ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE
Published 9.xii.2011 Volume 51(2), pp. 697–722 ISSN 0374-1036

Taxonomy of *Stenomicra cogani*, with description of *S. gracilior* sp. nov. from Turkey and comparative morphology of terminalia in Stenomicridae (Diptera)

Jindřich ROHÁČEK

Slezské zemské muzeum, Tyršova 1, CZ-746 01 Opava, Czech Republic; e-mail: rohacek@szmo.cz

Abstract. The European *Stenomicra cogani* Irwin, 1982 (Diptera: Stenomicridae) is redescribed including the previously undescribed female, and the variability, biology (with first photographs of living specimens) and distribution of the species are discussed. *Stenomicra gracilior* sp. nov., a closely allied and externally very similar species (also lacking dm-cu cross-vein), is described from southern Turkey. The morphology of the male and female terminalia is studied in detail in both these species and in *Podocera delicata* (Collin, 1944) and their structures are compared with those known in other genera of Stenomicridae. Female internal genitalia (genital chamber and associated structures) are described for the first time in the family Stenomicridae. Based on the analysis of the male and female genital characters, the relationships of the genera affiliated to Stenomicridae (*Cyamops* Melander, 1913, *Stenocyamops* Papp, 2006, *Podocera* Czerny, 1929, *Stenomicra* Coquillett, 1900 and *Planinasus* Cresson, 1914) are discussed and the validity of the genus *Podocera* Czerny, 1929 is corroborated. The first record of *Podocera soniae* (Merz & Roháček, 2005) from Sweden is given.

Key words. Diptera, Stenomicridae, *Stenomicra cogani*, *S. gracilior* sp. nov., taxonomy, morphology, male genitalia, female terminalia, biology, distribution, Turkey, Palaearctic Region

Introduction

The western Palaearctic species of Stenomicridae (Diptera) have recently been reviewed by Merz & Roháček (2005). This paper also includes a synopsis of the previous opinions regarding the systematic position and relationships of the genus *Stenomicra* Coquillett, 1900 and, consequently, this information is not repeated here. The family Stenomicridae (treated as

a subfamily of Periscelididae in the latter paper) is represented by two genera in the area, viz. *Stenomicra* and *Podocera* Czerny, 1929, each including two species. *Podocera* has formerly often been considered either a subgenus of *Stenomicra*, as by Merz & Roháček (2005), or a mere synonym of the latter (Grimaldi 2009). However, Papp (2006) elevated the subgenus *Podocera* to generic rank and also supported the family rank of Stenomicridae, which was followed by Roháček (2009). Thus, two species of *Podocera*, viz. *P. delicata* (Collin, 1944) and *P. soniae* (Merz & Roháček, 2005) and two species of *Stenomicra*, viz. *S. cogani* Irwin, 1982 and *S. jordanensis* Freidberg & Mathis, 2002 have been known from the western Palaearctic area up to the present. While both the above *Podocera* species were described by Merz & Roháček (2005) in detail, including the internal structures of the male genitalia, the two species of *Stenomicra* are poorly known in this respect as only external male genitalia were described and illustrated in *S. cogani* by Irwin (1982). Moreover, the structures of the female terminalia (inner genitalia in particular) have insufficiently been known in the family Stenomicridae, with partial information provided only by Baptista & Mathis (1994, 1996, 2000), Sueyoshi & Mathis (2004) and Mathis & Sueyoshi (2011) for the genus *Cyamops* Melander, 1913 and by Grimaldi (2009) for the genus *Stenocyamops* Papp, 2006; no data are available for the genera *Stenomicra*, *Podocera* or *Planinasus* Cresson, 1914. The female of *Stenomicra cogani* remains undescribed until now although the species has recently been relatively frequently recorded (particularly from Great Britain), for references see Merz & Roháček (2005) and Roháček (2009).

In May 2011 a pair of *Stenomicra* specimens was collected in southern Turkey (Antalya province). They were originally identified as *S. cogani* and recorded as the first representative of Stenomicridae in Turkey by Roháček (2011), but have been subsequently found not to fall within the variability of the former species. The description of this new species from Turkey necessitated redescription of *S. cogani* including detailed study of its male and female terminalia and also examination of female postabdominal structures in a species of *Podocera*, viz. *P. delicata* (Collin, 1944). The results from these morphological studies are also presented below in addition to taxonomic treatment of both *Stenomicra* species.

Material and methods

The material listed in this paper is deposited in collections as follows:

BMNH The Natural History Museum, London, Great Britain;
CDAG C. M. Drake private collection, Axminster, Great Britain;
MBPC M. Barták private collection, Praha, Czech Republic;
NHRS Naturhistoriska Riksmuseet, Stockholm, Sweden;
SMOC Silesian Museum, Opava, Czech Republic.

Living *Stenomicra* specimens were photographed in special boxes by means of a digital camera Canon EOS 60D with a macro lens (Canon MP-E 65 mm 1–5×) and ring macro flash (Canon MR-14EX). Dry mounted or ethanol preserved specimens have been examined, drawn and measured using two types of binocular stereoscopic microscopes (Reichert, Olympus). Male genitalia and female terminalia were examined after detachment, treating in hot 10%

KOH, washing in water and dissection of the whole abdomen in a drop of glycerine under a binocular microscope. After examination, all parts were transferred to a small plastic tube in glycerine and pinned below the respective specimens. Detailed examinations were performed with a compound microscope (Jenaval) and genital structures were drawn by means of Abbe's drawing apparatus on this microscope at a higher magnification (130–350×). For more detail see Roháček (2006).

The morphological terminology used in descriptions follows that by Merz & Roháček (2005) except for terms of the male and female terminalia, which are adopted from Roháček (2006, 2010). Consequently, the terminology of the male genitalia is largely based on the 'hinge' hypothesis of the origin of the eremoneuran hypopygium, rediscovered and documented by Zatwarnicki (1996). The synonymous terms proposed by other major hypotheses, including also those used by Baptista & Mathis (1994, 2000), Merz & Roháček (2005), Papp (2006) and/or Grimaldi (2009) are given in parentheses as follows: ejacapodeme (ejaculatory apodeme), epandrium (periandrium), gonostylus (surstylus), medandrium (intraepandrial sclerite, intraperiandrial sclerite, bacilliform sclerites), pregonite (gonite), postgonite (paramere), phallapodeme (aedeagal apodeme), phallophore (basiphallus). For recognition of particular postabdominal and male genital structures, see also Figs. 7, 8, 10, 14, 28 in this paper.

Abbreviations of morphological terms used in text and/or figures:

A_1 – anal vein
ac – acrostichal (setulae)
C – costa
ce – cercus
Cs_3, Cs_4 – 3rd and 4th costal sector
CuA_1 – cubitus
dc – dorsocentral setae
dp – distiphallus
dm-cu – discal medial-cubital (= posterior, t_p) cross-vein
ea – ejacapodeme
ep – epandrium
f – filum of distiphallus
f_1, f_2 – fore, mid femur
g – genal (seta)
gs – gonostylus
hu – humeral (seta)
hy – hypandrium
M – media
ma – medandrium
npl – notopleural (setae)
oc – ocellar (setae)
ors – fronto-orbital (setae)
pa – postalar (seta)
per – peristomal (setae)
pha – phallapodeme
pp – phallophore
prg – pregonite
pv – pseudovibrissa
pvt – postvertical (seta)
R_1 – 1st branch of radius
R_{2+3} – 2nd branch of radius
R_{4+5} – 3rd branch of radius
r-m – radial-medial (= anterior, t_a) cross-vein
s – saccus of distiphallus
S1–S10 – abdominal sterna
sc – scutellar (seta)
Sc – subcosta
sp – spermatheca
T1–T10 – abdominal terga
t_2 – mid tibia
vr – ventral receptacle
vte – external vertical (seta)
vti – internal vertical (seta)

Results

TAXONOMY

Stenomicra cogani Irwin, 1982

(Figs. 1–5, 7–20)

Stenomicra cogani Irwin, 1982: 235 (description); Merz & Roháček (2005): 521, 536 (key, records); Roháček (2009): 4 (biology, distribution).

Type material. Holotype: ♂, **GREAT BRITAIN: Wales:** Anglesey, Llanfflewyn, Grid. Ref. 23/353891, 11.vii.1976, swept from vegetation beside a small lake, A. Irwin leg. Paratypes: 3 ♂♂, with same data as for holotype, all deposited in BMNH (not examined).

Material examined. GREAT BRITAIN: England: Norfolk, Surlingham Church Marsh, TG 308 070, 21.vi.2009, 4 ♂♂ 2 ♀♀, C. M. Drake leg. (CDAG, in ethanol). **ITALY:** Mantova pr. Marmirolo, Bosco d. Fontana, 50 m, 42.12 N, 10.45 E, 20.v.2001, 2 ♂♂ 1♀, Merz & Mason leg. (SMOC). **CZECH REPUBLIC: N Bohemia:** Sosnová 1.5 km SW, Peklo reserve, 50°39′N, 14°31′E, sweeping *Carex acutiformis* in alder forest, 27.vi.2008, 2 ♂♂; Pavlovice 2 km W, Dolské údolí (valley), 50°36′N, 14°30′E, sweeping *Scirpus sylvaticus* in boggy meadow, 25.vi.2008, 1 ♂ 2 ♀♀; Doksy env., Břehyňský rybník (pond) reserve, 50°35′N, 14°43′E, sweeping *Carex acuta* in boggy meadow, 24.vi.2008, 2 ♀♀; Hradčany 1.5–2 km W, Ploučnice valley, 50°37′N, 14°41′E, sweeping *Carex rostrata* in boggy meadow, 23.vi.2008, 1 ♂ 2 ♀♀, sweeping *Carex rostrata* in boggy meadow, 26.vi.2008, 1 ♂; Višňová, Meandry Smědé res., 50°59′06″N, 15°01′38″E, 225 m, sweeping *Carex nigra* in boggy meadow, 14.vi.2011, 1 ♂ 2 ♀♀; Černousy, Dubák pond, 50°59′54″N, 15°02′32″E, 230 m, sweeping *Scirpus sylvaticus* in alder forest, 16.vi.2011, 7 ♂♂ 13 ♀♀, all J. Roháček leg. (SMOC). **S Bohemia:** Vráž nr. Písek, 49°24′12″N, 14°7′13″E, 430 m, damp meadow, 18.–22.vii.2007, 1 ♂, M. Barták leg. (MBPC). **N Moravia:** Polanka nad Odrou, Přemyšov reserve, 49°47′N, 18°11′E, sweeping *Carex acuta* in boggy meadow, 16.vii.2008, 2 ♀♀, sweeping *Carex vesicaria* in boggy meadow, 16.vii.2008, 1 ♂ 1 ♀, sweeping *Scirpus sylvaticus* in boggy meadow, 16.vii.2008, 1 ♂ 1 ♀; same locality, reared ex tussock of *Scirpus sylvaticus* collected in boggy meadow 11.vii.2009 – 1 ♂ 1 ♀, emerged 11.v.–9.vi.2009 and 1 ♂ emerged 9.vi.–9.vii.2009, reared ex tussock of *Carex elongata* collected in boggy meadow 11.v.2009 – 1 ♀ emerged 9.vi.–9.vii.2009; Šilheřovice, Černý les res., 49°54′25″N, 18°16′31″E, 240 m, reared ex tusocks of *Scirpus sylvaticus* collected at forest creek 9.vi.2010 – 4 ♂♂ 1 ♀ emerged 9.–24.vi.2010, 1 ♀ emerged 24.vi. –28.vii.2010. **SW Moravia:** Třešť 1 km E, Lávecká cesta (distr. Jihlava), sweeping *Scirpus sylvaticus* in boggy meadow, 5.viii.2005, 1 ♀, 11.viii.2005, 1 ♂. **S Moravia:** Hrabětice, Trávní Dvůr 1 km SW, 48°47′N, 16°26′E, sweeping *Carex* sp. in floodplain forest, 18.v.2009, 1 ♂, sweeping *Carex vesicaria* in boggy meadow, 7.vii.2009, 2 ♂♂ 3 ♀♀, all J. Roháček leg. (SMOC). **ROMANIA: Banat:** Gornea nr. Sicheviţa 1 km S, Gornea river valley, 73 m, 44°39′51″N, 21°51′39″E, sweeping *Carex acuta* in boggy meadow, 4.vi.2008, 3 ♂♂, J. Roháček leg. (SMOC). A number of specimens with genitalia prepared.

Diagnosis. A small, slender, largely yellow species (Figs. 1–3) with posterior cross-vein (dm-cu) absent. It differs from the only other *Stenomicra* species lacking dm-cu, viz. *S. gracilior* sp. nov. (described below), by generally paler colouring and setae, 5–6 ac setulae, male mid femur with anteroventral row of 7–8 setae, smaller brownish spots on female abdominal terga T2, T3–T5 and by other characters (including those in male and female terminalia) listed below in the diagnosis of *S. gracilior* sp. nov.

Redescription. ***Male***. Total body length 1.36–1.81 mm. General colour yellow to pale yellow (head with frons and occiput yellowish white), only small ocellar triangle dark reddish brown, thorax dorsally and some parts of its pleura sometimes with faint pale brown darkening and abdomen with 3rd–4th segments usually appearing reddish brown due to internal colouration (best visible on living specimens – see Fig. 3).

Head subtriangular in profile (Fig. 4), with face strongly protruding in front of anteroventral eye margin, yellow but yellowish white and whitish microtomentose on frons (lightest pos-

Figs. 1–4. *Stenomicra cogani* Irwin, 1982 (Czech Republic: N Bohemia). 1 – female (body length ca. 2 mm) sitting on leaf of *Scirpus sylvaticus*; 2 – same, dorsal view; 3 – male (body length ca. 1.5 mm) on the same leaf; 4 – male, head and thorax laterally (from dry mounted specimen). Photo by J. Roháček (Figs. 1–3) and M. Deml (Fig. 4).

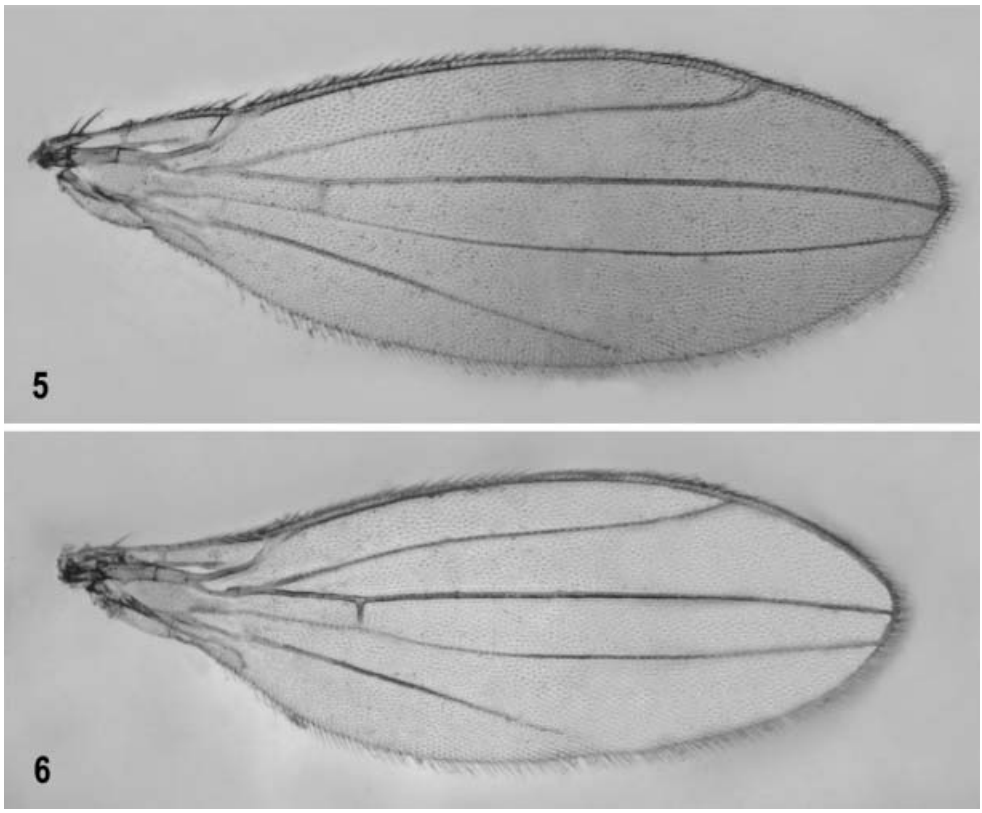
teriorly) and on occiput. Compound eye diagonal, elongately reniform (its longest diameter about 2.3 times as long as shortest) and exposing a large area of occiput at side of head, dark reddish brown (red when alive), with facets slightly larger in dorsal half and with whitish interfacetal microsetulae. Frons largely bare, wide, parallel-sided, almost square (1.05–1.10 times as high as wide), flat, medially (particularly anteriorly) somewhat depressed, yellowish white and microtomentose; ocellar triangle small, dark red to brown, slightly raised, situated in the middle of frons; ocelli relatively small. Face darker yellow than frons, slightly carinate and with shallow concavities below antennae, narrowing ventrally and strongly produced above mouthedge. Facial sensilla (medially above pseudovibrissa) reduced, poorly visible (in contrast to those in *Podocera* species, cf. Merz & Roháček 2005: Figs. 13–14). Antennae yellow, somewhat divergent; pedicel relatively large, expanded on inner side and so partly covering base of 1st flagellomere (postpedicel) and bearing a few proclinate setae dorsally subapically; 1st flagellomere with a fringe of long white hairs on tip; arista brown, slightly longer than antenna, long-pectinate (longest rays longer than 1st flagellomere), dorsally with 4–5, ventrally with 2 rays in addition to apical fork. Mouthparts yellow, small, with palpus strongly reduced, bare, poorly visible.

Chaetotaxy. Cephalic setae and setulae largely yellow, at most tips of major setae brown; 2 ors in anterior half of frons – 1 strong and long posterior and 1 short (half length of the former) anterior, both slightly reclinate; 1 long, slightly lateroclinate vte; 1 slightly shorter, proclinate vti (= pseudopostocellar of Merz & Roháček 2005); posteromedially of the latter with 1 short, upright, slightly divergent pvt (= postocellar) on dorsal margin of occiput; no oc seta; 1 strong, porrect, somewhat lateroclinate pseudovibrissa (pv), inserted on ventral side of 'vibrissal' angle; posteriorly of it with 1 short, proclinate setula and with a series of 6–7 ventroclinate peristomal (per in Figs. 21, 22; genal of Merz & Roháček 2005) setae, becoming shorter posteriorly. On the boundary of gena and occiput, near posteroventral eye margin there is 1 strong (genal) upcurved seta (cf. Fig. 22); posteroventral angle of occiput with a few small setulae; postoculars reduced to only 1–2 setulae behind posterodorsal margin of eye.

Thorax slender, somewhat narrower than head, yellow with sparse pale grey microtomentum, but its dorsum (scutum, scutellum and subscutellum) sometimes with pale brownish tinge, also anepisternum, anepimeron and meron can be partly slightly darkened. Entire metanotum darker brown (up to base of haltere). Scutellum triangular, slightly wider than long, convex; subscutellum bulging.

Chaetotaxy. All setae yellow to ochreous; 5–6 ac setulae, in single irregular row which may be doubled in front of suture (in this case up to 9 acrostichals are present), ending at most behind the level of anterior dc macroseta; 2 strong postsutural dc, the anterior about two-thirds of the more robust posterior, 4–5 dc setulae in front of them but no setulae in large gap between them; no hu (postpronotal) seta but 3–4 posthumeral setulae and 1–2 setulae also between them and foremost dc setulae; 2 stronger subequal npl; 1 short pa; no intraalar seta, only a few (usually 2–3) setulae; scutellum with only 1 long apical sc (as long as posterior dorsocentral seta); 1 long katepisternal seta and several (more than 5) short setae on ventral portion of katepisternum.

Wing (Fig. 5) relatively long and narrow, with whitish membrane and yellowish white veins. C reaching to apex of R_{4+5}, with single costal break in front of apex of R_1. Sc short, ending



Figs. 5–6. Wings of *Stenomicra* species. 5 – *Stenomicra cogani* Irwin, 1982, female (Czech Republic: N. Bohemia), length 1.95 mm; 6 – *S. gracilior* sp. nov., male (holotype), length 1.63 mm. Photo by J. Roháček.

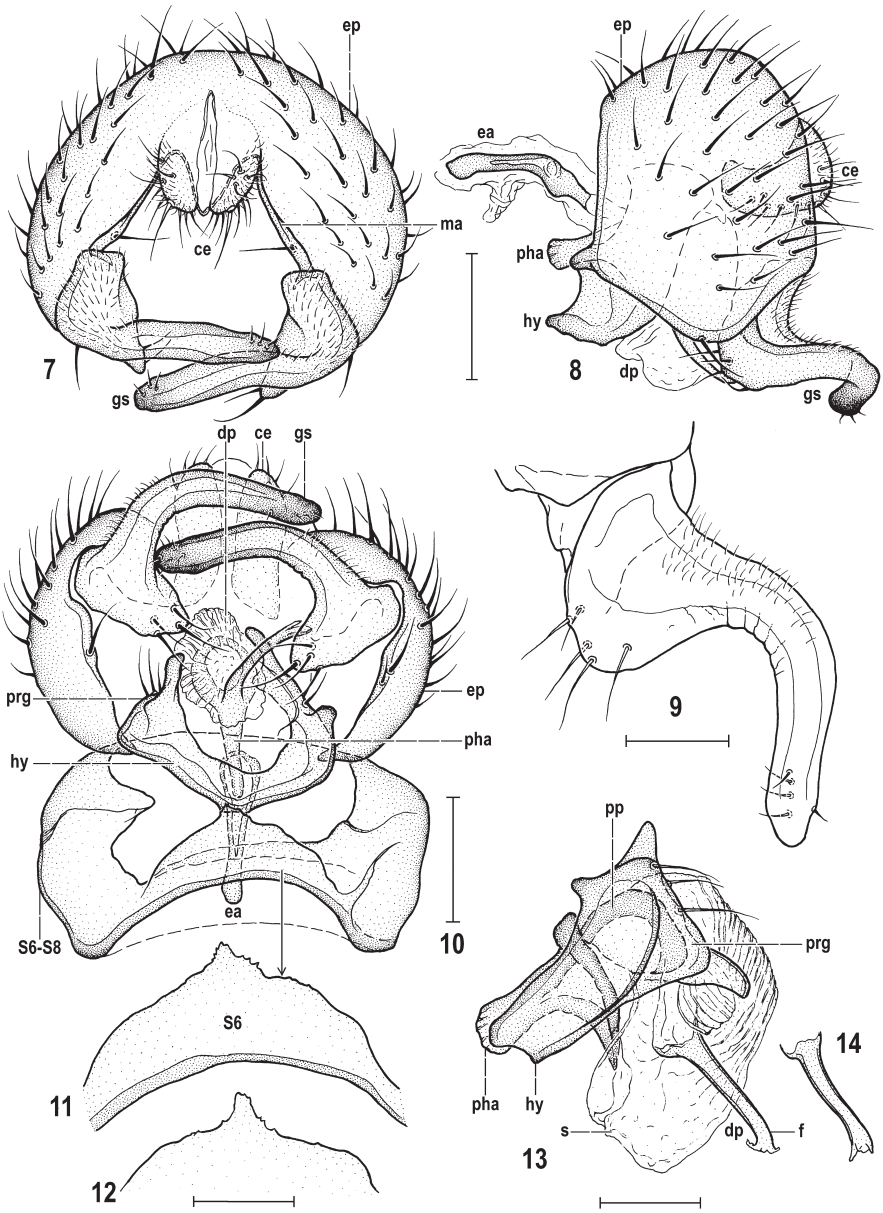
free in subcostal cell. R_{2+3} slightly sinuate, ending far from apex of R_{4+5}, the latter basally straight, apically slightly recurved and terminating in wing apex. M slightly but distinctly bent forward, strongly convergent with R_{4+5} distally and ending close to it. CuA_1 almost straight, not reaching wing margin. Cross-vein r-m present, removed less than one-third from wing base; cross-vein dm-cu absent. A_1 reduced, very short, not reaching wing margin. Alula absent. Posterior wing margin with relatively long ciliation. Wing measurements: length 1.62–1.95 mm, width 0.49–0.85 mm, $Cs_3 : Cs_4 = 6.00–7.63$. Haltere pale yellow.

Legs yellow with yellow setosity, only last tarsal segment of fore and mid leg brownish. Fore femur (f_1) with a series of 5–7 posteroventral long and thicker setae (the longest situated in distal third slightly longer than maximum width of femur) and with a row of 7–8 shorter and finer posterodorsal setae (longest in proximal third of femur); f_2 with anteroventral row of 7–8 finer setae (longest about two-thirds width of femur); t_2 with ventroapical seta (distinctly longer than maximum width of tibia); legs otherwise uniformly setulose but setae on femora relatively long.

Abdomen long and slender, with all sclerites yellow (3rd and 4th segments seemingly dark in living and dried specimens due to internal colouration, see Fig. 3). T1+2 long, longer than T3 or T4, with boundary between T1 and T2 poorly delimited. T3–T5 relatively long but distinctly transverse (wider than long) and becoming narrower posteriorly. All preabdominal terga with sparse short yellow setae on lateral and posterior margins. Preabdominal sterna S2–S5 large (hence pleural membrane between terga and sterna small), pale yellow; S1 short (about one-fourth of length of S3), transverse, as wide as S2 anteriorly; S2–S5 very slightly transverse, becoming somewhat smaller posteriorly but all of similar shape and with scatered short setosity. Abdominal spiracles reduced, hardly visible. Postabdomen: T6 well developed although short and transverse (about 3 times wider than long), almost as wide as T5, with a row of short setae on posterior margin. S6–S8 (see Fig. 10) fused to relatively symmetrical ring-shaped complex; its ventral medial crescent-shaped plate (original S6) almost symmetrical (most asymmetrical case in Fig. 11), posteromedially more or less projecting and with denticulate margin (Figs. 11, 12).

Genitalia. Epandrium (Figs. 7, 8, 10) yellow, slightly higher than long, as broad as high (Fig. 7), uniformly, relatively densely and shortly setose and with 1 (rarely 2) setae near middle of each ventrolateral margin. Anal fissure small and narrow, and its membrane gradually transient in epandrial sclerites. Cerci small, closely attached but extended inside epandrial capsule (thus long), setose not only posteriorly but also ventrally (Fig. 8). Gonostylus (Figs. 7–9) strongly bent inside (inclined) and often poorly visible in lateral view (it is somewhat unnaturally straightened in Fig. 8 to show its insertion); in widest extension view (Fig. 9) with flat, dilated and anteriorly setose (5–6 setae) proximal third, and slender, strongly curved remaining distal part being characteristically wrinkled in concavity, micropubescent posterodorsally and bearing 4–5 short setae on the rounded and darkened apex. Medandrium (subepandrial sclerite, bacilliform sclerite) reduced to 2 slender, medially (under cerci) connected sclerites, each with 1 distinct seta and attached to posterior margin of epandrium (Fig. 7). Hypandrium (Figs. 8, 10, 13) formed as rather asymmetrical frame-like structure, posteriorly open, anteriorly without apodeme, integrating posteroventral asymmetrical appendages (pregonites) projecting ventrally and bearing 2–3 (3 on left side) long setae dorsally. Aedeagal complex (Fig. 13) also asymmetrical, lacking postgonites. Phallophore poorly visible, short, probably crescent-shaped and widely connected with voluminous but short distiphallus. Distiphallus composed of large membranous part (saccus) with striated surface (mainly posteriorly and ventrally) and of slender, sclerotized, relatively short tubular structure (filum) having membranous forked apex (Fig. 14). Phallapodeme (Fig. 13) relatively short but robust, with simple anterior rod and extended basal part projecting ventrally. Ejacapodeme (Fig. 8) free, rather large, as long as phallapodeme, rod-like but proximally somewhat thickened.

Female (newly described). Similar to male unless mentioned otherwise. Total body length 1.58–2.06 mm. Somewhat darker, with abdomen laterally spotted (Figs. 1, 2) and all setae distinctly darker, setulae ochreous, macrosetae usually brown. Face with distinct brown U-shaped line bordering parafacialia. Fore femur with somewhat longer setae in posterodorsal row; mid femur uniformly setulose, without anteroventral row of longer setae. Wing measurements: length 1.92–2.26 mm, width 0.56–0.67 mm, $Cs_3 : Cs_4 = 6.04–7.57$. Abdomen (Figs. 15, 16) with preabdominal sclerites yellow to pale yellow except for T2, T3



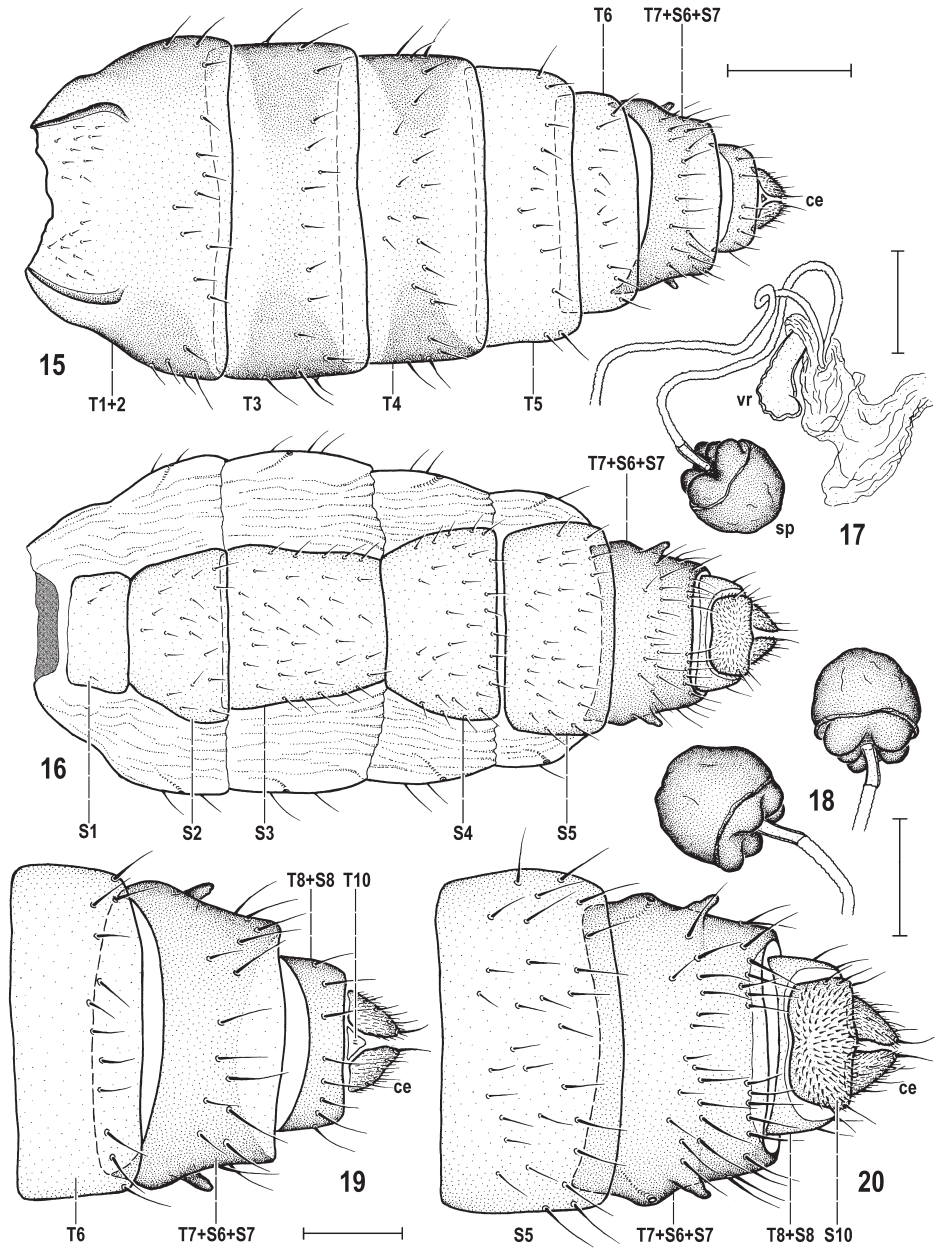
Figs. 7–14. *Stenomicra cogani* Irwin, 1982, male. 7 – external genitalia, caudally; 8 – genitalia, laterally; 9 – gonostylus, subventrally, widest extension; 10 – genitalia and pregenital synsternum S6–S8 in situ, ventrally; 11 – part with original S6, ventrally; 12 – same, another variant; 13 – internal genitalia, laterally (with ea omitted); 14 – filum of distiphallus, anteroventrally. Figs. 7, 12 based on specimen from Romania: Banat, others on specimens from England. Scales = 0.1 mm (Figs. 7, 8, 10), and 0.05 mm (Figs. 9, 12–14). For abbreviations see text (p. 701).

and T4 having distinct brown lateral spots (see also Fig. 1). T1 coalesced with T2 and this syntergum markedly longer than T3. T3–T5 becoming slightly narrower posteriorly but all of similar shape. T1 with small setulae medially, T2–T5 with short setae in front of posterior margin and a few longer laterally. S1 smallest preabdominal sternum, almost bare; S2 and S4 subtrapezoidal (narrower anteriorly), S3 narrow and long (longest sternum) and S5 widest, transversely oblong. S2–S5 with short scattered setae. Spiracles 2–5 very small and poorly visible, situated below lateral margin of relevant terga.

Postabdomen (Figs. 19, 20). T6 normal, yellow, transversely oblong, with a row of short setae in front of posterior margin. T7, S6 and S7 forming a peculiar tergosternal ring, dark pigmented dorsally (two basal thirds) and laterally, armed by a conspicuous ventrolateral digitiform projection on each side (obviously a part of the original S6). Dorsal part (= T7) of this tergosternum with sparse longer setae; ventral part with two series of denser setae, one at original posterior margin of former S6, the other on posterior margin of original S7. 6th spiracle situated laterally, in part belonging to original S6. T8 and S8 also coalesced, forming a short tergosternal ring but only its dorsal part (= T8) longer, pale brown pigmented and setose (Fig. 19); its ventral part (= S8) reduced to very short, transverse, bare, unpigmented (and poorly visible) strip (Fig. 20). Genital chamber membranous, without sclerotized structures; ventral receptacle (Fig. 17) also membranous, vesiculate, distally somewhat widened and with rugged surface. Spermathecae (1+1) black, heavily sclerotized (visible through pale abdominal sclerites also in dry specimens), roughly globular but large distal part with plain surface while its proximal part, separated by fine ledge-like line, formed by 5–6 bulges surrounding insertion of spermathecal duct (Fig. 18); the latter relatively short (see Fig. 17) and provided with pale-pigmented distal collar being about half length of spermathecal body. T10 (supra-anal plate) extremely reduced, hardly recognizable, forming small to minute subtriangular unpigmented plate with 2 microsetulae in the middle (Fig. 19). S10 (subanal plate), on the contrary, large, trapezoidal, pale-pigmented, covered by dense and long micropubescence and with 2–3 lateral setae. Cercus (Figs. 15, 19) subconical but dorsoventrally somewhat flattened, relatively short and robust, with short setae (apical longest) and fine micropubescence.

Discussion. The species is redesribed here on the basis of specimens from Great Britain, Italy, Czech Republic and Romania (thus from most of its known distribution range) to recognize the variability of adult characters. However, it was found that the geographical variability is not larger than variability recorded within the single population from the locality Černousy, Dubák pond (CZ: N Bohemia) where the largest sample (20 specimens) was available for study. This knowledge enabled true differences from *S. gracilior* sp. nov. from Turkey to be revealed. The study of the female abdomen (postabdomen in particular) resulted in finding of additional structural differences supporting the validity of the new species.

Biology. The knowledge of habitat and host plant association was summarized in detail by Roháček (2009). The additional material obtained since this study confirmed preference of *S. cogani* for *Scirpus sylvaticus* L. growths in swampy habitats, including a series of 20 adults collected (2011) and 5 additional specimens reared (2010) from tussocks of this sedge. There is also a new collecting record (2011) of the species from *Carex nigra* (L.) Reichard which again demonstrates that the species can also live in stands of various large *Carex* species as already found by British dipterists (e.g. Drake 2004), for more detail see Roháček (2009). Adult occur in May to August.



Figs. 15–20. *Stenomicra cogani* Irwin, 1982, female (Czech Republic: N Bohemia). 15 – abdomen dorsally; 16 – same, ventrally; 17 – genital chamber with ventral receptacle and spermatheca, laterally; 18 – spermathecae; 19 – postabdomen, dorsally; 20 – S5 and postabdomen ventrally. Scales = 0.2 mm (Figs. 15, 16), 0.05 mm (Figs. 17, 18) and 0.1 mm (Figs. 19, 20). For abbreviations see text (p. 701).

Distribution. The species is probably widespread in Europe. Hitherto, it has been recorded from southern Spain, northern Italy, Ireland, Great Britain (Wales, England), northern Germany, southern Sweden, Czech Republic (Bohemia, Moravia) and southwestern Romania (Banat), for more detail, relevant references and distribution map see Roháček (2009).

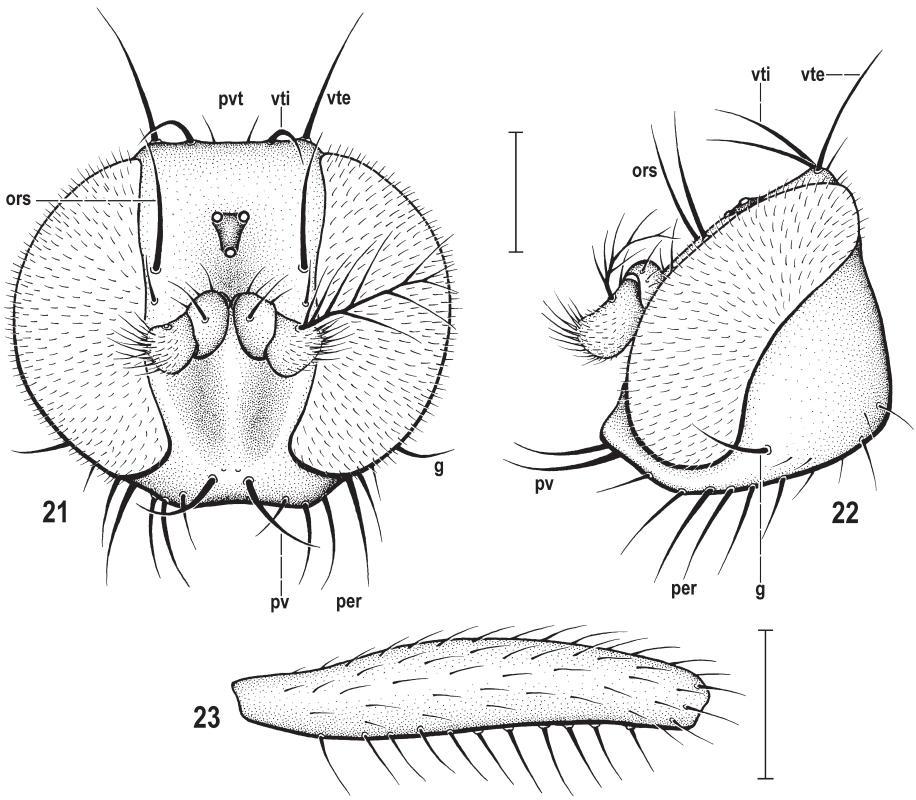
Stenomicra gracilior sp. nov.

(Figs. 6, 21–34)

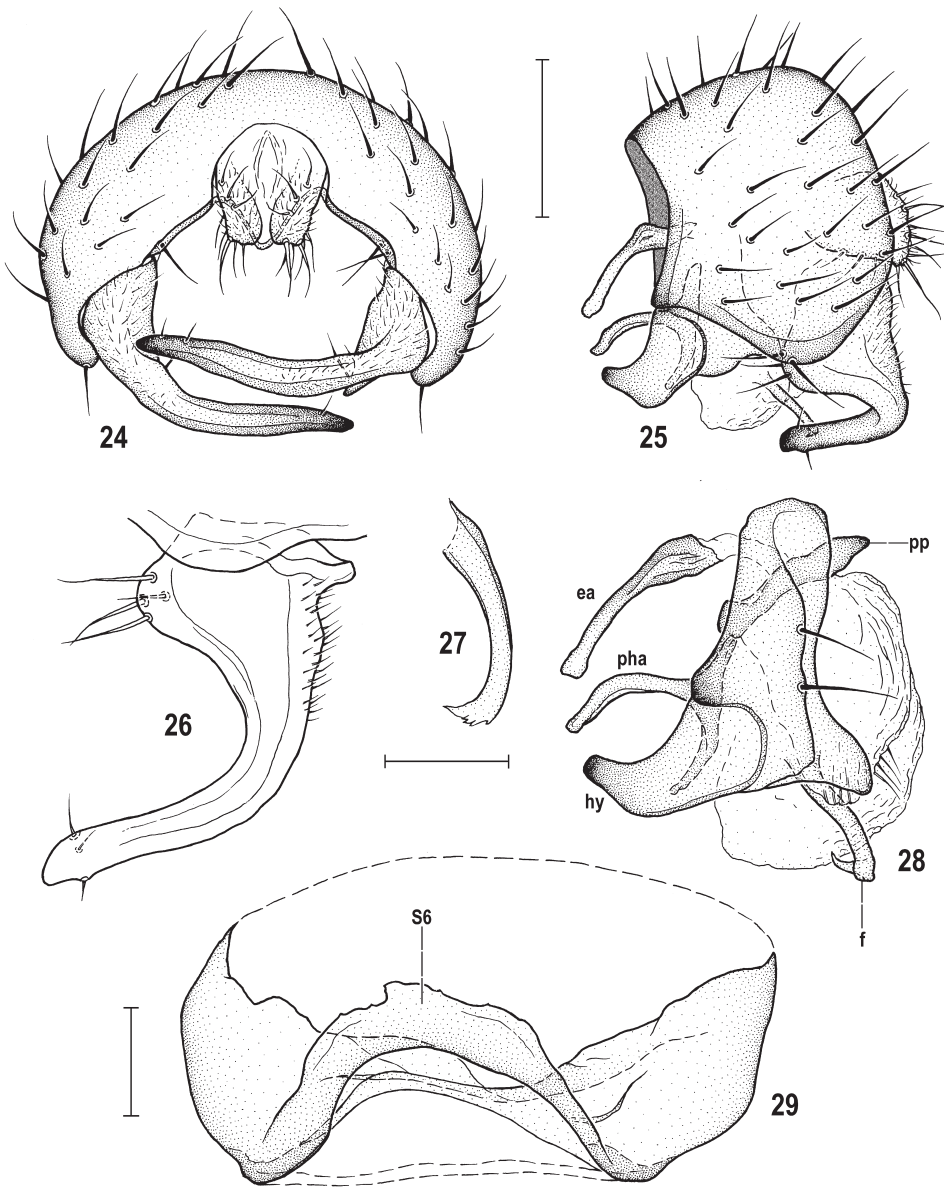
Stenomicra cogani: Roháček (2011): 150 (misidentification, record from Turkey).

Type material. Holotype: ♂, labelled: 'S. TURKEY: Antalya prov., Manavgat 7.1 km SE, 0–1 m, mouth of Manavgat river, 36°44′17″N, 31°29′44″E, 11.5.2011, J. Roháček leg.', 'sweeping marshland graminoids: *Typha, Scirpus, Phragmites, Juncus* etc.', 'Holotypus ♂, *Stenomicra gracilior* sp.n., J. Roháček det. 2011' (red label). Paratype: ♀ with same locality data but with yellow label: 'Paratypus ♀, *Stenomicra gracilior* sp.n., J. Roháček det. 2011'. Both specimens with genitalia prepared, deposited in SMOC.

Diagnosis. A small yellow species externally very similar to *Stenomicra cogani* including the absence of posterior cross-vein (dm-cu). It differs from the latter species by anterior fronto-



Figs. 21–23. *Stenomicra gracilior* sp. nov., male (holotype). 21 – head frontally; 22 – head, laterally; 23 – f_2 anteriorly. Scales = 0.2 mm. For abbreviations see text (p. 701).



Figs. 24–29. *Stenomicra gracilior* sp. nov., male (holotype). 24 – external genitalia, caudally; 25 – genitalia, laterally; 26 – gonostylus, subventrally, widest extension; 27 – filum of distiphallus, anteroventrally; 28 – internal genitalia, laterally; 29 – pregenital synsternum S6–S8, ventrally. Scales = 0.1 mm (Figs. 24, 25) and 0.05 mm (Figs. 27–29). For abbreviations see text (p. 701).

orbital seta shorter, postvertical setae shorter and closer to each other and only 4 ac setulae, in male sex also by all setae darker and f_2 with a row of 11 anteroventral setae and in female by larger brown spots on abdominal terga. The principal differences are, however, in the male and female terminalia: male T6 longer and less transverse, ventral plate of synsternum S6–S8 (original S6) shorter and asymmetrical, epandrium wider, gonostylus more slender, with reduced chaetotaxy and without wrinkles in central concavity, filum of distiphallus with single apical tooth-like projection, phallapodeme slender, female syntergosternum T7+S6+S7 with lateral processes reduced to short bulges, female T8+S8 longer and its ventral bare part (= S8) as long as dorsal part (= T8), spermathecae shorter and with only 4 proximal bulges, female T10 completely absent.

Description. ***Male***. Total body length 1.58 mm. Colouring closely resembling that of male *S. cogani* but setae (macrosetae in particular) distinctly darker, brownish.

Head (Figs. 21, 22) of the same shape, structure and colour as that of *S. cogani* but antenna darker yellow, with pedicel orange, darkest on inner side dorsally. Also cephalic chaetotaxy as in *S. cogani* but all macrosetae darker, anterior ors shorter and weaker (one-third length of the posterior ors), pvt setae shorter and more medially inserted (closer to each other) and ventroclinate peristomal setae fewer (5 only), see Fig. 22.

Thorax with same structure and colouring as in *S. cogani*. Thoracic chaetotaxy also similar to that species but all setae brownish and number of ac setulae reduced to 4, arranged in single row not reaching beyond level of anterior dorsocentral seta.

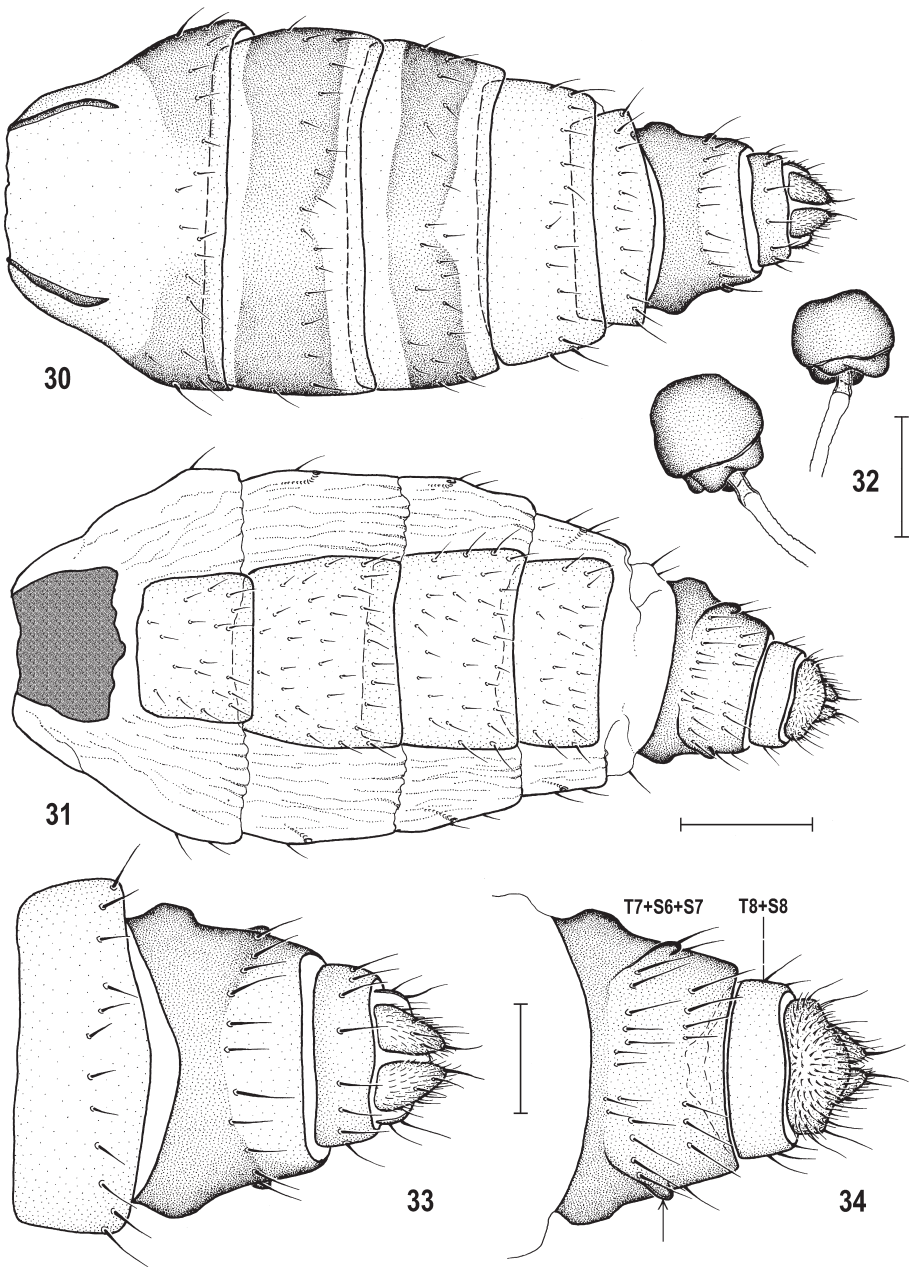
Wing (Fig. 6) with the same venation (including loss of dm-cu cross-vein) and colouring as that *S. cogani*; also haltere similar. Wing measurements: length 1.63 mm, width 0.51 mm, $Cs_3 : Cs_4 = 6.37$.

Legs yellow as in *S. cogani* but not only last but 3–4 terminal tarsal segments of fore and mid leg darkened, pale brown. Fore femur (f_1) and t_2 with the same chaetotaxy but f_2 with anteroventral row longer and consisting of 11 ochreous setae (Fig. 23).

Abdomen closely resembling that of *S. cogani* but somewhat wider, with T3–T5 more transverse; T4 not only narrower but also shorter than T5. All preabdominal sterna (S1–S5) also wider and more transverse but their chaetotaxy similar to those of *S. cogani*.

Postabdomen. T6 yet larger than in *S. cogani*, two-thirds of length of T5 and less transverse, only twice as wide as long. S6–S8 (see Fig. 29) forming ring-shaped synsternum but shorter than in *S. cogani* and its plate-shaped ventral part (original S6) asymmetrical, anteromedially with deeper emargination and posteromedial projection (including marginal denticles) reduced.

Genitalia generally formed as in *S. cogani* but differing as follows. Epandrium (Figs. 24, 25) distinctly broader in caudal view, less densely setose. Anal fissure yet smaller; cerci as in *S. cogani*. Gonostylus (Figs. 24–26) with distinctly more slender distal part (particularly in caudal view, Fig. 24), smooth (without wrinkles) in concavity, and with setosity reduced (4 long setae proximally, 2–3 short setae on darkened apex). Medandrium with lateral sclerites shorter and each with 1–2 setae (Fig. 24). Hypandrium (Fig. 28) of somewhat different shape; with left pregonite (fused with hypandrium) bearing only 2 setae. Aedeagal complex (Fig. 28) with phallophore hardly curved. Distiphallus with saccus more finely striated and ventrally bearing a group of 4 pale setae. Filum of distiphallus more bent and its apex differ-



Figs. 30–34. *Stenomicra gracilior* sp. nov., female (paratype). 30 – abdomen dorsally; 31 – same, ventrally; 32 – spermathecae; 33 – postabdomen dorsally; 34 – same, ventrally. Scales = 0.2 mm (Figs. 30, 31), 0.05 mm (Fig. 32) and 0.1 mm (Figs. 33, 34). For abbreviations see text (p. 701).

ently formed (Figs. 27, 28), with single tooth-like projection and several small denticles on tip. Phallapodeme (Fig. 28) markedly different from that of *S. cogani*, very slender including both anterior rod and basal projection. Ejacapodeme (Fig. 28) of similar shape to that of *S. cogani* but more slender.

Female. Similar to male unless mentioned otherwise. Total body length 1.75 mm. Setae darker, macrosetae blackish brown. Face with distinct brown U-shaped line bordering parafacialia as in *S. cogani*. f_1 with setae in posterodorsal row as short as in male; f_2 uniformly setulose, without long anteroventral row of setae. Wing measurements: length 1.97 mm, width 0.59 mm, $Cs_3 : Cs_4 = 6.67$. Abdomen (Figs. 30, 31) with darker pigmentation than that of *S. cogani*, with brown lateral spots on T2–T4 extended and in T3 and T4 forming almost complete band (Fig. 30); S2 and, particularly, S5 narrower (Fig. 31).

Postabdomen (Figs. 33, 34) similarly formed to that of *S. cogani* but differing as follows. T6 somewhat shorter, more transverse. Syntergosternum T7+S6+S7 longer and narrower, with lateral processes reduced to short bulges (Fig. 34, arrow). Syntergosternum T8+S8 longer and its ventral part (= S8) not strip-like but almost as long as dorsal part (= T8) although unpigmented and completely bare. Genital chamber similar to that of *S. cogani* but spermathecae (Fig. 32), particularly their proximal part, shorter and with only 4 bulges around duct insertion; also collar distinctly shorter. T10 (supra-anal plate) seems to be completely absent (Fig. 33) and S10 (subanal plate) is somewhat shorter, more produced posteromedially (Fig. 34) and with longer setae also posteriorly (in addition to long micropubescence). Cercus closely resembling that of *S. cogani*.

Discussion. Because of great external similarity of *S. gracilior* sp. nov. to *S. cogani* this new species was previously misidentified as the latter species and recorded under this name as the first representative of Stenomicridae from Turkey (Roháček 2011). However, subsequent detailed evaluation of the variability of *S. cogani* revealed that the dissimilarities found in Turkish specimens (although relatively small) enable their safe separation from the European specimens of *S. cogani*. Because also the presumption that the more slender gonostylus (and other features in the male genitalia) of Turkish males are caused by their small size was disproved by the examination of several yet smaller European males of *S. cogani* and additional structural differences were also found in the female terminalia, the specimens from Turkey are described above as a new species.

Biology. The type specimens were collected in a Mediterranean subcoastal wetland area, swept from graminoid vegetation composed mainly of various species of *Typha*, *Scirpus*, *Phragmites*, and *Juncus* (for habitat photograph see Roháček 2011: Fig. 6) on May, 11th.

Distribution. Southern Turkey (Antalya province).

***Podocera delicata* (Collin, 1944)**

(Figs. 35–38)

Diadelops delicata Collin, 1944: 266

Stenomicra delicata: Sabrosky (1965): 211 (catalog, generic combination)

Stenomicra (*Podocera*) *delicata*: Irwin (1982): 235; Papp (1984): 62 (catalog); Merz & Roháček (2005): 522–527 (redescription)

Stenomicra (*Diadelops*) *delicata*: Chandler (1998): 142 (checklist, subgeneric combination)

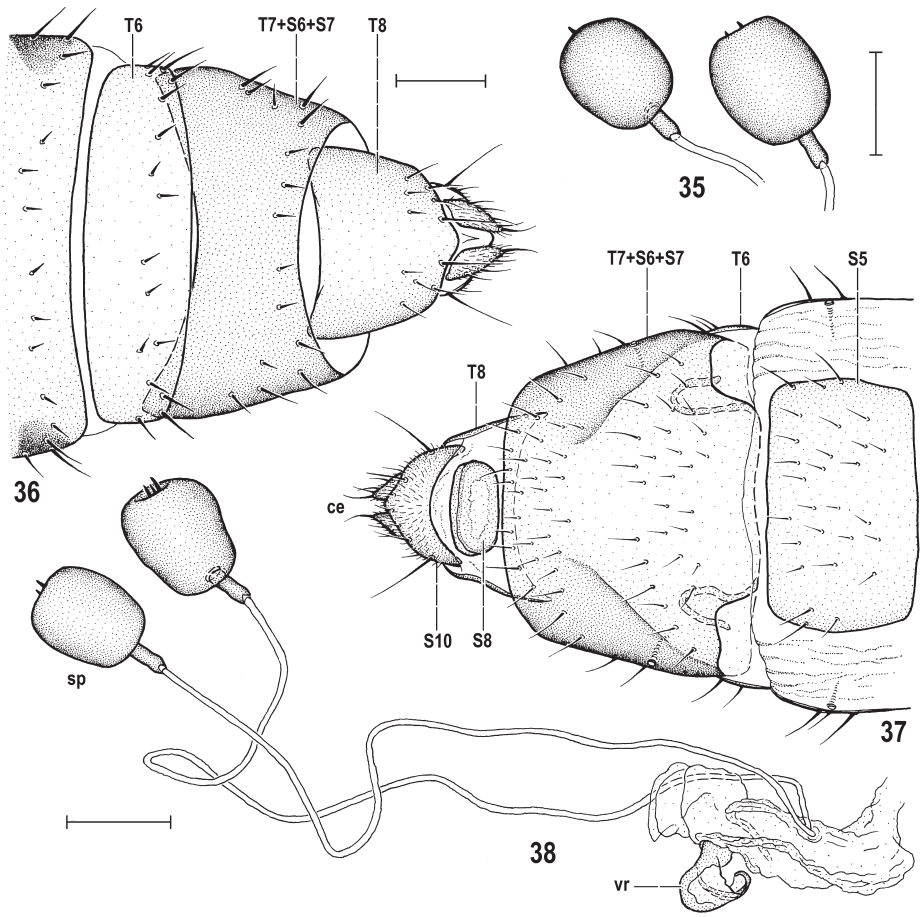
Podocera delicata: Roháček (2009): 1–3 (generic combination, biology, distribution)

Material examined. CZECH REPUBLIC: N Bohemia: Pavlovice 2 km W, Dolské údolí (valley), 50°36′N, 14°30′E, sweeping *Scirpus sylvaticus* in boggy meadow, 25.vi.2008, 1 ♂; Doksy env., Břehyňský rybník (pond) reserve, 50°35′N, 14°43′E, sweeping *Carex acuta* in boggy meadow, 24.vi.2008, 1 ♀; Hradčany 1.5–2 km W, Ploučnice valley, 50°37′N, 14°41′E, sweeping *Carex acuta* in boggy meadow, 23.vi.2008, 1 ♀, sweeping *Carex rostrata* in boggy meadow, 23.vi.2008, 1 ♀, sweeping *Carex rostrata* in boggy meadow, 26.vi.2008, 2 ♂♂ 1 ♀; Hradčany 1.5 km SE, Držník pond, 50°36′N, 14°43´E, sweeping tussocks of *Carex paniculata* near brook, 26.vi.2008, 13 ♂♂ 7 ♀♀. **N Moravia:** Polanka nad Odrou, Přemyšov reserve, 49°47′N, 18°11′E, reared ex tussock of *Carex vesicaria* collected in boggy meadow 11.v.2009 – 1 ♀ emerged 11.v.–9.vi.2009. **S Moravia:** Hrabětice, Trávní Dvůr 1 km SW, 48°47′N, 16°26′E, sweeping *Carex vesicaria* in boggy meadow, 7.vii.2009, 1 ♂, all J. Roháček leg. (SMOC). Several specimens with genitalia prepared.

Supplement to description. The species was redescribed in detail, including male abdomen and genitalia, by Merz & Roháček (2005), however without information about female terminalia, and the female abdomen was charaterized only superficially. Female abdominal structures are hence described below, based on specimens from the Czech Republic (N Bohemia).

Female. Abdomen relatively flat, largely ochreous to pale yellow, with small brown spots on some terga as follows. T1 and T2 fused to form syntergum T1+2 being longer than T3; its anterior part (= original T1) largely brown, posterior part ochreous-yellow with brown spots laterally. T3–T5 transversely oblong, of similar shape but becoming smaller posteriorly, all largely yellow, each with 1 small brown lateral spot (see T5 on Fig. 36) and with sparse, short but relatively robust setae (longest on lateral margins). Preabdominal sterna pale yellow, all with fine scattered setulae. S1 smallest, narrower and shorter than S2, with reduced setosity; S2 and S4 of the same width but S2 shorter; S3 widest sternum, transversely suboblong, as long as S2; S4 narrower than S3 but distinctly longer (longest of preabdominal sterna); S5 (Fig. 37) narrower and distinctly shorter than S4.

Postabdomen (Figs. 36, 37). T6 short, transverse, distinctly shorter and narrower than T5, pale yellow, with one transverse row of short setae. T7 fused with S6 and S7, forming large and long annular tergosternal sclerite (T7+S6+S7) being dorsally and partly laterally (original T7) ochreous-brown pigmented and bearing short setae in front of posterior margin and laterally (Fig. 36). T8 narrow and unusually long, almost as long as wide, strongly convex, paler than dorsal part of T7+S6+S7, with 2 rows of sparse setae in posterior third, posteromedial pair of which longest. S6 and S7 integrated in tergosternal ring T7+S6+S7 but still recognizable as ventral paler parts of the sclerite (Fig. 37), each with a group of fine setae. Anterior part of original S6 with peculiar internal pouch-like invagination on each side (Fig. 37). S8 also strongly modified, formed as bare, small, oval to subcircular plate (shape depending on viewing angle) of annular structure (Fig. 37). Genital chamber (Fig. 38) membranous, without sclerotized structures, terminally with short, curved ventral receptacle of complex form. Spermathecae (1+1) small, blackish brown, subcylindrical to suboval (Figs. 35, 38), with smooth surface except for 1–3 small, short to elongate, spinulae on apex. Terminal part of spermathecal duct (= collar) dark-pigmented and strongly sclerotized, about half length of body of spermatheca; duct itself membranous, long, markedly narrower than collar. T10 absent (Fig. 36); S10 narrower than T8, convex, anteriorly wider and emarginate, posteriorly more or less tapered (shape depending on viewing angle), finely micropubescent, with 1 very long lateral seta on each side (Fig. 37) in addition to 2 short setae at posterior margin. Cercus (Figs. 36, 37) relatively small, subconical, with 3 short setae laterally and 1 slightly longer curved seta on apex.



Figs. 35–38. *Podocera delicata* (Collin, 1944), female (Czech Republic: N Bohemia). 35 – spermathecae; 36 – postabdomen with posterior part of T5, dorsally; 37 – postabdomen with S5, ventrally; 38 – genital chamber with ventral receptacle and spermathecae, laterally. Scales = 0.05 mm (Figs. 35, 38) and 0.1 mm (Figs. 36, 37). For abbreviations see text (p. 701).

Podocera soniae (Merz & Roháček, 2005)

Material examined. SWEDEN: Södermanland: Tyresta N. P., Brandfält från 1999 vid Lycksjöhagen: Malaisefalla, 11.vi.–17.vii.1999, 1 ♂, Bert Viklund leg. (NHRS).

Discussion. The specimen listed above was examined in 2003 by B. Merz and identified as *Stenomicra delicata*. However, this record was forgotten and, hence, the specimen was not revised by Merz & Roháček (2005). During my 2011 visit in the Naturhistoriska Riksmuseet (Stockholm), the specimen was re-examined and found to belong to *S. soniae*. Roháček (2009) discussed the probable occurrence of *S. soniae* in Sweden (Småland) on the basis of notes by Andersson (1991) but stated that without the revision of a voucher specimen this record

cannot be verified. Thus, the above listed male specimen represents the first reliable record from Sweden (Södermanland) and the northernmost known locality of *S. soniae*.

Distribution. Hitherto the species has been recorded from Switzerland, Germany, Czech Republic (Bohemia, Moravia), Slovakia, Romania, Bulgaria (see Merz & Roháček 2005), northern Italy (von Tschirnhaus 2008) and Sweden (new).

MALE AND FEMALE TERMINALIA IN STENOMICRIDAE

Male postabdomen and genitalia

The terminalia of males are rather well known in the genus *Cyamops* thanks to studies by Baptista & Mathis (1994, 1996, 2000), Sueyoshi & Mathis (2004) and Mathis & Sueyoshi (2011). In other genera of the family knowledge is poorer in this respect: only Merz & Roháček (2005) described these structures in detail in two species of *Podocera*; descriptions and illustrations of a few other species of this genus by Papp (2006) and Grimaldi (2009) are rather incomplete or simplified and the same (more so) holds also for the genus *Stenomicra* (see Papp 2006, Grimaldi 2009). The male genitalia of the recently described genus *Stenocyamops* are known in 4 species (cf. Papp 2006, Grimaldi 2009) and those of the genus *Planinasus* remain unpublished (Mathis & Rung, in litt.) but rather good illustrations of the male genitalia (not postabdomen) of several species are available at internet (http://www.eol.org/pages/82934). Based on the above published information and knowledge of terminalia in two *Stenomicra* species described here it is now possible to perform some comparison of the main postabdominal structures in the genera of Stenomicridae.

Male pregenital sclerites. T6 disparate, well developed in all genera of Stenomicridae but markedly smaller (short and narrower) than is the (very large) T6 in true Periscelididae, see also Baptista & Mathis (1994).

S6, S7, S8 (the latter called T7 by Baptista & Mathis (1994)) are fused to form an incomplete (not closed) to complete ring-shaped synsclerite which is, however, differently formed in particular genera: in *Cyamops* it is strongly asymmetrical, in contrast to remaining genera not closed on the right side, with short, asymmetrical, partly separate S8 dorsally and strongly asymmetrical S6 ventrally (cf. Baptista & Mathis 1994, 1996, 2000); in *Stenocyamops* it is relatively symmetrical, with ventral part (S6) reduced to a transverse ribbon-shaped connection (Papp 2006: Fig. 116; Grimaldi 2009: Fig. 4A, B); in *Podocera* it is most similar to that of the former but its band-shaped ventral part (S6) is somewhat asymmetrical, medially often interrupted (see Merz & Roháček 2005: Fig. 6); in *Stenomicra* it is also relatively symmetrical and with (original) S6 plate-like expanded and posteromedially produced (see Figs. 10–12, 29, and Grimaldi 2009: Fig. 4E). No information about the pregenital sclerites is available for *Planinasus*.

Male genitalia. In *Cyamops* the genitalia are strongly asymmetrical, including gonostyli and often also epandrium (see Baptista & Mathis 1994, 1996, 2000; Sueyoshi & Mathis 2004; Mathis & Sueyoshi 2011). In other genera the external genitalia (epandrium, gonostyli and cerci) are more or less symmetrical, only internal genitalia (hypandrial and aedeagal complex, the former somewhat less) are asymmetrical.

Epandrium is sometimes asymmetrical only in the genus *Cyamops* (Baptista & Mathis 2000: Figs. 20, 21), in other genera it seems to be symmetrical. Anal fissure is narrowly open ventrally in *Cyamops*, more open in *Stenocyamops* (cf. Grimaldi 2009: Fig. 19A), moderately to widely open in *Stenomicra* (Fig. 7) and *Podocera* (cf. Merz & Roháček 2005: Fig. 20). In *Planinasus* it is open to closed with cerci shifted below closed anal opening.

Cerci are small, more or less asymmetrical, directed (postero)ventrally in *Cyamops* (see Baptista & Mathis 1994, 1996, 2000; Sueyoshi & Mathis 2004; Mathis & Sueyoshi 2011), symmetrical in other genera but markedly elongate, narrow and ventrally directed in *Stenocyamops* (cf. Grimaldi 2009: Fig. 19A); moderate, ventrally directed and distinctly separate in *Podocera* (cf. Merz & Roháček 2005: Fig. 20); small but prolonged anteriorly into the epandrial capsule (thus with longitudinal axis horizontal) and closely attached in *Stenomicra* (Figs. 7, 8, 10) and reduced or fused with epandrium below anal fissure in *Planinasus*.

Medandrium (= bacilliform sclerites in Merz & Roháček (2005); subepandrial sclerite in Papp (2006) is in most representatives of Stenomicridae present as lateral, distinctly setose sclerites (sometimes connected medially, in front of cerci) attached to epandrium laterally to anal fissure and connected (articulated) ventrally with gonostyli, dorsally with posterior arms of hypandrium (cf. Grimaldi (2009): Fig. 13B, as 'tergal remnant'). Their form, connection with gonostylus and distinct setosity demonstrate that they are ***of gonopodal origin*** and each represents the basal remnant of a gonopod (= basistylus), as Zatwarnicki (1996) suggested. In other families of Schizophora they are usually de-bristled and modified to form single (often compact) sclerite. Medandrium remains undescribed in *Cyamops*, possibly reduced. In *Stenocyamops* it is shifted inside the epandrium (called 'tergal remnant' by Grimaldi (2009): Fig. 18A); in *Podocera* it is well developed, free, and composed of 1–2 sclerites (Merz & Roháček (2005): Fig. 20; Grimaldi (2009): Fig. 13A,B – 'tergal remnant'); in *Stenomicra* it seems to be simplified and forming a narrow sclerite attached to the (ventro)lateral margin of anal fissure (Fig. 7). There is no information about this structure in *Planinasus*.

Gonostylus (= surstylus of authors). These paired appendages are strongly asymmetrical and directed ventrally in *Cyamops* (cf. Baptista & Mathis 1994, 1996, 2000; Sueyoshi & Mathis 2004; Mathis & Sueyoshi 2011). Gonostyli in all other genera are more or less symmetrical, but those of *Stenocyamops*, *Podocera* and *Stenomicra* are distinctly inclinate, often with apices overlapping or crossed medially (cf. Grimaldi 2009: Fig. 19A; Merz & Roháček 2005: Fig. 20; Figs. 7, 24 here) and usually elongate, while those of *Planinasus* are directed ventrally, short to elongate.

Hypandrium is largely asymmetrical in Stenomicridae (in contrast to that in true Periscelididae), posteriorly open, anteriorly simple, without hypandrial rod, even anteromedially interrupted. In *Planinasus* and *Stenocyamops* it appears to be less asymmetrical (in some species, probably secondarily, almost symmetrical) than in other genera.

Pregonite (called gonopod or gonite by the above authors, lamella by Grimaldi (2009): Fig. 20B), the usually paired appendage of hypandrium, seems to be variously formed in Stenomicridae. In *Cyamops* the pregonites are strongly asymmetrical, often fused to the hypandrium on one side and relatively loose on the other (see Baptista & Mathis 1994: Fig. 16) or both fused with the hypandrium (Sueyoshi & Mathis 2004: Fig. 1f); in *Stenocyamops* they are more or less symmetrical, of similar shape (Grimaldi 2009: Fig. 20B, as lamella). In *Podocera* they are large, strongly asymmetrical, both articulated with the hypandrium or

the right one fused to the hypandrium (cf. Merz & Roháček 2005: Figs. 10, 11, 22), while in *Stenomicra* both pregonites (also asymmetrical) are wholly integrated in the hypandrium, forming its (sparsely setose) posterior projecting parts (see Figs. 10, 13, 28). In *Planinasus* both pregonites are well developed, relatively symmetrical, densely setose lobes somewhat articulating with posterior arms of the hypandrium.

Aedeagal complex is asymmetrical in all genera of Stenomicridae. In *Cyamops* the aedeagal complex, including aedeagus (phallus), is relatively large (cf. Baptista & Mathis 2000, Fig. 9), with postgonites (= parameres) usually lacking, only in *C. nebulosus* Melander, 1913 a single (left), small setulose postgonite is described (Baptista & Mathis 1994: Fig. 16); aedeagus (both phallophore and distiphallus) are distinctly sclerotized. *Stenocyamops* species have the aedeagal complex small, without postgonites, and aedeagus largely membranous, spinulose, with a few internal sclerites (Grimaldi 2009: Fig. 18B). Members of *Podocera* also have aedeagal complex relatively small, with postgonites paired but strongly asymmetrical or the right postgonite entirely lacking, distiphallus largely membranous and spinulose (but with some internal sclerites) and phallophore sclerotized, more or less projecting posteriorly (as epiphallus), see Merz & Roháček (2005). In *Stenomicra* the aedeagal complex is small and short compared to the epandrium, with both postgonites lacking, aedeagus largely membranous, but the very short phallophore sclerotized, distiphallus striated or spinulose on surface, and often provided with a projecting tubular sclerite (see Figs. 13, 28), being possibly homologous with the filum in Anthomyzidae (cf. Roháček 2006: Figs. 40, 47; Roháček 2010: Fig. 2). In *Planinasus* species the aedeagus is very small, short, with some sclerites but not spinulose on surface; small paired postgonites are probably present.

Phallapodeme (= aedeagal apodeme) and ejacapodeme (= ejaculatory apodeme) seem to be present in all genera of Stenomicridae though the latter was undescribed in *Stenomicra* and *Stenocyamops* species by Grimaldi (2009). In *Cyamops* the phallapodeme is simple, rod-like, hardly longer than hypandrium but ejacapodeme is often enlarged and dorsoventrally blade-like expanded (cf. Baptista & Mathis 1994: Figs. 15, 16). The phallapodeme is strongly shortened in *Stenocyamops* (see Papp 2006: Fig. 120; Grimaldi 2009: Fig. 18B) but ejacapodeme seems to be well developed (Papp 2006: Figs. 122, 123). The *Podocera* species have the phallapodeme relatively short but basally expanded and projecting ventrally; their ejacapodeme is longer than phallapodeme, more or less rod-like, with modified proximal part (Merz & Roháček 2005: Figs. 7, 9, 19, 21). In *Stenomicra* both these sclerites are very similarly formed as in *Podocera*, both of subequal length (Figs. 8, 10, 13, 28). In *Planinasus* both phallapodeme and ejacapodeme are long (longer than hypandrium), the former simple, rod-like but the latter strongly dilated, spatulate, thus markedly different from those in other genera of Stenomicridae.

Female postabdomen and genitalia

The female terminalia have hitherto been insufficiently known in Stenomicridae, particularly as regards the formation of internal genitalia. External sclerites of female postabdomen and spermathecae were described in the genus *Cyamops* only by Baptista & Mathis (1994, 1996) and Sueyoshi & Mathis (2004) and in the genus *Stenocyamops* by Grimaldi (2009). In other genera the female postabdominal structures have not been studied up to the present but they

are described here for two species of *Stenomicra* and one species of *Podocera*. No information is available for the genus *Planinasus*. The comparison of the structures of the female terminalia in Stenomicridae is therefore made on the basis of rather fragmentary published data and the descriptions of postabdomina of three species presented above.

Postabdominal sclerites. The fusion of some terga and sterna to form tergosternal ring-shaped sclerites is the most characteristic feature of Stenomicridae but also occurs in some genera of Periscelididae. However, this modification developed differently in particular genera of Stenomicridae. In the genus *Cyamops* the sclerites of the 6th segment are always fused to form T6+S6 tergosternum, while T7+S7 form the complete annular tergosternum in the majority of species except for Australian species where T7 and S7 are separate (see Baptista & Mathis 1994, Mathis & Sueyoshi 2011). In all other genera (no data for *Planinasus*) T6 is a separate plate but S6 can be fused with other sclerites (see below). In *Stenocyamops* both T6 and S6 are disparate plates but T7+S7 are fused in a complete tergosternal ring (Grimaldi 2009: Figs. 21A, B, C). In *Podocera* and *Stenomicra* T6 is separate (see Figs. 19, 33, 36) but S6 is fused with the usual tergosternal ring T7+S7 to form a large synsclerite T7+S6+S7. This tergosternal complex seems to be a synapomorphy of *Podocera* + *Stenomicra*.

Also the 8th abdominal segment is variously modified in Stenomicridae. In *Cyamops* T8 and S8 are distinctly separate but S8 might sometimes be partly fused with S7 (in some Australian species – Khoo (1985), Baptista & Mathis (1994)). The *Stenocyamops* species have both T8 and S8 simple and separate (Grimaldi 2009). In *Podocera* T8 and S8 are also separate but T8 is elongate and convex, while S8 forms a small, bare, transversely oval plate. *Stenomicra* species, on the contrary, have (always ?) T8 fused with S8 to form a tergosternal ring T8+S8 but its ventral part (= S8) is bare and pale-pigmented (Fig. 34) or even reduced to a transverse strip-like connection (Fig. 20).

The 10th abdominal segment is formed by T10 (supra-anal plate, epiproct) and S10 (subanal plate, hypoproct). In the genus *Cyamops* both T10 and S10 are developed but T10 is short, transverse and without setosity (only with micropubescence) while S10 is larger and distinctly setose (Baptista & Mathis 1994: Figs. 6, 7, 17–19). Also in *Stenocyamops* T10 is well developed, semicircular to rounded, triangular and bare (Grimaldi 2009: Figs. 21A–C); no information is given about S10. On the other hand, T10 is strongly reduced or absent in *Podocera* (Fig. 36) and also *Stenomicra* (Figs. 19, 33) while S10 is plate-shaped, distinctly micropubescent and with long setae posterolaterally (Figs. 20, 34; 1 seta markedly prolonged in *Podocera*, see Fig. 37).

Cerci are always present in Stenomicridae, developed as one-segmented appendages, usually shortly setose. Species of *Cyamops* have cerci relatively short to elongate and sometimes with long terminal setae (Baptista & Mathis 1994: Fig. 6). In *Stenocyamops* they are shortly ovoid, thus rather broad, shortly setulose (Grimaldi 2009: Figs. 21A–C). *Stenomicra* species have cerci subconical, close to each other, shortly setose (Figs. 19, 33); cerci in *Podocera* seem to be small, more separate, with short setae (Fig. 36).

Internal female genitalia. With the 8th abdominal segment internal genitalia are also associated. However, apart from the spermathecae, no description of the structures of the female genital chamber has hitherto been published. The female genital chamber including the

ventral receptacle is described and illustrated above for *Stenomicra* and *Podocera*. It seems to be generally similar in both these genera, though some differences can be seen in the form of the ventral receptacle (cf. Figs. 17, 38). Originally 2 spermathecae (each on a separate duct) are developed in Stenomicridae. However, in *Cyamops* one or both of the spherical to oblong spermathecae can be duplicated so 2, 3 or 4 spermathecae occur in various clades of this genus (Baptista & Mathis 1994); spermathecal ducts seem to be short and relatively robust (cf. Baptista & Mathis 1996: Fig. 6). In *Stenocyamops* species two heavily sclerotized spherical to ovoid spermathecae with a plain surface and short ducts are described (Grimaldi 2009: Figs. 21A–C). Spermathecae in *Podocera* and *Stenomicra* are studied in detail for the first time here. In both genera only 2 spermathecae occur. In *Podocera* they are characterised by presence of small terminal spines, a well-sclerotized collar and very long spermathecal duct (Figs. 35, 38) while in *Stenomicra* they are bare but with proximal bulges surrounding the duct insertion, a membranous collar and a short spermathecal duct (Figs. 17, 18, 32). Unfortunately, there is no published information about spermathecae in the genus *Planinasus* (cf. also Mathis & Rung 2010).

Discussion and conclusions

The comparison of morphological structures of the male and female terminalia in the genera of Stenomicridae, despite being hitherto incomplete, could contribute to the study of their phylogenetic relationships. The family itself (Papp (1984, 2006); or as subfamily of Periscelididae – see Baptista & Mathis (1994); Mathis & Papp (1998); Grimaldi (2009); Mathis & Rung (2010)) is rather well characterised by non-genital external features although most of these diagnostic criteria are probably plesiomorphic. However, one of them, the loss or reduction (in the Baltic amber fossil genus *Procyamops* Hoffeins & Rung, 2005) of ocellar setae, surely is a autapomorphy of Stenomicridae. In addition to characters listed by the above authors, Stenomicridae seems also to differ from true Periscelididae in having a small T6 and more or less asymmetrical male pregenital sclerites (S6–S8) being fused to form a closed or (on right side) open ring-shaped synsclerite, asymmetrical (at least) male internal genitalia, relatively simple and posteriorly open hypandrium, reduced or absent postgonites, markedly short, often largely membranous aedeagus and relatively small male cerci. Also the tendency to form tergosternal rings in female postabdominal segments (not only in 7th but also in 6th or 8th segments) may be a significant character of Stenomicridae. Which of the above features are true autapomorphies of Stenomicridae it is a matter of further study. Nevertheless, the genital differences against Periscelididae (or Periscelidinae of authors) are distinct and rather numerous and seem to support Papp's (1984) concept of this acalyptrate group as a separate family, though it is obviously most closely related to Periscelididae. The Stenomicridae are already known from amber fossils (*Procyamops succini* Hoffeins & Rung, 2005 from Baltic amber (Hoffeins & Rung 2005); *Planinasus electrus* Grimaldi & Mathis, 1993, *Stenomicra sabroskyi* Grimaldi & Mathis, 1993 and *S. anacrostichalis* Grimaldi & Mathis, 1993 from Dominican amber (Grimaldi & Mathis 1993)) and are thus recorded from an older era (Eocene) than true Periscelididae (hitherto only Dominican amber, Miocene, see Grimaldi & Mathis (1993)). The genera of Stenomicridae are widespread and three of them,

Cyamops, *Podocera* and *Stenomicra*, are represented in most of the major biogeographical regions of the world.

Judging from the above comparison, all the genera hitherto established within Stenomicridae are proved to be distinct as regards the characters of the male genitalia (and possibly also female terminalia).

The genus *Cyamops* is distinguished by extensive asymmetry of the male external genitalia (including gonostyli, cerci and often also epandrium), the largest internal genitalia (hypandrial and aedeagal complex) and distinctive ejacapodeme; in the female it differs from all other genera by its annular tergosternun T6+S6 (cf. Baptista & Mathis 1994) and by the tendency to duplicate one or both spermathecae.

Stenocyamops, described as a taxon somewhat intermediate between *Cyamops* and *Stenomicra*, is characterised by the reduced ventral part of the pregenital synsclerite S6–S8 (similar in this respect to that of *Podocera*), elongate and slender male cerci, hypandrium only slightly asymmetrical and with relatively symmetrical pregonites, postgonites entirely absent and phallapodeme very shortened (Papp 2006, Grimaldi 2009).

Podocera proved to be most closely related to *Stenomicra* under which it was formerly synonymized or treated as a subgenus (cf. Baptista & Mathis 1994, 1996; Merz & Roháček 2005). This sister-group relationship is also demonstrated by a few male genital characters (e.g. phallapodeme with similarly expanded proximal end) but mainly by distinctive synapomorphies in the female terminalia, viz. the large ring-shaped synsclerite formed by T7+S6+S7 and the strong reduction to absence of T10. On the other hand, the striking differences in the male genitalia support the validity of the generic status of *Podocera*. It differs from *Stenomicra* chiefly by the pregenital sclerite being ventrally strip-like and often interrupted (plate-like extended in *Stenomicra*), male cerci ventrally directed and separate (small, closely attached, prolonged into epandrium and directed posteriorly in *Stenomicra*), medandrium large, developed as a pair of free setose sclerites (smaller, narrowed and attached to epandrium in *Stenomicra*), large asymmetrical pregonites anteriorly articulating with hypandrium (small, less asymmetrical and fused to posterior part of hypandrium in *Stenomicra*), postgonites paired and asymmetrical or right postogonite absent (both postgonites absent in *Stenomicra*), phallophore longer and posteriorly projecting as the epiphallus (very short, without epiphallus in *Stenomicra*). As in non-genital external characters, most of above features probably have a plesiomorphic state in *Podocera* (apomorphic in *Stenomicra*) but at least the following two seem to be autapomorphies of *Podocera* and unique within Stenomicridae: pregonites enlarged and situated anteriorly; phallophore posteriorly projecting into epiphallus. In my opinion these characters support the monophyly of *Podocera*. Nevertheless, *Podocera* is the more 'plesiomorphic' sister group of *Stenomicra* because the latter is also characterised by a number of apomorphies in the male genitalia. This also seems to be valid as regards the female postabdominal characters (cf. plesiomorphic separate though bare S8 in *Podocera*) although the prolonged spermathecal ducts and sclerotized collar of the spermatheca are probably autapomorphies of *Podocera* because the short ducts and none or membranous collar occur not only in *Stenomicra* but also in *Cyamops* and *Stenocyamops*.

Planinasus is a rather enigmatic genus of Stenomicridae whose affiliation with this family was already doubted by Baptista & Mathis (1994). Actually, its male genital structures dis-

play many dissimilarities (including relatively symmetrical structures) against those of other genera but their general formation (including posteriorly open hypandrium, distinct setose pregonites attached to posterior part of hypandrium, small aedeagus) is more similar to those of other genera of Stenomicridae than those known in true Periscelididae.

The formation of the medandrium (= bacilliform sclerites; subepandrial sclerite) in Stenomicridae (*Stenocyamops*, *Podocera*, *Stenomicra*), being developed as lateral setose sclerites articulating with both gonostyli and posterior arms of hypandrium, seems to be a rather ancestral character, not occurring in related acalyptrate families where these sclerites are fused, bare and often firmly connected with other parts of genitalia. The primitive form of the medandrium, its articulation and setosity in these genera indicate that each of these sclerites is obviously a remnant of the basal segment of the gonopod (thus homologous with basistylus). This is in conformity with the hinge hypothesis of the origin of hypopygium in Diptera Schizophora as documented by Zatwarnicki (1996).

Acknowledgements

Although this study is largely based on specimens deposited in SMOC, some comparative material has been loaned from other collections or colleagues. My thanks are therefore extended to the following curators and owners of collections who kindly borrowed or donated specimens of Stenomicridae for this study: M. Barták (Praha, Czech Republic), I. Brodin (Stockholm, Sweden), C. M. Drake (Axminster, England) and B. Merz (Genève, Switzerland). C. Hoffeins (Hamburg, Germany), W. N. Mathis (Washington, USA), L. Papp (Budapest, Hungary) and M. von Tschirnhaus (Bielefeld, Germany) are acknowledged for their help to obtain relevant literature. I should like particularly to thank P. Chandler (Melksham, England) for his critical review of the manuscript and many useful suggestions, and M. Deml (Morávka, Czech Republic) for photograph of *S. cogani*. The study was supported by a grant from the Silesian Museum no. IGS201103.

References

ANDERSSON H. 1991: Dvärgflugor, Stenomicridae, en för Norden ny flugfamily (Diptera). (Stenomicridae, a new family for North Europe (Diptera)). *Entomologisk Tidskrift* **112**: 149–151 (in Swedish, English summary).

BAPTISTA A. R. P. & MATHIS W. N. 1994: A revision of New World Cyamops Melander (Diptera: Periscelididae). *Smithsonian Contributions to Zoology* **563**: 1–28.

BAPTISTA A. R. P. & MATHIS W. N. 1996: A new species of Cyamops Melander (Diptera: Periscelididae) from Brazil, with distributional notes on another species. *Proceedings of the Entomological Society of Washington* **98**: 245–248.

BAPTISTA A. R. P. & MATHIS W. N. 2000: Notes on the genus Cyamops Melander (Diptera: Periscelididae), including description of ten new species. *Proceedings of the Entomological Society of Washington* **102**: 481–506.

CHANDLER P. J. 1998: Stenomicridae. P. 142. In: CHANDLER P. J. (ed.): *Checklists of Insects of the British Isles (New Series), Part 1: Diptera*. Handbooks for the Identification of British Insects 12, Royal Entomological Society, London, 234 pp.

COLLIN J. E. 1944: The British species of Anthomyzidae (Diptera). *Entomologist's Monthly Magazine* **80**: 265–272.

COQUILLETT D. W. 1900: Report on a collection of Dipterous Insects from Puerto Rico. *Proceedings of the United States National Museum* **22**: 249–270.

CZERNY L. 1929: Podocera ramifera, eine neue Gattung und Art der Perisceliden von Ceylon. *Konowia* **8**: 93–94.

DRAKE C. M. 2004: Small Diptera collected preferentially using a suction sampler. *Dipterists Digest* **11(1)**: 1–8.

FREIDBERG A. & MATHIS W. N. 2002: The Periscelididae (Diptera) of Israel, with description of a new species of Stenomicra Coquillett. *Israel Journal of Zoology* **48**: 43–51.

GRIMALDI D. A. 2009: The Asteioinea of Fiji (Insecta: Diptera: Periscelididae, Asteiidae, Xenasteiidae). *American Museum Novitates* **3671**: 1–59.

GRIMALDI D. A. & MATHIS W. N. 1993: Fossil Periscelididae (Diptera). *Proceedings of the Entomological Society of Washington* **95**: 383–403.

HOFFEINS C. & RUNG A. 2005: Procyamops succini, a new genus and species of Periscelididae (Diptera, Brachycera) from Baltic amber (Tertiary, Eocene). *Studia Dipterologica* **12**: 23–27.

IRWIN A. G. 1982: A new species of Stenomicra Coquillett (Diptera, Aulacigastridae) from Anglesey, North Wales. *Entomologist's Monthly Magazine* **118**: 235–238.

KHOO K. C. 1985: The Australian species of Cyamops Melander (Diptera: Periscelididae). *Australian Journal of Zoology* **32** (1984): 527–536.

MATHIS W. N. & PAPP L. 1998: 3.24. Family Periscelididae. Pp. 285–294. In: PAPP L. & DARVAS B. (eds.): *Contributions to a Manual of Palaearctic Diptera*. *Vol 3*. Science Herald, Budapest, 880 pp.

MATHIS W. N. & RUNG A. 2010: Periscelididae (Periscelid flies) 83. Pp. 1087–1092. In: BROWN B. V., BORKENT A., CUMMING J. M., WOOD D. M., WOODLEY N. E. & ZUMBADO M. A. (eds.): *Manual of Central American Diptera*. Vol. 2, Research Press, Ottawa, Ontario, Canada, xvi + 715–1442 pp.

MATHIS W. N. & SUEYOSHI M. 2011: New species of the genus Cyamops Melander from New Zealand (Diptera, Periscelididae, Stenomicrinae). *ZooKeys* **114**: 29–40.

MERZ B. & ROHÁČEK J. 2005: The Western Palaearctic species of Stenomicra Coquillett (Diptera, Periscelididae, Stenomicrinae), with description of a new species of the subgenus Podocera Czerny. *Revue Suisse de Zoologie* **112**: 519–539.

PAPP L. 1984: Family Stenomicridae. Pp. 61–63. In: SOÓS A. & PAPP L. (eds.): *Catalogue of Palaearctic Diptera*. *Vol. 10.* Akadémiai Kiado, Budapest, 402 pp.

PAPP L. 2006: Periscelididae – Stenomicridae. Pp. 208–220. In PAPP L., MERZ B. & FÖLDVÁRI M. (eds.): Diptera of Thailand. A summary of the families and genera with references to the species representations. *Acta Zoologica Academiae Scientiarum Hungaricae* **52**: 97–268.

ROHÁČEK J. 2006: A monograph of Palaearctic Anthomyzidae (Diptera) Part 1. *Časopis Slezského Zemského Muzea, Opava (A)* **55(Supplement 1)**: 1–328.

ROHÁČEK J. 2009: New biological and biogeographical data about two European species of Stenomicridae (Diptera). *Časopis Slezského Zemského Muzea, Opava (A)* **58**: 1–8.

ROHÁČEK J. 2010: A peculiar male genitalia monstrosity in Anthomyza neglecta (Diptera: Anthomyzidae). *Acta Entomologica Musei Nationalis Pragae* **50**: 619–628.

ROHÁČEK J. 2011: New records of Anthomyzidae and Stenomicridae (Diptera) from Turkey. *Časopis Slezského Zemského Muzea, Opava (A)* **60**: 147–153.

SABROSKY C. W. 1965: Asiatic species of the genus Stenomicra (Diptera: Anthomyzidae). *Bulletin of the British Museum (Natural History), Entomology* **17(5)**: 209–218.

SUEYOSHI M. & MATHIS W. N. 2004: A new species of Cyamops Melander 1913 (Diptera: Periscelididae) from Japan and a review of Japanese Periscelididae. *Proceedings of the Entomological Society of Washington* **106**: 74–84.

TSCHIRNHAUS M. von 2008: 4.3.01 Acartophthalmidae, Borboropsidae, Chyromyidae, Micropezidae, Odiniidae, Opetiidae, Periscelididae, Pseudopomyzidae, and Tanypezidae. In: ZIEGLER J. (ed.): Diptera Stelviana. A dipterological perspective on a changing alpine landscape. Vol. 1. *Studia Dipterologica*, *Supplement* **16**: 65–97.

ZATWARNICKI T. 1996: A new reconstruction of the origin of eremoneuran hypopygium and its implications for classification (Insecta: Diptera). *Genus* **7**: 103–175.