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Faunistic data of Sepsidae (Diptera) from Switzerland and additional countries including the first Swiss record of *Meroplius fukuharai* (Iwasa, 1984)

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In order to understand the evolution and ecology of organisms, detailed data on the distribution and habitat preferences are essential. Although black scavenger flies (Diptera, Sepsidae) are common and abundant acalyptratae in European grass- and farmlands, a detailed understanding of their ecology and distribution is currently limited. This is particularly problematic since this taxon has received considerable interest in evolutionary ecology and continues to be studied in ecotoxicology and speciation. The aim of this study is to publish faunistic data, gathered from the extensive private collection of G. Bächli. Additionally, the occurrence of an additional species, *Meroplius fukuharai*, for Switzerland is documented.

Keywords: Switzerland, Diptera, Sepsidae, black scavenger flies, *Meroplius fukuharai*, faunistics, new records.

INTRODUCTION

Black scavenger flies (Acalyptratae: Cyclorrhapha: Sepsidae) are small, ant-like Diptera commonly found in European grass and farmlands. Adults can aggregate by the thousands in the periphery of decaying organic matter which is used as oviposition substrate and location for courtship and mating. Sepsids breed in various kinds of decaying organic matter, although, depending on the species, vertebrate (often livestock) dung represents their primary breeding substrate (Pont & Meier, 2002).

Fig. 1. Female *Sepsis* sp. captured in Flumserberg SG, 26.viii.2016. Photo with kind permission of Rassim Khelifa.

Sepsids have received considerable attention in evolutionary biology and developmental research due to the evolution of several unique structures and morphological adaptations (Ingram *et al.* 2008, Bowsher & Nijhout 2009), as well as elaborate courtship and mating behaviour (Puniamoorthy *et al.* 2009). In some species, males engage in intrasexual contests for access to females (*Palaeosepsis dentatiformis*; Eberhard 2002), while in others females are more likely to choose their mates (*Sepsis cynipsea*; Blanckenhorn *et al.* 2000). Sepsid mating systems are diverse and can vary strongly across species and even populations within species (Puniamoorthy *et al.* 2012; Rohner *et al.* 2016). Sepsids also evolved several peculiar morphological traits. Males of most species have strongly modified forelegs, including pronounced protrusions and emarginations of the fore femur and fore tibia. These modifications are used by the male to hold onto the female wing base during copulation (Ingram *et al.* 2008) and have been argued to play a major role in female choice (Eberhard 2001). Foreleg morphology is usually species specific and can be used to identify male specimens to the species level (see e.g.: Ang *et al.* 2013). Interestingly, these modifications have been lost repeatedly, coinciding with a derived mating behaviour which does not involve the male holding on to the female wing during copulation (Puniamoorthy *et al.* 2008). This suggests some functionality of the foreleg modifications but its mechanisms are largely unexplored.

Apart from fore leg morphology, also the hind legs are sexually dimorphic. This is due to the presence of an osmeterium located on the male hind tibia (which is lacking in females). This structure produces chemical compounds that are transferred during mating onto the females (Araujo *et al.* 2014). Furthermore, at least two lineages of sepsids convergently evolved moveable abdominal brush-like appendages (Bowsher *et al.* 2013). These brushes are derived from male sternites and are used to stimulate the female during mating. Recent findings demonstrate that the stimulation of females with these brushes is essential for sperm transfer, suggesting strong selection on male sternite morphology, potentially associated with cryptic female choice (Herath *et al.* 2015).

All of these studies and many more (ecotoxicology: Blanckenhorn *et al.* 2013; phylogenetics: Lei *et al.* 2013; genome size evolution: Su *et al.* 2016) demonstrate great scientific interest in the evolution of sepsids, in contrast, the ecology and distribution of black scavenger flies received relatively little attention in the past, despite being crucial in understanding the biology of any organism (but see Bährmann & Bellstedt 2012). The topography and climatic variability found in Switzerland make faunistic data particularly valuable. So far, 28 species have been recorded for Switzerland, and some faunistic data are available (Haenni, 1997, 1998; Rohner, 2015). The aim of this study is to publish additional, more detailed records for the scientific community studying sepsids, and to lay a broader foundation for future research on the ecology of this group of flies.

MATERIALS & METHODS

All specimens stem from the private collection of the second author who untiringly captured, stored and identified thousands of specimens over the past decades. In total, the collection encompasses more than 3,700 pinned specimens which were individually examined, the identification was verified and while doing so, some recent taxonomical changes were incorporated. The identification was based on keys

Fig. 2. *Meroplius fukuharai* (Iwasa, 1984), male: — above: abdomen, ventral view; — below: habitus, lateral view. Scale bar: 0.5 mm. This species has herein been documented for Switzerland for the first time, increasing the number of native species to 29. Photo: with kind permission from Yuchen Ang (Sepsdnet; Ang *et al.* 2013).

provided by Pont (1979) and Pont & Meier (2002). For high resolution images and additional notes, we refer the reader to sepsidnet, a large online database on the taxonomy and morphology of sepsids (http://sepsidnet-rmbr.nus.edu.sg/; Ang *et al.* 2013).

The following official abbreviations are used for the cantons of Switzerland: AG – Aargau; BE – Bern; BL – Basel Landschaft; BS – Basel Stadt; FR – Fribourg; GE – Genève; GL – Glarus; GR – Graubünden; JU – Jura; LU – Luzern; NE – Neuchâtel; SH – Schaffhausen; SO – Solothurn; SZ – Schwyz; TG – Thurgau; TI – Ticino; UR – Uri; VD – Vaud; VS –Valais; ZG – Zug; ZH – Zürich.

RESULTS & DISCUSSION

All specimens were collected by the second author, unless stated otherwise. We present records for Switzerland first and consecutively additional countries. If several

records stem from the same location, dates are ordered by season and not by year. All data stem from pinned specimens which represent only a small fraction of all collected individuals. We thus hesitate to present the number of specimens as it does not represent actual abundances in each sample, although this information can be obtained from G. Bächli. Furthermore, we only present brief and rudimentary comments to each species and refer the interested reader to other literature which provides detailed information on the ecology, morphology and behaviour of each species (e.g.: Hennig 1949, Pont 1979, Munari 1987, Pont & Meier 2002, Rohner 2014).

Meroplius Rondani, 1874

Meroplius is a widespread genus but is rarely encountered in Switzerland. Species appear to be attracted to «especially filthy habitats» (Pont & Meier 2002).

Meroplius minutus (Wiedemann, 1830)

Material: **Switzerland**: **TI**: Origlio, 420 m, 9.ix.1988.
Distribution: Holarctic, Oriental (Ozerov 2005).
Comments: The specimens were collected around a manure pile. According to several authors, *M. minutus* is especially attracted to human faeces (Melander & Spuler 1917; Pont & Meier 2002). It has thus been argued that the observed population decline of this species may be linked to improved hygienic conditions in Central Europe (van der Goot 1987).

Meroplius fukuharai (Iwasa, 1984)

Material: **Switzerland**: **GE**: Cartigny, Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Bernex, Tuilières, 430 m, 12.viii.2000.
Distribution: Palaearctic (Ozerov 2005).
Comments: There are very few and sporadic records of this species for Europe in general (Pont & Meier 2002). It was not included in published Swiss checklists (Haenni 1998, 1997; Merz *et al*. 2001; Ozerov 2006; Rohner 2015), and to the best of our knowledge represents a new record for Switzerland (Fig. 1).

Nemopoda Robineau-Desvoidy, 1830

There are three species of *Nemopoda* recorded for Switzerland but most records are from *N. nitidula*, while *N. pectinulata* and *N. speiseri* (not present in this collection) are less common. *Nemopoda* spp. can occasionally be found on cow pastures but are particularly common on wet decaying animal tissue.

Nemopoda nitidula (Fallén, 1820)

Material: **Switzerland**: **AG**: Habsburg, 450 m, 19.vii.2004, 26.vii.2004, 6.ix.2004, 20.ix.2009 (all leg. Wermelinger); Rheinfelden, 300 m, 12.vi.2010; Rottenschwil, 450 m, 14.vi.2008; Sarmenstorf, 550 m, 2.viii.2004, 16.viii.2004, 23.viii.2004, 6.ix.2004 (all leg. Wermelinger); Wettingen, 420 m, 8.vii.1996; Wohlen, 470 m, 21.v.2011; Würenlingen, 420 m, 25.vii.1990, 2.viii.1998; 6.vii.2000; Würenlingen/alter Steinbruch, 420 m, 15.5.viii.1991; Würenlingen/Firsthalde, 420 m, 14.vii. 1991. **BE**: Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 22.–

29.vi.2000, 29.vi.–6.vii.2000, 20.–27.vii.2000, 27.vii.–3.viii.2000, 10.–17.viii.2000 (all leg. Wolf). **BS**: Basel/Zolli, 15.–29.iv.2005, 29.iv.–13.v.2005, 27.v.–11.vi.2005, 24.vi.–8.vii.2005 (all leg. Baur *et al.*). **FR**: Nuvilly, 650 m, 2001 (leg. Duelli). **GE**: Chancy, 350 m, 25.vii.2004; Dardagny/Essertines, 400 m, 11.viii.2000 (leg. Merz & Bächli). **GL**: Klöntal, 850 m, 11.–14.ix.1974; Richisau, 1100 m, 7.–8.viii.1991; Vorauen, 800 m, 4.–8.viii.1991. **GR**: Surrein, 1300 m, 11.viii.1991. **JU**: Delémont, 500 m, 2.–6.viii.1974. **LU**: Dierikon, 550 m, 2000 (leg. Duelli); Menzberg, 1000 m, 3.–6.viii.1983. **NE**: Marin/Les Tertres, 450 m, 19.v.2001; Rochefort, 800 m, 5.–8.vii.1982. **SG**: Rheineck, 400 m, 14.–17.viii.1973. **SH**: Merishausen, 540 m, 8.–10.viii.1992. **SO**: Messen, 500 m, 1.vi.2004, 5.vii.2004, 26.vii.2004, 16.viii.2004, 23.viii.2004, 6.ix.2004, 14.ix.2004, 20.ix.2004 (all leg. Wermelinger). **SZ**: Pragelpass, 1550 m, 5.viii.1991. **TG**: Lommis/Immenberg, 700 m, 4.viii.2007. **TI**: Acquarossa, 530 m, 17.–20.vii.1998; Biasca, 300 m, 16.–20.vi.1995; Bolle di Magadino, 200 m, 17.–20.vi.1995 (leg. Merz & Bächli); Faido, 720 m, 26.vii.1997; Origlio, 420 m, 13.vii.1988; Someo, 390 m, 25.–29.vii.1997. **VS**: Grône, Poutafontana, 500 m, 18.v.1996 (leg. Merz & Bächli); Grône, Poutafontana, 500 m, 1.vi.2001; Leuk/Brentjong, 1000 m, 25.vi.1999; Leuk/Platten, 600 m, 19.v.1996 (leg. Merz & Bächli); Morgins/Têtes, 1500 m, 28.vii.2004; Morgins/Vièze, 1400 m, 27.vii.2004; Pfynwald, 600 m, 2.–5.viii.1999, 25.vi.1999, 30.vi.–4.vii.2001; Visperteminen, 1550 m, 4.viii.1998 (leg. Merz & Bächli). **ZH**: Dietikon, 390 m, 14.v.2014, 6.vi.2015, 13.vi.1991, 3.–7.vii.2000, 14.–18.vii.1995, 20.vii.1989, 3.–10.viii.1984, 8.–16.viii.1984, 27.viii.–1.ix.1984, 6.–10.ix.1987, 10.–14.ix.1985. Embrach/Haumühle, 400 m, 9.v.1998; Flaach, 350 m, 7.viii.2001; Gattikon, 500 m, 27.xi.1979 (leg. Wolf); Katzensee, 440 m, 23.vii.1991; Zürich/Hönggerberg, 520 m, 29.vi.2000, 29.vi.–3.vii.1999, 1.–7.vii.1998, 3.–7.vii.1998, 3.–7.vii.2000, 14.–18.vii.1995, 15.–19.vii.1989, 16.–20.vii.1992, 18.–22.vii.1991, 18.–23.vii.1990, 24.–28.vii.1987, 2.–6.viii.1997, 6.–10.ix.1987.

Bosnia/Herzegovina: Dobro Polje, 1100 m, 25.–28.vii.1984. **Czech Republic**: Hluboka n. V., 450 m, 20.viii.1998. **Germany**: Bisperode, 300 m, 19.–31.viii.1971 (leg. Jungen); Edersee, 250 m, 12.–17.viii.1984. **France**: Colmar, 200 m, 19.–22.viii.1957 (leg. Burla). **Italy**: San Sebastiano (Sondrio), 500 m, 31.vii.–3.viii.2000. **Montenegro**: Durmitor, 1500 m, 30.vii.–5.viii.1988. **Romania**; Cimpulung, 600 m, 28.iv.1983, 23.v.1981, 24.v.1978, 28.v.1983, 1.vi.1988, 7.vii.1976, 12.vii.1976, 12.vii.1979, 21.vii.1982, 27.vii.1976, 30.vii.1985, 22.viii.1980, 20.ix.1975, 27.ix.1976; 700 m, 6.vi.1976; 21.vii.1962, 27.vii.1976, 30.vii.1982, 4.viii.1982, 8.viii.1982, 9.viii.1975; 800 m, 19.v.1988, 19.vii.1983, 21.vii.1975, 31.vii.1976, 3.viii.1975, 7.viii.1982, 14.viii.1974, 27.viii.1974, 14.ix.1974, 24.ix.1987; Cornelu, 5.vi.1981, 16.vi.1981, 20.vi.1980, 5.viii.1981, 3.ix.1987; Hantesti, 19.vii.1978; Snagov, 10.ix.1976; Timisoara, 5.v.1960; Val. Pulnai, 900 m, 25.v.1977, 2.vi.1960, 8.vi.1976, 15.vii.1974; 6.ix.1987; 1000 m, 28.vii.1981 (all leg. Ceianu). **Serbia**: Popovica, 500 m, 1.–3.viii.1980. **Turkey**: Trabzon, 50 m, 8.–10.vii.1982 (leg. Götz).

Distribution: Afrotropical, Holarctic (Ozerov 2005).

Comments: This is arguably the most common species of *Nemopoda* in Switzerland (Rohner *et al.* 2015). This large sepsid fly is frequently found near animal carcasses, decaying fruit or other rotting plant material. It can be found on cow dung as well but this does not seem to represent its main breeding substrate.

Nemopoda pectinulata Loew, 1873

Material: **Switzerland**: **BE**: Guttannen, 1000 m, 6.viii.1999. **GL**: Klöntal, 11.–14.ix.1974; Richisau, 7.–11.viii.1995. **GR**: Landquart, 9.–12.viii.1974. **LU**: Menzberg, 3.–6.viii.1983. **SG**: Rheineck, 14.–17.viii.1973. **ZH**: Dietikon, 8.–16.vi.1984; Zürich/Hönggerberg, 15.–19.vii.1989;
Bosnia/Herzegovina: Dobro Polje, 25.–28.vii.1984. **France:** Colmar, 18.–22.1957, leg. Burla. **Romania**: Cimpulung, 600 m, 21.v.1977, 23.v.1975, 7.vii.1976, 10.vii.1983, 30.vii.1985, 23.viii.1976, 700 m, 21.v.1988, 5.vi.1986, 13.vi.1986, 8.viii.1987, 26.ix.1988; 800 m, 26.v.1983, 3.vi.1987, 13.vi.1987, 14.vii.1974, 7.viii. 1982, 24.viii.1981, 31.viii.1976; Cornetu, 10.vi.1981, 15.vi.1981, 20.vi.1981, 4.vii. 1984; Rarau, 1500 m, 3.viii.1978; Snagov, 14.ix.1976; Solca, 500 m, 10.vii.1979; Val. Pulnei, 900 m, 28.v.1985, 30.v.1981, 15.vii.1974; 1000 m, 2.vii.1976, 18.vii.1981, 10.viii.1982 (all leg. Ceianu). **South Korea**: Mount Sulak, 3.–25.vii.1985, leg Choi.
Distribution: Oriental, Palaearctic (Ozerov 2005).
Comments: This species looks very similar to *N. nitidula* and often occurs in sympatry, but can be distinguished from the latter by the more pronounced setulae on the katepisternum (Pont & Meier 2002).

Saltella Robineau-Desvoidy, 1830

There are only two species of *Saltella* recorded for Switzerland, but *Saltella sphondylii* in particular is quite common on cow pastures. Both species are usually associated to old, dry cow dung pads. In *Saltella*, the medial and the basal radial wing cells are fused. In contrast to most other black scavenger flies, *Saltella* has an unusually dull habitus such that specimens are sometimes mistaken for members of other families.

Saltella nigripes Robineau-Desvoidy, 1830

Material: **Switzerland**: **AG**: Habsburg, 450 m, 25.iii.2004 (leg. Wermelinger); Untersiggenthal/Schlatt, 450 m, 15.viii.1991; Würenlingen, 420 m, 19.viii.2003; Würenlingen/Firsthalde, 420 m, 14.vii.1991. **BE**: Rümligen, 540 m, 2000, 2004, 2005 (all leg. Duelli). **BL**: Bubendorf, 13.–20.vii.2000, 31.viii.–7.ix.2000 (all leg. Wolf). **FR**: Courlevon, 600 m, 2000, 2004 (all leg. Duelli); Nuvilly, 650 m, 2005 (leg. Duelli). **GE**: Bernex/Chante–Merle, 420 m, 7.viii.2000 (leg. Merz & Bächli); Bernex/Tuilières, 420 m, 12.viii.2000; Cartigny/Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Russin/Biolay, 360 m, 9.viii.2000 (leg. Merz & Bächli). **GL**: Schwändital, 1250 m, 2000 (leg. Duelli). **GR**: Rothenbrunnen, 630 m, 8.viii.1996. **JU**: La Chaux-des-Breuleux, 1000 m, 28.vi.2003. **LU**: Dierikon, 550 m, 2003 (leg. Duelli); Ruswil, 800 m, 2005 (leg. Duelli); Sursee, 500 m, 13.vi.2004. **SH**: Merishausen, 540 m, 9.viii.1999. **SO**: Messen, 500 m, 25.iii.2004 (leg. Wermelinger). **TG**: Lommis/Immenberg 700 m, 4.viii.2007; Roggwil, 420 m, 2000, 2003 (all. leg. Duelli). **TI**: Bolle di Magadino, 200 m, 2000 (leg. Duelli); Sessa, 31.viii.–2.ix.1991 (leg. Wilhelm); **VD**: Senarclens, 600 m, 2000 (leg. Duelli). **VS**: Jeizinen, 1500 m, 10.viii.2013; Visp, 650 m, 2000 (leg. Duelli). **ZG**: Steinhausen, 500 m, 2000, 2001, 2003, 2004, 2006 (all leg. Duelli). **ZH**: Rafz, 420 m, 2001 (leg. Duelli); Uitikon, 540 m, 2000, 2001 (all leg. Duelli)
Liechtenstein: Ruggell, 430 m, 8.viii.1988.

Distribution: Palaearctic (Ozerov 2005).
Comments: Apparently the first record for Liechtenstein. This species is relatively large and can be collected on cow dung. Males are larger than females when raised under common laboratory conditions (Rohner *et al*. 2016) but both sexes vary strongly in size when collected in the field. It is rarely recorded during spring and early summer but can occur in great numbers late in the season (pers. obs. P. T. Rohner).

Saltella sphondylii (Schrank, 1803)

Material: **Switzerland**: **AG**: Habsburg, 450 m, 5.vii.2004, 19.vii.2004, 26.vii.2004, 8.viii.2004 (all leg. Wermelinger); Sarmenstorf, 550 m, 1.vi.2004, 21.vi.2004, 28.vi.2004, 12.vii.2004, 26.vii.2004, 16.viii.2004, 30.viii.2004, 6.ix.2004 (all leg. Wermelinger); Schlossrued, 600 m, 2000 (leg. Duelli); Untersiggenthal/Schlatt, 450 m, 15.viii.1991; Würenlingen, 420 m, 14.viii.1997; Würenlingen/Firsthalde, 420 m, 14.vii.1991. **BE**: Guttannen, 1000 m, 6.viii.1999; Ligerz, 450 m 19.v.2010; Rümligen, 540 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 22.–29.vi.2000 (leg. Wolf); Pratteln, 480 m, 2001, 2004, 2005 (all leg. Duelli). **FR**: Courlevon, 600 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Nuvilly, 650 m, 2000, 2001, 2003, 2004, 2005 (all leg Duelli). **GL**: Schwändital, 1250 m, 2001, 2004, 2005 (all leg. Duelli); Vorauen, 800 m, 20.vii.1995, 4.–8.viii.1991. **GR**: Davos, 2540 m, 2006 (leg. Duelli); Dischmatal, 1600 m, 16.–30.vi.1990, 1.–15.vii.1990, 1.–15.vii.1991, 1.–15.vii.1992, 16.–31.vii. 1991, 1.–24.viii.1990, 1.–27.viii.1992 (all leg. Brodmann); Lantsch, 1460 m, 2005 (leg. Duelli); Lenzerheide, 1520 m, 11.–14.vii.1988, 8.viii.1998, 11.–14.viii.1988; Nationalpark, 2000 m, 2004, 2005 (all leg. Duelli); Rothenbrunnen, 630 m, 6.viii.1996 (leg. Merz & Bächli). **JU**: La Chaux-des-Breuleux, 1000 m, 26.vi.2003. **LU**: Dierikon, 550 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli); Luzern, 550 m, 24.vi.–5.viii.2006 (leg. Sattler); Ruswil, 800 m, 2000, 2001, 2004, 2004 (all leg. Duelli); Sursee, 500 m, 13.vi.2004. **SG**: Schänis, 2001 (leg. Duelli). **SO**: Messen, 500 m, 24.v.2004, 7.vi.2004, 14.vi.2004, 21.vi.2004, 28.vi.2004, 5.vii.2004, 12.vii.2004, 19.vii.2004, 26.vii.2004, 2.viii.2004, 23.viii.2004, 30.viii. 2004, 14.ix. 2004 (all leg. Wermelinger); Balmberg, 1050 m, 16.viii.1992; Weissenstein, 1400 m, 6.vii.2001. **SZ**: Biberbrugg, 1000 m, 25.vi.2011; Holzegg, 1440 m, 19.–21.viii.1975; Pragelpass, 1550 m, 5.viii.1991. **TG**: Lommis/Immenberg, 700 m, 4.8.2007; Roggwil, 420 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli). **TI**: Acquacalda, 1800 m, 22.–24.vi.2001; Bolle di Magadino, 200 m, 2001, 2005 (all leg. Duelli); Lucomagno, 1400 m, 8.viii.1997; Lugano, 24.vi.–5.viii.2006, (leg. Sattler). **VD**: Changins 430 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Cudrefin, 430 m, 2000, 2004, 2005 (all leg. Duelli); La Dôle, 1500 m, 26.vii.2004; Senarclens, 600 m, 2000, 2001, 2004, 2005 (all leg. Duelli). **VS**: Bürchen, 1500 m, 2.vii.2001; Guttet, 1500 m, 29.vii.–6.viii.1993; Jeizinen, 1500 m, 26.iv.1999; Mörel, 735 m, 850 m 1090 m, 28.v.2010 (all leg. Obrist); Morgins/Portes de Culet, 1800 m, 28.vii.1004; Morgins/Portes du Soleil, 1800 m, 27.vii.1004; Visp, 650 m, 2001, 2005 (all leg. Duelli). **ZG**: Steinhausen, 500 m, 2000, 2001, 2004, 2005, 2006 (all leg. Duelli). **ZH**: Dietikon, 390 m, 27.vii.1989, 22.vii.1991; Flaach, 350 m, 7.viii.2001; Rafz, 420 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Uitikon, 540 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Zürich, 450 m, 24.vi.–5.viii.2006 (leg. Sattler).

Czech Republic: Borova Lada, 900 m, 26.viii.1998; Veseli n.L., 450 m, 22.viii. 1998. **Liechtenstein**: Ruggell, 430 m, 8.viii.1989. **France**: Haute-Savoie, Salève/Observatoire, 1250 m, 10.viii.2000 (leg. Merz & Bächli). **Italy**: Sardegna/Costa Caldera, 19.–23.ix.1980 (leg. Arter). **Slovakia**: Bratislava/Abrod Nature Reserve, 150 m, 1.ix.1990.
Distribution: Holarctic (Ozerov 2005).
Comments: *S. sphondylii* is commonly found on cow pastures, where it tends to be more frequent on old dung (Püchel 1993; Pont & Meier 2002). Males range in colour from dark brown to bright yellow. This species is characterized by an unusual reproductive behaviour (Martin & Hosken 2004). Copulations are short but females remate readily. Laboratory trials demonstrate that frequent copulation has a strong negative effect on male longevity, while females are not affected.

Sepsis Fallén, 1810

This is the most species-rich and commonly recorded clade of Sepsidae in Switzerland. Species of *Sepsis* are characterized by a black spot near the tip of the wing, although some species that do not occur in Switzerland lack this characteristic. Most species breed in animal dung and are an essential part of the European cow dung fauna. Often, six to seven species co-occur on cow pastures, but up to twelve species have been recorded in Lenzerheide GR (Rohner *et al.* 2014). The high degree of sympatry suggests some degree of spatio-temporal niche separation, which is poorly understood but begs for scrutiny.

Sepsis biflexuosa Strobl, 1893

Material: **Switzerland**: **BE**: Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **FR**: Nuvilly, 650 m, 2005 (leg. Duelli). **GR**: Rothenbrunnen, 630 m, 8.viii.1996 (leg. Merz & Bächli). **SO**: Messen, 500 m, 20.ix.2004 (leg. Wermelinger). **VS**: Leuk/Platten, 600 m, 3.viii.1998 (leg. Merz & Bächli); Visp, 650 m, 2004 (leg. Duelli).
Distribution: Holarctic, Oceanian, Oriental (Ozerov 2005).
Comments: This species is relatively rare in Europe but much more common in North America (pers. obs. P. T. Rohner). According to Pont & Meier (2002), this species prefers older cow and buffalo dung, but personal observations do not necessarily support this notion.

Sepsis cynipsea (Linnaeus, 1758)

Material: **Switzerland**: **AG**: Habsburg, 450 m, 15.iii.2004, 22.iii.2004, 5.iv.2004, 21.vi.2004, 12.vii.2004, 19.vii.2004, 26.vii.2004, 9.viii.2004, 16.viii.2004, 23.viii. 2004, 30.viii.2004, 6.ix.2004, 14.ix.2004, 20.ix.2004, 27.ix.2004 (all leg. Wermelinger); Sarmenstorf, 550 m, 22.iii.2004, 29.iii.2004, 5.vii.2004, 12.vii.2004, 19.vii.2004, 26.vii.2004, 2.viii.2004, 16.viii.2004, 23.viii.2004, 30.viii.2004, 9.ix. 2004, 14.ix.2004 (all leg. Wermelinger); Schlossrued, 600 m, 2001, 2004, 2005 (all leg. Duelli); Vordemwald, 480 m, 2001 (leg. Duelli); Wettingen, 420 m, 29.vii.1999; Wohlen, 470 m, 21.v.2011; Würenlingen, 420 m, 20.vii.1996, 25.vii.1990, 27.vii.2001, 7.viii.1998, 31.viii.1999; Würenlingen/alter Steinbruch, 420 m, 15.viii.1991; Würenlingen/Firsthalde, 420 m, 13.v.1998. **BE**: Beatenberg,

1470 m, 2000, 2001, 2004, 2005, 2006 (all leg. Duelli); Biel, 450 m, 27.–31.vii. 1973; Guttannen, 1000 m, 6.viii.1999; Ligerz, 450 m, 29.v.2010; Rümligen, 540 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 25.–31.v.2000, 8.–15.vi.2000, 22.–29.vi.2000, 6.–13.vii. 2000, 13.–20.vii.2000, 20.–27.vii.2000, 27.vii.–3.viii.2000, 3.–10.viii.2000, 17.–24.viii.2000, 24.–31.viii.2000, 31.viii.–7.ix.2000 (all leg. Wolf). **FR**: Courlevon, 600 m, 2001, 2004, 2005 (all leg. Duelli); Nuvilly, 650 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli). **GE**: Bernex/Chantemerle, 420 m, 7.viii.2000 (leg. Merz & Bächli); Bernex/Signal, 510 m, 8.viii.2000 (leg. Merz & Bächli); Bernex/Tuilières, 420 m, 12.viii.2000; Cartigny/Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Chancy/La Laire, 350 m, 7.viii.2000 (leg. Merz & Bächli); Russin/Biolay, 360 m, 9.viii.2000 (leg. Merz & Bächli). **GL**: Klöntal, 850 m, 11.–14.ix.1974; Schwändital, 1250 m, 2000 (leg. Duelli); Vorauen, 800 m, 4.–8.viii.1991, 20.vii. 1995. **GR**: Ardez, 1400 m, 6.viii.1996 (leg. Merz & Bächli); Davos, 2540 m, 2006 (leg. Duelli); Dischmatal, 1600 m, 1.–15.vi.1991, 1.–15.vi.1992, 16.–30.vi.1990, 16.–30.vi.1991, 16.–31.vii.1990, 16.–31.vii.1991, 1.–16.viii.1990, 1.–27.viii.1992 (all leg. Brodmann); Lantsch, 1460 m, 2001 (leg. Duelli); Lenzerheide, 1520 m, 8.viii.1998, 11.–14.viii.1988; Nationalpark, 2000 m, 2001 (leg. Duelli); Santa Maria/Müstair/Craistas, 1800 m, 26.vi.2015, 30.vi.2013; Santa Maria/Müstair/Val Vau, 1700 m, 29.vi.2013; Savognin, 1360 m, 17.–20.viii.1988; Susch/Fortezza, 1500 m, 7.viii.1996 (leg. Merz & Bächli); Tschierv, 1700 m, 27.vi.2015; Tschlin, 1500 m, 25.vi.2004. **JU**: Delémont, 500 m, 2.–6.viii.1974; La Chaux-des-Breuleux, 1000 m, 28.vi.2001. **LU**: Dierikon, 550 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli); Luzern, 550 m, 10.vi.2006 (leg. Sattler); Ruswil, 800 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Sursee, 500 m, 13.vi.2004. **NE**: Ponts-de-Martel, 1000 m, 20.vi.–19.x.1974 (leg. Greber); St. Blaise/Les Rièdes, 500 m, 19.v.2001. **SG**: Schänis, 700 m, 2005 (leg. Duelli). **SH**: Merishausen, 540 m, 19.viii.1992. **SO**: Balmberg, 1050 m, 18.viii.1992; Messen, 500 m. 22.iii.2004, 29.iii.2004, 5.iv.2004, 13.iv.2004, 1.vi.2004, 26.vii.2004, 2.viii.2004, 30.viii.2004, 6.ix.2004, 14.ix.2004 (all leg. Wermelinger); Mariastein, 350 m, 21.–25.vii.1973; Weissenstein, 1000 m, 25.vi.2006. **SZ**: Alptal, 1150 m, 2005 (leg. Duelli); Biberbrugg, 1000 m, 25.vi.2011; Holzegg, 1440 m, 19.–21.viii.1975. **TG**: Roggwil, 420 m, 2000, 2004 (all leg. Duelli); Weiningen/Ochsenfurt, 450 m, 29.v.99. **TI**: Acquacalda, 1800 m, 22.–24.vi.2001; Robiei, 1900 m, 4.–5.vii.2008. **UR**: Furkapass, 2400 m, 23.vii.2012, 24.vii.2012). **VD**: Changins, 430 m, 2001, 2005 (all leg. Duelli); La Dôle, 1500 m, 26.vii.2004. **VS**: Baltschieder, 690 m, 17.v.1996 (leg. Merz & Bächli); Grône/Poutafontana, 500 m, 1.vii.2001; Guttet, 1500 m, 1.vii.2001; Jeizinen, 1500 m, 26.vi. 1999, 10.viii.2013, 2000 m, 3.vii.2001; Leuk, 700 m, 23.viii.–2.ix.1977; Leuk/Brentjong, 1000 m, 25.vi.1999; Morgins/Portes du Soleil, 1800 m, 27.vii. 2004); Mund/Finnen, 1400 m, 21.vi.2014; Oberwald, 1820 m, 13.–15.viii.1975; Pfynwald, 580 m, 25.vi.1999; Visperterminen, 1400 m, 21.vii.1998 (leg. Merz & Bächli). **ZG**: Steinhausen, 500 m, 2000, 2001, 2004, 2005, 2006 (all leg. Duelli). **ZH**: Bachs, 500 m, 13.–15.v.1988 (leg. Haigis); Dietikon, 390 m, 6.vi.2015, 20.vii.1989, 27.vii.1989, 22.viii.1991, 6.–9.ix.1974; Marthalen/Niderholz, 370 m, 17.iv.2006 (leg. Frei); Rafz, 420 m, 2001, 2004 (all leg. Duelli); Uitikon, 540 m, 2000, 2001, 2005 (all leg. Duelli), Unterengstringen, 540 m, 15.ix.1977; Wettswil/Oelerde, 650 m, 26.vi.2011; Zürich, 450 m, 14.–16.ix.1973; Zürich/Höngerberg, 520 m, 15.–19.vii.1989.

Bosnia/Herzegovina: Dobro Polje, 1100 m, 25.–28.vii.1984. **Czech Republic**: Borova Lada, 900 m, 26.viii.1998. **Liechtenstein**: Ruggell, 430 m, 8.viii.1998. **France**: Haute-Savoie, Salève/Observatoire, 1250 m, 10.viii.2000 (leg. Merz & Bächli); Fontainebleau, 120 m, 22.–28.viii.1957 (leg. Burla). **Montenegro**: Durmitor, 1500 m, 30.vii.–5.viii.1988. **Romania**: Calmani, 1700 m, 28.vii.1978; Cimpulung, 600 m, 6.vi.1984, 3.viii.1980; Cimpulung, 700 m, 18.vii.1982, 29.viii.1980; Cometu, 1.iv.1981; Mestecani, 1200 m, 18.viii.1981; P. Stampei, 1000 m, 7.viii.1978; Val. Dolnei, 800 m, 18.v.1978, 26.v.1980, 1000 m, 26.vii.1978; Varna, 1100 m, 11.x.1984 (all leg. Ceianu). **Slovakia**: Bratislava/Abrod Nature Reserve, 150 m, 1.ix.1990. **Serbia**: Popovica, 500 m, 1.–3.viii.1980.
Distribution: Palaearctic (Ozerov 2005).
Comments: *S. cynipsea* is by far the most commonly collected species in Switzerland (Rohner *et al.* 2014, 2015). It occurs in great numbers on cow pastures throughout the season. Adults are attracted to fresh cow dung in particular. *S. cynipsea* has been widely used as model organism in evolutionary ecology and life history evolution, and is to date the best studied sepsid species (Blanckenhorn 1997, 1999; Blanckenhorn *et al.* 2000).

Sepsis duplicata Haliday, 1838

Material: **Switzerland**: **AG**: Habsburg, 450 m, 9.viii.2004 (leg. Wermelinger); Sarmenstorf, 550 m, 5.vii.2004, 9.viii.2004, 23.viii.2004 (all leg. Wermelinger); Schlossrued, 600 m, 2001, 2005 (all leg. Duelli); Würenlingen/alter Steinbruch, 420 m, 15.viii.1991. **BE**: Guttannen, 1000 m, 6.viii.1999; Ligerz, 450 m, 29.v.2010; Rümligen, 540 m, 2000, 2001, 2005 (all leg. Duelli); Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 6.–13.vi.2000, 22.–29.vi.2000, 13.–20.vii.2000, 20.–27.vii.2000, 27.vii.–3.viii.2000, 3.–10.viii.2000, 24.–31.viii.2000 (all leg. Wolf). **FR**: Courlevon, 600 m, 2000, 2004 (all leg. Duelli); Nuvilly, 650 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli). **GE**: Bernex/Chante-Merle, 420 m, 7.viii.2000 (leg. Merz & Bächli); Chancy, 350 m, 25.vii.2004. **GL**: Schwändital, 600 m, 2004 (leg. Duelli); Vorauen, 800 m, 20.vii.1995). **GR**: Celerina, 1890 m, 2004 (leg. Duelli); Dischmatal, 1600 m, 16.–30.vi.1990, 16.–30.vi.1992, 1.–15.vii.1991, 1.–15.vii.1992, 1.–16.viii.1990, 1.–20.viii.1991, 1.–27.viii.1992 (all leg. Brodmann); Ftan/Clünas, 2000 m, 5.viii.1996 (leg. Merz & Bächli); Lantsch, 1460 m, 2005 (leg. Duelli); Lenzerheide, 1520 m, 8.viii.1998, 11.–14.viii.1988; Rothenbrunnen, 630 m, 8.viii.1996 (leg. Merz & Bächli); Sur/Avadala Cuorts, 1835 m, 2.vi.2000 (leg. Reser). **JU**: La Chaux-des-Breuleux, 1000 m, 28.vi.2003. **LU**: Dierikon, 550 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli); Luzern, 550 m, 24.vi.–5.viii.2006 (leg. Sattler); Ruswil, 800 m, 2000, 2001, 2004, 2005 (all leg. Duelli). **SH**: Merishausen, 540 m, 9.viii.1998, 19.viii.1992. **SO**: Balmberg, 1050 m, 18.viii. 1992; Mariastein, 350 m, 21.–23.vii.1973; Messen, 500 m, 14.vi.2004, 5.vii.2004, 2.viii.2004, 16.viii.2004, 23.viii.2004 (all leg. Wermeliger). **SZ**: Alptal, 1150 m, 2000 (leg. Duelli); Biberbrugg, 1000 m, 25.vi.2011; Holzegg, 1440 m, 19.–21.viii. 1975; **TG**: Roggwil, 420 m, 2000, 2003, 2004 (leg. Duelli). **TI**: Acquacalda, 1800 m, 22.–24.vi.2001; Bolle di Magadino, 200 m, 2001 (leg. Duelli). **UR**: Furkapass, 2400 m, 24.vii.2012. **VD**: Changins, 430 m, 2001, 2005 (all leg. Duelli); Cudrefin, 430 m, 2004 (leg. Duelli); La Dôle, 1500 m, 26.vii.2004; Senarclens, 600 m, 2000, 2005 (all leg. Duelli). **VS**: Baltschieder, 650 m, 24.vi.2000; Bürchen, 1600

m, 2.vii.2001; Guttet, 1500 m, 27.vii.–6.viii.1993; Jeizinen, 1500 m, 3.vii.2001, 10.viii. 2013; Mörel, 1090 m, 26.v.2010 (leg. Obrist); Morgins/Portes de Culet, 1800 m, 28.vii.2004; Morgins/Portes du Soleil, 1800 m, 27.vii.2004; Visperterminen, 1400 m, 31.vii.1998. **ZG**: Steinhausen, 500 m, 2000, 2001, 2004, 2005, 2006 (all leg. Duelli). **ZH**: Rafz, 420 m, 2001, 2004 (leg. Duelli); Uitikon, 540 m, 2001, 2005 (leg. Duelli);
Liechtenstein: Ruggell, 430 m, 8.viii.1998. **Turkey**: Zonguldak, 200 m, 23.vii. 1962 (leg. Götz).
Distribution: Palaearctic (Ozerov 2005).
Comments: Apparently the first records from Liechtenstein and Turkey. *S. duplicata* is a small species commonly found on cow pastures where it seems to prefer older cow pats that have already developed a dry crust (Püchel 1993). Males lack strong modifications on the foreleg, but instead exhibit long hairs on the mid and hind femora. Comparative studies revealed that the loss of fore femur morphology coincides with the evolution of a novel mating behaviour which does not involve the use of the male foreleg holding onto the female (Puniamoorthy *et al.* 2008).

Sepsis flavimana Meigen, 1826

Material: **Switzerland**: **AG**: Würenlingen, 420 m, 20.vii.1996, 14.viii.1997; Würenlingen/alter Steinbruch, 420 m, 15.viii.1991; Würenlingen/Firsthalde, 420 m, 13.v.1998, 14.viii.1991. **BE**: Guttannen, 1000 m, 6.viii.1999; Ligerz, 450 m, 29.v.2010; Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 8.–15.vi.2000, 15.–22.vi.2000, 6.–13.vii.2000, 13.–20.vii.2000, 17.–24.viii.2000, 24.–31.viii.2000, 31.viii.–7.ix.2000 (all leg. Wolf). **GL**: Klöntal, 850 m, 11.–14.ix.1974; Richisau, 1100 m, 7.–11.viii.1995; Schwändital, 1250 m, 2000 (leg. Duelli). **GR**: Celerina, 1890 m, 2000 (leg. Duelli); Dischmatal, 1600 m, 16.–30.vi.1990, 16.–30.vi.1991, 1.–15.vii.1990, 1.–15.vii.1991, 1.–15.vii.1992, 16.–31.vii.1990, 16.–31.vii.1991, 1.–24.viii.1990, 1.–27.viii.1992 (all leg. Brodmann); Ftan/Clünas, 2000 m, 6.viii.1996 (leg. Merz & Bächli); Lenzerheide, 1500 m, 8.viii.1998; Nationalpark, 2000 m, 2005 (leg. Duelli); Rothenbrunnen, 630 m, 8.viii.1996 (leg. Merz & Bächli); Zernez, 1450 m, 4.viii.1996 (leg. Merz & Bächli); Zernez/Gon., 1500 m, 4.–7.viii.1996; Zuoz/Nüd, 1700 m, 7.viii.1996. **JU**: La Chaux-des-Breuleux, 1000 m, 28.vi.2003. **LU**: Dierikon, 550 m, 2000, 2001, 2003, 2005 (all leg. Duelli); Luzern, 550 m, 24.vi.–5.viii.2006 (leg. Sattler); Menzberg; 1000 m, 3.–6.vii.1983; Ruswil, 800 m, 2001 (leg. Duelli). **SH**: Merishausen, 540 m, 26.vii.2001. **SO**: Messen, 500 m, 15.iii.2004, 18.viii.2004, 30.viii.2004 (all leg. Wermelinger); Weissenstein, 1000 m, 25.vi.2006. **SZ**: Alptal, 1150 m, 2000 (leg. Duelli); Biberbrugg, 1000 m, 25.vi.2011; **TG**: Lommis/Immenberg, 700 m, 4.viii.2007. **TI**: Acquacalda, 1800 m, 22.–24.vi.2001; Fusio, 1300 m, 26.vii.1997; Robiei, 1900 m, 4.–5.vii.2008. **VS**: Grône/Poutafontana, 520 m, 1.vii.2001; Guttet, 1500 m, 29.vii.–6.viii.1993; Jeizinen, 1500 m, 10.viii.2013; Morgins/Portes de Culet, 1800 m, 28.vii.2004; Morgins/Portes du Soleil, 1800 m, 27.vii.2004; Morgins/Vièze, 1400 m, 27.vii.2004; Visp, 650 m, 2000 (leg. Duelli). **ZH**: Dietikon, 550 m, 6.vi.2015; Flaach, 350 m, 30.vi.2000; Zürich/Hönggerberg, 520 m, 1.vii.2011, 15.–19.vii.1989, 18.–23.vii.1980, 24.–28.vii.1987, 2.–6.viii.1997.
Czech Republic: Val/Veseli n.L., 19.viii.1998. **Romania**: Calimani, 1700 m, 27.vii.1978; Cimpulung, 600 m, 23.v.1981, 28.v.1984, 700 m, 16.viii.1987, 800 m,

7.viii.1983; Codz. Voiv., 500 m, 7.v.1984; Val. Pulnei, 1000 m, 18.vii.1981 (all leg. Ceianu).
Distribution: Holarctic (Ozerov 2005).
Comments: This species is widespread and can be locally very abundant. It is apparently specialized on cow dung (Pont & Meier 2002). Small specimens can be mistaken for *S. biflexuosa* or *S. nigripes*, but can be differentiated from the latter two mainly by the characteristic beak-like shape of the hypopygial surstylus in both lateral and posterior views (e.g.: Pont & Meier 2002; Rohner *et al.* 2014).

Sepsis fulgens Meigen, 1826

Material: **Switzerland**: **AG**: Habsburg, 450 m, 22.iii.2004, 5.iv.2004, 19.vii.2004, 26.vii.2004, 16.viii.2004, 30.viii.2004, 14.ix.2004, 20.ix.2004, 27.ix.2004 (all leg. Wermelinger); Rottenschwil, 450 m, 14.vi.2008; Sarmenstorf, 550 m, 22.iii.2004, 26.vi.2004, 20.ix.2004 (all leg. Wermelinger); Schlossrued, 600 m, 2000, 2001, 2004, 2005 (all. leg. Duelli); Würenlingen, 420 m, 3.vii.2004, 6.vii.2000, 7.vii.2000, 20.vii.1996, 14.viii.1997, 31.viii.1999. **BE**: Beatenberg, 1470 m, 2000, 2001, 2005, 2006 (all leg. Duelli); Rümligen, 540 m, 2000, 2004, 2005 (all leg. Duelli); Ruppoldsried, 500 m, iv.–x.1987. **BL**: Bubendorf, 15.–22.vi.2000, 22.–29.vi.2000, 29.vi.–6.vii.2000, 13.–20.vii.2000, 20.–27.vii.2000. 27.vii.–3.viii.2000, 3.–10.viii. 2000 (all leg. Wolf); Pratteln, 480 m, 2004, 2005 (leg. Duelli). **BS**: Basel/Zolli, 24.vi.–8.vii.2005 (leg Baur *et al.*). **FR**: Courlevon, 600 m, 2001, 2004, 2005 (all leg. Duelli); Nuvilly, 650 m, 2001, 2004, 2005 (all leg. Duelli); **GE**: Bernex/Chante-Merle, 420 m, 7.viii.2000 (leg. Merz & Bächli); Bernex/Signal, 510 m, 8.viii.2000 (leg. Merz & Bächli); Bernex/Tuilières, 430 m, 12.viii.2000; Cartigny/Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Chancy, 350 m, 25.vii.2004; Chancy/La Laire, 350 m, 7.viii.2000 (leg. Merz & Bächli); Jussy/Prés de Villette, 475 m, 8.viii.2000 (leg. Merz & Bächli); Russin/Biolay, 360 m, 9.viii.2000 (leg. Merz & Bächli). **GL**: Klöntal, 850 m, 11.–14.ix.1974; Schwändital, 1250 m, 2000, 2001 (all leg. Duelli); Vorauen, 800 m, 20.vii.1995, 4.–8.viii.1991. **GR**: Ardez, 1400 m, 6.viii.1996 (leg. Merz & Bächli); Dischmatal, 1.–20.viii.1991 (leg. Brodmann); Ftan/Clünas, 2000 m, 5.viii.1996 (leg. Merz & Bächli); Lantsch, 1460 m, 2000 (leg. Duelli); Lenzerheide, 1520 m, 8.viii.1998; Nationalpark, 2000 m, 2001, 2004, 2005 (all leg. Duelli); Rothenbrunnen, 630 m, 8.viii.1998 (leg. Merz & Bächli); Saas, 1100 m, 7.viii.2010; Santa Maria/Müstair/Craistas, 1850 m, 26.vi.2015; Susch/Fortezza, 1500 m, 7.viii.1996 (leg. Merz & Bächli); Tinizong, 1350 m, 2.vi.2000; Tschierv, 1700 m, 27.vi.2015; Tschlin, 1500 m, 25.vi.2016; Zernez, 1450 m, 4.viii.1996; Zernez/Gondas, 1500 m, 4.–8.viii.1996; Zuoz/Nüd, 1700 m, 7.viii.1996 (leg. Merz & Bächli). **JU**: Delémont, 500 m, 2.–6.viii.1974; La Chaux-des-Breuleux, 1000 m, 28.vi.2003. **LU**: Dierikon, 550 m, 2000, 2001, 2003, 2004 (all leg. Duelli); Ruswil, 800 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Sursee, 500 m, 13.vi.2004; NE: St. Blaise/Les Rièdes, 500 m, 19.v.2001. **SH**: Merishausen, 540 m, 9.viii.1999; SO: Balmberg, 1050 m, 18.viii.1992; Weissenstein, 1000 m, 25.vi.2006. **SO**: Messen, 500 m, 7.vi.2004, 14.vi.2004, 21.vi.2004, 28.vi.2004, 5.vii.2004, 12.vii.2004, 16.viii.2004, 23.viii.2004, 30.viii.2004 (all leg. Wermelinger). **SZ**: Alptal, 1150 m, 2000, 2001 (all leg. Duelli); Biberbrugg, 1000 m, 25.vi.2011. **TG**: Lommis/Immenberg, 700 m, 4.viii.2007; Roggwil, 420 m, 2001, 2004, 2005 (all leg. Duelli). **TI**: Biasca, 300 m, 7.viii.1997; Bolle di Magadino, 200

m, 2000 (leg. Duelli); Cevio-Cerentino, 430 m, 15.–16.vii.1997; Fusio, 670 m, 26.vii.1997; Lucomagno, 1400 m, 3.viii.1997; Lugano, 24.vi.–5.viii.2006 (leg. Sattler); Monte San Giorgio, 1100 m, 18.vii.1995 (leg. Merz & Bächli); Ravatoi, 1350 m, 10.viii.1997; Robiei, 1900 m, 4.–5.vi.2008; Serpiano, 600 m, 22.viii.2000; Val Bavona, 600 m, 27.viii.1997. **UR**: Seelisberg, 810 m, 4.–7.viii.1973. **VD**: Changins, 430 m, 2004 (leg. Duelli); La Dôle, 1500 m, 25.vii.2004; Senarclens, 600 m, 2001, 2005 (all leg. Duelli). **VS**: Baltschieder, 650 m, 24.vi.2000; Grône/Poutafontana, 500 m, 1.vii.2001; Jeizinen, 1500 m, 26.vi.1999, 3.vii.2001, 10.viii.2013; Leuk/ Brentjong, 1000 m, 25.vi.1999; Leuk/Platten, 600 m, 1.viii.1998 (leg. Merz & Bächli); Mörel, 735 m, 28.v.2010, 850 m, 28.v.2010, 1090 m, 28.v.2010 (all leg. Obrist); Morgins/Têtes, 1500 m, 28.vii.2004; Pfynwald, 580 m, 25.vi.1999; Visp, 650 m, 2001, 2004, 2005 (all leg. Duelli); Visperterminen, 1550 m, 4.viii.1998; 1400 m, 13.vii.1998 (all leg. Merz & Bächli); 1300 m, 30.viii.1998; 1600 m, 21.vii.2004; Zeneggen, 1400 m, 22.vi.2014. **ZG**: Steinhausen, 500 m, 2000, 2001, 2005, 2006 (all leg. Duelli). **ZH**: Dietikon, 390 m, 23.v.–12.vii.1998, 6.vi.2015; Katzensee, 440 m, 23.vii.1991; Marthalen, 390 m, 5.vi.200; Marthalen/Niderholz 390 m; 17.iv. 2006; Oetwil a. L., 450 m, 27.vii.–1.viii.1996; Rafz, 420 m, 2001, 2004, 2005 (all leg. Duelli); Uitikon, 540 m, 2000, 2004, 2005 (all leg. Duelli); Wettswil/Oelerde, 650 m, 26.vi.2011; Zürich, 450 m, 24.vi.–5.viii.2006 (leg. Sattler); Zürich/Hönggerberg, 520 m, 29.vi.2002.
Czech Republic: Borova Lada, 900 m, 26.viii.1998; Hluboka n. V., 450 m, 30.viii.1998; Val/Veseli n.L., 19.viii.1998; Veseli n.L., 450 m, 22.viii.1998. **Germany**: BW, Schelingen, 350 m, 28.v.2011; Berching, 26.vii.–14.viii.1988 (leg. Schacht). **Liechtenstein**: Ruggell, 430 m, 8.viii.1998. **France**: Haute-Savoie, Salève/Observatoire, 1250 m, 10.viii.2000 (leg. Merz & Bächli); Salève/Téléphérique, 1100 m, 10.viii.2000 (leg. Merz & Bächli); Rennes, 50 m, 28.viii.–1.ix.1957 (leg. Burla). **Romania**: Calimani, 1700 m, 27.viii.1976; 1500 m. 9.x.1987; Cimpulung, 600 m, 27.v.1980, 7.vii.1976, 10.vii.1983, 12.vii.1981, 21.vii.1982, 30.vii. 1985, 22.ix.1976, 27.ix.1976, 22.x.1981, 25.x.1980; 700 m, 25.v.1976, 9.viii.1987, 16.viii.1987; 800 m, 26.v.1983, 3.viii.1975, 7.viii.1982, 6.x.1983, 8.x.1983; 1000 m, 3.viii.1975, 6.x.1983; Cornetu, 1.iv.1981, 5.vi.1982, 10.vi.1981, 15.vi.1981, 20.vi. 1980, 2.vii.1983; Gara Jegara, 3.vi.1972; Moldovita, 800 m, 31.v.1983; Rarau, 1500 m, 4.viii.1978; Solca, 500 m, 27.vi.1980; Turda, 30.v.1986; Val. Pulnei, 900 m, 28.iv.1980, 8.vi.1976, 1.viii.1980 (all leg. Ceianu). **Slovenia**: Dolnya Bitnya, 400 m, 2001 (leg. Haring). **Serbia**: Beograd, 100 m, 2.–6.vii.1995 (leg. Kekić).
Distribution: Palaearctic (Ozerov 2005).
Comments: This species is particularly common on pig dung, muck hills and manure near farm-houses, but can also be caught on cow pastures at a lower frequency. There are some records of swarming behavior, which is supposedly linked to hibernation (Pont 1987b), but to our knowledge such reports lack in Switzerland. As illustrated in Munari (1987), the morphology of the forefemur varies quiet drastically.

Sepsis lateralis Wiedemann, 1830

Material: **Egypt**: Alexandria, 8.–9.iii.1978, 31.iii.–2.iv.1978; Assiut, 200 m, 18.iii.1978; Cairo, 28.–29.iii.1978; Fayum, -30 m, 16.iii.1978.
Distribution: Afrotropical, Oceanian, Palaearctic, Oriental (Ozerov 2005).

Comments: Absent from Switzerland. The specimens were collected over decaying banana baits. Can be collected on dog excrements or compost (pers. obs. P. T. Rohner).

Sepsis luteipes Melander & Spuler, 1917

Material: **Switzerland**: **AG**: Würenlingen, 420 m, 6.–11.vi.1973, 27.vii.2001. **BE**: Beatenberg, 1470 m, 2000 (leg. Duelli). **BL**: Bubendorf, 8.–15.vi.2000, 13.–20.vii.2000, 3.–10.viii.2000 (all leg. Wolf). **GE**: Chancy, 350 m, 24.vi.2004. **GR**: Zernez, 1450 m, 4.viii.1996 (leg. Merz & Bächli). **JU**: La Chaux-des-Breuleux, 1000 m, 28.vi.2003; **SZ**: Biberbrugg, 1000 m, 25.vi.2011. **TI**: Biasca, 300 m, 7.–11.viii.1997; Cevio-Cerentino, 420 m, 15.–16.vii.1997; Lucomagno, 1400 m, 8.viii.1998. **VS**: Grône/Poutafontana, 500 m, 1.vi.2001; Jeizinen, 1500 m, 3.vii.2001; Leuk/Brentjong, 1000 m, 25.vi.1999; Pfynwald, 580 m, 15.v.1996 (leg. Merz & Bächli); 30.vi.–4.vii.2001, 3.–7.vii.2000. **ZH**: Zürich/Hönggerberg, 520 m, 3.–7.vi.1998, 13.–17.vii.1996.
Austria: Leutschach, 350 m, 13.–17.vii.2001. **Italy**: Sondrio, Bormio, 1300 m, 29.vii.–3.viii.2000; Torino, Villar Pellice, 700 m, 9.–13.vii.2002.
Distribution: Holarctic (Ozerov 2005).
Comments: Apparently the first record from Austria. This species has been found on cow dung (Rohner *et al*. 2015) and goose excrements (Pont & Meier 2002), but its ecology and behaviour are largely unknown. Note that *Sepsis helvetica* Munari, 1985 was synonymized with *Sepsis luteipes* by Ozerov (1999), although different species concepts lead to conflicting conclusions (Rohner *et al*. 2014).

Sepsis neocynipsea Melander & Spuler, 1917

Material: **Switzerland**: **AG**: Sarmenstorf, 550 m, 7.vi.2004, 9,viii.2004 (all leg. Wermelinger). **BE**: Beatenberg, 1470 m, 2004, 2005 (all leg. Duelli); Guttannen, 1000 m, 6.viii.1999; Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 6.–13.vii.2000 (leg. Wolf). **FR**: Nuvilly, 650 m, 2003 (leg. Duelli). **GL**: Klöntal, 850 m, 11.–14.ix.1974; Schwändital, 1250 m, 2001, 2004 (all leg. Duelli); Vorauen, 800 m, 20.vii.1995. **GR**: Alp Flix, 1850 m, 4.–8.viii.1975; Celerina, 1890 m, 2004 (leg. Duelli); Davos, 2540 m, 2001, 2006 (all leg. Duelli); Dischmatal, 1600 m, 30.v.–24.vii.1979, 1.–15.vi.1990, 1.–15.vi.1992, 16.–30.vi.1990, 16.–30.vi.1991, 16.–30.vi.1992, 1.–15.vii.1990, 1.–15.vii.1991, 1.–15.vii.1992, 16.–31.vii.1990, 16.–31.vii.1991, 16.–31.vii.1992, 1.–20.viii.1991, 1.–24.viii.1990, 1.–27.viii.1992 (all leg. Brodmann); Ftan/Clünas, 2000 m, 5.viii.1996 (leg. Merz & Bächli); Lenzerheide, 1520 m, 8.viii.1998; Nationalpark, 2000 m, 2000, 2001, 2005 (all leg. Duelli); Saas, 1100 m, 3.viii.2010; Santa Maria/Müstair/Craistas, 1850 m, 26.vi.2015, 30.vi.2013; Savognin, 1360 m, 17.–20.viii.1988; Sur/ava dalla Cuorts, 1835 m, 2.vi.2000 (leg. Reser); Tinizong, 1350 m, 5.vi.2000; Tschierv, 1700 m, 27.v.2015; Tschlin, 1500 m, 25.vi.2016; Zernez, 1450 m, 4.viii.1996 (leg. Merz & Bächli); Zuoz/Nüd, 1700 m, 7.viii.1996. **JU**: Delémont, 500 m, 2.–6.viii.1974. **LU**: Dierikon, 550 m, 2003 (leg. Duelli); Ruswil, 800 m, 2000 (leg. Duelli); Sursee, 500 m, 13.vi.2004; **SG**: Weisstannen, 1400 m, 6.vii.2001. **SO**: Messen, 500 m, 5.iv.2004, 1.vi.2004, 14.vi.2004 (all leg, Wermelinger); Weissenstein, 1000 m, 25.vi.2006. **SZ**: Holzegg, 1440 m, 19.–21.viii.1975; Pragelpass, 1550 m, 5.viii.1991. **TI**: Ravatoi, 1350 m, 10.viii.1997; Robiei, 1900 m, 4.–5.vii.2008. **UR**: Furkapass, 2400 m,

25.vii.2012, 23.vii.2012; Seelisberg, 810 m, 4.–7.viii.1973. **VD**: La Dôle, 1500 m, 26.vii.2004; Senarclens, 600 m, 2004 (leg. Duelli). **VS**: Baltschieder, 650 m, 17.v.1996 (leg. Merz & Bächli); Bürchen, 1500 m, 2.vii.2001; Guttet, 1500 m, 1.vii. 2001, 29.vii.–6.viii.1993; Jeizinen, 1500 m, 26.vi.1999, 10.viii.2013; Leuk, 700 m, 23.viii.–2.ix.1977; Leuk/Platten, 600 m, 19.v.1996 (leg. Merz & Bächli); Morgins/Portes de Culet, 1800 m, 28.vii.2004; Morgins/Portes du Soleil; 1800 m; 27.vii.2004; Morgins/Têtes, 1500 m, 28.vii.2004; Morgins/Vièze, 1400 m, 27.vii. 2004; Mund/Finnen, 1400 m, 21.vi.2014; Oberwald, 1820 m, 13.–15.viii.1975; Pfynwald, 580 m, 19.v.1996 (leg. Merz & Bächli); 26.–28.vii.1993; Riederalp, 2050 m, 31.vii.–8.viii.1976; Visperterminen, 1300 m, 20.vii.1998 (leg. Merz & Bächli); 1600 m, 21.vii.2004; 1400 m, 31.vii.1998 (leg. Merz & Bächli); 1550 m, 4.viii.1998 (leg. Merz & Bächli); Zeneggen, 1400 m, 22.vi.2014.
France: Haute-Savoie, Salève/Observatoire, 1250 m, 10.viii.2000 (leg. Merz & Bächli). **Montenegro**: Durmitor, 1500 m, 30.vii.–5.viii.1988.
Distribution: Holarctic, Oriental, Neotropical (Ozerov 2005).
Comments: At high altitudes *S. neocynipsea* can be highly abundant on cow pastures, but the species is rather rare in the Swiss lowlands (Rohner *et al.* 2015). This trend is also represented in the data above. Similar observations from the British Isles suggest that *S. neocynipsea* prefers habitats at high altitudes (Pont 1987a). In contrast to European populations, this species is much more common in North America, where it seems to take the ecological role of *S. cynipsea*, which has never been recorded for the Nearctic Region.

Sepsis nigripes Meigen, 1826

Material: **Switzerland**: **BE**: Rümligen, 540 m, 2001, 2005 (all leg. Duelli). **FR**: Nuvilly, 650 m, 2001, 2005 (all leg. Duelli). **GE**: Bernex/Chante-Merle, 420 m, 7.vii.2000 (leg. Merz & Bächli). **TG**: Roggwil, 420 m, 2004 (leg. Duelli). **VD**: Senarclens, 600 m, 2000 (leg. Duelli). **VS**: Mund/Finnen, 1400 m, 21.vi.2014; Visperterminen, 2300 m, 30.vii.1998 (leg. Merz & Bächli). **ZH**: Rafz, 420 m, 2005 (leg. Duelli); Uitikon, 540 m, 2005 (leg Duelli).
Distribution: Palaearctic (Ozerov 2005).
Comments: *S. nigripes* is a rare and enigmatic species. It can be difficult to distinguish from *S. flavimana* and *S. biflexuosa*, especially small, female specimens (Rohner *et al.* 2014). Adults have been collected on cow pastures (Rohner *et al.* 2015), but its ecology and habitat preferences remain unknown.

Sepsis orthocnemis Frey, 1908

Material: **Switzerland**: **AG**: Aristau, 400 m, x.1985 (leg. Wunderlich); Habsburg, 450 m, 23.iii.2004, 5.iv.2004, 26.vii.2004, 23.viii.2004, 30.viii.2004, 6.ix.2004, 20.ix.2004, 27.ix.2004 (all leg. Wermelinger); Sarmenstorf, 550 m, 22.iii.2004, 29.iii.2004, 19.vii.2004, 6.ix.2004 (all leg. Wermelinger); Schlossrued, 600 m, 2001 (leg. Duelli); Würenlingen, 420 m, 6.–11.vi.1973, 7.viii.1998, 14.viii.1997; Würenlingen/Firsthalde, 420 m, 14.viii.1991. **BE**: Beatenberg, 1470 m, 2000, 2001, 2004, 2005, 2006 (all leg. Duelli); Biel, 450 m, 27.–31.vii.1973; Rümligen, 540 m, 2000, 2001, 2005 (all leg. Duelli). **BL**: Bubendorf, 15.–22.vi.2000, 13.–20.vii.2000. 27.vii.–3.viii.2000, 17.–24.vii.2000, 20.–27.viii.2000. **BS**: Basel/Zolli, 24.vi.–4.vii. 2005 (leg. Baur *et al.*). **FR**: Courlevon, 600 m, 2001, 2004, 2005 (all leg. Duelli);

Nuvilly, 650 m, 2001, 2005 (all leg. Duelli). **GE**: Bernex/Signal, 510 m, 8.viii.2000 (leg. Merz & Bächli); Cartigny/Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Chancy/La Laire, 350 m, 7.viii.2000 (leg. Merz & Bächli); Jussy/Prés de Villette, 475 m, 8.viii.2000 (leg. Merz & Bächli); Russin/Biolay, 360 m, 9.viii.2000 (leg. Merz & Bächli). **GL**: Elm/Wichlen, 1300 m, 15.viii.2001; Klöntal, 850 m, 11.–14.ix.1974; Richisau, 1100 m, 7.–8.viii.1991; Schwändital, 1250 m, 10.viii.2013 (leg. Duelli); Vorauen, 800 m, 20.vii.1975. **GR**: Alp Flix, 1830 m, 4.–8.viii.1975; Davos, 2540 m, 2006 (leg. Duelli); Dischmatal, 1600 m, 30.v.–24.vii.1979, 1.–15.vi. 1991, 15.–30.vi.1990, 16.–31.vii.1990, 1.–16.viii.1990, 1.–20.viii.1991, 1.–27.viii. 1992 (all leg. Brodmann); Ftan/Clünas, 2000 m, 3.viii.1996; Saas, 1100 m, 7.viii. 2010; Santa Maria/Müstair/Craistas, 1850 m, 26.vi.2015; Susch/Fortezza, 1500 m, 7.viii.1996 (leg. Merz & Bächli); Zernez, 1450 m, 4.viii.1996. **JU**: Delémont, 500 m, 2.–6.viii.1974. **LU**: Dierikon, 550 m, 2000, 2003, 2004, 2005 (all leg. Duelli); Luzern, 550 m, 10.vi.2006; Luzern, 550 m, 24.vi.–5.viii.2006 (leg. Sattler); Ruswil, 800 m, 2001, 2005 (all leg. Duelli). **SH**: Merishausen, 540 m, 9.viii.1999, 19.viii.1992. **SO**: Messen, 500 m, 5.iv.2004, 13.iv.2004 (all leg. Wermelinger); Weissenstein, 1000 m, 15.vi.2006. **SZ**: Biberbrugg, 1000 m, 25.vi.2011. **TG**: Lommis/Immenberg, 700 m, 4.viii.2007. **TI**: Lucomagno, 1400 m, 8.viii.1997. **VD**: Changins, 430 m, 2001 (leg. Duelli); Senarclens, 600 m, 2000, 2001, 2005 (all leg. Duelli). **VS**: Baltschieder, 650 m, 24.vi.2000; Guttet, 1500 m, 1.vii.2001; Jeizinen, 1500 m, 26.vi.1999, 10.viii.2013; 2000 m, 3.vii.2001; Leuk/Brentjong, 1000 m, 16.v.1996, 25.vi.1999 (all leg. Merz & Bächli); Mörel, 1090 m, 28.v.2010 (leg. Obrist); Morgins/Têtes, 1500 m, 28.vii.2004; Mund/Finnen, 1400 m, 21.vii.2014; Oberwald, 1820 m, 13.–15.viii.1975; Pfynwald, 580 m, 15.v.1996; St. Germann, 650 m, 3.viii.1998 (leg. Merz & Bächli); Visperterminen, 1300 m, 30.vii.1998, 1550 m, 4.–8.viii.1998; (all leg. Merz & Bächli). **ZG**: Steinhausen, 500 m, 2000, 2001, 2005, 2006 (all leg. Duelli). **ZH**: Dietikon, 390 m, 1974; 6.–12.ix.1987; Rafz, 420 m, 2004 (leg. Duelli); Uitikon, 540 m, 2000, 2004 (all leg. Duelli); Zürich, 450 m, 14.–16.ix.1973.

Czech Republic: Borova Lada, 900 m, 26.viii.1998. **Germany**: BW, Schelingen, 350 m, 28.v.2011. **France**: Haute-Savoie, Monnetier/Salève, 700 m, 10.viii.2000; Haute-Savoie, Salève/Observatoire, 1250 m, 10.viii.2000 (all leg. Merz & Bächli). **Montenegro**: Durmitor, 1500 m, 30.vii.–5.viii.1988. **Romania**: Calimani, 1700 m, 26.vii.1976; Cimpulung, 600 m, 2.v.1979; 700 m, 6.vi.1976, 13.viii.1987; 800 m, 2.v.1979, 27.v.1980, 21.vii.1975, 22.viii.1980, 25.x.1980; Cornetu, 2.iv.1984; Mestecani, 1200 m, 18.vii.1981; Solca, 500 m, 27.vi.1980; Val. Pulnei, 900 m, 25.v.1980; 26.v.1980, Varna, 1100 m, 13.vii.1980 (all leg. Ceianu). **Serbia**: Goć, 900 m, 4.–7.viii.1980.

Distribution: Oriental, Palaearctic (Ozerov 2005).

Comments: This species is very widespread across Europe. Although it is often found on cow pastures, it seems present at very low densities.

Sepsis pseudomonostigma Ursu, 1969

Material: **Croatia**: Kupari, 16.–19.ix.1979. **Turkey**: Trapzon, 50 m, 9.–10.vii. 1962; Samsun, 50 m, 14.–16.viii.1962 (all leg. Götz).

Distribution: Palaearctic (Ozerov 2005).

Comments: Apparently the first record from Croatia. Does not occur in Switzerland.

Sepsis punctum (Fabricius, 1794)

Material: **Switzerland**: **AG**: Aristau, 400 m, iii.1975, vii.1975 (leg. Wunderlich); Rheinfelden, 300 m, 12.vi.2010; Sarmenstorf, 550 m, 16.viii.2004 (leg. Wermelinger). **BE**: Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 3.–10.viii.2000, 10.–17.viii.2000, 24.–31.viii.2000 (all leg. Wolf). **FR**: Nuvilly, 650 m, 2005 (leg. Duelli). **GE**: Bernex/Signal, 510 m, 8.viii.2000 (leg. Merz & Bächli); Chancy, 350 m, 25.vii.2004; Jussy/Prés de Villette, 475 m, 8.viii.2000 (leg. Merz & Bächli); Russin/Biolay; 360 m; 9.viii.2000 (leg. Merz & Bächli). **GL**: Richisau, 1100 m, 7.–8.viii.1991. **GR**: Lenzerheide, 1520 m, 8.viii.1998; Saas, 900 m, 8.viii.2010. **JU**: La Chaux-des-Breuleux, 1000 m, 28.vi.2003. **LU**: Dierikon, 550 m, 2001, 2003, 2004, 2005 (all leg. Duelli); Luzern, 550 m, 10.vi.2006; 24.vi.–5.viii.2006 (leg. Sattler). **SO**: Mariastein, 350 m, 21.–26.vii.1973; Messen, 500 m, 15.iii.2004, 26.vii.2004, 23.viii.2004, 30.viii.2004 (all leg. Wermelinger); Weissenstein, 1000 m, 25.vi.2006. **TG**: Roggwil, 420 m, 2001 (leg. Duelli); Weinfelden/Ochsenfurt, 450 m, 29.v.1999. **TI**: Acquarossa, 530 m, 17.–20.vii.1998; Biasca, 300 m, 16.–20.vi.1995, 7.–11.viii.1997; Bolle di Magadino, 200 m, 19.vi.1995; Lugano, 24.vi.–5.viii.2006 (leg. Sattler); Origlio, 420 m, 13.vii.1988; Robiei, 1900 m, 4.–5.vii.2008; Val Bavona, 600 m, 27.vii.1997. **VS**: Grône/Poutafontana, 500 m, 1.vii.2001; Leuk/Brentjong, 1000 m, 25.vi.1999; Leuk/Platten; 600 m, 22.vii.2004; 1.viii.1998 (leg. Merz & Bächli); Pfynwald, 580 m, 30.vi.–4.vii.2001. **ZH**: Andelfingen, 400 m, 31.v.1972 (leg. Glatthaar); Dietikon, 390, 14.v.2015, 6.vi.2015, 13.vi.1991, 3.–8.vii.2000, 3.–10.viii.1984, 5.viii.1989; Flaach, 350 m, 30.vi.2000, 22.vii.1996; Uitikon, 540 m, 2005 (leg. Duelli); Wettswil/Ölerde, 650 m, 26.vi.2011; Zürich, 450 m, 24.vi.–5.viii.2006 (leg. Sattler); Zürich/Hönggerberg, 520 m, 29.vi.–3.vii.1999, 14.–19.vii.1988, 14.–18.vii.1995, 15.–19.vii.1989, 16.–20.vii.1986, 18.–23.vii.1990, 24.–28.vii.1987; Zürich/Irchelpark, 550 m, 6.v.–28.vi.1986.
Austria: Purgstall, 400 m, 16.–31.vii.1977 (leg. Hüttinger). **Bosnia/Herzegovina**: Dobro Polje, 1100 m, 25.–28.vii.1984. **Czech Republic**: Borova Lada, 900 m, 25.viii.1998; Hluboka n.V., 450 m, 20.viii.1998; Val/Veseli n.L., 19.viii.1998. **Romania**: Brosleni, 800 m, 8.vi.1984; Bucuresti, 16.vii.1986; Calimani, 1700 m, 30.vi.1976; Cimpulung, 600 m, 23.v.1981, 25.v.1981, 13.vi.1976, 17.vii.1975, 22.vii.1976, 12.viii.1981, 22.viii.1980, 27.ix.1976, 22.x.1981; 700 m, 6.vi.1976, 21.vii.1975, 2.viii.1962, 29.viii.1981; 800 m, 15.vi.1986, 3.viii.1975, 16.viii.1987, 27.ix.1975; 900 m, 6.vi.1976; Codz. Voiv., 500 m, 21.vi.1984; Cornetu, 9.iv.1981, 13.iv.1981, 26.iv.1985, 26.v.1985, 10.vi.1981, 15.vi.1981, 16.vi.1981, 18.vii.1981, 5.viii.1981, 24.ix.1981; Frasin, 500 m, 21.vi.1984; Meslecani, 1200 m, 18.vii.1981; Snagov, 17.ix.1976; Stampei, 1000 m, 26.vii.1976; Val. Pulnei, 900 m, 26.v.1980, 1.viii.1980, 2.viii.1981;1000 m, 10.vii.1982 (all leg. Ceianu). **Serbia**: Beograd, 100 m, 2.–6.vii.1995 (leg. Kekić); Popovica, 500 m, 1.–3.viii.1980. **Turkey**: Samsun, 50 m, 14.–16.vii.1962; Trabzon, 50 m, 8.–10.vii.1962 (all leg. Götz).
Distribution: Holarctic, Neotropical, Oriental (Ozerov 2005).
Comments: Apparently the first record from Liechtenstein. This species can be found on cow pastures, but is more abundant in parks and at lake-shores. *S. punctum* reproduces in all kinds of animal dung and other decaying substrates, but seems to be particularly attracted to dog excrements. In Switzerland, males are larger than females (which is not the case in North American populations: Puniamoorthy *et al.*

2012) and range in colour from dark brown to partially bright yellow/orange. Intrasexual aggression is commonly observed between males, whereafter larger males are more likely to mate with a female (Puniamoorthy *et al*. 2012).

Sepsis thoracica (Robineau-Desvoidy, 1830)

Material: **Switzerland**: **AG**: Habsburg, 450 m, 12.vii.2004, 19.vii.2004, 26.vii.2004, 2.viii.2004, 23.viii.2004, 30.viii.2004, 14.ix.2004, 20.ix.2004, 27.ix.2004 (all leg, Wermelinger); Sarmenstorf, 550 m, 7.vi.2004, 21.vi.2004, 28.vi.2004, 5.vii.2004, 12.vii.2004, 19.vii.2004, 16.viii.2004, 30.viii.2004, 6.ix.2004, 14.ix.2004, 20.ix.2004 (all leg. Wermelinger); Schlossrued, 600 m, 2004 (leg. Duelli); Würenlingen, 420 m, 7.viii.1998. **BE**: Rümligen, 540 m, 2001, 2004 (all leg. Duelli); Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **FR**: Courlevon, 600 m, 2001, 2004, 2005 (leg. Duelli); Nuvilly, 650 m, 2001, 2004, 2005 (all leg. Duelli). **GE**: Bernex/Chante-Merle, 420 m, 7.viii.2000 (leg. Merz & Bächli); Bernex/Tuilières, 420 m, 12.viii.2000; Cartigny/Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Chancy, 350 m, 25.vii.2004; Russin/Biolay, 360 m, 9.viii.2000 (leg. Merz & Bächli). **GR**: Ardez, 1400 m, 6.viii.1996 (leg. Merz & Bächli); Ftan/Clünas, 2000 m, 5.viii.1996 (leg. Merz & Bächli); Lenzerheide, 1520 m, 8.viii.1998; Nationalpark, 2000 m, 2001, 2004, 2005 (all leg. Duelli); S-chanf/Flin, 1650 m, 7.viii.1996 (leg. Merz & Bächli); Susch/Fortezza, 1500 m, 7.viii.1996 (leg. Merz & Bächli); Tschierv, 1700 m, 27.vi.2015; Tschlin, 1500 m, 25.vi.2016); Zernez, 1450 m, 6.viii.1996 (leg. Merz & Bächli); Zernez, 1450 m, 4.viii.1996; Zernez/Nüd, 1700 m, 7.viii.1996 (leg. Merz & Bächli);.**LU**: Dierikon, 550 m, 2004 (leg. Duelli); Ruswil, 800 m, 2004 (leg. Duelli); Sursee, 500 m, 13.vi.2004. **SO**: Messen, 500 m, 15.iii.2004, 14.vi.2004, 21.vi.2004, 28.vi.2004, 26.vii.2004, 23.viii.2004, 30.viii.204, 6.ix.2004, 20.ix.2004, 27.ix.2004 (all leg. Wermelinger). **SZ**: Holzegg, 1440 m, 19.–21.viii.1975. **TG**: Lommis/Immenberg, 700 m, 4.viii.2007; Roggwil, 420 m, 2003, 2004 (leg. Duelli). **TI**: Bolle di Magadino, 200 m, 9.viii.1997; Bolle di Magadino, 200 m, 2001, 2004 (all leg. Duelli); Lugano, 24.vi.–5.viii.2006 (leg. Sattler); Robiei, 1900 m, 4.–5.vii.2008. **UR**: Furkapass, 2400 m, 23.vii.2012, 24.vii.2012, 25.vii.2012. **VD**: Changins, 430 m, 2001 (leg. Duelli); La Dôle, 1500 m, 26.vii.2004; Senarclens, 600 m, 2005 (leg. Duelli). **VS**: Baltschieder, 650 m, 17.v.1996, 2.viii.1998 (all leg. Merz & Bächli), 24.vi.2000; Grône/Poutafontna, 520 m, 18.v.1996 (leg. Merz & Bächli); Guttet, 1500 m, 1.vii.2001; Jeizinen, 1500 m, 26.vi.1999, 3.vii.2001, 10.viii.2013; Leuk/Brentjong, 1000 m, 16.v.1996 (leg. Merz & Bächli); 25.vi.1999; Leuk/Platten, 600 m, 19.v.1996, 1.viii.1998, 3.viii.1998 (all leg. Merz & Bächli), 22.vii.2004; Mörel, 850 m, 28.v.2010 (leg. Forster); Morgins/Portes de Culet, 1800 m, 28.vii.2004; Morgins/Portes du Soleil, 1800 m, 27.vii.2004; Morgins/Têtes, 1500 m, 28.vii.2004; Visperterminen, 1600 m, 21.vii.2004. **ZG**: Steinhausen, 500 m, 2001, 2004, 2005 (all leg. Duelli). **ZH**: Rafz, 420 m, 2004 (leg. Duelli); Uitikon, 540 m, 2004 (leg. Duelli); Zürich, 450 m, 14.–16.ix.1973; Zürich/Hönggerberg, 520 m, 7.–11.ix.1992;
Bosnia/Herzegovina: Durmitor, 1500 m, 30.vii.–5.viii.1988. **Liechtenstein**: Ruggell, 430 m, 8.viii.1998. **France**: Haute-Savoie, Monnetier/Salève, 700 m, 10.viii.2000 (leg. Merz & Bächli); Alsace, Steinbach, 27.viii.–8.viii.2010 (leg. Schaffner).
Distribution: Aftortopical, Oceanian, Oriental, Palaearctic (Ozerov 2005).

Comments: Males range in colour from black to brightly yellow, while females are always dark. The species is common on cow pastures but appears to be more active during hot weather. Similar to *S. punctum*, males engage in male-male combat.

Sepsis violacea Meigen, 1826

Material: **Switzerland**: **AG**: Habsburg, 450 m, 15.iii.2004, 22.iii.2004, 19.vi.2004, 20.ix.2004 (all leg. Wermelinger); Rottenschwil, 450 m, 14.vi.2008; Sarmenstorf, 550 m, 22.iii.2004, 29.iii.2004, 19.vii.2004 (all leg, Wermelinger); Schlossrued, 600 m, 2001 (leg. Duelli); Würenlingen, 420 m, 6.vii.2000. **BE**: Beatenberg, 1470 m, 2000 (leg. Duelli). **BL**: Bubendorf, 13.–20.vii.2000 (leg. Wolf). **BS**: Basel/Zolli, 29.iv.–13.v.2005 (leg. Baur *et al.*). **GE**; Bernex/Chante-Merle, 420 m, 7.viii.2000 (leg. Merz & Bächli); Bernex/Signal, 510 m, 8.viii.2000 (leg. Merz & Bächli). **GL**: Schwändital, 1250 m, 2000 (leg. Duelli). **GR**: Dischmatal, 1600 m, 16.–31.vii.1991 (leg. Brodmann); Lantsch, 1460 m, 2000 (leg. Duelli); Lenzerheide, 1520 m, 8.viii.1998; Rothenbrunnen, 630 m, 8.viii.1996 (leg. Merz & Bächli); Saas, 1100 m, 7.viii.2010; Savognin, 1360 m, 17.–20.vii.1988; Tinizong, 1350 m, 3.vi.2000; Tschlin, 1600 m, 24.vi.2016, 1500 m, 25.vi.2016. **JU**: Delémont, 500 m, 2.–6.viii.1974; **LU**: Dierikon, 550 m, 2000, 2003, 2004 (all leg. Duelli); Luzern, 550 m, 24.vi.–5.viii.2006 (all leg. Sattler). **NE**: St. Blaise/Les Rièdes, 500 m, 19.v.2001. **SO**: Balmberg, 1050 m, 18.viii.1992; Messen, 500 m, 15.ii.2004, 22.iii.2004, 5.iv. 2004, 13.iv.2004, 14.vi.2004 (all leg. Wermelinger); Weissenstein, 1000 m, 25.vi. 2006. **TG**: Lommis/Immenberg, 700 m, 4.viii.2007; Roggwil, 420 m, 2004, 2005 (all leg. Duelli). **TI**: Bolle di Magadino, 200 m, 9.viii.1997; Robiei, 1900 m, 4.–5.vii.2008. **VD**: La Dôle, 1500 m, 26.vii.2004. **VS**: Baltschieder, 650 m, 24.vi.2000; Bürchen, 1600 m, 7.–13.viii.1993; Jeizinen, 1500 m, 26.vi.2004, 3.vii.2001, 10.viii. 2013; Leuk/Platten, 600 m, 19.v.1996 (leg. Merz & Bächli); 22.vii.2004; Mörel, 850 m, 28.v.2010 (leg. Obrist); Mund/Finnen; 1400 m, 21.vi.2014; Visperterminen, 1300 m, 30.vii.1998, 31.vii.1998 (leg. Merz & Bächli). **ZH**: Flaach, 350 m, 30.vi. 2000; Marthalen/Niderholz, 390 m, 17.iv.2006 (leg. Frei); Uitikon, 540 m, 2004 (leg. Duelli); Wettswil/Oelerde, 650 m, 26.vi.2011; Zürich, 450 m, 24.vi.–5.viii. 2006 (leg. Sattler).
Austria: Leutschach, 350 m, 13.–17.vii.2001. **Czech Republic**: Borova Lada, 900 m, 26.viii.1998; **Italy**: Bormio, Sondrio, 1300 m, 29.vii.–3.viii.2000. **Romania**: Bucuresti, 16.vii.1986; Calimani, 1700 m, 21.viii.1981; Cimpulung, 600 m, 21.v. 1988, 23.v.1981, 7.vii.1976, 12.vii.1981, 22.x.1981; 800 m, 19.vi.1988, 5.viii.1975, 24.ix.1987; Cornetu, 30.iii.1983, 7.iv.1981; Rarau, 1500 m, 4.viii.1978; Val. Pulnei, 900 m, 11.vi.1984, 22.v.1978 (all leg. Ceianu).
Distribution: Palaearctic (Ozerov 2005).
Comments: *S. violacea*'s ecology appears to be similar to *S. fulgens*, but *S. violacea* is much larger and less frequent than the latter. The species is most common at muck hills, pig dung and manure.

Themira Robineau-Desvoidy, 1830

This is a relatively large genus including species of striking disparity. Foreleg modifications are particularly strong and more pronounced than in *Sepsis*, *Saltella*, *Meroplius* and *Nemopoda*. Many species of *Themira* are known to breed in waterfowl dung and are thus common near lakes or rivers with large bird populations or other

damp places. There are comparably few records for this genus for Switzerland (with the exception of *T. annulipes*, which is common on cow pastures), and there are likely more species present that have not been recorded yet (Haenni 1997; Rohner 2015).

Themira annulipes (Meigen, 1826)

Material: **Switzerland**: **AG:** Aristau, 400 m, v.1974, vi.1974, vii.1974, viii.1974, x.1974 (all leg. Wunderlich); Habsburg, 450 m, 19.vii.2004 (leg. Wermelinger); Rottenschwil, 450 m, 14.vi.2008; Schlossrued, 600 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Würenlingen, 420 m, 7.viii.1998, 14.viii.1997. **BE**: Biel, 450 m, 27.–31.vii.1973; Guttannen, 1000 m, 6.viii.1999; Ligerz, 450 m, 29.v.2010; Rümligen, 540 m, 2000, 2001, 2005 (all leg. Duelli); Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli). **BL**: Bubendorf, 25.–31.v.2000, 6.–13.vii.2000 (leg. Wolf); Pratteln, 480 m, 2000, 2001, 2005 (all leg. Duelli). **BS**: Basel/Zolli, 24.vi.–8.vii.2005, 8.–22.vii.2005 (all leg. Baur *et al.*). **FR**: Courlevon, 600 m, 2000, 2001, 2004, 2005 (all leg. Duelli); Nuvilly, 650 m, 2000, 2001, 2005 (all leg. Duelli). **GE**: Cartigny/Moulin de Vert, 350 m, 9.viii.2000 (leg. Merz & Bächli); Chancy, 350 m, 25.vii.2004; Chancy/La Laire, 350 m, 7.viii.2000 (leg. Merz & Bächli). **GL**: Elm/Wichlen, 1300 m, 15.viii.2001; Richisau, 1100 m, 7.–11.viii.1995; Vorauen, 800 m, 20.vii.1995, 4.–8.viii.1991. **GR**: Dischmatal, 1600 m, 16.–30.vi.1990, 16.–30.vi.1992, 1.–15.vii.1990 , 1.–15.vii.1991, 1.–15.vii.1992, 16.–31.vii.1991, 16.–31.vii.1992, 1.–16.viii.1990, 1.–20.viii.1991, 1.–27.viii.1992 (all leg. Brodmann); Saas, 1100 m, 7.viii.2010; Santa Maria/Müstair, 1540 m, 26.vi.2015; Savognin, 1360 m, 17.–20.viii.1988; Tschierv, 1700 m, 27.vi.2015; Zernez, 1450 m, 4.viii.1996 (leg. Merz & Bächli). **JU**: La Chaux-de-Breuleux, 1000 m, 28.vi.2003. **LU**: Dierikon, 550 m, 2000, 2001, 2003, 2004, 2005 (all leg. Duelli); Luzern, 550 m, 10.vi.2006, 24.vi.–5.viii.2006 (leg. Sattler); Ruswil, 800 m, 2000, 2001, 2004, 2005 (all leg. Duelli). **NE**: Marin/Tertres, 450 m, 19.v.2001; Neuchâtel, 600 m, 3.vii.2010. **SO**: Mariastein, 350 m, 21.–25.vii.1973; Messen, 500 m, 21.viii.2004 (leg. Wermelinger); Weissenstein, 1000 m, 25.vi.2006. **SZ**: Alpthal, 1150 m, 2005 (leg. Duelli); Pragelpass, 1550 m, 5.viii.1991. **TG**: Roggwil, 420 m, 2001, 2003, 2004, 2005 (leg. Duelli). **TI**: Acquacalda, 1800 m, 22.–24.vi.2001; Fusio, 1300 m, 26.vii.1997; Lugano; 24.vi.–5.viii.2006 (leg. Sattler); Robiei, 1900 m, 4.–5.vii.2008. **UR**: Seelisberg, 810 m, 4.–7.viii.1973. **VD**: Changins, 430 m, 2000, 2001, 2005 (all leg. Duelli). **VS**: Jeizinen, 1500 m, 3.vii.2001; Leuk/Platten, 600 m, 1.viii.1998 (leg. Merz & Bächli); Mörel, 850 m, 28.v.2010 (leg. Obrist); Morgins/Portes du Soleil, 1800 m, 27.vii.2004; Morgins/Têtes, 1500 m, 28.vii.2004; Visperterminen, 1400 m, 31.vii.1998. **ZG**: Holzhäusern, 2.v.–30.viii.1996 (leg. Röösli); Steinhausen, 500 m, 2000, 2001, 2005, 2006 (all leg. Duelli). **ZH**: Dietikon, 390 m, 6.vi.2015, 20.vii.1989, 29.vii.1989, 5.viii.1989; Embrach/ Haumühle, 400 m, 9.v.1998; Flaach, 350 m, 30.vi.2000; Katzensee, 440 m, 23.vii.1991; Kempthal, 480 m, 21.vi.1972 (leg. Glatthaar); Oetwil/L., 450 m, 27.vii.–1.viii.1996; Rafz, 420 m, 2000, 2001, 2005 (all leg. Duelli); Uitikon, 540 m, 2000, 2004, 2005 (all leg. Duelli); Zürich, 450 m, 24.vi.–5.viii.2006 (leg. Sattler), 14.–16.ix.1973; Zürich/Hönggerberg, 520 m, 29.vi.2002, 13.–17.vii.1996, 14.–18.vii.1995, 16.–20.vii.1986, 24.–28.vii.1987; Zürich/Irchelpark, 550 m, 6.v.–26.vi.1986.

Bosnia/Herzegovina: Dobro Polje, 1100 m, 25.–28.vii.1984. **Germany**: BW, Oberbergen, 300 m, 28.v.2011; Schelingen, 350 m, 28.v.2011; Bisperode, 130 m, 19.–31.vii.1971 (leg. Jungen); Edersee, 250 m, 12.–17.viii.1984. **Liechtenstein**: Ruggell, 430 m, 8.viii.1998. **France**: Haute-Savoie, Salève/Observatoire, 1250 m, 10.viii.2000 (leg. Merz & Bächli); Romania: Cheile Turzii, 30.v.1986; Cimpulung, 600 m, 21.v.1977, 21.vii.1982, 30.vii.1985; 700 m, 6.vi.1986, 4.vii.1982; Hantisti, 19.iv.1978; Val. Pulnei, 900 m, 28.v.1980, 6.ix.1984 (all leg. Ceianu). **Serbia**: Popovica, 500 m, 1.–3.viii.1980.
Distribution: Holarctic (Ozerov 2005).
Comments: Apparently the first record from Liechtenstein. Males exhibit strongly modified mid tarsomeres, which are used in courtship behaviour (Puniamoorthy *et al*. 2009). The species can be collected on cow pastures but is also common on horse dung (e.g.: Ang *et al*. 2015).

Themira germanica Duda, 1926

Material: **Switzerland**: **BE**: Ruppoldsried, 500 m, iv.–x.1987 (leg. Duelli).
Distribution: Palaearctic (Ozerov 2005).
Comments: This is a rather uncommon and rare species.

Themira gracilis (Zetterstedt, 1847)

Material: **Switzerland**: **GL**: Richisau, 1100 m, 7.–8.viii.1991; Schwändital, 1250 m, 2000 (leg. Duelli); Vorauen, 800 m, 4.–8.viii.1991. **GR**: Dischmatal, 1600 m, 16.–30.vi.1991, 1.–15.vii.1990, 1.–15.vii.1992, 1.–16.viii.1990 (all leg. Brodmann). **SZ**: Alptal, 2000 (leg. Duelli).
Montenegro: Durmitor, 1500 m, 30.vii.–5.viii.1988. **Romania**: Cimpulung, 600 m, 27.v.1977, 27.v.1985, 31.v.1981, 14.vii.1974, 18.vii.1982, 20.vii.1985, 30.vii.1985; 700 m, 28.v.1984, 4.ix.1988; Dragosa, 800 m, 13.vii.1979; Frasin, 500 m, 23.v. 1981; Statioara, 800 m, 28.v.1981; Val. Pulnei, 900 m, 28.v.1985; 1000 m, 18.vii. 1981, 10.viii.1982 (all leg. Ceianu).
Distribution: Palaearctic (Ozerov 2005).
Comments: Apparently the first record from Montenegro. This rather small species is often associated to horse dung, but it can also be found on cow pastures.

Themira leachi (Meigen, 1826)

Material: **Switzerland**: **FR**: Nuvilly, 650 m, 2001 (leg. Duelli). **GL**: Richisau, 1100 m, 7.–8.viii.1991. **GR**: Surrein, 1300 m, 11.vii.1991. **LU**: Dierikon, 550 m, 2005 (leg. Duelli); Kriens, 600 m, 20.viii.–3.ix.1997 (leg. Röösli). **ZG**: Holzhäusern, 2.v.–30.viii.1996 (leg. Röösli). **ZH**: Dietikon, 390 m, 6.vi.2015; Flaach, 350 m, 30.vi.2000.
Germany: BW, Oberbergen, 300 m, 28.v.2011.
Distribution: Holarctic (Ozerov 2005).
Comments: Male forelegs and sternites are strikingly modified (Pont & Meier 2002). Both sexes have rather short wings and are poor fliers.

Themira lucida (Staeger in Schiødte, 1844)

Material: **Switzerland**: **AG**: Rottenschwil, 450 m, 14.vi.2008. **SG**: Rheineck, 400 m, 14.–17.viii.1973.

Distribution: Holarctic (Ozerov 2005).
Comments: Commonly found in the surrounding of ponds and lakes. It has also been found indoors (pers. observ. P. T. Rohner).

Themira minor (Haliday, 1833)

Material: **Switzerland**: **AG**: Aristau, 400 m, x.1975 (leg. Wunderlich). **LU**: Dierikon, 550 m, 2000 (leg. Duelli); Luzern 550 m, 24.vi.–5.viii.2006 (leg. Sattler); Ruswil, 800 m, 2001 (leg. Duelli). **TI**: Bolle di Magadino, 200 m, 19.vi.1995 (leg. Merz & Bächli).
Romania: Calimani, 1700 m, 25.v.83; Cimpulung, 600 m, 25.v.1976; 800 m, 3.viii.1975; Cornetu, 23.v.1984 (all leg. Ceianu).
Distribution: Holarctic (Ozerov 2005).
Comments: Often associated with waterfowl droppings, but can also be found on cow dung (which it readily accepts as breeding substrate under laboratory conditions).

Themira nigricornis (Meigen, 1826)

Material: **Romania**: Cornetu, 21.iii.1983, 1.iv.1986, 2.iv.1984, 20.vi.1980.
Distribution: Holarctic (Ozerov 2005).
Comments: Although this collection does not include specimens from Switzerland, this species has been recorded previously (Haenni 1998; Rohner 2015).

Themira putris (Linnaeus, 1758)

Material: **Switzerland**: **GR**: Dischmatal, 1600 m, 1.–15.vii.1991 (leg. Brodmann). **Czech Republic**: Borova Lada, 900 m, 26.viii.1998; **Romania**: Cimpulung, 600 m. 28.iv.1983, 6.v.1984, 9.v.1982, 1.vii.1988; Cornelu, 22.vi.1988; Gara Jegalia, 3.vi.1982; Hantesti, 19.vii.1978; Morile, 18.v.1976; Val. Pulnei, 900 m, 20.v.1978; 1000 m, 25.v.1977 (all leg. Ceianu).
Distribution: Holarctic (Ozerov 2005).
Comments: This relatively large species prefers liquid and quite filthy substrates such as stale manure or wet dung heaps as characteristic breeding grounds.

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REFERENCES

Ang, Y., Puniamoorthy, J., Pont, A.C., Bartak, M., Blanckenhorn, W.U., Eberhard, W.G., Puniamoorthy, N., Silva, V. C., Munari, L. & Meier, R. 2013. A plea for digital reference collections and other science-based digitization initiatives in taxonomy: Sepsidnet as exemplar. — Systematic Entomology 38: 637–644.

Ang, Y., Rohner, P.T. & Meier, R. 2015. Across the Baltic: a new record for an enigmatic black scavenger fly, *Zuskamira inexpectata* (Pont, 1987) (Sepsidae) in Finland. — Biodiversity Data Journal 3: e4308.

Araujo, D.P., Tuan, M.J.M., Yew, J.Y. & Meier, R. 2014. Analysing small insect glands with UV-LDI MS: High-resolution spatial analysis reveals the chemical composition and use of the osmeterium secretion in *Themira superba* (Sepsidae: Diptera). — Journal of Evolutionary Biology 27: 1744–1750.

Bährmann, R. & Bellstedt, R. 2012. Neuere öko-faunistische Untersuchungen an Schwingfliegen (Insecta: Diptera: Brachycera-Acalyptratae: Sepsidae) Thüringens. — Thüringer Faunistische Abhandlungen 17: 93–110.

Blanckenhorn, W.U. 1997. Altitudinal life history variation in the dung flies *Scathophaga stercoraria* and *Sepsis cynipsea*. — Oecologia 109: 342–352.

Blanckenhorn, W.U. 1999. Different growth responses to temperature and resource limitation in three fly species with similar life histories. — Evolutionary Ecology 13: 395–409.

Blanckenhorn, W.U., Mühlhäuser, C., Morf, C., Reusch, T. & Reuter, M. 2000. Female choice, female reluctance to mate and sexual selection on body size in the dung fly *Sepsis cynipsea*. — Ethology 106: 577–593.

Blanckenhorn, W.U., Puniamoorthy, N., Schäfer, M.A., Scheffczyk, A. & Römbke, J. 2013. Standardized laboratory tests with 21 species of temperate and tropical sepsid flies confirm their suitability as bioassays of pharmaceutical residues (ivermectin) in cattle dung. — Ecotoxicology and Environmental Safety 89: 21–28.

Bowsher, J.H., Ang, Y., Ferderer, T. & Meier, R. 2013. Deciphering the evolutionary history and developmental mechanisms of a complex sexual ornament: The abdominal appendages of Sepsidae (Diptera). — Evolution 67: 1069–1080.

Bowsher, J.H. & Nijhout, H.F. 2009. Partial co-option of the appendage patterning pathway in the development of abdominal appendages in the sepsid fly *Themira biloba*. Development Genes and Evolution 219: 577–587.

Eberhard, W.G. 2001. The functional morphology of species-specific clasping structures on the front legs of male *Archisepsis* and *Palaeosepsis* flies (Diptera, Sepsidae). — Zoological Journal of the Linnean Society 133: 335–368.

Eberhard, W.G. 2002. The Relation between Aggressive and Sexual Behavior and Allometry in *Palaeosepsis dentatiformis* Flies (Diptera: Sepsidae). — Journal of the Kansas Entomological Society 75: 317–332.

Haenni, J.-P. 1997. Sepsidae (Diptera) nouveaux pour la faune de Suisse. — Bulletin Romand d'Entomologie 15: 69–78.

Haenni, J.-P. 1998. 64. Sepsidae. *In*: Merz, B., Bächli, G. Haenni, J.-P. & Gonseth, Y. (eds). Diptera - Checklist. — Fauna Helvetica 1, 369 pp., CSCF, Neuchâtel.

Hennig, W. 1949. 39a Sepsidae. *In*: Lindner, E. (ed.), Die Fliegen der palaearktischen Region, pp. 1–92. — Schweizerbart, Stuttgart, Germany

Herath, B., Dochtermann, N.A., Johnson, J.I., Leonard, Z. & Bowsher, J.H. 2015. Selection on bristle length has the ability to drive the evolution of male abdominal appendages in the sepsid fly *Themira biloba*. — Journal of Evolutionary Biology 28: 2308–2317.

Ingram, K.K., Laamanen, T., Puniamoorthy, N. & Meier, R. 2008. Lack of morphological coevolution between male forelegs and female wings in *Themira* (Sepsidae: Diptera: Insecta). — Biological Journal of the Linnean Society 93: 227–238.

Martin, O.Y. & Hosken, D.J. 2004. Copulation reduces male but not female longevity in *Saltella sphondylli* [*sphondylii*] (Diptera: Sepsidae). — Journal of Evolutionary Biology 17: 357–362.

Melander, A.L. & Spuler, A. 1917. The dipterous families Sepsidae and Piophilidae. — Bulletin of the Agricultural Experimental Station Washington 143: 1–103.

Merz, B., Bächli, G. & Haenni, J.-P. 2001. Erster Nachtrag zur Checkliste der Diptera der Schweiz. — Mitteilungen der Entomologischen Gesellschaft Basel 51: 110–140.

Munari, L. 1987. Studi sulla ditterofauna della Lessinia (Veneto). II. I Sepsidae della Lessinia Centrale: osservazioni faunistiche ed ecologiche. Notulae Sepsidologicae XI (Diptera Cyclorrhapha). — Società Veneziana di Scienze Naturali 12: 71–86.

Pont, A.C. 1979. Sepsidae: Diptera, Cyclorrhapha, Acalyptrata. — Handbooks for the Identification of British Insects 10: 1–35.

Pont, A. 1987a. Provisional atlas of the Sepsidae (Diptera) of the British Isles, pp.1–33 — Biological Records Centre, Huntingdon.

Pont, A.C. 1987b. «The mysterious swarms of sepsid flies»: an enigma solved? — Journal of Natural History 21: 305–317.

Pont, A.C. & Meier, R. 2002. The Sepsidae (Diptera) of Europe. — Fauna Entomologica Scandinavica 37: 1–221.

Püchel, F. 1993. Untersuchungen über die Besiedlung von Kuhdung durch Sepsiden (Diptera). — Diplomarbeit Universität Bielefeld, Bielefeld, Germany.

Puniamoorthy, N., Ismail, M.R.B., Tan, D.S.H. & Meier, R. 2009. From kissing to belly stridulation: Comparative analysis reveals surprising diversity, rapid evolution, and much homoplasy in the mating behaviour of 27 species of sepsid flies (Diptera: Sepsidae). — Journal of Evolutionary Biology 22: 2146–2156.

Puniamoorthy, N., Schäfer, M.A. & Blanckenhorn, W.U. 2012. Sexual selection accounts for the geographic reversal of sexual size dimorphism in the dung fly, *Sepsis punctum* (Diptera: Sepsidae). — Evolution 66: 2117–2126.

Puniamoorthy, N., Su, K.F.-Y. & Meier, R. 2008. Bending for love: losses and gains of sexual dimorphisms are strictly correlated with changes in the mounting position of sepsid flies (Sepsidae: Diptera). — BMC Evolutionary Biology 8: 155.

Ozerov, A. L. 1999. 88. Fam. Sepsidae. *In*: Ler. L.P. (ed.) Key to the insects of the Russian Far East. 6, Diptera and Siphonaptera, part 1, pp. 556–570. — Dal'nauka: Vladivostok.

Ozerov, A.L. 2005. World catalogue of the family Sepsidae (Insecta: Diptera). —Zoologicheskie issledovania (Zoological Studies) 8: 1–74.

Rohner, P.T., Ang, Y., Lei, Z., Puniamoorthy, N., Blanckenhorn, W.U. & Meier, R. 2014. Genetic data confirm the species status of *Sepsis nigripes* Meigen (Diptera: Sepsidae) and adds one species to the Alpine fauna while questioning the synonymy of *Sepsis helvetica* Munari. — Invertebrate Systematics 28: 555–563.

Rohner, P.T., Bächli, G., Pollini, L., Duelli, P., Obrist, M.K., Jochmann, R. & Blanckenhorn, W.U. 2015. Distribution, diversity gradients and Rapoport's elevational rule in the black scavenger flies of the Swiss Alps (Diptera: Sepsidae). — Insect Conservation and Diversity 8: 367–376.

Rohner, P.T. 2015. An updated checklist of the Sepsidae (Diptera) of Switzerland, including the first record of *Themira superba* (Haliday, 1833). — Mitteilungen der Schweizerischen Entomologischen Gesellschaft 88: 371–377.

Rohner, P.T., Blanckenhorn, W.U. & Puniamoorthy, N. 2016. Sexual selection on male size drives the evolution of male-biased sexual size dimorphism via the prolongation of male development. — Evolution 70: 1–11.

Su, K.F.Y., Puniamoorthy, J., Özsu, N., Srivathsan, A. & Meier, R. 2016. Evolutionary analysis identifies multiple genome expansions and contractions in Sepsidae (Diptera) and suggests targets for future genomic research. — Cladistics 32: 308–316.

van der Goot, V.S. 1987. *Meroplius minutus* (Wiedemann) (Dipt., Sepsidae) extinct in the Low Countries. — Entomologist's Monthly Magazine 123: 82.

Lei, Z., Ang, S. H. A, Srivathsan, A., Su, K. F. Y. & Meier, R. 2013. Does better taxon sampling help? A new phylogenetic hypothesis for Sepsidae (Diptera: Cyclorrhapha) based on 50 new taxa and the same old mitochondrial and nuclear markers. — Molecular Phylogenetics and Evolution 69: 153–164.

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