

# Contribution to the taxonomy of *Polynema* Haliday, 1833 and *Stephanodes* Enoch, 1909 (Hymenoptera: Mymaridae) of Sweden

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Fairyflies (Mymaridae) of the genera *Polynema* and *Stephanodes* collected all over Sweden by the Swedish Malaise Trap Project (SMTP) were examined. Five *Polynema* species were identified as known taxa: *P. (Doriclytus) euchariforme* Haliday, 1833, *P. (Polynema) flavipes* Walker, 1848, *P. (Polynema) fuscipes* Haliday, 1833, *P. (Polynema) gracile* (Nees ab Esenbeck, 1834), and *P. (Polynema) pusillum* Haliday, 1833. *Stephanodes similis* (Foerster, 1847) was the only occurring species for this genus, of which a brief description of Swedish material is provided. The five species of *Polynema* are redescribed and, in addition, illustrated notes are given on the five unnamed morphospecies of *Polynema*, in order to provide information for future taxonomic revisions of this genus. A preliminary identification key to all these taxa is provided.

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Fairyflies (Mymaridae) are among the smallest winged insects (Huber & Noyes 2013). The body size of the imago varies from 0.13–6.0 mm (Gibson 1997, Huber & Noyes 2013, Pricop 2013, Huber 2017). The family has a worldwide distribution and contains around 100 genera and 1400 nominal extant species (Huber & Greenwalt 2011). Fossils of Mymaridae date the family to at least 97 million years old (Heraty et al. 2013). With a very few exceptions, Mymaridae parasitize eggs of various insects, most commonly Hemiptera (Lin et al. 2007). Given their abundance (Lin et al. 2007) and occurrence in a wide range of different habitats (Triapitsyn & Berezovskiy 2002), they certainly have an important role in ecosystems (Pricop 2009, Triapitsyn 2013). Because of their importance and poor state of species level taxonomy in Sweden, we

review the species of *Polynema* Haliday, 1833 and *Stephanodes* Enoch, 1909, based mainly on recently collected material from throughout the country by the Swedish Malaise Trap Project (SMTP). We redescribe already identified named species and we describe five morphospecies recognized in order to provide potentially useful information for future taxonomic work. There is an urgent need of taxonomic revision for *Polynema* and the entire *Polynema* group of genera (Triapitsyn & Fidalgo 2006, Huber et al. 2009) but this enormous task is clearly beyond the scope of the present paper and must be based on a Europe-wide revision, at least.

## Methods

Insect material from the Swedish Malaise Trap Project (SMTP) was examined in search for specimens

of the mymarid genera *Polynema* and *Stephanodes*. This material was collected using Malaise traps; material from 39 traps out of the total 75 traps at 54 locations all over Sweden (URL 1) were examined. Examined material was caught in the years 2003 to 2007. In total, 232 specimens of *Polynema* and seven specimens of *Stephanodes* were found, of which 57 female *Polynema* and five female *Stephanodes* individuals from 18 traps were separated into species for this paper. Five *Polynema* species and one *Stephanodes* species were assigned to named species after comparison with primary type and other reference material. Another five *Polynema* species were recognized and treated as unnamed morphospecies (no. 1-5). Although uncommon, that was done in order to clearly separate them and allow for a proper assignment to species, after a European-wide revision is available, without giving new names to them, as it is highly likely that they are already described species. For each species one representative individual was chosen for description and pictures. Determination to genus followed the relevant keys in Triapitsyn & Huber (2000), Triapitsyn & Fidalgo (2006), and Pricop (2013).

The insect material was stored in 96% ethanol. Several different preparation methods were used, 43 specimens were card mounted and 9 were prepared as slides. For the remaining ten individuals wings and antennae were slide mounted, whereas the body was card mounted. This was done in order to compare detailed characters with the habitus of the mounted individual. Specimens for slide preparation were left in creosote to clear overnight, then dissected before placing the parts (wings, antennae, head, legs and metasoma) in Canada balsam under separate cover slips. Each individual received a consecutive specimen ID (e.g., NHRS143700001), followed by the trap number and ID when it was emptied.

Specimens collected for this study are deposited in the Naturhistoriska Riksmuseet Stockholm, Sweden (NHRS). Type specimens and other material were examined for comparison in the Naturhistorisches Museum Wien, Vienna, Austria (NHMW), as well as the Natural History Museum, London, England, UK (BMNH), the Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada (CNC), and Entomology Research Museum, Department of Entomology, University of California, Riverside, California, USA (UCRC), and photographs of specimens in the National Museum of Ireland,

Dublin, Ireland (NMID). The taxonomic notes of Triapitsyn & Fidalgo (2006) and Graham (1982) were of particular value for separation of the specimens to subgenera and species identification, respectively.

Use of morphological terms for the descriptions of species follows Gibson (1997) and Huber (2015). Abbreviations used in the species descriptions are:  $f_x$  = funicular segment of antenna,  $t_x$  = tarsus segment,  $gt_x$  = gastral tergum of metasomal segments, mps = multiporous plate sensillum or sensilla on antennal segments, POL = posterior ocellar line, LOL = lateral ocellar line, OOL = ocellular line. The torulus refers to the antennal insertion on the face (Fig. 12 d). The articulation between mesoscutum and scutellum is the transscutal articulation. Body length is measured in lateral view from front of head to tip of gaster. Mesosoma length in lateral view was measured with mounted individuals diagonal from directly behind the head to end of propodeum. Mesosoma width is measured in dorsal view at the level of the fore wing base, all other measurements follows Huber (2015). All measurements are given in micrometers ( $\mu\text{m}$ ) as minimum-maximum range and were made from card mounted specimens, except for wing and antennal segments, which was from slide mounted specimens. If only one number is given it indicates the same measurement for all individuals measured. The number of specimens of each species examined for measurements (e.g.,  $n=3$ ) is given with the whole body length and is valid for all following measurements in the description. Additionally, location, trapping time and trap ID is given within material section of each species description. Such data is based on the trap information given by SMTP (URL1) and not provided by the authors, more information such as coordinates and predominating vegetation is available on the website. Collection data of the specimens were analysed to gather information about the occurrence of *Polynema* species and *Stephanodes similis* in Sweden. A map for every species (Fig. 13 a-k) was created, showing the trap location in which the specimens were found.

An earlier molecular study of SMTP specimens at NHRS also provided DNA sequences. These sequences are published in BOLD (<http://www.boldsystems.org/>). After testing, the non-destructive whole body extraction method was found to be the most successful. Qiagen® DNeasy Blood and Tissue Micro Kit was used, additionally DTT (Dithiothreitol, 1 mMol, 20  $\mu\text{L}$ ) was added as lysis

buffer. Lysis was performed at 56 °C for 10 hours. The specimens were transferred into 96 % ethanol after extracting DNA. The Barcode gene region cytochrome oxidase subunit 1 (COI, mitochondrial) was chosen. Primers for COI were used after Folmer et al. (1994) with 658 bp length. The following PCR thermo cycle with 2.5 µL extract was selected: 5 min at 94 °C, 40 cycles of (30 sec at 94 °C, 40 sec at 48 °C, 1 min at 72 °C), finally 5 min with 72 °C, cooling and hold at 12 °C. Purification and cleaning followed the QIAGEN and Applied Biosystems cleaning protocols, sequencing was performed with Applied Biosystem Sequencer 3730. Sequences were edited with GENEIOUS version R7.0 and controlled with the BLAST function. Specimens with sequences available have a Process ID number of BOLD after the specimen ID in bold enclosed by square brackets.

Photographs of habitus, mesosoma, metasoma and head were taken with a Leica MZ 16 compound microscope with attached Leica DMC4500 Camera and Leica Application Suite software, Version 3.4.0. Those of wings and antennae were taken with a Zeiss AXIO Lab A1 microscope and attached Axio Cam ERc5s with Zen lite camera software. The photographs were stacked manually and edited with Gimp 2.8.16 software and post-edited with Adobe photoshop CS6. All drawings were done by the first author using an Olympus BX50 microscope and a drawing-mirror attached to the microscope.

### Historical review

*Polynema*, with *P. flavipes* Walker, 1846 as type species (Huber & Bouček 2001), and *Stephanodes*, with *S. elegans* Enock, 1909 as type species, are two cosmopolitan genera of Mymaridae (Huber & Fidalgo 1997, Triapitsyn & Fidalgo 2006). Huber & Fidalgo (1997) revised the latter genus and reduced the number of valid species from ten to five, with *Stephanodes similis* (Foerster, 1847) as the only species occurring in Europe. Aquino et al. (2016) transferred the New World species *Polynema giraulti* Perkins, 1912 to *Stephanodes* as *S. giraulti* (Perkins, 1912). At least two additional, undescribed species of *Stephanodes*, one from Burkina Faso (material in CNC) and one from Tahiti Nui Island, Society Islands, French Polynesia (material in UCRC), are known to the junior author of this publication. In contrast, *Polynema* includes about 270 nominal species worldwide (Hayat & Anis 1999, Triapitsyn & Fidalgo 2006), with an estimated 127 nominal species recorded

from Europe (Noyes 2016), and remains unrevised taxonomically. However, as explained below, that number is highly overestimated and is likely to decrease at least three-fold.

Both genera are often confused with each other because of their similar morphological appearance (Huber & Fidalgo 1997); e.g., Foerster (1847) originally described *S. similis* in *Polynema*. Ogloblin (1946) provided the first morphological character to separate both genera by the position of spiracle on the “internal suture between mesoscutum and pronotum” in *Stephanodes*. Huber & Fidalgo (1997) showed that the spiracle is much closer to the tegula than to the pronotum in *Polynema*.

The classification of subgenera and species within *Polynema* is difficult because of the large number of described species (Hayat & Anis 1999, Triapitsyn & Fidalgo 2006, Triapitsyn & Aquino 2010), including around 90 nominal species described mainly by W. Soyka (1956) from just a handful of localities in Europe alone. In particular, Soyka described numerous species from single specimens based on intraspecific rather than interspecific variation (Soyka 1956), so his key, later translated into Russian by Trjapitzin (1978), does not work and thus cannot be used for correct identification of the European species of *Polynema*. Most of Soyka’s nominal species will eventually be synonymized under the previously described taxa or with each other, as the true number of *Polynema* species in Europe would unlikely exceed about 35 valid taxa. We estimate that most of both published and unpublished identifications of *Polynema* species in Europe were based on misidentifications.

*Polynema* itself has several junior synonyms (Huber 2005, Noyes 2016): *Barypolynema* Ogloblin, 1946, with its two subgenera *Barypolynema* (*Notopolynema*) Ogloblin, 1960, and *Barypolynema* (*Tarphypolynema*) Ogloblin, 1960, *Cosmocomma* Foerster, 1856, *Doriclytus* Foerster, 1847, *Eutriche* Nees, 1834, *Maidliella* Soyka, 1946 and *Novickyella* Soyka, 1946. While Huber (2005) listed *Formicomymar* Yoshimoto, 1990 and *Restisoma* Yoshimoto, 1990 as valid genera and *Xenopolynema* Ogloblin, 1960 as a synonym of *Polynema*, Triapitsyn & Fidalgo (2006) synonymized the two former genera under *Polynema* as they both belong to the subgenus *Polynema* (*Doriclytus* Foerster, 1847), and then Triapitsyn & Berezovskiy (2007) reinstated *Xenopolynema* as a valid genus.

*Polynema* is currently divided into three subgenera (Hayat & Anis 1999, Triapitsyn & Fidalgo 2006, Triapitsyn & Aquino 2008, Huber et

al. 2009): *Polynema (Polynema) sensu stricto*, *P. (Doriclytus)* and *P. (Dorypolynema)* Hayat & Anis, 1999). *Polynema (Dorypolynema)*, with *Polynema mendeli* Girault, 1913 as type species, is defined by the strongly elongated ovipositor and the fore wing having a rather thin marginal plus stigmal vein and the discal microtrichia originating just beyond the apex of the wing venation (Hayat & Anis 1999, Triapitsyn & Aquino 2010). *Polynema (Dorypolynema)* is particularly common in the Afrotropical and Oriental regions; at least one undescribed species is known from Taiwan (Triapitsyn 2018). One species of *P. (Dorypolynema)* is known from the New World (Triapitsyn & Aquino 2010, Aquino et al. 2016). The subgenus has not yet been recorded in the Palearctic region, however (Triapitsyn & Fidalgo 2006, Triapitsyn & Aquino 2010). Triapitsyn & Fidalgo (2006) treated *Doriclytus*, with *Doriclytus vitripennis* Foerster, 1847 as type species. *Polynema (Doriclytus)* is separated, amongst other characters, from the other two subgenera by having a pit on the inner side next to each torulus, a feature that the subgenus shares with *Himopoly-nema* Taguchi, 1977, which occurs in the eastern Palearctic, Oriental and Australasian regions (Triapitsyn & Berezovskiy 2002, Lin et al. 2007), and *Platyfrons* Yoshimoto, 1990 (Triapitsyn & Fidalgo 2006), which occurs in the Neotropical region.

## Results

### Molecular work

Success rate was low; only eleven CO1 sequences were achieved. Although a non-destructive methodology was applied, some associated specimens were still destroyed and were therefore not included in the analysis of species. Only four CO1 sequences are associated with species in this paper.

### Key to species of *Polynema* and *Stephanodes* of SMTF

1. Fore wing with marginal vein thin; scape with inner surface imbricate (Fig. 11e-g, 12e).....  
.....*Stephanodes similis* (Foerster, 1847)
- Fore wing with marginal vein thickened; scape with inner surface either smooth or with transverse striation (Fig. 1f-g, 12a, c)....  
.....*Polynema* 2
- 2(1) Face with a pit medial to each torulus (Fig. 12 d)  
.....*Polynema (Doriclytus)* 9
- Face without a pit medial to each torulus (Fig. 12b).....*Polynema (Polynema)* 3

- 3(2) Scape on inner surface with transverse striations (Fig. 12a).....4
- Scape with inner surface smooth (Fig. 12c)..... 5
- 4(3) Scape dark (Fig. 3a, e) and its length about 100  $\mu\text{m}$ .....  
.....*Polynema (Polynema) fuscipes* Haliday, 1833
- Scape yellow (Fig. 2a) and its length about 175  $\mu\text{m}$ .....  
.....*Polynema (Polynema) flavipes* Walker, 1846
- 5(3) Fore wing with long conspicuous microtrichia on disc and long setae on wing margin (Fig. 4f-g), the length of longest apical fringe setae 200–300  $\mu\text{m}$ .....*Polynema (Polynema) gracile* (Nees ab Esenbeck, 1834)
- Fore wing with microtrichia and setae on wing shorter, not particularly striking (Fig. 6f, 7f), the length of longest apical fringe setae 70–180  $\mu\text{m}$ .....6
- 6(5) Body length > 1500  $\mu\text{m}$ ; fore wing broad (Fig. 6f), its width 400–500  $\mu\text{m}$ .....  
.....*Polynema (Polynema) sp. 1*
- Body length < 1500  $\mu\text{m}$ ; fore wing slender (Fig. 5f-g, 7f-g, 8f-g), its width 150–300  $\mu\text{m}$ .....7
- 7(6) Pronotum with median carina extending its entire length (Fig. 7c).....  
.....*Polynema (Polynema) sp. 2*
- Pronotum with median carina extending 0.33 to 0.5 of its length.....8
- 8(7) Body length > 950  $\mu\text{m}$ ; fore wing length > 1000  $\mu\text{m}$ , width > 200  $\mu\text{m}$ .....*Polynema (Polynema) sp. 3*
- Body length < 950  $\mu\text{m}$ ; fore wing length < 1000  $\mu\text{m}$ , width  $\leq$  200  $\mu\text{m}$ .....  
.....*Polynema (Polynema) pusillum* Haliday, 1833
- 9(2) Ovipositor long, projecting beyond apex of gaster by 140–150  $\mu\text{m}$  (Fig. 1a–b).....*Polynema (Doriclytus) euchariforme* Haliday, 1833
- Ovipositor shorter, projecting beyond apex of gaster by 10–40  $\mu\text{m}$ .....10
- 10(9) Body length < 1300  $\mu\text{m}$ ; gaster lateral length 360–430  $\mu\text{m}$ ; fore wing with view thin microtrichia behind marginal vein; legs light yellow to brown (Fig. 9 a, f–g).....*Polynema (Doriclytus) sp. 4*
- Body length > 1300  $\mu\text{m}$ ; gaster lateral length 620–630  $\mu\text{m}$ ; fore wing with microtrichia behind marginal vein as strong as beyond venation; legs reddish (Fig. 10 a, f–g).....*Polynema (Doriclytus) sp. 5*

**Synopsis of species in alphabetical order*****Polynema (Doriclytus) euchariforme* Haliday, 1833 (Fig. 1)**

**Diagnosis.** Body length 1020–1050 (n=2); Scape on inner surface smooth;  $f_3$  to  $f_6$  each with one sickle shaped sensillum;  $f_6$  with one mps; clava with seven mps. Propodeum with median carina extending to middle of propodeum. Ovipositor projecting beyond gaster by about one third of the entire gaster length.

**Redescription.** *Colour.* Head brown; scape brown; pedicel yellow; flagellum and clava brown; mesosoma brown to dark brown. Coxae dark brown; femora and tibiae varying from light yellow to brown; tarsi light yellow, except  $t_4$  which is brown. *Head* (Fig. 1 a, c–d, 12 d). Eye margin and vertex with a few short setae; posterior ocelli close to eye margin. POL: LOL: OOL about 80–90: 40: 20–30, head length in lateral view 120–150, head width in dorsal view 210–220. *Antenna* (Fig. 1 a, e, 12 c). Scape smooth, length: width 2: 1. Pedicel same width as scape, in lateral view circular. Funicular segments  $f_1$  to  $f_6$  except  $f_2$  approximately equal in length;  $f_2$  only slightly longer than other segments.  $F_3$  to  $f_6$  each ventrally with one sickle shaped sensillum;  $f_6$  with one mps. Clava 3x as long as wide and with seven mps, slightly longer than  $f_4$  to  $f_6$  together. Length of antennal segments: scape 70, pedicel 50,  $f_1$  40–50,  $f_2$  60,  $f_3$  50,  $f_4$  40,  $f_5$  40–50,  $f_6$  50; length/width of clava 130/40–50. *Mesosoma* (Fig. 1 c) in dorsal view with a faint sculpture, lateral length: lateral height = 2: 1, lateral length: dorsal width = 2.5: 1, about 2x as long as high and 2.5x as long as wide. Scutellum with campaniform sensilla midway between mesoscutum and frenal groove, the same distance between them as between the notauli at their junction with transscutal articulation. Propodeum with median carina extending to middle of propodeum. Length in dorsal view: mesoscutum 140, distance of campaniform sensilla to transscutal articulation 40, scutellum 70–80, frenum 40–50, propodeum 70, median carina 40. Mesosoma length in lateral view 340–360, width in dorsal view 150–170. *Fore wing* (Fig. 1 f–g) broad; microtrichia on wing membrane and marginal setae short. Fore wing length/width ratio 920–1030/260–300. Marginal vein about 50 long; longest apical fringe setae 70–90. *Metasoma* (Fig. 1 a–b).  $Gt_1$  occupies a quarter of the gaster; ovipositor projecting beyond gaster by a length equal to 0.3 of entire gaster. Length measurements

in lateral view: petiole 90, gaster 450–470,  $gt_1$  200–250, exerted part of ovipositor 140–150.

**Swedish material examined.** **Södermanland:** Huddinge kommun, 02.vii–14.vii.2003 (NHRS 143700046, Trap 5, ID 65); **Öland:** Mörbylånga kommun, 13.vii–24.vii.2007 (NHRS 143700045, Trap: 2006, ID: 2016); **Uppland:** Häbo kommun, 27.viii–10.ix.2004 (NHRS 143700127, Trap: 8, ID: 1562).

**Other material examined:** Images of *P. euchariforme*, lectotype NMID (1 ); BMNH (5 ) and NHMW (3 ).

***Polynema (Polynema) flavipes* Walker, 1846 (Fig. 2)**

**Diagnosis.** Body length 1460–1540 (n=2). Scape on inner surface with cross-ridges;  $f_3$ ,  $f_4$  and  $f_6$  each with ventrally one sickle shaped sensillum;  $f_5$  with two sickle shaped sensilla.  $F_6$  with one mps; clava with seven mps. Propodeum with median carina extending to 0.75 of its length; ovipositor exerted part 20–70. Fore wing slender with a length: width ratio = 1: 4.5.

**Redescription.** *Colour.* Head brown to black; scape, pedicel and  $f_1$  yellow;  $f_2$  to  $f_4$  light brown;  $f_5$ ,  $f_6$  and clava brown; mesosoma black; legs dark yellow except  $t_4$  which is dark brown; petiole dark yellow; gaster black. *Head* (Fig. 2 a, c–d). Gena with short and sparse setae; face and clypeus with long and dense setae. POL: LOL: OOL about 90: 50: 20–30; head length in lateral view 190, width in dorsal view 270–290. *Antenna* (Fig. 2 a, e–f). Antennae from basal to apical segments with long setae, increasing in density towards  $f_6$ ; clava with dense setae but shorter than on other segments. Scape slender, 3x as long as wide, on inner surface with striations. Pedicel length 0.5x scape length;  $f_1$  0.9x pedicel length;  $f_2$  2x  $f_1$  length;  $f_3$ ,  $f_5$  and  $f_6$  each in about the same length as  $f_1$ . Clava long and slender, length about 3x its width and about 1.3x  $f_2$  length.  $F_3$ ,  $f_4$  and  $f_6$  each ventrally with one sickle shaped sensillum;  $f_5$  with ventrally and dorsally one sickle shaped sensillum;  $f_6$  with one mps; clava with seven mps. Length of antennal segments: scape 120–130, pedicel 60–70,  $f_1$  60,  $f_2$  120–130,  $f_3$  70,  $f_4$  60–70,  $f_5$  60,  $f_6$  70; length/width of clava 170–190/50–60. *Mesosoma* (Fig. 2 c). Scutellum with campaniform sensilla in the anterior third; propodeum with median carina extending to 0.75 of its entire length, in lateral view elevated. Length measurements in dorsal view: mesoscutum 150, distance campaniform sensilla to transscutal artic-

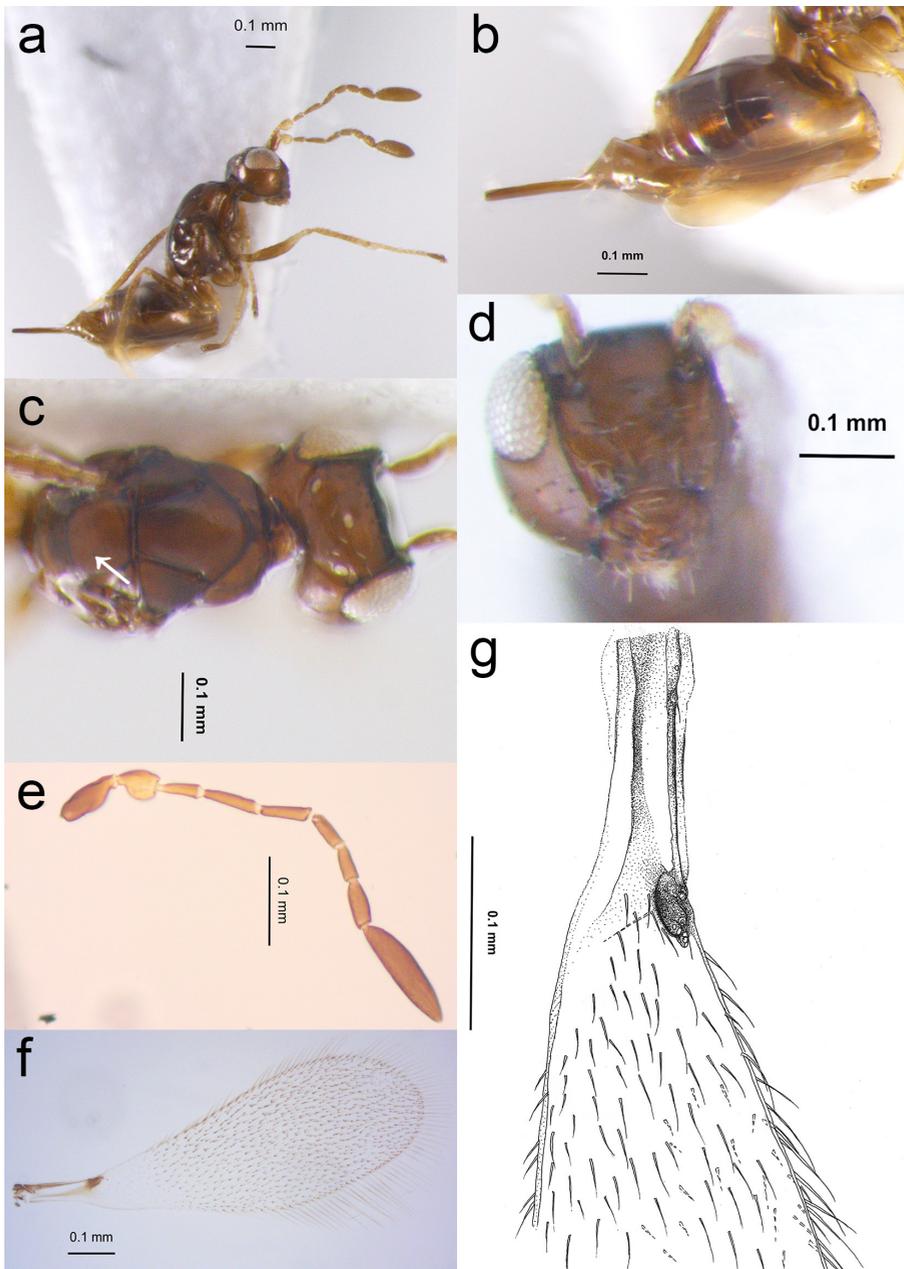


Figure 1. *Polynema (Doriclytus) euchariforme*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

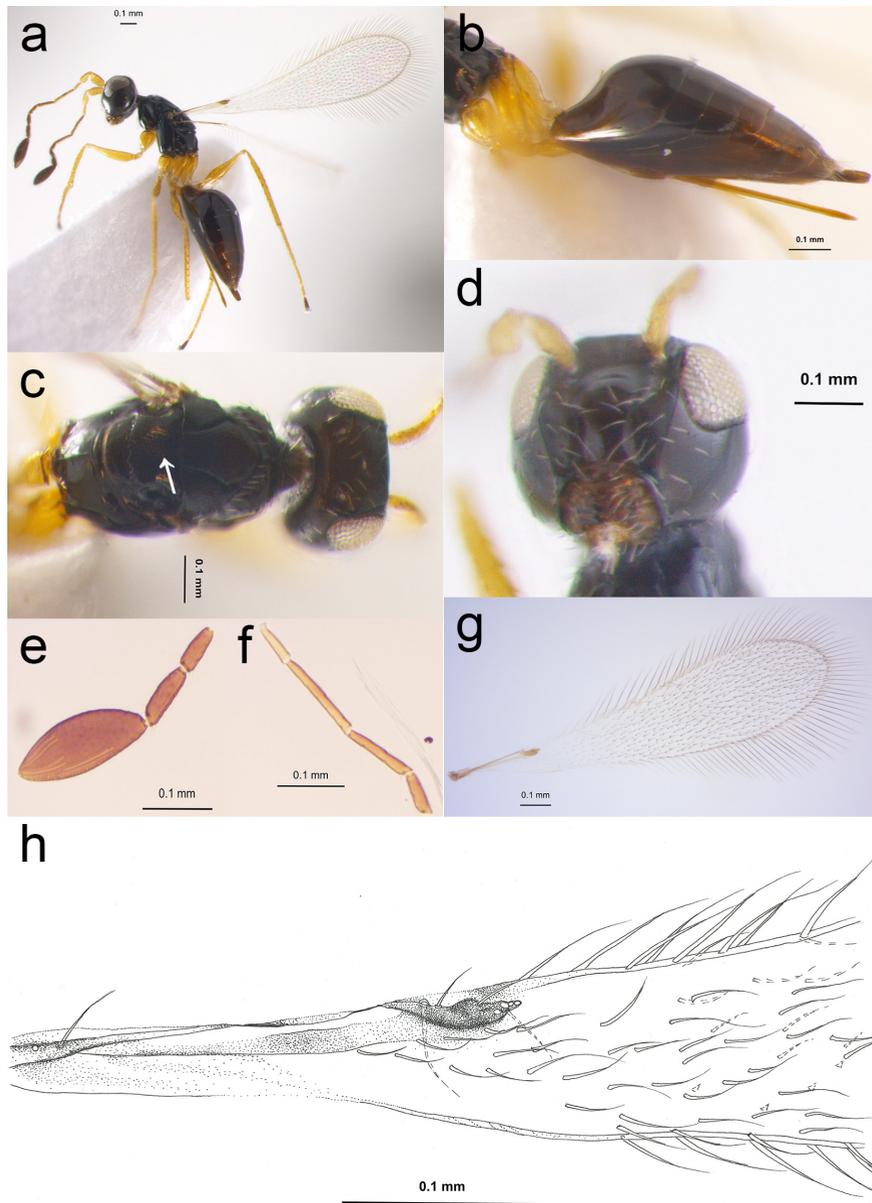


Figure 2. *Polynema (Polynema) flavipes*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna part with clava,  $f_6$  and  $f_5$ ; – f) antenna part with  $f_1$  to  $f_4$ ; – g) fore wing; – h) anterior part of fore wing.

ulation 20–40, scutellum 100, frenum 40, propodeum 100, median carina 70–100. Mesosoma length in lateral view 470–480, width in dorsal view 190–200. *Fore wing* (Fig. 2 g–h) slender with moderate number of marginal setae; setae length on posterior margin 1.5x those on anterior margin; microtrichia dense, extending from stigmal vein to wing apex. Wing length/width ratio 1460–1470/330; marginal vein 50–60 long; longest apical fringe setae 150. *Metasoma* (Fig. 2 a–b). Petiole same length but more slender than metacoxa. Ovipositor exerted beyond gaster by a length equal to apical tergum length. Length measurement in lateral view: petiole 200–220, gaster 580–670,  $gt_1$  300, exerted part of ovipositor 20–70.

**Variation.** The body colour sometimes differs slightly towards darker brown; campaniform sensilla on scutellum may be located slightly more posteriorly, almost in the middle of scutellum.

**Swedish material examined. Uppland:** Båtfors, 17.vii–16.viii.2005 (NHRS 143700030, Trap: 7, ID: 1593); Ekdalens naturreservat, 04.viii–18.viii.2003 (NHRS 143700025, Trap: 27, ID: 468).

**Other material examined.** BMNH (2 ♂, 2 ♀) and NHMW (8 ♂).

***Polynema (Polynema) fuscipes Haliday, 1833*** (Fig. 3)

**Diagnosis.** Body length 1230–1440 (n=6); scape on inner surface with conspicuous cross-ridges;  $f_3$  to  $f_6$  each with one sickle shaped sensillum.  $F_6$  with one mps; clava with seven mps. Propodeum with median carina extending 0.66x its length; ovipositor slightly exerted beyond gaster, the projecting part equal in length of the last tergum segment.

**Redescription. Colour.** Head dark brown to black; scape brown to dark brown; pedicel in light yellow; flagellomere and clava all uniformly in brown. Mesosoma black; coxae and femor dark with a colour shift from basally brown/black to apically yellow/shiny. Tarsomere segments with  $t_1$  in light yellow;  $t_2$  and  $t_3$  light brown;  $t_4$  dark brown. Petiole anteriorly brown fading to yellow posteriorly. *Head* (Fig. 3 a, c–d). Vertex, gena and clypeus with short and strong setae. Anterior ocellus in front with light grooves; posterior ocelli with grooves extending laterally to eye margin. POL: LOL: OOL = 100–120: 50–60: 30. Head length in lateral view 150–190, width in dorsal view 250–280. *Antenna* (Fig. 3 a, e, 12 a). Antennae from basal to apical segments with increasing number of setae. Scape 2x as long as wide, on inner surface with obvious diagonal striation and long but

few setae. Pedicel 0.4x scape;  $f_1$ ,  $f_4$  and  $f_5$  equal in length and width;  $f_2$  2.2x  $f_1$ ;  $f_3$  about 0.8x  $f_2$ ;  $f_6$  intermediate in length between  $f_3$  and  $f_4$ .  $F_3$  to  $f_6$  each with ventrally one sickle shaped sensillum;  $f_6$  with one mps; clava with seven mps. Clava slender, length about 3.2x width. Length of antennal segments: scape 100–110, pedicel 60–70,  $f_1$  40–60,  $f_2$  100–130,  $f_3$  70–90,  $f_4$  50–70,  $f_5$  50–60,  $f_6$  70–80; length/width of clava 150–180/50–60. *Mesosoma* (Fig. 3 c). Slender, about 4x as long as wide, in dorsal view with clearly visible reticulate structure. Campaniform sensilla on scutellum in its anterior quarter. Frenal groove on the apical third of scutellum. Propodeum with median carina 0.66x its length, elevated towards petiole in lateral view. Length measurements in dorsal view: mesoscutum 150–190, distance campaniform sensilla to transscutal articulation 10–30, scutellum 90–120, frenum 50, propodeum 70–100, median carina 40–70. Mesosoma length in lateral view 390–500, width in dorsal view 180–210. *Fore wing* (Fig. 3 f–g). Fore wing slender, with even, strong microtrichia, inconspicuous behind marginal vein. Wing margin with setae even in length throughout. Wing length/width 1230–1610/270–390, marginal vein 50–70, longest apical fringe setae 110–120. *Metasoma* (Fig. 3 a–b). Gaster ventrally slightly attenuated, keel-like. Entire gaster 2.5x as long as wide; ovipositor slightly exerted by about half the length of the last tergum segment. Length measurements in lateral view: petiole 130–200, gaster 540–580,  $gt_1$  260–340, exerted part of ovipositor 40–100.

**Variation.** Not all specimens have such a dark colouration as described above and illustrated. The ovipositor can be more exerted; gaster at its last segment with varying amount of bristles. Propodeum with median carina varying in length.

**Comments.** Soyka (1946) regarded the striations on the inner side of the scape (“Schaft mit deutlichen Querleisten”) as a generic feature for his genus *Maidliella* and genotype *M. neofuscipes* Soyka, 1956. *Maidliella* was synonymized with *Polynema* (Huber 2005, Triapitsyn & Fidalgo 2006), because the striations on the inner surface of the scape may be either present or absent in different species of other genera of the *Polynema* group, e.g., *Acmopolynema* Ogloblin, 1946, *Himopolynema* Taguchi, 1977.

**Swedish material examined. Öland:** Ottenby military radar station, 01.viii–26.viii.2005 (NHRS 143700091, Trap: 21, ID: 1508); Västerstads allmunds naturreservat, 10.vi–09.vii.2014 (NHRS 143700083 Trap: 3001, ID: 3052); Station Linné,

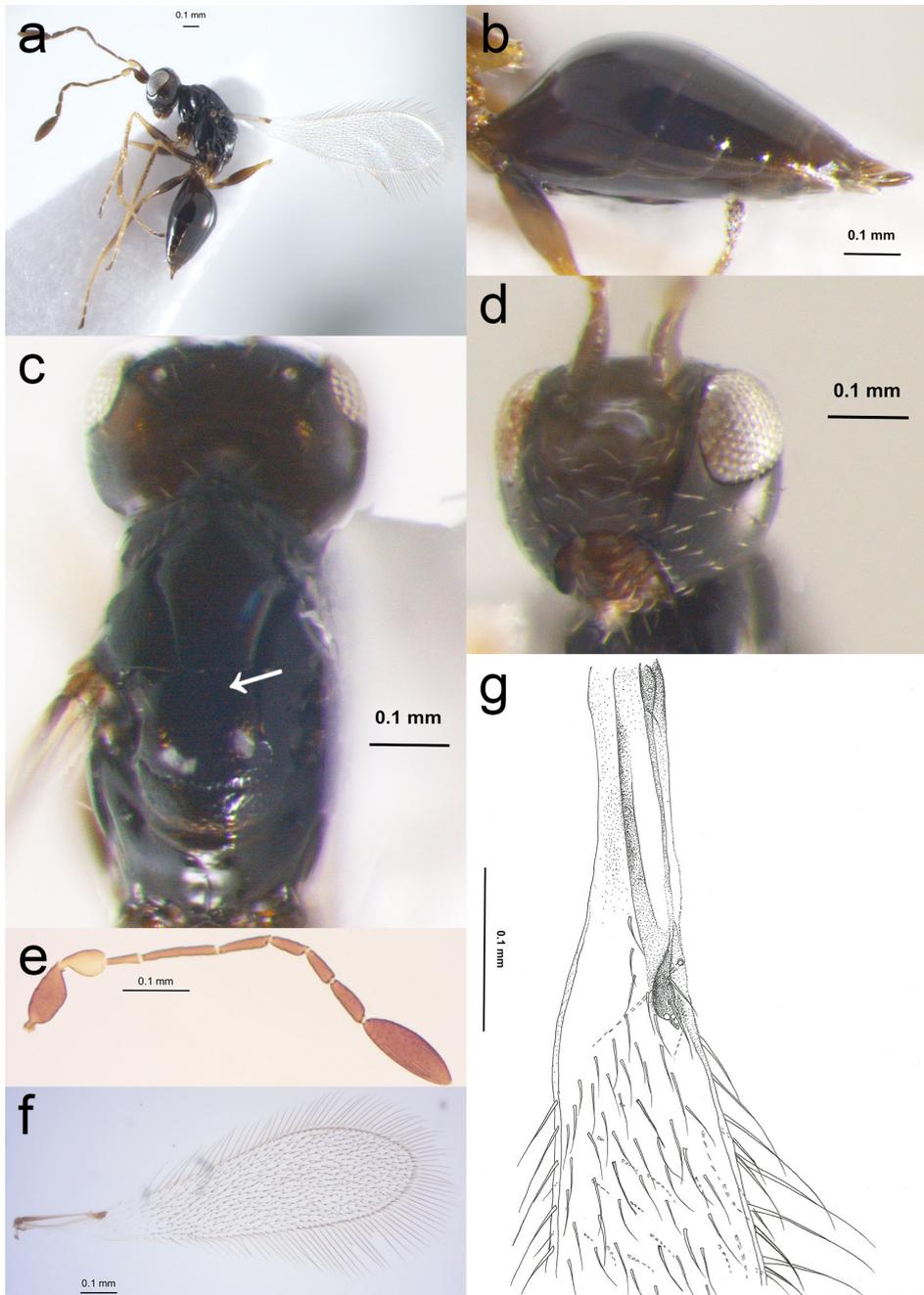


Figure 3. *Polynema (Polynema) fuscipes*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

10.v–22.v.2007 (NHRS 143700084, Trap: 2006, ID: 2011) and 13.vii–14.viii.2007 (NHRS 143700085, Trap: 2006, ID: 2016); **Bohuslän**: Stora Snixholmen, 31.vii–14.viii.2004 (NHRS 143700087 & NHRS 143700118, Trap: 32, ID: 1071) **Skåne**: Drakamölan, 28.vi–02.vii.2005 (NHRS 143700090, Trap: 38, ID: 1448).

**Other material examined.** Images of lectotypes NMID (6 ), BMNH (2 , 2 ) and NHMW (5 sex?).

***Polynema (Polynema) gracile* (Nees ab Esenbeck, 1834)** (Fig. 4)

**Diagnosis.** Body length 1200–1390 (n=3); Scape on inner surface smooth;  $f_5$  and  $f_6$  each with one sickle-shaped sensillum;  $f_6$  with one mps; clava with seven mps. Propodeum with median carina extending 0.66x its length; ovipositor exerted part 10–30. Fore wing with conspicuous long microtrichia and marginal setae 220–300.

**Redescription.** *Colour.* Head light to dark brown; scape light yellow; pedicel, flagellum and clava light brown; mesosoma light brown; pronotum slightly lighter than mesosoma; petiole and legs light yellow except apical tarsomere light brown; metasoma light brown. *Head* (Fig. 4 a, c–d, 12 b). Vertex around ocelli and on gena with long setae; POL: LOL: OOL about 80: 40–50: 20–30; head length in lateral view 150–170, width in dorsal view 250–270. *Antenna* (Fig. 4 a, e). Scape about 2.3x as long as wide, on inner surface smooth.  $F_1$  0.33x scape;  $f_2$  1.8x  $f_1$ ;  $f_3$  1.2x  $f_1$ ;  $f_4$  and  $f_5$  equal in length;  $f_6$  the same length as  $f_1$  but wider.  $F_5$  and  $f_6$  each ventrally with one sickle-shaped sensillum;  $f_6$  with one mps. Clava almost same length as scape, with seven mps. Length of antennal segments: scape 120–150, pedicel 70,  $f_1$  40–50,  $f_2$  100–120,  $f_3$  70,  $f_4$  40–50,  $f_5$  50,  $f_6$  60–70; length/width of clava 160–170/60. *Mesosoma* (Fig. 4 c). Pronotum with numerous setae covering it completely. Mesoscutum in dorsal view with reticulate structure clearly visible; scutellum with weak sculpture. Scutellum with campaniform sensilla midway between transscutal articulation and frenal groove. Propodeum with median carina one to two thirds its length. Length measurements in dorsal view: mesoscutum 120–140, campaniform sensillum to transscutal articulation 40, scutellum 80–100, frenum 40–50, propodeum 90, median carina 40–70. Mesosoma length in lateral view 380–450, width in dorsal view 160–180. *Fore wing* (Fig. 4 f–g) with microtrichia and marginal setae long; setae on posterior margin 1.5x setae on anterior margin. Fore wing length/width 1330–1650/350–420; marginal

vein about 60–70 long; longest apical fringe setae 220–300. *Metasoma* (Fig. 4 a–b). Petiole slightly longer and 0.5x as wide as metacoxa. Gaster in lateral view tent-shaped, with ventral surface flat;  $gt_1$  extending about 0.5x length of gaster. Ovipositor slightly exerted. Length measurement in lateral view: petiole 180–220, gaster 480–550,  $gt_1$  270–300, exerted part of ovipositor 10–30.

**Variation.** Campaniform sensilla on scutellum may be located more anteriorly. Fore wing with varying length and number of microtrichia and marginal setae.

**Comments.** Hincks (1950) described the species with very long microtrichia and marginal setae, sometimes as long as the greatest wing width. His descriptions, illustrations, and the type specimen showed great similarities in colour, venation and size with the *Polynema (Polynema)* from Sweden re-described above and we are confident they are conspecific. Graham (1973) synonymized *P. britteni* under *P. gracile*.

**Swedish material examined. Västerbotten:** Kulbäcksliden försökspark Grandslide, 05.viii–20.viii.2004 (NHRS 143700019 [SMYM001-16], Trap: 55, ID: 1261) and 05.viii–20.viii.2004 (NHRS 143700109 + NHRS 143700110, Trap: 59, ID: 1289); **Uppland:** Ekdalens naturreservat, 04.viii–18.viii.2003 (NHRS 143700017 Trap: 27, ID: 468); **Södermanland:** Sofielunds återvinningsanläggning, 11.viii–30.viii.2003 (NHRS 143700018, NHRS 143700101 and NHRS 143700102 Trap: 5, ID: 77); **Småland:** Alsterbro/Alsterån, 20.vi–25.vi.2005 (NHRS 143700020, Trap: 1008, ID: 1342); **Öland:** Ottenby military radar station, 01.viii–26.viii.2005 (NHRS 143700100 Trap: 21, ID: 1508).

**Other material examined.** Holotype of *Polynema britteni* Hincks, 1950 (BMNH, 1 ). Card mounted. Number: 5.1450. First label: “*Polynema britteni* Hincks type”, second label “*Cosmocoma hirtipennis* Enoch Co-type”, followed by a yellow co-type label, then a label by C. O. Waterhouse: “Llandudno, 16.08.1910” followed by a red type label. Additional material examined: BMNH (3 , 3 ).

***Polynema (Polynema) pusillum* Haliday, 1833** (Fig. 5)

**Diagnosis.** Body length 810–850 (n=3); Scape on inner surface smooth;  $f_5$  and  $f_6$  each with one sickle-shaped sensillum;  $f_6$  with one mps. Fore wing slender, 4.5x as long as wide; fore wing with longest marginal setae 160, maximum wing width 200. Propodeum with median carina extending to 0.33x its length; ovipositor exerted part 20.

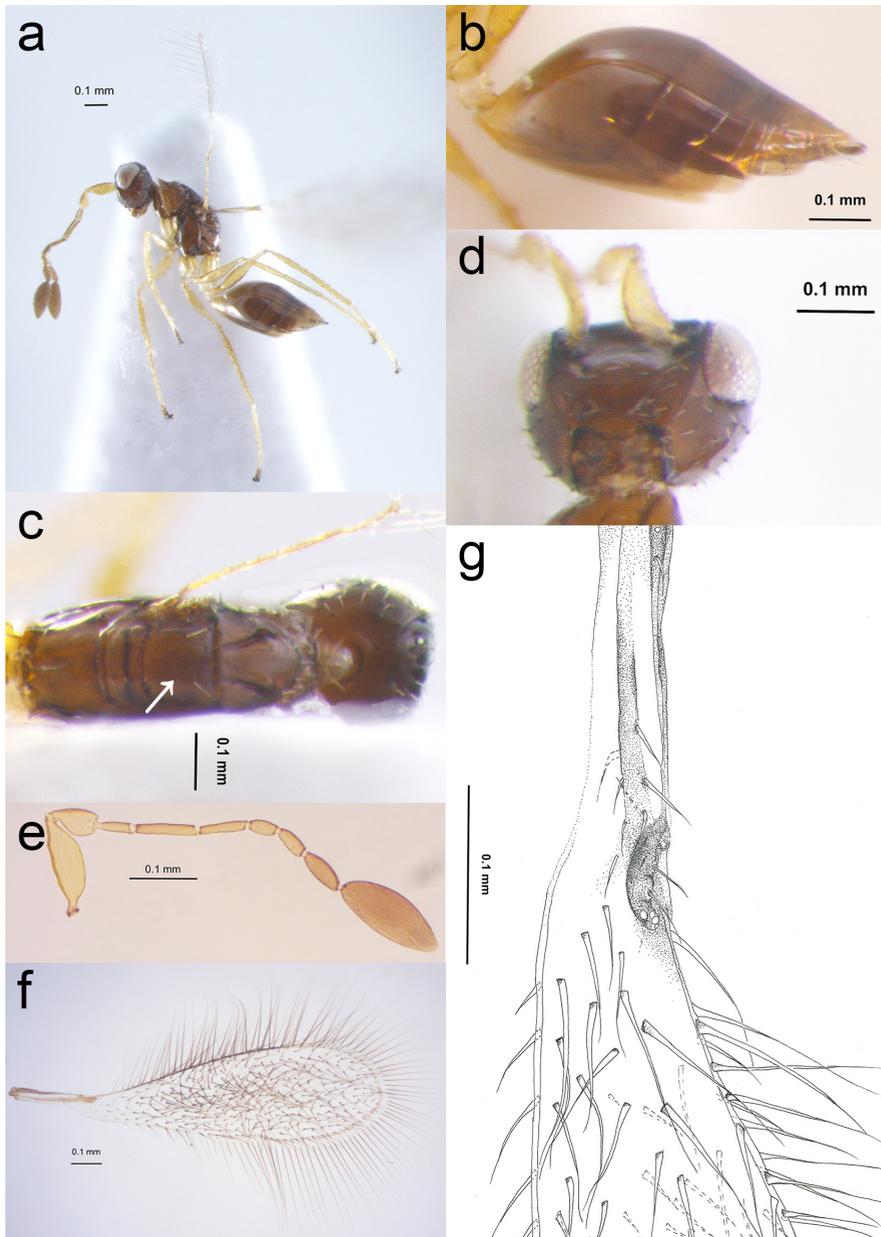


Figure 4. *Polynema (Polynema) gracile*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

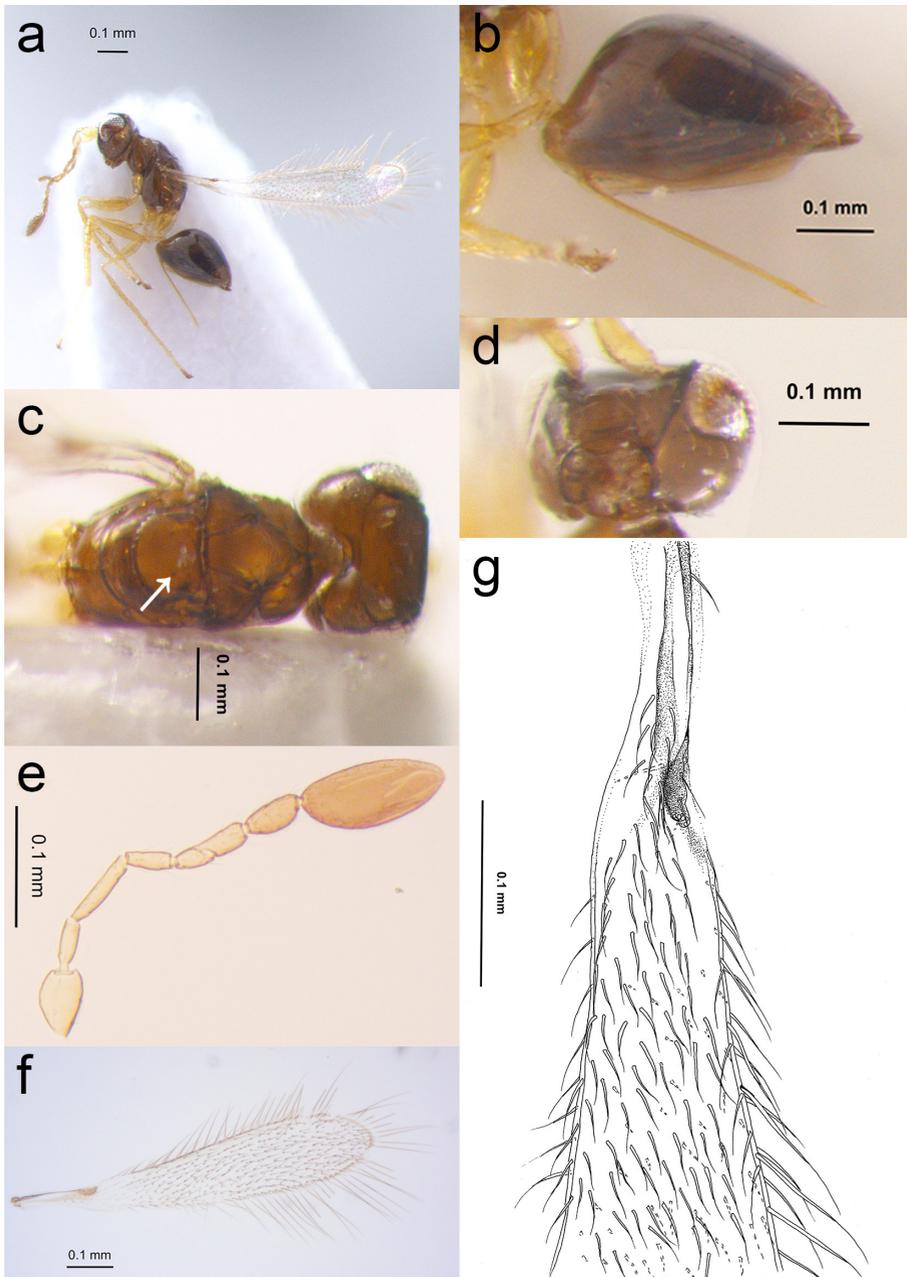


Figure 5. *Polynema (Polynema) pusillum*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

**Redescription.** *Colour.* Head brown; scape yellow; pedicel with a colour shift from basally yellow to apically light brown;  $f_1$  to  $f_5$  in light brown;  $f_6$  and clava brown; mesosoma brown; legs light yellow except  $t_4$  light brown; petiole yellow; gaster brown. *Head* (Fig. 5 a, c–d). POL: LOL: OOL about 70–80: 40: 20–30, head length in lateral view 110–120, width in dorsal view 180–220. *Antenna* (Fig. 5 a, e). Scape length 3x width, on inner surface smooth; pedicel 0.5x scape;  $f_1$  0.5x  $f_2$ . Funicular segments  $f_3$  to  $f_5$  each in same length as  $f_1$ ;  $f_6$  1.2x  $f_5$ . Clava almost same length as  $f_1$  to  $f_3$  together.  $F_5$  and  $f_6$  each with ventrally one sickle-shaped sensillum;  $f_6$  with one mps; clava with seven or eight mps (not clearly visible). Length of antennal segments: scape 90–100, pedicel 50–60,  $f_1$  30–40,  $f_2$  60–70,  $f_3$  40,  $f_4$  30–40,  $f_5$  40,  $f_6$  50; length/width of clava 110–130/40–50. *Mesosoma* (Fig. 5 c). Pronotum in dorsal view with few setae and reticulate structure clearly visible. Scutellum with campaniform sensilla in the anterior third; propodeum with median carina extending 0.33x its length. Length measurement in dorsal view: mesoscutum 100–110, distance campaniform sensilla to transscutal articulation 30–40, scutellum 60–70, frenum 30, propodeum 50–70, median carina 20–30. Mesosoma length in lateral view 270–310, width in dorsal view 150–180. *Fore wing* (Fig. 5 f–g). Fore wing slender, setae on posterior margin 2.5x on anterior margin. Fore wing length/width 820–900/170–200; marginal vein 40–50; longest apical fringe setae 120–160. *Metasoma* (Fig. 5 a–b). Petiole is 1.2x as long as metacoxa, dorsally with a narrow suture. Ovipositor slightly exerted by about 0.5x of apical segment of gaster. Length measurement in lateral view: petiole 100–110, gaster 300–330,  $gt_1$  70–180, exerted part of ovipositor 20.

**Swedish material examined.** **Öland:** Station Linné, 13.vii–24.vii.2007 (NHRS 143700041, Trap: 2006, ID: 2016); Mörbylånga kommun, 24.vii–01.viii.2007 (NHRS 143700040, Trap: 2006, ID: 2017); **Uppland:** Ekdalens naturreservat, 04.viii–18.viii.2003 (NHRS 143700039, Trap: 27, ID: 468); **Småland:** Store mosse, 20.vi–17.vii.2005 (NHRS 143700042, Trap: 41, ID: 1778); **Södermanland:** Sofielunds återvinningsanläggning, 11.viii–30.viii.2003 (NHRS 143700043, Trap: 5, ID: 77); **Bohuslän:** Sora Snixholmen, 29.vii–13.ix.2003 (NHRS 143700044, Trap: 32, ID: 519).

**Other material examined.** Images of lectotype female (NHMW). Additional material examined: BMNH (3 , 2 ).

### *Polynema (Polynema) sp. 1* (Fig. 6)

**Diagnosis.** Scape 3x as long as wide, on inner surface smooth;  $f_3$ ,  $f_4$  and  $f_6$  each ventrally with one sickle-shaped sensillum;  $f_5$  with ventrally and dorsally one sickle-shaped sensillum; clava 3x as long as wide with seven mps. Mesosoma with posterior pronotum and outer parts of the collar with dense, long setae, varying in amount. Scutellum with campaniform sensilla positioned in the last third of scutellum. Propodeum with median carina extending almost to dorsellum. Fore wing broad; microtrichia strong; anterior and posterior margin with setae in almost the same length. Petiole thinner than metacoxa;  $gt_1$  expanding up to 0.33x of the entire gaster length. Projecting part of ovipositor is in same length as last tergite segment.

**Colour.** Head light to dark brown; scape and pedicel light yellow;  $f_1$  light brown;  $f_2$  to  $f_6$  and clava brown; mesosoma light to dark brown; legs uniformly yellow, except  $t_4$ , which is brown to dark brown; petiole yellow; gaster brown.

**Measurements.** (=4) Body length 1610–1760; POL: LOL: OOL about 90–100: 40–50: 30; head length in lateral view 190–200 and in dorsal view 310–350. Length of antennal segments: scape 160–170, pedicel 50–70,  $f_1$  60,  $f_2$  160–170,  $f_3$  110–120,  $f_4$  70–80,  $f_5$  60–80,  $f_6$  70–80; length/width of clava 210–230/80–90. Length measurement in dorsal view: mesoscutum 180–200, distance campaniform sensilla to transscutal articulation 70–80, scutellum 120–130, frenum 50–60, propodeum 120, median carina 80–100. Mesosoma length in lateral view 450–600, width in dorsal view 220–260. Fore wing length/width 1750–1890/420–520; marginal vein 80–90 long; longest apical fringe setae 170–180 long. Length measurements in lateral view: petiole 220–270, gaster 570–630,  $gt_1$  270–300, exerted part of ovipositor 60–90.

**Swedish material examined.** **Västerbotten:** Kulbäckslidens försökspark Grandliden, 05.viii–20.viii.2004 (NHRS 143700033, NHRS 143700034, NHRS 143700103 and NHRS 143700104 Trap: 55, ID: 1261); **Uppland:** Ekdalens naturreservat, 04.viii–18.viii.2003 (NHRS 143700031, Trap: 27, ID: 468); Båtfors, 04.vii–17.vii.2005 (NHRS 143700032, Trap: 7, ID: 1592).

### *Polynema (Polynema) sp. 2* (Fig. 7)

**Diagnosis.** Head with front-eye-margin at height of toruli with sharp edge. Scape twice as long as wide, smooth;  $f_6$  with one sickle-shaped sensillum; clava 2.3x as long as wide, with seven mps. Mesosoma with pronotum in dorsal view with few but

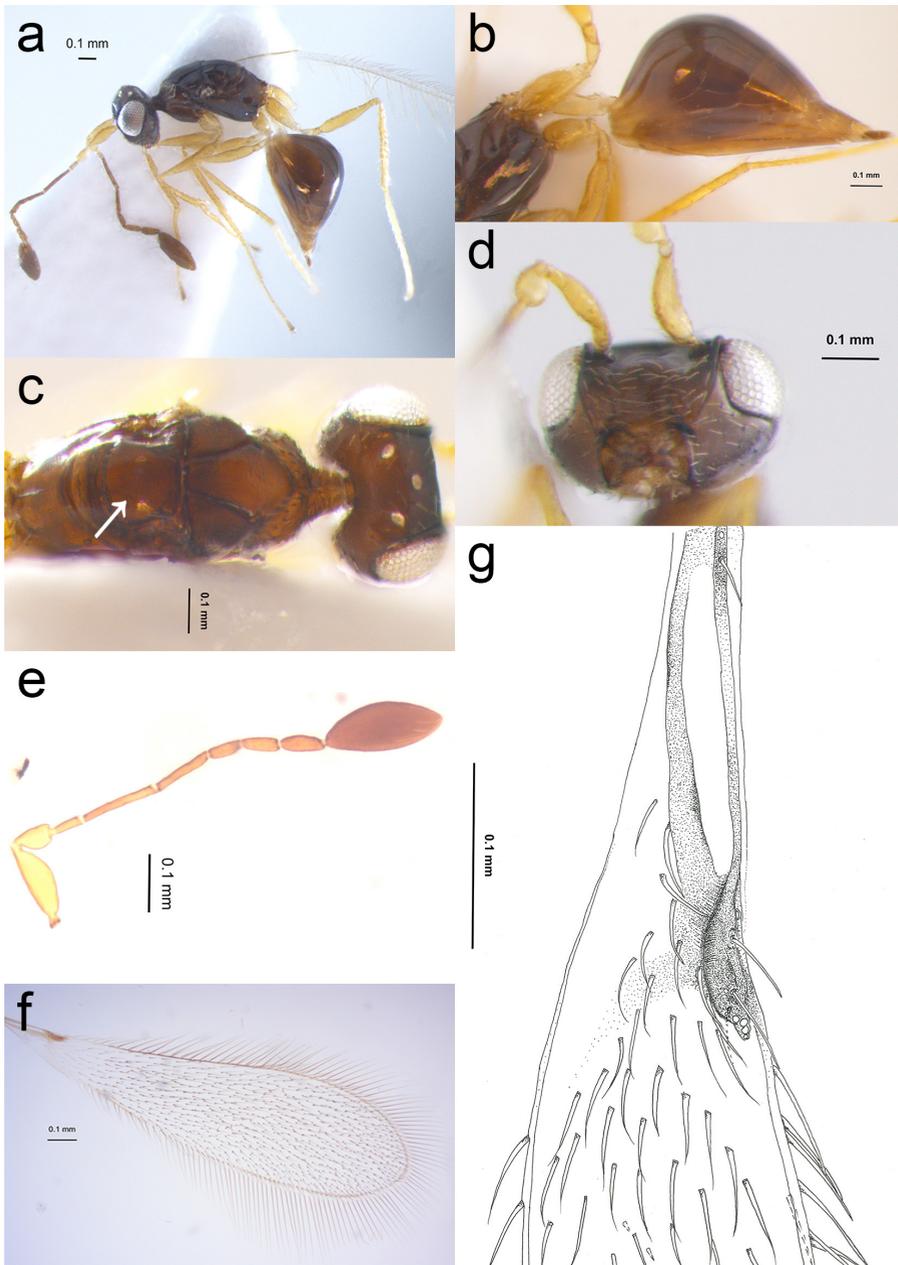


Figure 6. *Polynema (Polynema)* sp. 1: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

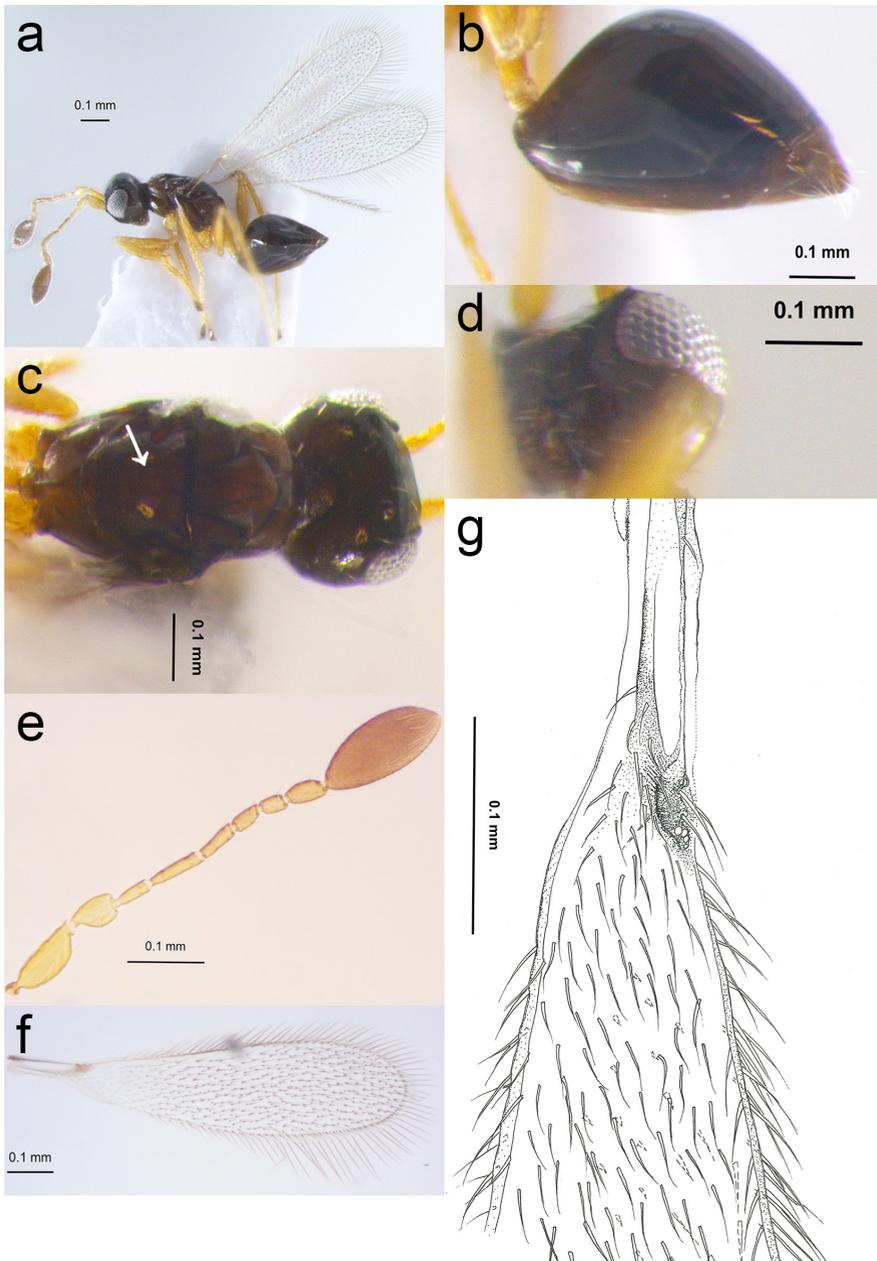


Figure 7. *Polynema (Polynema) sp. 2*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

long setae. Scutellum with campaniform sensilla in the middle between transscutal articulation and frenal groove. Propodeum with median carina extending over its entire length, in lateral view elevated towards petiole. Fore wing slender; microtrichia dense. Marginal setae on posterior margin 1.3x on anterior margin. Metasoma with petiole about 1.2x longer than metacoxa. Gaster with  $gt_1$  taking 0.5x of the whole gaster; ovipositor not exerted.

**Colour.** Head dark brown; scape, pedicel and  $f_1$  light yellow;  $f_2$  to  $f_6$  light brown; clava brown. Mesosoma dark brown; pronotum brown; leg segments yellow, except  $t_4$ , which is light brown.

**Measurements.** (n=3) Body size 1060–1100; POL: LOL: OOL about 60–90: 40–50: 30. Head length in lateral view 140–150, width in dorsal view 230–240. Length of antennal segments: scape 70–120, pedicel 60–70,  $f_1$  40–50,  $f_2$  60–80,  $f_3$  40–50,  $f_4$  30–40,  $f_5$  30–40,  $f_6$  50; length/width of clava 150–170/60–70. Length measurements in dorsal view: mesoscutum 100–110, distance from campaniform sensillum to transscutal articulation 40–50, scutellum 80–100, frenum 30–40, propodeum 80, median carina 80. Mesosoma length in lateral view 380–400, width in dorsal view 150–170. Fore wing length/width 950–990/220–230; marginal vein about 40–60 long; longest apical fringe setae 70–90 long. Length measurements in lateral view: petiole 150–160, gaster 380–400,  $gt_1$  180–200.

**Swedish material examined. Småland:** Alsterbro/Alsterån, 10.vii–15.vii.2005 (NHRS 143700123, NHRS 143700124, NHRS 143700125 and NHRS 143700126, Trap: 1008, ID: 1346).

### *Polynema (Polynema) sp. 3* (Fig. 8)

**Diagnosis.** Head with frons with long and strong setae. Scape 3x as long as wide, smooth;  $f_3$  to  $f_6$  each ventrally with one sickle shaped sensillum;  $f_6$  with one mps; clava 3x as long as wide, with seven mps. Mesosoma with distance between frenal groove and end of frenum wide. Scutellum with campaniform sensilla very small and in mounted specimens hardly visible, located in the anterior part of scutellum, almost directly beneath the notauli. Propodeum with median carina extending to 0.5 of its length. Forewing long and slender, microtrichia starting before marginal vein. Metasoma with petiole in same length as metacoxa; ovipositor slightly exerted beyond gaster, in length 0.5x  $gt_1$ .

**Colour.** Head dark brown and black; scape and pedicel dark yellow;  $f_1$  and  $f_2$  light brown;  $f_3$  to  $f_6$  brown; calva and mesosoma dark brown. All coxae in dark yellow to reddish; femora and tibiae with

a colour shift from anterior dark brown to posterior yellow;  $t_1$  is yellow to light brown;  $t_2$  and  $t_3$  in brown;  $t_4$  dark brown to black; petiole dark yellow to reddish; gaster brown.

**Measurements.** (n=5) Body size 1040–1300; POL: LOL: OOL about 80–100: 40–50: 30; head length lateral 140–160, width dorsal 240–270. Length of antennal segments: scape 100–140, pedicel 60–80,  $f_1$  20–50,  $f_2$  100–140,  $f_3$  70–100,  $f_4$  50–70,  $f_5$  40–70,  $f_6$  60–80; length/width of clava 140–160/50–60. Length measurement in dorsal view: mesoscutum 130–160, distance campaniform sensilla to transscutal articulation 20, scutellum 100, frenum 50, propodeum 70–90, median carina 40–50. Mesosoma length in lateral view 370–450, width in dorsal view 170–200. Fore wing length/width 1070–1350/220–300; marginal vein 50–70; longest apical fringe setae 120–170. Length measurement in lateral view: petiole 120–180, gaster 400–550,  $gt_1$  170–280, exerted part of ovipositor 30–40.

**Swedish material examined. Uppland:** Ekdalens naturreservat, 04.viii–18.viii.2003 (NHRS 14370131, NHRS 14370132, Trap: 27, ID: 468); Håbo kommun, 27.viii–10.ix.2004 (NHRS 14370027, Trap: 8, ID: 1562); **Öland:** Västerstads almlunds naturreservat, 10.vi–09.vii.2014 (NHRS 14370026, Trap: 3002, ID: 3053); **Södermanland:** Huddinge kommun, 07.vi–16.vi.2004 (NHRS 14370136, Trap: 5, ID: 354).

### *Polynema (Doriclytus) sp. 4* (Fig. 9)

**Diagnosis.** Head with face and vertex with dense setae. Antenna segments all covered by dense and long setae. Scape smooth; pedicel broad, 0.5x scape;  $f_3$ ,  $f_4$  and  $f_6$  each ventrally with one sickle-shaped sensillum;  $f_5$  with ventrally and dorsally one sickle-shaped sensillum.  $F_6$  with one mps; clava with six mps. Pronotum with collar in lateral view with several conspicuous setae. Scutellum with campaniform sensilla positioned in the first third of the scutellum. Propodeum with median carina covering its whole. Fore wing broad; marginal setae and microtrichia short but strong; posterior margin with setae twice as long as on anterior margin. Metasoma with ovipositor slightly exerted.

**Colour.** Head brown to dark brown; scape light brown; pedicel light yellow;  $f_1$  light yellow to transparent;  $f_2$  to  $f_6$  light brown to brown; clava brown; mesosoma brown to dark brown; tibiae and femora light brown; tarsus segments yellow;  $t_4$  dark brown. Petiole light brown; gaster dark brown.

**Measurements.** (n=8) Body size 1050–1120; POL: LOL: OOL about 80–90: 40: 20–30. Head

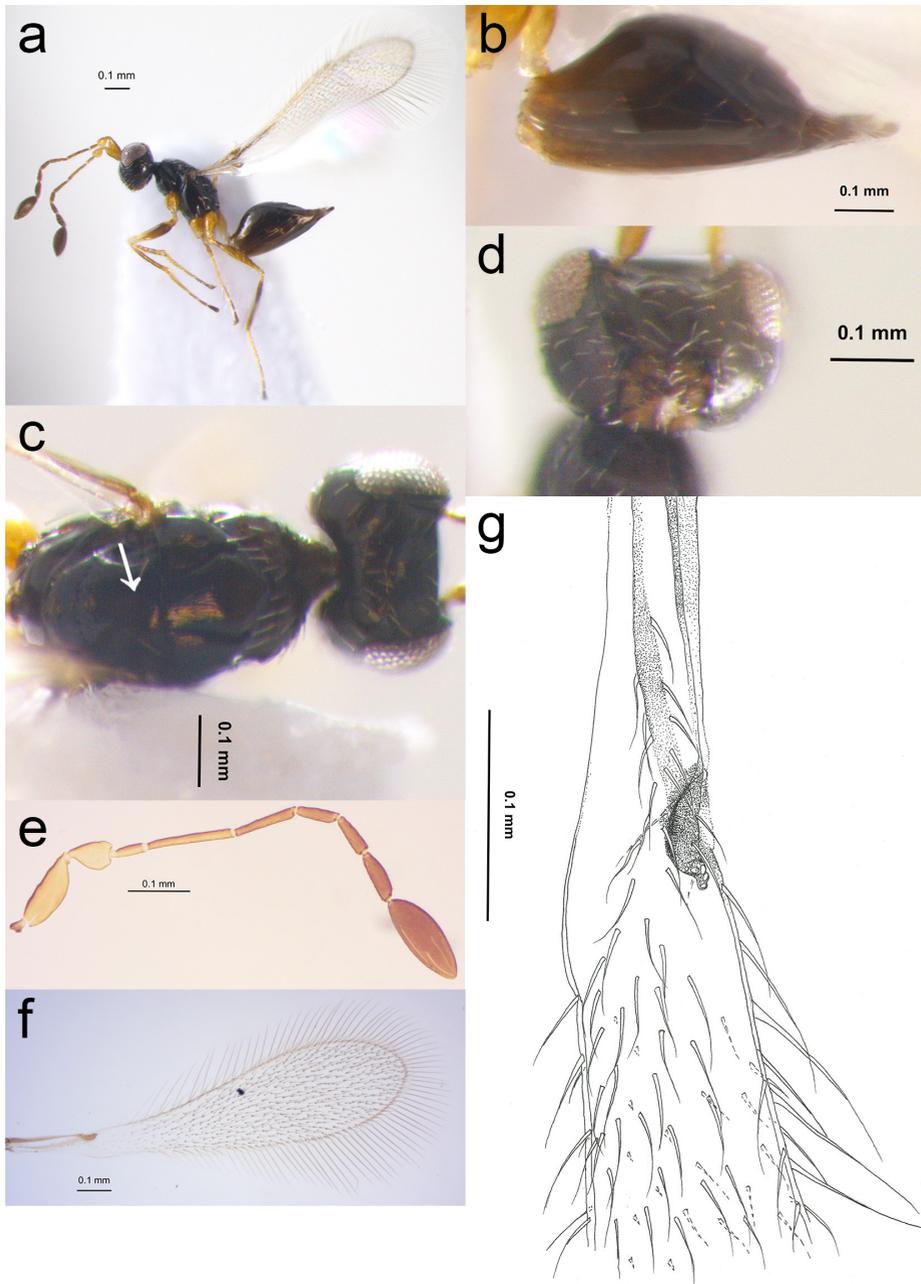


Figure 8. *Polynema (Polynema) sp. 3*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

length in lateral view 150, width in dorsal view 110–120. Length of antennal segments: scape 110–120, pedicel 50–60,  $f_1$  30–40,  $f_2$  70–130,  $f_3$  60–70,  $f_4$  40–60,  $f_5$  40–50,  $f_6$  50–60, length/width of clava 170–200/50–60. Length measurement in dorsal view: mesoscutum 110–150, distance campaniform sensilla to transscutal articulation 40–50, scutellum 90–100, frenum 50–60, propodeum 80–90, median carina 70–80. Mesosoma length in lateral view 380–400, width in dorsal view 180–220. Fore wing length/width 1030–1150/320–390; the marginal vein is about 40–60 long; longest apical fringe setae 70–90. Length measurement in lateral view: petiole 150–170, gaster 360–430,  $gt_1$  150–200, exserted part of ovipositor 10–40.

**Variation.** Whole body especially  $f_2$  to  $f_6$  can appear in darker brown. Scape can vary in colour from light to dark brown, some have a strong colour shift from basally dark brown to apically light yellow.

**Swedish material examined.** **Öland:** Ottenby military radar station, 01.viii–26.viii.2005 (NHRS 14370071, NHRS 143700072 [SMYM004-17], NHRS 143700073 [SMYM005-17] & NHRS 143700105, Trap 21, ID 1508); **Småland:** Hornsö kronpark, 30.viii–10.ix.2004 (NHRS 143700052 & NHRS 143700057 [SMYM003-17], Trap: 18, ID: 729); **Södermanland:** Sofielunds återvinningsanläggning, 11.viii–30.viii.2003 (NHRS 143700066, NHRS 14370067, NHRS 143700106, NHRS 143700107 & NHRS 143700108, Trap: 5, ID: 77); **Upland:** Biskops-Arnö northern beach, 27.viii–10.ix.2004 (NHRS 143700068 & NHRS 143700069, Trap: 8, ID: 1562).

### *Polynema (Doriclytus) sp. 5* (Fig. 10)

**Diagnosis.** Head with face and vertex with short but dense setae. Ocelli comparably larger than in other species. Antenna segments with many short setae; Scape 3x as long as wide, smooth;  $f_3$ ,  $f_4$  and  $f_6$  each ventrally with one sickle-shaped sensillum;  $f_5$  with two sickle-shaped sensilla;  $f_6$  with one mps. Clava 3 times as long as wide, with six mps. Mesosoma with pronotum with three to four setae; Scutellum with campaniform sensilla located in the middle; propodeum with median carina covering it completely. Fore wing broad; microtrichia on disc and margin short and dense; posterior margin with setae 2x of those on anterior margin. Metasoma with petiole 1.2x metacoxa;  $gt_1$  expanding to middle of the gaster; ovipositor exserted in the same length as last tergite segment.

**Colour.** Head black; scape brown; pedicel and

$f_1$  yellow;  $f_2$  and  $f_3$  light brown;  $f_4$  to  $f_6$  brown; clava dark brown. Mesosoma black; coxa light yellow; other segments dark yellow to reddish;  $t_4$  in dark brown; petiole yellow to reddish, gaster dark brown.

**Measurement.** (n=2) Body size 1550–1610. POL: LOL: OOL about 100–110: 40: 30; head length in lateral view 180–200, width in dorsal view 320–350. Length of antennal segments: scape 130–160, pedicel 70,  $f_1$  50,  $f_2$  140–150,  $f_3$  100–110,  $f_4$  60,  $f_5$  60,  $f_6$  70; length/width of clava 220/70. Length measurement in dorsal view: mesoscutum 180–190, distance campaniform sensilla to transscutal articulation 70, scutellum 110–130, frenum 60, propodeum 120, median carina 120. Mesosoma length in lateral view 530–570, width in dorsal view 260. Fore wing length/width 1550–1600/500–530; marginal vein 60–70 long; longest apical fringe setae 10. Length measurement in lateral view: petiole 210–220, gaster 620–630,  $gt_1$  270–350, exserted part of ovipositor 40.

**Swedish material examined.** **Västerbotten:** Kulbäckslidens försökspark, 05.viii–20.viii.2004 (NHRS 143700114 & NHRS 143700115, Trap: 59, ID: 1289).

### *Stephanodes similis* (Foerster, 1847) (Fig. 11)

**Diagnosis.** See Huber & Fidalgo (1997).

**Description.** *Colour.* Head dark brown to black; scape, pedicel and  $f_1$  yellow;  $f_2$  and  $f_3$  light brown;  $f_4$  to  $f_6$  and clava dark brown; mesosoma dark brown to black; all leg segments dark yellow to reddish, except  $t_4$  brown. Petiole dark yellow to reddish; gaster dark brown. *Antenna* (Fig. 11 a, e, 12 e).  $F_4$  with ventrally one sickle shaped sensillum;  $f_5$  and  $f_6$  each with ventrally one and dorsally one sickle shaped sensillum;  $f_6$  with one mps; clava with eight mps. *Mesosoma* as in Fig. 11 c. *Metasoma* (Fig. 11 a–b). Petiole 2.5x as long as wide; gaster with first segment extending 0.66x to 0.88x entire gaster length; ovipositor sometimes slightly exserted beyond gaster.

**Measurements.** (n=3) Body: 1190–1240; POL: LOL: OOL about 40–60: 20: 40; head length lateral 160–170, width dorsal 240–250. Length of antennal segments: scape 70–100, pedicel 40–50,  $f_1$  90–100,  $f_2$  100–120,  $f_3$  80–90,  $f_4$  60–70,  $f_5$  60–70,  $f_6$  60–70; length/width of clava 140–160/40–60. Length measurements in dorsal view: mesoscutum 160–170, scutellum 100, frenum 40, propodeum 100. Mesosoma in length in lateral view 420–450, width in dorsal view 170–180. Fore wing length/width 1310–1400/330–380; marginal vein about

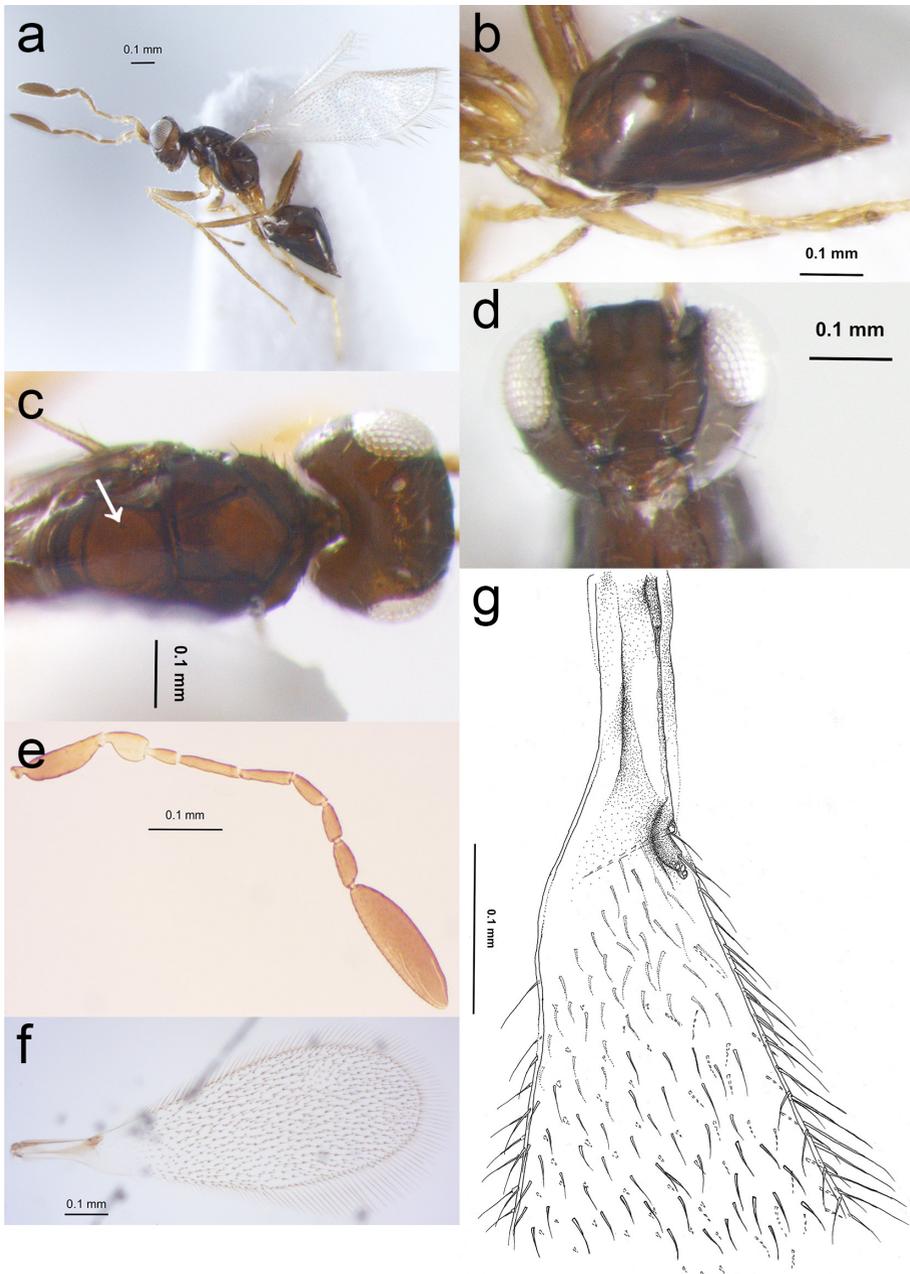


Figure 9. *Polynema (Doriclytus)* sp. 4: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

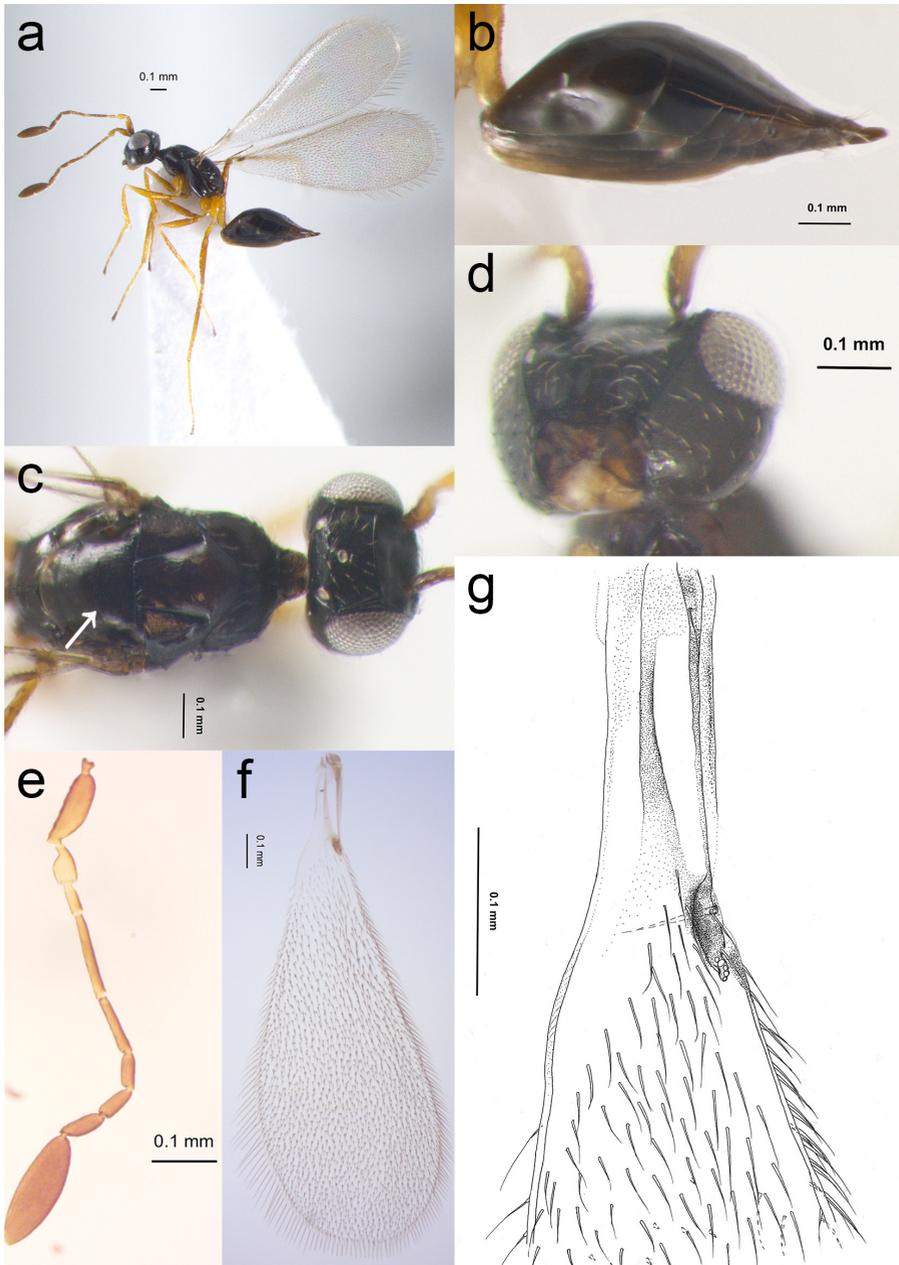


Figure 10. *Polynema (Doriclytus)* sp. 5: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal (arrow indicates position of campaniform sensilla); – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

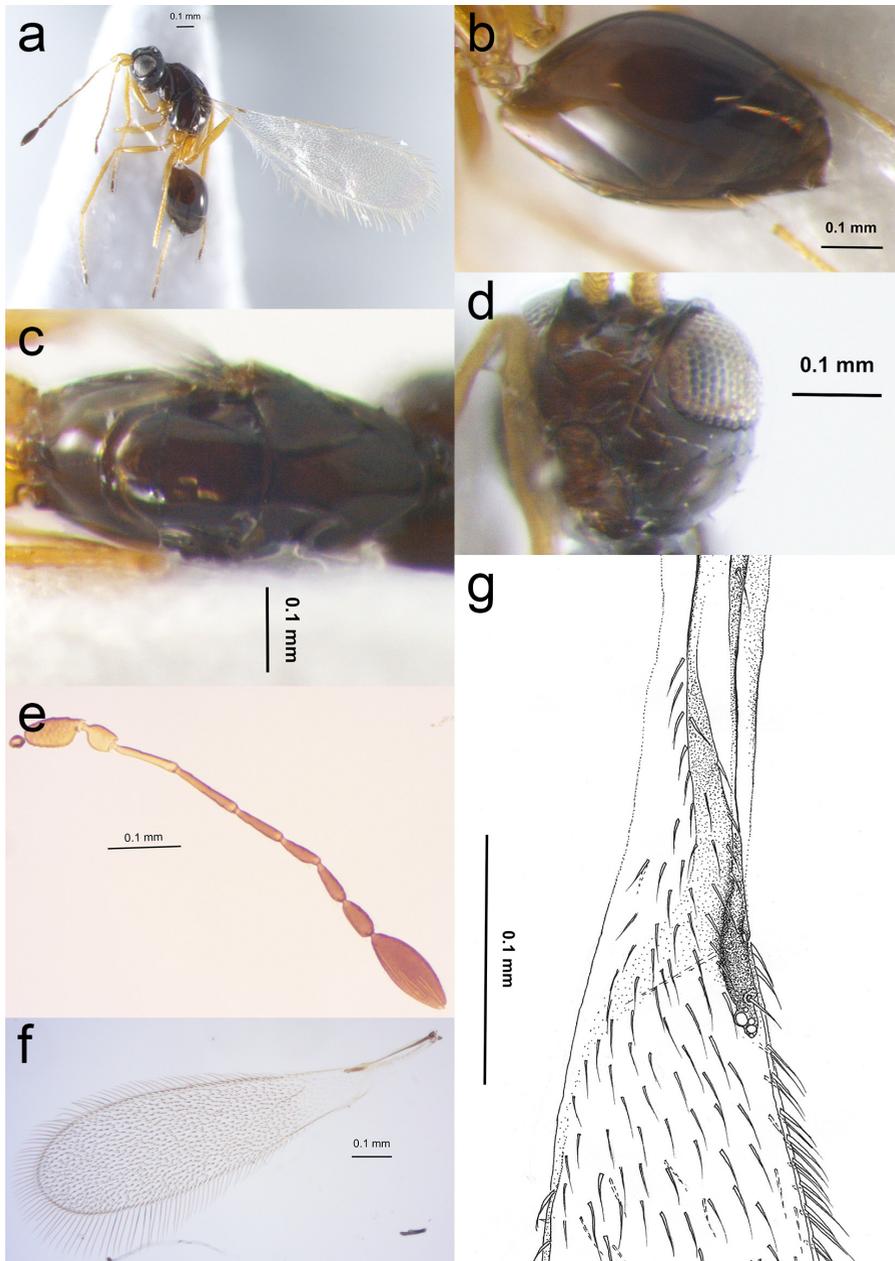


Figure 11. *Stephanodes similis*: – a) habitus lateral; – b) gaster lateral; – c) mesosoma dorsal; – d) head anterior; – e) antenna; – f) fore wing; – g) base of fore wing.

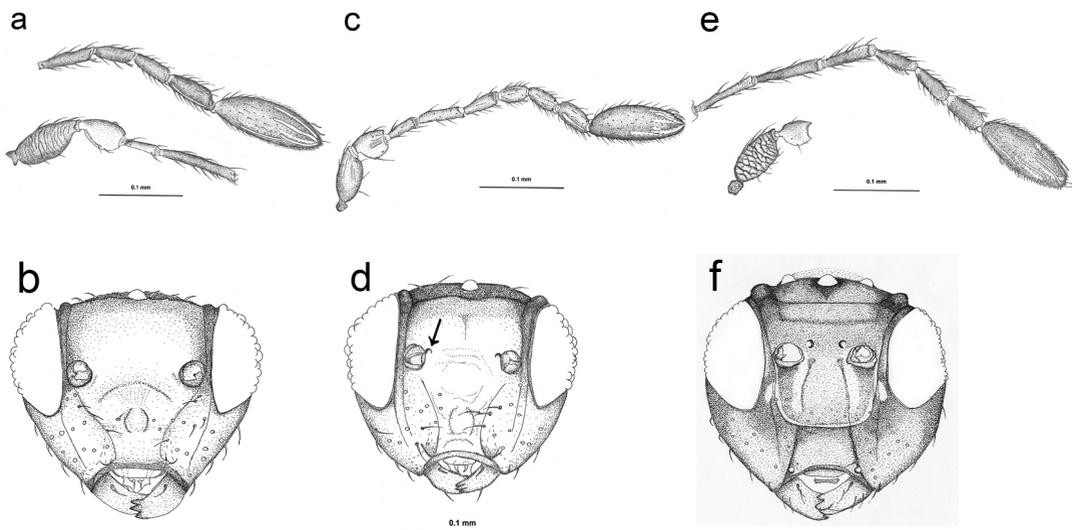


Figure 12. – a) *Polynema (Polynema) fuscipes*: antenna; – b) *Polynema (Polynema) gracile*: head anterior; – c & d) *Polynema (Doriclytus) euchariforme*: antenna and head anterior, (arrow indicates pit next to torulus, 0.1 mm scale applies for all heads). – e & f) *Stephanodes similis*: antenna and head anterior.

50–60 long; longest apical fringe setae 70–80. Metasoma length measurements in lateral view: petiole 170–200, gaster 430–440,  $gt_1$  300–350, exerted part of ovipositor 0–10.

**Variation.** Shape of gaster very variable;  $gt_2$  sometimes covers almost 0.5x to 0.9x of gaster.

**Comments.** The redescription by Huber and Fidalgo (1997) is completely adequate to determine this species so we only provide brief descriptive notes of the Swedish material. Huber and Fidalgo (1997) indicated that *S. similis* is very likely to be confused with *Stephanodes reduvioli* Perkins, 1905. The reason for this is the presence or absence of a sickle shaped sensillum on  $f_3$ ; it is the only character available for separation of these two nominal species. None of the Swedish specimens showed any trace of sickle-shaped sensillum on  $f_3$  as described by Huber and Fidalgo (1997). But they were not satisfied with this character, because some *S. similis* specimens showed a sickle-shaped sensillum on  $f_3$ . So determination of these two nominal taxa for now is based mainly on their distribution: *S. similis* occurs in Europe, North America and Argentina, while *S. reduvioli* is widespread in the Oriental, Australasian, parts of the Palearctic region and also on the Pacific Islands (Huber and Fidalgo 1997).

**Swedish material examined. Södermanland:** Sofielunds återvinningsanläggning, 09.vi–29.vi.2006 (NHRS 143700076, trap: 2003, ID: 2033); **Småland:** Store mosse, 20.vi–17.vii.2005 (NHRS 143700080, Trap: 41, ID: 1778), 17.vii–03.viii.2005 (NHRS 143700120, Trap: 41, ID: 1779); Alsterbro/Alsterån, 06.v–12.v.2006 (NHRS 143700081, Trap: 1008, ID: 1733); Grytsjöns naturreservat, 12.vii–18.vii.2005 (NHRS 143700121, Trap: 1001, ID: 1333).

**Other material examined.** NHMW (4 ), BMNH (1 , 1 ) and CNC (2 , 1 ).

### Discussion and Conclusions

Identifying *Polynema* to species in Sweden is difficult in the absence of a meaningful revision for all the European taxa, because the key to the European species of *Polynema* by Soyka (1956) does not work. Noyes (2016) listed 11 named species of *Polynema* from Sweden and provided the relevant references. Some of these certainly represented misidentifications, as were most of the earlier published records of *Polynema* species in Europe. Without access to voucher specimens (when such exist) and especially before a Europe-wide revision of *Polynema* becomes available we cannot correct, where necessary, their identifications. Besides, their study was also beyond the scope of our study. Hedqvist (2003) listed nine species, among

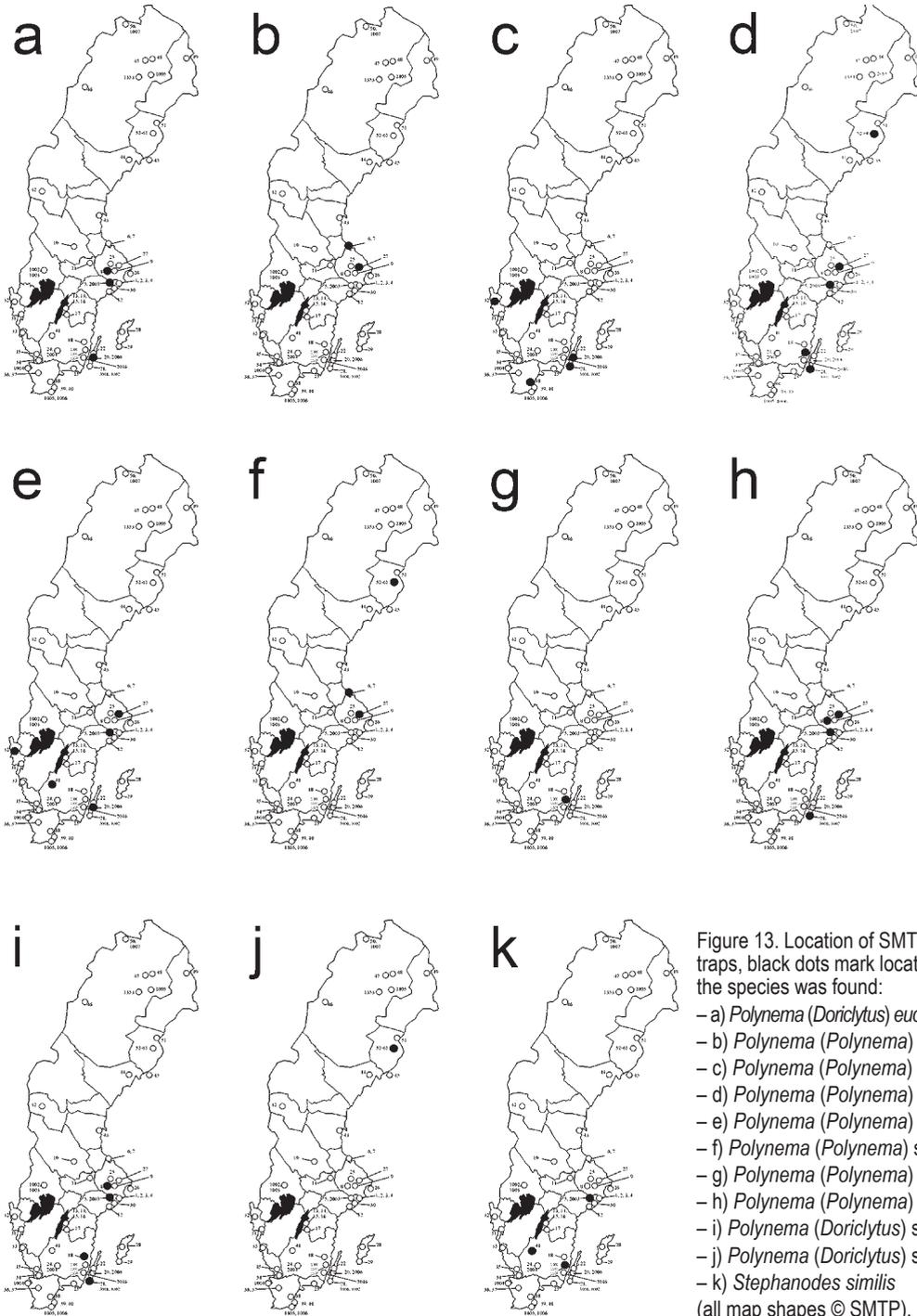


Figure 13. Location of SMTP Malaise traps, black dots mark location where the species was found:

- a) *Polynema (Doriclytus) euchariforme*;
  - b) *Polynema (Polynema) flavipes*;
  - c) *Polynema (Polynema) fuscipes*;
  - d) *Polynema (Polynema) gracile*;
  - e) *Polynema (Polynema) pusillum*;
  - f) *Polynema (Polynema) sp. 1*;
  - g) *Polynema (Polynema) sp. 2*;
  - h) *Polynema (Polynema) sp. 3*;
  - i) *Polynema (Doriclytus) sp. 4*;
  - j) *Polynema (Doriclytus) sp. 5*;
  - k) *Stephanodes similis*
- (all map shapes © SMTP).

*P. (Doriclytus) atratum* Haliday, 1833, surprisingly, among the specimens collected in the SMTP there were no specimens of *P. atratum*, which is very common in northern Europe. It has been listed in the neighbouring Finland, where it is by far the most frequent species of the genus in net sweep samples (S. V. Triapitsyn and M. Koponen, unpublished).

Considering the number of all Mymaridae individuals collected during the course of SMTP, the number of described species of *Polynema* and *Stephanodes* is comparable low. In 2014, 63 % of the captured material from SMTP was sorted, i.e., 1260 Malaise trap samples, 956 of which included specimens of Mymaridae. The average number of Mymaridae specimens per sample was 33, which makes a total number of roughly 31.500 Mymaridae individuals caught in over half of the samples (pers. Comm. Dave Karlsson, 04.12.2017). Whereas every third Mymaridae sample in SMTP examined by us contained a *Polynema* individual and every 30<sup>th</sup> sample included a *Stephanodes* specimen. It is therefore highly likely, that besides the 239 examined specimens and the 57 selected individuals for this paper more species of *Polynema* can be found in the SMTP samples.

Further it is to mention, that proportional out of 100 examined *Polynema* individuals only 15 were males. The specimens examined for this study where caught from May through September, which not necessarily shows their period of flight. Also the habitats where the specimens were collected are based on trap location, which likely does not cover the entire natural habitat for the various species and obviously does not give any information on their hosts.

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