



The genus *Phthinia* Winnertz (Diptera, Mycetophilidae) in the Neotropical region, with the first records from Brazil

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Abstract

Three Neotropical species of *Phthinia* Winnertz have been described to date. The genus is known from Chile and southern Argentina. Four new species are herein described for the genus in the region, two from Brazil—*Phthinia theresae*, **sp.n.**, from the State of Espírito Santo, and *Phthinia urubici*, **sp.n.**, from the State of Santa Catarina—and two from Chile—*Phthinia freemani*, **sp.n.**, and *Phthinia parafurcata*, **sp.n.** Comments are made about the relationships between the Neotropical species. Some notes are added about *P. furcata* Freeman, *P. flagellata* Freeman, and *P. fasciata* Freeman, from Chile and southern Argentina. Attention is called for the fact that *Phthinia* has two species in Brazil disjunct from the other temperate species of the genus in South America, differently from most similar cases, that have a single known representative in Brazil.

Key words: *Phthinia*, Mycetophilidae, Diptera, Neotropics, Taxonomy

Introduction

The family Mycetophilidae has about to 4,100 described species (Evenhuis *et al.* 2007) in 135 extant genera in the world, and in the Bibionomorpha it is only less diverse than Cecidomyiidae, with more than 6,000 species worldwide. In the Neotropical region, there are close to 1,000 species of Mycetophilidae described in 53 genera. Most of these species were described by F. W. Edwards, Paul Freeman, John Lane, and José Pedro Duret (Papavero 1978, Amorim *et al.* 2002).

The monophyly of Mycetophilidae is well supported but Sciophilinae *s.l.* has been demonstrated as paraphyletic in several phylogenetic studies based on both morphological (Søli 1997, Tozoni 1998, Amorim & Rindal 2007) and molecular data (Rindal *et al.* 2009). The Sciophilinae *s.s.* includes 36 genera, most with macrotrichia on the wing membrane. A group of genera in the subfamily seems to compose a clade including species with M₄ incomplete or absent. This group includes *Megalopelma* Enderlein, *Sciophila* Meigen, *Acnemia* Winnertz, *Afrocnemia* Matile, *Cluzobra* Edwards, *Monoclona* Mik, *Parvicellula* Marshall, *Azana* Walker, *Neoaphelomera* Miller, *Neotrizygia* Tonnoir & Edwards, *Paratryzia* Tonnoir, *Trizygia* Skuse, *Morganiella* Tonnoir & Edwards, and *Paramorganiella* Tonnoir (Matile 1999, Amorim & Oliveira 2008) – even though some species of *Sciophila* and *Megalopelma* have complete M₄. The remaining genera of the subfamily are presumably plesiomorphic for this feature, including *Phthinia* Winnertz.

Phthinia was established for three Palearctic species, of which Johannsen (1909) designated *Phthinia humilis* (Winnertz 1863) to be the type-species. The biology of *Phthinia* is known from the larva of *P. winnertzi* Mik, which is widely distributed in the Palearctic Region and attacks fruiting bodies of the fungi *Russula fava* (Rom.) Rom. ap. Lindbl. and *Pholiota* (Fr.) P. Kumm., in rotting logs of aspen and common alder (Kurina 1998, Alexander 2002, Jakovlev *et al.* 2008).

The genus *Phthinia* is predominantly Palearctic, with 16 extant species, but has six additional Nearctic species, three Neotropical and one Australasian species. One fossil species from the Oligocene in Germany, *P.*

longipoda Statz, has been described (Statz 1944).

The three previously known Neotropical species of *Phthinia* were described from temperate latitudes in South America by Freeman (1951): *P. fasciata* Freeman and *P. furcata* Freeman from Chile, and *P. flagellata* Freeman from southern Argentina. Williston (1896) described a species from Saint Vincent, *P. fraudulenta*, but it actually belongs in *Megalopelma* Enderlein (Papavero 1978), a genus included in *Sciophila* Meigen (Vockeroth 2009). The genus *Phthinia* is monophyletic, as is clearly indicated by the very elongated legs, the mesonotum particularly short and arched, and some modified wing venation features. There are no phylogenetic studies for the relationships between the species of the genus to date.

We provide here a brief diagnosis of the described species of *Phthinia* and describe four new species, two from the southern Atlantic Forest of Brazil and two from Chile. This marks the first record of the genus from Brazil. A key for the Neotropical species of the genus is furnished.

Material and methods

The material from the Atlantic Forest of Brazil was collected with Malaise traps and preserved in 80% ethanol, while the material from Chile consist of dried, pinned specimens. One or more wings from each species were mounted as permanent slide preparations in Canada balsam. The male terminalia of some specimens were detached and heated in KOH solution, neutralized, dehydrated, and mounted in temporary glycerin or in jelly with phenol (modified of Zandler 2003) on depression slides. Photographs were taken using a Leica DC camera attached to a Leica MZ16 stereomicroscope or a DM2500 transmission microscope and mounted using AutoMontage software. Initial drawings were made using a camera lucida and redrawn using Adobe Illustrator 11.0. The descriptions followed Sølvi (1997), abbreviations used includes: Ae, aedeagus; Ce, cercus; Gc, gonocoxite; Gs, gonostyle; S10, sternite 10; T9, tergite 9; Tg, tegmen. The given GPS coordinates are approximate.

The types of Freeman's species of *Phthinia* are at the Natural History Museum (NHM), London, and were photographed in the context of a general documentation of the types of Neotropical species of Mycetophilidae at the NHM. All type material of species described here is housed in the Diptera collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP), Brazil.

Phthinia Winnertz

Phthinia Winnertz, 1863: 779. Type-species, *Phthinia humilis* Winnertz, 1863: 779 (Johannsen, 1909: 83, by subseq. des.).

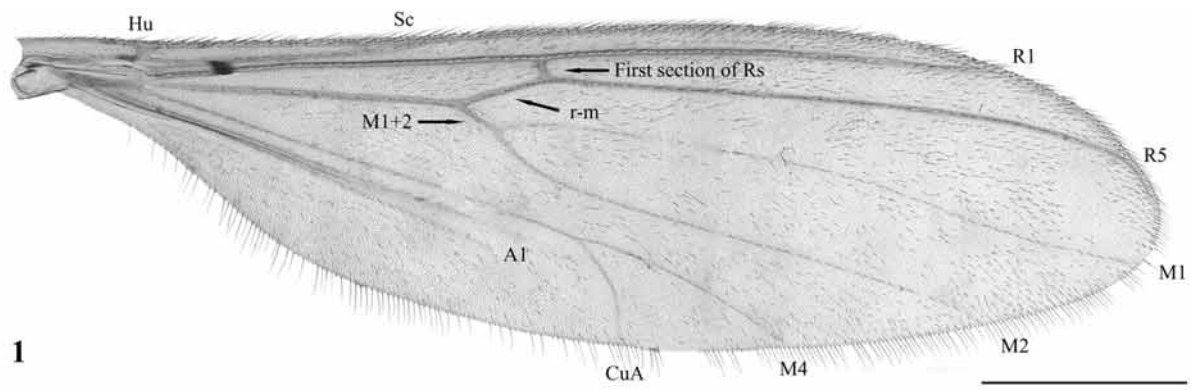
Diagnosis. Legs particularly long and slender; fore legs with the first tarsomere approximately twice the length of the tibia, mid and hind first tarsomeres about as long as tibial length. Thorax short, strongly arched; laterotergite and mediotergite setose. Wing membrane covered with macro and microtrichia; M_{1+2} short, usually shorter or only slightly longer than r-m, medial fork very long; cubital fork very distal, beyond origin of Rs, second sector of CuA strongly curved toward wing base on distal half.

Phthinia theresae, sp.n.

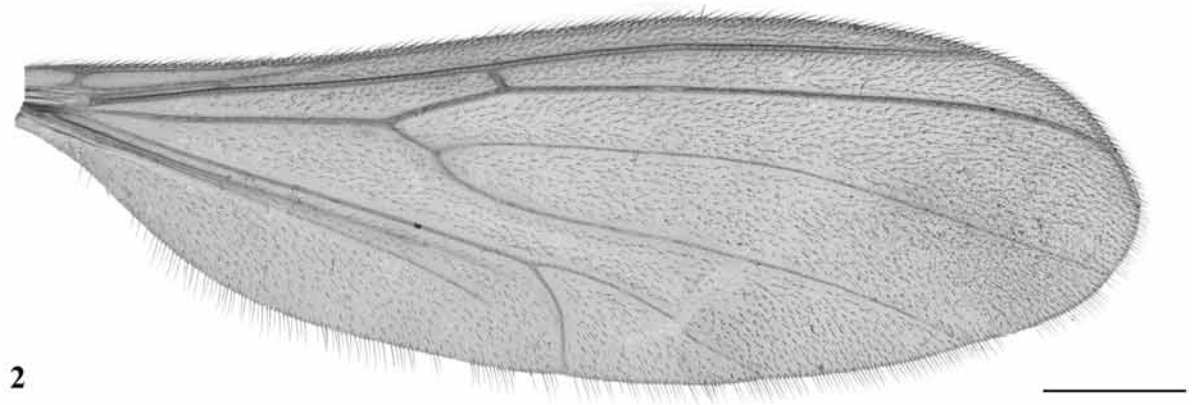
(Figs. 1, 5)

Diagnosis. Sc reaching C well before basal end of r-m; first sector of Rs short and transverse; M_{1+2} about half the length of r-m; gonocoxite with an anterior distal projection ending beyond gonostyle; gonostyle short, with a distal tooth-like sclerotization.

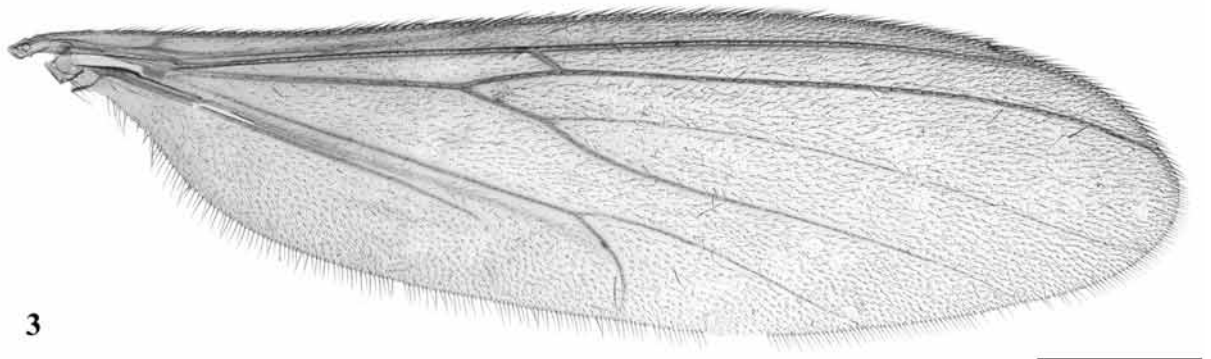
Material examined. Holotype ♂, BRAZIL, State of Espírito Santo, Santa Teresa, Estação Biológica Santa Lúcia, 840 m, 19° 58' 16" S 40° 32' 06,9" W, 9-12.iv.2001 (C.O. Azevedo & eq. cols.).



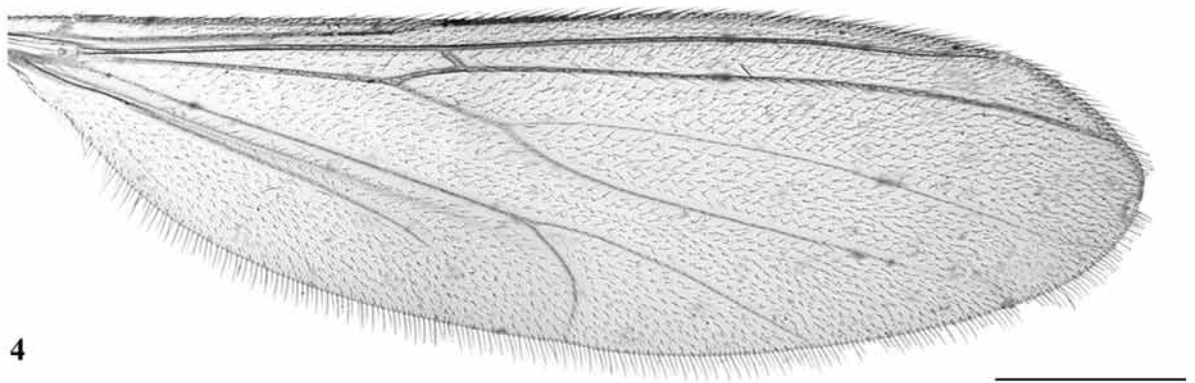
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2



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4

FIGURES 1–4. Wings of *Phthinia*. **1.** *P. theresae*, **sp.n.** Holotype. **2.** *P. urubici*, **sp.n.** Paratype. **3.** *P. freemani*, **sp.n.** Paratype. **4.** *P. parafurcata*, **sp.n.** Paratype. Scale: 0.5 mm.

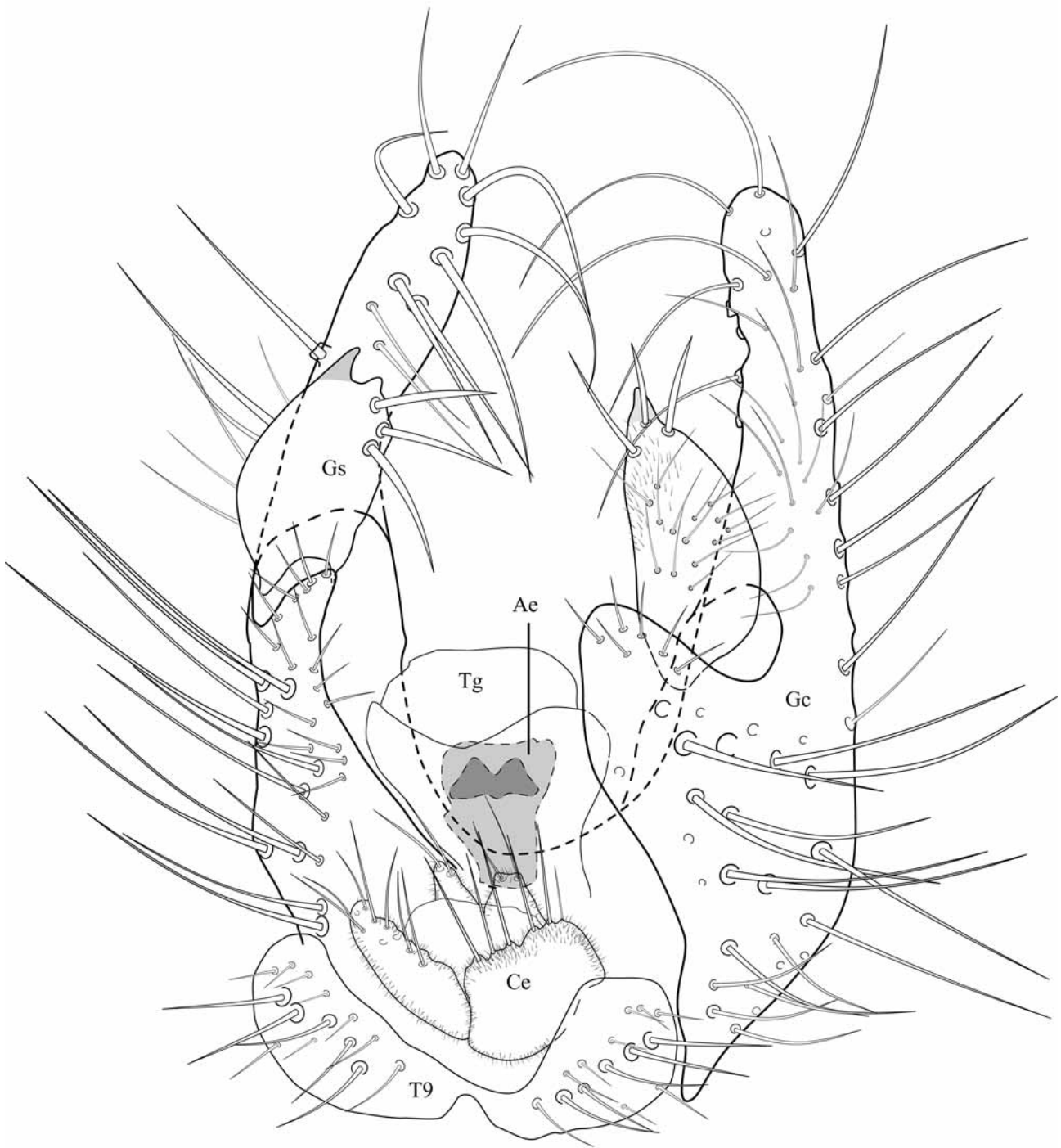


FIGURE 5. Male terminalia of *Phthinia theresae*, **sp.n.**, dorsolateral view. Holotype. Abbreviations: Ae, aedeagus; Ce, cercus; Gc, gonocoxite; Gs, gonostylus; T9, tergite 9; Tg, tegmen.

Description. Male. Head. Vertex yellow, setose; three ocelli, aligned, lateral ocelli larger than mid ocellus; occiput brown; eyes setose. Scape and pedicel rounded, yellow, with a distal aureole of setae; 14 yellow, elongate flagellomeres, with scattered setae, with no distal neck, flagellomeres in contact with each other, first flagellomere longer, about 1.4 the length of flagellomere 2, flagellomeres 2-14 longer than scape and pedicel length together. Front and clypeus yellow, setose; labella yellow; four yellow palpomeres increasing in length to apex, first and second short, rounded, third and fourth elongate, fourth twice length of third. **Thorax.** Thorax yellow. Pronotum setose. Scutum short, strongly arched, covered with scattered small setae and rows of stronger dorsocentrals and acrosticals; scutellum setose, two mesal scutellar bristles. Pleural

membrane setose along margin of anterior spiracule. Mediotergite setose laterally, laterotergite setose on posterior half. Halter yellow. **Legs.** Legs yellow, long and slender; first tarsomere of anterior leg about twice length of tibia; mid and hind first tarsomeres about as long as tibial length. Tibial spurs 1:2:2, short, approximately as long as tibial width at apex. **Wings** (Fig. 1). Length, 2.8 mm. Width, 0.9 mm. Membrane hyaline, densely covered with macrotrichia, microtrichia regularly distributed over the membrane. C extending about a third of the distance between R_5 and M_1 , ending at wing apex; Sc complete, short, reaching C before anterior apex of r-m; sc-r present, in a basal position; R_1 long, reaching C at about distal fifth of wing; first sector of Rs nearly transverse, about as long as width of cell r1; r-m long, nearly longitudinal, about three times length of first sector of Rs; M_{1+2} present, short, less than half length of r-m; medial fork complete, M_1 sinuous apically, slightly depressed before apex; cubital fork complete, M_4 originating beyond medial fork, about a third of length of first sector of CuA; apex of CuA strongly arched towards base; A_1 ending far from wing margin, before origin of M_4 . **Abdomen.** Abdomen yellow, setose, long and slender. **Terminalia** (Fig. 5). Gonocoxites fused to each other ventrally, with a distal extension at the ventral face of the terminalia much longer than apex of gonostyle, a dorsal extension embracing the base of the gonostyle, setose all over; gonostyle short, obovoid, with a sclerotized tooth at apex, with three spine-like setae distally at inner face and some other scattered setae; tegmen wide distally, membranous; aedeagus strongly sclerotized; sternite 10 sclerotized, bilobed, with a pair of setae distally on each lobe; tergite 9 almost entirely divided into a pair of lobes; cercus lobose. **Female.** Unknown.

Etymology. Feminine. The species is named after the type-locality, Santa Teresa, in the State of Espírito Santo, in Brazil. This is a type-locality of many species and one of the spots with highest species diversity in the Atlantic Forest.

Comments. This species can be easily distinguished from *P. urubici*, **sp.n.**—which also has the long digitiform distal projection of the gonocoxite—by the shape of the gonostyle. The gonostylus in *P. theresae*, **sp.n.** is short, obovoid, with a sclerotized tooth at apex, and three spine-like setae distally. On the other hand, the gonostylus in *P. urubici*, **sp.n.** shows a long digitiform, sclerotized dorsal extension and an additional rather translucent blade, besides three stronger setae at dorsal face. The wing of *P. theresae*, **sp.n.** has shorter M_{1+2} , as well as *P. urubici*, **sp.n.**, but first sector of Rs is clearly transverse.

Phthinia urubici, **sp.n.**

(Figs. 2, 6)

Diagnosis. Sc reaching C well before basal end of r-m; first sector of Rs slightly oblique; M_{1+2} about half the length of r-m; gonocoxite with an anterior distal projection ending beyond gonostyle; gonostyle with a pair of dorsal elongated projections, one of them well sclerotized, one quite translucent.

Material examined. Holotype. ♂, BRAZIL, State of Santa Catarina, Urubici, Morro Igreja, 28° 00' 05,0" S 49° 35' 30" W, 18.viii.2005-06.i.2006 (Pinho & Bizzo cols.). Paratypes. 1 ♂, same data as holotype; 1 ♂ idem, except Urubici, 05.xii.2004-08.ii.2005 (Bizzo & Hugo cols.).

Description. Male. Head. Vertex yellow, setose; three ocelli, aligned, lateral ocelli larger than mid ocellus; occiput brown; eyes setose. Scape and pedicel rounded, yellow, with a distal aureole of setae; 14 yellow, elongate flagellomeres, with scattered setae, with no distal neck, flagellomeres in contact with each other, first flagellomere longer, about 1.4 the length of flagellomere 2, flagellomeres 2-14 longer than combined length of scape and pedicel. Front and clypeus yellow, setose; labella yellow; four yellow palpomeres increasing in length to apex, first and second short, rounded, third and fourth elongate, fourth twice length of third. **Thorax.** Thorax yellow. Pronotum setose. Scutum short, strongly arched, covered with scattered small setae and rows of stronger dorsocentrals and acrosticals; scutellum setose, two mesal scutellar bristles. Pleural membrane setose along margin of anterior spiracule. Mediotergite setose laterally; laterotergite setose on posterior half. Halter yellow. **Legs.** Legs yellow, long and slender; first tarsomere of anterior leg about twice length tibia. Tibial spurs 1:2:2, short, approximately as long as tibial width at apex. **Wing** (Fig. 2). Length, 4.0 mm. Width, 1.3 mm. Membrane hyaline, densely covered with macrotrichia,



FIGURE 6. Male terminalia of *Phthinia urubici*, **sp.n.**, dorsolateral view. Paratype. Abbreviations: Ae, aedeagus; Ce, cercus; Gc, gonocoxite; Gs, gonostylus; S10, sternite 10; T9, tergite 9; Tg, tegmen.

microtrichia regularly distributed over the membrane. C extending about half the distance between Rs and M_1 , ending at wing apex; Sc complete, short, reaching C before anterior apex of r-m; sc-r present, in a basal position; R_1 long, reaching C at about distal fifth of wing; first sector of Rs only slightly oblique; r-m long, nearly longitudinal, more than three times length of first sector of Rs; M_{1+2} present, short, less than half length of r-m; medial fork complete, M_1 not sinuous at apex; cubital fork complete, M_4 originating beyond medial fork, about a third of length of first sector of CuA; apex of CuA strongly arched towards base; A_1 ending far from wing margin, before origin of M_4 . **Abdomen.** Abdomen yellow, setose, long and slender. **Terminalia** (Fig. 6). Distal margin of syngonocoxite at level of insertion of gonostyles, gonocoxite extending quite beyond apex of gonostyle; gonostyle complex, with a long digitiform, sclerotized dorsal extension and an additional rather translucent blade, three stronger setae at dorsal face, and additional scattered setae ventrally; tegmen wide distally, translucent; aedeagus rather long, well sclerotized; sternite 10 sclerotized, bilobed, with a pair of distal setae at each lobe; tergite 9 entirely divided into two setose lobes, connected by a thin membrane mesally; cercus lobose. **Female.** Unknown.

Etymology. Feminine. This species name refers to the type-locality of the species used in apposition.

Comments. Despite many similarities between *P. theresae*, **sp.n.** and *P. urubici*, **sp.n.**, the latter species can be easily recognized by the distinctive shape of the gonostyle. In *P. urubici*, **sp.n.** the gonostylus shows a sclerotized digitiform dorsal extension and an additional more translucent blade, besides three stronger setae at the dorsal face. On the other hand, in *P. theresae*, **sp.n.** the gonostylus is short, obovoid, with a sclerotized tooth at apex, and three spine-like setae distally.

Phthinia freemani, **sp.n.**

(Figs. 3, 7)

Diagnosis. Sc reaching C close to the origin of Rs; first sector of Rs clearly oblique; M_{1+2} about as long as r-m; ventral margin of gonocoxite with a short, incurved, setose projection; gonostyle digitiform, slender towards apex.

Material examined. Holotype. ♂, CHILE, Chiloé, Dalcahue, 42°22'45.5"S 73°38'50.1"W, iv.1968 (L. E. Peña col.). Paratypes. 2 ♂, same data as holotype.

Description. Male. Head. Vertex brownish, setose; three ocelli present, in a triangular arrangement, the lateral large, near eye margin, the middle one small; occiput brown; eyes setose. Scape and pedicel rounded, yellow, with distal setae, pedicel larger than scape; 14 flagellomeres brownish, with scattered setae, with no distal neck, flagellomeres in contact with each other, the first very long, approximately twice the length of the other ones. Front and clypeus yellow, setose; labella yellow, setose; four palpomeres increasing in length to apex, yellow, setose; palpomeres one and two rounded and small, three and four long. **Thorax.** Thorax predominantly yellowish. Pronotum yellow, setose. Scutum highly arched, setose, yellow with three longitudinal bands, thick and brown; scutellum yellow, setose, with two long central bristles. Pleural membrane yellow. Mediotergite brownish, setose laterally. Laterotergite brownish, nude. Halter with a yellow pedicel and a brown knob, setose. **Legs.** Legs yellow, long and slender; tarsomere one anterior approximately twice the length of the tibiae. Tibial spurs 1:2:2, approximately as long as the tibial width at apex. **Wing** (Fig. 3). Length, 3.6 mm. Width, 1.2 mm. Membrane hyaline, densely covered with macrotrichia, microtrichia also present. C extending about a third of the distance between R_5 and M_1 , ending at wing apex; Sc complete, reaching C just basal to origin of Rs; sc-r present, basal; R_1 long, reaching C at about distal fifth of wing; first sector of Rs oblique, almost half the length of r-m; r-m about as long as M_{1+2} ; medial fork complete, M_1 sinuous apically, slightly depressed before apex; cubital fork complete, M_4 originating just beyond M_{1+2} fork, about a third of length of first sector of CuA; apex of CuA strongly arched towards base; A_1 ending far from wing margin, before origin of M_4 . **Abdomen.** Abdomen brownish, setose, long and slender. **Terminalia** (Fig. 7). Terminalia brownish. Distal margin of syngonocoxite almost reaching base of gonostyles, gonocoxite distal extension curved inward ventrally, not extending beyond apex of gonostyle, inner margin of gonocoxite

with a blade slightly projecting inwards; gonostyle digitiform, with some long setae, not bifid or strongly sclerotized; tegmen with a pair of short distal projections; aedeagus not strongly sclerotized; sternite 10 present, bilobed, with setae distally on each lobe; tergite 9 with a pair of lateral lobes connected mesally; cercus lobose. **Female.** Unknown.

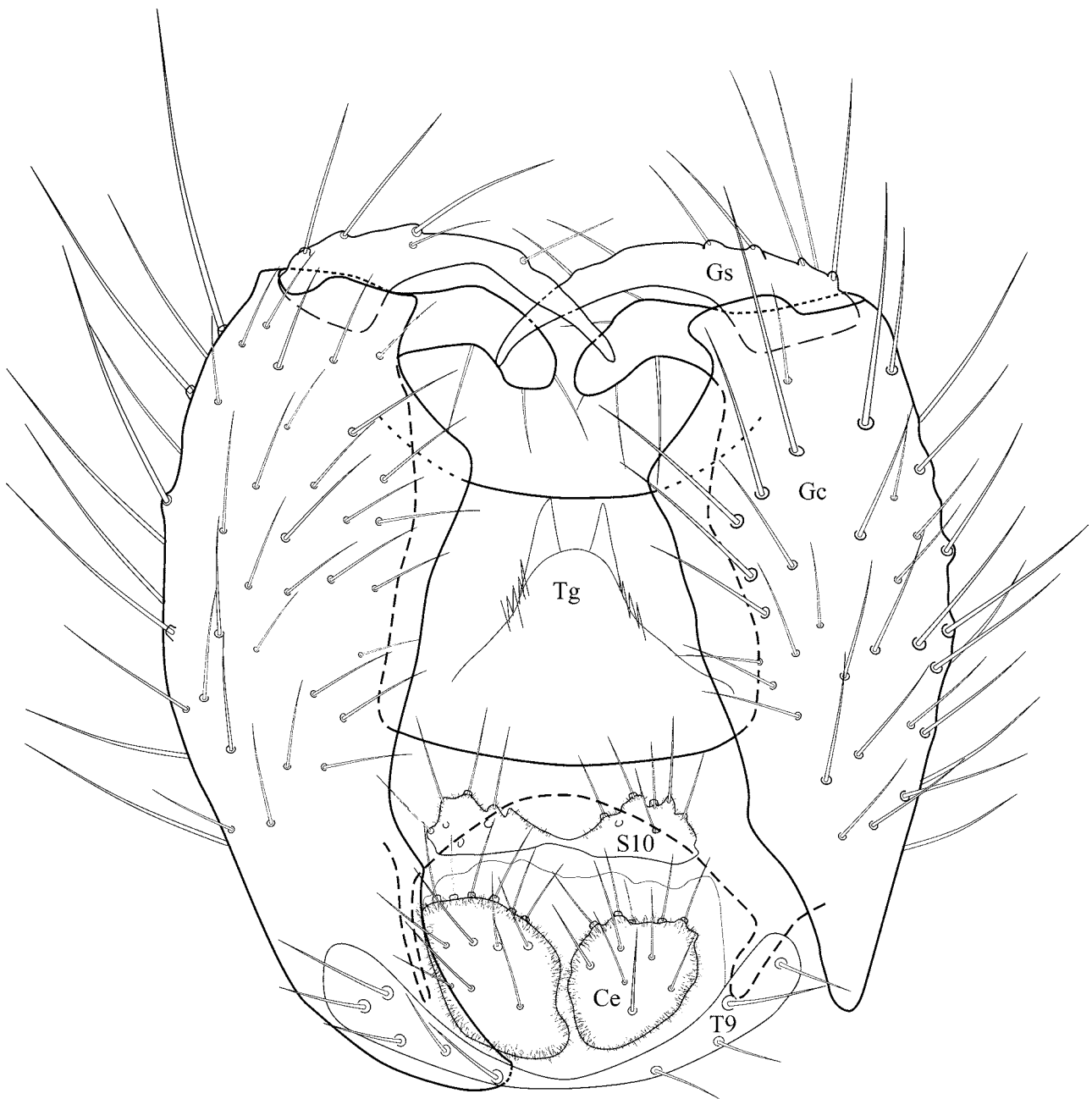


FIGURE 7. Male terminalia of *Phthinia freemani*, **sp.n.**, dorsal view. Paratype. Abbreviations: Ce, cercus; Gc, gonocoxite; Gs, gonostylus; S10, sternite 10; T9, tergite 9; Tg, tegmen.

Etymology. Feminine. The species is named in honor to the British entomologist Paul Freeman, who authored the major review on the temperate South American Mycetophilidae *s.l.*

Comments. This species seems to be close to *P. furcata* Freeman and to *P. parafurcata*, **sp.n.** It can be separated from both by its tapered gonostylus, and from the latter species by lacking the distal lateral extensions of the tergite 9 and for not having a dorsal projection in the gonocoxite.

Phthinia parafurcata, sp.n.

(Figs. 4, 8)

Diagnosis. Sc reaching C close to the origin of Rs; first sector of Rs clearly oblique; r-m shorter than M_{1+2} ; tergite 9 with long distal lateral projections; apical margin of gonocoxite ventrally with a short, setose projection dorsally with a blade-like, bare projection, both of them projected inward; gonostyle digitiform, with two spine-like setae.

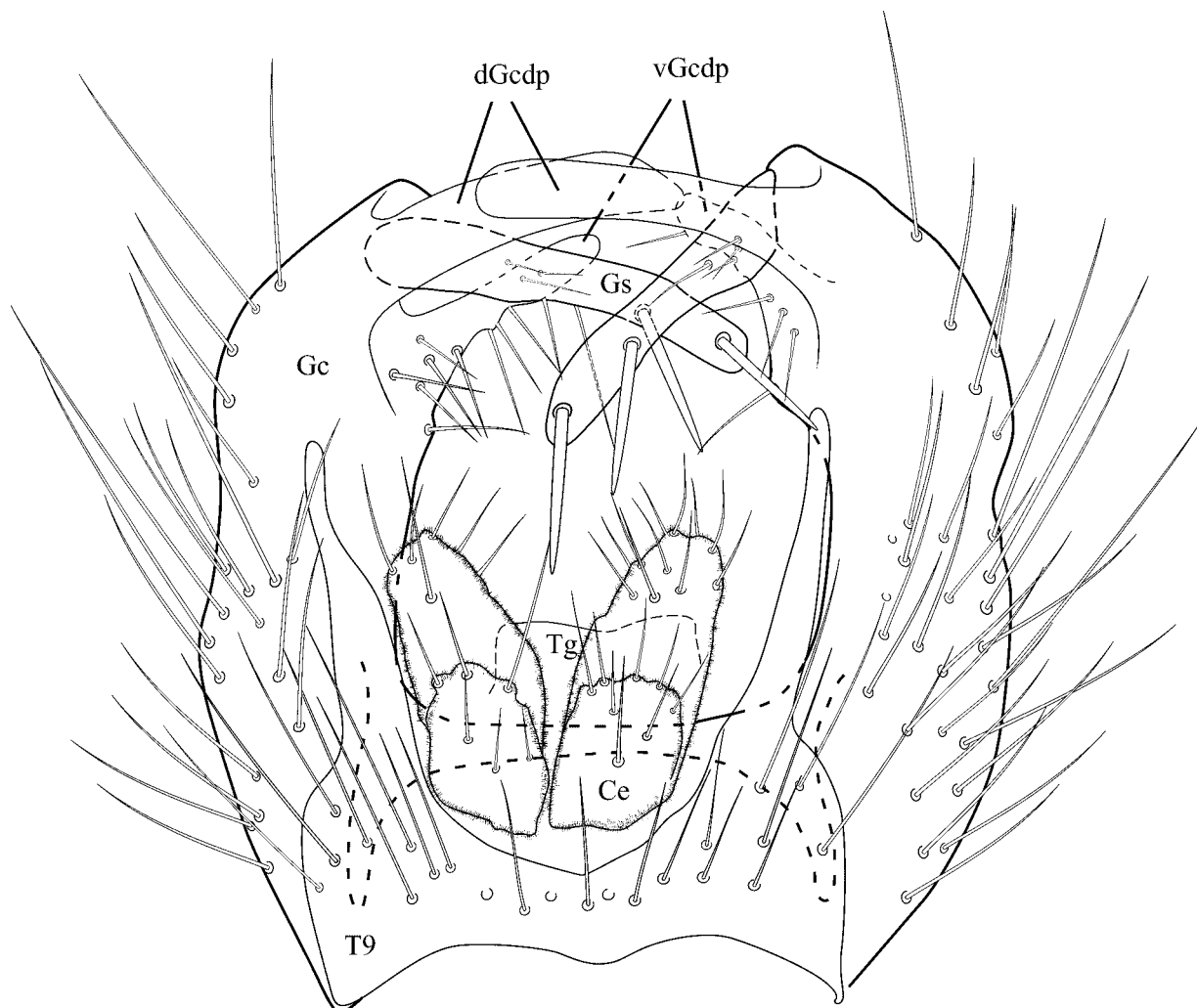


FIGURE 8. Male terminalia of *Phthinia parafurcata*, sp.n., dorsal view. Paratype. Abbreviations: Ce, cercus; dGcdp, dorsal gonocoxite distal projection; Gc, gonocoxite; Gs, gonostylus; T9, tergite 9; Tg, tegmen; vGcdp, ventral gonocoxite distal projection.

Material examined. Holotype. ♂, CHILE, Chiloé, Dalcahue, 42°22'45.5"S 73°38'50.1"W, iv.1968 (L. E. Peña col.). Paratypes. 12 ♂, same data as holotype; 1 ♂, idem, except i.1962.

Description. Male. Head. Vertex brownish, setose; three ocelli present, in a triangular arrangement, the lateral large, near eye margin, the middle one small; occiput brown; eyes setose. Scape and pedicel rounded, yellow, with distal setae, pedicel larger than scape; 14 flagellomeres brownish, with scattered setae, with no distal neck, flagellomeres in contact with each other, the first very long, approximately twice the length of the other ones. Front and clypeus yellow, setose; labella yellow, setose; four palpomeres increasing in length to apex, yellow, setose; palpomeres one and two rounded and small, three and four long. **Thorax.** Thorax yellow. Pronotum setose. Scutum highly arched, setose; scutellum yellow, setose, with two long central bristles. Pleural membrane yellow. Mediotergite setose laterally. Laterotergite nude. Halter with a yellow pedicel and a brown knob, setose. **Legs.** Legs yellow, long and slender; tarsomere one anterior approximately twice the

length of the tibiae. Tibial spurs 1:2:2, approximately as long as the tibial width at apex. **Wings** (Fig. 4). Length, 3.0 mm. Width, 1.1 mm. Membrane hyaline, densely covered with macrotrichia, microtrichia also present. C extending about a third of the distance between R_5 and M_1 , ending at wing apex; Sc complete, reaching C just basal to origin of Rs; sc-r present, basal; R_1 long, reaching C at about distal fifth of wing; first sector of Rs oblique, about half the length of r-m; r-m shorter than M_{1+2} ; medial fork complete, M_1 sinuous apically, slightly depressed before apex; cubital fork complete, M_4 originating opposite to fork of M_{1+2} , about a third of length of first sector of CuA; apex of CuA strongly arched towards base; A_1 ending far from wing margin, before origin of M_4 , running quite apart from first sector of CuA. **Abdomen.** Abdomen brownish, setose, long and slender. **Terminalia** (Fig. 8). Terminalia yellow. Distal margin of syngonocoxite short; gonocoxite with a mesal constriction, a ventral distal projection curved inwards, not extending distally to the apex of the gonostyle, besides a dorsal, blade-like projection also curved inwards; gonostyle digitiform, with two slender spine-like setae; tegmen rectangular, translucent distally; aedeagus not strongly sclerotized; tergite 9 with a pair of long distal projections laterally, mesally connected; cercus bilobed. **Female.** Unknown.

Etymology. Feminine. This species was named considering its similarity to *Phthinia furcata* Freeman, 1951.

Comments. This species seems to be close to *P. furcata* and *P. freemani*, **sp. n.**, as can be seen by the ventral digitiform distal projection of the gonocoxite. It differs from *P. freemani*, **sp. n.** in bearing an additional dorsal, blade-like projection of the gonocoxite and by the long distal lateral projections of the tergite 9, which seem to be present in *P. furcata*, but are much shorter. The wing of this species has r-m shorter than in *P. freemani* **sp.n.**, and has A_1 more distant from CuA along its course than most other species.

Phthinia flagellata Freeman

P. flagellata Freeman, 1951: 53, figs. 107 (♂ terminalia), 276 (wing). Type-locality: Argentina, Río Negro, Lago Nahuel Huapí, eastern end. Holotype ♂, NHM.

Diagnosis. M_{1+2} about as long as r-m; CuA with a sigmoid curve close to apex. Gonostyle styliform, apically at the distal part of the gonocoxite.

Comments. Freeman (1951: 54) refers to the male terminalia as “with cerci longer than coxites, style simple, coxite bearing a long thin process with a bristle at the end of and a short process at its base”. It seems questionable whether the homology he proposed for these sclerites is correct. In all related species the gonocoxites extends beyond the distal margin of the syngonocoxite and the shape of the gonostyle is variable. It seems likely that the sclerite referred to as the “flagellum” distally (Freeman, 1951, fig. 107) is an elongated, digitiform gonostyle, with an apical seta. For the purposes of identification, however, it can be very easily distinguished from all remaining Neotropical species, mainly for the flagellum-like gonostyle, not seen in the others neotropical species. Apparently the drawing is in ventral view, not dorsal, as originally stated.

Phthinia furcata Freeman

P. furcata Freeman, 1951: 54, fig. 108 (♂ terminalia). Type-locality: Chile, Llanquihue Prov., Ancud. Holotype ♂, NHM.

Diagnosis. M_{1+2} longer than r-m. Gonocoxite with a digitiform projection distally to the insertion of the gonostyle, gonostyle blunt at apex.

Comments. In Freeman’s (1951, fig. 108) drawing there appears to be an articulation between the basal part of the syngonocoxite and a distal, quite large structure. In *P. parafurcata*, **sp.n.** it is very clear that the large, distal structure is an extension of the gonocoxite, with a mesal constriction. The gonostyle, hence, is the articulated distal digitiform element of the gonocoxite, with a distal extension of the gonocoxite curved inwards. This species is very close to *P. parafurcata*, **sp.n.** but lacks the second distal extension of the

gonocoxite and having shorter distal extensions of the tergite 9 laterally. In Freeman's (1951) original drawing of the terminalia, tergite 9 can be clearly recognized and its indication of dorsal view seems correct.

Phthinia fasciata Freeman

P. fasciata Freeman, 1951: 54, fig. 109 (♂ terminalia). Type-locality: Chile, Llanquihue, Peulla. Holotype ♂, NHM.

Diagnosis. M_1 and M_2 strongly diverging at base, M_{1+2} shorter than r-m. Gonostyle with one basal and two apical projections.

Comments. The comparison of the new species of *Phthinia* from Chile described here with Freeman's (1951) illustration of the male terminalia of his species suggests some mistakes on his drawings and interpretations, as commented above. His drawings of *P. fasciata* (Freeman, 1951, fig. 109) seem to mistake the distal extension of the gonocoxite with the gonostyle itself. It seems more likely that the gonostyle corresponds to one of the distal furcations of the "style", the large distal projection being an extension of the gonocoxite, as in the remaining Neotropical species of the genus. The drawing also seems to be in ventral view, despite the indication to the contrary.

Key for the Neotropical species of *Phthinia* (modified from Freeman 1951)

- 1 Wing membrane with macrotrichia covering the entire surface, but microtrichia only close to the veins (Chile).
Gonostyle with one basal and two apical projections *P. fasciata* Freeman
- Wing membrane with both, macro and microtrichia covering the entire surface. Gonostyle not as above 2
- 2(1) Sc reaching C close to the origin of Rs; M_{1+2} as long as or longer than r-m; gonocoxite without distal projections
beyond apex of gonostyle (Figs. 3, 4, 7, 8) 3
- Sc reaching C before anterior end of r-m; M_{1+2} shorter than r-m; gonocoxite distal projections extending much
beyond apex of gonostyle (Figs. 1, 2, 5, 6) 6
- 3(2) M_{1+2} longer than r-m (Fig. 4) 4
- M_{1+2} as long as r-m (Fig. 3) 5
- 4(3) Gonocoxite with two distal digitiform projections, one dorsal and one ventral to the gonostyle (Chile) (Fig. 8)
..... *P. parafurcata*, **sp.n.**
- Gonocoxite with a single distal projection, ventral to the gonostyle (Chile) *P. furcata* Freeman
- 5(3) No distal extension of the gonocoxite; gonostyle flagellum-like (southern Argentina) *P. flagellata* Freeman
- Gonocoxite with a distal extension; gonostyle wide at base, slender to apex (Chile) (Fig. 7) *P. freemani*, **sp.n.**
- 6(2) Gonostyle with a single distal tooth-like, well sclerotized projection (Brazil, State of Espírito Santo) (Fig. 5)
..... *P. theresae*, **sp.n.**
- Gonostyle with a pair of flattened extensions, one of them rather translucent, the other well sclerotized (Brazil, State
of Santa Catarina) (Fig. 6) *P. urubici*, **sp.n.**

Discussion

The number of known species of *Phthinia* in the Neotropical region after this paper increases from three to seven, all from southern temperate latitudes in South America. Knowledge on the systematics of *Phthinia* is still too limited to allow a reconstruction of the phylogenetic relationships within the genus, a task beyond the scope of this paper. It is possible that the set of Neotropical species composes a clade within the genus, but this has still to be formally demonstrated based on a phylogenetic study of the genus as a whole. The Brazilian species have a long distal extension of the gonocoxite, not seen in the Chilean species. In this sense, the Brazilian pair of species seems to compose a clade within the genus. *P. furcata*, *P. freemani*, **sp.n.**, and *P. parafurcata*, **sp.n.** share some modifications in the gonocoxite, especially the distal projections, curved inwards ventrally. The distal lateral projections of the tergite 9 of *P. furcata* and *P. parafurcata*, **sp.n.** strongly

suggest that they would be sister species. *P. flagellata* is rather different from all remaining Neotropical species of genus in its male terminalia, without any distal projection of the gonocoxite.

The presence of temperate species of *Phthinia* in southern Brazil is not surprising. Other Mycetophilidae genera are shared between Chile, southern Argentina and southern Brazil, especially within the Sciophilinae, as *Allocotocera* Mik, *Eudicrana* Loew, *Leptomorphus* Curtis, *Neoaphelomera* Miller, and *Stenophragma* Skuse. In the Rangomaramidae, this applies to *Chiletricha* Chandler and *Colonomyia* Colless (Amorim & Rindal 2007), while in the Ditomyiidae *Nervijuncta* Marshall extends itself to southern Brazil (Falaschi & Amorim 2009).

Most of the southern temperate dipteran genera known in Brazil have one species extending from northern Rio Grande do Sul state to the state of São Paulo, occasionally reaching the state of Rio de Janeiro. Most of these genera usually have a single species in Brazil, as can be seen in the genera *Nervijuncta* and *Chiletricha*, each with a single species known from Santa Catarina to São Paulo. This is the first record to our knowledge of a dipteran group with southern temperate distribution reaching as north as Espírito Santo, with two species in Brazil.

This extension of southern temperate species to Brazil seems closely related to that of *Araucaria angustifolia* (Bertoloni) Otto Kuntze (Conifera, Araucariaceae) in southern Brazil, which extends its distribution in areas of higher altitudes in southeastern Brazil. Its sister species, *Araucaria araucana* (Mol.) Koch occurs only in Chile. The continuity of the geographic distribution of the common ancestor of these two *Araucaria* species in South America was interrupted in the later Oligocene (30–28 MYA) (Dutra & Stranz 2009). Biogeographically this suggests that after the separation between the Chilean and southern Brazil elements of the genus *Araucaria* in the Oligocene, there was enough time for the Brazilian species of *Phthinia* to undergo further division at its northern range, constituting separate endemic elements in Espírito Santo at areas of higher altitudes.

Acknowledgments

This paper is a result of a project supported by FAPESP Grant # 03/10.274–9. The second author has a research fellowship from the Brazilian National Science Research Agency, CNPq. Maria Isabel P.A. Balbi has been essential in our lab along the Atlantic Forest Diptera diversity project sorting and preparing high quality slide mountings, and to whom we are deeply indebted. Erica McAlister, of the Natural History Museum, London, has been extremely helpful providing access to all Neotropical types of Mycetophilidae in the NHM collection, to whom we are deeply indebted. Two anonymous referees have done an excellent review of the paper, with very useful suggestions and corrections, so we want to acknowledge their help. Peter Kerr, the Zootaxa editor for the Mycetophiliformia, has been keen along the editorial process with criticisms and suggestions and we thankfully acknowledge his help.

References

- Alexander, K.N.A. (2002) The invertebrates of living and decaying timber. *In*: Britain & Ireland (eds). *A provisional annotated checklist*. English Nature Research Reports. No. 467, English Nature, Peterborough. 142 pp.
- Amorim, D.S. & Oliveira, S.S. (2008) Eleven new species of the genus *Cluzobra* Edwards (Diptera, Mycetophilidae, Sciophilinae) from the Atlantic Forest of Brazil. *Zootaxa*, 1920, 1–28.
- Amorim, D.S. & Rindal, E. (2007) Phylogeny of the Mycetophiliformia, with proposal of the subfamilies Heterotrichinae, Ohakuneinae, and Chiletrichinae for the Rangomaramidae (Diptera, Bibionomorpha). *Zootaxa*, 1535, 1–92.
- Amorim, D.S., Silva, V.C. & Balbi, M.I.P.A. (2002) Estado de conhecimento dos Diptera neotropicais. *In*: C. Costa; S.A. Vanin; J.M. Lobo; A. Melic. (Org.). *Projeto de Red Iberoamericana de Biogeografía y Entomología sistemática PrIBES 2002*. 1ª. ed. Zaragoza: Sociedad Entomológica Aragonesa, v. 2, p. 29–36.
- Dutra, T.L. & Stranz, A. (2009) Biogeografía, evolução e ecologia da família Araucariaceae: o que mostra a paleontologia. *In*: Fonseca, C.R., Souza, A.F., Leal-Zanchet, A.M., Dutra, T., Backes, A. & Ganade, G. (eds),

- Floresta com Araucária: Ecologia, Conservação e Desenvolvimento Sustentável*. Holos, Editora, Ribeirão Preto.
- Evenhuis, N.L., Pape, T., Pont, A.C. & Thompson, F.C. (2007) *Biosystematic Database of World Diptera*, Version 10. Available at <http://www.diptera.org/biosys.htm>, accessed May 10, 2007.
- Falaschi, R.L. & Amorim, D.S. (2009) Revision of the Neotropical species of *Nervijuncta* Marshall, 1896 (Diptera, Ditomiyidae). *Zootaxa*, 2219, 18–30.
- Freeman, P. (1951) *Diptera of Patagonia and South Chile based mainly on material in the British Museum (Natural History)*. Part III-Mycetophilidae. London, Br. Mus. (Nat. Hist.). vii & 138 pp.
- Jakovlev, J., Kjærandsen, J. & Viklund, B. (2008) Fungus gnats (Diptera: Bolitophilidae, Diadocidiidae, Ditomiyidae, Keroplatidae & Mycetophilidae) from Tyresta National Park and Nature Reserve in Sweden. *Sahlbergia*, 14, 29–52.
- Johannsen, O.A. (1909) Diptera. Fam. Mycetophilidae. In: Wytzman, P. (ed.). *Genera insectorum*, 93, 141. Bruxelles.
- Kurina, O. (1998) *Fungus gnats in Estonia (Diptera: Bolitophilidae, Keroplatidae, Macroceridae, Ditomiyidae, Diadocidiidae, Mycetophilidae)*. PhD thesis, Tartu.
- Matile, L. (1999) Notes sur les Sciophilinae austraux du groupe *Azana* et description d'un nouveau genre Afrotropical (Diptera : Mycetophilidae). *Annales de la Société Entomologique de France*, (N.S.), 34(4), 385–395.
- Papavero, N. (1978) Mycetophilidae. In: Papavero, N. (ed.), *A Catalogue of the Diptera of the Americas South of the United States*. Museu de Zoologia, Secretaria da Agricultura do Estado de São Paulo.
- Rindal, E., Sjøli, G.E.E. & Bachmann, L. (2009) Molecular phylogeny of the fungus gnat family Mycetophilidae (Diptera, Mycetophiliformia). *Systematic Entomology*, 34, 524–532.
- Sjøli, G.E.E. (1997) The adult morphology of Mycetophilidae (s. str.), with a tentative phylogeny of the family (Diptera, Sciaroidea). *Entomologica Scandinavica* (Supplement), 50, 5–55.
- Statz, G. (1944) Neue Dipteren (Nematocera) aus der Oberoligocän von Rott. II. Familie Fungivoriden (Pilzmücken). *Paleontographica* (A), 95, 67–92.
- Tozoni, S.H.S. (1998) *Sistemática filogenética dos Mycetophilidae (Diptera: Bibionomorpha)*. Tese de Doutorado. Universidade Federal do Paraná, Curitiba. 124 pp.
- Vockeroth, J.R. (2009) Mycetophilidae (fungus gnats). In: Brown, B., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M.A. (eds.), *Manual of Central American Diptera, Vol. 1*, 267–278. NRC Research Press, Ottawa.
- Williston, S.W. (1896) On the Diptera of St. Vincent (West Indies). *Transactions of the Entomological Society of London*, 1896, 253–446, pl. VIII-XIV.
- Winnertz, J. (1863) Beitrag zu einer Monographie der Pilzmücken. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien*, 13, 637–964.
- Zandler, R.H. (2003) Glycerin Jelly as a Substitute for Hoyer's Solution Mountant. *Res Botanica*, Missouri Botanical Garden. April, 30. <http://www.mobot.org/plantscience/ResBot/Meth/GlycerinJelly.htm>. Accessed in January 2008.