



Review of the Neotropical species of *Nervijuncta* Marshall, 1896 (Diptera, Ditomyiidae)

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Abstract

Both known Neotropical species of *Nervijuncta* – *N. conjuncta* (Freeman) and *N. laffooni* Lane – are redescribed and the male terminalia illustrated in detail. Specimens of *N. laffooni*, previously known only from the type-locality (São Paulo, Brazil), are reported from Nova Teutônia, and Urubici, both in the State of Santa Catarina, Brazil. The females of both Neotropical species of the genus are described in detail and the genitalia illustrated for the first time. These redescriptions provide further information on the position of these two species within the genus.

Key words: Neotropics, taxonomy, biodiversity

Introduction

Ditomyiids appear to be composed of two main groups of genera. The first clade includes *Ditomyia* Winnertz (exclusively Holarctic), *Asiaditomyia* Saigusa (monotypic from Japan), *Celebesomyia* Saigusa (monotypic from Celebes), *Nervijuncta* Marshall (19 species in New Zealand, two species in New Caledonia, one species in Chile and one species in southern Brazil), *Rhipidita* Edwards (two Neotropical species) and *Calliceratomyia* Lane (with a single Neotropical species). The other clade includes *Symmerus* Walker (with 18 Nearctic species) and *Australosymmerus* Freeman (25 Neotropical species and 14 Australian species), the latter with a number of subgenera, reviewed in detail by Munroe (1974).

Over the last 30 years collections from the Neotropical Region have captured a great number of ditomyiids, including additional specimens of *Nervijuncta*, *Rhipidita*, *Calliceratomyia*, *Australosymmerus* (*Melosymmerus*), as well as species that fit into new genera. This is the first paper of a series revising the family Ditomyiidae in the Neotropical region, including new species descriptions and proposed phylogenetic relationships for the group.

The question of name priority for *Nervijuncta* is slightly complicated. Three genera were proposed by Marshall (1896) in the same paper for three New Zealand species, *Cyrtoneura* (type-species, *C. hudsoni* Marshall), *Nervijuncta* (type-species, *N. nigrescens* Marshall), and *Huttonia* (type-species, *H. tridens* Hutton). Both *Cyrtoneura* and *Huttonia* were preoccupied, replaced by Hutton (1904) as *Arctoneura* and *Casa*, respectively. Tonnoir & Edwards (1927: 750) synonymized all three genera; *Cyrtoneura* would have page precedence (p. 262) in relation to *Nervijuncta* (p. 265), but its replacement name (proposed by Hutton 1904) is more recent, so *Nervijuncta* is the valid name.

Edwards (1921) added one species to the genus, and Tonnoir & Edwards (1927) added an additional 14 (one with two subspecies). Lane (1948) described the first Neotropical species of the genus from southeastern Brazil, but the name was preoccupied and later replaced by *N. laffooni* (Lane 1952). Freeman (1951) described *Ditomyia conjuncta* from Chile and southern Argentina, a species later transferred by Papavero

(1977) to *Nervijuncta* without indicating that it was a new combination. More recently, Matile (1988) described three species from New Caledonia. This brings the total to 23 species in the genus; 21 are from New Zealand and two are from southern South America. The distinctions between *Ditomyia*, *Asioditomyia*, and *Nervijuncta* however, are not very clear and a comparative study with the Holarctic and Oriental genera is necessary to properly define their limits.

The original descriptions of *N. conjuncta* (Freeman) and *N. laffooni* Lane are sufficient for identification of the species, but many details were neglected, especially regarding the male terminalia. Details of the female terminalia were omitted in the description of both *N. laffooni* (Lane 1952) and *N. conjuncta* (Freeman 1951). This paper reviews *Nervijuncta* in the Neotropical Region, redescribing and illustrating both species in detail, with some initial comments on the phylogenetic relationships within the genus.

Material and methods

The material examined in this study belongs to the Diptera collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP, São Paulo, Brazil) and to the Muséum National d'Histoire Naturelle (MNHN, Paris, France). Head, thorax, wing, and terminalia were drawn after dissection, clearing and mounting on permanent slides. The terminology used follows McAlpine (1981) and Wood (1991), except for wing venation which follows Amorim & Rindal (2007).

Nervijuncta Marshall, 1896

Cyrtoneura Marshall 1896: 262. Type-species, *Cyrtoneura hudsoni* Marshall 1896, by monotypy.

Nervijuncta Marshall 1896: 265. Type-species, *Nervijuncta nigrescens* Marshall 1896, by monotypy.

Huttonia Marshall 1896: 267 Type-species, *Platyura tridens* Hutton 1881, by monotypy.

Arctoneura Hutton 1904: 133 (*nomen novum* for *Cyrtoneura*).

Casa Hutton 1904: 133 (*nomen novum* for *Huttonia*).

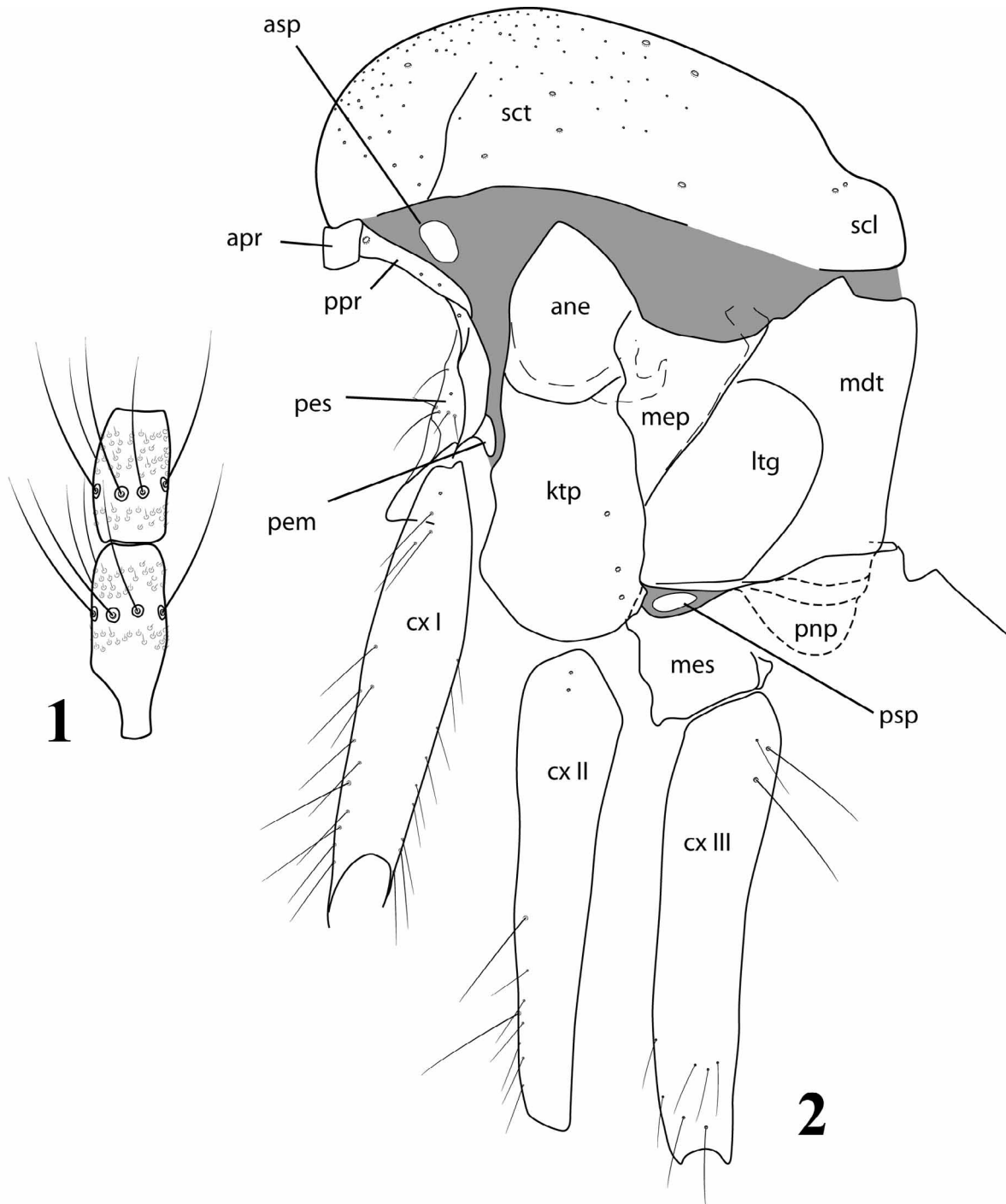
Cycloneura, error for *Cyrtoneura*. Matile 1989:126.

Diagnosis of *Nervijuncta* in the Neotropical Region. Antennal segments cylindrical; gonostyli elongate, blade-like, bearing a long row of short spines along inner margin.

In the Neotropical region, *Nervijuncta* can be promptly differentiated from *Rhipidita* and *Calliceratomyia* based on the antenna and the male terminalia. The flagellomeres in *Nervijuncta* are cylindrical, a plesiomorphic condition in the genus, while both *Rhipidita* and *Calliceratomyia* have flattened flagellomeres, in *Calliceratomyia* pectinate. Also, the gonostyli of *Rhipidita* are short and more or less laterally compressed, while *Calliceratomyia* have slightly more elongated gonostyli, but not blade-like. *Nervijuncta* has in both Neotropical species very long, flat gonostyli, with a long row of inner teeth. In some degree, this is also seen in some Australian species of *Nervijuncta* and in some Nearctic and Palearctic species of *Ditomyia*, but definitely not in *Calliceratomyia* or *Rhipidita*.

Key to the Neotropical species of *Nervijuncta*

1. Eye-bridge complete; wing with a single light mark in the middle of the wing amidst a dark membrane (Fig. 4); gonostyli with a wide basal enlargement (Figs 5-6) (southern and southeastern Brazil) *N. laffooni* Lane
Eye-bridge incomplete; wing with two transverse light markings amidst a dark membrane (Fig 9); gonostyli not conspicuously enlarged basally (Fig. 10-11) (Chile and southern Argentina) *N. conjuncta* (Freeman)



FIGURES 1–2. *Nervijuncta laffooni* (Brazil, Santa Catarina, Urubici), male. **1.** Antennal flagellomere. **2.** Thorax, lateral view. Abbreviations: ane, anepisternum; apr, antepronotum; asp, anterior spiracle; cx, coxa.; ktp, katepisternum; ltg, laterotergite; mdt, mediotergite; mep, mesepimeron; mes, metepisternum; pem, proepimeron; pes, proepisternum; ppr, postpronotum; pnp, postnotal phragma; psp, posterior spiracle; scl, scutellum; sct, scutum.

***Nervijuncta laffooni* Lane, 1952**

(Figs. 1–8)

N. laffooni Lane, 1952: 139 (new name for *N. marshalli* Lane). Type-locality: Brazil, State of São Paulo, Salesópolis, Estação Biológica de Boracéia. Distr. – Brazil (São Paulo, Santa Catarina). Holotype ♂, MZUSP. Ref. – Papavero 1977: 4 (catalogue).

N. marshalli Lane, 1948: 250, figs. 5 (male terminalia), 6 (detail of T9 and cerci), 7 (aedeagus); Lane, 1952: 131 (female) (preocc. Edwards 1927). Type-locality: Brazil, State of São Paulo, Salesópolis, Estação Biológica de Boracéia. Holotype ♂, MZUSP. Ref. – Papavero 1977: 4 (catalogue).

N. marshalli; Lane 1952: 131, error.

Diagnosis. Single light area across middle of wing; distal projection of gonocoxites dorsally less than half length of gonocoxite at midline, with a very long distal setae; gonostyli with a wide basal enlargement.

Material examined. Holotype ♂, Brazil, State of São Paulo, Salesópolis, Boracéia, 14.viii.1947, Rabello, E., Travassos, F. & Lane, J. col. “Alotype” ♀, same data as holotype, but ix.1949, Travassos, E. col. Additional specimens: 1 ♂, Brazil, State of Santa Catarina, Nova Teutônia, 04.x.1970, 27°11’B, 52°23’L, 300–500 m, Plaumann, F. col; 1 ♂, Brazil, State of Santa Catarina, Urubici, Morro Igreja, 18.viii.2005–06.i.2006, Malaise trap, Pinho, L. & Bizzo, L. col. (all specimens at MZUSP).

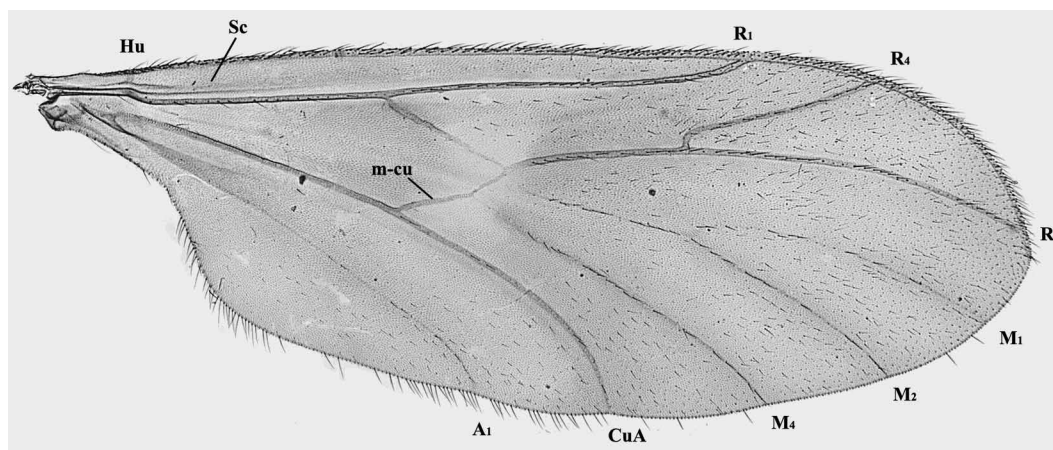


FIGURE 3. *Nervijuncta laffooni* (Brazil, Santa Catarina, Urubici), male wing.

Redescription. Male. Body, 6 mm. Wing, 5 mm. **Color.** Body mostly dark brown, legs and terminalia light brown, yellowish spots basally on abdominal segments. Wings maculate, mostly brownish with a brighter area across middle of wing. **Head.** Clypeus about twice as wide as long, yellowish, covered with scattered, brownish setulae. Frons narrow, yellowish. Eyes large, strongly emarginated above base of antennae, forming a complete eye-bridge; fine setulae among ommatidia. Three ocelli, mid ocellus minute, lateral ocelli displaced ventrally to nearly touch eye margin. Occiput brownish-yellow, covered with scattered brownish setae. Antenna twice as long as thorax; pedicel, scape and base of first flagellomere light yellow, remaining flagellomeres brownish; flagellomeres with a medial, regular whorl of setae each with large sockets (Fig. 1). Maxillary palpus brownish, with three segments, first segment wider, with numerous, scattered sensillae each with large sockets. **Thorax** (Fig. 2). Scutum yellow, with three longitudinal brown stripes, with scattered small setae, some larger setae along the dorsocentral lines. Scutellum brownish, yellowish laterally, with two lateral pairs of longer setae. Pleural sclerites brownish, except for the yellowish pronotum and yellowish band along the dorsal half of the katapisternum; katapisternum with three long setae at posterior margin, other sclerites bare. Antepnotum present as a wide stripe anterior to the mesonotum; postpronotum slender, elongate, with a large anterior seta and two small, posterior setae. Proepisternum and proepimeron slender. Primary anapleural suture complete, curved, katapisternum extending dorsally along anterior margin of the anepisternum. Mesepimeron restricted to the dorsal part of the thorax due to the fusion of the katapisternum posteriorly to the laterotergite; laterotergite relatively small, not protruded, mediotergite nearly straight in lateral view. Metepisternum large, but weakly sclerotized, metepimeron scarcely visible. Postnotal phragma short, just ventral to the mediotergite, well sclerotized. Halter light brownish, a yellowish macula on pedicel. **Legs.** Legs light brown, very long and thin. Fore and mid coxa with elongate setae distally on anterior face, hind coxa with a group of basal posterior setae and some posterior apical setae. Tibiae covered with

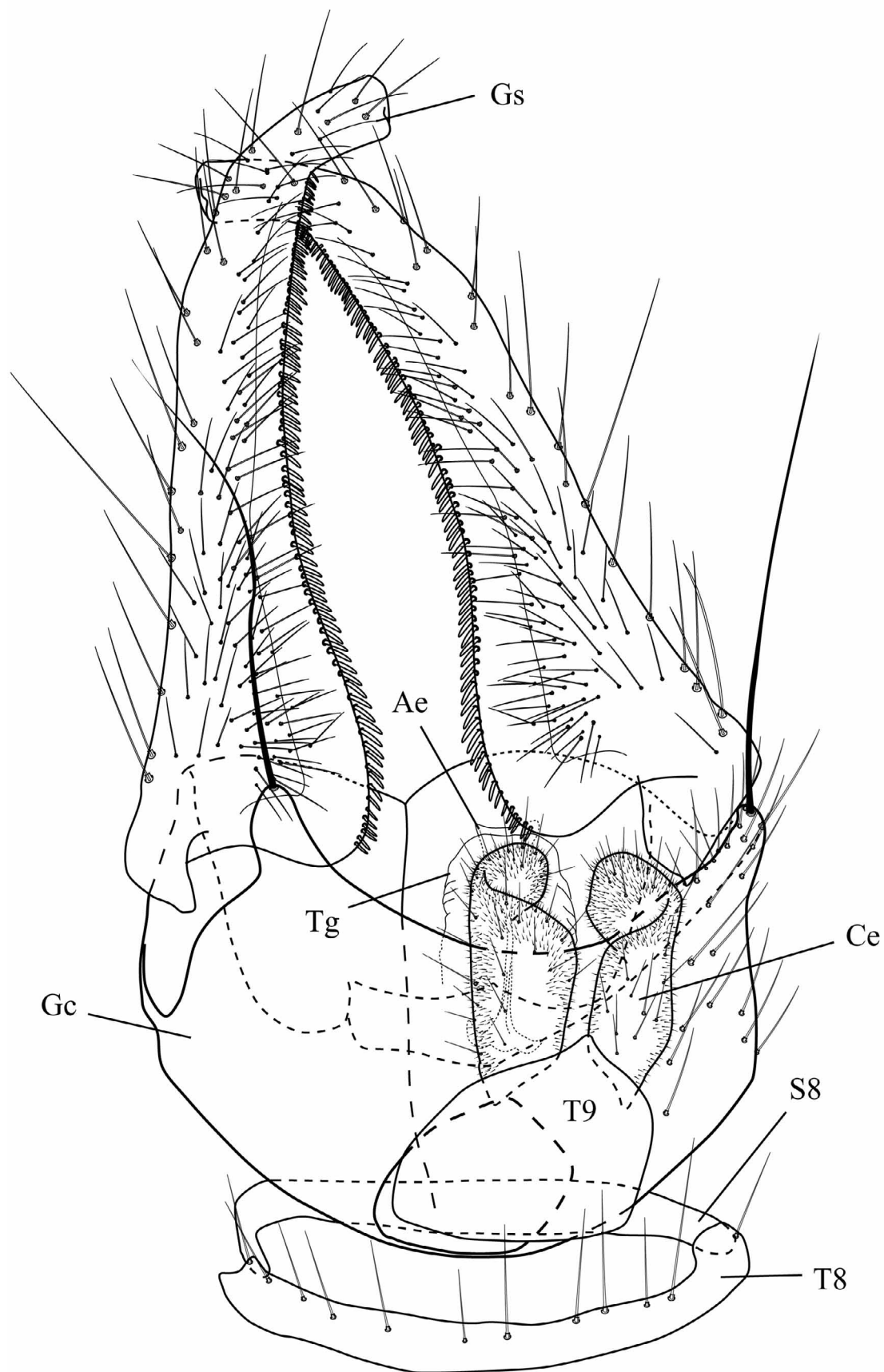
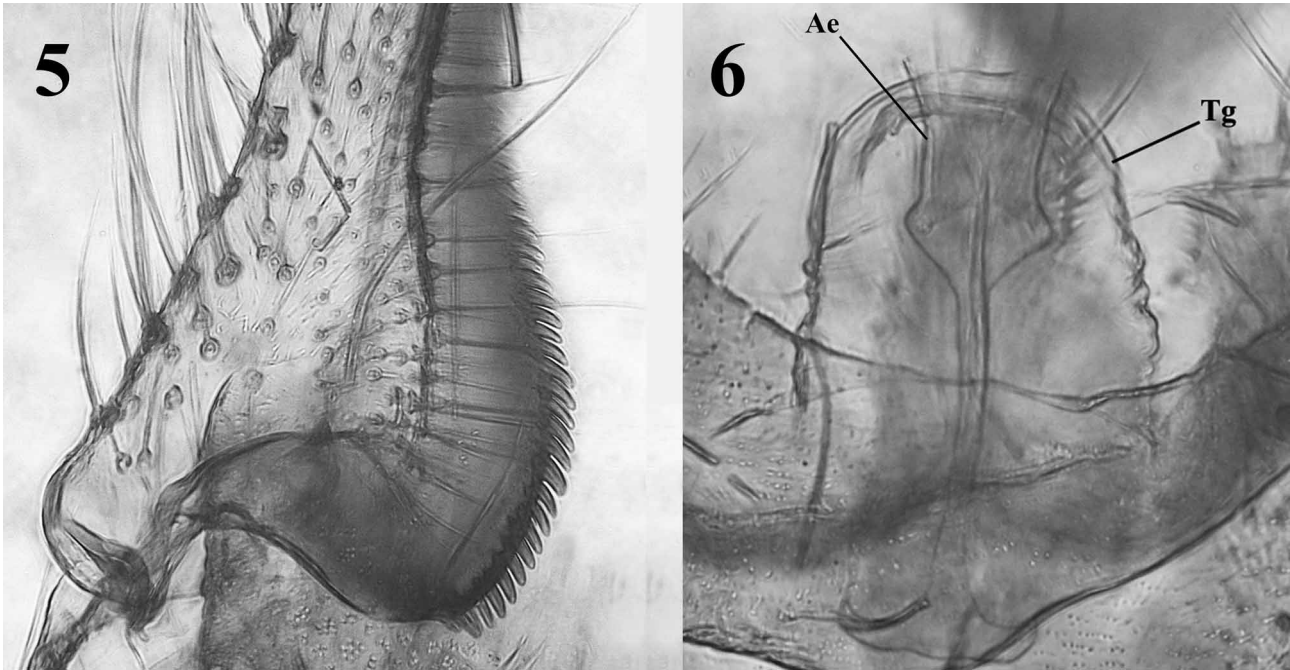


FIGURE 4. *Nervijuncta laffooni* (Brazil, Santa Catarina, Urubici), male terminalia, dorsolateral view. Ae, aedeagus; Ce, cercus; Gc, gonocoxite; Gs, gonostylus; S8, sternite 8; T8, tergite 8; T9, tergite 9; Tg, tegmen.



FIGURES 5–6. *Nervijuncta laffooni* (Brazil, Santa Catarina, Urubici), male. **5.** Detail of gonostylus. **6.** Detail of aedeagus (Ae) and tegmen (Tg).

dark, dense, scattered setae. Front tibial spur almost twice as long as diameter of tibial apex; mid and hind tibial spurs largely unequal in length, the larger one almost twice length of tibial apex, the smaller very short. **Wing** (Fig. 3). Wing brownish, lighter area across middle of wing. Wing membrane covered with macrotrichia on distal two thirds, basal third more setose on anal lobe; microtrichia covering entire wing membrane. C extending beyond apex of R_5 ; Sc incomplete, not reaching origin of R_s ; R_s originating before middle of wing, extending almost straight to point of contact of r-m, distal third of first sector of R_s weakly sclerotized; R_4 originating just before apex of R_1 , not too long, oblique, with an evident angle close to origin; r-m almost absent, base of M_{1+2} almost fused to R_s ; bM entirely absent; M_{1+2} long, medial fork originating just below base of R_4 ; m-cu long, almost longitudinal; CuA clearly curved close to apex; A1 complete. All posterior wing veins with macrotrichia except first sector of R_s , first sector of CuA, M_{3+4} , m-cu, and basal half of A1. M_2 , M_4 and CuA more sclerotized than M_{1+2} , M_1 , and A1. **Abdomen.** Abdomen elongate, segments longer than wide; segments brown with a yellowish basal band on segments II to VII. **Terminalia** (Fig. 4–6). Gonocoxites fused to each other ventrally, forming a syngonocoxite, but also dorsally; a pair of short, distal dorsal projection of gonocoxites about twice as long as the width, ending in a distinctively long bristle. Gonostyli very long and flattened, tapering to the apex, with a curved tip, inner margin blade-like, with a row of about 100 teeth-like spines, slightly separated from each other, base of gonostylus expanded inwards (Fig. 5). Tegmen longer than wider, rugose laterally; aedeagus with a pair of lateral extensions basally, cup-shape at apex (Fig. 6). Tergite 9 small, slightly longer than the width, covering the “opening” left by the dorsal fusion of the gonocoxites; cerci elongated, setose, with a fold at apex forming a distal lobe.

Female. Similar to the male (including size), though lighter markings of mesonotum, halteres and abdominal bands. The allotype is missing the head, so the eye-bridge cannot be verified. **Terminalia** (Fig. 7). Sternite 8 elongated, longer than wide, a deep notch almost dividing sclerite in two, long setae on digitiform projections distally. Tergite 8 well developed. Sternite 9 (vaginal furca) as long as sternite 8, sides of basal extension parallel. Tergite 10 short, sternite 10 not recognizable. Basal segment of cerci short, apical segment short, with apical digitiform projections bearing longer setae.

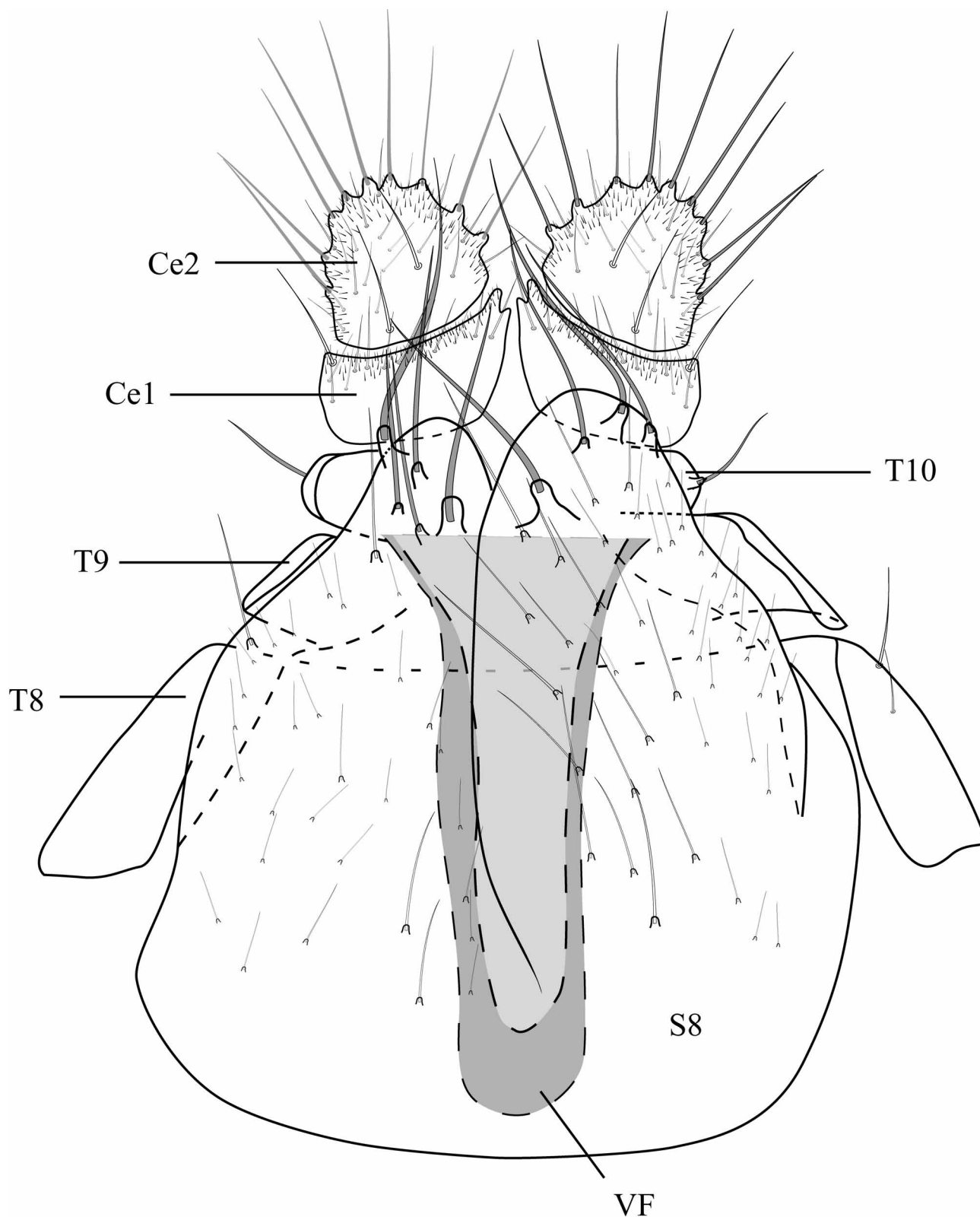


FIGURE 7. *Nervijuncta laffooni*, female (Brazil, São Paulo, Salesópolis). Terminalia, dorsal view. Ce1, basal segment of cercus; Ce2, distal segment of cercus; S8, sternite 8; T8, tergite 8; T9, tergite 9; T10, tergite 10; VF, vaginal furca.

Comments. *N. laffooni* has a single lighter area across the first section of Rs, base of M_{1+2} and base of M_4 , while the only other Neotropical species of the genus, *N. conjuncta*, has two light transverse areas across the wing. The gonostyli in *N. laffooni* are longer than in *N. conjuncta*, wider at the base and thinner at apex. The

distal projections of the gonocoxites dorsal to the insertion of the gonostyli are shorter in *N. laffooni*, than in *N. conjuncta*. The head of the only female specimen of *N. laffooni* is missing, so it is not possible to confirm whether the eye-bridge in females of this species is complete, as in males.

Nervijuncta conjuncta (Freeman), 1951

(Figs. 8–12)

Nervijuncta conjuncta (Freeman), 1951: 7, figs. (1 ♂ terminalia), 297 (wing). Type-locality: Argentina, Rio Negro, Lago Correntoso. Distr. – Argentina (Rio Negro), Chile (Llanquihue, Chiloé). Ref.: Papavero 1977: 4 (catalogue). Holotype ♂, NHM.

Ditomyia conjuncta Freeman, 1951: 7, figs. (1 ♂ terminalia), 297 (wing).

Diagnosis. Two light transverse areas across wing; distal projection of gonocoxites dorsally as long as length of gonocoxite at midline; gonostyli not conspicuously enlarged basally.

Material examined. ♀, Chile, Osorno, Pucatrihue 10.ii.1980, Duret, J.P. col.; ♂, Argentina, Neuquen, Parque Nacional Lanin, 07.x.1971, Duret, J.P. col. (MNHN); ♂, same data, but 09.xi.1971; ♂, same data, but 15.xi.1973 (all specimens of MNHN).

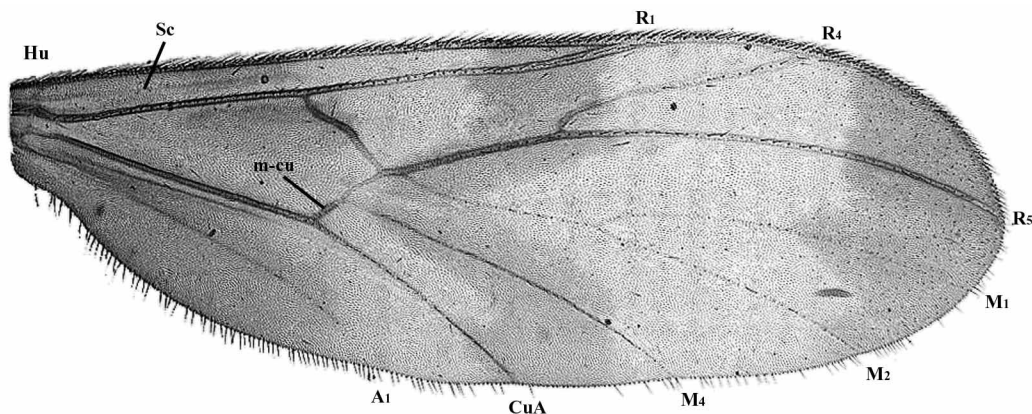


FIGURE 8. *Nervijuncta conjuncta*, male wing (Argentina, Neuquén).

Redescription. Male. Body, 6 mm. Wing, 4 mm. **Color.** Body mostly dark brown, legs light brown, yellowish bands basally on abdominal segments. Wings maculate, mostly brownish, with two brighter areas across the wing. **Head.** Brown, darker around the ocelli; face yellowish; palpi brown, remainder of mouthparts yellow or brownish. Clypeus about twice as wide as long, yellowish. Eyes large, eye-bridge hardly extending above eye; fine setulae among ommatidia. Occiput brownish, covered with scattered brownish setae. Antenna twice as long as thorax; pedicel, scape and base of first flagellomere light yellowish, remaining flagellomeres brownish; flagellomeres covered with brownish setae. Maxillary palpus brownish, with three segments, first segment wider. **Thorax.** Mainly brownish; prothorax yellowish; Scutum yellow, with three longitudinal brown stripes, yellowish laterally, anteriorly to wing base, scattered small setae, some larger setae along the dorsocentral lines; small setae scattered on the scutum; some larger setae along the dorsocentral lines. Scutellum brownish, yellowish laterally, with two strong scutellar bristles. Pleural sclerites brownish, except for the yellowish pronotum and yellowish band along the dorsal half of the katepisternum; katepisternum with three long setae at posterior margin, other sclerites bare. Antepronotum present as a wide stripe anterior to the mesonotum; postpronotum slender, elongate, with a large anterior seta and two small, posterior setae. Proepisternum and proepimeron slender. Primary anapleural suture complete, curved, katepisternum extending dorsally along anterior margin of the anepisternum. Mesepimeron restricted to the dorsal part of the thorax due to the fusion of the katepisternum posteriorly to the laterotergite; laterotergite

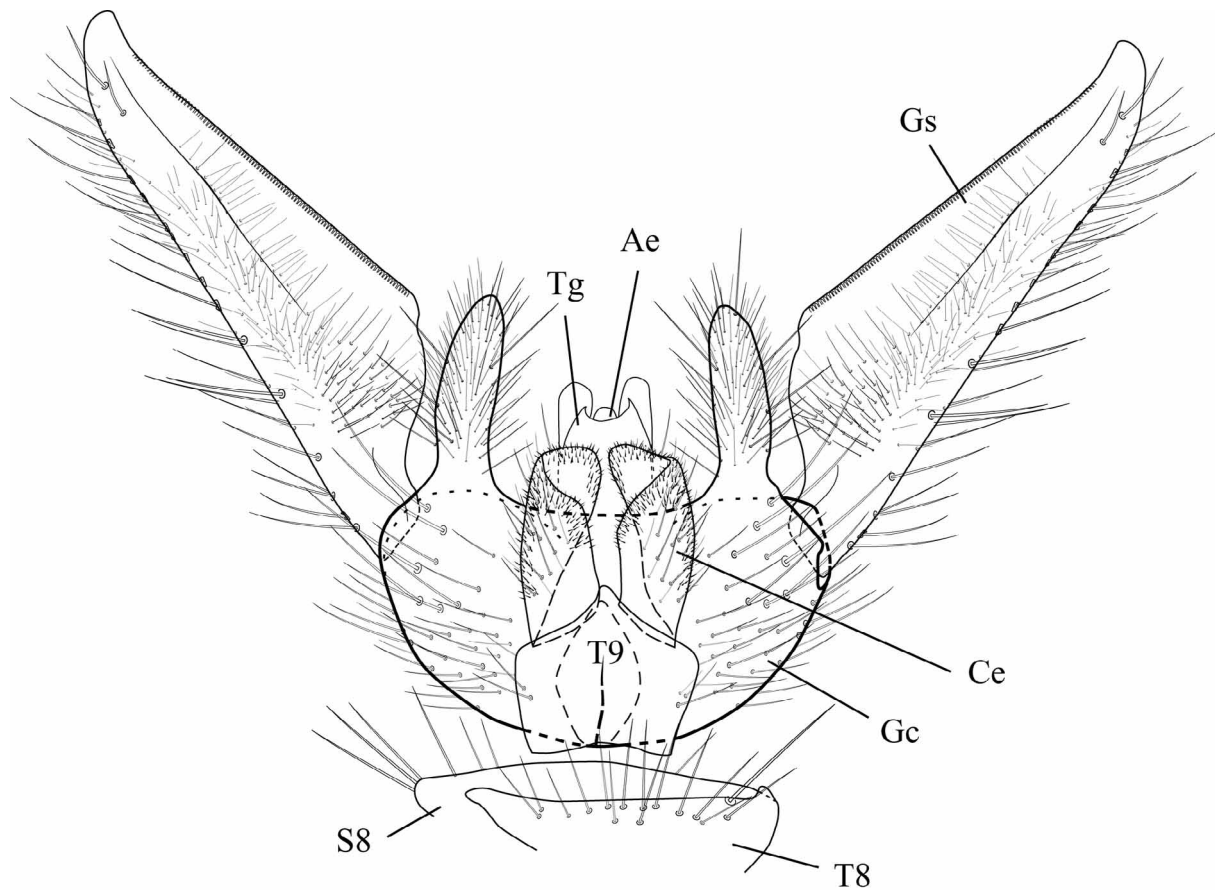
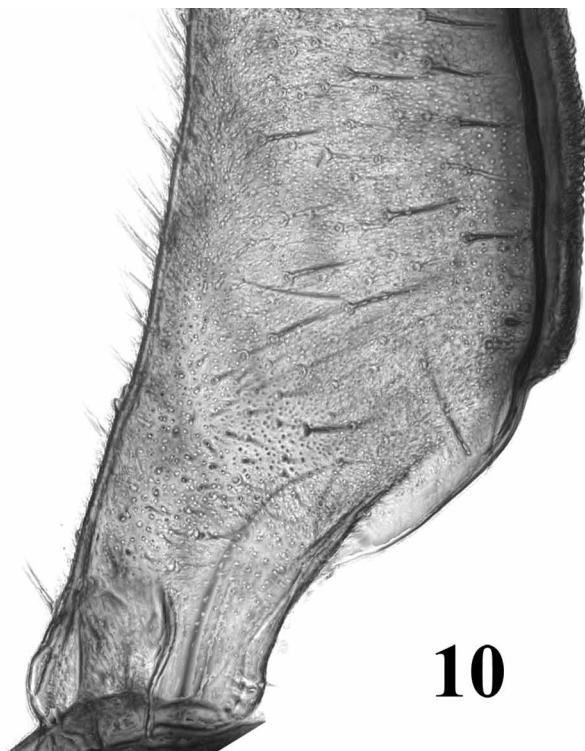
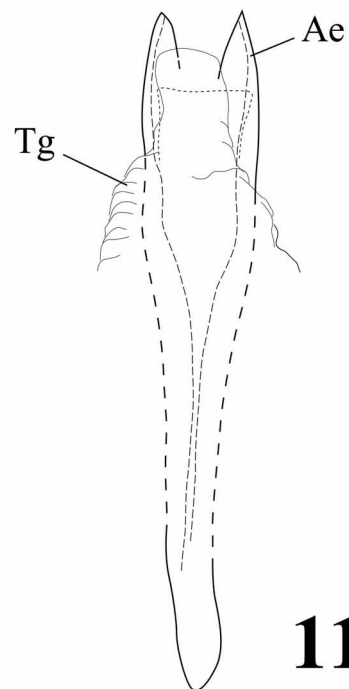


FIGURE 9. *Nervijuncta conjuncta*, male terminalia (Argentina, Neuquén). Dorsal view. Ae, aedeagus; Ce, cercus; Gc, gonocoxite; Gs, gonostylus; S8, sternite 8; T8, tergite 8; T9, tergite 9; Tg, tegmen.



10



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FIGURES 10–11. *Nervijuncta conjuncta*, male (Argentina, Neuquén). **10.** Detail of gonostylus. **11.** Detail of aedeagus (Ae) and tegmen (Tg), dorsal view.

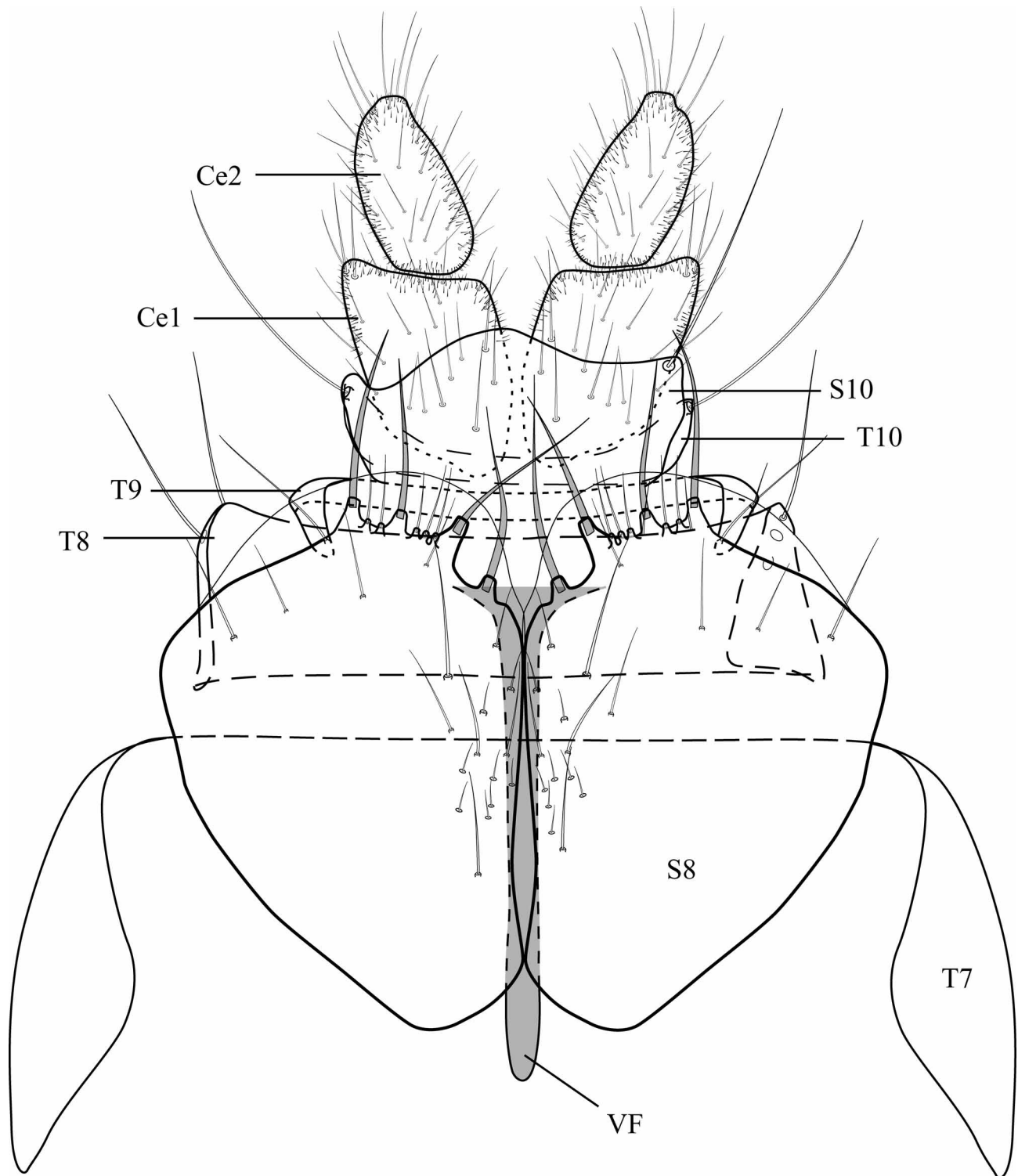


FIGURE 12. *Nervijuncta conjuncta*, female terminalia (Chile, Osorno, Pucatrihue). Ventral view. Ce1, basal segment of cercus; Ce2, distal segment of cercus; S8, sternite 8; T8, tergite 8; T9, tergite 9; T10, tergite 10; VF, vaginal furca.

relatively small, not protruded, mediotergite nearly straight in lateral view. Metepisternum large, but weakly sclerotized, metepimeron scarcely visible. Postnotal phragma short, just ventral to the mediotergite, well sclerotized. Halter light brownish, a yellowish macula on pedicel. Halter entire yellowish. **Legs.** Legs light brownish, very long and thin. Fore coxa yellowish and with elongate setae distally on anterior face; mid coxa with a group of basal anterior setae and hind coxa with a group of lateral setae. Tibiae covered with dark, dense, scattered setae. Front tibial spur almost twice as long as diameter of tibial apex; mid and hind tibial

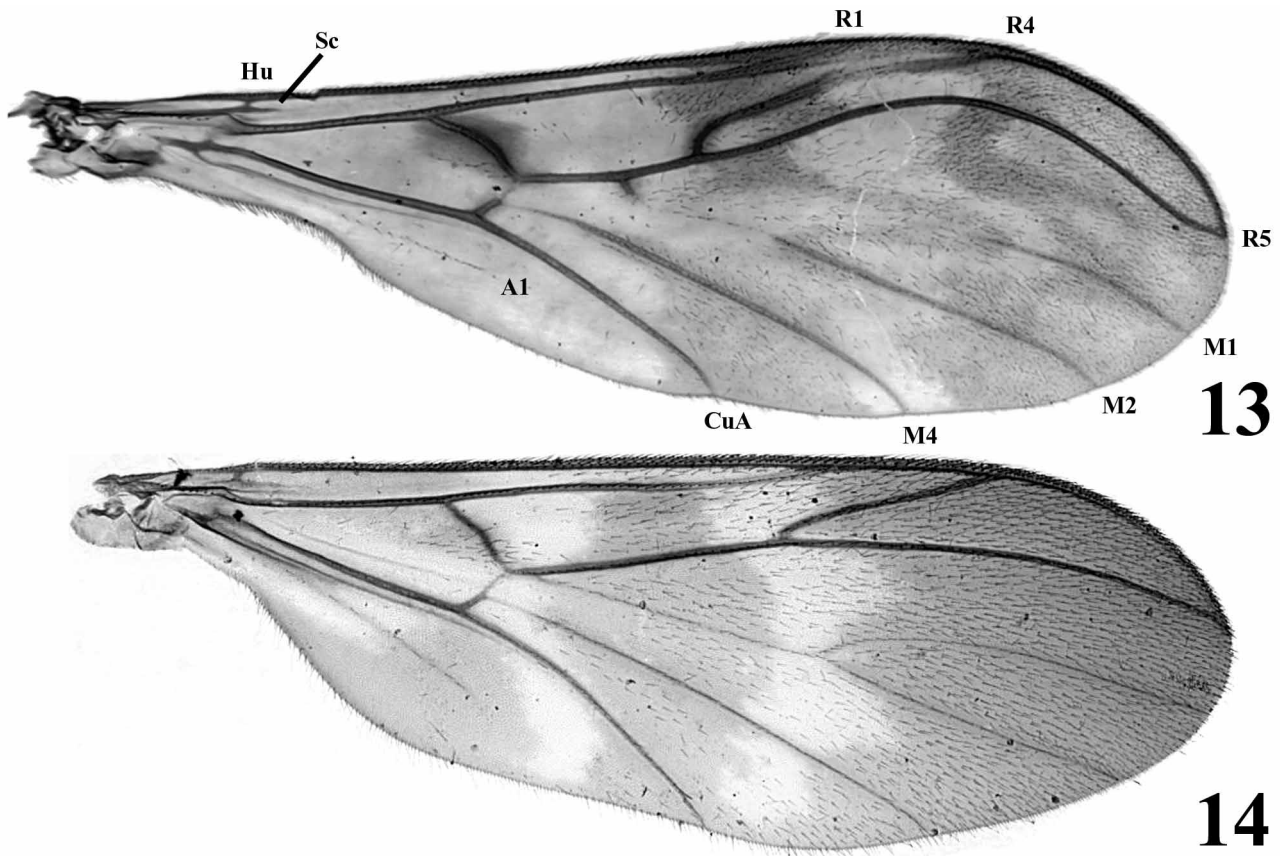


FIGURE 13–14. Wings of New Zealand species of *Nervijuncta*. **13.** *N. wakefieldi* Edwards (New Zealand, Governor’s Bay). **14.** *N. nigrescens* Marshall (New Zealand, Raetihi Hill).

spurs largely unequal in length, the larger one almost twice length of tibial apex, the smaller very short. **Wing** (Fig. 8). Wing brownish, two light transverse areas across the wing. Wing more densely covered with macrotrichiae on distal half, with macrotrichiae also on anal lobe; microtrichiae covering entire wing membrane. C extending very shortly beyond apex of R_5 ; Sc incomplete, not reaching level of origin of R_s ; R_s originating at basal third of wing; first sector of R_s short, sinuose, well sclerotized; R_4 long, originating basally to medial fork, oblique, without clear angle close to origin; r-m absent, base of M_{1+2} clearly fused to R_s ; bM entirely absent; M_{1+2} long, medial fork originating slightly basal to apex of R_1 ; m-cu long, almost longitudinal; CuA clearly curved close to apex; A_1 very faint at apex. All posterior wing veins with macrotrichia except first sector of R_s , basal half of first sector of CuA, M_{3+4} , m-cu, and basal third of A_1 . M_2 , M_4 and CuA more sclerotized than M_{1+2} , M_1 , and A_1 . **Abdomen.** Brown, apices of segments obscurely pale; Abdomen elongate, segments wider than long; segments brown with a yellowish basal band on segments II to VII. **Terminalia** (Fig. 9–11). Gonocoxites fused to each other ventrally, forming a syngonocoxite, but also dorsally, distal dorsal projection of gonocoxites about three times the width, no distinctive distal bristle. Gonostyli long and flattened, thinner at apex, but not blunt, inner margin blade-like, with a row of about 100 teeth-like spines, slightly separated from each other, base of gonostylus not expanded inwards (Fig. 10). Tegmen longer than wide; aedeagus with no lateral expansions at base, with an irregular shape at apex (Fig. 11). Tergite 9 small, weakly sclerotized, slightly longer than wide, covering the “opening” left by the dorsal fusion of the gonocoxites; cerci longer than tergite 9 and folded.

Female. Similar to male (including size). **Terminalia** (Fig. 12). Sternite 8 slightly wider than long, medial distal notch entirely dividing sternite into two separate sclerites, individual digitiform projections distally with either long or short setae. Tergite 8 well developed. Sternite 9 (vaginal furca) extending anteriorly slightly

beyond base of sternite 8, parallel sides, very slender. Tergite 10 short, sternite 10 wide, quite membranous. Basal and distal segments of cerci elongate, longer setae not on digitiform projections.

Comments. The species was originally described in *Ditomyia* and the first time it appears as a *Nervijuncta* species was in the catalogue of the family in the Neotropical Region (Papavero 1977), but without indicating that it was a new combination. For the differences with *N. laffooni*, see above.

Discussion

Some of the species of *Ditomyia*, as *D. fasciata* Meigen, illustrated by Blaschke-Berthold (1994), have gonostyli quite similar to that found in several of the *Nervijuncta* species, such as *N. conjuncta*. On the other hand, the species that run in Tonnoir & Edwards's (1927) key into couplet 2 (under the name "*Arctoneura*") have the distal part of M_1 stronger and darker, which may compose a clade within the genus. Most of these species also have R5 strongly curved towards the wing margin close to the apex, e.g., as in *N. wakefieldi* Edwards (Fig. 13), as well as gonostyli with very apomorphic shapes (Tonnoir & Edwards 1927, Figs. 140, 153). The blade-like shape of the gonostyli of *N. conjuncta* and *N. laffooni*, with a regular row of spines along the inner margin, is somewhat similar to some of the species of *Ditomyia*, such as *D. fasciata*, and to *Asioditomyia japonica* (Sasakawa). The Neotropical species of *Nervijuncta*, however, share with the type-species of the genus and other similar New Zealand species the dorsal extension of the gonocoxites distally (e.g., in *N. ruficeps*, *N. longicauda* and *N. tridens*; Tonnoir & Edwards 1927, Figs. 137, 139, and 145, respectively), as well as some features of the wing venation (e.g., *N. nigrescens* Marshall; Fig. 14). A better understanding of the relationships within the genus and of its relationship with *Ditomyia*, however, as already stated by Matile (1988: 141), cannot be achieved without a formal phylogenetic study of the genus.

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