ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE
Published 15.xii.2014 Volume 54(2), pp. 729–739 ISSN 0374-1036
http://zoobank.org/urn:lsid:zoobank.org:pub:8FF046B2-6267-454D-8A28-9AE80CC0F23C

Notes on *Nepaletricha* (Diptera: Sciaroidea *incertae sedis*), with description of three new species from India and Vietnam

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Abstract. The following new species are described: *Nepaletricha dembickyi* sp. nov. (India), *N. lobosa* sp. nov. (Vietnam) and *N. sigma* sp. nov. (India). The systematic position of the genus is briefly discussed. A key to the six known species of *Nepaletricha* is given.

Key words. Insecta, Diptera, Sciaroidea, Antefungivoridae, Pleciomimidae, Rangomaramidae, *Heterotricha* group, *Nepaletricha*, fungus gnats, taxonomy, key, Oriental Region

Introduction

The genus *Nepaletricha* was established by Chandler (2002) for a single Oriental species *Nepaletricha mystica* Chandler, 2002. Subsequently, Hippa et al. (2009) re-characterized the genus and added two new species from northern Thailand and Vietnam, respectively. The genus was considered as Sciaroidea *incertae sedis* by Chandler (2002) and Hippa & Vilkamaa (2005, 2006). Amorim & Rindal (2007) placed *Nepaletricha* in the family Rangomaramidae, together with many other earlier unplaced genera of Sciaroidea. Concerning *Nepaletricha*, Hippa et al. (2009) followed this placement. The classification of Amorim & Rindal (2007) was strongly criticized by Jaschhof (2011) who did not accept the new concept of Rangomaramidae and suggested to continue using Sciaroidea *incertae sedis* for a number of problematic genera of Sciaroidea.

The aim of this contribution is to describe three new Oriental species of *Nepaletricha* and to re-open the question of its systematic position. The new species are based on the very interesting material from the little-studied north-eastern parts of India and from similarly little-known areas of northern Vietnam. The number of currently known *Nepaletricha* species is herewith doubled to six.

Material and methods

The material was collected by interception traps and preserved in ethanol. We detached the apical part of the abdomen from the specimens and macerated it in warm concentrated potassium hydroxide (KOH). We then detached the hypopygium beyond segment 8. After washing in water and step-wise dehydration in alcohol, we placed the parts of the abdomen for a few seconds in clove oil (eugenol), after which we mounted them in "Euparal", between two pieces of cover glass, which enables the specimen to be studied from both sides under a compound microscope. Afterwards, *Nepaletricha lobosa* sp. nov. and *N. sigma* sp. nov. were further dissected so that the parts could be turned and studied in different angles (Figs 4 B,C,D and 5B). Today the parts are not in the position shown in Figures in any of the three species. The preparations between two pieces of cover glass are now attached to usual glass slides by a couple of strips of adhesive tape across their edges and are easily detached when needed. Other parts of the body have not been treated with potassium hydroxide. After dehydration we mounted them as they were in "Euparal", heads, wings and part of legs detached, heads placed so that they can be studied in frontal view.

One male of *Nepaletricha sigma* sp. nov. has been kept in alcohol and used for the molecular study by Ševčík et al. (2014).

Verbal description of the illustrated characters is restricted to a minimum. Wing length is given from humeral cross vein to wing tip.

Illustrations were made with the aid of a drawing tube attached to a Leitz Diaplan compound microscope. The habitus photograph of *Nepaletricha lobosa* sp. nov. was taken with Olympus SZX7 stereo microscope equipped with Olympus E400 digital camera.

The material is preserved in the Moravian Museum, Brno, Czech Republic (MMBC), the Royal Belgian Institute of Natural Sciences, Brussels (IRSN) and in the collection of Jan Ševčík, Ostrava (JSOC).

Results

Family assignment of *Nepaletricha*

Chandler (2002) in his description of the genus did not assign it to a family and placed it in the *Heterotricha* Loew, 1850 group. In his phylogenetic analysis, *Nepaletricha* nested in a common clade with Sciaridae and several other genera belonging to the so-called *Heterotricha* group not assigned to any family. On the other hand, Chandler (2002) presented several arguments against a close relationship of the *Heterotricha* group to Sciaridae.

Hippa & Vilkamaa (2005, 2006) performed phylogenetic analyses of both extant and fossil taxa of Sciaroidea. As in Chandler (2002), *Nepaletricha* appeared as the sister group of *Kenyatricha* Chandler, 2002 in a clade including a part or all the genera of the *Heterotricha* group. They did not assign *Nepaletricha* in any family.

Amorim & Rindal (2007) placed *Nepaletricha* and most other enigmatic genera of Sciaroidea in the family Rangomaramidae. Hippa et al. (2009) followed this classification without any argumentation. This practice was, however, strongly criticized by Jaschhof (2011) who suggested using Sciaroidea *incertae sedis* for all the previously unplaced genera in the *Heterotricha* group.

Fig. 1. *Nepaletricha lobosa* sp. nov. (paratype). Habitus.

In wing venation, the extant genera of Sciaroidea *incertae sedis* placed in the *Heterotricha* group fit the Upper Jurassic and Lower Cretaceous family Pleciomimidae. They resemble especially the genera *Pleciomima* Rohdendorf, 1938, *Lycoriomimodes* Rohdendorf, 1946, and *Sciaromima* Kovalev, 1990 (cf. Kovalev 1990) and it is in our opinion impossible to find any difference of importance. It is worth mentioning that when characters of *Pleciomima* are taken from Kovalev's (1990) paper and placed in the matrix of fossil and recent Sciaroidea by Hippa & Vilkamaa (2005), instead of the original ones, the genus harbours in the clade *Chiletricha* Chandler, 2002 + *Rhynchoheterotricha* Freeman, 1960. Pleciomimidae is now regarded as a junior synonym of Antefungivoridae (see Evenhuis 1994, Sabrosky 1999). We suspect that the correct family assignment for *Nepaletricha* and the other genera in the *Heterotricha* group is Antefungivoridae and a closer study of this, which is beyond the scope of this paper, is much needed.

No molecular methods have so far been used to study extant taxa of Sciaroidea *incertae sedis*, although they could definitely shed more light on their systematics, as was recently shown for some enigmatic taxa of Mycetophilidae (cf. Ševčík et al. 2013). Only quite recently, Ševčík et al. (2014) included *Nepaletricha* in their molecular phylogenetic study. The possible relationship of *Nepaletricha* with the other members of the *Heterotricha* group or with Rangomaramidae could not be shown because no species of the two latter have been analysed.

Until the family question concerning the *Heterotricha* group is settled we follow Jaschhof's (2011) suggestion and place *Nepaletricha* in Sciaroidea *incertae sedis*.

Chaetotaxy of wing in *Nepaletricha*

In the earlier papers on *Nepaletricha* (Chandler 2002, Hippa et al. 2009) the setosity of the wing veins and the wing membrane was incompletely studied and described. Concerning the species described in this paper, the setosity of the veins and the membrane both on the dorsal and ventral sides is described. One of the new species differs from the others by both the dorsal setosity of Sc and the ventral setosity of M_1. Earlier, *N. montana* is known to differ from other *Nepaletricha* by its totally non-setose vein A_1 (Hippa et al. 2009). *Nepaletricha furcata*, *N. montana* and *N. mystica* have not been restudied for the present paper.

Key to the species of *Nepaletricha*

1 Tergite 9 dorsally at posterior margin with a pair of non-setose lobes. 2
– Tergite 9 dorsally at posterior margin with a pair, three, or two pairs of setose lobes, the setosity widely distributed on the lobes or represented by 3–4 apical megasetae. 3
2 The lobes at the posterior margin of tergite 9 short, in dorsal or ventral view subquadrangular, as long as broad, scutum without acrostichal setae (Hippa et al. 2009: Figs 3 A, B). ..... ***N. furcata*** Hippa, Chandler & Papp, 2009
– The lobes at the posterior margin of tergite 9 long, in dorsal or ventral view attenuating, more than twice longer than broad, scutum with acrostichal setae (Chandler 2002: Fig. 55). ..... ***N. mystica*** Chandler, 2002
3 Tergite 9 with three setose lobes at the posterior margin, a strong dorsomedial one and a pair of weaker ones in a lateral position at the base of the former (Hippa et al. 2009: Figs 4 A,B). ..... ***N. montana*** Hippa, Chandler & Papp, 2009
– Tergite 9 with one or two pairs of setose lobes at posterior margin. 4
4 Tergite 9 with two pairs of setose lobes at the posterior margin (Fig. 3A), both lobes with a number of setae. ..... ***N. dembickyi* sp. nov.**
– Tergite 9 with one pair of lobes at the posterior margin, the lobes with 3–4 apical megasetae only. 5
5 The lobes at the posterior margin of tergite 9 short and robust, ca. 5 times longer than broad, with 4 apical megasetae, gonocoxa without a long sigmoid lobe posterodorsally (Fig. 4 A). ..... ***N. lobosa* sp. nov.**
– The lobes at the posterior margin of tergite 9 long and slender, more than 10 times longer than broad, with 3 apical megasetae, gonocoxa with a long, sigmoid lobe posterodorsally (Fig. 5C). ..... ***N. sigma* sp. nov.**

Descriptions of the new species

Nepaletricha dembickyi sp. nov.

(Figs 2A, 2D, 3A–C)

Type material. Holotype: ♂, **NE INDIA: Arunachal Pradesh:** Hunli vicinity, 1300±100m, 28°19´32´´N, 95°57' 31´´E, 26.v.–1.vi.2012, L. Dembický leg., AP 4 / 2012, MZM Expedition (MMBC).

Description. ***Male.*** **Head.** Distal part of antennae lost beyond flagellomere 9 or 11 in the single specimen. Colour of head brown, antenna slightly paler beyond the middle of flagello-

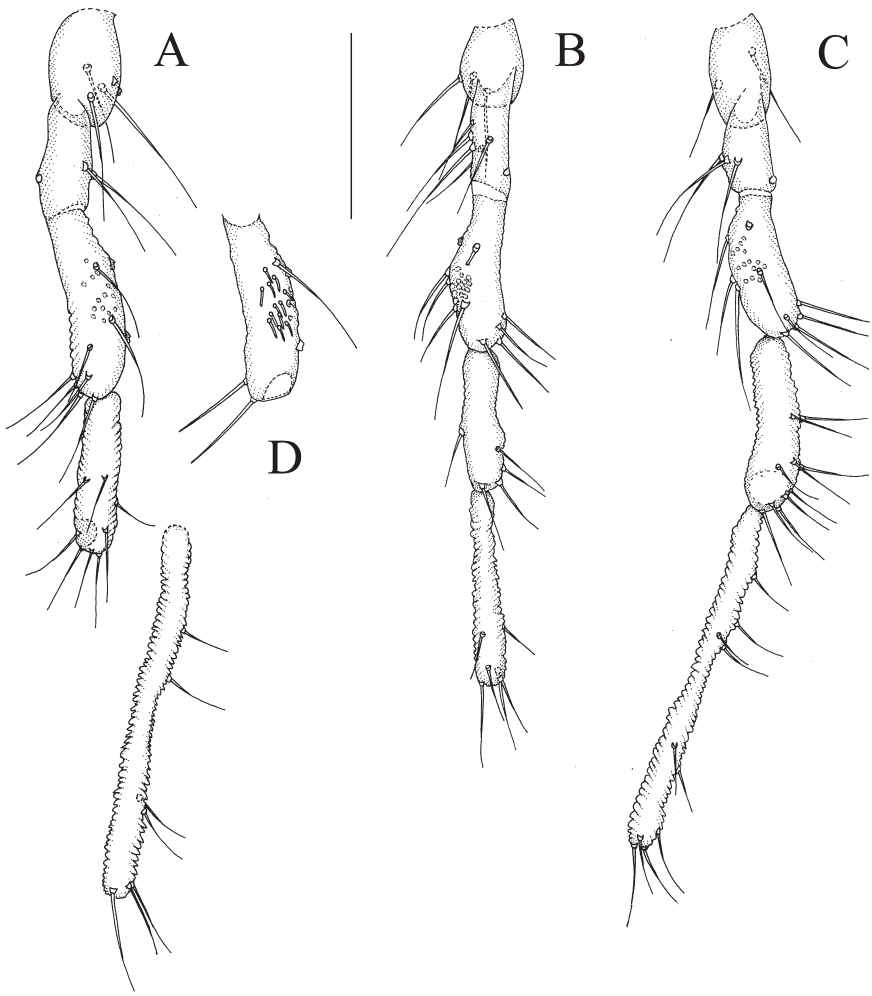

Fig. 2. Maxillary palpus, dorsal view (A, B, C) and palpomere 3, ventral view (D). A, D – *Nepaletricha dembickyi* sp. nov. (holotype). B – *N. sigma* sp. nov. (holotype). C – *N. lobosa* sp. nov. (holotype). Scale 0.1 mm.

mere 1. Face with two setae medioventrally. Maxillary palpus, Fig. 2A,D: palpomere 2 with dome-like sensilla mesially on distal part, palpomere 3 with a patch of close to each other placed hyaline sensilla ventrolaterally. Antenna similar to *N. montana* (Hippa et al. 2009: Figs 1 B,E): scapus with two setae, flagellomere 1 6.4 times longer than broad, flagellomere 4 3.4 times longer than broad. **Thorax.** Brown. Scutum with 8–10 lateral setae, ca. 10 dorsocentral setae and with 0 acrostichal setae, scutellum with 4 setae and prothoracic epimeron with 5 setae. Wing length 2.2 (2.5) mm. **Legs.** Femur, tibia and tarsus of leg 1 lost on both sides. Colour of the remaining parts brown. Coxae similar to *N. furcata* (Hippa et al. 2009: Fig. 1A).

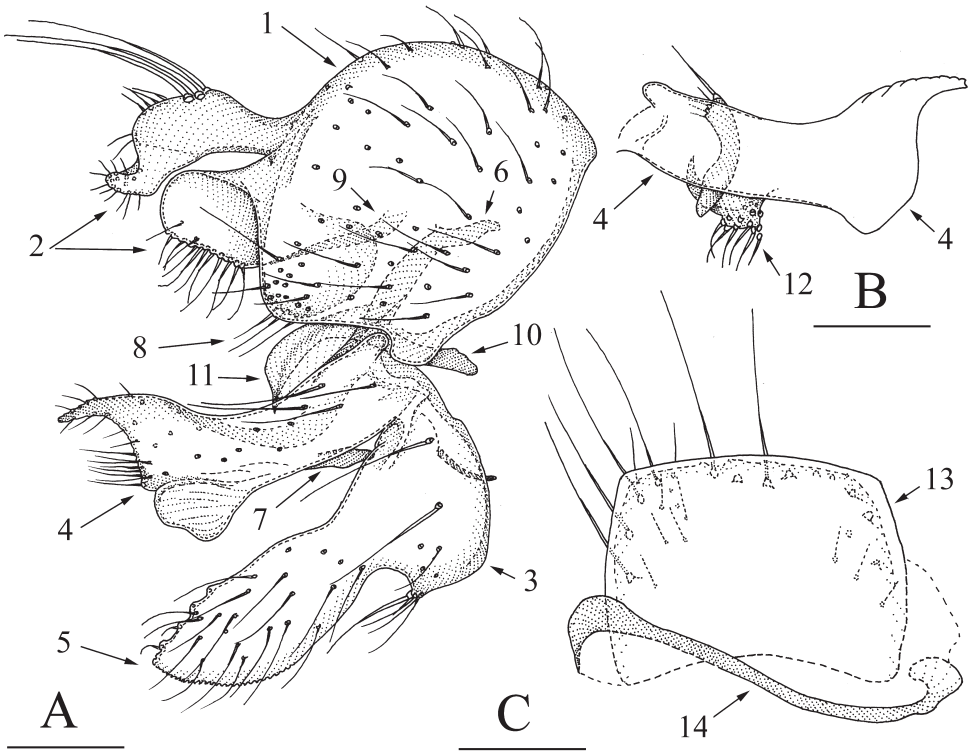

Fig. 3. *Nepaeltricha dembickyi* sp. nov. (holotype). A – Hypopygium, lateral view. B – Left side dorsal gonocoxal lobe with associated parts, lateral view. C – Abdominal segment 8, ventral view. Scale 0.1 mm. 1 – tergite 9, 2 – lobes at posterior margin of tergite 9, 3 – gonocoxa, 4 – posterodorsal lobe of gonocoxa, 5 – posteroventral lobe of gonocoxa, 6 – gonocoxal apodeme, 7 – gonostylus, 8 – setae of cercus, 9 – sternite 10, 10 – aedeagal apodemes, 11 – tegmen, 12 – sublobe on the mesial side of the larger dorsal gonocoxal lobe, 13 – tergite 8, 14 – sternite 8.

Wing. Similar to *N. furcata* (Hippa et al. 2009: Fig. 2B): Sc setose dorsally, R and R_1 setose dorsally, R_1 distally setose on both sides, R_{4+5} setose dorsally and ventrally, stM, M_1 and M_2 setose dorsally and ventrally, CuA_1 and CuA_2 setose dorsally and A_1 setose dorsally and ventrally; wing membrane setose dorsally and ventrally. Colour of wing and halter brownish.
Abdomen. Brown. Segment 8, Fig. 3C: note the totally non-setose sternite. Hypopygium, Figs 3A,B: Tergite 9 with two pairs of setose plate-like lobes posteriorly. Gonocoxa deeply cut into two large posterolateral setose lobes, the more dorsal one of these further bearing a curved posterodorsal lobe, a plate-like posteroventral lobe and a richly setose lobe on its mesial side, near the attachment of gonostylus. Gonostylus sickle-shaped with one long and a few shorter setae at apex (dorsal end). Aedeagus and parameres not seen in detail in the mount (Fig. 3A). Cerci large, roundish, with several long setae. Sternite 10 medially divided into two halves, with 1 long setae posteriorly on each half.

Female. Unknown.

Etymology. The species is named after Luboš Dembický, the collector of the type material of the present species and that of *Nepaletricha sigma*.

Discussion. *Nepaletricha dembickyi* sp. nov. is greatly similar to *N. montana*. Both differ from other *Nepaletricha* by having the lateral side of gonocoxa divided into a dorsal and ventral lobe by a very deep cleft so that the lobes are posteriorly only narrowly connected. *Nepaletricha dembickyi* is distinguished from *N. montana* by having two pairs of setose lobes at the posterior margin of tergite 9, in *N. montana* there is one setose medial lobe and a pair of inconspicuous setose lobes at its base. Further, *N. dembickyi* differs from *N. montana* by having the wing vein A_1 setose on both sides instead of being non-setose. Both the discussed species resemble *N. mystica* by having the palpomere 5 short, not much longer than palpomere 4.

Nepaletricha lobosa sp. nov.

(Figs 1, 2C, 4A–D)

Type material. Holotype: ♂, **VIETNAM:** Con Dao N. P., Con Son Isl., 8°41′30″N, 106°38′00″ E, 17–24.vi.2012, Malaise trap, leg. J. Constant & J. Bresseel. I.G.: 32.161 (IRSN).

Description. ***Male.*** **Head**. Distal part of antennae lost beyond flagellomere 7 or 8. Colour of head brown. Face medioventrally with transverse row of 4 setae. Maxillary palpus, Fig. 2 C: palpomere 2 with dome-like sensilla mesially on distal part, palpomere 3 with scattered hyaline sensilla ventrolaterally. Antenna similar to *N. montana* (Figs 1B,E in Hippa et al. 2009): scapus with 2 setae, flagellomere 1 7.2 times longer than broad, flagellomere 4 2.8 times longer than broad. **Thorax.** Brown. Similar to *N. furcata* (Hippa et al. 2009: fig. 1 A): scutum with 5 lateral setae, 8–10 dorsocentral setae and 3 acrostichal setae anteriorly, scutellum with 4 setae and prothoracic epimeron with 2 setae. **Legs.** Brown. Coxae similar to *N. furcata* (Fig. 1A in Hippa et al 2009). Apical part of tibia 1 similar to *N. montana* (Hippa et al. 2009: Fig. 1G) but tibial organ (patch of setae subapically on the prolateral side) still less differentiated. **Wing.** Similar to *N. furcata* (Hippa et al. 2009: Fig. 2B). Sc setose dorsally, with only 2 or 3 setae, R setose dorsally, R_1 setose dorsally and ventrally, R_{4+5} setose dorsally and ventrally, stM, M_1 and M_2 setose dorsally and ventrally, CuA_1 setose dorsally, CuA_2 setose dorsally and A_1 setose dorsally and ventrally; wing membrane setose dorsally and ventrally. Colour of wing and halter brownish. Wing length 1.9 (2.2) mm. **Abdomen.** Brown. Segment 8 similar to Fig. 5D, sternite similarly laterally setose. Hypopygium, Figs 4A–D: Tergite 9 conspicuously small in relation to gonocoxa, posteriorly with curved horn-like lobe with 4 megasetae apically. Gonocoxa with large posteroventral setose lobe and a smaller more lateral setose lobe. Gonostylus crescent-shaped or bilobed with 3 setae on both lobes. Aedeagus in dorsal or ventral view arrow-shaped. Tegmen surrounding the aedeagus, with a pair of large dorsal lobes. Cerci narrow, with 2 setae posteriorly. Sternite 10 medially divided, with 1 seta posteriorly on each half.

Female. Unknown.

Etymology. The name is Latin adjective *lobosus* (*-a*, *-um*), full of lobes, referring to the numerous different lobes on the gonocoxa 9.

Discussion. *Nepaletricha lobosa* is similar to *N. sigma* sp. nov. They differ from other *Nepaletricha* e.g. by having a pair of curved horn-like lobes with apical megasetae dorsally

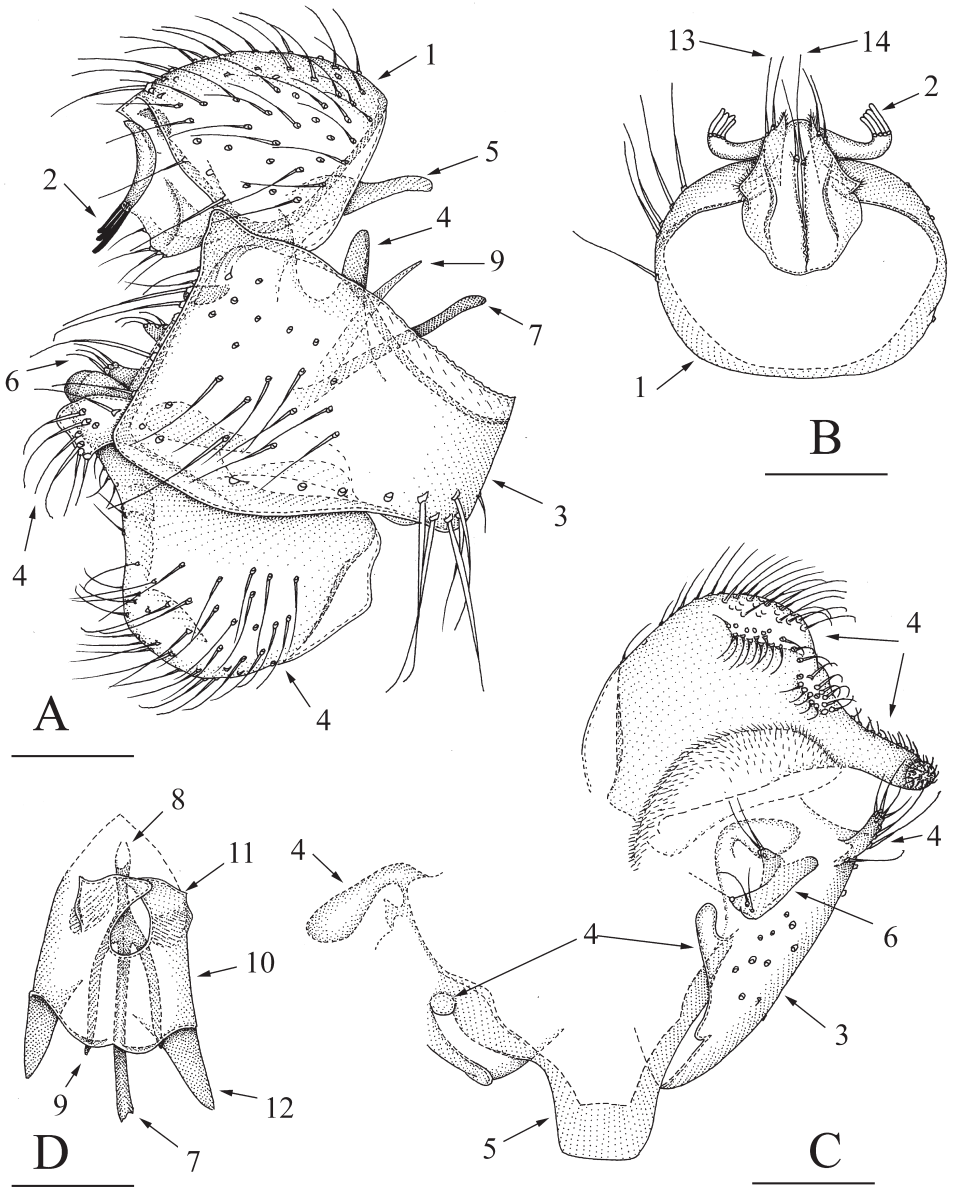

Fig. 4. *Nepaletricha lobosa* sp. nov. (holotype). A – Hypopygium, lateral view. B – Tergite 9 with associated parts, ventral view. C – Part of gonocoxa with associated parts, dorsal view. D – Aedeagus and tegmen, dorsal view. Scale 0.1 mm. 1 – tergite 9, 2 – apical megasetae of the lobe at the posterior margin of tergite 9, 3 – gonocoxa, 4 – gonocoxal lobe, 5 – gonocoxal apodeme, 6 – gonostylus, 7 – aedeagal apodemes, 8 – apex of aedeagus, 9 – lateral lobe of aedeagus, 10 – tegmen, 11 – lobe of tegmen, 12 – apodemes of tegmen (parameral apodeme), 13 – seta of cercus, 14 – seta of sternite 10.

at the posterior margin of tergite 9. *Nepaletricha lobosa* differs from *N. sigma* by having its tergite 9 unusually small in relation to gonocoxa, by having the horn-like lobes at the posterodorsal margin of tergite 9 much shorter and with 4 apical megasetae instead of 3, by having the posterolateral ventral plate-like lobe very large and by lacking a long S-shaped branched lobe posterodorsally on the gonocoxa (Figs 5C). The latter is represented in *N. lobosa* by a flat subquadrangular lobe, in Fig. 4A visible at ventral posterolateral corner of the gonocoxa. *Nepaletricha lobosa* seems to differ from other *Nepaletricha* by having only a couple, not many, setae dorsally on the wing vein Sc. It differs from *N. dembickyi* and *N. sigma* by having the vein R_1 setose both dorsally and ventrally, not only dorsally; the ventral chaetotaxy is not known concerning the three earlier described species. *Nepaletricha lobosa* is similar to *N. mystica* by having acrostichal setae on the scutum.

Nepaletricha sigma sp. nov.

(Figs 2B, 5A–D)

Type material. Holotype: ♂, **INDIA: Arunachal Pradesh:** Etalin vicinity, 700 m, 28°36′56″N, 95°53′21″E, 12–25.v.2012, L. Dembický leg., AP 3 / 2012, MZM Expedition (MZMC). Paratype: ♂, **INDIA: Arunachal Pradesh:** Hunli vicinity, 1300±100m, 28°19′32″N, 95°57′31″E, 26.v.–1.vi.2012, L. Dembický leg., AP 4 / 2012, MZM Expedition (JSOC), GenBank accession numbers for its DNA sequences are KJ136697 (12S) and KJ136733 (16S), see Ševčík et al. (2014).

Description. ***Male.*** **Head**. Distal part of antennae lacking beyond flagellomere 1 or 3. Colour of head brown, mouthparts and antenna slightly paler. Face with 5 setae medioventrally. Maxillary palpus, Fig. 2B: palpomere 2 with dome-like sensilla mesially on distal part, palpomere 3 with scattered hyaline sensilla ventrolaterally. Antenna similar to *Nepaletricha montana* (Hippa et al. 2009: Fig. 1B): scapus with 2 setae, flagellomere 1 7.1 times longer than broad. **Thorax.** Brown. Similar to *N. furcata* (Hippa et al. 2009: Fig. 1A): scutum with 6 stronger lateral setae plus a few weaker ones posteriorly which are poorly visible in the mount, 11–12 dorsocentral setae and 0 acrostichal setae, scutellum with 4 setae and prothoracic epimeron with 5–6 setae. **Legs.** Distal part beyond trochanters lost on all legs. Colour of coxae and trochanters brown. Coxae similar to *N. furcata* (Hippa et al 2009: Fig. 1A) but their lateral setae more distinctly in a single row. **Wing.** Similar to *N. furcata* (Hippa et al. 2009: Fig. 2B): Sc setose dorsally, one seta ventrally on the left side, R and R_1 setose dorsally, R_1 distally setose on both sides, R_{4+5} setose dorsally and ventrally, stM, M_1 and M_2 setose dorsally and ventrally, CuA_1 setose dorsally, apically also ventrally, CuA_2 setose dorsally and A_1 setose dorsally and ventrally; wing membrane setose dorsally and ventrally. Colour of wing and halter brownish. Wing length 2.7 (3.0) mm. **Abdomen.** Brown. Segment 8, Fig. 5 D: note the lateral setae on sternite. Hypopygium, Figs. 5A,B,C: Tergite 9 posteriorly with a pair of curved lobes apically bearing 3 megasetae. Sternite 9 posterodorsally with an S-shaped setose lobe with a branch on apical half, posteroventrally with a plate-like setose lobe. Gonostylus bilobed, with a few setae on both. Aedeagus not visible in detail in the mount, apparently in dorsal or ventral view arrow-shaped as in Fig. 4D. Tegmen (parameres) not visible in detail in the mount. Cerci narrow, with a few long setae. Sternite 10 medially divided, each half with two long posterior setae.

Female. Unknown.

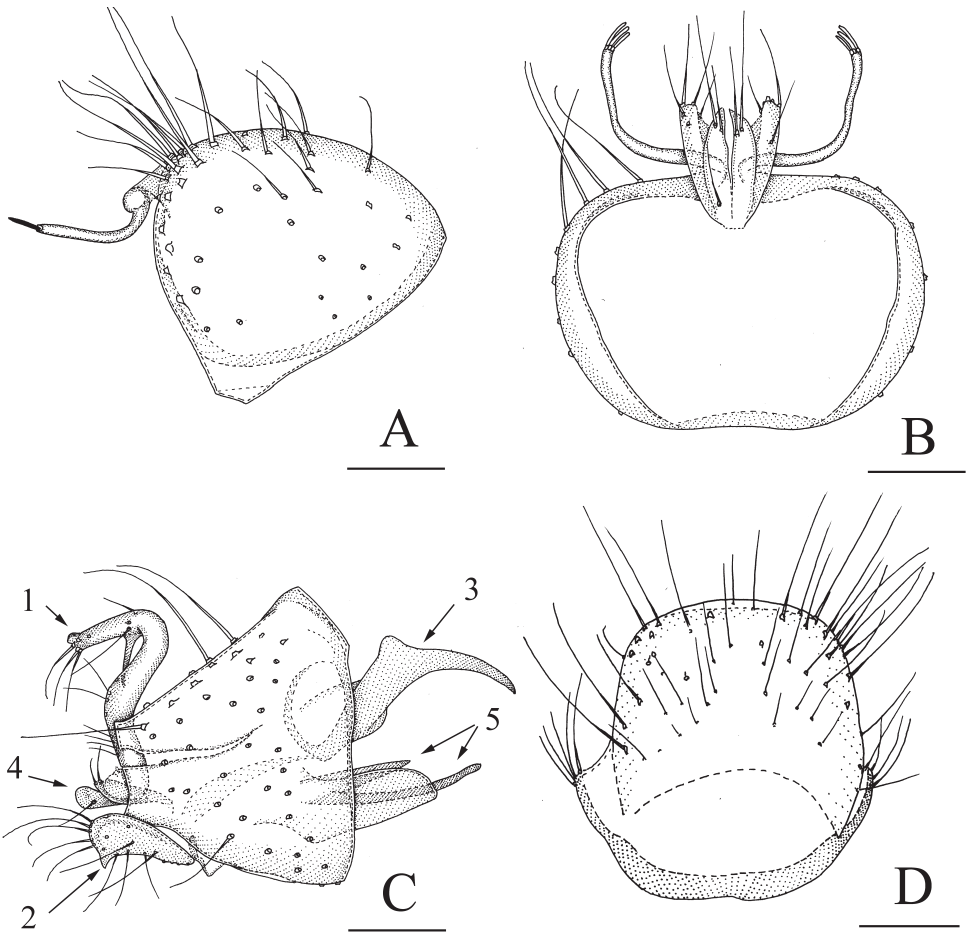

Fig. 5. *Nepaletricha sigma* sp. nov. A – Tergite 9 with associated parts, lateral view (holotype). B – Tergite 9 with associated parts, ventral view. C – Gonocoxa with associated parts, lateral view. D – Abdominal segment 8, dorsal view. Scale 0.1 mm. 1 – posterodorsal sigmoid lobe of gonocoxa, 2 – posteroventral plate-like lobe of gonocoxa, 3 – gonocoxal apodeme, 4 – gonostylus, 5 – aedeagus + tegmen.

Etymology. The name *sigma* is derived from the eighteenth letter of the Greek alphabet and refers to the sigma-shaped lobe posterolaterally on the gonocoxa; noun in apposition.
Discussion. *Nepaletricha sigma* is similar to *N. lobosa* sp. nov. For further discussion, see under the latter.

Acknowledgements

We are grateful to Luboš Dembický (MMBC, Brno, Czech Republic) and Patrick Grootaert (IRSN, Brussels, Belgium) for providing us with this interesting material. The visit of the

junior author to the Royal Belgian Institute of Natural Sciences (Brussels) was supported by the SYNTHESYS Project (http://www.synthesys.info) which was financed by European Community Research Infrastructure Action under the FP6 "Structuring the European Research Area" Programme (project No. BE-TAF-2780). Peter J. Chandler (Melksham, Great Britain) and an anonymous reviewer kindly reviewed this paper.

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