

**An annotated list of Ptychopteridae (Insecta, Diptera)
from Romania, with notes on the individual variability of
Ptychoptera albimana (FABRICIUS, 1787)**

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Summary: The Ptychopteridae fauna of Romania has attracted little attention in the past; hence the exact number of species from here remains uncertain. The last Romanian checklist was published in 2007 and further sporadic faunistic data cumulated together a number of five species only. Based on our intensive faunistic survey carried out between 1998 and 2011 a number of eight species, three of them new for Romania, are recorded. Wings and male genital organs of *Ptychoptera handlirschi*, *P. longipennis*, and *P. silvicola* are figured. Notes on individual variability of *Ptychoptera albimana* from Bulgaria, Romania, Germany and Luxembourg are figured and discussed.

Key words: faunistic data, check list, Ptychopteridae, Romania, new records, *Ptychoptera albimana*, individual variability.

Introduction

The family Ptychopteridae comprises slender flies of tipuloid appearance with shiny black body colouration, sometimes with lighter markings on thorax and/or abdomen and mostly spotted wings (OOSTERBROEK 2006). They frequent muddy banks of stream and pools, marshes of various types, including peat bogs, *Sphagnum*-pools and similar habitats (ANDERSSON 1997). The larvae are aquatic or semi-aquatic, having a conspicuous long respiratory siphon at the end of the abdomen allowing atmospheric respiration (WICHARD *et al.* 1995). They live in mud and detritus in shallow waters along the margins of lakes, ponds or streams, where they feed on fine particulate organic matter (FPOM) with high bacterial compound and play an important role in FPOM-dynamics in lenitic areas (WOLF *et al.* 1997, WOLF and ZWICK 2001).

The family Ptychopteridae comprises only a few recent species, but these are most interesting because of their phylogenetic age and relict status of a number of species (ZITEK-ZWIRTEK 1971, ROZKOŠNÝ 1997, BERTONNE *et al.* 2008). About 66 species belong to Ptychopteridae was recorded worldwide (ROZKOŠNÝ 1997). The family is apparently absent from Neotropical, Australasian and Oceanic regions. In the Palaearctic region only 26 species were recorded (ROZKOŠNÝ 1997). A number of 14 species, all belonging to genus *Ptychoptera* MEIGEN, 1803, are present in Europe (ZWICK and STARÝ 2002). Several European species are widespread and occur far into Siberia (ROZKOŠNÝ 1992). However, a number of

other species have restricted ranges which reflect relict status and new species can still be discovered even in Central Europe (KRZEMIŃSKI and ZWICK 1993, ROZKOŠNÝ 1997).

The genus *Ptychoptera* can further be divided into two sharply different morphological groups. In Europe seven species have a complex auxiliary sexual organ on male sternite 3 which receives the tips of the female cerci during copula for which the generic name *Paraptychoptera* was proposed first by TONNOIR (1919). Several other species not assigned to *Paraptychoptera* have rudiments or lack similar structures. The phylogenetic importance of this conspicuous organ in male abdomen has not yet been investigated, but the monophyly of *Paraptychoptera* and its recognition as a subgenus of *Ptychoptera* was recently proposed by ZWICK and STARÝ 2002. The remaining European species not assigned to *Paraptychoptera* was recently considered a paraphyletic taxon, and a comprehensive phylogenetic study of *Ptychoptera* at global scale was highly recommended (ZWICK and STARÝ 2002).

Selected species of *Ptychoptera* are readily distinguishable by the structure of the male and female terminalia using reference literature (FREEMAN 1950, PEUS 1958, KRZEMIŃSKI 1986, ZITEK-ZWIRTEK 1971, ANDERSSON 1997). Additionally, the pattern of wing venation and design (arrangements of the spots on the wings), coloration and pubescence of the pleurae and the coloration of the abdomen are recommended in identification of species (TJEDER 1968, ZITEK-ZWIRTEK 1971, DELINÉ-DRASKOVITS 1983, KRZEMIŃKI 1986, KRZEMIŃKI and ZWICK 1993, ANDERSSON 1997, ROZKOŠNÝ 1997). Taxonomically important characters

in larvae are the chaetotaxy of the body segments, shape of the mouthparts, particularly the hypostome and hypostomal bridge. Important larval keys were published by BRINDLE (1962, 1966) and ANDERSSON (1997). The sex as well as specific identity of pupae can be determined by the shape of terminal capsules covering the future genitalia, but auxiliary chaetotaxy can be important taxonomical character as well (JOOST 1974).

The family Ptychopteridae has not yet been comprehensively studied in Romania. Scattered faunistic data are available in a few papers only (THALHAMMER 1898, PÂRVU 2003, 2004). These data record five species from a few regions (Maramureş, Southern Carpathians and Banat). These species are: *Ptychoptera albimana* (FABRICIUS, 1787), *P. contaminata* (LINNAEUS, 1758), *P. lacustris* MEIGEN, 1830, *P. paludosa* MEIGEN, 1804 and *P. scutellaris* MEIGEN, 1818. Surprisingly, the most recently published list of Ptychopteridae of Romania overlooked the majority of these data and recorded two species, *P. paludosa* and *P. scutellaris*, only (MOLDOVAN 2007).

Material and methods

Between 1998 and 2011 a number of 91 individuals of Ptychopteridae belonging to eight species were investigated by us from different habitats, mostly in mountainous regions of Romania. Additionally a number of 56 individuals belong to five different species from Luxembourg, Germany, Hungary and Bulgaria were used as a comparative material to study the geographic variability of the species.

Part of the material was stored in 96% alcohol and deposited in the Diptera Collection of the Faculty of Biology and Geology, Cluj, Romania. A number of 27 additional individuals studied belong to the Diptera Collections of the Natural History Museum,

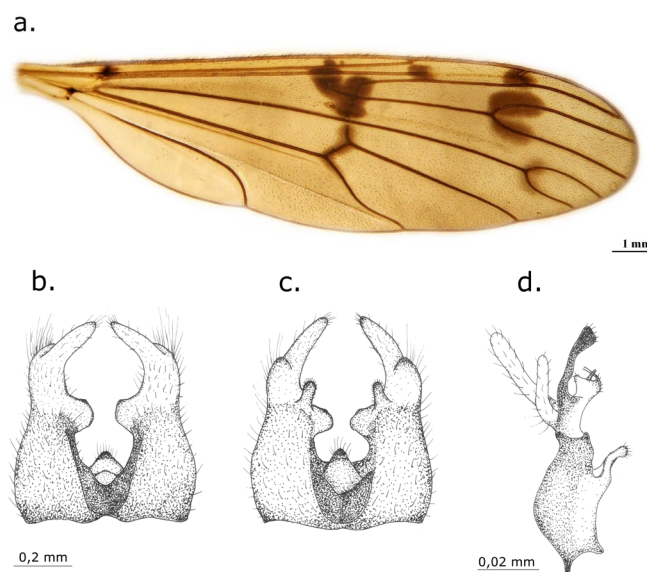


Fig. 1. *Ptychoptera handlirschi*, a. left wing; b. surstylus, dorsal; c. surstylus, ventral; d. left gonostylus lateral

Budapest, Hungary. The postabdomen of the male individuals was macerated in KOH 10% and then put on glycerol prior to morphology studies. Specimens were examined with an Olympus SZ50 dissection microscope equipped with Olympus SP500UZ camera. Digital microscope images were generated with the assistance of Gimp 2.6. Measurements were taken using an ocular measurement graticule mounted on the dissection microscope. The adopted terminology follows PEUS 1958. All material was identified by the first author, with exception of the material from Germany (identified P. ZWICK) and Hungary (identified by A. DELINE-DRASKOVICS).

Results

During our investigation a number of 91 individuals of *Ptychopteridae* belonging to eight different species were identified from different parts of Romania.

List of the Romanian Ptychopteridae with new records

1. *Ptychoptera (Parapteroptera) handlirschi* (CZIŽEK, 1919)

Material examined: **Romania, Transylvania:** Comandău, 1006 m, 45,45 N; 25,16 E; July 19, 2006, 2 ♂♂, leg. M. Bálint; Feleacu, Valea Morii, 640 m, 46,41 N; 23,36 E, June 12, 2010, 5 ♂♂, 1 ♀, 2 larvae, leg. L. Ujvárosi; Voşlăbeni, Senetea marshy area, 766 m, 46,37 N; 25,35 E, July 6, 2011, 2 ♂♂, leg. L.P. Kolcsár; Pietroasa, Boga, Padis Karst area, 900 m, 46,36 N; 22,39 E, June 29, 2011, 2 ♂♂, leg. E. Török. **Bulgaria, Velingrad:** Velingrad, Rhodope Mts., 870 m, 41,58 N; 23,56 E, June 12, 2008, 1 ♂, leg. M. Bálint.

During our investigation the species was frequently collected along marshy springs and brooks in mountainous and hilly area from Transylvania. The species has a flight period lasting from May to August. It is a Central European species recorded from Czechia, Slovakia and Poland (ROZKOŠNÝ 1992). The wing pattern and male hypopygium are presented in Fig. 1. *It is a new record to Romania.*

2. *Ptychoptera (Parapteroptera) lacustris* MEIGEN, 1830

Material examined: **Romania, Transylvania:** Valea Iadului, Leşu Area, Iadolina waterfall, 920 m, 46,43 N; 22,33 E, May 21, 2006, 9 ♂♂, leg. L. Ujvárosi; Rimetea, marshy brook, 480 m, 46,26 N; 23,33 E, May 28, 2007, 1 ♂, leg. L. Ujvárosi; **Banat,** Băile Herculane, 150 m, 44,52 N; 22,24 E, July 9, 2006, 1 ♀, leg. L. Ujvárosi; Poiana Mărului, Semenic Mts., 970 m, 45,23 N; 22,32 E, June 16, 2008, 3 males, leg. M. Bálint; Sasca Română, Valea Beiului, marshy springs, 240 m, 44,54 N; 21,44 E, May 8, 2009, 7

♂♂, 4 ♀♀, leg. L. Ujvárosi. **Bulgaria, Velingrad:** Velingrad, Rhodope Mts., 870 m, 41,58 N; 23,56 E, June 12, 2008, 1 ♂, leg. M. Bálint.

The species was collected by us in Transylvania and Banat, frequently in marshy areas close to the headwaters. The species was quite recently first recorded from Romania, from Piatra Craiului, Southern Carpathians (PÂRVU 2004). It is a widespread European species with a flight period restricted to the summer period from May to August (ROZKOŠNÝ 1992).

3. *Ptychoptera (Parptychoptera) longicauda* (TONNOIR, 1919)

Material examined: **Romania, Dobrogea:** Telița, Măcin Mts., Čelic Dere, 109 m, 45,07 N; 28,34 E, June 2, 2005, 7 males, leg. L. Ujvárosi; Luncavița, Măcin Mts., Valea Fagilor, 151 m, 45,12 N; 28,20 E, June 10, 2006, 10 ♂♂, 4 ♀♀, leg. L. Ujvárosi.

The species was initially recorded only in the western part of Europe, but later it was collected in Central Europe, in Czechia, too (ZITEK-ZWIRTEK 1971). It was collected by us only in Dobrogea area, along different marshy headwaters in early June. *It is a new species for Romania.* The wing pattern and male hypopygium are presented in Fig. 2.

4. *Ptychoptera (Parptychoptera) paludosa* MEIGEN, 1804

The species was not collected during our investigation, but has sporadic literature data from Romania from the Banat region, at Băile Herculane (THALHAMMER 1898) and from the Southern Carpathians, Piatra Craiului Mts. (PÂRVU 2004). In Europe the species has frequently been collected along swamps and marshes in forested areas, mostly in summer period (from May to July) (ZITEK-ZWIRTEK 1971). In Germany, *P. paludosa* is very common and the characteristic inhabitant of small rithral streams (P. ZWICK, in litt.).

5. *Ptychoptera (Parptychoptera) silvicola* ZWYRTEK et ROZKONÝ, 1967

Material examined: **Romania, Transylvania:** Suatu, steppe ecosystem with ponds, 340 m, 46,46 N; 23,58 E, July 23, 1998, 1 ♂, leg. A. Ruicănescu, light trap material.

The species has a restricted distribution in Central Europe. It was recorded only from Slovakia (ROZKOŠNÝ 1992). The species has a restricted distribution in Romania, too. The single site near Suatu where the species was collected by us is an important steppe ecosystem with a number of protected plant and animal species with eastern distribution. *It is a new species for Romania.* The wing pattern and male

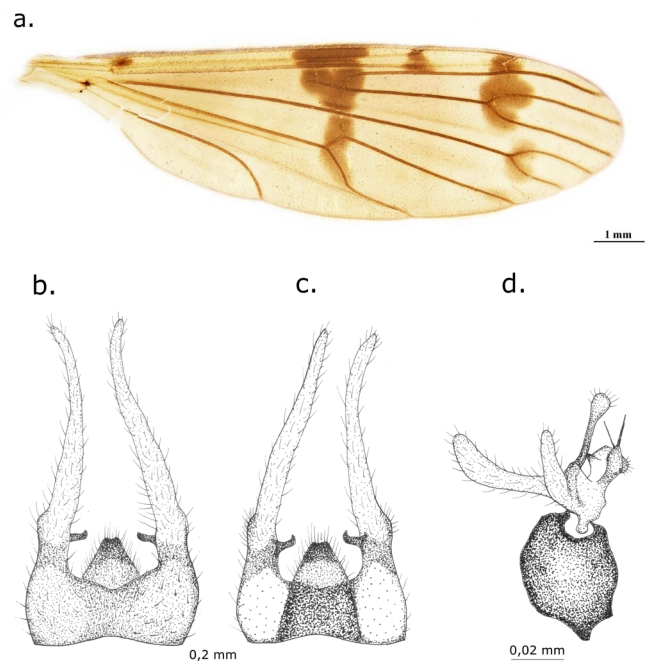


Fig. 2. *Ptychoptera longicauda*, a. left wing; b. surstylus, dorsal; c. surstylus, ventral; d. left gonostylus lateral

hypopygium are presented in Fig. 3.

6. *Ptychoptera (Ptychoptera) albimana* (FABRICIUS, 1787)

Material examined: **Romania, Transylvania:** Voșlăbeni, Gheorgheni Depression, Sűgó brook, marshy meadow, 764 m, 46,37 N; 25,35 E, May 22, 2010, 2 ♂♂, leg. L.P. Kolcsár. **Bulgaria, Velingrad:** Velingrad, Rhodope Mts., 870 m, 41,58 N; 23,56 E, June 12, 2008, 1 ♂, leg. M. Bálint. **Hungary, Bükk National Park,** Szilvasvarad, Szalajka völgy, 608 m, 48.06 N; 20.40 E, July 7 – October 25, 1981, 22 ♂♂, leg. Z. Szabo; **Bakony,** Hajmaspuszta, 194 m, 47.16

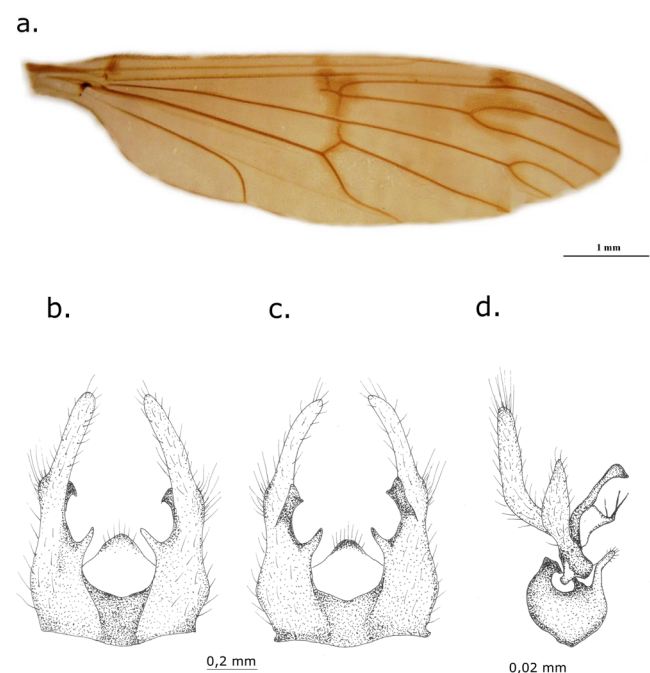


Fig. 3. *Ptychoptera silvicola*, a. left wing; b. surstylus, dorsal; c. surstylus, ventral; d. gonostylus lateral

N; 18.03 E, April 23, 1976, 2 ♂♂, leg. S. Tóth; Zirc, Cigánydomb, 452 m, 47.27 N; 17.84 E; April 21, 1976, leg. S. Tóth and A. Kasper; *Börzsöny*, Kemence puszta, m, 47.99 N; 18.92 E, May 1, 1958, leg. S. Endródi. **Germany**, *Hessen*: Schlitz, Bambej, 265 m, 50.39 N; 9.34 E, May 16, 1979, 11 ♂♂, 1 ♀, 1 larvae, leg. A. Brink; *Schleswig-Holstein*: Grebin, Lütjen lake shore, 33 m, 54.11 N; 10.29 E, May 16, 1982, 1 ♂, leg. A. Brink. **Luxembourg**, *Grewenmacher*: Echternach, marshy meadow, 312 m, 49.48 N; 6.24 E, September 5, 2005, 1 ♂, leg. L. Ujvárosi. **Serbia**, *Northern Serbia*: Gostun, shrubs along marshy meadow, 848 m, 43.12 N; 19.45 E, May 22, 2010, 1 ♀, leg. L.P. Kolcsár.

It is a large and abundant species in Europe, with a long period of flight from the end of April to the beginning of October. It was frequently collected along swampy meadows and marshy streams in forested areas (ZITEK-ZWIRTEK 1971). However, in Romania there is only a single literature record from the Southern Carpathians, at Sătic (Piatra Craiului Mts.) (PÂRVU 2004).

7. *Ptychoptera (Ptychoptera) contaminata* (LINNAEUS, 1758)

Material examined: **Romania**, *Transylvania*: Cluj, Fânațele Clujului, marshy ponds, 427 m, 46.49 N; 23.38 E, May 10, 2006, 1 ♀, leg. L. Ujvárosi; April 25, 2009, 4 ♂♂, 4 ♀♀, leg. J. Csepregi; Adrian, marshy channels along Tur river, 150 m, 47.54 N; 23.07 E, July 9, 2011, 5 ♂♂, 1 ♀, leg. L.P. Kolcsár; Livada, marshy channels along Tur river, 150 m, 47.53 N; 23.08 E, July 13, 2011, 1 ♂, leg. L.P. Kolcsár; Bercu, 110 m, 47.54 N; 22.53 E; July 7, 2011, 1 ♂, leg. L.P. Kolcsár; Voșlăbeni, Gheorgheni Depression, Senetea marshy meadow, 766 m, 46.37 N; 25.35 E, July 2, 2011, 1 ♀, leg. L.P. Kolcsár. **Bulgaria**, *Burgas*: Burgas, lake shore, 17 m, 42.29 N; 27.28 E; May 2, 2011, 10 ♂♂, leg. L.P. Kolcsár.

It is a widespread West Palaearctic species, frequently collected along swamps, marshes and along different ponds and lakes, with a flight period beginning in April and ends in the beginning of October (ZITEK-ZWIRTEK 1971). The species has sporadic data in Romania, from Maramureș (PÂRVU 2003) and Southern Carpathians (PÂRVU 2004).

8. *Ptychoptera (Ptychoptera) scutellaris* MEIGEN, 1818

Material examined: **Romania**, *Transylvania*: Voșlăbeni, Gheorgheni Depression, Súgó brook, marshy meadow, 939 m, 46.40 N; 25.40 E, May 25, 2005, 4 ♂♂, leg. L.Ujvárosi; 764 m, 46.37 N; 25.35 E, May 22, 2010, 2 ♂♂, leg. L.P. Kolcsár; Ditrău, Gheorgheni Depression, 802 m, 46.49 N; 25.31 E, May 25, 2010, 1 ♂, leg. L.P. Kolcsár; June 6, 2011, 1 male, leg. L.P. Kolcsár; August 8, 2011, 1 ♂, leg.

L.P. Kolcsár; Padiș, Apuseni, karst springs, 1320 m, 46.35 N; 22.44 E, 29 June, 2011, 1 ♀, leg. E. Török; *Maramureș*: Complex Borșa, Rodnei Mts., Știol glacial lake shore, 1657 m, 47.38 N; 24.48 E, June 15, 2010, 1 ♂, leg. L.Ujvárosi. **Bulgaria**, *Dospat*: Dospat, Rhodope Mts., 1320 m, 41.32 N; 26.06 E; 1 ♂, leg. M. Bálint.

It is a medium sized and generally dark colored European species which was frequently collected by us along swampy brooks on the margins of woods. The adults are active from May to August.

Individual variability of *Ptychoptera (Ptychoptera) albimana*

During our investigation, important intraspecific variability of the male genital structures was discovered in the case of the European widespread, large dipteran, *Ptychoptera albimana*. A number of 61 male individual were analyzed and compared. The investigated structures in wing and male genital structures are presented in Figs. 4 and 5.

Two sharply different morphological groups can be recognized among individuals investigated by us. The morpho-group 1 of *P. albimana*, identified among

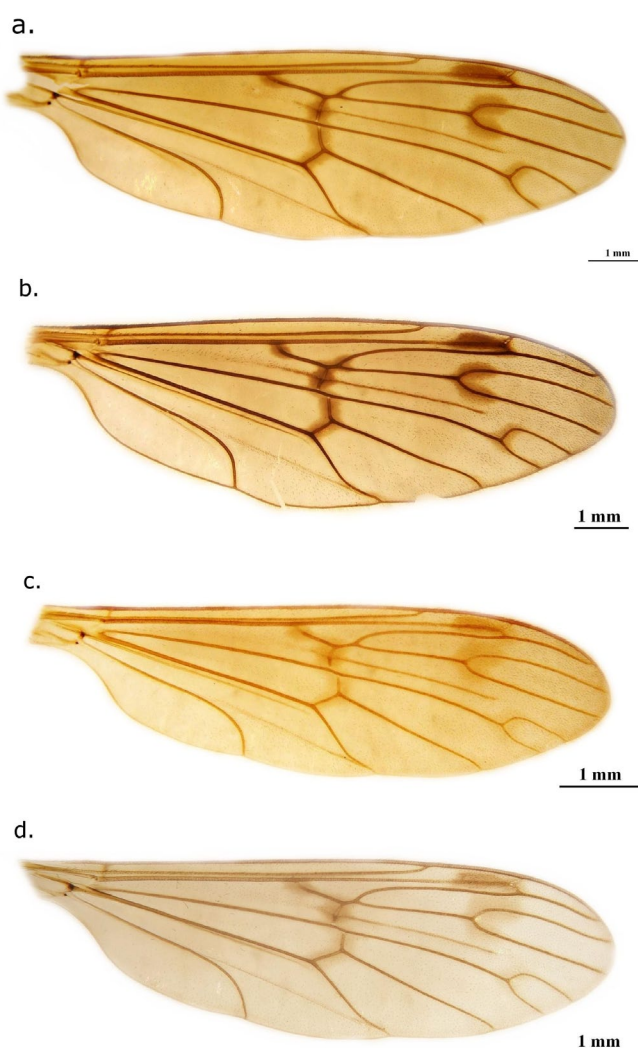


Fig. 4. Left wing of *Ptychoptera albimana*, a. Bulgaria, b. Romania, c. Germany, d. Luxembourg

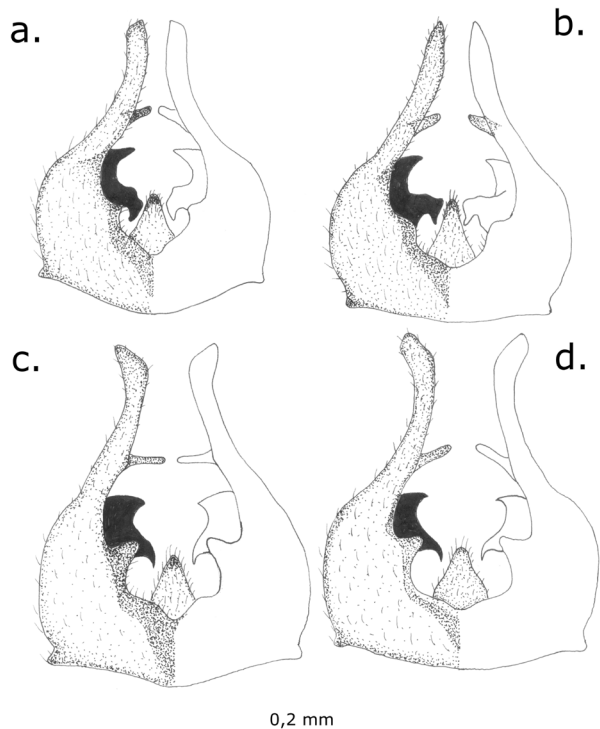


Fig. 5. Surstyli of *Ptychoptera albimana* dorsal view, a. Bulgaria, b. Romania, c. Germany, d. Luxembourg

populations from Romania and Bulgaria can be characterized by the combinations of the following characters: wings wider (Figs. 4a, b); surstyli has in their dorsal side shorter caudal process, and the digitiform interior process on the surtyli are wider and shorter, the apex of the sursyli are straight (Figs. 5 a, b); the basal sclerotized processes of the surstyli (the interbase) has their inferior arm well developed and widened (Figs. 5 a, b).

However the morpho-goup 2, represented by populations from Germany, Luxembourg and Hungary differs significantly from the previous group by the combinations of the following characters: wings narrowest (Figs. 4c, d); surstyli having in their dorsal side longer caudal process, and the digitiform interior process on the surtyli are narrower and longer, the apex of the sursyli are more or less rounded and widened toward the apex, conspicuous mostly in the case of individuals from Luxembourg (Figs. 5 c, d); the sclerotized basal process of the surstyli has a more or less thorn-like inferior interior arms, conspicuously rounded and shortened in the Hungarian populations. The major morphological differences between the western and eastern populations of the species reveal the existence of deeply divergent and morphologically well defined structures in the case of the European widespread *P. albimana*. However the taxonomy value of the discovered differences can be test only statistically, after processing of a large set of morphological data in combination with its associated genetic structures from the whole range of the species. A phylogenetic analyses is highly recommended because of the high level of

cryptic diversity frequently registered in the case of a number of other aquatic insect species (Trichoptera, Ephemeroptera) with highly divergent genetic and morphological structures between different allopatric populations (PAULS *et al.* 2006, 2009, BÁLINT *et al.* 2011, THEISSINGER 2010).

Discussion

Despite their rather sporadic literature data, Ptychopteridae are well represented in Romanian aquatic fauna. The presence of 8 of the 14 European species puts Romania among the most diverse country concerning its Ptychopteridae diversity (close to Germany, Austria, Czechia, Slovakia or Poland). Only a few species are well represented in more than one region in Romania, like *P. contaminata*, *P. handlirschi* and *P. scutellaris*. All other species have a more restricted distribution in different parts of Romania. *P. silvicola* and *P. longicauda* have the most restricted distributions. Both species were collected along at single site in a low numbers of individuals only.

The taxonomic identity of the eight species identified from Romania is certain without any doubt using morphological characters of the male terminalia, as it was suggested in the most important references (PEUS 1958, ZITEK-ZWIRTEK 1971, DELINÉ-DRASKOVITS 1983, KRZEMIŃSKI 1986). However, highly divergent morphological structures were identified between the western (Luxembourg, Germany, Hungary) and eastern populations (Bulgaria and Romania) of the European *P. albimana*. The presently identified morphological diversity was overlooked in the existing literature. During our investigation only a few individuals of a limited number of populations from Bulgaria, Romania, Hungary, Germany and Luxembourg were compared. To test the taxonomic value of the identified morphological differences additional genetic data, as well as other ecological or biological information are highly recommended. However, a series of recently published phylogeographic data reveal deep morphological and genetic divergence among allopatric populations in a series of other aquatic insects and a peculiar insular distribution in correlation with the rather disjunct distribution of the available aquatic habitats (BÁLINT *et al.* 2011). Comprehensive studies reveal deeply divergent morphological and genetic structures in the case of a number of allopatric populations belongs to Lepidoptera (SCHMITT, 2007; SCHMITT *et al.*, 2005); Trichoptera (PAULS *et al.* 2006, 2009, BÁLINT *et al.* 2008, 2011), Ephemeroptera (THEISSINGER 2011) and Diptera species (UJVÁROSI *et al.*, 2009, 2010). The presence of such highly divergent structures among a series of European widespread taxa is a result of the repeated range shifts during the Pleistocene climate changes and the existence of multiple glacial refugia, mostly in the southern part of the continent (SCHMITT 2007). Similar pattern of divergence can be

expected in the case of *P. albimana*, as well. The two, morphologically divergent structures are allopatric and no intermediate structures were identified during the present study. The morphological differences on the male terminalia between the two allopatric structures are important (involved the sclerotized interbase of the surstylus, copulatory organs, inner branch of the gonostylus, tegmen, hypoproct) which reflect long term isolation and most probably surviving Pleistocene glaciations in at least two distant refugia. The western morphotype were identified among populations from Luxembourg, Germany and Hungary and most probably represents a postglacial expansion from one or more western Mediterranean refugia. The eastern morphotype identified among populations from Romania and Bulgaria is conspicuously different in a series of details on wing ratio and genital structures from the previous form and the Balkan region is the most likely refuge and postglacial expansion centre for this lineage. Further phylogeography studies can reveal the population history of these two divergent structures identified in the case of *P. albimana* and the taxonomic importance of these evidences can be test using an integrative approach, only.

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