes seven described species. Ward & Scheffer (2000) described the New Caledonian endemic genus *Agmina*, to receive nineteen New Caledonian species, and eight more species were subsequently described into the genus by Ward (2003). Neboiss (2002) separated the Australian ecnomid genus *Ecnomina* s.

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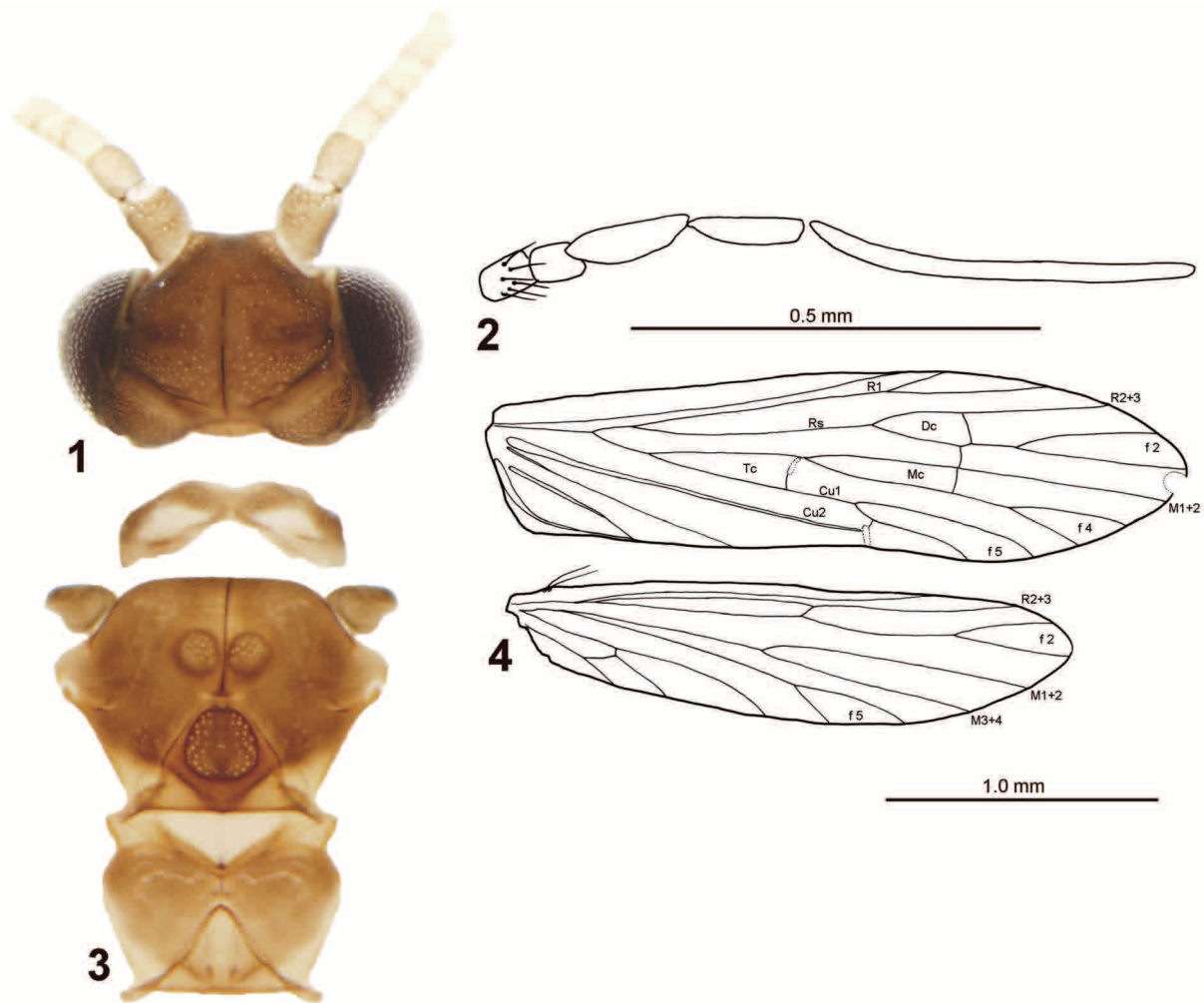
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lat. into *Ecnomina* s. str. and a new genus *Daternomina*. Based on Australian material, Cartwright (2008) revised the genera *Ecnomina* and *Daternomina* and listed sixteen species in *Daternomina* and 36 species in *Ecnomina*, and was not able to distinguish these genera morphologically based on male characters. In addition, he indicated that *Ecnomina krokale* (Neboiss 1978) belongs to a separate genus under description.

The first hypothesis about the relationship between the Ecnomidae genera was presented by Flint (1973) who, based on few morphological characters, grouped *Psychomyiellodes* and *Ecnomus* as sistergroups and *Parecnomina* as the sistergroup to (*Psychomyiellodes* + *Ecnomus*). These three genera formed the sistergroup to (*Ecnomina* + *Austrotinodes*).

Li & Morse (1997) performed a parsimony analysis of the Ecnomidae genera, excluding *Agmina* and

*Daternomina*, based on thirteen morphological characters and by using Hydropsychidae and Polycentropodidae as out-groups. They found that *Parecnomina* is more related to (*Ecnomina* + *Austrotinodes*) than (*Ecnomus* + *Psychomyiellodes*). Holzenthal *et al.* (2007a) included the two genera *Ecnomus* and *Austrotinodes* in their analysis of the relationship between Trichoptera families. Their Bayesian analysis left the Ecnomidae monophyletic with 100% posterior probability and a sistergroup to Polycentropodidae. Johanson & Espeland (2010) also concluded that Ecnomidae are monophyletic, but only when including *Zelandoptila* Tillyard 1924, which was previously classified within the Psychomyiidae. They concluded that *Psychomyiellodes* and *Ecnomus* are synonyms, and supported Flint's (1973) view that *Parecnomina* are more related to *Ecnomus* than to *Ecnomina* and *Austrotinodes*. They also identified three



Figures 1–4  
*Caledomina noumea* n. gen. et n. sp., holotype. 1, head, dorsal; 2, maxillary palp, mesal; 3, thorax, dorsal; 4, right wings.

potentially un-described genera, one from Australia and under description (Cartwright 2008), another one from Australia possibly being con-generic with the otherwise Neotropical genus *Austrotinodes* (Cartwright 2009), and one being described below from New Caledonia. The New Caledonian Ecnomidae includes two previously identified genera, *Ecnomina* and *Agmina*, the latter being endemic to the island (Ward & Scheffer 2000). The aim of this work is to increase our knowledge about the family Ecnomidae, by describing the second endemic genus from New Caledonia, and to provide an updated key to males of ecnomid genera based on a modern phylogenetic hypothesis.

#### Material and methods

The specimens in this study were collected into 80% ethanol using a 22W, 12V, circular, portable UV light trap on January 15, 2004.

In the laboratory, the specimens were macerated and mounted according to the method described by Johanson & Ward (2009). Illustrations were produced using a drawing tube mounted on a Leitz Ortholux II light microscope. Photographs were taken using an Olympus DP70 digital microscope camera mounted on an Olympus SZX12 microscope. After illustrating, the specimens were transferred to ethanol.

The nomenclature applied to morphological features follows that of Ward & Scheffer (2000).

The following abbreviations are used for institutions:

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

NHRS: Swedish Museum of Natural History, Stockholm, Sweden.

### *Caledomina* n. g. (Figs 1–9)

**Type species.** *Caledomina noumea* n. sp., hereby designated.

**Etymology.** *Caledomina*, from New Caledonia, the presently known distribution area of the type species. Gender is feminine.

**Phylogenetic relationship.** The genus forms a monophyletic group together with *Agmina*, *Ecnomina* and *Ecnomina krokale*.

**Diagnosis.** *Caledomina* is morphologically close to *Agmina* and *Ecnomina* in having strongly anterad pointed mesoscutellum; to *Agmina* and *Ecnomina krokale* by the absence of forewing nygma in Fork 2; and to *Agmina* by the presence of a stalked forewing Fork 2, absence of hind wing Fork 3, hind wing Fork 5 being about as long as Fork 2, and metascutellum being anteriorly rounded. *Caledomina* is easily separated from other genera in the family by the absence of forewing Fork 3, presence of a long forewing Fork 5 (but also long in *Ecnomina* and *Daternomina*), the crossvein between Cu1 and Cu2 situated on Cu1b; and the interantennal frontal margin being about as long as each scape length.

**Description.** Body and wings uniformly pale brown (in alcohol).

**Head** (figs 1, 2): Maxillary palps 5-segmented; segment 1 and segment 2 subequal in length; large sensilla on mesal surface of

segment 1 absent; segments 3 and 4 about equally long; segment 5 longer than sum of segments 1–4 by length of segment 1. Eyes blackish. Antennal flagellomeres cylindrical. Occipital setal wart well-developed; frontal dorsal warts indistinct. **Thorax** (figs 3, 4): Two pairs pronotal setal warts nearly flat, of equal size. Mesoscutum with one pair rounded, nearly tangential setal warts. Mesoscutellum with short parallel lateral margins; narrowing anterad from mid-length; anteriorly rounded; pair of mesoscutellar setal warts nearly united into large, nearly round wart. Metascutellum nearly triangular; anteriorly slightly rounded. Forewings (fig. 4): R1 fork about as long as Fork 4; Fork 1 and Fork 3 absent; discoidal cell present, about as long as Fork 4; Fork 5 two times longer than Fork 4; crossvein Cu1-Cu2 present on Cu1b; thyridium cell and median cell subequal in size; nygma absent in Fork 2 and thyridium cell. Hind wing (fig. 4) R1 connected to Rs by crossvein; Fork 1 and Fork 3 absent; Fork 2 without nygma; crossveins R-M and M-Cu absent; discoidal cell absent. Spur formula 2,4,4. **Genitalia** (figs 5–9): Segment IX anteriorly rounded in lateral view; forming pair of rectangular branches in ventral view, and pair of narrow, sigmoid processes in dorsal view. Posterior part of segment IX forming pair of lateral branches of triangular sternites and tergites; sternites each with long, narrow sternal process with apical spine. Inferior appendages shorter than sternal processes. Segment X small, membranous, situated between branches of tergite IX. Superior appendages large, bifurcated; dorsal branches smooth, with serial of apical spines; ventral branches long, setose. Phallic apparatus compact, without processes.

**Included species.** *Caledomina noumea* n. sp.

### *Caledomina noumea* n. sp. (Figs 1–9)

**Diagnosis.** This is the only species known in the genus, and is distinguished from all other species in the family by the diagnostic characters presented for the genus.

**Material examined.** Holotype ♂: New Caledonia, Province Sud, Monts Kwa Ne Mwa, 20 m upstream Noumea-Yaté road, 2.0 km E Pic Mouirange, 22°12.356'S, 166°40.798'E, 220 m, 15.I.2004, light trap, loc#120 (19–20 h) [KA Johanson leg.], MNHN (DNA voucher: FN9).

Paratype (1♂): same data as holotype, except NHRS (DNA voucher: EM7).

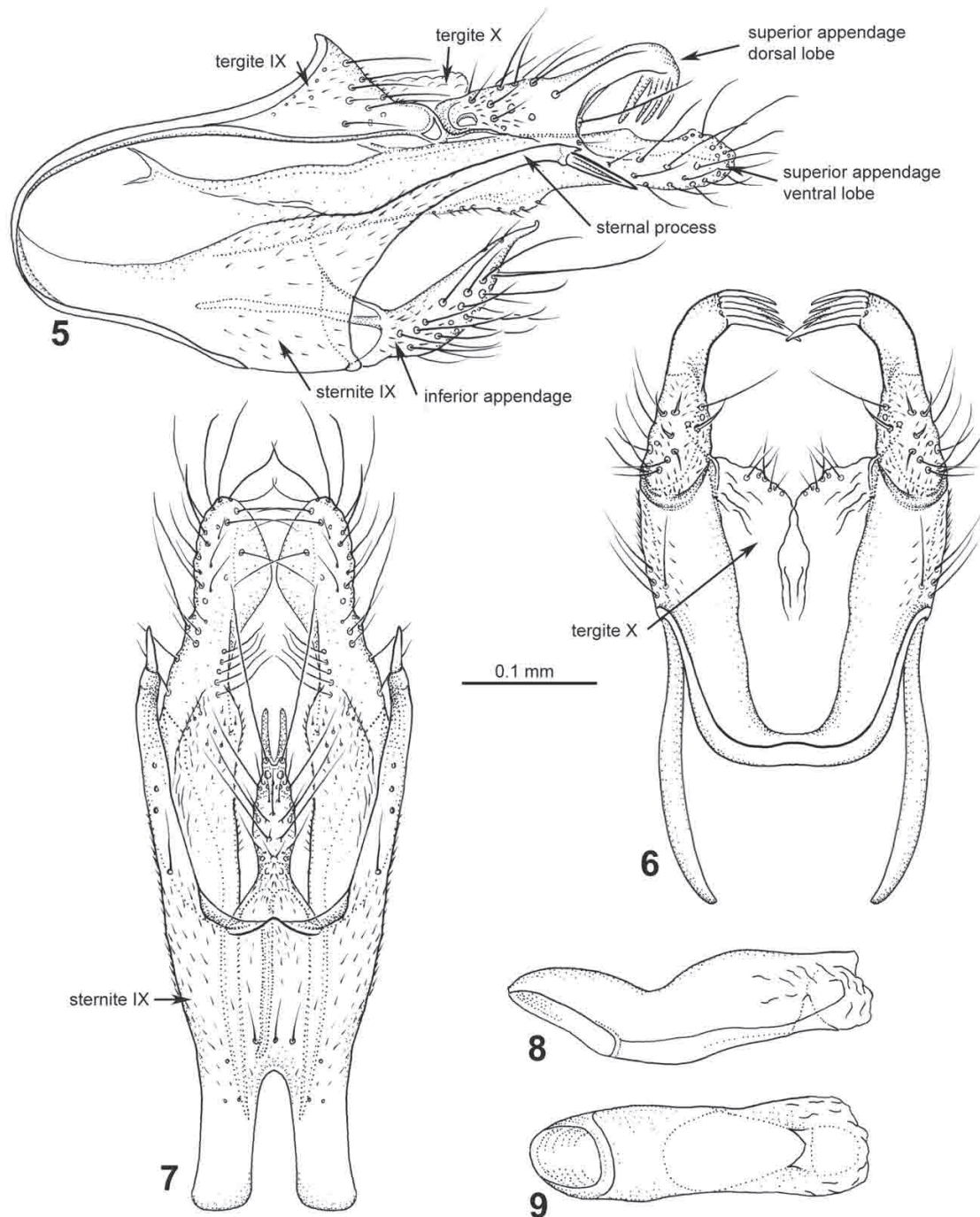
**Etymology.** *Noumea*, named after the administration centre of New Caledonia.

**Description.** Head and thorax (figs 1–4) as for genus. Forewings length 2.7 mm, hind wings length 2.2 mm. **Genitalia:** Total length about 0.55 mm. Segment IX divided into pair of strong, anteriorly rounded ridges in lateral view (fig. 5); sternite IX originating from anterior ridge at mid-height; broadening posterad into pair nearly bottle-shaped plates with posterodorsal sternal process (fig. 5); smooth, except few ventral setae. Sternal processes slender, slightly curving, with large apical spine nearly half as long as sternal process (figs 5, 7); orienting posterad along their length in ventral view (fig. 7); reaching point of bifurcation of superior appendages (fig. 5). Tergite IX triangular in lateral view (fig. 5), anterodorsal corners slightly curving anterad; with long setae on lateral faces; in dorsal view (fig. 6) with anterior-most part fused mesally; posterior part divided into broad branches. Tergite X membranous, present above posterior apex of tergite IX in lateral view (fig. 5); in dorsal view divided into



two lobes associated with branches of tergite IX; with posterior marginal setae (fig. 6). Superior appendages large; each divided into posterior dorsal and ventral lobes (fig. 5). Dorsal lobes

smooth, except with long row of spines oriented ventromesad (figs 5, 6). Ventral lobes originating from anterior part of each tergite IX; nearly straight along their length; ventral margin



**Figures 5–9**

*Caledomina noumea* n. gen. et n. sp., holotype. 5, genitalia, lateral; 6, genitalia, dorsal; 7, genitalia, ventral; 8, phallic apparatus, lateral; 9, phallic apparatus, ventral.

Scale bar refers to all figures.

with minute spines in row; posterior apex rounded, covered with setae; exceeding dorsal lobe in length (fig. 5). Inferior appendages completely fused into small, mesal process, connected to central part of sternite IX by sclerotized ridges (figs 5, 7); dorsal margin nearly straight; ventral margin convex; apex long, narrow in lateral view (fig. 5); in ventral view (fig. 7) with broad basis; narrowing strongly at one quarter its length, apex smooth, bifurcated. Phallic apparatus without processes (figs 8, 9); tube-shaped; dorsal margin strongly narrowing at anterior one-third; posterior apex membranous.

### Key to Ecnomidae genera, males

At present males of *Ecnomina* and *Daternomina* are not distinguished by morphological characters, but the two genera are easily distinguished in the female genitalia and larvae, not evaluated here due to lack of associations. *Ecnomina krokale* is separated in the key as this species was suggested representing a distinct genus by Cartwright (2008).

1. Forewing Fork 1 present ..... 2
- Forewing Fork 1 absent ..... 3
2. Forewing Fork 5 about half as long as Fork 2; hind wing R4 equal to or shorter than stalk of Fork 2; hind wing Fork 3 absent; hind wing Fork 5 shorter than Fork 2; hind wing Dc absent; mesoscutellum with lateral projection ..... *Ecnomus* (including *Psychomyiellodes*)
- Forewing Fork 5 about as long as Fork 2; hind wing R4 longer than stalk of Fork 2; hind wing Fork 3 present; hind wing fork 5 about as long as Fork 2; hind wing Dc present; mesoscutellum without lateral projection ..... *Parecnomina*
3. Each foreleg with one spur; hind wing Dc absent ..... 4
- Each foreleg with three spurs; hind wing Dc present ... 5
4. Forewing R1 apically bifurcated; forewing Fork 2 nygma absent; forewings with Fork 5 about two times longer than Fork 2; hind wing Fork 3 absent; hind wings with Fork 5 about as long as Fork 2 ..... *Caledomina*
- Forewing R1 not bifurcated; forewing Fork 2 nygma present; forewings with Fork 5 about as long as Fork 2; hind wing Fork 3 present; hind wings with Fork 5 shorter than Fork 2 ..... *Zelandoptila*
5. Eyes brownish; forewing crossvein R-M continuous with crossvein m ..... *Austrotinodes*
- Eyes blackish; forewing crossvein R-M located basally of crossvein m ..... 6
6. Forewing Fork 2 stalked; forewings with crossvein R-M located basally of crossvein m by two times length of crossvein m; hind wing Fork 3 absent; hind wing Fork 5 about as long as Fork 2 ..... *Agmina*
- Forewing Fork 2 sessile; forewings with crossvein R-M located basally of crossvein m by length of crossvein m; hind wing Fork 3 present; hind wing Fork 5 shorter than Fork 2 ..... 7
7. Forewing Fork 2 nygma present; forewing Mc as long as Tc; hind wing Fork 1 absent; hind wing Fork 2 sessile ..... *Ecnomina/Daternomina*

- Forewing Fork 2 nygma absent; forewing Mc longer than Tc; hind wing Fork 1 present; hind wing Fork 2 stalked ..... *Ecnomina krokale*

### Remarks

*Caledomina noumea* is extremely rare and is known from only two exemplars. The type locality was visited repeatedly and sampled at by Malaise traps and light trap. In 2004 a light trap was operated between 7 p.m. on January 15 and 7 a.m. on January 16, and emptied every hour. During that period *C. noumea* was trapped only between 7 p.m. and 8 p.m. Malaise traps were up continuously during three different time intervals: 7.–30.XI.2003 (emptied twice), 5.–18.X.2006 (emptied once), and 17.XII.2006–17.XII.2007 (emptied every month). Despite the long period of Malaise trapping, no further specimens were collected.

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