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Starkomyia gen. nov. from New Zealand and its implications for the phylogeny of the Sciaroidea (Diptera: Bibionomorpha)

[*Starkomyia* gen. nov. aus Neuseeland und ihre Bedeutung für die Phylogenie der Sciaroidea (Diptera: Bibionomorpha)]

by
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Abstract	<i>Starkomyia inexpecta</i> gen. et spec. nov. from New Zealand is described and illustrated, and its systematic position is analyzed and discussed. <i>Starkomyia</i> appears to be another recent southern hemisphere representative of the enigmatic sciaroids that cannot be assigned to any of the recognized family-group taxa of the Sciaroidea. It is hypothesized to be the sister-group of a clade including the <i>Heterotricha</i> and <i>Ohakunea</i> groups. Sciaridae, Rangomaramidae and Cecidomyiidae. The significance of particular wing veins for the evaluation of phylogenetic relationships within the Sciaroidea is critically discussed.
Key words	Diptera, Sciaroidea, phylogeny, taxonomy, new genus, new species, New Zealand
Zusammenfassung	<i>Starkomyia inexpecta</i> gen. et spec. nov. aus Neuseeland wird beschrieben, illustriert und ihre systematische Stellung analysiert und diskutiert. <i>Starkomyia</i> ist ein weiterer bemerkenswerter Vertreter von Sciaroidea, der keinem derzeit anerkannten Taxon der Familiengruppe zugeordnet werden kann. <i>Starkomyia</i> ist hypothetische Schwestergruppe eines Monophylum, das Sciaridae, die <i>Heterotricha</i> - und <i>Ohakunea</i> -Gruppen und vermutlich weitere Taxa einschließt. Die Bedeutung bestimmter Flügeladern für die Erhellung phylogenetischer Beziehungen innerhalb der Sciaroidea wird kritisch geprüft.
Stichwörter	Diptera, Sciaroidea, Phylogenie, Taxonomie, neue Gattung, neue Art, Neuseeland

Introduction

As one may expect from the unique geohistory and biogeography of New Zealand, its fauna of fungus gnat-like flies (Sciaroidea) includes a disproportionately high number of phylogenetically interesting species. Their adults exhibit a very peculiar external morphology and cannot be assigned to any of the traditionally recognized family-group taxa of the Sciaroidea. Such 'unplaceable' sciaroids known from New Zealand are two species of the genus *Anisotricha* CHANDLER (TONNOIR & EDWARDS 1927, CHANDLER 2002, JASCHHOF 2004a); three species of the genus *Insulatracha* JASCHHOF (JASCHHOF 2004a); two species of the genus *Ohakunea* TONNOIR & EDWARDS (TONNOIR & EDWARDS 1927, JASCHHOF & HIPPA 2003); and five species of the family Rangomaramidae (JASCHHOF & DIDHAM 2002). Even though the systematic relationships among them and to the traditional families in the Sciaroidea could not yet be explained convincingly, it is clear that these sciaroids represent at least three distinct, ancient lineages: the *Heterotricha* LOEW group sensu stricto (CHANDLER 2002) that, among others, includes the New Zealand genera *Anisotricha* and *Insulatracha*; the *Ohakunea* group (JASCHHOF, in press); and the Rangomaramidae. In this paper, I introduce *Starkomyia inexpecta* gen. et spec. nov., which is another enigmatic sciaroid obviously representing a lineage distinct from those referred to above. Superficially similar to the southern-neotropical *Freemanomyia elongata* (FREEMAN, 1951)¹, detailed mor-

¹ *Freemanomyia* JASCHHOF, 2004 is a replacement name for *Pterogymnus* FREEMAN, 1951 (JASCHHOF 2004b).

phological study of *Starkomyia inexpecta* revealed its sciarid rather than mycetophilid affinities. Further, this new species demonstrates exemplarily the traps that lie in wait for someone aiming to explain the phylogeny of the Sciaroidea through hints mainly from wing venation. In the following, the new taxa are described, illustrated and the phylogenetic relationship of *Starkomyia* is analyzed and discussed.

The type-locality, Ohakune, of *Starkomyia inexpecta* is well known among researchers of New Zealand Diptera and workers on enigmatic Sciaroidea. The forests north-northeast of Ohakune, at the southern foothills of the active volcano Mount Ruapehu, is one of the finest preserved examples of a mature, mixed stand of podocarp trees (intermingled with broadleaf trees including southern beeches that predominate with increasing altitude) on New Zealand's North Island. These forests survived the deforestation by both the cataclysmic Taupo eruption some 1850 years ago (GABITES 1986) and later human activity – which was a stroke of luck not only for dipterology. As regards enigmatic sciaroids, the Ohakune region was previously shown to provide the habitat for *Insulatricha hippai* JASCHHOF; *Ohakunea bicolor* EDWARDS; and *Rangomarama tonnoiri* JASCHHOF & DIDHAM. Such an accumulation of ancient sciaroids, with *Starkomyia inexpecta* added now, at one and the same site leaves little doubt that at least sizable patches of the Ohakune forest have a long, uninterrupted faunal history. The impression Ohakune forest makes on a human intruder is to step back into Cretaceous times, all the more with such information on ancient flies in mind. In my opinion, flies like *Starkomyia inexpecta* and others, overlooked by most naturalists due to its inconspicuous appearance, are capable of documenting the preciousness of ancient forest ecosystems in New Zealand and elsewhere. Even though not as susceptible to public fascination like, for instance, kiwi birds and leiopelmid frogs, these flies have a successful evolutionary history longer than that of many praised and more attractive forest-dwellers endemic to New Zealand. This fact alone should justify the need for acceptance of research on silvicolous flies, which should be expressed through more generous funding of such research independent of its economic relevance but motivated through a broad sense of responsibility for our natural heritage.

Material and methods

The one individual known of *Starkomyia inexpecta* was collected in course of the author's research visit to New Zealand in 2001/2002. The specimen was made transparent by treatment with KOH, dehydrated in ethanol and eventually, after treatment with beechwood creosote, mounted in Canada balsam on a microscope slide. The holotype is deposited in the New Zealand Arthropod Collection, formerly at Auckland/Mt. Albert and now at Auckland/Tamaki. Other specimens of various Sciaroidea studied comparatively come from the author's collection in the Zoological Institute and Museum Greifswald, Germany; the New Zealand Arthropod Collection, Auckland; the Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica; the Museum für Tierkunde Dresden, Germany; and the United States National Museum, Smithsonian Institution, Washington, D.C. Usage of morphological terminology follows that of SOLI (1997) for Mycetophilidae and, in case of several additional terms related to male terminalia, JASCHHOF & DIDHAM (2002). Drawings were made using an Olympus BX50 microscope in combination with the U-DA drawing unit.

Genus *Starkomyia* gen. nov.

Type species. *Starkomyia inexpecta* spec. nov., described below.

Description (based on male only)

Habitus: Slender, humpbacked sciaroids some 3 mm in size; long antennae, legs and wings; rather narrow waist; slightly downcurved abdomen; and distinctive wing venation. Ethanol-preserved specimens coloration light-brownish.

Head: Head capsule higher than long; setation short and undifferentiated. Postfrons slightly two-lobed, non-setose, with slightly two-pointed frontal tubercle. Face large, non-setose. Clypeus subequal in size to face, projecting in profile, setose, fused with face along upper margin. Antennae longer than abdomen, upturned, inserted near midheight of head. Scape somewhat conical, somewhat larger than pedicel, setose. Pedicel subglobular, setose. Flagellum with 14 flagellomeres, first flagellomere longest, terminal flagellomere longer than penultimate; each flagellomere cylindrical, practically without neck, several times as long as wide. Flagellum without microtrichia except some on flagellomere 1 basally. Each flagellomere with even cover of setae arising from membranous rings, setae as long as diameter of flagellomere or shorter; flagellomeres 1–6 dorsally also with short setae arising from sockets. With 3 ocelli at vertex, arranged in narrow triangle. Eyes reniform, distance between eye portions at vertex subequal to width of ocellar triangle; without interommatidal setulae. Mouthparts well developed, with short proboscis. Labrum beak-like, well sclerotized, non-setose, fringed apically. Lingua with dense fringes apically. Maxillae with lacinia style-like, comparatively broad, fringed terminally. Maxillary palpus with 5 palpomeres, with first palpomere ('presegment') well-developed and setose. Palpomeres 2–5 setose; palpomere 3 with hyaline sensory hairs; palpomeres 2 and 3 thickest and 5 clearly longest. Labium with prementum present as pair of setose lobes. Labial palpus 2-segmented, labellum 1 smaller than 2; labellum 1 non-setose; labellum 2 with numerous, partly spine-like setae.

Thorax: Postpronotum barely traceable, present as narrow sclerite above antepronotum (if correctly identified). Antepronotum subtriangular, setose, with 2 setae very strong and long. Episternum 1 non-setose. Epimeron 1 very weak. Scutum in profile evenly arched to slight degree, with anterior parapsidal suture weak and median transverse suture not traceable. Vestiture of scutum consisting of irregular rows of acrostichal, dorsocentral and lateral setae; some dorsocentrals and laterals very strong and long. Scutellum with pair of very strong and long setae. Prescutoscutal suture deep. Prescutum not traced. Mediotergite high, in profile almost straight. Postphragma well developed, i.e. extending into abdominal cavity, comparatively sharply pointed. Mediotergite and laterotergites with distinct suture in between. Laterotergite large, little pronounced, with long setae. Anepisternum subrectangular; separated from preepisternum 2 by distinct suture. Anepisternal cleft deep. Preepisternum 2 much larger than anepisternum, subtriangular ventrally. Mid-pleural pit present but indistinct. Epimeron 2 with deep cleft dorsally indicating a subdivision into upper anepimeron and lower katepimeron, latter strongly narrowed ventrally. Metanotum very short, barely traceable. Episternum 3 weakly sclerotized, with some short setae posteriorly. Epimeron 3 very narrow. Openings of spiracles without striking features. **Legs:** Coxae clearly longer than half the height of thorax. Coxae with setae as long as coxal diameter. Femora with longer, somewhat erect setae along hind margin and short, adpressed setae elsewhere. Tibial spurs 1:2:2; on mid and hind tibiae, one spur slightly shorter than other. Fore tibia with well developed, almost circular anteroapical depression delineated by sharp rim and bearing numerous spine-like setae. Tibiae and tarsi densely covered with large trichia and short setae, latter mostly adpressed but some setae stronger, spine-like and somewhat erect, additionally with few erect fine, short sensory hairs.

Tarsomeres 1–5 gradually decreasing in length. Pretarsal claws small, curved, with 1 big tooth and 3–4 finer teeth in line. Pulvilli delicate, about as long as claws. Empodia as long as claws. **Wing:** Long, i.e. more than two times as long as wide, but shorter than body. Calypteral and alular areas very little convex; anal area weakly developed. Membrane covered with fine setae from both sides, more sparsely so towards wing base; setae 2–3 times as long as microtrichia. Venation: C extending to apex of wing, ending half way between apices of R5 and M1; Sc1 long, joining C clearly beyond Rs; Sc2 very weak; Rs somewhat oblique, short, barely two times as long as ta; ta very short and oblique; R4 present at approximately midpoint of wing, joining R1; R5 extending to apex of wing; M absent; M1+2 stem shorter than fork, fork clearly diverging; tb–mcu almost parallel to anterior wing margin, tb longer than mcu; CuP going beyond half length of CuA2; A1 subequal in length to CuP; A2 absent. With setae present along wing margin and dorsally on Sc1, R, R1 (also ventrally), R4, R5 (also ventrally), M1+2 stem and fork (also ventrally), CuA1, CuA2, and A1. Pattern of sensory pores: R, 2; R1, 3; Rs, 1; R5, 1–3 medially distally, apart from pores on Sc1 and stem vein. Halter club-shaped with fine setae on stem and knob.

Abdomen: Sclerites evenly densely covered with long setae. Sternite 1 non-setose. With six pairs of spiracles, one each on segments 2–7. Tergal plaques inconspicuous, situated in anterolateral position, one each on tergites 2–5 at least. **Terminalia:** Sternite 9 present as distinct but weakly developed sclerite. Gonocoxites almost separated ventrobasally, with bare lobe in gonocoxal section 3; gonocoxal apodemes connected by sclerotized transverse bridge. Gonostyli simple, one-lobed and without noteworthy modifications of setation. Aedeagus with short, broad, weakly sclerotized apodeme. Parameres partly fused to form an incomplete tegmen. Dorsal parameral apodemes short. Tergite 9 simple, plate-like. Tergite 10 absent. Cerci present as subtriangular, setose lobes. Hypoproct two-lobed, setose.

Etymology. The name of this extraordinary new genus is to honour a remarkable person, Dr Andreas STARK, Halle (Saale), Germany, who unites exemplarily a strong passion for and broad knowledge of the order Diptera, without ignoring the fascination radiating from all other living creatures. At times when both taxonomy and dipterology go through a very difficult period, his private edition of the high-quality journal *Studia dipterologica* must be considered an unparalleled achievement. The journal has celebrated its 10th anniversary (1994–2003) last year. The second component “myia” is Greek meaning ‘midge’. The gender is feminine.

Starkomyia inexpecta spec. nov.

(Figs 1–9)

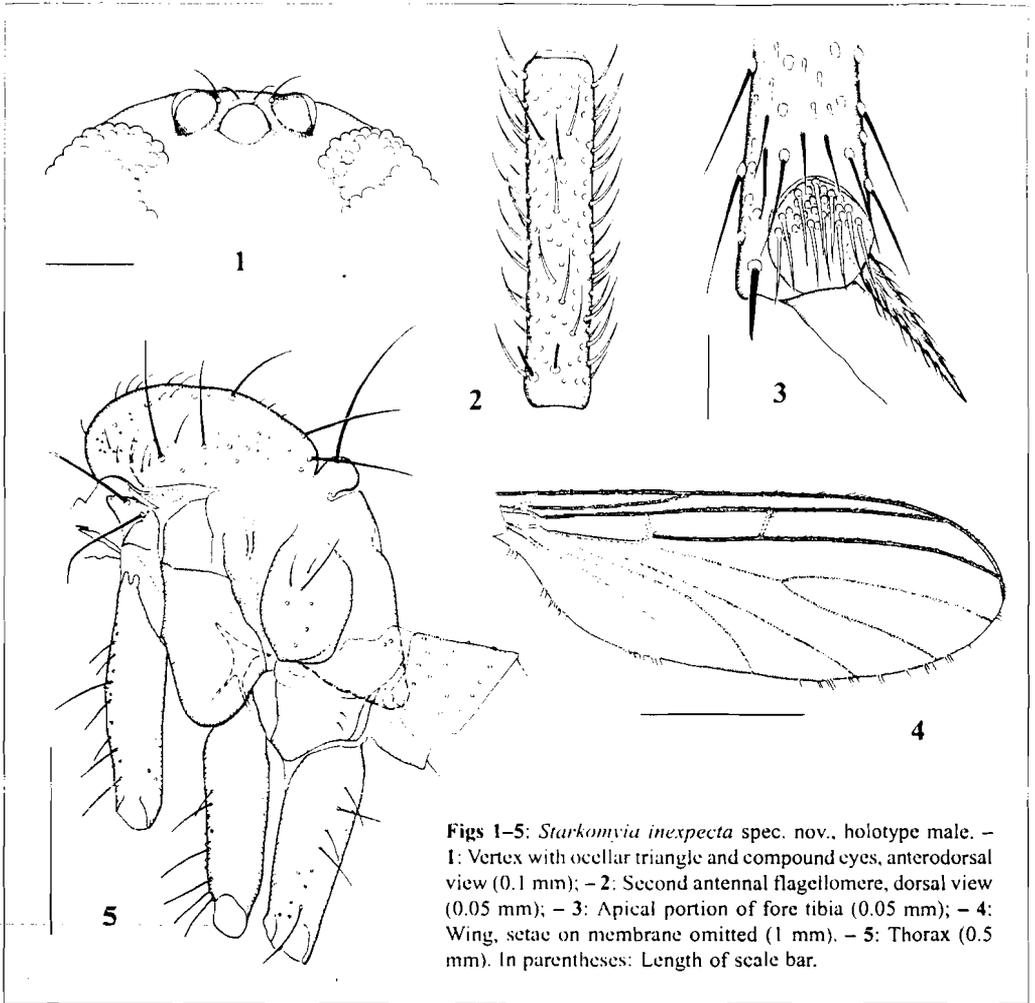
Description (for characters not mentioned here, see genus description above)

Male. Body length: 3 mm. **Head:** Antenna with second flagellomere as in Fig. 2 and fourth flagellomere almost five times as long as wide. Eye bridge and ocellar triangle as in Fig. 1.

Thorax: See Fig. 5. **Legs:** Fore tibia with anteroapical depression as in Fig. 3. **Wing:** See Fig. 4.

Terminalia: Gonocoxites (Fig. 6) ventrally with wide, V-shaped emargination, below emargination largely membranous and non-setose, with setae of various lengths elsewhere; lobe in gonocoxal section 3 rounded, small, and non-setose; gonocoxal apodemes narrow. Gonostyli (Figs 6, 7) elongate, in proximal half broadest and with long setae, in distal half narrow, somewhat flattened and with setae fine and very short, rounded terminally. Ejaculatory apodeme (Fig. 8) present as broad, roughly U-shaped, weakly sclerotized structure shorter than tegmen. Tegmen (Fig. 8) somewhat wider than long, deeply split medially resulting in two subtriangular lobes distolaterally; ventral parameral apodemes swept ventrally; dorsal parameral apodemes short, interconnected by heavily sclerotized transverse bridge. Tergite 9 (Fig. 9) plate-like, with broadly rounded distal margin and setae of various lengths. Cerci (Fig. 6) setose, rounded terminally. Hypoproct (Fig. 6) slightly two-lobed, setose, turned ventrally in the one specimen available for study.

Female and preimaginal stages. Unknown.



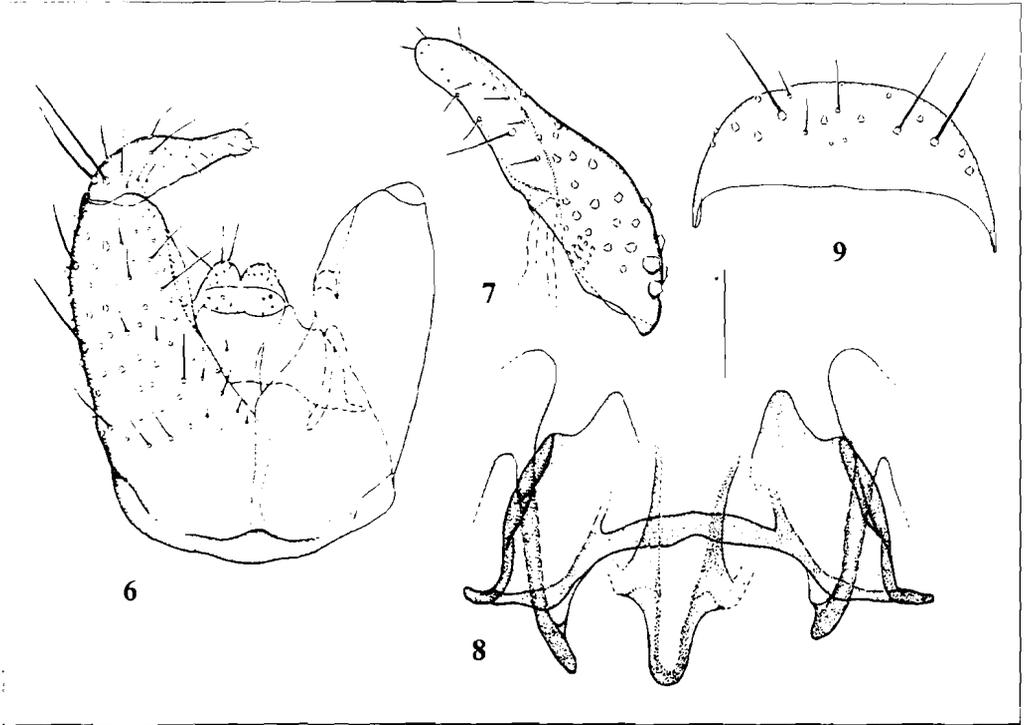
Figs 1–5: *Starkomyia inexpectata* spec. nov., holotype male. – 1: Vertex with ocellar triangle and compound eyes, anterodorsal view (0.1 mm); – 2: Second antennal flagellomere, dorsal view (0.05 mm); – 3: Apical portion of fore tibia (0.05 mm); – 4: Wing, setae on membrane omitted (1 mm). – 5: Thorax (0.5 mm). In parentheses: Length of scale bar.

Etymology. The name is Latin meaning 'unexpected', which applies to the peculiar assemblage of morphological features shown in this new species rather than its unexpected finding per se.

Holotype: Male, New Zealand, North Island, Taupo, Tongariro National Park, Mangawhero River valley 7 km NE Ohakune, in mixed southern beech/podocarp forest, 3 Feb. 2002, by sweepnet, M. JASCHHOF.

Diagnosis and discussion

The genus *Starkomyia* is characterized by the unique combination of the following characters: (1) very long antennal flagellomeres without necks (plesiomorphous states); (2) short antennal setation (plesiomorphous); (3) absence of a closed eye bridge (plesiomorphous); (4) five-segmented maxillary palpi (plesiomorphous); (5) wing with macrotrichia present on the membrane and most veins (plesiomorphous); (6) presence of a complete Sc1 (plesiomorphous); (7) presence of a Sc2 (plesiomorphous); (8) presence of a R4 (plesiomorphous); (9) CuA1 and CuA2 running separately into the transversal vein (plesiomorphous); and (10) presence of a large postphragma (plesiomorphous). There are a few apomorphous characters recognizable in *Starkomyia*, but those seem to me of little more than specific relevance: (A) presence of setae on the laterotergites; and



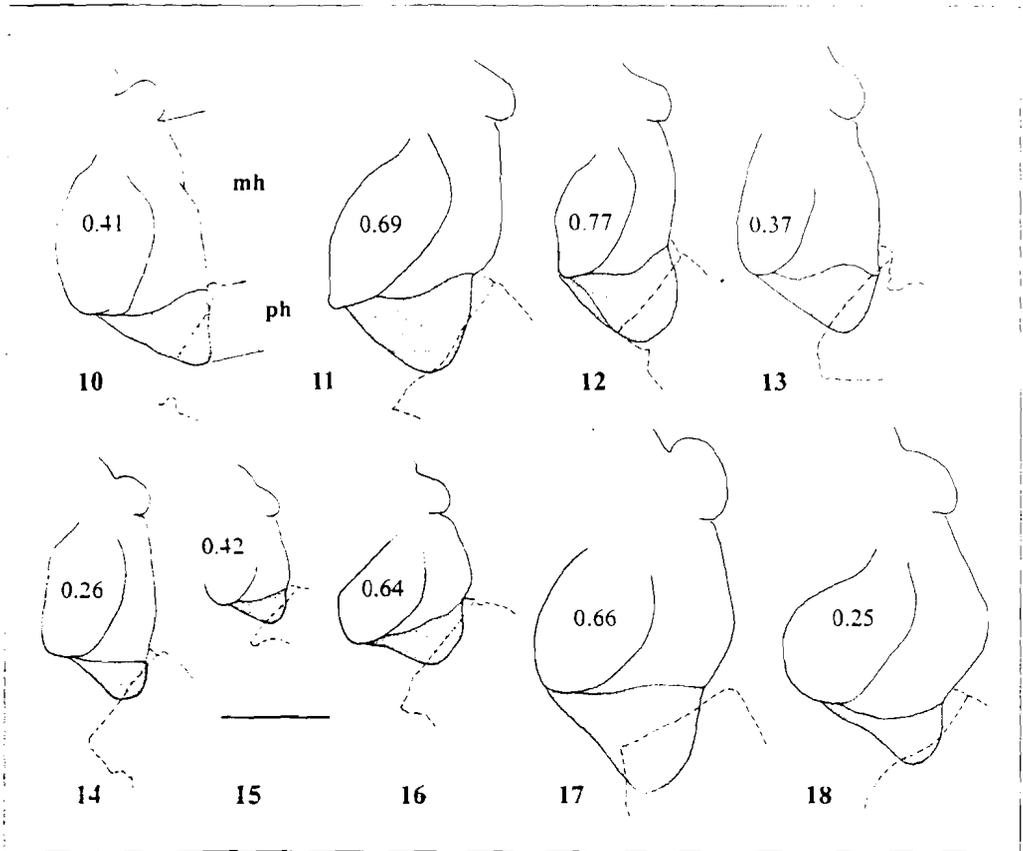
Figs 6–9: *Starkomyia inexpectata* spec. nov., holotype male. – 6: Terminalia, ventral view (0.1 mm); – 7: Gonostylus, ventral view (0.05 mm); – 8: Aedeagus and tegmen, ventral view (0.05 mm); – 9: Tergite 9, dorsal view (0.1 mm). In parentheses: Length of scale bar.

(B) presence of setae on episternum 3. Additionally, male terminalia must be considered simplified, a fact that includes apomorphic character states, like (C) the partial fusion of parameres resulting in an incomplete tegmen; and (D) the presence of a heavily sclerotized transverse bridge interconnecting the gonocoxal apodemes. Admittedly, this generic diagnosis is polythetic and autapomorphies are not recognizable for *Starkomyia*. This new genus is mainly characterized by, and thus justified due to, the absence of autapomorphies found in the taxa most plausibly related to it. As shown below, these potentially related taxa are *Freemanomyia*, the *Heterotricha* and *Ohakunea* groups, Sciaridae, Rangomaramidae and Cecidomyiidae. From *Freemanomyia* (in parentheses), *Starkomyia* is easily distinguished by the presence of a large postphragma (small), setae on the wing membrane (setae absent) and the structures of male terminalia. From the *Heterotricha* group, Sciaridae, Rangomaramidae and Cecidomyiidae (in parentheses), *Starkomyia* differs most obviously in having the R4 present (absent). The *Ohakunea* group differs from *Starkomyia* in having Rs and other wing veins strikingly basalized.

Phylogenetic implications. In the considerations that follow, both plesiomorphous and apomorphic character states are taken into account. There is general agreement on the relevance of apomorphies in order to determine monophyla and to argue for the assignment of species to particular clades. Plesiomorphies, through the absence of their corresponding (apomorphic) counterparts, may help to reveal that a particular species cannot belong to a particular clade – possible reversals not taken into account. Plesiomorphies gain even major importance when apomorphies are scarce or absent. As is the problem with most enigmatic

sciaroids known to date, adult morphology in *Starkomyia* is marked by a unique assemblage of many plesiomorphous features and very few apomorphous characters that occur also here and there in the sciaroids supposed to be related to *Starkomyia*. As obvious 'positive apomorphies' are so scarce, no researcher of Sciaroidea hesitates to reason from 'negative apomorphies', i.e. reductions from the ground plan. However, the explanatory value of arguments inferred from reductions is low as long as the argumentation is not further supported by positive characters. This dilemma is most obvious with respect to wing characters, wing venation in particular, which undergo a general simplification throughout the Sciaroidea. In principle, we cannot decide whether a particular vein was reduced once or more than once. The most recently published hypothesis on phylogenetic relationships between the family-group taxa in the Sciaroidea, with particular focus on the *Heterotricha* group (CHANDLER 2002), forms the basis for the following considerations on the position of *Starkomyia* (see below hypotheses 1–4). Wing characters – due to their easy perceptibility and paucity of alternative character complexes – are assigned great relevance in this context, a fact reflected in the study by CHANDLER (2002) as well as earlier analyses [for instance, MATILE (1990, 1997)]. As shown in the following, *Starkomyia* might be a (or further) case where interpretation of vein patterns is misleading in our attempts to reconstruct the phylogeny of an ancient and complex group like the Sciaroidea. Admittedly, in the following I cannot offer more convincing arguments (characters) alternative to those I just criticized. Perhaps this situation exists due to the nature of our objects of study rather than to a lack of cognitive faculties.

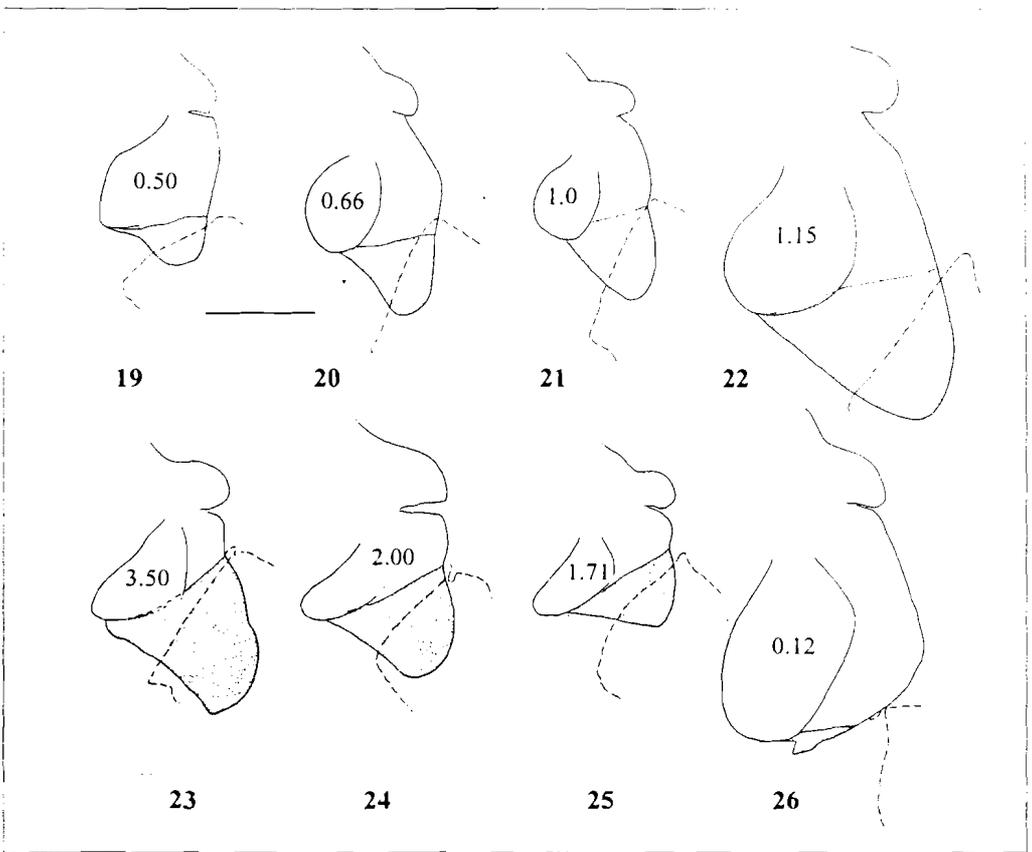
Hypothesis 1: *Starkomyia* is most closely related to *Freemanomyia* JASCHHOF. This hypothesis is mainly based on the presence of R4 and a complete Sc1 (which are two plesiomorphies) in both *Starkomyia* and *Freemanomyia*. Or, in other words, *Starkomyia* is considered not to belong to a clade comprising the *Heterotricha* group sensu stricto, the *Ohakunea* group and Sciaridae, a clade based on the absence of R4 and abbreviation of Sc1 [CHANDLER (2002): Fig. 103, characters 5 and 6]. This argumentation is in conflict with the outline of the postphragma which is large and projecting into the abdomen in *Starkomyia*, while it is small and not projecting in *Freemanomyia*, or *Freemanomyia*+ (Lygistorrhinidae+Mycetophilidae), respectively. Further, the absence of Sc2 (= sc-r by CHANDLER) is considered an autapomorphy of *Freemanomyia* (CHANDLER 2002); in *Starkomyia*, however, Sc2 is present – a fact which formally contradicts rather than supports a close affinity between these two genera. However, more generally speaking, the significance of neither presence nor absence, respectively, of Sc2 – which is a minute and often weak vein – should be overestimated. In Catotrichinae (a species-poor group comprising the most primitive Cecidomyiidae), for instance, Sc2 may be present or absent among congeneric species (JASCHHOF 2001). Also in *Catotricha*, Sc1 either joins (plesiomorphy) or does not join (apomorphy) the costa. In the core group of the *Heterotricha* group sensu CHANDLER (2002), Sc2 may be present as distinct vein (in *Chiletricha* CHANDLER), present but extremely weak (in *Anisotricha* CHANDLER), or absent (in *Insulatricha* JASCHHOF). R4 may be another questionable indicator of relationship: Within the *Ohakunea* group, R4 was found to be present in two of the enclosed genera while being absent in two others (JASCHHOF, in press). Among species of the genus *Tetragoneura* WINNERTZ (in Mycetophilidae) the presence of R4 is as common as its absence, and both presence and absence may occur within the limits of one and the same species and even individual (JASCHHOF, pers. obs.). There are other findings indicating that *Starkomyia inexpecta* is not closely related to *Freemanomyia elongata*. Male terminalia in the two species are largely different [see Figs 6–9 versus CHANDLER (2002): Figs 74–76]. The pleural pit is present in *Starkomyia*, while it was described as being absent in *Freemanomyia*; setae on the wing membrane are present in *Starkomyia*, while absent in



Figs 10–18: Postphragma in various Sciaroidea, lateral view (Part I). – 10: *Starkomyia inexpecta* spec. nov. (holotype); – 11: *Anisotricha novaezealandiae* (TONNOIR) (male, New Zealand, Lake Rotoroa, 15 Jan. 2001, in Auckland); – 12: *Insulatricha hippai* JASCHHOF (male, New Zealand, North Egmont, 26–30 Nov. 1975, in Auckland); – 13: *Ohakunea bicolor* EDWARDS (male, New Zealand, Croydon Bush, 5 Dec. 2002, in Greifswald); – 14: *Colonomyia* spec. (male, Costa Rica, Finca los Lagos, June 1994, in Santo Domingo); – 15: Gen. et spec. indet. (male, Costa Rica, Corcovado National Park, 20 Dec.–7 Feb. 2002, in Santo Domingo); – 16: Gen. et spec. indet. (male, Costa Rica, Corcovado National Park, 14 March–5 April 2003, in Santo Domingo); – 17: *Sciarosoma borealis* CHANDLER (male, Germany, Bavaria, Sojernspitze, 27 June 1998, det. U. KALLWEIT & M. JASCHHOF, in Dresden); – 18: *Sciaropota japonica* CHANDLER (female, Japan, Ogawa Forest, 14–27 May 1996, det. U. KALLWEIT & M. JASCHHOF, in Dresden). Values given within laterotergites: relative postphragma size, rps. Abbreviations in Fig. 10: mh = mediotergite height; ph = postphragma height.

Freemanomyia: male flagellomeres have a short setation in *Starkomyia*, while in *Freemanomyia* flagellomeral setae were described as being very long (FREEMAN 1951, CHANDLER 2002). There might be even more differences; however, several structural details in *Freemanomyia* were not yet described. Conclusion: Evidence for *Starkomyia* and *Freemanomyia* have a close relationship is weak, despite the largely corresponding wing venation. In particular, the presence of a large postphragma in *Starkomyia* (Fig. 10) contradicts hypothesis 1.

Hypothesis 2: *Starkomyia* is a living representative of the Mesosciophilidae known from Jurassic and Cretaceous fossils. CHANDLER (2002) points to the fact that wing venation in Mesosciophilidae is basically identical to that in *Freemanomyia*. Consequently, it is also identical to that in *Starkomyia*, considering that Sc2 is present in both *Starkomyia* and the mesosciophilid genus *Mesosciophilopsis* BLAGODEROV (BLAGODEROV 1994). (Again, one should



Figs 19–26: Postphragma in various Sciaroidea, lateral view (Part II). – 19: *Rangomarama tonnoiri* JASCHHOF & DIDHAM (female, New Zealand, Pureora Forest, 24/25 Nov. 2002, in Greifswald); – 20: *Leptosciarella fuscipalpa* (MOHRIG & MAMAEV) (male, Germany, Island of Vilm, 8 June 2002, det. W. MOHRIG, in Greifswald); – 21: *Bradysia fungicola* (WINNERTZ) (male, Germany, Island of Vilm, 8 June 2002, det. W. MOHRIG, in Greifswald); – 22: *Catoiricha subobsoleta* (ALEXANDER) (female, California, Oakland, 4 Feb. 1952, in Washington); – 23: *Gongromastix ignigena* JASCHHOF (male, Sweden, Tyresta, 14 April–5 June 2000, in Greifswald); – 24: *Catocha latipes* HALIDAY (male, Sweden, Arjeplog, 23 May–20 Aug. 1993, in Greifswald); – 25: *Strobliella brachycornis* SPUNGIS & JASCHHOF (female paratype, Germany, Bavaria, Sommerbichel, 7 June 1996, in Greifswald); – 26: *Taxicnemis* spec. (female, New Zealand, Granville Forest, Dec. 1994, in Auckland). Length of scale bar = 0.25 mm. Values given within laterotergites: relative postphragma size, rps.

not ascribe too much significance to the presence or absence of Sc2, all the more when sediment fossils are involved. Considering that Sc2 is extremely weak in *Starkomyia*, one can easily imagine how difficult, if not impossible, it was to recognize such a vein trace in fossilized wing prints.) As long as nothing is known on the outline of the postphragma in the Mesosciophilidae including *Mesosciophilopsis*, it is quite speculative to see a relationship between these fossil species and living sciaroids, like *Freemanomyia* and *Starkomyia*. As argued earlier (JASCHHOF 2004a), sediment fossils may be helpful in reconstructing general tendencies in the evolution of sciaroid wing venation, but most of them are object of speculation rather than interpretation in a particular taxonomic case. Conclusion: Hypothesis 2 must be dismissed.

Hypothesis 3: *Starkomyia* belongs to the *Heterotricha* group sensu stricto. As already explained under hypothesis 1, the presence of R4 and the Sc1 joining C in *Starkomyia* speak

against its belonging to the *Heterotricha* group, while the large postphragma (Fig. 10) is an argument in favour of it. In fact, if R4 were absent and Sc1 abbreviated in *Starkomyia*, one would assign this genus without hesitation to the *Heterotricha* group, also because other relevant characters do not contradict this idea or form the basis for plausible alternative explanations. On the other hand, *Starkomyia* cannot be assigned convincingly to any of the lineages recognized by CHANDLER (2002) within the *Heterotricha* group on the basis of wing venation and a few other characters. Conclusion: Hypothesis 3 may be accepted under the assumption that R4 and a complete Sc1 were regained in *Starkomyia*. Regain means re-activation from the cryptotype (OSCHE 1965), with the presence of R4 and a complete Sc1 then being apomorphies of *Starkomyia*. Admittedly, it is difficult to demonstrate the selective advantage of these re-activations.

Hypothesis 4: *Starkomyia* is the sister-group of a clade comprising the *Heterotricha* group sensu stricto, *Ohakunea* group and Sciaridae. Based on the presence of a large postphragma projecting into the abdomen, CHANDLER (2002) postulates a clade consisting of the Sciaridae and *Heterotricha* group excluding the genus *Sciaropota* CHANDLER. Further, *Sciaropota* and/or *Ohakunea* + *Colonomyia* then appear to be the presumed sister-group of such a clade. At this point, we need to focus in more detail on the postphragma which is another much-cited potential indicator of relationship. As recently shown (JASCHHOF & HIPPA 2003, JASCHHOF 2004a, HIPPA & JASCHHOF, in press), the postphragma in the genera *Ohakunea* (Fig. 13) and *Colonomyia* COLLESS (Fig. 14) does project into the abdomen and is only little smaller than that typical of the Sciaridae (Figs 20, 21) and *Heterotricha* group (Figs 11, 12). The same applies to the postphragma in other sciaroids hypothesized to belong to the *Ohakunea* group (Figs 15, 16). As regards *Sciaropota japonica* CHANDLER, a series of specimens of this species I have at hand shows the postphragma to be unlike that figured by CHANDLER (2002: Fig. 68 versus my Fig. 18); it is indeed the smallest among the sciaroids studied here, but it has the same – i.e., postero-ventral – orientation. In order to assess the postphragma size more objectively, the ratio between postphragma height (ph) and mediotergite height (mh) was calculated (relative postphragma size, rps = ph : mh) for the sciaroids in question (Figs 10–26). The higher the rps value, the larger is the postphragma. As one would expect, rps values vary greatly among the sciaroids in question; rps is clearly lowest for *Taxicnemis* MARSHALL (in Mycetophilidae) and highest in *Catotricha* EDWARDS (in Cecidomyiidae-Catotrichinae) and *Gongromastix* ENDERLEIN, *Catocha* HALIDAY and *Strobliella* KIEFFER (all in Cecidomyiidae-Lestremiinae). In *Taxicnemis*, the outline of the postphragma differs not only regarding size; also it is ventrally orientated and bearing a ventral keel. Such a keel is present in other mycetophilid genera as well [SØLI (1997): Figs 14A–D; JASCHHOF, pers. obs.], a fact giving reason to speak here of the mycetophilid type of the postphragma. On the other hand, a cecidomyiid type is difficult to define, as, apart from its size, the outline of the postphragma in the Cecidomyiidae is basically the same as in the Sciaridae, Rangomaramidae, *Heterotricha* and *Ohakunea* groups. As regards the last four groups of sciaroids, I find it difficult to clearly define different values (states) for the character ‘postphragma size’. The difficulty would be even greater if more species of a particular family-group taxon were taken into consideration; for Sciaridae, for instance, the full range of rps values was certainly not ascertained and the question remains what postphragma size should be assumed to reflect the ground plan. In my opinion, the reliability of the postphragma argument may be questioned if *Sciaropota* and *Ohakunea* + *Colonomyia* have to be excluded from the clade comprising the Sciaridae and *Heterotricha* group. For *Freemanomyia*, the rps value is 0.2 [based on Fig. 101 in CHANDLER (2002)] and consequently half as high as for *Starkomyia* (see my hypotheses 1 and 3). Rps value, abdom-

inal invasion and orientation of the postphragma in *Freemanomyia* resemble the conditions shown in the Mycetophilidae rather than Sciaridae, *Heterotricha* group and others; therefore I agree with CHANDLER'S (2002) view and consider *Freemanomyia* to be the sister-group of Mycetophilidae + Lygistorrhinidae.

To return to the systematic position of *Starkomyia*, a hypothesis alternative to 3 is to consider *Starkomyia* to be the sister-group of a clade comprising the *Heterotricha* and *Ohakunea* groups, Sciaridae, Rangomaramidae and Cecidomyiidae (in the following this clade is abbreviated H+). This hypothesis is taking into account that *Starkomyia* shows a large postphragma and does not possess the two synapomorphies of H+, which are the absence of R4 and abbreviation of Sc1 [= characters 5 and 6 in the cladogram by CHANDLER (2002): Fig. 103]. This seems to be the most parsimonious explanation, even though I am not absolutely convinced that these two vein characters have indeed such a relevance at this point of argumentation (see discussion under my hypothesis 1). Conclusion: Hypothesis 4 offers the most parsimonious explanation for the systematic position of *Starkomyia* and should be favoured formally. It is beyond the aim of this paper to investigate and discuss the relationships between the taxa within the clade H+; in this respect I refer to the papers published earlier (JASCHHOF & DIDHAM 2002, JASCHHOF & HIPPA 2003).

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