

Zeitschrift: Mitteilungen der Schweizerischen Entomologischen Gesellschaft =
Bulletin de la Société Entomologique Suisse = Journal of the Swiss
Entomological Society

Herausgeber: Schweizerische Entomologische Gesellschaft

Band: 88 (2015)

Heft: 3-4

Artikel: Faunistical data of Carnidae (Diptera) from Switzerland and additional
countries with the description of three new Meoneura species

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DOI: <https://doi.org/10.5169/seals-583861>

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Faunistical data of Carnidae (Diptera) from Switzerland and additional countries with the description of three new *Meoneura* species

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The previously unidentified Carnidae from the collection of Gerhard Bächli have been investigated. All in all, faunistical records of 26 species from Switzerland are presented. *Meoneura alphabetica* Carles-Tolrá & Ventura, 2002, *Meoneura exigua* Collin, 1930, *Meoneura milleri* Gregor, 1973, *Meoneura moravica* Gregor & Papp, 1981, and *Meoneura obscurella* (Fallén, 1823) are new for the fauna of Switzerland. *Meoneura occulta* spec. nov., *Meoneura pappi* spec. nov., and *Meoneura ziegleri* spec. nov. are described. Additional records of Carnidae are reported from Austria, Canada, Czech Republic, Egypt, France, Germany, Iran, Italy, Liechtenstein, Montenegro, Norway, Serbia, and the USA.

Keywords: Diptera, Carnidae, *Meoneura*, *Hemeromyia*, faunistics, new species, Switzerland.

INTRODUCTION

Carnidae are a small family of acalyptrate flies with worldwide only 105 species known so far. The flies are up to 2 mm long, mainly black and without obvious characters for the family diagnosis. When you are looking for the least obvious flies Carnidae are good candidates! Due to the similarity to several other more common acalyptrate families Carnidae are recognised only by experts of Acalyptratae and are easily overlooked in samples. Therefore it is not surprising that the knowledge of this group is poor and that we are only at the beginning of understanding the species richness and the distribution of species. Up to now there have been only twelve papers that mention records of Carnidae from Switzerland: The earliest records of Carnidae were published by Wegelin (1933) and Büttiker (1969, 1975) and are dealing with the bird parasite *Carnus hemapterus*. Additions are published by Papp (1985, 1997) who afterwards compiled the first comprehensive species list for Switzerland (Papp 1998). This list included 19 species, 14 species of them are reported as new faunistical records without giving data. Afterwards there were single records published by Grimaldi (1997), Roulin (1998, 1999), Merz *et al.* (2001), Roulin *et al.* (2001) and Merz (2012) Due to the faunistical research of Gerhard Bächli, a large amount of unpublished material is available for Switzerland. The aim of our paper is to publish these records.

MATERIALS & METHODS

Most of the specimens have been caught by sweeping with a net in the vegetation and at flowers. To elect the specimens out of the net, the method of Tschirnhaus

was used (cf. Černý & von Tschirnhaus 2014). Additional material was collected with fruit (mainly banana) baits, at cadavers, with canopy traps, with colour traps, and with window traps. The specimens collected by Peter Duelli with window traps are pooled per year and location. All material was stored at first in alcohol and dried afterwards. The material in alcohol was sorted out and dried with the following liquid drying method: (a) pinning the specimen with minuten pins; (b) placing the specimen in 100 % alcohol for at least two hours; (c) placing the specimen in tertiary butanol C₄H₁₀O for at least two hours; (d) placing the specimen in hexane for at least two hours. Afterwards, the specimen is dried on tissue while wings and legs are arranged, mostly by blowing. The identification is almost completely based on male genital structures and therefore females are not taken into account. The basis for the identification are the keys of Collin (1930) and Papp (1978). In addition, the original descriptions of all species that were published later were taken into account. The identification of those species that cannot be identified with the keys of Collin (1930) and Papp (1978) are discussed in detail in the results. In several specimens the diagnostic structures at the postabdomen could be identified without any preparation. Otherwise the abdomen was dissected, macerated for about four hours in NaOH(aq) solution and stored in glycerin in a microvial together with the specimen on the insect pin. The nomenclature is adopted from Brake (2011). The terminology for the description of the flies is adopted from Cumming & Wood (2009) and Wheeler (2010), the terminology for the male postabdomen is illustrated in Figs 5–8. The interpretation of the subepandrial sclerites and the hypoproct remains difficult because these two structures are more or less fused to a subepandrial plate. The material is deposited in the collection of Gerhard Bächli (PGBA) or Jens-Hermann Stuke (PJHS), if not otherwise stated.

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

RESULTS

Hemeromyia longirostris Carles-Tolrá, 1992

Material: SWITZERLAND: 1 ♂, 2000, TI, Bolle di Magadino, 200 m, window trap, leg. Duelli, coll. PGBA.

Comments: A revision of the genus *Hemeromyia* is in preparation by Freidberg *et al.* The diagnosis of *H. longirostris* is based on these characters: proboscis as long as the head, labellum elongated, gena less than half eye height, praescutellar seta present, 1 + 3 dorsocentral setae. *Hemeromyia longirostris* has previously been reported from Switzerland only by Merz *et al.* (2001).

Meoneura alphabetica Carles-Tolrá & Ventura, 2002

Material: SWITZERLAND: 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 31.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA.

Comments: The specimens presented here have been identified by the characteristic shape of the surstylus as illustrated in Carles-Tolrá & Ventura (2002: 290). *M. alphabetica* belongs to a group of species with a divided surstylus-lamella-

complex. In *M. alphabetica* the two arms of the surstylus have the same length and are u-shaped. These are the first records from Switzerland. *M. alphabetica* has previously only been recorded from the locus typicus in Spain (Gerona).

Meoneura alpina Hennig, 1948

Material: **SWITZERLAND:** 1 ♂, 2000, GL, Schwändital, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2005, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2004, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PJHS; 4 ♂♂, 2000, GR, Davos, 2300 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2005, dito; 2 ♂♂, 2006, dito; 3 ♂♂, 2004, GR, Davos, 2300 m, window trap, leg. Duelli, coll. PJHS; 2 ♂♂, 2001, dito; 2 ♂♂, 2005, dito; 2 ♂♂, 2000, dito; 6 ♂♂, 1.–15.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 2 ♂♂, 1.–27.viii.1992, dito; 1 ♂, 1.–15.vii.1991, dito; 1 ♂, 1.–15.vii.1992, dito; 1 ♂, 1.–20.viii.1991, dito; 1 ♂, 16.–31.vii.1991, dito; 2 ♂♂, 4.–16.viii.1990, dito; 2 ♂♂, 1.–15.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PJHS; 1 ♂, 1.–16.viii.1990, dito; 1 ♂, 15.–30.vi.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PJHS; 2 ♂♂, 1.–15.vii.1991, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PJHS; 1 ♂, 1.–20.viii.1991, dito; 2 ♂♂, 1.–27.viii.1992, dito; 3 ♂♂, 16.–31.vii.1990, dito; 8 ♂♂, 5.viii.1996, GR, Ftan, Clünas, 2050 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 1 ♂, 11.–14.viii.1988, GR, Lenzerheide, 1600 m, banana bait, leg. Bächli, coll. PGBA; 4 ♂♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2.vi.2000, GR, Marmorera, 1650 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 2000, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 8 ♂♂, 2004, dito; 3 ♂♂, 2005, dito; 5 ♂♂, 2004, dito; 1 ♂, 3.vi.2000, GR, Sur, 1550 m, net, leg. Bächli, coll. PGBA; 1 ♂, 4.viii.1996, GR, Zernez, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 2 ♂♂, 6.viii.1996, dito; 3 ♂♂, 5.viii.1996, GR, Zuoz, Nüd, 1600 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PGBA; 1 ♂, 26.vii.1997, TI, Fusio, 1200 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 4.–5.vii.2008, TI, Robiei, 1900 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 4.–5.vii.2008, TI, Robiei, 1900 m, net, leg. Bächli, coll. PJHS; 6 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 4 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 27.vii.2004, VS, Morgins, Portes du Soleil, 1850 m, net, leg. Bächli, coll. PGBA; 1 ♂, 21.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PJHS; 1 ♂, 31.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA.

Comments: These are the first records of *M. alpina* from Switzerland.

Meoneura atoma Papp, 1981

Material: **SWITZERLAND:** 4 ♂♂, 6.viii.1999, BE, Guttannen, 1000 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2004, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 20.vii.2010, GR, Davos, 2300 m, net, leg. Hauenstein, coll. PJHS; 1 ♂, 1.–24.viii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 1 ♂, 5.–30.vi.1990, dito; 1 ♂, 1.–24.viii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PJHS; 3 ♂♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 4 ♂♂, 4.–5.vii.2008, TI, Robiei, 1900 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 3.vii.2001, VS, Guttet, 1500–1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 8 ♂♂, 10.viii.2013, dito; 1 ♂, 28.v.2010, VS, Mörel, 1090 m, net, leg. Obrist, coll. PGBA; 1 ♂, 22.viii.2004, VS, Morgins, Portes du soleil, 1850 m, net, leg. Bächli, coll. PGBA; 1 ♂, 13.–15.viii.1975, VS, Oberwald, 1800 m, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 2.viii.1998, VS, Visperterminen, 800 m, net, leg. Bächli, coll. PGBA; 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA; 1 ♂, 4.viii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 21.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PJHS.

Comments: *Meoneura atoma* can be easily identified by comparing the post-abdomen with the original description of Papp (1981). The most obvious character is the very small lamella at the surstylus.

Meoneura elongella (Zetterstedt, 1838)

Material: **SWITZERLAND:** 1 ♀, 11.viii.1991, GR, Oberalppass, 1950 m, net, leg. Bächli, coll. PGBA.

Comments: Papp (1998) reported this specimen from Switzerland before but mentioned in a footnote that he couldn't reexamine it. This specimen represents the

only record from central Europe. *M. elongella* has only been reported from Norway, Sweden and Finland before (Deeming 1976, Kahanpää 2014, Zetterstedt 1838). Another female from Norway is in the collection of Stuke: 19.vii.2004, Vogelinsel Hornoya, 70° 23,13' N, 31° 09,34' E, 20 m, leg. Stuke. However, the status of this species remains uncertain because the identification is based on the dark colouration of the haltere only and males are not known yet. On the other hand there are valid *Meoneura* species known from the Nearctic Region (Sabrosky 1959) that are characterised by dark halteres.

Meoneura exigua Collin, 1930

Material: **FRANCE:** 1 ♂, 10.viii.2000, Haute-Savoie, Salève, Téléphérique, 1100 m, net, leg. Bächli, coll. PJHS. **SWITZERLAND:** 1 ♂, 6.vii.2000, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 7.viii.2000, GE, Bernex, Chante-Merle, 420 m, net, leg. Merz & Bächli, coll. PGBA; 3 ♂♂, 12.viii.2000, GE, Bernex, Tuilières, 420 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 7.viii.2000, GE, Bernex, Chante-Merle, 420 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 12.viii.2000, GE, Bernex, Tuilières, 420 m, net, leg. Bächli, coll. PJHS; 2 ♂♂, 9.viii.2000, GE, Cartigny, Moulin de Vert, 350 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 25.vii.2004, GE, Chancy, 350 m, net, leg. Bächli, coll. PGBA; 1 ♂, 7.viii.2000, GE, Chancy, La Laire, 350 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PJHS; 1 ♂, 1.viii.1998, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PGBA; 7 ♂♂, vii.1996, VS, Morgins, Viège, 700 m, cadavre, leg. Besuchet, coll. PGBA; 7 ♂♂, vii.1996, VS, Morgins, Viège, 700 m, leg. Besuchet, coll. PJHS; 1 ♂, 2005, ZH, Uitikon, 550 m, window trap, leg. Duelli, coll. PGBA.

Comments: *M. exigua* is widely distributed in Europe but has previously not been recorded from France nor Switzerland.

Meoneura falcata Papp, 1997

Material: **SWITZERLAND:** 1 ♂, 2000, GR, Davos, 2300 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 1.–15.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PJHS; 4 ♂♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA, PJHS; 1 ♂, 7.–13.viii.1993, VS, Bürenchen, 1600 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 16.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PJHS.

Comments: The postabdomen of this species is unique and cannot be confused with any other *Meoneura* species (cf. Papp 1997: 155, fig. 4). *M. falcata* might be an endemic species of the Alps.

Meoneura flavifacies Collin, 1930

Material: **CZECH REPUBLIC:** 2 ♂♂, 26.viii.1998, Borova Lada, net, leg. Bächli, coll. PGBA. **FRANCE:** 1 ♂, 10.viii.2000, Haute-Savoie, Salève, Observatoire, 1200 m, net, leg. Merz & Bächli, coll. PGBA; 2 ♂♂, 10.viii.2000, Haute-Savoie, Salève, Téléphérique, 1100 m, net, leg. Merz & Bächli, coll. PGBA. **LIECHTENSTEIN:** 5 ♂♂, 8.viii.1998, Ruggell, 450 m, leg. Bächli, coll. PGBA, PJHS. **MONTENEGRO:** 3 ♂♂, 30.vii.–5.viii.1988, Durmitor, banana bait, leg. Bächli, coll. PGBA. **SWITZERLAND:** 1 ♂, 2000, AG, Schlossrued, 500 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 2005, dito; 1 ♂, 2.viii.1998, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 6.–13.vii.2010, BL, Bubendorf, 623.54/253.54/FFI, 500 m, color trap, leg. Wolf, coll. PJHS; 1 ♂, 2000, BE, Rümligen, 700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2004, dito; 18 ♂♂, FR, Courlevon, 550 m, net, leg. Bächli, coll. PJHS; 51 ♂♂, 2004, FR, Courlevon, 550 m, window trap, leg. Duelli, coll. PGBA, PJHS; 2 ♂♂, 2000, FR, Nuvilly, 650 m, window trap, leg. Duelli, coll. PGBA; 13 ♂♂, 2004, dito; 1 ♂, 8.viii.2000, GE, Bernex, Signal, 510 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 12.viii.2000, GE, Bernex, Tuilières, 420 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 8.viii.2000, GE, Jussy GE, Prés de Villette, 475 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 9.ix.2000, GE, Rusin, Biolay, 360 m, net, leg. Merz & Bächli, coll. PGBA; 3 ♂♂, 2000, GL, Schwändital, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2004, dito; 1 ♂, 2000, GL, Schwändital, 2200 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 20.vii.1995, GL, Vorauen, 850 m, net, leg. Bächli, coll. PGBA; 1 ♂, 6.viii.1996, GR, Ardez, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 2004, GR, Davos, 2300

m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 1.–24.viii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 2 ♂♂, 1.–15.vii.1990, dito; 4 ♂♂, 16.–30.vi.1990, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 1 ♂, 1.–15.vii.1991, dito; 5 ♂♂, 1.–15.vii.1992, dito; 5 ♂♂, 1.–15.vii.1991, dito; 10 ♂♂, 1.–15.vii.1992, dito; 1 ♂, 1.–24.viii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 1 ♂, 1.–24.viii.1992, dito; 3 ♂♂, 15.–30.vi.1990, dito; 5 ♂♂, 16.–30.vi.1990, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 6 ♂♂, 1.–15.vii.1991, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PJHS; 3 ♂♂, 5.viii.1996, GR, Ftan, Clünas, 2050 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 6 ♂♂, 11.–14.viii.1988, GR, Lenzerheide, 1600 m, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 29.vii.1994, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA; 51 ♂♂, 8.viii.1998, dito; 1 ♂, 2005, GR, Nationalpark, 2200 m, net, leg. Bächli, coll. PJHS; 3 ♂♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 11.viii.1991, GR, Oberalppass, 1950 m, net, leg. Bächli, coll. PGBA; 25 ♂♂, 8.viii.1996, GR, Rothenbrunnen, 800 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 17.–20.viii.1988, GR, Savognin, 1400 m, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 3.vi.2000, GR, Sur, 1550 m, net, leg. Bächli, coll. PGBA, PJHS; 7 ♂♂, 7.viii.1996, GR, Gusch, Fortezza, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 28 ♂♂, 6.viii.1996, GR, Zerne, 1500 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 1 ♂, 2.–6.viii.(19)74, JU, Delémont, 600 m, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 2000, LU, Dierikon, 500 m, window trap, leg. Duelli, coll. PGBA, PJHS; 8 ♂♂, 2000, LU, Ruswil, 650 m, window trap, leg. Duelli, coll. PGBA, PJHS; 1 ♂, 13.vi.2004, LU, Sursee, 500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 18.viii.1992, SO, Balmberg, 600 m, net, leg. Bächli, coll. PGBA; 15 ♂♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PJHS; 3 ♂♂, 26.vii.1997, TI, Faido, 700 m, net, leg. Bächli, coll. PGBA; 1 ♂, 8.viii.1997, TI, Lucomagno, 1900 m, net, leg. Bächli, coll. PGBA; 11 ♂♂, 26.vii.2004, VD, La Dôle, 1500 m, net, leg. Bächli, coll. PGBA, PJHS; 2 ♂♂, 2000, VD, Senarclens, 600 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 27.–31.vii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 29.vii.–6.viii.1993, dito; 26 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 30 ♂♂, 3.vii.2001, dito; 33 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 22.vii.2004, VS, Leuk, Platten, 650 m, net, leg. Bächli, coll. PGBA; 1 ♂, 28.v.2010, VS, Mörel, 1090 m, leg. Obrist, coll. PGBA; 2 ♂♂, 21.vi.2014, VS, Mund, Finnen, 1400 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 25.vi.1999, VS, Pfynwald, 650 m, net, leg. Bächli, coll. PGBA; 1 ♂, 11.viii.2193, dito; 1 ♂, 2001, VS, Visp, 700 m, window trap, leg. Duelli, coll. PGBA; 2 ♂♂, 2004, dito; 1 ♂, 2000, dito; 1 ♂, 2004, VS, Visp, 700 m, window trap, leg. Duelli, coll. PJHS; 6 ♂♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 1 ♂, 31.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 2.viii.1998, dito; 1 ♂, 21.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA; 1 ♂, 22.vi.2014, VS, Zeneggen, 1500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2000, ZG, Steinhausen, 450 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2004, dito; 1 ♂, 2000, dito; 1 ♂, 2004, ZG, Steinhausen, 450 m, window trap, leg. Duelli, coll. PJHS.

Comments: The characters for identification of *M. flavifacies* are described in the diagnosis of *M. occulta*. *M. flavifacies* might be the most common European *Meoneura* species. The records from Montenegro, and Liechtenstein are the first published so far for these countries.

Meoneura flavifrons Papp, 1981

Material: SWITZERLAND: 1 ♂, 6.viii.1999, BE, Guttannen, 1000 m, leg. Bächli, coll. PGBA; 2 ♂♂, 6.viii.1999, BE, Guttannen, 1000 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2005, BE, Rümligen, 700 m, window trap, leg. Duelli, coll. PGBA; 6 ♂♂, 2004, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA, PJHS; 1 ♂, 2000, GR, Davos, 2300 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2006, dito; 1 ♂, 2004, dito; 2 ♂♂, 2000, GR, Davos, 2300 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 2004, dito; 3 ♂♂, 1.–24.viii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 1 ♂, 16.–30.vi.1990, dito; 1 ♂, 1.–16.viii.1990, dito; 3 ♂♂, 1.–15.vii.1991, dito; 5 ♂♂, 1.–15.vii.1991, dito; 1 ♂, 1.–27.viii.1992, dito; 12 ♂♂, 1.–15.vii.1991, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 70 ♂♂, 1.–15.vii.1992, dito; 1 ♂, 1.–16.viii.1990, dito; 36 ♂♂, 1.–24.viii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 9 ♂♂, 1.–25.vii.1990, dito; 3 ♂♂, 1.–27.viii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 17 ♂♂, 15.–30.vi.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 1 ♂, 16.–30.vi.1990, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 2 ♂♂, 16.–31.vii.1991, dito; 2 ♂♂, 16.–31.vii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 2 ♂♂, 16.–31.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 2 ♂♂, 1.–16.viii.1990, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PJHS; 9 ♂♂, 1.–15.vii.1991, dito; 1 ♂, 15.–30.vi.1990, dito; 1 ♂,

30.v.–24.vii.1979, GR, Dischmatal, 1800 m, leg. Wartmann, coll. PGBA; 42 ♂♂, 5.viii.1996, GR, Ftan, Clünas, 2050 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 3 ♂♂, 8.viii.1998, GR, Lenzerheide, 1600 m, leg. Bächli, coll. PGBA; 1 ♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2000, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2001, dito; 8 ♂♂, 2004, dito; 2 ♂♂, 2000, dito; 1 ♂, 2005, dito; 10 ♂♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PJHS; 2 ♂♂, 3.vi.2000, GR, Sur, 1550 m, net, leg. Bächli, coll. PGBA, PJHS; 2 ♂♂, 6.viii.1996, GR, Zernez, 1500 m, net, leg. Merz & Bächli, coll. PJHS, PGBA; 21 ♂♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 8.viii.1997, TI, Lucomagno, 1900 m, net, leg. Bächli, coll. PGBA; 20 ♂♂, 4.–5.vii.2008, TI, Robiei, 1900 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 24.vii.2012, UR, Furkapass, Alpfor aerea 11.2, 2400 m, net, leg. Bächli, coll. PJHS; 3 ♂♂, 23.vii.2012, UR, Furkapass, ALPFOR area 4.1, 2400 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 26.vii.2004, VD, La Dôle, 1500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2.vii.2000, VS, Bürchen, 1600 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 1.vii.2001, VS, Guttet, 1500–1600 m, net, leg. Bächli, coll. PGBA; 8 ♂♂, 3.vii.1991, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PJHS; 4 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, leg. Bächli, coll. PGBA; 21 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 20 ♂♂, 3.vii.2001, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 26.vi.2004, dito; 4 ♂♂, 10.viii.2013, dito; 1 ♂, 23.viii.–2.ix.1977, VS, Leuk, 800 m, canopy trap, leg. Bächli, coll. PGBA; 5 ♂♂, 28.vii.2004, VS, Morgins, Portes de Culet, 1700 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 27.vii.2004, VS, Morgins, Portes du soleil, 1850 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 13.–15.viii.1975, VS, Oberwald, 1800 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, leg. Merz & Bächli, coll. PGBA.

Comments: *M. flavifrons* has an unique surstylus as illustrated by Papp (1981: 185) and can be easily identified. In addition to former records from the Alps (Stockner 1980, Papp 1981, 1998). *M. flavifrons* has only been recorded from Spain and Great Britain so far (Carles-Tolrá *et al* 1993, Grayson 2009).

Meoneura freta Collin, 1930

Material: **SWITZERLAND:** 1 ♂, 1.viii.1996, GR, Rothenbrunnen, 800 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 8.viii.1996, GR, Rothenbrunnen, 800 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 1.vii.2001, VS, Grône, Poutafontana, 500 m, net, leg. Bächli, coll. PGBA; 5 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 5 ♂♂, 3.viii.1998, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 11 ♂♂, vii.1996, VS, Morgins, Viège, 700 m, leg. Besuchet, coll. PGBA, PJHS; 1 ♂, 2004, VS, Visp, 700 m, window trap, leg. Duelli, coll. PGBA; 3 ♂♂, 2.viii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PGBA, PJHS.

Meoneura glaberrima Becker, 1907

Material: **AUSTRIA:** 1 ♂, 16.–31.vii.1977, Purgstall, leg. Hüttinger, coll. PJHS. **MONTENEGRO:** 34 ♂♂, 30.vii.–5.viii.1988, Durmitor, banana bait, leg. Bächli, coll. PGBA, PJHS. **SERBIA:** 1 ♂, viii.1993, Gradište, net, leg. Kekič, coll. PGBA. **SWITZERLAND:** 1 ♂, 1.–15.vii.1990, GR, Dischmatal, 1800 m, color trap, leg. Brodmann, coll. PGBA; 1 ♂, 1.–15.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 1 ♂, 7.viii.1996, GR, Susch, Fortezza, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 15.–18.viii.1978, GR, Zernez, 1500 m, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 4.viii.1996, GR, Zernez, 1500 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 2 ♂♂, 6.viii.1996, dito; 1 ♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PGBA; 1 ♂, 4.–5.vii.2008, TI, Robiei, 1900 m, net, leg. Bächli, coll. PGBA; 1 ♂, 17.–19.viii.1993, VS, Bürchen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 29.vii.–6.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 27.–31.vii.1993, dito; 1 ♂, 3.vii.2001, VS, Guttet, 1500–1600 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 24 ♂♂, 3.vii.2001, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 20 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 10.viii.2013, dito; 17 ♂♂, 25.vi.1999, VS, Leuk, Brentjong, 900 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 19.v.1996, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 1.viii.1998, VS, Leuk, Platten, 650 m, net, leg. Bächli, coll. PGBA; 1 ♂, 22.vii.2004, VS, Leuk, Platten, 650 m, net, leg. Bächli, coll. PJHS; 6 ♂♂, 19.v.1996, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 28.v.2010, VS, Mörel / 4, 1090 m, leg. Obrist, coll. PGBA; 1 ♂, 27.vii.2004, VS, Morgins, Portes du Soleil, 1850 m, net, leg. Bächli, coll. PJHS; 1 ♂, 28.vii.2004, VS, Morgins, Têtes, 1500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 20.vi.2014, VS, Naters, Geimen, 1100 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2004, VS, Visp, 700 m, window trap, leg. Duelli, coll. PGBA; 46 ♂♂, 21.vii.2004, VS, Visperterminen, 1300–2300 m, net,

leg. Bächli, coll. PGBA, PJHS; 1 ♂, 31.vii.2004, dito; 1 ♂, 22.vi.2014, VS, Zeneggen, 1500 m, net, leg. Bächli, coll. PGBA.

Comments: This species has been reported as *M. neglecta* Collin, 1930 from Switzerland by Papp (1998). However, *M. neglecta* was synonymised with *M. glaberrima* by Ozerov (1994). *M. glaberrima* is published herewith for the first time from Austria, Montenegro and Serbia.

Meoneura helvetica Papp, 1997

Material: **MONTENEGRO:** 10 ♂♂, 30.vii.–5.viii.1988, Durmitor, banana bait, leg. Bächli, coll. PGBA, PJHS. **SWITZERLAND:** 1 ♂, 6.viii.1999, BE, Guttannen, 1000 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2000, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PJHS; 4 ♂♂, 5.viii.1996, GR, Ftan, Clünas, 2050 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 1 ♂, 11.–14.viii.1988, GR, Lenzerheide, 1600 m, banana bait, leg. Bächli, coll. PGBA; 3 ♂♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2005, dito; 5 ♂♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 7.viii.1996, GR, S-chanf, Flin, 1700 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 15.–18.viii.1978, GR, Zerne, 1500 m, banana bait, leg. Bächli, coll. PJHS; 3 ♂♂, 7.viii.1996, GR, Zuoz, Nüd, 1600 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 26.vii.2004, VD, La Dôle, 1500 m, net, leg. Bächli, coll. PJHS; 4 ♂♂, 29.vii.–6.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 27.–31.vii.1993, dito; 1 ♂, 29.vii.–6.viii.1993, dito; 1 ♂, 2.–3.viii.1993, VS, Guttet, 1400 m, banana bait, leg. Bächli, coll. PJHS; 7 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 2 ♂♂, 23.viii.–2.ix.1977, VS, Leuk, 800 m, banana bait, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 19.v.1996, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PJHS; 2 ♂♂, 27.vii.2004, VS, Morgins, Portes du soleil, 1850 m, net, leg. Bächli, coll. PGBA; 5 ♂♂, 13.–15.viii.1975, VS, Oberwald, 1800 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 13.–15.viii.1975, VS, Oberwald, 1800 m, banana bait, leg. Bächli, coll. PJHS; 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PJHS; 6 ♂♂, 21.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 31.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA.

Comments: *M. helvetica* is easily recognised by the characteristic shape of the surstylus as illustrated in the original description (Papp 1997: 155). Besides the type specimens from Switzerland, the species has previously only been reported from Spain (Carles-Tolrá & Ventura 2001).

Meoneura lacteipennis (Fallén, 1823)

Material: **GERMANY:** 1 ♂, 28.v.2011, Baden-Württemberg, Oberbergen, net, leg. Bächli, coll. PGBA. **SWITZERLAND:** 1 ♂, 2001, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA; 4 ♂♂, 2.vi.2000, GR, Marmorea, 1650 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 2.vi.2000, GR, Marmorera, 1650 m, net, leg. Bächli, coll. PJHS; 1 ♂, 2005, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 2.vi.2000, GR, Sur, 1550 m, net, leg. Bächli, coll. PJHS; 1 ♂, 3.vi.2000, GR, Sur, 1550 m, net, leg. Bächli, coll. PGBA; 7 ♂♂, 4.–5.vii.2008, TI, Robiei, 1900 m, net, leg. Bächli, coll. PGBA, PJHS; 2 ♂♂, 27.vii.1997, TI, Val Bavona, 800 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 2.vii.2001, VS, Bürchen VS, 1500–1650 m, net, leg. Bächli, coll. PJHS; 3 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 3.vii.2001, dito; 1 ♂, 16.v.1996, VS, Leuk, Brentjong, 900 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 28.v.2010, VS, Mörel / 1, 850 m, leg. Obrist, coll. PJHS; 1 ♂, 27.vii.2004, VS, Morgins, Portes du soleil, 1850 m, net, leg. Bächli, coll. PJHS; 1 ♂, 2.viii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PGBA.

Meoneura longifurca Papp, 1997

Material: **SWITZERLAND:** 1 ♂, 2001, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 7.viii.1996, GR, Zuoz, Nüd, 1600 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 29.vii.–6.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 2 ♂♂, 10.viii.2013, dito.

Comments: The species is well characterised by the shape of the surstylus as figured by Papp (1997: 153). *M. longifurca* has previously only been reported in the original description and all records known so far are from Switzerland.

***Meoneura milleri* Gregor, 1973**

Material: **SWITZERLAND:** 7 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 14 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 31.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2.viii.1998, dito.

Comments: The structure of the postabdomen as illustrated by Gregor (1973) is unique. The first records of *M. milleri* from Switzerland are surprising because this rarely found species has only been recorded from Spain, Slovakia and the Czech Republic before (Carles-Tolrá & Báez 2002, Gregor & Papp 1981).

***Meoneura minutissima* (Zetterstedt, 1860)**

Material: **FRANCE:** 1 ♂, 10.viii.2000, Haute-Savoie, Salève, Téléphérique, 1100 m, net, leg. Merz & Bächli, coll. PJHS. **SWITZERLAND:** 1 ♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 10.viii.2013, dito; 1 ♂, 16.v.1996, VS, Leuk, Rotafen, 900 m, net, leg. Merz & Bächli, coll. PGBA.

Comments: *M. minutissima* is widely distributed in Western Europe. It has been reported from Switzerland by Papp (1998) but has not been recorded from France before.

***Meoneura moravica* Gregor & Papp, 1981**

Material: **SWITZERLAND:** 1 ♂, 9.viii.2000, GE, Cartigny, Moulin de Vert, 350 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 25.vii.2004, GE, Chancy, La Laire, 350 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 28.vii.2004, VS, Morgins, Têtes, 1500 m, net, leg. Bächli, coll. PJHS.

Comments: *M. moravica* is easily recognised by (i) the broad surstylus that becomes narrower basally and that has no obvious setae, (ii) the lack of a lamella attached to the surstylus and (iii) the lack of strong, outstanding setae at the epan-drium. Contrary to the original description (based on two males only) the specimens reported here have the surstylus not directed medially. The fore femur has 1–3 strong setae anteroventrally and the frontal triangle reaches almost up to the anterior margin of the frons. The paratype of *M. moravica* that should be stored at the Hungarian Natural History Museum (Budapest) is lost (Soltész *in litt.*). The holotype has been sent to JHS for comparison from Moravske Muzeum [Moravian Museum], Brno, Czech Republic. The specimen is stored in alcohol in a plastic tube without any label and additionally there is another tube with alcohol in which the original labels are stored: (a) «32 Podhradi / 6.VII.59 / F. Gregor»; (b) «*Meoneura / moravica* / holotype ♂ / det. L. Papp». The postabdomen of the holotype is dissected but has not been included in one of the tubes. It is therefore probably lost and cannot be compared. Contrary to the original description the holotype has a frontal triangle that reaches almost to the anterior margin of the frons and the fore femur has two strong posteroventral setae only. In these characters the holotype fits well the material from Switzerland.

First record from Switzerland. After the description from the Czech Republic (Gregor & Papp 1981), *M. moravica* has only been reported from Spain so far (Carles-Tolrá 1992, 2004).

***Meoneura neottiophila* Collin, 1930**

Material: ITALY: 1 ♂, 29.vii.–3.viii.2000, Bormio, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 29.vii.–3.viii.2000, Bormio, banana bait, leg. Bächli, coll. PJHS. LIECHTENSTEIN: 1 ♂, 8.viii.1998, Ruggell, 450 m, leg. Bächli, coll. PGBA. SWITZERLAND: 2 ♂♂, viii.–ix.1995, GE, Sézenove, 450 m, canopy trap, leg. Besuchet, coll. PGBA; 4 ♂♂, vii.–ix.1997, GE, Vandoevres, 450 m, canopy trap, leg. Besuchet, coll. PGBA, PJHS; 1 ♂, 7.viii.1996, GR, Susch, Fortezza, 1500 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 16.v.1996, VS, Leuk, Brentjong, 900 m, net, leg. Merz & Bächli, coll. PGBA; 2 ♂♂, 15.v.1986, VS, Pfynwald, 650 m, net, leg. Merz & Bächli, coll. PGBA; 4 ♂♂, 2.–22.viii.1997, ZH, Dietikon, 550 m, canopy trap, leg. Bächli, coll. PJHS.

Comments: *M. neottiophila* is widely distributed in Western Europe but is reported here for the first time from Italy and Liechtenstein.

***Meoneura obscurella* (Fallén, 1823)**

Material: FRANCE: 1 ♂, 28.viii.–1.ix.1957, Rennes, banana bait, leg. Burla, coll. PGBA. SWITZERLAND: 1 ♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA.

Comments: Surprisingly the Holarctic *M. obscurella* was not recorded from Switzerland and France before.

***Meoneura occulta* Stuke spec. nov.**

(Figs 1–4)

Material: Holotype ♂: (1) «CH: Jeizinen VS / 10.VIII.2013 / G. Bächli leg.»; (2) Holotypus / *Meoneura occulta* ♂ / spec. nov. / det. Stuke, 2015».

Paratypes: SWITZERLAND: 6 ♂♂ with the same data as holotype, coll. PGBA, PJHS; 2 ♂♂ with the same data as holotype but collecting date 26.vi.1999, coll. PGBA, PJHS.

The holotype is deposited in PGBA. Abdomen dissected, macerated and stored in glycerine in a microvial pinned beneath the specimen. The left fore leg is missing but otherwise the holotype is in a good condition.

Diagnosis: *M. occulta* belongs to the *Meoneura flavifacies* species group that is characterised by a simple surstylus with at most a few scattered hairs and with a fused lamella, the lack of obvious strong setae on the epandrium, the lack of tufts of long hairs or setae at the postabdomen, and 3 dorsocentral setae. Several species of this group have a more or less yellow frons and are therefore distinguished from *M. occulta*. *M. occulta* is easily confused with *M. carpathica* and *M. pappi* spec. nov. that might have a completely black frons, too. However, *M. occulta* is distinguished from all other *Meoneura* species by the combination of characters shown in Figs 1–4: epandrium with one pair of outstanding but not strong setae; surstylus moderately long, neither very broad nor very long, pointed anteriorly and with 2–3 long hairs dorsobasally; lamella elongated, almost as long as surstylus, and distinctly fused with the surstylus basally; postgonite straight and pointed, not bent like a hook apically; distiphallus quite long, with obviously dense brown microchaeta; sternite 5 parallel sided, hardly widened posteriorly; scutum not completely microtomentose (dusted) but shining or subshining posterolaterally and here contrasting to the microtomentose central part. A key to separate the similiar species of the *Meoneura flavifacies* group is given below.

Description of the holotype (male): Length about 1.4 mm. Wing length = 1.2 mm. Head height = 0.4 mm.

Head completely black, except for very narrow dark brown anterior margin of frons. Antenna black. Arista without pubescence. Eye with scattered short ommatrichia. Maximum eye length : maximum eye height = 1.1. Posteroventral margin of gena to closest eye margin: maximum eye height = 0.4. Frons not microtomen-

tose. Frontal triangle reaching anteriorly about half distance of anterior ocellus to frontal margin. Face shining. Carina small. Postcranium slightly microtomentose. Prementum as long as labellum and distinctly wider. Palpus brown, about half as long as the haustellum. 1 pair of distinct ocellar setae. Supralunular setae cruciate. 4 fronto-orbital setae, the 2 anterior mesocline, the 2 posterior laterocline. 2 vertical setae. Postorbital setae not found in holotype but parallel in paratypes. 1 strong vibrissal seta. 2 supravibrissal setae, the ventral one distinctly smaller. 3 strong genal setae, the posterior smaller than the two anterior.

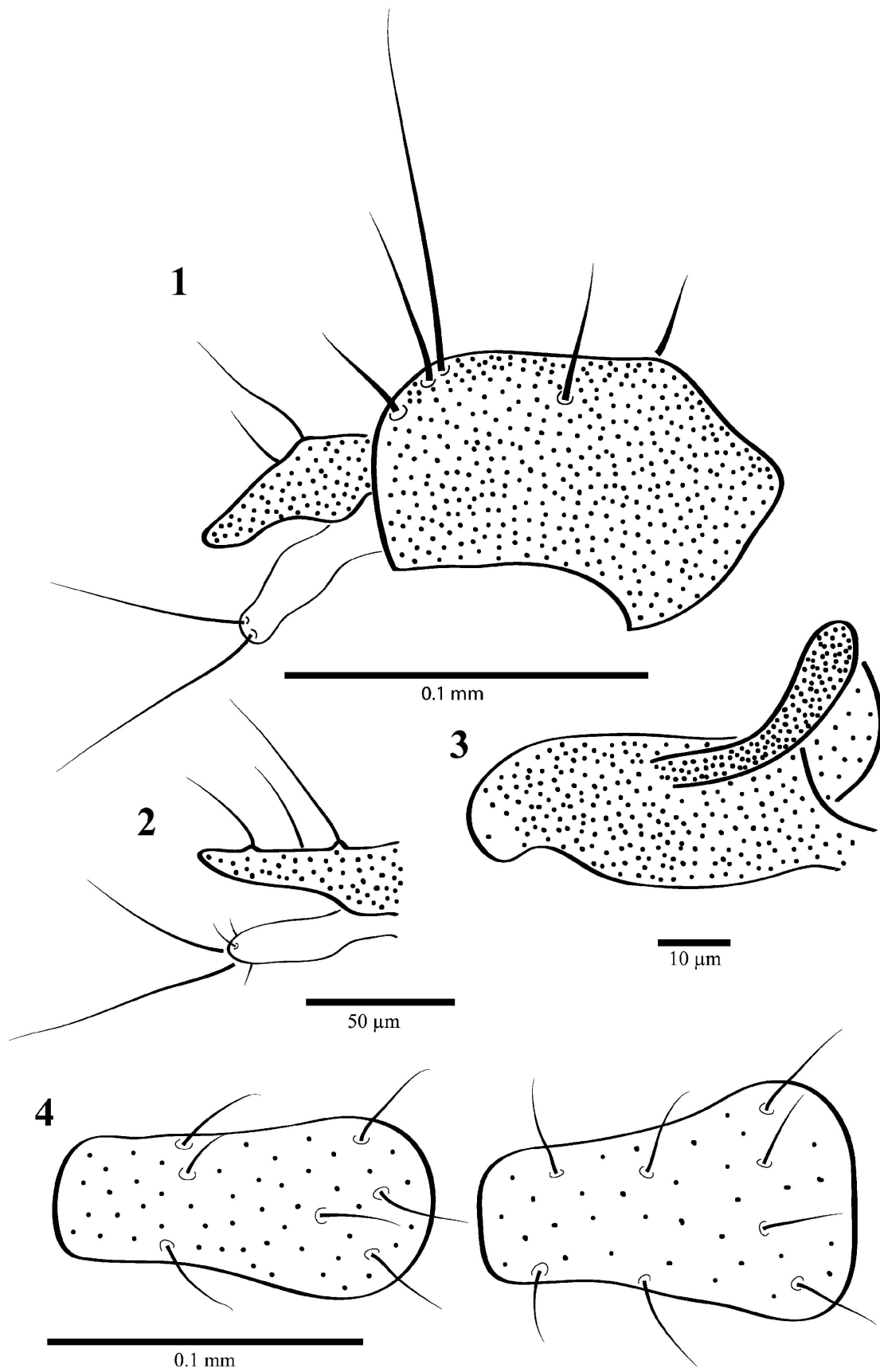
Scutum mainly microtomentose but shining posterolaterally. Scutum covered with semiadpressed black hairs. Scutellum microtomentose, with one additional lateral scutellar seta. Pleura shining, only anepimeron obviously microtomentose. Scutum with 3 dorsocentral setae, only the posterior long and distinct. 2 setae on postpronotum; 1 praesutural seta; 2 notopleural setae; 1 supraalar seta; 2 postalar setae; 1 praescutellar seta; 1 apical and 1 lateral scutellar seta. 1 seta on posterior margin of anepisternum. Katepisternum with one dorsal and one ventral seta. Wing completely covered with microtrichia. Costa without setae beyond radial vein r_1 . Wing hyaline, veins light brown to whitish. Base of haltere brown, knob of haltere whitish. Legs black to brown. Fore femur apically with 2 strong posteroventral setae. Hind femur apically with 1 strong anteroventral seta. Coxa without obvious setae.

Tergites without obvious depressions or hair tufts. Abdominal pleura with several setae on segments 3–5. Segments 1–5 narrow, width of tergite 3 : length of tergite 3 = 3.3. Protandrium short, about as long as epandrium and about $\frac{1}{2}$ of length of tergite 5. Tergites 3–5 each with a lateral seta at the posterior margin, tergite 5 additionally with 4 pairs of long setae at posterior margin. Midventral tergite 7 distinctly developed. Sternite 5 small, about as broad as sternite 4, parallel sided, and slightly longer than wide (Fig. 4). Sternite 5 with a few scattered hairs only. Epandrium with a few hairs and one longer seta close to the surstylus (Fig. 1). Maximum length in the middle of epandrium : maximum width of epandrium = 0.6. Cerci distinct, not obviously projecting, and with a few hairs only. Subepandrial sclerites slightly sclerotized, triangular, fused with each other and with the hypoproct to a subepandrial plate. Subepandrial sclerites without any hairs. Hypoproct slightly sclerotized, not projecting out of the epandrium, with several small hairs. No tooth in the middle of the subepandrial plate. Surstylus as in Fig. 2: small, not forked apically, with a pointed tip. Surstylus dorsobasally with 1–3 distinct hairs; apically with one long medially directed hair. Lamella elongated, about as long as surstylus. Lamella apically with 2–3 hairs, the longest of these is about as long as the lamella. Lamella and surstylus broadly fused at their bases. Postgonite as Fig. 3: slightly sclerotized, with a broad base, slightly elongated, hardly pointed, not bent like a hook. Distiphallus elongated, about twice the length of epandrium. Distiphallus with dense brown hairs but without any sclerotisation.

Variability: One paratype specimen is more microtomentose with a completely microtomentose scutum and slightly microtomentose pleura. All paratypes have two postalar setae and one additional lateral scutellar seta.

Etymology: From the latin «occultus» (hidden), describing that this species was overlooked and confused with similar species before.

Distribution: Up to date *M. occulta* is only known from the locus typicus that is situated in the Canton Valais (VS) at an altitude of about 1500 m. All specimens were netted from flowers, in particular from Apiaceae.



Figs 1–4. *Meoneura occulta* Stuke spec. nov. (drawn after holotype). — 1. Lateral view of epandrium and surstylus. — 2. Lateral view of surstylus and lamella. — 3. Lateral view of postgonite. — 4. Ventral view of sternite 4 (left) and sternite 5 (right).

Key to the species of the Meoneura flavifacies species group with a thin, moderately long surstylus and a distinct lamella.

- 1 Surstylus with distinct hairs dorsobasally (Fig. 2); postgonite straight or slightly bent and pointed, not bent like a hook apically (Fig. 3) **2**
- Surstylus without hairs dorsobasally (Fig. 5); postgonite bent like a hook apically (Fig. 7) **4**
- 2 Lamella elongated, almost as long as surstylus, and distinctly merged with the surstylus basally; epandrium with one pair of outstanding but not strong setae; sternite 5 parallel sided, hardly widened posteriorly; frons completely black; scutum usually distinctly shining posterolaterally and clearly contrasting to the microtomentose medial part ***occulta* spec. nov.**
- Lamella not elongated, almost half as long as surstylus, and not merged with the surstylus basally; epandrium without distinct outstanding setae; shape of sternite 5 variable; frons black or anteriorly yellow to yellow orange; scutum completely microtomentose **3**
- 3 Frons anteriorly broadly yellow, face and usually parts of the gena yellow; sternite 5 widened posteriorly ***pseudoflavifacies* Papp, 1997**
- Frons completely black or at most with a very small brown to orange anterior margin, face and gena black; sternite 5 parallel sided, hardly widened posteriorly ***carpathica* Papp, 1977**
- 4 Frons anteriorly broadly yellow, face and parts of the gena usually yellow; epandrium with less dense long hairs; lamella longer than half the length of surstylus; a few of the hairs on lamella distinctly longer than lamella ***flavifacies* Collin, 1930**
- Frons black or with narrow orange brown anterior margin, face and gena completely black; epandrium with a fringe of dense long hairs (Fig. 6); lamella about as long as half the length of surstylus (figs. 5, 8); hairs on lamella hardly longer than lamella (Fig. 8) ***pappi* spec. nov.**

***Meoneura pappi* Stuke spec. nov.**

(Figs 5–9)

Material: Holotype ♂: (1) «D: Schelingen /BW / 28.V.2011 / G. Bächli leg.»; (2) Holotypus / *Meoneura pappi* ♂ / spec. nov. / det. Stuke, 2015».

Paratypes: **CZECH REPUBLIC:** 50 ♂♂, 26.viii.1996, Borova Lada, net, leg. Bächli, coll. PGBA. **FRANCE:** 18 ♂♂, 10.viii.2000, Haute-Savoie, Salève, Téléphérique, 1100 m, net, leg. Merz & Bächli, coll. PGBA, PJHS. **GERMANY:** 15 ♂♂, 28.v.2011, Baden-Württemberg, Oberbergen, net, leg. Bächli, coll. PGBA, PJHS; 57 ♂♂, 28.v.2011, Baden-Württemberg, Schelingen, net, leg. Bächli, coll. PGBA, PJHS. **SWITZERLAND:** 2 ♂♂, 2004, BE, Beatenberg, 1600 m, window trap, leg. Duelli, coll. PGBA, PJHS; 59 ♂♂, 6.viii.1999, BE, Guttannen, 1000 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 25.vii.2004, GE, Chancy, La Laire, 350 m, net, leg. Bächli, coll. PJHS; 1 ♂, 15.viii.2001, GL, Elm Wichlen, 1300 m, net, leg. Bächli, coll. PGBA; 1 ♂, 20.–21.vii.1991, GL, Richisau, 1150 m, net, leg. Bächli, coll. PJHS; 5 ♂♂, 2000, GL, Schwändital, 2200 m, window trap, leg. Duelli, coll. PGBA, PJHS; 2 ♂♂, 2004, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2006, GR, Davos, 2300 m, window trap, leg. Duelli, coll. PJHS; 3 ♂♂, 1.–15.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PGBA; 1 ♂, 1.–16.viii.1990, dito; 1 ♂, 1.–15.vii.1992, GR, Dischmatal, 1800 m, net, leg. Brodmann, coll. PJHS; 8 ♂♂, 5.viii.1996, GR, Ftan, Clüinas, 2050 m, net,

leg. Merz & Bächli, coll. PGBA; 6 ♂♂, 11.–14.vii.1988, GR, Lenzerheide, 1600 m, det. as *M. flavifacies* by Papp (1996), banana bait, leg. Bächli, coll. PGBA; 1 ♂, 11.–14.viii.1988, GR, Lenzerheide, 1600 m, banana bait, leg. Bächli, coll. PJHS; 50 ♂♂, 8.viii.1988, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA; 34 ♂♂, 8.viii.1998, dito; 1 ♂, 2005, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 2 ♂♂, 2004, dito; 1 ♂, 11.viii.1991, GR, Oberalppass, 1950 m, net, leg. Bächli, coll. PJHS; 1 ♂, 8.viii.1996, GR, Rothenbrunnen, 800 m, det. as *M. flavifacies* by Papp (1996,) net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 17.–20.viii.1988, GR, Savognin, 1400 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 17.–20.vii.1988, dito; 2 ♂♂, 7.viii.1996, GR, Susch, Fortezza, 1500 m, as *M. flavifacies* det. Papp 1996, net, leg. Merz & Bächli, coll. PGBA, PJHS; 5 ♂♂, 4.viii.1996, GR, Zernez, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 16 ♂♂, 6.viii.1996, dito; 6 ♂♂, 28.vi.2003, JU, La Chaux-des-Breuleux, 950 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2000, SZ, Alptal, 1000 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 2000, SZ, Alptal, 1000 m, window trap, leg. Duelli, coll. PGBA; 3 ♂♂, 18.viii.1992, SO, Balmberg, 600 m, det. as *M. flavifacies* by Papp (1996), net, leg. Bächli, coll. PGBA; 1 ♂, 18.viii.1992, SO, Balmberg, 600 m, leg. Bächli, coll. PJHS; 7 ♂♂, 18.viii.1992, SO, Balmberg, 600 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 27.vii.1997, TI, Val Bavona, 800 m, net, leg. Bächli, coll. PGBA; 96 ♂♂, 26.vii.2004, VD, La Dôle, 1500 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 27.vii.2004, VD, La Dôle, 1500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 7.–13.viii.1993, VS, Bürchen, 1600 m, det. as *M. flavifacies* by Papp (1996), banana bait, leg. Bächli, coll. PGBA; 1 ♂, 7.–16.viii.1993, dito; 1 ♂, 2.vii.2000, VS, Bürchen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 7.–13.viii.1993, VS, Bürchen VS, 1500–1650 m, banana bait, leg. Bächli, coll. PJHS; 1 ♂, 2.vii.2001, VS, Bürchen VS, 1500–1650 m, net, leg. Bächli, coll. PJHS; 2 ♂♂, 29.vii.–6.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 1.vii.2001, VS, Guttet, 1500–1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 29.vii.–6.viii.1993, VS, Guttet, 1400 m, banana bait, leg. Bächli, coll. PJHS; 25 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 26.vi.1999, dito; 9 ♂♂, 3.vii.2001, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 26.vi.2004, dito; 12 ♂♂, 10.viii.2013, dito; 11 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, leg. Bächli, coll. PJHS; 1 ♂, 23.viii.–2.ix.1977, VS, Leuk, 800 m, banana bait, leg. Bächli, coll. PJHS; 4 ♂♂, 28.vii.2004, VS, Morgins, Portes de Culet, 1700 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 27.vii.2004, VS, Morgins, Portes du Soleil, 1850 m, net, leg. Bächli, coll. PGBA; 45 ♂♂, 28.vii.2004, VS, Morgins, Têtes, 1500 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 28.vii.2004, VS, Morgins, Portes de Culet, 1700 m, net, leg. Bächli, coll. PJHS; 7 ♂♂, 26.vii.2004, VS, Morgins, Portes du soleil, 1850 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 27.vii.2004, VS, Morgins, Portes du soleil, 1850 m, net, leg. Bächli, coll. PJHS; 13 ♂♂, 28.vii.2004, VS, Morgins, Têtes, 1500 m, net, leg. Bächli, coll. PJHS; 1 ♂, 27.vii.2004, VS, Morgins, Vieze, 1500 m, net, leg. Bächli, coll. PJHS; 1 ♂, 21.vi.2014, VS, Mund, Finnen, 1400 m, net, leg. Bächli, coll. PGBA; 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2.viii.1998, dito; 1 ♂, 21.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PJHS; 1 ♂, 31.vii.2004, VS, Visperterminen, 1300–2300 m, net, leg. Bächli, coll. PGBA. Additional Nearctic material from the Canadian National Collection of Insects, Ottawa (CNC): **CANADA**: 1 ♂, 27.vii.1973, British Columbia, Mt. Whister, 1520 m, leg. J. R. Vockeroth; 1 ♂, 4.vii.1952, Manitoba, Fort Churchill, leg. J. G. Chillcott; 1 ♂, 15.vii.1958, Manitoba, Ninette, leg. J. G. Chillcott; 1 ♂, 28.v.1923, Québec, Aylmer, leg. C. H. Curran; 34 ♂♂, 16.vii.1960, Yukon, Otter Lake, 4000' [62°30'N 130°25'W], malaise trap, leg. J. E. H. Martin; 2 ♂♂, 20.vi.1960, Yukon, Ross River, 3000' [61°56'N 132°30'W], leg. J. E. H. Martin. **USA**: 1 ♂, 23.vii.1961, Colorado, Echo L., Mt. Evans, 10.600', leg. C. H. Mann; 1 ♂, 22.vii.1961, Colorado, Mt. Evans, Timberline II, 700', leg. C. H. Mann.

The holotype is deposited in PGBA. The abdomen is not dissected due to the perfect everted genital structures. The pinned holotype is in a very good condition.

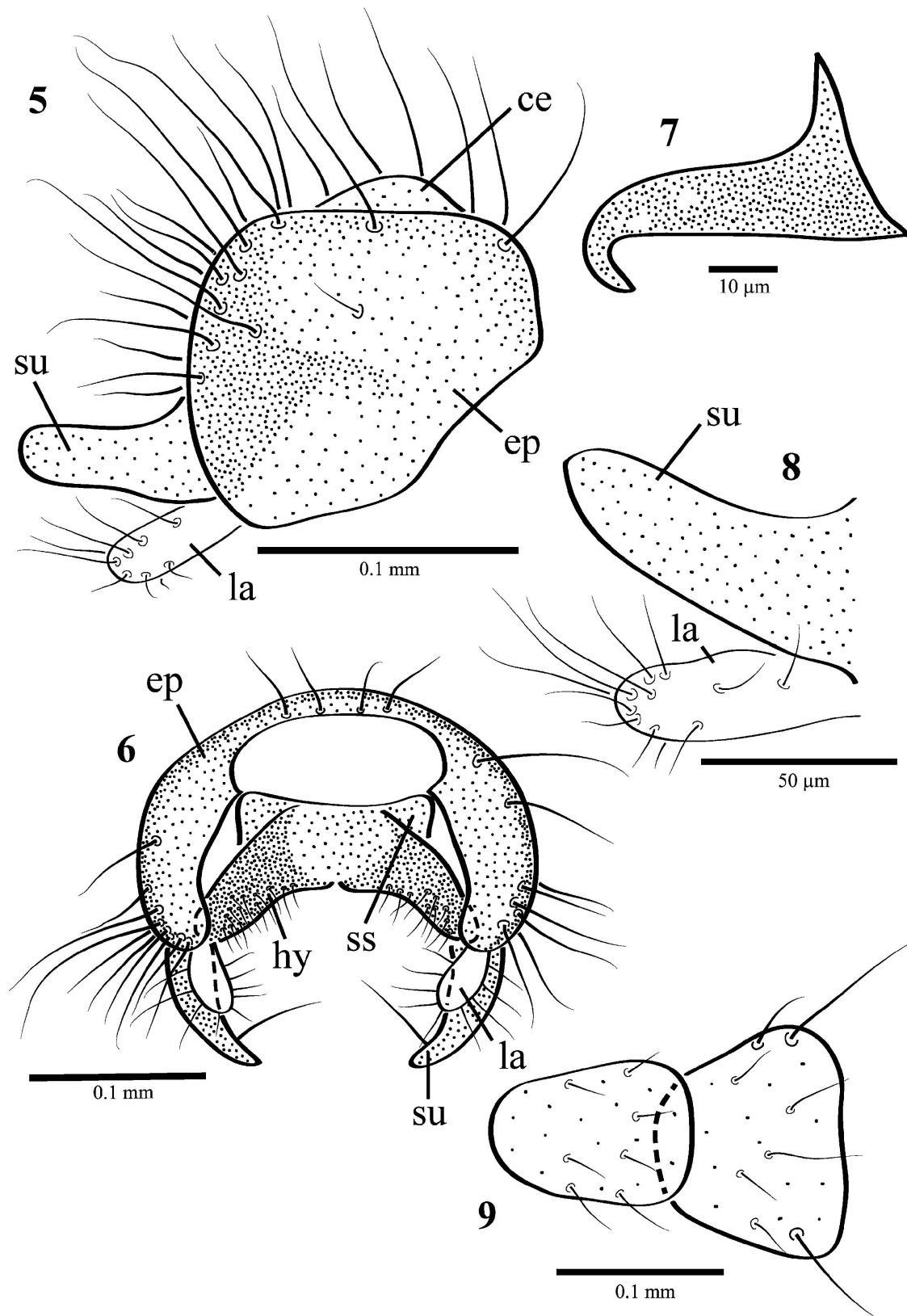
Diagnosis: *M. pappi* belongs to the *Meoneura flavifacies* species group as defined in the diagnosis of *Meoneura occulta*. It is another species of this group with almost completely black frons and a black face and therefore is very similar to *M. carpathica* and *M. occulta*. However it is easily distinguished from these two species by the postgonite that is bent like a hook apically, the lack of hairs dorsobasally at the surstylus and the hair fringe on the epandrium. The completely microtomentose scutum and the lamella that is not fused with the surstylus basally and that is about half as long as the surstylus are two additional characters to distinguish *M. pappi* from *M. occulta*. The identification is summarised in the key for the *Meoneura flavifacies* group given in the description of *M. occulta*.

Description of the holotype (male): Length about 1.5 mm. Wing length = 1.5 mm. Head height = 0.3 mm.

Head completely black, the anterior margin of the frons inconspicuous dark brown. Antenna black. Arista without pubescence. Eye with scattered short ommatrichia. Maximum eye length : maximum eye height = 0.7. Posteroventral margin of gena to closest eye margin : maximum eye height = 0.3. Frons slightly microtomentose, frontal triangle shiny. Frontal triangle reaching anteriorly about half distance of anterior ocellus to frontal margin. Face slightly microtomentose. Carina small. Postcranium slightly microtomentose. Prementum as long as labellum and distinctly wider. Palpus brown, about as long as the haustellum. 1 pair of distinct ocellar setae. Supralunular setae cruciate. 4 fronto-orbital setae, the 2 anterior meso-clinate, the 2 posterior latero-clinate. 2 vertical setae. Postorbital setae parallel. 1 strong vibrissal seta. 2 supravibrissal setae, the ventral one distinctly smaller. 3 strong genal setae.

Scutum completely microtomentose. Scutum covered with semiadpressed black hairs. Scutellum microtomentose. Pleura shining, only hind margin of anepisternum and anepimerum obviously microtomentose. Scutum with 3 dorsocentral setae, only the posterior long and distinct. 1 seta on postpronotum; 1 praesutural seta; 2 notopleural setae; 1 supraalar seta; 2 postalar setae; 1 praescutellar seta; 1 apical and 1 lateral scutellar seta. 1 seta on posterior margin of anepisternum. Katepisternum with one dorsal and ventral seta. Wing completely covered with microtrichia. Costa without setae beyond radial vein r_1 . Wing hyaline, veins light brown. Base of haltere brown, knob of haltere whitish. Legs black to brown. Fore femur apically with 2 strong posteroventral setae. Hind femur apically with 1 strong anteroventral seta. Only middle coxa with 3 short, strong, black setae.

Tergites without obvious depressions or hair tufts. Abdominal pleura with scattered setae on segments 4–5. Segments 1–5 narrow, width of tergite 3 : length of tergite 3 = 3.4. Protandrium short, slightly shorter than epandrium and less than $\frac{1}{2}$ of length of tergite 5. Tergites 3–5 each with a lateral seta at the posterior margin, tergite 5 additionally with 4 pairs of long seta at the posterior margin. Mid-ventral tergite 7 distinctly developed. Sternite 5 medium sized, broader than sternite 4, widened posteriorly, and shorter than maximum width (Fig. 9). Sternite 5 with a few scattered hairs only. The male postabdomen of the holotype is not macerated and the description of the postabdomen is based on macerated paratypes from the locus typicus. Epandrium with several hairs and no longer setae (Fig. 5). The long hairs are concentrated at the posterior margin of epandrium between bases of surstyli and cerci and are typically regularly arranged as a fringe. Maximum length in the middle of epandrium : maximum width of epandrium = 0.5. Cerci distinct, not obviously projecting, and with a few hairs only. Subepandrial sclerites slightly sclerotized, triangular, fused with each other and with the hypoproct to a subepandrial plate. Subepandrial sclerites without any hairs. Hypoproct slightly sclerotized; not projecting out of the epandrium; with several small hairs. No tooth in the middle of the subepandrial plate. Surstylus as in Fig. 8: small, not forked apically, with a pointed tip. Surstylus dorsobasally without hairs; apically with one long medially directed hair. Lamella medium sized, about half as long as surstylus. Lamella with about 10 hairs, the longest of these are about as long as the lamella. Lamella and surstylus not fused at their bases. Postgonite as Fig. 7: slightly sclerotized, with a broad base, elongated, pointed, apically bent like a hook. Distiphallus



Figs 5–9. *Meoneura pappi* spec. nov. (drawn after paratype, Schelingen, 28.v.2011, coll. PJHS). — 5. Lateral view of epandrium and surstylus. — 6. Ventral view of epandrium, surstylus and subepandrial plate. — 7. Lateral view of postgonite. — 8. Lateral view of surstylus and lamella. — 9. Ventral view of sternite 4 (left) and sternite 5 (right). — Abbreviations: ce - cercus; ep - epandrium; hy - hypoproct (part of the subepandrial plate); la - lamella; ss - subepandrial sclerite (part of the subepandrial plate); su - surstylus.

slightly elongated, not much longer than length of epandrium. Distiphallus slightly sclerotized, without distinct hairs.

Variability: Frons may be completely black or distinctly orange brown anteriorly. Several specimens are brownish but this may be a preparation artefact or due to a longer storage time in alcohol.

Etymology: This species is dedicated to László Papp (Budapest) who is the most important recent researcher in Carnidae (he described 32 of the worldwide 105 valid Carnidae species). He was the first who compiled a species list of the Carnidae from Switzerland and he started the research of the difficult *M. flavifacies* group with the description of *M. carpathica* and *M. pseudoflavifacies*.

Distribution: *M. pappi* is a widely distributed holarctic species hitherto confused with *M. flavifacies* or *M. carpathica*. It is confirmed with the records presented here from Czech Republic, France, Germany, Switzerland, Canada, and the USA. Gaps in the distribution are probably due to the poor collecting activities in most regions. The majority of the specimens were netted from flowers.

Remarks on *Meoneura carpathica* Papp, 1977

Papp (1977) described *M. carpathica* on the basis of a single male from Romania. Afterwards Papp (1978) recognised *M. carpathica* as widespread in Central Europe with records from Hungary, the Czech Republic and Austria. In the meantime, *M. carpathica* has been recorded from several additional countries (Brake 2011).

In the original description Papp (1978) compared *M. carpathica* with *M. flavifacies*. When describing *M. pseudoflavifacies* Papp (1997) pointed out the similarity between these two taxa and therefore described *M. pseudoflavifacies* only as a subspecies of *M. carpathica*. Roháček (1999) showed that the two taxa live sympatrically in the Czech Republic and gave *M. pseudoflavifacies* species status as a consequence. Roháček checked specimens reported from Germany that have been published by Stuke & Doczkal (2012). Only when describing *M. occulta* it became obvious that the specimens previously identified as *M. carpathica* don't fit in important characters to the original description. Therefore it was necessary to check the holotype. The male abdomen of the holotype is deposited in a small microvial and labeled as «*Meoneura carpathica* HT / ♂ Homoród-fürdő / Sail 931.VI. 22.». The abdomen of the holotype was fixed in Canada balsam and has been removed to glycerine afterwards. The following characters could be found by JHS in the abdomen of the holotype: Sternite 5 parallel sided, hardly widened posteriorly; epandrium with several hairs; one pair close to the surstylus and one pair posteriorly distinctly larger (as shown in Papp 1977: 177, Fig. 6). Several (? smaller) setae are broken and therefore not illustrated in the original description. Lamella slightly less than half as long as surstylus, with 5–6 setae, fused with the surstylus basally. Base of surstylus dorsally with three minute hairs; no long thin medially directed hair at tip of surstylus; postgonite slightly bent anteriorly, but not like a hook. The hypoproct and the subepandrial sclerites cannot be examined in the abdomen without additional preparation. From these characters it is obvious that *M. carpathica* is not conspecific with *M. pappi*. Due to the confusion it is necessary to check the faunistical records of *M. carpathica* carefully. At least *M. carpathica* has to be excluded from the German and the Swiss species lists until confirmed material will be found.

Meoneura prima (Becker, 1903)

Material: **EGYPT:** 6 ♂♂, 31.iii.–2.iv.1978, Alexandria, banana bait, leg. Bächli, coll. PGBA; 2 ♂♂, 8.–9.iii.1978, dito; 1 ♂, 31.iii.–2.iv.1978, Alexandria, banana bait, leg. Bächli, coll. PJHS; 1 ♂, 8.–9.iii.1978, dito; 6 ♂♂, 31.iii.–2.iv.1978, dito; 1 ♂, 14.vii.1978, Cairo, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 16.iii.1978, Fayum, banana bait, leg. Bächli, coll. PJHS; 2 ♂♂, 16.iii.1978, Fayum, banana bait, leg. Bächli, coll. PGBA. **IRAN:** 1 ♂, 28.–29.vi.1962, Rasht, fruit bait, leg. Götz, coll. PGBA; **ITALY:** 1 ♂, 29.vii.–3.viii.2000, Bormio, banana bait, leg. Bächli, coll. PGBA. **SWITZERLAND:** 16 ♂♂, 13.vii.1988, TI, Origlio, 450 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 9.ix.1988, TI, Origlio, 450 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 1.viii.1998, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PGBA.

Comment: *M. prima* is a widely distributed Holarctic and Afrotropical species that is here reported from Iran and Italy for the first time. The specimens from outside Switzerland were attracted by fruit baits; the Swiss specimens were netted from flowers.

Meoneura pseudoflavifacies Papp, 1997

Material: **CZECH REPUBLIC:** 1 ♂, 19.viii.1998, Val/Veselí n. L., net, leg. Bächli, coll. PJHS. **FRANCE:** 1 ♂, 10.viii.2000, Haute-Savoie, Salève, Téléphérique, 1100 m, net, leg. Merz & Bächli, coll. PGBA. **SWITZERLAND:** 1 ♂, 6.viii.1999, BE, Guttannen, 1000 m, net, leg. Bächli, coll. PGBA; 1 ♂, 11.–14.viii.1988, GR, Lenzerheide, 1600 m, banana bait, leg. Bächli, coll. PJHS; 7 ♂♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 17.–20.viii.1988, GR, Savognin, 1400 m, banana bait, leg. Bächli, coll. PGBA; 3 ♂♂, 7.viii.1996, GR, Susch, Fortezza, 1500 m, net, leg. Merz & Bächli, coll. PJHS, PGBA; 9 ♂♂, 6.viii.1996, GR, Zerne, 1500 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 2 ♂♂, 12.–17.viii.1981, TI, Bedretto, 1400 m, banana bait, leg. Jungen, coll. PGBA, PJHS; 17 ♂♂, 26.vii.2004, VD, La Dôle, 1500 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 7.–13.viii.1993, VS, Bürchen, 1600 m, banana bait, leg. Bächli, coll. PGBA; 7 ♂♂, 29.vii.–6.viii.1993, dito; 1 ♂, 2.vii.2001, VS, Bürchen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 3.vii.2001, VS, Bürchen, 1600 m, net, leg. Bächli, coll. PJHS; 1 ♂, 29.vii.–6.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 7 ♂♂, 1.vii.2001, VS, Guttet, 1500–1600 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 29.vii.–6.viii.1993, VS, Guttet, 1400 m, banana bait, leg. Bächli, coll. PJHS; 2 ♂♂, 1.vii.2001, VS, Guttet, 1400 m, net, leg. Bächli, coll. PJHS; 33 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 16 ♂♂, 3.vii.2001, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 25 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 16.v.1996, VS, Leuk, Brentjong, 900 m, net, leg. Merz & Bächli, coll. PGBA; 2 ♂♂, 21.vi.2014, VS, Mund, Finnen, 1400 m, net, leg. Bächli, coll. PGBA; 1 ♂, 13.–15.viii.1975, VS, Oberwald, 1800 m, banana bait, leg. Bächli, coll. PJHS; 2 ♂♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 2.vi.2014, VS, Zeneggen, 1500 m, net, leg. Bächli, coll. PGBA.

Comments: A diagnosis of *M. pseudoflavifacies* can be found in the description of *M. occulta*. The record from France is the first record for this country.

Meoneura triangularis Collin, 1930

Material: **CZECH REPUBLIC:** 1 ♂, 19.viii.1998, Val/Veseli, net, leg. Bächli, coll. PGBA. **SWITZERLAND:** 2 ♂♂, 9.viii.2000, GE, Cartigny, Moulin de Vert, 350 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 25.vii.2004, GE, Chancy, La Laiterie, 350 m, net, leg. Bächli, coll. PJHS; 1 ♂, 8.viii.2000, GE, Jussy, Prés de Villette, 475 m, net, leg. Merz & Bächli, coll. PJHS; 2 ♂♂, 2000, GR, Celerina, 1700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 5.viii.1996, GR, Ftan, Clünas, 2050 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PJHS; 1 ♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 3.vii.1996, GR, Rothenbrunnen, 800 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 11.viii.1991, GR, Sedrun, 1500 m, net, leg., coll. PGBA; 2 ♂♂, 4.viii.1996, GR, Zerne, 1500 m, net, leg. Merz & Bächli, coll. PGBA, PJHS; 1 ♂, 6.viii.1996, leg. Merz & Bächli, coll. PGBA; 1 ♂, 22.–24.vi.2001, TI, Acquacalda, 1800 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2.–3.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg., coll. PGBA; 8 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 3 ♂♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 25.vi.1999, VS, Leuk, Brentjong, 900 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 1.viii.1998, VS, Leuk, Platten, 650 m, net, leg.

Merz & Bächli, coll. PGBA; 1 ♂, 16.v.1996, VS, Leuk, Rotafen, 900 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 28.v.2010, VS, Mörel / 3, 890 m, net, leg. Obrist, coll. PJHS; 1 ♂, 21.vi.2014, VS, Mund, Finnen, 1400 m, net, leg. Bächli, coll. PGBA; 1 ♂, 17.v.1996, VS, Pfynwald, 650 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 25.vi.1999, VS, Pfynwald, 650 m, net, leg. Bächli, coll. PGBA; 1 ♂, 31.vii.–8.viii.1976, VS, Riederalp, 2000 m, banana bait, leg. Bächli, coll. PJHS; 1 ♂, 30.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 31.vii.1998, VS, Visperterminen, 1300–2300 m, net, leg. Merz & Bächli, coll. PJHS.

Meoneura vagans (Fallén, 1823)

Material: CANADA, ONTARIO: 1 ♂, 15.–17.viii.1994, Guelph, net, leg. Bächli, coll. PGBA. CZECH REPUBLIC: 6 ♂♂, 26.viii.1998, Borova Lada, net, leg. Bächli, coll. PGBA; 2 ♂♂, 22.viii.1998, Veselí n. L., net, leg. Bächli, coll. PGBA. FRANCE: 2 ♂♂, 10.viii.2000, Haute-Savoie, Salève, Observatoire, 1200 m, net, leg. Merz & Bächli, coll. PJHS. LIECHTENSTEIN: 11 ♂♂, 8.viii.1998, Ruggell, 450 m, net, leg. Bächli, coll. PGBA, PJHS. SWITZERLAND: 2 ♂♂, 15.viii.1991, AG, Untersiggenthal, Schlatt, 450 m, net, leg. Bächli, coll. PGBA; 1 ♂, 29.vi.1999, AG, Wettingen, 500 m, net, leg. Bächli, coll. PGBA; 5 ♂♂, 14.viii.1991, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 20.vii.1996, dito; 1 ♂, 14.vii.1997, dito; 2 ♂♂, 14.viii.1997, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PJHS; 2 ♂♂, 7.viii.1998, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PGBA; 4 ♂♂, 7.viii.1999, dito; 5 ♂♂, 31.viii.1999, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PJHS; 2 ♂♂, 6.vii.2000, dito; 1 ♂, 1.vii.2004, AG, Würenlingen, 500 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 14.viii.1991, AG, Würenlingen, Firsthalde, 500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 14.viii.1991, AG, Würenlingen, Firsthalde, 500 m, net, leg. Bächli, coll. PJHS; 1 ♂, 13.–20.vii.2000, BL, Bubendorf, 500 m, color trap, leg. Wolf, coll. PGBA; 1 ♂, 22.–29.vii.2000, dito; 3 ♂♂, 3.–10.vii.2000, dito; 1 ♂, 3.–10.viii.2000, BL, Bubendorf, 623.25/253.75/FFII, 500 m, color trap, leg. Wolf, coll. PJHS; 1 ♂, 14.viii.1997, BE, Beatenberg, 1600 m, net, leg. Bächli, coll. PJHS; 6 ♂♂, 6.viii.1999, BE, Guttannen, 1000 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 2000, FR, Nuvilly, 650 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2005, FR, Nuvilly, 650 m, color trap, leg. Duelli, coll. PGBA; 5 ♂♂, 7.viii.2000, GE, Bernex, Chante-Merle, 420 m, net, leg. Merz & Bächli, coll. PGBA; 2 ♂♂, 7.viii.2000, GE, Bernex, Chante-Merle, 420 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 9.ix.2000, GE, Cartigny, Moulin de Vert, 350 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 9.viii.2000, GE, Cartigny, Moulin de Vert, 350 m, net, leg. Merz & Bächli, coll. PJHS; 2 ♂♂, 7.viii.2000, GE, Chancy, La Laiterie, 350 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 25.vii.2004, GE, Chancy, La Laiterie, 350 m, net, leg. Bächli, coll. PGBA; 2 ♂♂, 7.viii.2000, GE, Chancy, La Laiterie, 350 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 11.viii.2000, GE, Dardagny, Le Moulin, 380 m, net, leg. Merz & Bächli, coll. PJHS; 19 ♂♂, 8.viii.2000, GE, Jussy, Prés de Villette, 475 m, net, leg. Merz & Bächli, coll. PGBA; 7 ♂♂, 8.viii.2000, GE, Jussy, Prés de Villette, 475 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 9.ix.2000, GE, Russin, Biolay, 360 m, net, leg. Merz & Bächli, coll. PGBA; 13 ♂♂, 8.viii.1998, GR, Lenzerheide, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 2 ♂♂, 2004, GR, Nationalpark, 2200 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 17.–20.viii.1988, GR, Savognin, 1400 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 7.viii.1996, GR, Susch, Fortezza, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 3.vi.2000, GR, Tinizong, 1350 m, net, leg. Bächli, coll. PJHS; 2 ♂♂, 4.viii.1996, GR, Zerne, 1500 m, net, leg. Merz & Bächli, coll. PGBA; 5 ♂♂, 6.viii.1996, dito; 1 ♂, 2.–6.viii.(19)74, JU, Delémont, 600 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 2.–6.viii.1974, JU, Delémont, 600 m, banana bait, leg. Bächli, coll. PJHS; 1 ♂, 28.vi.2003, JU, La Chaux-des-Breuleux, 950 m, net, leg. Bächli, coll. PGBA; 3 ♂♂, 2000, LU, Dierikon, 500 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 2005, LU, Ruswil, 650 m, color trap, leg. Duelli, coll. PGBA; 9 ♂♂, 9.viii.1999, SH, Merishausen, 650 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 2000, SZ, Alptal, 1000 m, window trap, leg. Duelli, coll. PJHS; 1 ♂, 15.viii.1992, SO, Balmburg, 600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 26.vi.2006, SO, Weissenstein, 1250 m, net, leg. Bächli, coll. PGBA; 1 ♂, 2000, TG, Roggwil, 450 m, window trap, leg. Duelli, coll. PJHS; 4 ♂♂, 7.–13.viii.1993, VS, Bürchen, 1600 m, banana bait, leg. Bächli, coll. PGBA; 3 ♂♂, 2.vii.2000, VS, Bürchen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 29.vii.–6.viii.1993, VS, Guttet, 1500–1600 m, banana bait, leg. Bächli, coll. PGBA; 6 ♂♂, 26.vi.1999, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA, PJHS; 1 ♂, 10.viii.2013, VS, Jeizinen, 1600 m, net, leg. Bächli, coll. PGBA; 1 ♂, 16.v.1996, VS, Leuk, Brentjong, 900 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 25.vi.1999, VS, Leuk, Brentjong, 900 m, net, leg. Bächli, coll. PJHS; 1 ♂, 3.viii.1998, VS, Leuk, Platten, 650 m, net, leg. Merz & Bächli, coll. PJHS; 1 ♂, 28.v.2010, VS, Mörel / 4, 1090 m, leg. Obrist, coll. PJHS; 3 ♂♂, 28.vii.2004, VS, Morgins, Têtes, 1500 m, net, leg. Bächli, coll. PGBA; 1 ♂, 15.v.1886, VS, Pfynwald, 650 m, net, leg. Merz & Bächli, coll. PGBA; 1 ♂, 2000, VS, Visp, 700 m, window trap, leg. Duelli, coll. PGBA; 1 ♂, 20.vii.1998, ZH, Dietikon, 550 m, net, leg. Bächli, coll. PGBA; 1 ♂, 16.–20.vii.1986, ZH, Zürich Hönggerberg, 500 m, banana bait, leg. Bächli, coll. PGBA; 1 ♂, 2000, ZG, Steinhausen, 450 m, window trap, leg. Duelli, coll. PGBA.

Comments: *M. vagans* is widely distributed in the Holarctic Region and is now published for the first time from Liechtenstein.

***Meoneura ziegleri* Stuke spec. nov.**

(Figs 10–13)

Material: Holotype ♂: (1) «CH: Nationalpark GR / 2004 / P. Duelli leg.»; (2) Holotypus / *Meoneura ziegleri* ♂ / spec. nov. / det. Stuke, 2015».

Paratype: **ITALY:** 1 ♂, 29.vi.–04.vii.2005, Trentino-Alto Adige, South Tyrol, Glurnser Alm near Stilfser Joch southwest of Trafoi, 2315 m, 46°32'00.7 N, 10°28'27.8 E, Malaise trap, leg. Lange & Ziegler, coll. ZMHB.

The holotype is deposited in PGBA. The holotype is in a good condition without any missing parts.

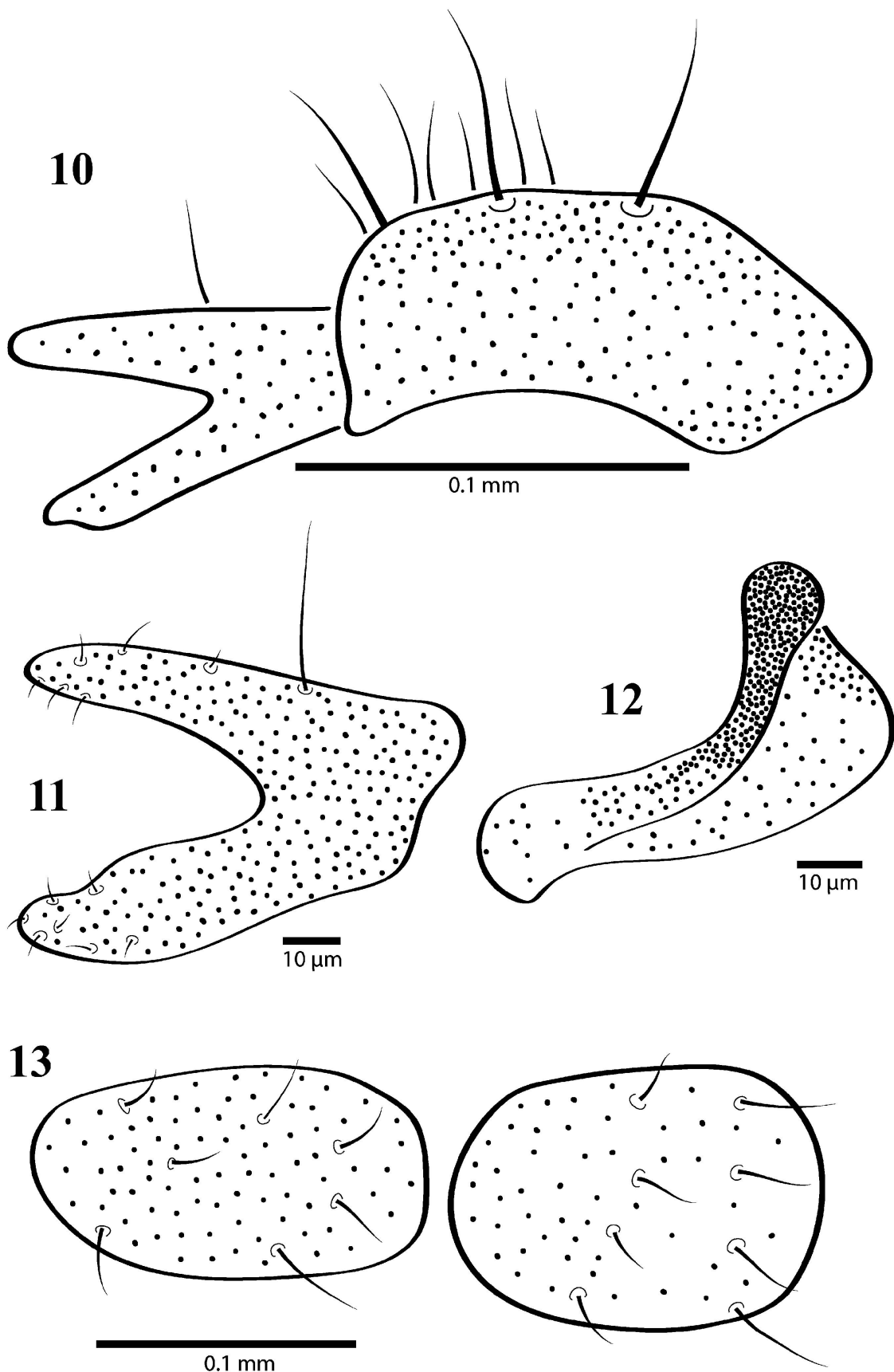
Diagnosis: *M. ziegleri* can be recognised by the shape of the surstylus-lamella-complex (Figs 10, 11). The surstylus and the lamella are largely fused at the base and due to the stronger sclerotisation of the lamella it cannot be ruled out that the «lamella» is only the anterior part of a bifurcate surstylus. This structure is v-shaped with both arms of equal length. Using Papp (1978) the species keys out to couplet 17 and two species with a similar surstylus-lamella-complex remain: *M. bicuspidata* (Collin, 1930) and *M. acuticerca* (Gregor, 1973). The surstyli of both species have arms of different length and the surstyli are not v-shaped. *M. alphabetica* Carles-Tolrá & Ventura, 2002 belongs to this group, too, but the surstylus-lamella-complex is not v-shaped but u-shaped and both arms are distinctly shorter.

Description of the holotype (male): Length about 1.6 mm. Wing length = 1.5 mm. Head height = 0.3 mm.

Head completely black. Antenna black. Arista with minute pubescens. Eye with scattered short ommatrichia. Maximum eye length : maximum eye height = 1.0. Posteroventral margin of gena to closest eye margin : maximum eye height = 0.4. Frons slightly microtomentose, frontal triangle shiny. Frontal triangle reaching anteriorly about $\frac{2}{3}$ distance of anterior ocellus to frontal margin. Face slightly microtomentose, gena shining. Carina small. Postcranium slightly microtomentose. Prementum as long as labellum and distinctly wider. Palpus brown, about as long as the haustellum. 1 pair of distinct ocellar setae. Supralunular setae bent medially. 4 fronto-orbital setae. The 2 anterior mesocline, the 2 posterior laterocline. 2 vertical setae. Postorbital setae parallel. 1 strong vibrissal seta. 2 supravibrissal setae, the ventral one slightly smaller. 3 strong genal setae.

Scutum completely microtomentose. Scutum covered with semiadpressed black hairs. Scutellum microtomentose. Pleura shining with indistinct dusting only. Scutum with 1 dorsocentral setae only. 1 strong and 1 small seta on postpronotum; 1 praesutural seta; 2 notopleural setae; 1 supraalar seta; 1 postalar setae; 1 praescutellar seta; 1 apical and 1 lateral scutellar seta. 1 seta on posterior margin of anepisternum. Katepisternum with one dorsal seta only. Ventrally several indistinct hairs on the katepisternum. Wing completely covered with microtrichia. Costa without setae beyond radial vein r_1 . Wing hyaline, veins light brown to white yellow. Haltere light brown. Legs black to brown. Fore femur apically with 2 strong posteroventral setae. Hind femur apically with 1 strong anteroventral seta. No strong black setae on coxa.

Tergites without obvious depressions or hair tufts. Abdominal pleura with scattered setae on segments 4–5. Segments 1–5 narrow, width of tergite 3 : length



Figs 10–13. *Meoneura zieglerei* spec. nov. (drawn after the paratype). — 10. Lateral view of epanthrium and surstylus. — 11. Lateral view of surstylus. — 12. Lateral view of postgonite. — 13. Ventral view of sternite 4 (left) and sternite 5 (right).

of tergite 3 = 2.7. Protandrium short, about as long as epandrium and distinctly shorter than tergite 5. Tergites 3–5 each without outstanding lateral seta at the posterior margin, tergite 5 with 5–6 pairs of moderately long seta at the posterior margin. Sternite 5 medium sized, slightly broader than sternite 4, hardly widened posteriorly, and longer than maximum width (Fig. 13). Sternite 5 with a few scattered hairs only. The male postabdomen of the holotype is not macerated and the description of the postabdomen is mainly based on the macerated paratype. Epandrium with several hairs and no longer setae (Fig. 10). Maximum length in the middle of epandrium : maximum width of epandrium = 0.3. Cerci distinct, not obviously projecting, and with a few hairs only. Subepandrial sclerites slightly sclerotized, triangular, fused with each other and with the hypoproct to a subepandrial plate. Subepandrial sclerites without any hairs. Hypoproct slightly sclerotized; not projecting out of the epandrium; with several small hairs. No tooth in the middle of the subepandrial plate. Surstylus and lamella fused basally to a surstylus-lamella-complex (Fig. 11), moderately large, v-shaped. Surstylus dorsally and apically with single inconspicuous hairs; apically with a long medially directed hair. No lamella but it cannot be ruled out that the v-shaped surstylus is in fact a fusion of a simple surstylus with a strong sclerotized lamella. «Lamella» with about 10 small hairs, all distinctly shorter than the lamella. «Lamella» and surstylus largely fused at their bases. Postgonite as Fig. 12: slightly sclerotized, with a broad base, elongated, rounded apically. Distiphallus elongated, longer than length of epandrium. Distiphallus slightly sclerotized, without distinct hairs.

Variability: Protandrium in the holotype is only partly visible and therefore much shorter than tergite 5.

Etymology: This species name is a patronym for Dr. Joachim Ziegler (Berlin). He initiated and organised the Diptera Stelvio project and caught within this project the first specimen of the new species that came to JHS's attention. He is always a big support in JHS's dipterological research.

Distribution: Up to date *M. ziegleri* is only known from the Italian and Swiss Alps. The holotype was collected with a window trap at about 2000 m. The paratype was taken from the Alpine altitude zone, the location of the malaise trap is described in detail by Ziegler (2008).

ACKNOWLEDGEMENTS

Zoltán Soltész (Hungary, Budapest) informed about the paratype of *Meoneura moravica* and sent the holotype of *Meoneura carpathica*. Jana Nerudová (Czech Republic, Brno) sent the holotype of *Meoneura moravica*, Joachim Ziegler (Berlin) helped to organise the loan of this type. Jeff Skevington and Scott Celsco (Ottawa) sent Carnidae from the CNC. Irina Brake checked the English and gave valuable comments on the manuscript.

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(received July 1, 2015; accepted November 6, 2015; published December 31, 2015)

