

A new genus of Microphorinae (Diptera Empidoidea) from New Zealand

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Abstract

Chimerothalassius, a new genus of empidoid flies in the subfamily Microphorinae, is described from New Zealand. It is actually monotypical with *Ch. ismayi* spec. nov. as type species. Although *Chimerothalassius* belongs to the tribe Parathalassiini it possesses a number of unique features for the Microphorinae on the whole. Phylogenetic relationships of the new genus with fossil and extant genera are discussed.

Keywords: Empidoidea, Microphorinae, Parathalassiini, new genus, new species, New Zealand.

Introduction

The subfamily Microphorinae (or family in some previous papers) is considered to form together with Dolichopodidae a separate lineage within the Empidoidea (HENNIG, 1971; CHVÁLA, 1981, 1983; ULRICH, 1991; GRIMALDI & CUMMING, 1999). This conclusion is mainly based on the structure of male and female terminalia. In Microphorinae + Dolichopodidae lineage the male terminalia is lateroflexed to the right, inverted and with caudal pole directed forward (ULRICH, 1988) and female tergite 10 and sternite 10 are articulated (SINCLAIR, 1995). The subfamily comprises presently seven extant and six Cretaceous fossil genera, which are united into the tribe Microphorini and Parathalassiini (CUMMING & BROOKS, 2002). Representatives of this group are known in all Biotic Regions except for the Neotropics. There are no Microphorinae species recorded from New Zealand. Here we described a new genus, with one new species, from the coast of New Zealand.

Material and methods

This study is based on Diptera material housed in the Entomology Department of the Royal Belgian Institute of Natural Sciences, Brussels (RBINS). Terms used for adult structures primarily follow those of MCALPINE (1981), although the terminology for the antenna is taken from STUCKENBERG (1999). Homologies for the male terminalia follow SINCLAIR (2000). To facilitate observations, some parts of the body were macerated in hot 10% KOH or 85% lactic acid (terminalia) and immersed in glycerine. Drawings of morphological features were made with a camera lucida attached to a compound microscope.

In describing the hypopygium, "dorsal" and "ventral" refer to morphological position prior to genital rotation and flexion. Figures showing the male genitalia in lateral view are oriented as they appear on the intact specimen (rotated and lateroflexed to the right), with the morphologically ventral surface up and dorsal surface down. Due to inconspicuous setation of this very small flies the term "bristle" is mainly used for differentiated large setae on the head, mesonotum, and legs bearing a particular name or one of a series with a particular name (e.g. notopleural bristle, dorsocentral bristle, ocellar bristle).

To illustrate the hypothesised phylogenetic relationships of the new genus a cladistic analysis was performed using the program NONA (GOLOBOFF, 1999). WINCLADA (NIXON, 1999) was used to edit the matrix and to import characters into NONA. The data matrix (Table 1) included 11 morphological

Table 1. Character state matrix for Microphorinae + Dolichopodidae lineage.

| Genera | Characters | | | | | | | | | | |
|--------------------------|------------|---|---|---|---|---|---|---|---|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| <i>Apalocnemis</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Microphor</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| <i>Schistostoma</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| <i>Parathalassius</i> | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| <i>Microphorella</i> | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| <i>Plesiothalassius</i> | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| <i>Amphithalassius</i> | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| <i>Thalassophorus</i> | 1 | 1 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 1 | 1 |
| <i>Chimerothalassius</i> | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| Dolichopodidae | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |

Characters: 1. Margins of eyes: emarginate near antennae (0), not emarginate (1). 2. Stylus: 2-segmented (0), 1-segmented (1). 3. Palpus: elongate, not appressed to labrum (0), shortened, appressed to labrum (1). 4. Precoxal bridge: incomplete (0), complete (1). 5. Costal vein vestiture: setose (0), with 1 row of spinules (1), with 2 rows of spinules (2). 6. Vein bm-cu: complete (0), incomplete or absent (1). 7. Male tergite 8: present (0), absent (1). 8. Male terminalia: not lateroflexed to right (0), lateroflexed to right (1). 9. Male genitalia size: compact (0), hypertrophied (1). 10. Female tergite 8 structure: undivided or cleft (0) divided (1). 11. Female tergite 10 vestiture: with spines (0), with setae (1).

characters compiled for 8 extant genera of Microphorinae, plus ground plan states for the Dolichopodidae. All characters were coded as binary, except character 5 (costal vein vestiture) which was treated as an unordered multistate character. Representatives of *Parathalassius* MIK, *Microphorella* BECKER and *Thalassophorus* SAIGUSA were examined to determine character state distributions. The character states listed for *Plesiothalassius* and *Amphithalassius* were extracted from the descriptions of the genera by ULRICH (1991). The genus *Apalocnemis* PHILIPPI (Trichopezinae) was chosen as the outgroup since it was already used to root the cladogram in previous analyses (SINCLAIR, 1995; CUMMING & BROOKS, 2002).

Chimerothalassius gen. nov.

Type species. *Chimerothalassius ismayi* spec. nov. Monotypic.

Etymology. *Chimaera*, Lat. Monster - in reference to the traits of the genus that includes many unique features for Microphorinae; - *thalassius*, a common suffix for generic names of microphorines living on the seashore.

Gender. Masculine.

Diagnosis. Antennae inserted somewhat above middle of head, with 1-segmented stylus; eyes dichoptic in both sexes, covered with distinct ommatrichia; anterior frontal-orbitals and anterior ocellars lateroreclinate; palpus long, clavate; precoxal bridge complete, narrow; anepisternum with 4 short setae; fore coxa at least with 1 very long, spine-like, basal seta, tarsomere 5 of all legs with dorsal apical finger-like process; crossvein bm-cu complete, discal cell absent (crossvein m-cu entirely absent).

Description. Head broader than thorax in dorsal view, rather subglobular in lateral view (Fig. 1). Occiput moderately rounded, not far projecting beyond hind margin of eye, with upper median part, behind vertex, weakly concave; neck inserted above middle of head. Ocellar triangle weakly prominent. Eyes dichoptic in both sexes, entirely covered with uniform, distinct ommatrichia, with inner margins somewhat emarginate near antennae; ommatidia large, uniform. Face narrow, clypeus small, weaker sclerotized than upper face. Bristles of head mostly well-differentiated; 2 lateroreclinate anterior frontal-orbitals (very close to base of antennae), 2 lateroreclinate anterior ocellars, 2 proclinate postocellars, 2 proclinate outer-verticals and 2 short proclinate inner-verticals; posterior ocellars undifferentiated, several setulae present; sometimes 2 additional short laterocline frontal-orbital bristles situated just behind anterior frontal-orbitals. Postocular occipital bristles arranged in 1 more or less regular row in upper part, lower part of occiput (including postgena) covered with very long dense setae. Antennae (Fig. 2) inserted somewhat above middle of head in profile; scape short, subtubular, bare (except microtrichia); pedicel subglobular, ringed with cirlet of long dorsal bristles; postpedicel bulbous. Stylus apical, arista-like, 1-segmented, with short basal part somewhat thickened, jointed distinctly with postpedicel, whip-like in subapical portion, microsetulose, with setulae in apical part longer than

width of arisal trunk, bearing sensory pit in subbasal part, lacking secondary sexual adornments. Proboscis short, well visible, pointing downward. Palpus (Figs 3-4) lacking palpifer, long, clavate, bearing several bristles of different length and dorsal papilla-like setae, basal sensory pit lacking. Labellum well developed, small, with long setae and spinule-like setulae along upper margin; stipes long, slender; labrum and hypopharynx arched posteriorly; 6 pairs of pseudotracheae present, with walls weakly sclerotized (Figs 5-8). Genae moderately broad.

Thorax with mesoscutum moderately arched, prescutellar depression well prominent. Prosternum fused with proepisternum (prothoracic precoxal bridge complete) (Fig. 9). Anteppronotum weakly developed, bearing 2 very short setae. Postpronotal lobe distinct, with 1 short bristle and 1-2 setulae. Scutum unicolorous. Mesonotum elongate, trapezium-like (viewed dorsally), with short bristles. Dorsocentrals 1-serial, about 7 per row, rather short, mostly of subequal length (1 pair near suture and prescutellars longer), lacking accessory setulae. Acrostichals very short, scattered, prominent in presutural part of scutum only, arranged in 2 more or less regular rows. Anepisternum with 4 short setae arranged in 1 more or less regular row posteriorly (Fig. 10).

Legs moderately long. Fore leg appearing raptorial in female (Figs 11-12). Fore tibia lacking tibial gland. Tarsomere 5 of all legs somewhat flattened dorsoventrally and with dorsal apical finger-like process (Fig. 13). Fore coxa at least with 1 very long spine-like basal seta anteriorly. Tarsal claws, pulvilli and setiform empodium well developed on all legs; tarsal claw shorter than apical width of tarsomere 5; pulvilli short and broad; empodium slender, with ventral pubescence.

Wing moderately broad, nearly 3.0 times longer than wide (Fig. 15); entirely covered with minute microtrichia (including veins); with anal lobe greatly reduced; alula absent. Basal section of costa with 2-3 short and 1 longer bristles; additionally, costa bearing 1 row of spinules mixed with ordinary setae along anterior margin and entirely ciliate along posterior margin. Pterostigma (or stigmatic sclerotization) lacking. Costa circumambient, distinct throughout. All longitudinal veins complete, distinctly reaching wing margin. Sc very close to R_1 , reduced to fold in its apical section, ending in costa. Rs in basal 1/5 of wing, short, with 2 branches. R_1 not thickened, moderately long, extended to about midpoint of wing, somewhat arcuate. R_{2+3} straight, ending nearer to wing apex. R_{2+3} and R_{4+5} subparallel. R_{4+5} unforked, ending near wing-tip. R_{4+5} and M_1 somewhat divergent near wing-apex. M unforked (M_2 lacking). CuA_2 reflexed. A_1 reduced to short fold. A_2 present on posterobasal margin of wing. Crossvein h almost opposite to base of Rs. Short r-m crossvein present, in basal 1/5 of wing, perpendicular to longitudinal veins. Crossvein bm-cu complete. Cell dm absent (crossvein m-cu entirely absent). Cells br, bm and cup in basal 1/5 of wing. Cell br slender, longer than cells bm and cup. Cells bm and cup subequal in length but cell bm broader than cell cup. Cell cup narrow.

Abdomen rather short and broad, with tergites lacking conspicuous posteromarginal setae. Abdominal muscle plaques present, distinct. Male with

segments 1-4 symmetrical, forming preabdomen, bearing ordinary setulae. Postabdomen spirally contorted, segments 5-7 (segment 5 very weakly) confined to left side forming cavity to place hypopygium (Fig. 16), segments 6-8 stronger sclerotized; sternites 5 and 6 lacking processes, with ordinary setulae; tergite 7 with 1 posterolateral seta, sternite 7 bare. Sternite 8 moderately large, subrectangular, lying at hind end exposed ventrolaterad, covered with numerous long setae; tergite 8 reduced to very narrow sclerite; foramen unformed. Hypopygium (Fig. 17) lateroflexed to right, inverted and with caudal pole directed forward, asymmetrical, small. Hypandrium long, more or less truncate at apex, with short lateral accessory processes, bare (except microtrichia). Epandrium (Figs 18-19) entirely separated from hypandrium, with ventral processes. Postgonites (Fig. 21) present, long, well sclerotized (especially right one), of complicated structure. Phallus tubular, more or less smoothly arcuate, directed downwards, with cup-shaped tip, closely associated in basal part with narrow and rather long process of uncertain homology (Fig. 20); ejaculatory apodeme subrectangular. Proctiger modified; cerci small, weakly sclerotized (Fig. 22). Bacilliform sclerite extending beyond phallus. Female with segments 1-5 forming preabdomen into which posterior segments are entirely retracted and usually only cerci visible. Sternite 8 fused with tergite 8 posteriorly, tergite 8 paired; tergite 10 fused with sternite 10, tergite 10 cleft posteriorly, with 3 long bristles on each side, lacking microtrichia (Figs 23-25). Cerci rather broad, well-sclerotized, bearing several ventral setae of different length. Spermatheca tubular, with receptacle hemispherical, strongly pigmented, black; middle part of spermathecal duct broadened, finely pigmented, with tracheae-like surface (Fig. 26).

Comments

The new genus can be readily distinguished from all other extant and fossil genera by a set of characters given above in the diagnosis. Many of them are unique among Microphorinae. For instance, this could be attributed to a greatly modified chaetotaxy of the palpus, anepisternal setae, apical finger-like process on tarsomere 5 of all legs, subbasal spine-like setae on fore coxa and a great sexual dimorphism.

Chimerothalassius lacks cell dm (crossvein m-cu entirely absent) and M_2 . This feature is only known in the fossil genus *Retinitus* described from the Upper Cretaceous of Siberia (NEGROBOV, 1978). *Retinitus* differs primarily from *Chimerothalassius* by bare eyes, incomplete costa and Sc fused with R_1 .

Chimerothalassius ismayi spec. nov.

(Figs 1-26)

Type material: Holotype male, New Zealand: S Birdlings Flat, beach, swept from stony beach, 12.XI.1986, leg. J.W. ISMAY.

Paratypes: 7 males, 14 females, same data as in holotype. All housed in the Collection of RBINS, Brussels.

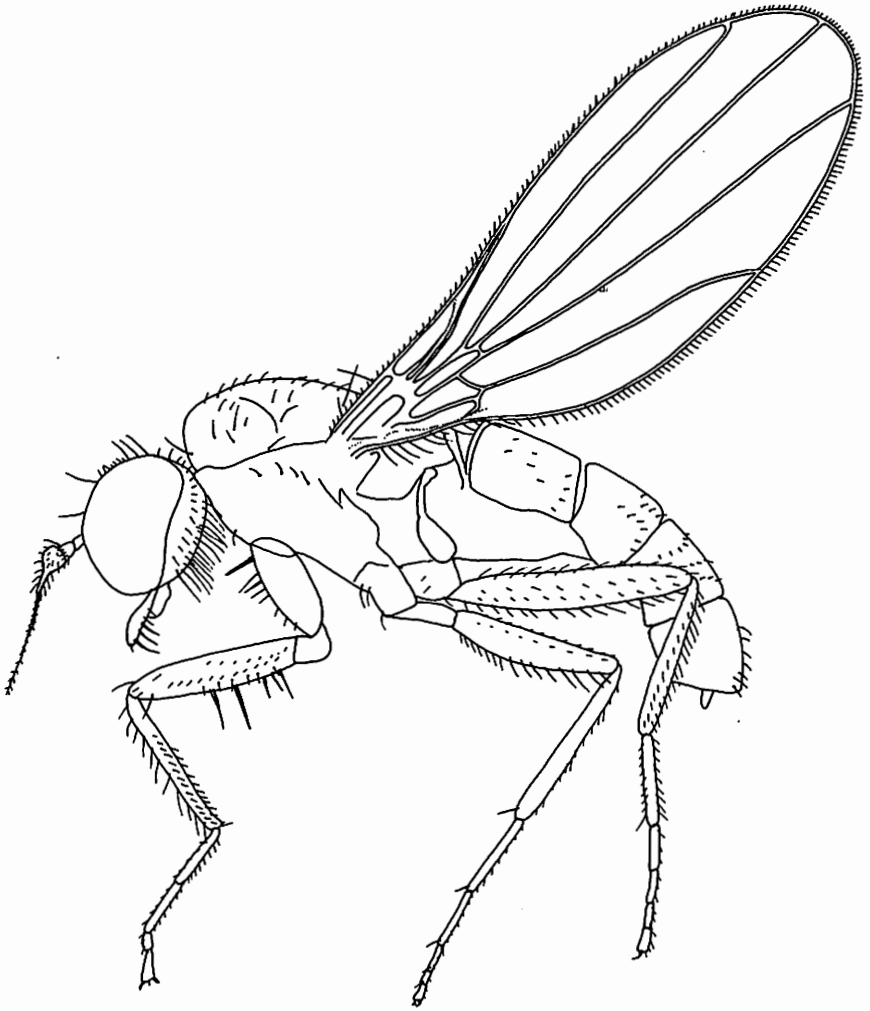
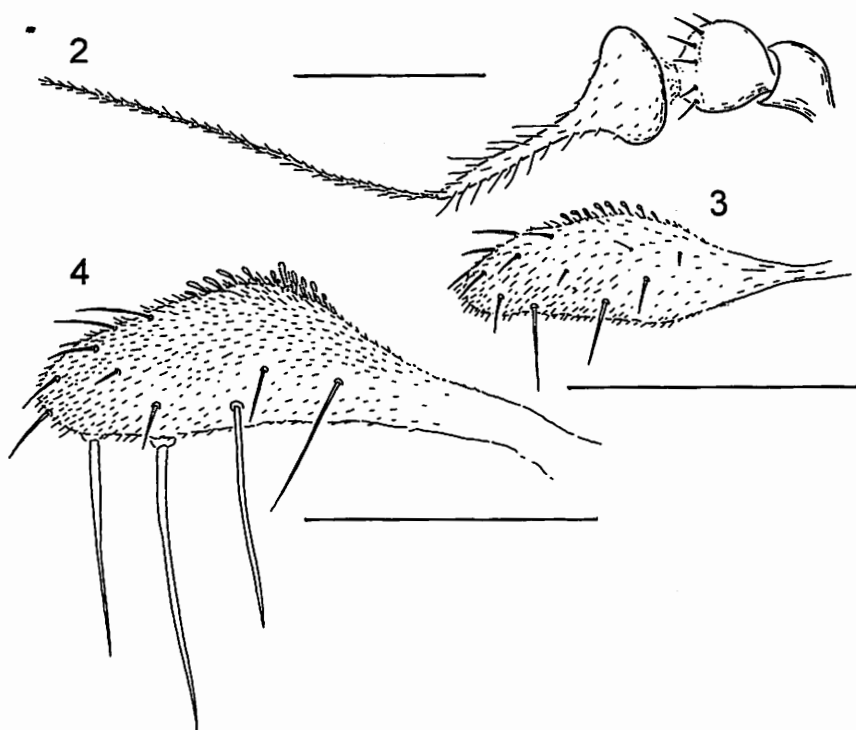


Fig. 1. *Chimerothalassius ismayi* sp. n. Habitus, female.

Diagnosis. As in genus.

Description. Male body length 1.2-1.3 mm, wing length 1.2-1.3 mm. **Head** black in ground-colour, with dark green tinge, densely grey pollinose; face (including clypeus) paler pollinose. Frons long, broad, triangularly widening above. Face almost parallel-sided, somewhat widened below, nearly as broad as half distance between posterior ocelli. Bristles of head mostly black; lower part of occiput (including postgena) covered with pale setae. Antenna with scape and pedicel reddish brown, postpedicel and stylus brown; postpedicel nearly 2.0 times broader than long, abruptly tapered, bearing rather long setulae in apical part. Stylus nearly 2.0 times longer than postpedicel.

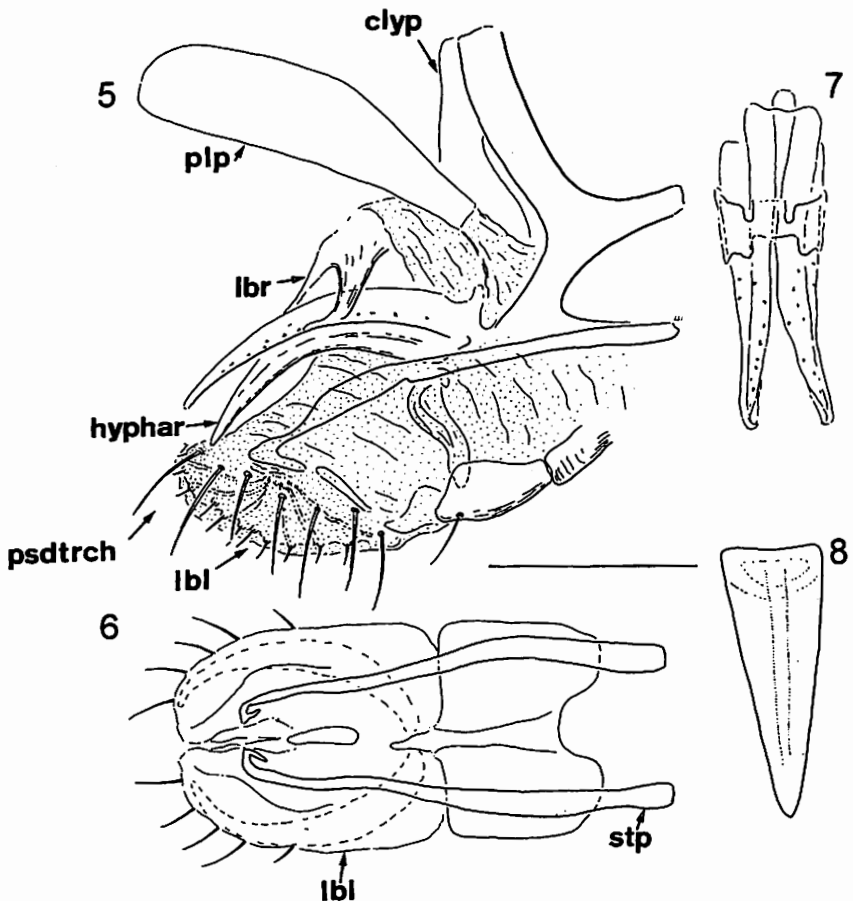


Figs 2-4. *Chimerothalassius ismayi* sp. n. 2: antenna, male, dorsal view; 3-4: palpus, lateral view; 3: male, 4: female. Scale bar: 0.1 mm.

Proboscis wholly brown. Palpus largely yellow (often darkened at apex), clothed in microtrichia, bearing several ventral bristles of different length (longest one nearly as long as palpus is broad) and dorsal papilla-like setae.

Thorax black in ground-colour, with dark green tinge, densely grey pollinose, with black setation. Proepisternum with 2 setae. Mesonotum with 1 presutural supra-alar, 1 short postsutural supra-alar, 2 notopleurals, 1 post-alar and 2 very long inclinate scutellars; additionally, upper part of vertical anterior surface of scutum with one pair of setulae, 1-2 setulae present on postalar callus, 1 rather long seta present laterad of postpronotal lobe, space between acrostichal bristles and scutal margin with numerous setulae arranged in 2 more or less regular rows. Thoracic spiracles black.

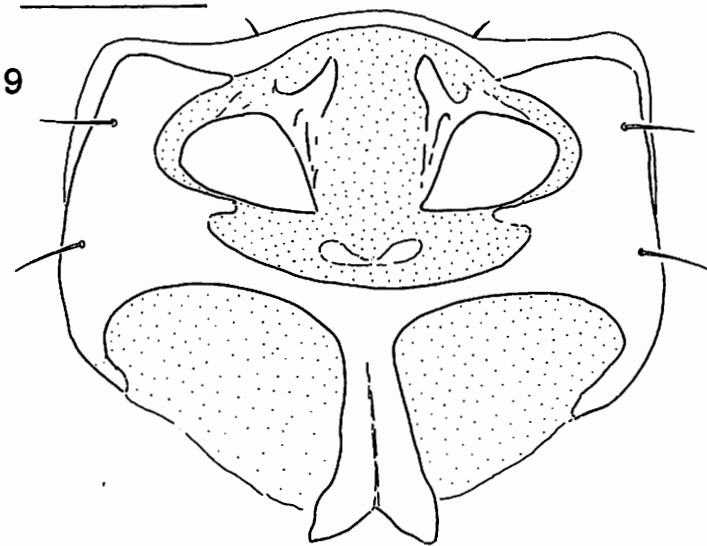
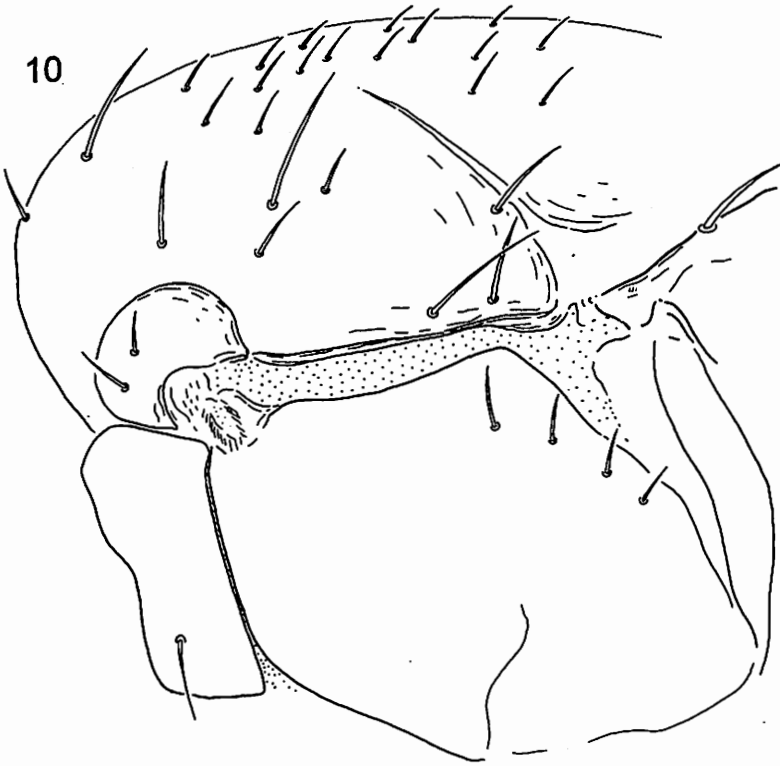
Legs subshining, largely yellow; fore coxa in extreme base, mid and hind coxae in basal part and tarsomere 5 of all tarsi darkened. Fore coxa 1.7-1.9 times longer than mid coxa. Femora rather slender, fore and hind femora subequal in thickness, both broader than mid femur. Fore tibia somewhat thickened, mid and hind tibiae slender. Fore coxa with 1 very long spine-like basal seta and scattered setulae anteriorly, mid and hind coxae and trochanters of all legs with ordinary setae. Fore femur with 1 row of postero- and 1 row of anteroventral setae becoming longer toward apex; mid and hind femora with



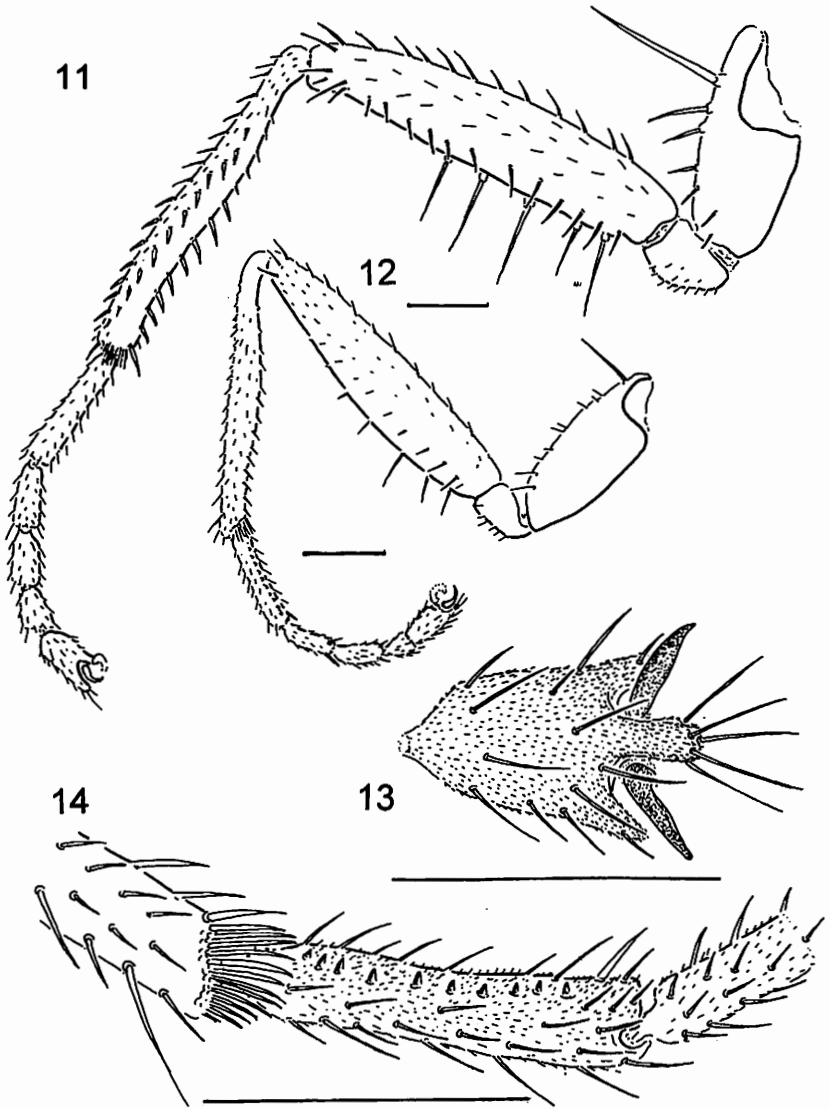
Figs 5-8. *Chimerothalassius ismayi* sp. n. 5: mouthparts, female, lateral view; 6: same, dorsal view; 7: labrum, dorsal view; 8: hypopharynx, dorsal view.

Abbreviations: cerc = cercus, clyp = clypeus, epand = epandrium, hypd = hypandrium, hyphar = hypopharynx, lbl = labellum, lbr = labrum, pgt = postgonite, ph = phallus, plp = palpus, psdtrch = pseudotrachea, stp = stipes, sur = surstylus, S = sternite, T = tergite.

similar shorter setae; additionally, some prominent short setae present on all femora near apex and dorsally; longest setae on femora at most as long as corresponding femur is wide; otherwise femora clothed in inconspicuous setulae. Fore tibia with very distinctive anterior apical comb and 1 spine-like ventral preapical seta; mid tibia with several setae around apex, including 1 longest ventral preapical one; hind tibia with posterior apical comb and 1 ventral apical seta; all tibiae with somewhat longer dorsal setae; otherwise tibiae clothed in inconspicuous setulae. Fore tarsomere 1 with 1 row of ventral spinules (Fig. 14); hind tarsomere 1 with posterior apical comb and 1 short ventral apical spine; tarsomeres 1-4 of all legs with more or less prominent



Figs 9-10. *Chimerothalassius ismayi* sp. n. 9: prothoracic pleurosternal region, female, anterior view; 10: details of thorax, lateral view.



Figs 11-14. *Chimerothalassius ismayi* sp. n. 11: fore leg, female, anterior view; 12: fore leg, male, anterior view; 13: fore tarsomere 5, female, dorsal view; 14: fore tarsomere 1, male, anterior view.

subapical spinule-like setae; process of tarsomere 5 bearing several long setae.

Wing 2.7-2.8 time longer than wide; finely infuscate, with brownish yellow to brownish veins, pale marginal fringe, dark basicostal setae and costal spinules. Squamae dirty yellow, with scattered long pale ciliae. Halter with yellowish stem and dark knob.

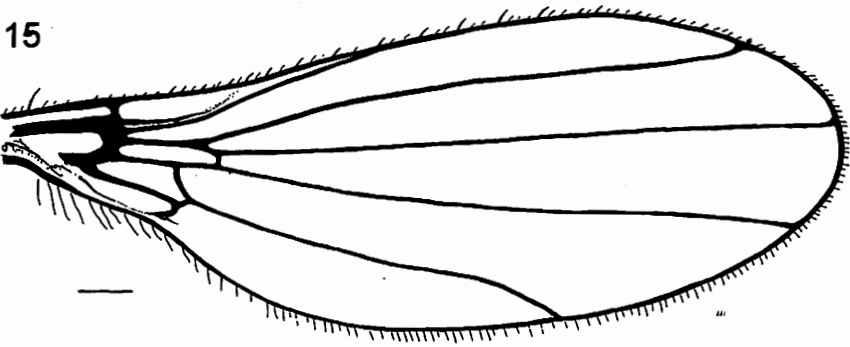
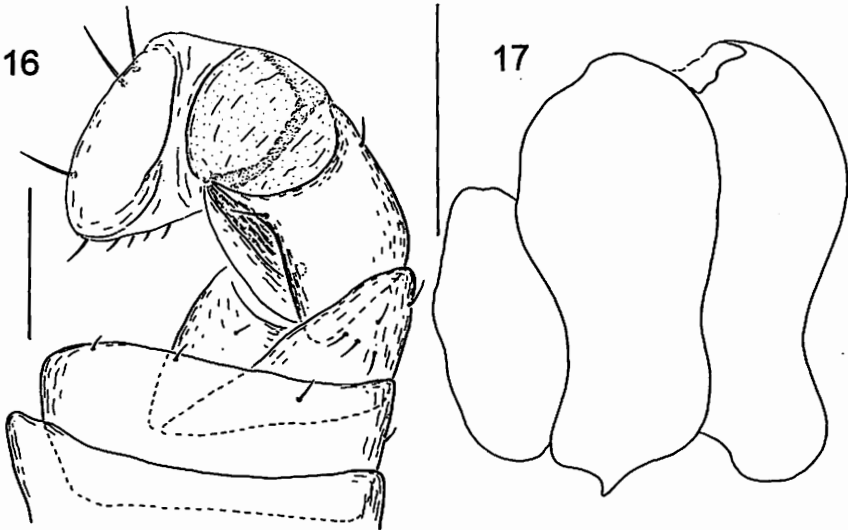
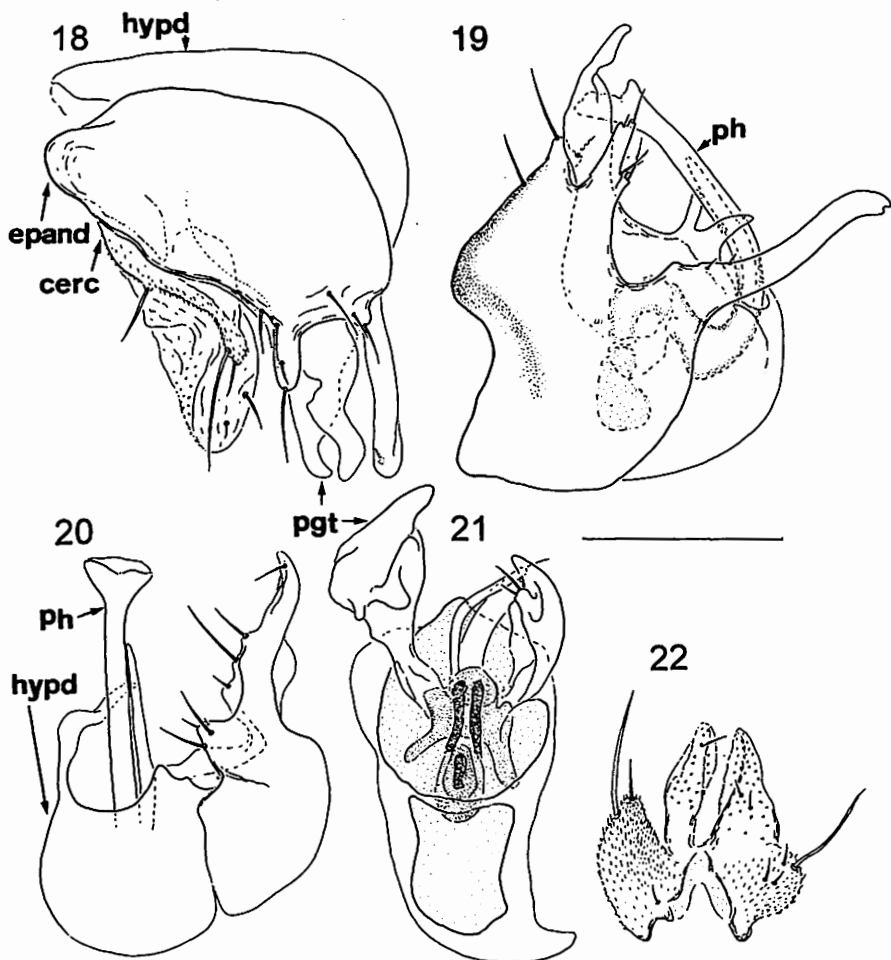


Fig. 15. *Chimerothalassius ismayi* sp. n. 15: wing, dorsal view.



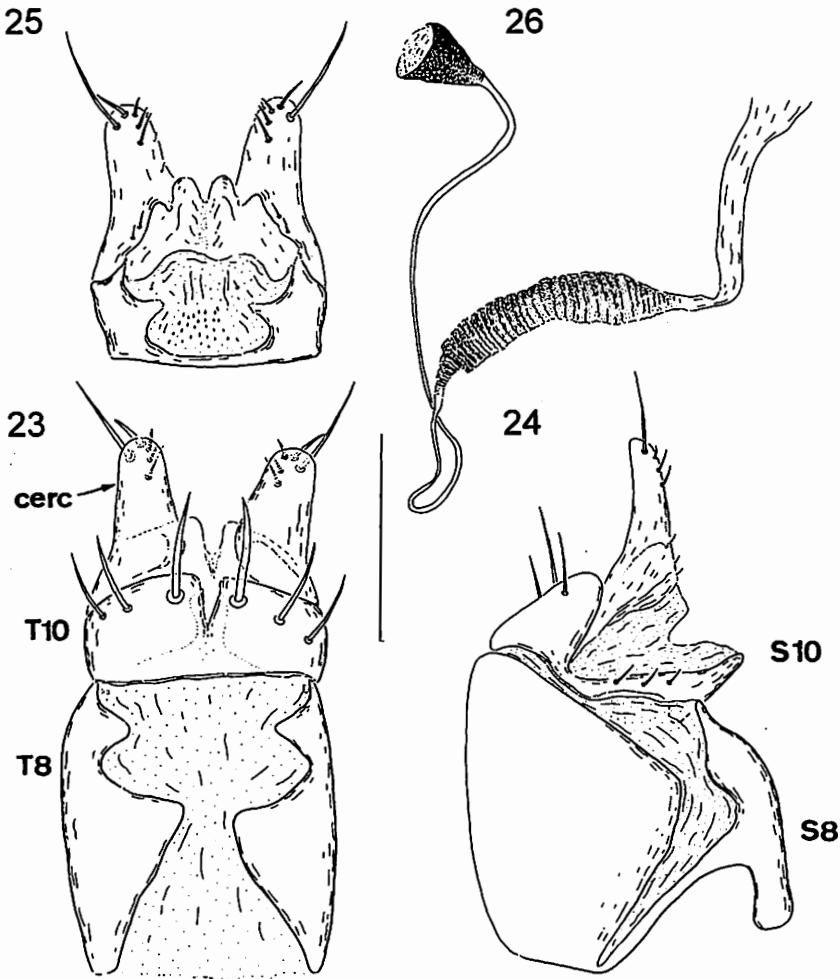
Figs 16-17. *Chimerothalassius ismayi* sp. n. 16: pregenital segments, male, dorsal view; 17: outline of hypopygium, dorsal view.

Abdomen mostly concolorous with thorax, bearing scattered dark setulae, postabdomen somewhat darker. Hypandrium and epandrium concolorous with pregenital segments. Hypopygium shorter than apical half of abdomen, elongate oval. Hypandrium about 2 times as long as wide in apical part. Right epandrial lobe with ventral (dorsal after rotation) process of complicated structure bearing several setae of different length; left epandrial lobe with long ventral process of simple structure bearing 2 setulae near base; surstyli lacking additional internal processes, bearing several setae of different length. Cerci covered with microtrichia and bearing several setae of different length including 1 longest subapical one; hypoproct longer than cerci, with lobes subtriangular, well sclerotized and covered with spinules dorsally.



Figs 18-22. *Chimerothalassius ismayi* sp. n. 18: right epandrial lamella, right lateral view; 19: left epandrial lamella, left lateral view; 20: apical part of hypandrium and right epandrial lobe, dorsal view; 21: hypandrium, ventral view; 22: hypoproct, ventral view.

Female body length 1.5-1.7 mm, wing length 1.4-1.5 mm. Face moderately broad, in middle nearly as wide as distance between posterior ocelli, somewhat widened in upper part and below. Frons usually with 1 additional pair of very short laterocline frontal-orbital bristles situated just behind anterior frontal-orbitals. Palpus brownish, clothed in microtrichia, bearing 3 very long ventral and several short bristles, with papilla-like setae in middle dorsally. Legs largely yellowish brown, fore coxa in apical part and trochanter of fore leg usually paler. Fore coxa with 3 strong, spine-like bristles of different length near base. Fore femur with 4-5 long posteroventral spine-like bristles on short tubercles and 1 more or less regular row of short anteroventral



Figs 23-26. *Chimerothalassius ismayi* sp. n. 23: apical part of ovipositor, dorsal view; 24: same, lateral view; 25: same, ventral view; 26: spermatheca, dorsal view.

spinule-like bristles. Fore tibia somewhat thickened and curved, bearing 1 row of ventral erect spinules in apical half, 1 row of similar spinules anteriorly and 1 row of anterodorsal spinules in apical part. Abdomen largely concolorous with thorax, tergite 5 often narrowly yellowish posteriorly. Preabdomen broad, with scattered ordinary setation; tergites with black and sternites with pale setae, tergite and sternite 5 bearing longer setae posteriorly. Postabdomen rather slender, paler in ground-colour; segments 6-8 with greatly reduced setation, segments 6-7 bearing 1 short seta in posterolateral corner, segment 8 with few minute setulae. Other characters as in male.

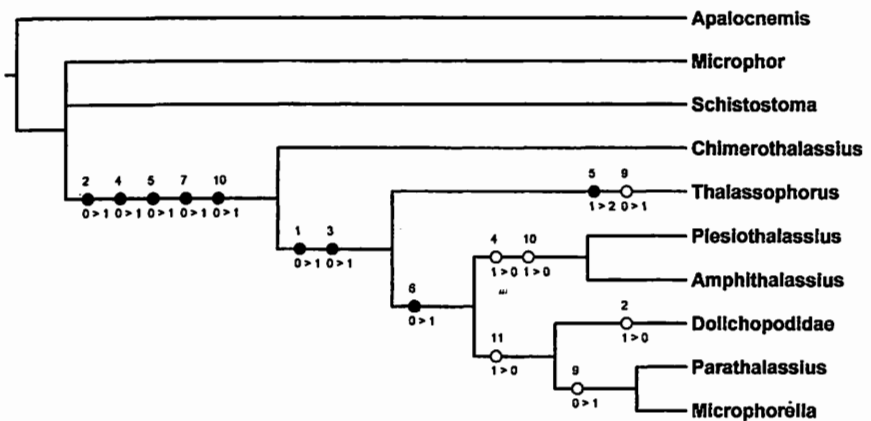


Fig. 27. Hypothesised cladistic relationships of the Microphorinae + Dolichopodidae lineage produced by unweighted parsimony analysis of the data matrix in Table 1.

Discussion

Hypothesised phylogenetic relationships of the new genus with other extinct genera of Microphorinae are illustrated in Fig. 27. The phylogenetic significance of most of the characters used was previously discussed by HENNIG (1971), CHVÁLA (1983, 1988), ULRICH (1991), SINCLAIR (1995), CUMMING & GRIMALDI (1999) and quite recently by CUMMING & BROOKS (2002). The unweighted cladistic analysis generated a single cladogram (Length = 17, C.I. = 0.70, R.I. = 0.86).

Chimerothalassius exhibits several apomorphies (1-segmented stylus, absent male tergite 8, dichoptic condition in male, etc.) which places it in the paraphyletic tribe Parathalassiini. The new genus is considered the basal lineage of this diverse clade. This position may be primarily because *Chimerothalassius* does not have straight inner eye margins near antennae and no shortened, appressed palpus to labrum.

The monophyly of *Chimerothalassius* is based on a number of apomorphies including strong ventral vertical setae on palpus, spine-like setae on fore coxa, lack of discal cell (crossvein m-cu entirely absent) and cup-shaped tip of phallus.

The relationships of the new genus within Parathalassiini are not quite clear. The situation is additionally complicated by still unresolved relationships in Parathalassiini itself. Like *Thalassophorus* (SAIGUSA, 1986), *Chimerothalassius* possesses a complete crossvein bm-cu. However, this is a plesiomorphous state of the character in the Microphorinae + Dolichopodidae lineage and may be reversal, at least in *Thalassophorus* (CUMMING & BROOKS, 2002). By the completely lacking of crossvein m-cu, *Chimerothalassius* can be compared with the fossil genus *Retinitus* only. This genus has bare eyes but it may be even more apomorphic in an incomplete costa, Sc fused to R₁ and an incomplete crossvein bm-cu. It should be noted that the crossvein m-cu is

completely absent in some species of *Cryptophleps* LICHTWARDT (Dolichopodidae) (GROOTAERT & MEUFFELS, 1987) and in the endemic New Zealand genus *Monodromia* COLLIN (Hemerodromiinae) (COLLIN, 1928; PLANT, 1993).

Nothing is known on the biology of the new genus. According to a label pinned, all specimens were collected on a stone beach. In this feature, *Chimerothalassius* is similar to Parathalassiini which are found almost exclusively on the sea coasts. Among the latter, only *Thalassophorus* was collected on wet stones on rocky or stony beach in north of Hokkaido (SAIGUSA, 1986).

To conclude, the fauna of the Microphorinae is still very poorly known in the southern Hemisphere. It may be, together with an insufficient knowledge of the fossil taxa, one of the reasons of unresolved relationships in the group. Undoubtedly, many new taxa of Microphorinae will be found in this region in the future.

Acknowledgements

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