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Contribution to the caddisfly fauna of the Nature Park "Alpi Maritime" in Italy with a note on the endemic Trichoptera species of the Alps (Insecta, Trichoptera)

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With 27 figures and 2 tables

Schlagwörter: Trichoptera, Insecta, Westalpen, Alpen, Imago, Endemismus, Taxonomie, Faunistik
Keywords: Trichoptera, Insecta, Province of Cuneo, Italy, Parco Naturale Alpi Marritime, western Alps, Alps, adult, endemics, taxonomy, faunistics

The Parco Naturale "Alpi Marritime" is a protected area situated in the south of the Piedmont region of Italy and covering parts of the northern slopes of the Maritime Alps. The Trichoptera of the park were sampled and studied in 2010 and 2011. A total of 71 species were registered, including 11 species endemic to the western Alps. The endemism of Trichoptera in the Alps was analysed at a regional level. 59 species were identified as being alpine endemics based on the application of two criteria: exclusively restricted to the Mountains of the Alps and ranges above the 1000 m contour line. The highest number of endemic species are observed in the western Alps.

1 Introduction

A remarkable initiative of the European Community for supporting biodiversity research in Europe was launched in 2007. Four nature reserves in France, Italy, Germany and Slovakia were selected each as target areas of comprehensive investigations of the autochthonous biodiversity. The administrations of the parks obtained funds which allowed the invitation and support of various professional and amateur experts for performing field work in the parks. The Mercantour National Park in France and the Parco Naturale "Alpi Marittime" (PNAM) in Italy were chosen as project areas. Together they form a large transnational nature reserve situated in the southwestern Alps. The inventory project was designed as an "All taxa biodiversity inventory (ATBI)". Coordinated by the Museum für Naturkunde, Berlin (MfN) and the State Museum of Natural History, Stuttgart as a work package of the European project EDIT (http://www.atbi.eu/mercantour-marittime), it was the first programme of its kind to be implemented in Europe. It was inspired, in part, by large scale inventory projects in North America (e. g. Janzen & Hallwachs 1994, Sharkey 2001). The aim of the project was to inventory as completely as possible the biodiversity of the Mercantour and Alpi Marittime parks, initially at reference spots, but later over the whole of the parks.

The author participated in the project as a specialist for Trichoptera, but concentrated his activities only to the PNAM in Italy. Three collecting excursions were conducted in different seasons of 2010 and 2011. The collected material was identified and the results were entered into the project database. The data were transmitted to the project manager associated with the administration of the park by the end of 2011 together with a small report on the obtained results. From the French side, the collected data from the Mercantour National Park were also managed via a database. On the basis of these data, two syntheses and overviews of the ATBI achievements were published (Deharveng et al. 2015, Ichter 2022). Regrettably, a similar or parallel publication providing a summary of the activities and results of the ATBI of the Alpi Marittime Park did not appear. Although detailed information

about species records up to the end of 2010 is available through the GBIF website (http://www.gbif.org/dataset/95d672e8-f762-11e1-a439-00145eb45e9a), the present article provides this data for Trichoptera, including additional records from 2011, in the traditional format of a faunistic journal paper.

A further motivation for embarking on the project was the prospect and expectation of obtaining new material for the collection of the MfN. The alpine fauna is largely underrepresented in many German museum collections. Of special interest were endemic species, which do not occur elsewhere outside the Alps. They are of biogeographic and evolutionary significance and have become something akin to target species during sampling activities in the field. The preoccupation with this group of species prompted me to take a deeper look into the significance, extent and distribution of Trichoptera endemism in the Alps (see below).

2 Material and methods

The main sites of collecting are indicated in figure 1. Their coordinates and altitudes (m a.s.l.) are provided in the list of localities.

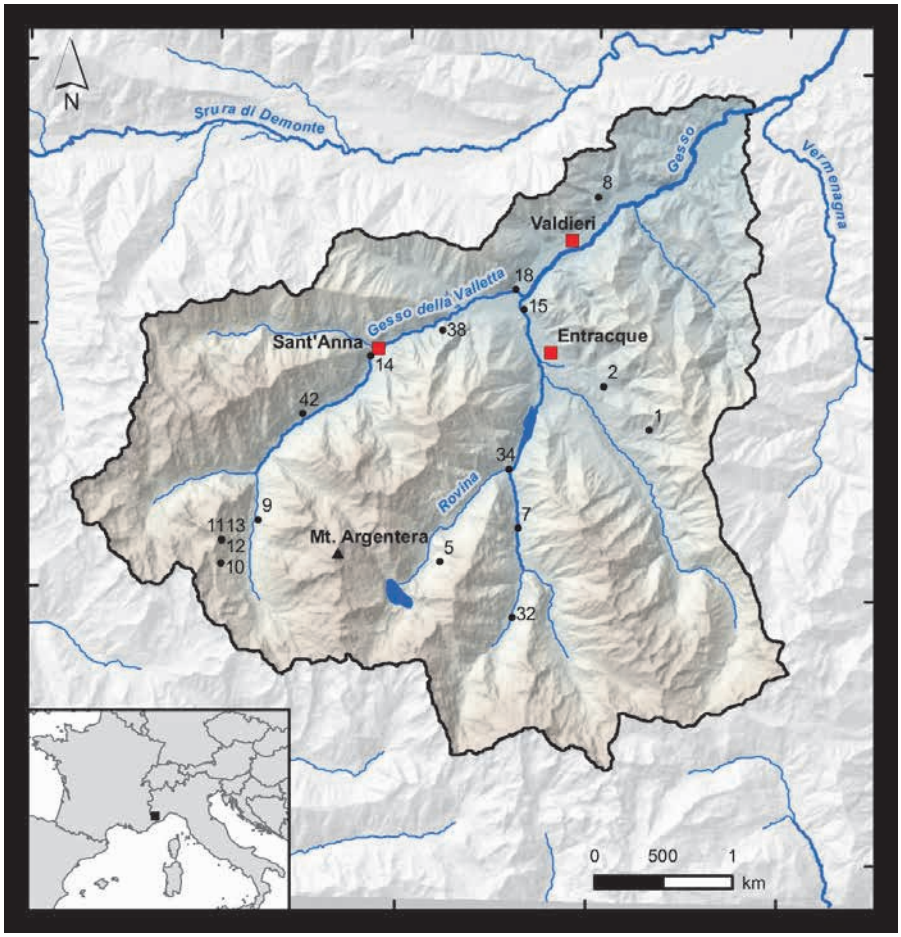

Fig. 1: Map of the Parco Naturale Alpi Marritime

The sampling of caddisflies concentrated on adults. Adult caddisflies were collected during the daytime using a conventional hand-net. Most of the material was collected by the author, and additionally in 2011 by K. Ebert, M. Gerstberger, and V. Richter (all MfN). It was gathered at the lights by picking up the insects manually from a white sheet illuminated by a single 250 W or HWL bulb. The lamp was powered by a Honda Ex 350 generator. Collecting at night was also accomplished with a 12V battery-operated light-tower (2 x 15 Watt, superactinic light tubes, F. Weber Company, Stuttgart, Germany). The tower was in operation for about 2-3 hours starting at sunset (Fig. 2). Most of the imagines were preserved in ethylalcohol (75 %), others were pinned or micro-pinned and preserved dry in small boxes.

Fig. 2: Night collecting with light tower, S. Giacomo (Loc. 7)

Dissection of the genitalia of the smaller species was performed according to the procedure described by Robinson (1976). The genitalia were embedded in Euparal. Chlorazol Black was used for staining. The cleared abdomens of the larger species are either on the corresponding pins in polyethylene vials with glycerine, or together with the corresponding specimens in alcohol. Genitalia preparations were drawn using a camera lucida attached to a Leica MZ12 compound microscope.

The collected material was identified and the results were entered into the project database of EDIT. The data were transmitted to GBIF and to the project manager associated with the administration of the park by the end of 2011 together with a small report on the obtained results. The material is deposited in the Museum für Naturkunde, Berlin (MfN).

Bibliographic data and the correctness of taxonomic names were checked by using Morse (2022).

The treatment and sequence of families is adopted from the atlas of Malicky (2004). Within supra-specific taxa, the genera and species are arranged alphabetically.

The Parco Naturale "Alpi Maritime" is situated in southwest Piedmont, in the province of Cuneo. This protected area was created in 1995 by unifying "Parco dell' Argentera" and "Riverva del Bosco e dei laghi di Palanfré". The park boundaries enclose an area of nearly 27.000 ha. The south peak of the Argentera Massif at 3297 m is the highest point in the park, whilst the lowest point is about 820 m. The park territory covers a significant part of

the Maritime Alps. 91 % of the protected area lies in the Gesso valley, which spread out in a characteristic fan shape above Valdieri. The Gesso splits into two main branches, Gesso della Valetta to the right (west) and Gesso della Barra to the left (east), these further splitting into shorter valleys.

The main collecting sites in the park, which were visited several times in different seasons, are indicated by numbers in the topographic map of Fig. 1. The map demonstrates the geographic position and area of the park. Photos of some localities showing aquatic habitats are provided in Figs 3-9. Some German notes attached to these collecting sites were taken from the field book of the author.

3 List of aquatic collecting sites and other sampling localities

Year 2010

1. Entracque, Trinità, kleiner Bach im Karst, N 44°13.189‘ E 07°26.441‘, 1076 m, Kescherfang, 26.07.2010
2. Entracque, Il Rio, Bachtal im Karst, N 44°13.18‘ E 07°26.44‘, 1000 m, Lichtfang: 21.30- 23.00 h, Temperaturverlauf: von 19 °C fallend bis 13 °C, 26.07.2010 (Fig. 3)
3. Entracque, Ponte della Rovina, linker Seitenbach des Gesso, N 44°12.401‘ E 07°22.789‘, 984 m, Kescherfang, 27.07.2010 (Fig. 4)
4. Entracque, Ponte della Rovina, Quellen und Quellbäche zum Rovina, N 44°12,402’ E 07°22.786’, 1015 m, 27.07.2010
5. Entracque, Lago della Rovina, östliche Zuflüsse zum See, N 44°10.620‘ E 07°21.008‘, 1700-1800 m, Kescherfang, 27.07.2010 (Fig. 5)
6. Entracque, Valle di Fenestrelle, Bach zum Stausee, 2000 m, Kescherfang, 27.07.2010
7. San Giacomo, Gesso del Barra, N 44°11.287‘ E 07°23.044‘, 1116 m, Lichtfang 21.30-23.00 h .Temperaturverlauf: von 20 °C steigend auf 22 °C, 27.07.2010 (Fig. 2)
8. Andonno, T. Gesso, N 44°17.587‘ E 07°25.001‘, 931 m, Lichtfang 23.30-00.30 h, Temperaturverlauf: konstant 18 °C, 27.07.2010 (Fig. 6)
9. Mt. Argentera, Westseite, Glas del Mesdi, Bäche, N 44°11.345‘ E 07°16.225‘, 1350 m, Kescherfang, 28.07.2010 (Fig. 7)
10. Tal des Gesso della Valetta, westlicher Seitenbach, unterhalb der Laghi di Freemamorta, N 44°10.509‘ E 07°15.270‘, 2243 m, Kescherfang, 28.07.2010
11. Tal des Gesso della Valetta, westlicher Seitenbach, kleiner und steiler Quellbach, N 44°10.954‘ E 07°15.270‘, 1778 m, Kescherfang, 28.07.2010
12. Tal des Gesso della Valetta, westlicher Seitenbach, N 44°10.955‘ E 07°15.271‘, 1765 m, Kescherfang, 28.07.2010
13. Gesso della Valetta, Oberlauf, N 44°10.101’ E 07°16.123’, 1720 m, Kescherfang, 28.07.2010 (Fig. 8-9)
14. San Anna di Valdieri, am Ufer des Gesso della Valetta, N 44°14.496’ E 07°19.083’, 1007 m, Lichtfang 21.30-23.00 h, Temperaturverlauf: konstant 20 °C, 27.07.2010
15. Entracque, 2 km unterhalb, Gesso di Entracque, N 44°15.427’ E 07°23.090’, 804 m, Kescherfang, 18.10.2010
16. Entracque, San Lucia, Il Rio, N 44°13.997’ E 07°25.233’, 1057 m, Kescherfang, 18.10.2010
17. Entracque, Trinitá, N 44°13.189’ E 07°26.441’, 1076 m, Kescherfang 18.10.2010
18. Ponte Rosso, Gesso della Valetta, N 44°15.800’ E07°22.876’, 800 m, Kescherfang 19.10.2010
19. Entracque, oberhalb Ponte della Rovinna, Quellen und Quellbäche zum Rovinna, N 44°12.402’ E 07°22.786’, 1010 m, Kescherfang 19.10.2010
20. Entracque, Lago della Rovinna, N 44°10.620’ E 07°21.008’, östliche Zuflüsse zum See, 1780 m, Kescherfang, auch auf Schnee, 19.10.2010
21. Entracque, Bach unterhalb Lago della Rovinna, Vallone Laitons, N 44°11.231’ E 07°20.847’, östliche Zuflüsse zum See, 1441 m, Kescherfang, 19.10.2010
22. Mt. Argentera, Westseite, Glas del Mesdi, Bäche, N 44°11.345‘ E 07°16.225‘, 1350 m, Kescherfang, 19.10.2010
23. Gesso della Valetta, Oberlauf, N 44°10.101’ E 07°16.123’, 1720 m, Kescherfang, 19.10.2010
24. Entracque, Ponte di Porcera, N 44°12.207’ E 07°26.374’, 1106 m, Kescherfang, 20.10.2010
25. Entracque, Vallone di Rua, N 44°11.757’ E 07°26.629’, 1171 m, Kescherfang, 20.10.2010
26. Entracque, N 44°14.290’ E 07°24.562’, 960 m, Kescherfang, 20.10.2010

Year 2011

27. Entracque, Lago della Rovina, östliche Zuflüsse zum See, N 44°10.620‘ E 07°21.008‘, 1700-1800 m, Kescherfang, 16.06.2011
28. Andonno, T. Gesso, N 44°17.587‘ E 07°25.001‘, 931 m, Lichtfang 22:00-00:30 h, Temperaturverlauf: 19,3 °C, 22:00, 17,1°C, 0:30, 16.6.2011

29. Entracque, Ponte della Rovina, linker Seitenbach des Gesso, N 44°12.401‘ E 07°22.789‘, 984 m, Kescherfang für 45 Minuten, danach Regen, 17.06.2011
30. Entracque, Ponte della Rovina, N 44°12.384‘ E 07°22.566‘, 1008 m, windig, bewölkt, Lichtfang, 22:00 (19 °C) bis 0:30 (15,5°C), 17.06.2011
31. Entracque, Ponte della Rovina, Quellen und Quellbäche zum Rovina, N 44°12,402’ E 07°22.786’, 1015 m, Kescherfang, 18.06.2011
32. Entracque, St. Giacomo, großer, beschatteter Quellbezirk mit Quellbachabfluss, N 44°09.599’ E 07°22.951’, 1336 m, Kescherfang, 18.06.2011
31. Entracque, Il Rio, Bachtal im Karst, N 44°13.189‘ E 07°26.441‘, 1000 m, Lichtfang: 21:30 bis 23:30, Temperaturverlauf: von 15 °C fallend auf 9, 9 °C, 18.06.2011
34. Tal des Gesso della Valetta, westlicher Seitenbach mit Seitenbächen, unterhalb der Laghi di Freemamorta, N 44°10.891‘ E 07°16.481‘, 1860 m, Kescherfang, 19.06.2011
35. Mt. Argentera, Westseite, Glas del Mesdi, Bäche, N 44°11.345‘ E 07°16.225‘, 1350-1600 m, Kescherfang, 19.06.2011
36. Vallone del Gesso, Oberlauf des Gesso della Valetta, N 44°09.831‘ E 07°16.310‘, 1763 m, Kescherfang, 19.06.2011
37. S. Anna di Valderi, hygropetrische Stelle an der Straße, N 44°15.003‘ E 07°20.972‘, 884 m, Kescherfang, 19.06.2011
38. S. Anna di Valderi, Gesso della Valetta, N 44°15.003‘ E 07°20.972‘, 884 m, Lichtfang, 22:10 (17,5 °C) bis 24.00 h (15,7 °C), 19.06.2011
39. S. Anna di Valdieri, Vallone della Meris, N 44°15.002’ E 07°17.776’, 1366 m, Kescherfang, 20.06.2011
40. Andonno, T. Gesso, N 44°15.333‘ E 07°23.132‘, 815 m, Lichtfang, 22:00 (19,4 °C) bis 23.30 h (16,2 °C), 20.06.2011
41. Entracque, Il Rio, N 44°14.239‘ E 07°24.461‘, 972 m, Lichtfang: 22:00 (20,1 °C) bis 00:30 h (14,9 °C), 21.06.2011
42. Terme di Valdieri, N 44°13‘37“ E 07°17‘34“, 1100 m, Lichtfang, leg. K. Ebert and V. Richter, 21-22.06.2011
43. Entracque, Ponte della Rovina, N 44°12.384‘ E 07°22.566‘, 984 m, Lichtfang, leg. K. Ebert and V. Richter, 25.06.2011

Fig. 3: Stream Il Rio (Loc.)

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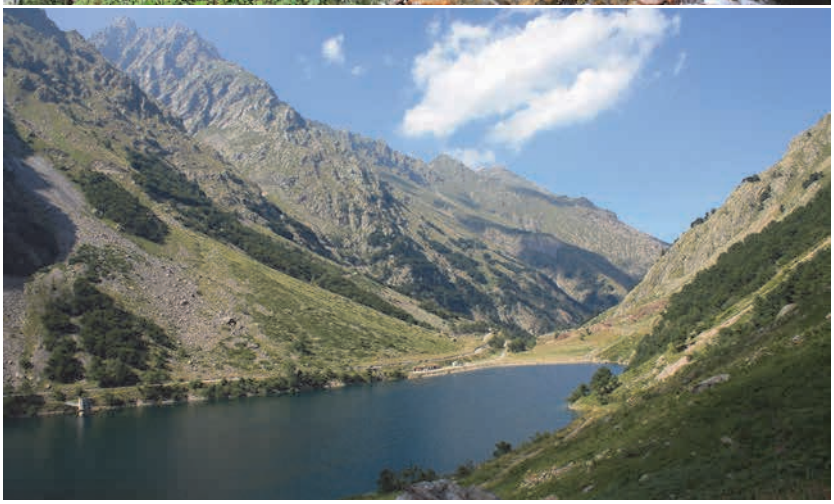

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Fig. 4: Fig. 4: Ponte della Rovina (Loc. 4)Fig. 5: Lago della Rovina (Loc. 5). Fig. 6: Gesso della Valetta, near Andonno (Loc. 8).

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Fig. 7: Mt. Argentera, west side (Loc. 9, 35). Fig. 8: Upper valley of Gesso della Valetta (Loc. 13). Fig. 9: Upper course of Gesso (Loc. 13)

4 Results

Species list

Rhyacophilidae

Rhyacophila arcangelina Navás, 1932 (Fig. 10)
Loc. 4: 2/0, Loc. 5: 2/0, Loc. 19: 1/0, Loc. 31: 1/0, Loc. 43: 1/0

Rhyacophila dorsalis acutidens McLachlan, 1879
Loc. 8: 11/0, Loc. 15: 14/0, Loc. 18: 1/0, Loc. 27: 22/6, Loc. 28: 31/2, Loc. 33: 2/0, Loc. 40: 1/0

Rhyacophila intermedia McLachlan, 1868
Loc. 23: 1/0, Loc. 25: 0/1

Rhyacophila kelnerae Schmid, 1971 (Fig. 11)
Loc. 1: 3/0, Loc. 2: 1/0, Loc. 5: 5/0, Loc. 11: 2/0, Loc. 19: 12/0, Loc. 21: 2/0, Loc. 25: 1/0

Rhyacophila pubescens Pictet, 1834
Loc. 19: 1/0, Loc. 32: 5/0

Rhyacophila ravizzai Moretti, 1991 (Fig. 12)
Loc. 16: 2/1, Loc. 17: 4/0, Loc. 18: 2/0, Loc. 20: 6/2, Loc. 24: 14/2, Loc. 25: 6/0, Loc. 26: 5/1

Rhyacophila torrentium Pictet, 1834
Loc. 2: 1/0, Loc. 3: 1/0, Loc. 7: 14/5, Loc. 14: 4/3, Loc. 33: 0/1, , Loc. 42: 3/0, Loc. 43: 4/0

Rhyacophila tristis Pictet, 1834
Loc. 3: 0/1, Loc. 4: 0/1, Loc. 5: 5/0, Loc. 9: 5/1, Loc. 30: 21/5, Loc. 31: 0/1, Loc. 32: 1/0, Loc. 33: 1/0, Loc. 38: 3/2

Rhyacophila vulgaris Pictet, 1834
Loc. 3: 3/0, Loc. 7: 19/1, Loc. 13: 1/0, Loc. 14: 9/0, Loc. 15: 1/0, Loc. 18: 1/3, Loc. 19: 0/1, Loc. 20: 9/3, Loc. 24: 5/0, Loc. 25: 0/1, Loc. 26: 2/2, Loc. 27: 1/1, Loc. 30: 6/0, Loc. 35: 1/0, Loc. 41: 2/0, Loc. 42: 1/0, Loc. 43: 9/0

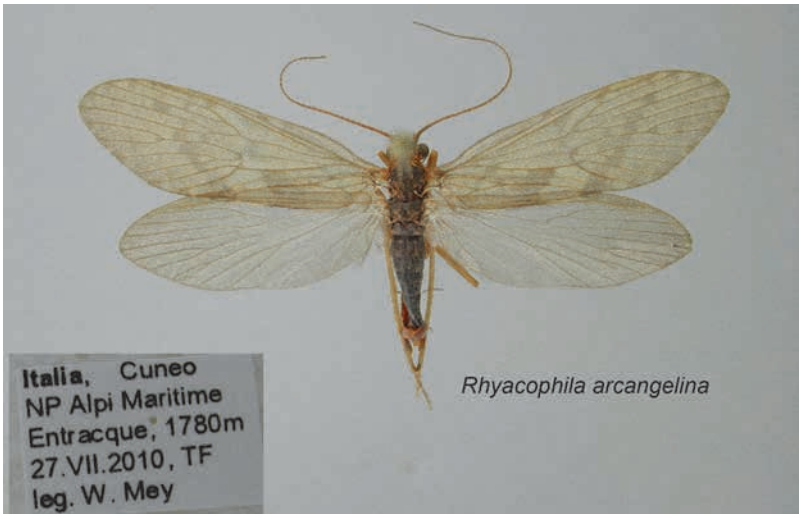


Fig. 10: Image of *Rhyacophila arcangelina*, male

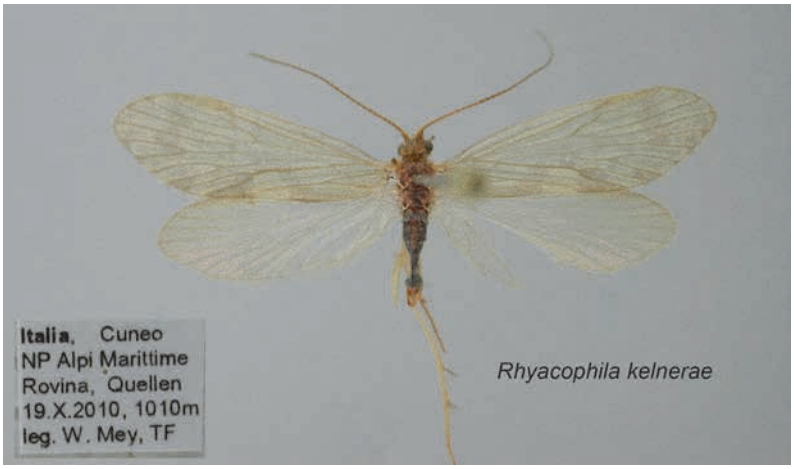


Fig. 11: Image of *Rhyacophila kelnerae*, male

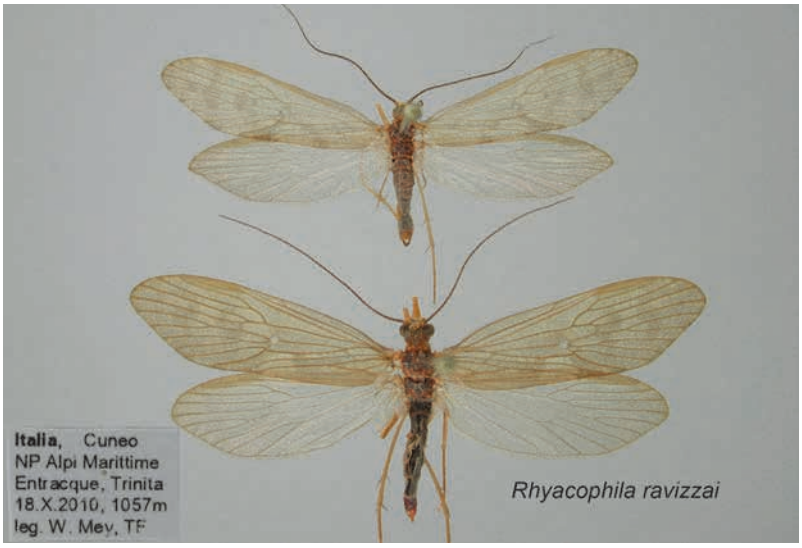


Fig. 12: Image of *Rhyacophila ravizzai*, male above, female below

Glossosomatidae

Agapetus nimbulus McLachlan, 1879
Loc. 8: 1/0, Loc. 27: 0/1

Glossosoma conformis Neboiss, 1963
Loc. 7: 2/4, Loc. 14: 0/3, Loc. 41: 1/3, Loc. 43: 1/1

Glossosoma bifidum McLachlan, 1879
Loc. 41: 0/1

Catagapetus nigrans McLachlan, 1884
Loc. 3: 0/2, Loc. 32: 0/1, Loc. 33: 1/3, Loc. 40: 1/0

Hydroptilidae

Hydroptila angulata Mosely, 1922
Loc. 7: 1/0, Loc. 14: 1/3, Loc. 28: 4/8, Loc. 40: 0/1 (genitalia slide Mey 26/23)

Hydroptila* cf. *forcipata Eaton, 1873 (Fig. 27)
Loc. 28: 1/1
Remarks: The male genitalia are depicted in Fig. 25. They differ in some parts from Central-European specimens.
Stactobia alpina Bertuetti, Lodovici & Valle, 2004 (Fig. 13)
Loc. 39: 1/1 (genitalia slides Mey 23/23, 24/23), Loc. 32: 42/8 (genitalia slide Mey 25/23)
Remarks: The species was recently recorded from localities in Tuscany (Oláh et al.2022) and, thus, cannot be considered as an alpine endemic species.

Fig. 13: Image of *Stactobia alpina*, female, scale bar: 1 mm

Ptilocolepidae

Ptilocolepus granulatus Pictet, 1834
Loc. 13: 1/0, Loc. 27: 2/1, Loc. 31: 3/1, Loc. 35: 11/0, Loc. 37: 1/0, Loc. 39: 0/1

Philopotamidae

Philopotamus liguricus Malicky, 1984 (Fig. 14)
Loc. 31: 1/0, Loc. 32: 3/1, Loc. 33: 3/1, Loc. 40: 1/0, Loc. 41: 1/0
Philopotamus ludificatus McLachlan, 1878
Loc. 1: 12/6, Loc. 2: 1/0, Loc. 3: 16/1, Loc. 4: 0/1, Loc. 5: 6/0, Loc. 6: 2/1, Loc. 7: 12/5, Loc. 8: 1/0, Loc. 9: 7/0, Loc. 10: 1/0, Loc. 11: 9/1, Loc. 13: 2/0, Loc. 14: 8/7, Loc. 26: 1/0, Loc. 27: 10/4, Loc. 30: 32/0, Loc. 31: 0/6, Loc. 32: 1/0, Loc. 33: 1/1, Loc. 35: 0/2, Loc. 36: 2/0, Loc. 38: 12/0, Loc. 40: 1/0, Loc. 42: 5/0, Loc. 43: 2/0
Philopotamus montanus (Donovan, 1813)
Loc. 18: 0/1, Loc. 20: 0/1, Loc. 43: 1/0
Philopotamus variegatus (Scopoli, 1763)
Loc. 7: 1/0, Loc. 14: 1/0, Loc. 38: 1/0
Wormaldia copiosa McLachlan, 1868
Loc. 33: 1/0
Wormaldia echinata Tobias, 1985
Loc. 16: 1/1, Loc. 17: 1/0, Loc. 20: 1/0, Loc. 38: 3/2, Loc. 40: 1/0, Loc. 41: 1/0
Wormaldia gattolliati Malicky & Graf, 2017
Loc. 32: 4/2, Loc. 35: 3/0, Loc. 39: 1/0
Remarks: The species was recently recorded from localities in Tuscany and Emilia-Romagna (Oláh et al.2022).
Wormaldia marlieri Moretti, 1981
Loc. 33: 2/0
Wormaldia occipitalis Pictet, 1934
Loc. 1: 1/0, Loc. 4: 4/1, Loc. 19: 15/1, Loc. 31: 3/0, Loc. 32: 2/1

Remarks: From the western Alps Oláh et al. (2022) have described *W. maritima* Oláh & Vicon, 2022, a species closely related to *W. occipitalis*. The morphological differences in the genitalia are minimal and molecular data may be necessary for confirming the validity of this species.

Wormaldia variegata maclachlani Kimmins, 1953
Loc. 4: 5/0, Loc. 31: 4/2, Loc. 32: 3/1

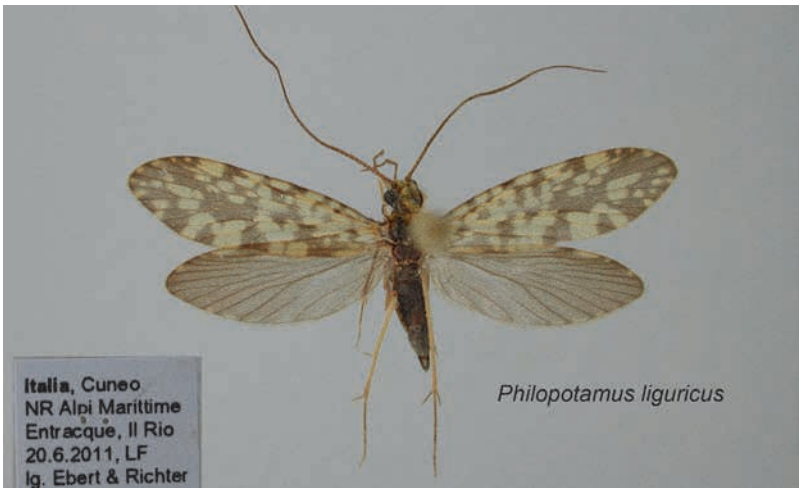


Fig. 14: Image of *Philopotamus liguricus*, male

Polycentropodidae

Plectrocnemia brevis McLachlan, 1871
Loc. 14: 1/0
Plectrocnemia praestans McLachlan, 1884
Loc. 2: 1/0, Loc. 5: 1/0, Loc. 9: 1/0, Loc. 11: 1/0
Plectrocnemia conspersa Curtis, 1834
Loc. 41: 5/3
Plectrocnemia geniculata McLachlan, 1871
Loc. 4Loc. 1: 1/0, Loc. 4: 4/1, Loc. 19: 15/1, Loc. 31: 3/0, Loc. 32: 2/1Loc. 4: 5/0, Loc. 31: 4/2, Loc. 32: 3/1Loc. 14: 1/0Loc. 2: 1/0, Loc. 5: 1/0, Loc. 9: 1/0, Loc. 11: 1/0Loc. 41: 5/3Lo 3: 1/0

Psychomyidae

Psychomyia pusilla (Fabricius, 1781)
Loc. 14: 0/1, Loc. 28: 1/4
Tinodes consiglioi Botosaneanu, 1980
Loc. 33: 4/2, Loc. 40: 9/3
Tinodes maclachlani Kimmins, 1966
Loc. 32: 3/2
Tinodes sylvia Ris, 1903
Loc. 41: 1/0
Tinodes spec.
Loc. 37: 0/1

Hydropsychidae

Diplectrona atra McLachlan, 1878
Loc. 32: 6/9
Hydropsyche angustipennis (Curtis, 1834)
Loc. 28: 0/1
Hydropsyche dinarica Marinkovic, 1979 (Fig. 15)
Loc. 8: 5/0, Loc. 14: 4/8, Loc. 28: 5/7, Loc. 33: 2/0, Loc. 40: 0/4, Loc. 41: 3/7, Loc. 43: 0/1
Hydropsyche instabilis Curtis, 1834
Loc. 2: 1/0, Loc. 7: 0/4, Loc. 8: 15/15, Loc. 14: 0/1
Hydropsyche tenuis Navás, 1932
Loc. 33: 1/0, Loc. 38: 3/0, Loc. 41: 4/3, , Loc. 42: 1/1, Loc. 43: 2/3

Fig. 15: Photo of *Hydropsyche dinarica*, male

Lepidostomatidae

Crunoecia cf. ***fortuna*** Malicky, 2002 (Fig. 26)
Loc. 9: 1/1
Remarks: The male genitalia are depicted in Fig. 27 They differ in some parts from the illustrations in Malicky (2004).
Crunoecia irrorata (Curtis, 1834)
Loc. 2: 1/0, Loc. 41: 4/0
Crunoecia spec.
Loc. 32: 0/3
Lepidostoma basalis (Kolenati, 1848)
Loc. 8: 0/1

Goeridae

Lithax niger (Hagen, 1859)
Loc. 35: 3/0, Loc. 36: 3/2
Silo nigricornis (Pictet, 1834)
Loc. 28: 1/0, Loc. 40: 1/0, Loc. 41: 8/6
Silo pallipes (Fabricius, 1781)
Loc. 40: 1/0

Limnephilidae
Drusinae

Drusus discolor (Rambur, 1842)
Loc. 5: 2/0, Loc. 9: 5/2, Loc. 11: 2/0, Loc. 13: 2/0, Loc. 30: 1/0, Loc. 42: 1/0, Loc. 43: 3/0
Remarks: From the western Alps Oláh et al. (2022) have described *Drusus ferdes* Oláh & Coppa, 2016, *D. leker* Oláh, 2016, and *D. italiano* Oláh & Vicon, 2022, all species closely related to *D. discolor*. The morphological differences in the genitalia are minimal and molecular data may be necessary for confirming the validity of these species.
Drusus lepidopterus (Rambur, 1842)
Loc. 35: 1/0
Remarks: The specimens from the western Alps were considered by Oláh et al. (2017) to represent three separate species, *Drusus dudar* Oláh, 2017, *D. piemontensis* Oláh, 2017 and *D. savoiensis* Oláh, 2017. The morphological differences in the genitalia are minimal and molecular data may be necessary for confirming the validity of these species.
Drusus melanchaetes McLachlan, 1876
Loc. 35: 1/0
Drusus nebulicola (McLachlan, 1867)
Loc. 5: 4/1, Loc. 9: 11/5
Ecclisopteryx guttulata Pictet, 1834
Loc. 7: 6/43, Loc. 8: 0/4, Loc. 14: 1/33, Loc. 43: 0/8
Remarks: The specimens from the western Alps were considered by Oláh et al. (2017) to represent a separate species, *E. legeza* Oláh & Lodovici, 2017. The morphological differences in the genitalia are minimal and molecular data may be necessary for confirming the validity of a separate species.
Metanoea flavipennis Pictet, 1834
Loc. 9: 10/0, Loc. 13: 9/2

Limnephilinae

Allogamus antennatus McLachlan, 1876 (Fig 17)
Loc. 20: 1/3, Loc. 24: 2/0, Loc. 25: 1/0
Allogamus auricollis Pictet, 1834
Loc. 16: 0/2, Loc. 18: 3/31, Loc. 20: 4/6, Loc. 26: 1/3, Loc. 27: 0/3
Allogamus hilaris McLachlan, 1876 (Fig. 18)
Loc. 20: 1/1, Loc. 24: 1/1
Allogamus mendax McLachlan, 1876 (Fig. 19)
Loc. 20: 5/2, Loc. 22: 2/4, Loc. 23: 4/0, Loc. 24: 6/4
Anisogamus difformis McLachlan, 1867
Loc. 5: 16/0, Loc. 9: 3/0, Loc. 10: 3/0, Loc. 11: 1/0, Loc. 34: 5/0
Chaetopteryx gessneri tomaszewski Moretti, 1991 (Fig. 20)
Loc. 15: 1/0, Loc. 27: 1/0
Remarks: Oláh et al. (2022) have elevated this subspecies to specific rank. The morphological differences in the male genitalia are minimal and molecular data may be necessary for confirming the presence of a distinct species.
Consorophylax consors McLachlan, 1880 (Fig. 21)
Loc. 20: 1/1, Loc. 23: 2/0
Remarks: From the western Alps Oláh et al. (2022) have described *Consorophylax cairos* Oláh & Vincon, 2022, *C. seolan* Oláh & Vincon, 2022, and *C. lagoverde* Oláh & Vincon, 2022, all species closely related to *C. consors*. The morphological differences in the genitalia

are minimal and molecular data may be necessary for confirming the validity of these species.

Melampophylax melampus McLachlan, 1876 (Fig. 22)
Loc. 20: 0/2, Loc. 22: 0/2, Loc. 25: 1/0, Loc. 26: 0/1

Micropterna sequax McLachlan, 1875
Loc. 42: 1/0

Potamophylax cingulatus (Stephens, 1837) (Fig. 16)
Loc. 18: 1/1, Loc. 20: 1/0, Loc. 27: 1/0

Potamophylax latipennis (Curtis, 1834)
Loc. 2: 0/1

Fig. 16: Photo of *Potamophylax cingulatus*, male

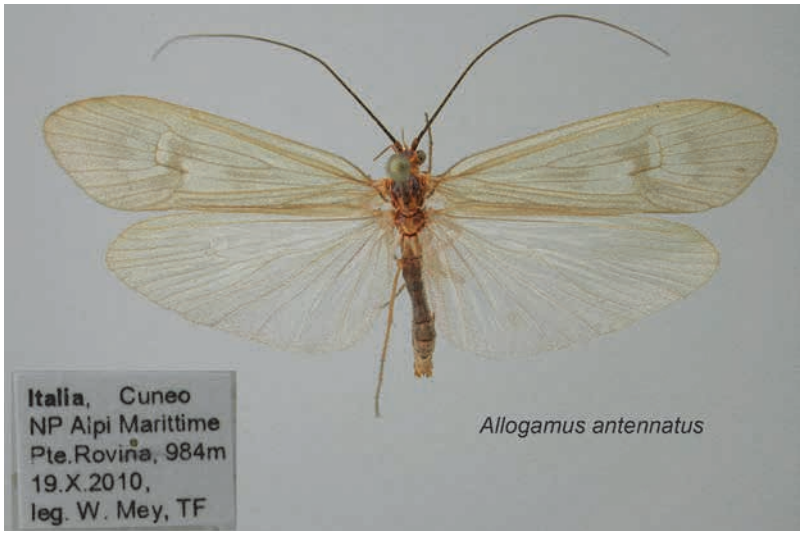
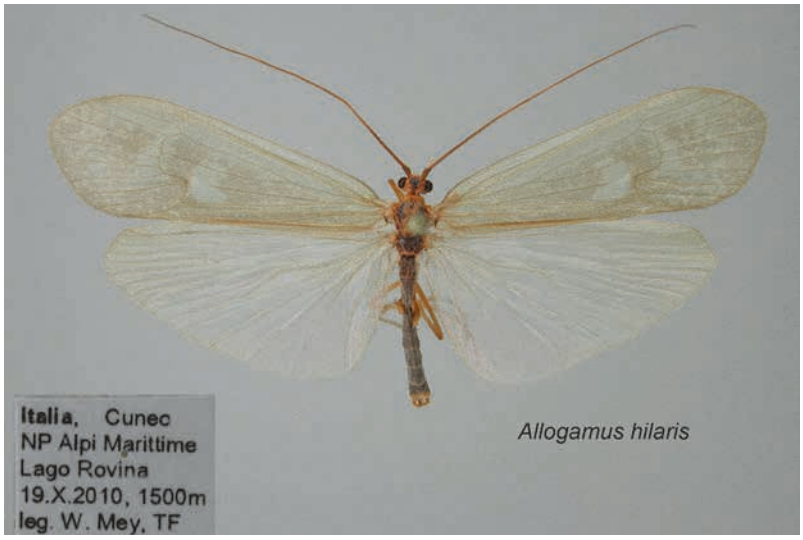
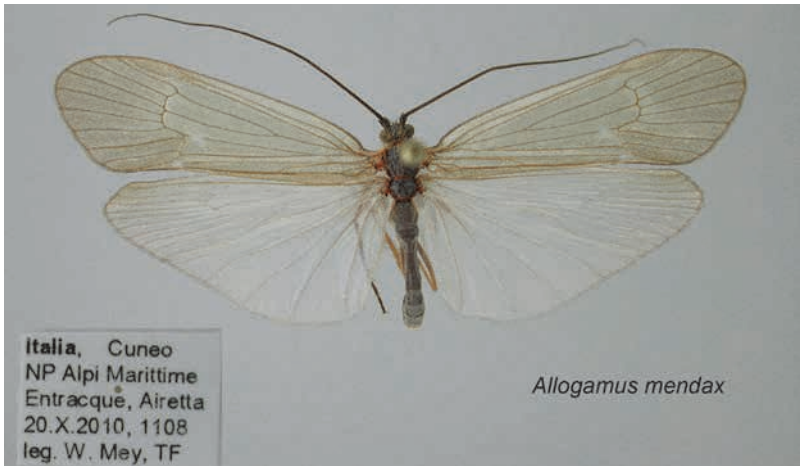


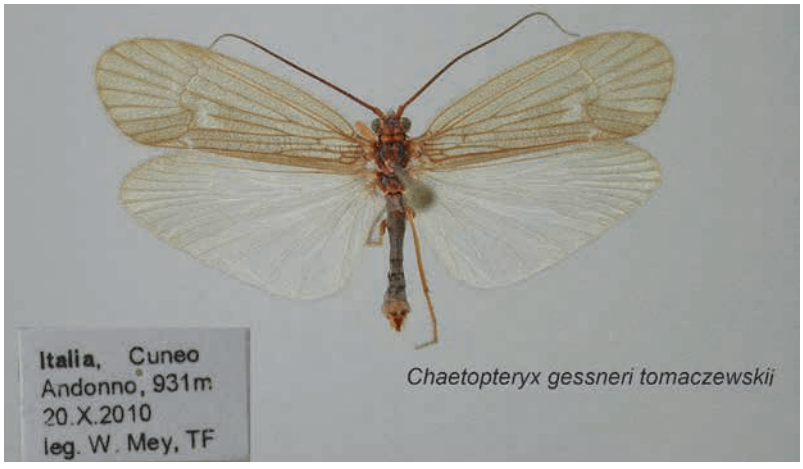
Fig. 17: Image of *Allogamus antennatus*, male



18



19



20

Fig. 18: Image of *Allogamus hilaris*, male. Fig. 19: Image of *Allogamus mendax*, male. Fig. 20: Image of *Chaetopteryx gessneri tomaszewski*, male

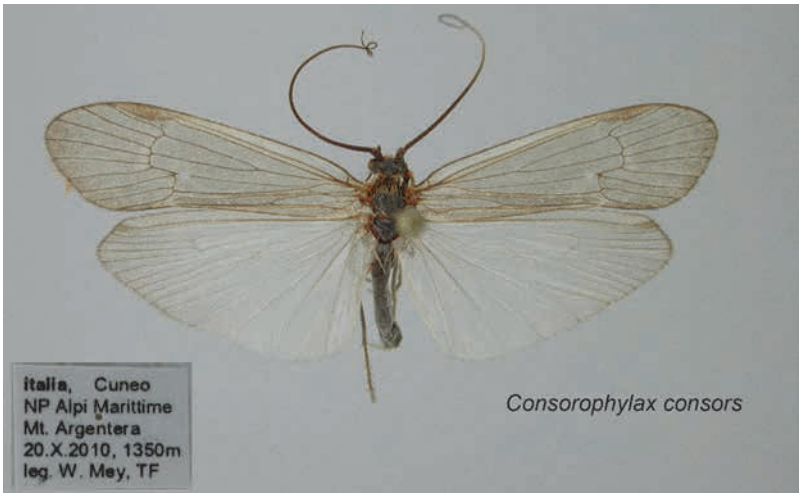


Fig. 21: Image of *Consorophylax consors*, male

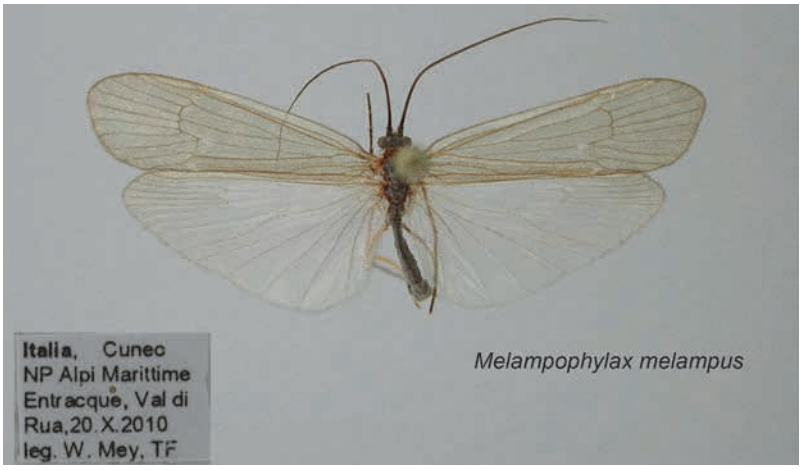


Fig. 22: Image of *Melampophylax melampus*, male

Beraeidae

Beraea maura (Curtis, 1834)
Loc. 39: 1/0, Loc. 41: 0/1
Beraeamyia gudrunae Malicky, 2002 (Fig. 23)
Loc. 14: 7/5, Loc. 31: 2/0, Loc. 39: 1/0
Ernodes botosaneanui Vaillant, 1982
Loc. 4: 0/2

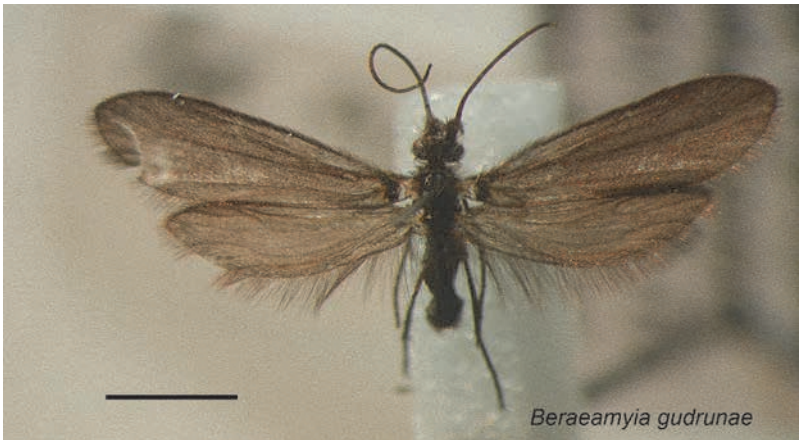


Fig. 23: Image of *Beraeamyia gudrunae*, male

Sericostomatidae

Sericostoma flavicorne Schneider, 1845
Loc. 14: 1/1
Sericostoma personatum (Kirby & Spencer, 1826)
Loc. 32: 1/1, Loc. 41: 0/1

Odontoceridae

Odontocerum albicorne (Scopoli, 1763)
Loc. 2: 4/0, Loc. 3: 3/0, Loc. 7: 2/0, Loc. 8: 3/0, Loc. 14: 1/0, Loc. 28: 25/0, Loc. 40: 7/2

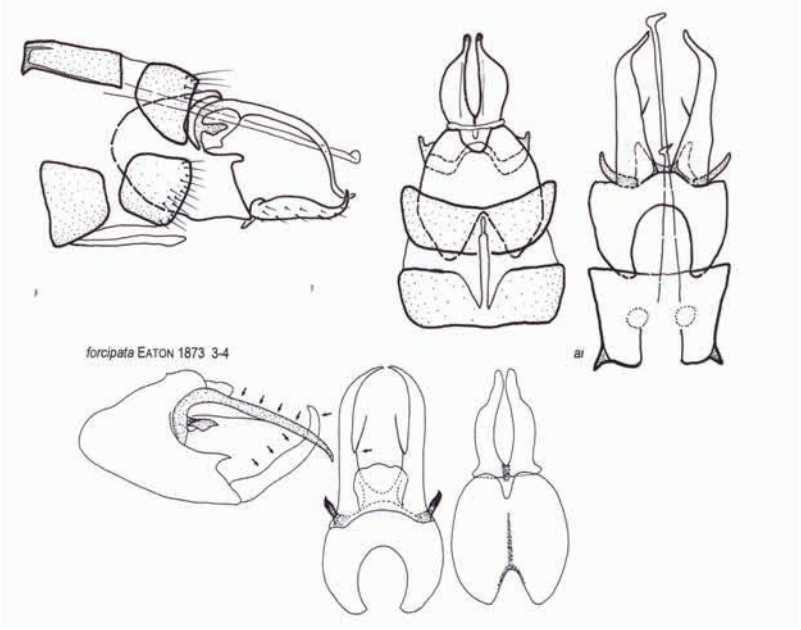


Fig. 25: Male genitalia of *Hydroptila forcipata*, individual from PNAM and figures from Malicky (2004)

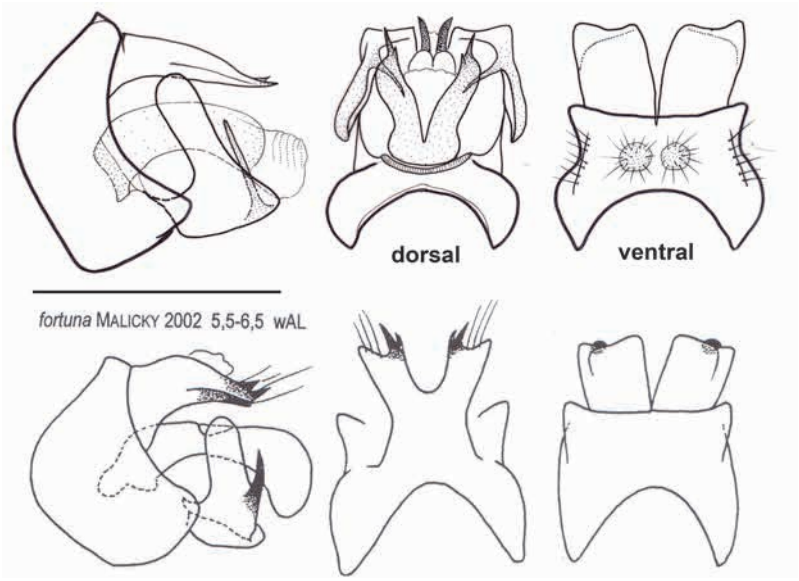


Fig. 26: Male genitalia of *Crunoecia fortuna*, individual from PNAM and figures from Malicky (2004)

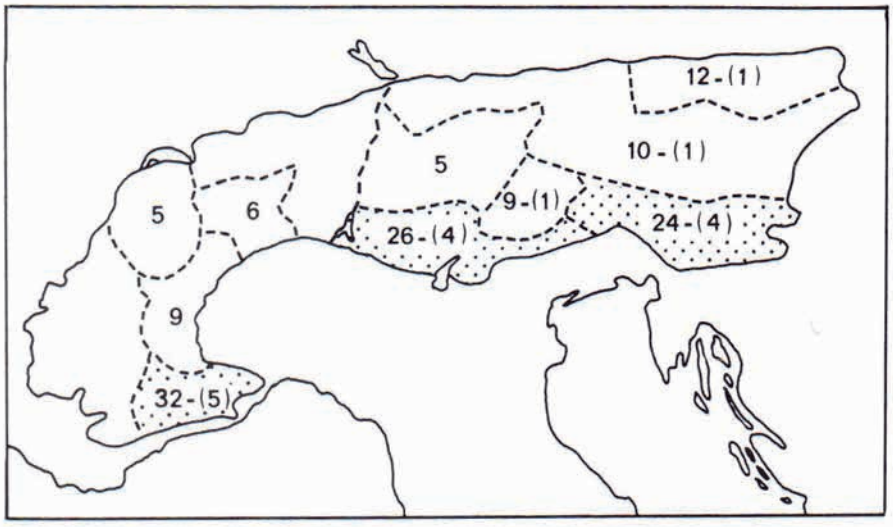


Abb. 2.26: Der Endemismus in den Alpen (nach PAWLOWSKI 1970). Die erste Ziffer nennt die Anzahl der echten Endemiten in jedem Gebiet. Die zweite Ziffer in Klammern die Zahl der überspezifischen endemischen Sippen (Sektionen oder Gattungen). Die beiden großen Pole des Endemismus der Alpen (grau) sind ein Teil der östlichen Haute-Provence, See- und Ligurischen Alpen und darüber hinaus Südostalpen.

Fig. 27: Pattern of plant endemism in the Alps (from Ozenda, 1988)

5 Discussion

The Trichoptera fauna of the western Italian Alps has been studied intensively in the past by Italian entomologists and limnologists. The data obtained were included in the first list of Italian Trichoptera (Moretti & Cianficconi 1981) and in subsequently published and updated versions (e.g. Corallini et al. 2007). The faunistic exploration of the Piedmont region continued and resulted in the discovery of new species and the provision of new distributional data (e.g. Bertuetti et al. 2004, Malicky et al. 2007). The PNAM in the south of the Piedmont region has obviously remained an only sporadically visited area. Therefore, the EDIT project appeared to be an opportunity to study the Trichoptera fauna in this undersampled area and to fill in information gaps about this group.

Of course, insect groups other than Trichoptera have been studied in the PNAM in the past by many Italian entomologists. Baldizzone (2005) has published a first synthesis on the Microlepidoptera, which included the descriptions of two new species. He continued his research in the park, and when he learned about the EDIT project and the participation of the author, he was very interested in examining the new material of micromoths, which was to be collected. Besides Trichoptera, the author is working on Microlepidoptera too, and had already been in cooperation with G. Baldidizzone for many years. We met in the park two times in 2010 and exchanged material. The photo in Fig. 24 was taken in one of those meetings.

Fig. 24: Group photo with G. Baldizzone (left), W. Mey (middle), Mrs. Baldizzone (right)

In the course of three collecting campaigns in 2010 and 2011, a total of 71 species were registered from more than 40 collecting sites distributed all over the park. However, not all interesting places could be visited. Sampling activities, especially night collecting, depended on possibilities to reach the target areas by car with the collecting equipment. There are still many places worth visiting, but getting there is not easy and would require longer marches and spending the nights in tents, often at high altitudes. The number of collected species must be considered as a preliminary result, encompassing most of the abundant and widely distributed species. The area has the potential for yielding many more species with regard to the large variety of different aquatic habitats distributed over the park. 143 species were recorded from the adjacent Mercantour National Park (Ichter et al. 2022), and a similar number of species might be expected to occur in the PNAM too.

Concerning endemic species, the PNAM did not yield any particular species living only here. However, two species were found, which show clear deviations in genitalia from published descriptions: *Crunoecia fortuna* Malicky 2004 and *Hydroptila forcipata* Eaton, 1873. The male genitalia are depicted in Figs 25-26. Both species deserve further attention, and new material should be collected to clarify their status. Besides these two cases, many of the endemics of the western Alps or of the Alps in general occur in the park. A comparison of the list of collected species in the PNAM with the list of alpine endemics in Tab. 1, yields a match of 11 species. This is about one third of the known endemics of the western Alps, and constitutes a welcome addition to the Trichoptera collection of the MfN. Moreover, a good deal of further Alpine and Italian endemics from the Apennines were collected too, which made the excursions to the PNAM a successful venture towards improving and enlarging the museum`s collection.

Tab. 1: The endemic caddisfly species of the Alps and their distribution in the adjoining countries (F = France, I = Italy, CH = Swiss and Lichtenstein, D = Germany, A = Austria, SLO = Slovenia. Category of endemism: A = entire Alps, c = central Alps, e = eastern Alps, s = southern Alps, w =western Alps). The western Alpine species are marked with grey

Taxon	F	I	CH	D	A	SLO	region
Rhyacophila arcangelina Navás, 1932	+	+					w
R. bonaparti Schmid, 1947		+	+	+	+	+	A
R. ferox Graf, 2006					+		e
R. kelnerae Schm., 1971	+	+					w
R. konradthaleri Mal., 2009					+		e
R. meyeri McL., 1879		+	+		+		A
R. orobica Mor.,1991		+	+				s
R. producta McL., 1879		+	-	+	+	+	e
R. rectispina McL., 1884		+	+				s
R. simulatrix vinconi Sipah. 1993	+		+	+	+		w
R. stigmatica (Kol., 1859)	+	+	+	+	+	+	A
Synagapetua padanus Bert. et al. 2004		+					s
Wormaldia echinata Tobias, 1995	+	+					w
W. vargai Mal., 1981		+			+	+	e
Plectrocnemia praestans McL., 1884		+					w
Tinodes luscinia Ris, 1903		+	+				s
T. zelleri McL., 1878	+	+	+	+	+	+	A
Micrasema morosum (McL., 1868)	+	?	+	+	+	+	A
Crunoecia fortuna Mal. 2002		+					w
Apatania helvetica Schmid, 1954			+				c
A. mercantoura Bot. & Guid., 2004	+						w
Drusus adustus McL., 1867		+	+		+	+	A
D. alpinus Meyr., 1875		+	+				w
D. arkos Oláh, 2017	+						w
D. chapmani McL., 1901		+	+				s
D. franzi Schm., 1956					+		e
D. katagelastos Vitecek, 2020		+					s
D. kronion Mal., 2002	+						w
D. melanchaetes McL., 1876	+	+	+		+		A
D. muelleri McL., 1861	+	+	+				s, c
D. nebulicola (McL., 1867)	+	+	+		+		A
D. nigrescens Meyr., 1875			+		+		c
D. noricus Mal., 1981					+		e
D. slovenicus Urb. et al. 2002						+	e
Ecclisopteryx asterix Mal., 1979		+			+	+	e
E. malickyi Mor., 1991		+					w
Metanoea euphorion Mal., 2001	+						w
M. flavipennis Pict., 1834	+	+	+				w

Taxon	F	I	CH	D	A	SLO	region
M. malickyi Sipahiler, 1992	+						w
M. rhaetica Schm., 1956		+	+	+	+	+	c, e
Alpopsyche uncenorum McL., 1876	+	+	+				w
Chaetopteryx ges. gessneri McL., 1857	+	+	+				w, c
Chaetopteryx rug. noricum Mal., 1976					+	+	e
Allogamus periphetes Mal., 2004		+	+				w
Consorophylax carinthiacus Mal. 1992					+	+	e
C. consors (McL., 1880)	+	+	+	+	+		A
C. corvo Mal., 2008	+						w
C. delmastroi Mal., 2004		+					w
C. lepontiorum Graf & Vitececk, 2016		+					w
C. montivagus (McL., 1867)		+			+	+	e
C. piemontanus Bots., 1967		+					w
C. styriacus Bots., 1967					+	+	e
C. vinconi Graf & Mal. 2015		+					w, c
Melampophylax austriacus Mal., 1990					+	+	e
Leptotaulius gracilis Schm., 1955		+	+		+	+	A
Platyphylax vinconi Oláh, 2022	+						w
Anisogamus difformis McL., 1867	+	+	+		+		A
Beraeamyia gudrunae Mal, 2002		+					w
Ernodes botosaneanui Vaill., 1982	+	+					w
59	23	39	25	8	25	16	

6 Trichoptera endemism in the Alps

A taxon is termed endemic if confined to a particular area which may be large or small. Here, this area refers to the Alps, beyond the contour line of 1000 m and including its gradual extension from the Maritime Alps into the Ligurian Apennines. The mountain system of the Alps is an outstanding area of species diversity and endemism for many plant and animal groups. In his textbook on the vegetation of the Alps, Ozenda (1988: 62) provided a map which shows the distribution and number of endemic plants (Abb. 27). The highest number of endemic species are observed in the western Alps, followed by the southern and eastern Alps. Because of the tight host-plant relationship most terrestrial insect groups probably follow this pattern. Trichoptera is an aquatic insect order, and it would be interesting to see whether or not the endemism of caddisflies correlates with the pattern of plant endemism?

The Alps have attracted the attention of Trichoptera students for centuries, resulting today in a good taxonomic and faunistic knowledge of the alpine Trichoptera fauna. Species lists from all countries with a greater or lesser share of the Alps were published in recent years, and information on alpine species, including endemics, are available from these papers (Cianficconi et al. 2007, Graf 2009, Krušnik & Urbanic 2002, Lubini-Ferlin 2005, Robert 2016). In addition, in the "Atlas of European Trichoptera", Malicky (2004) has attached to each species a biogeographic characterization. The exclusively alpine species are considered as endemics and were indicated as occurring in the western, southern, central, and eastern Alps, or given the label of having a general distribution throughout the Alps. The relevant species from these two literature sources were extracted and summarized into a preliminary table. Recent corrections and addition to the Atlas by Malicky (2022) were assessed and where necessary included in the table. Each species of the first draft of the table was examined again taking into consideration new records and data published during the last few years. Many species, which were thought to be alpine endemics, had to be excluded since they have subsequently been found outside of the Alps. An example from the eastern

Alps is *Crunoecia kempnyi* Morton, 1901, which has a range extending from the Alps into the southeast to Bosnia (Malicky 2018). Examples from the western Alps are *Stactobia alpina* Bert. et al. 2004 and *Wormaldia gattolliati* Malicky & Graf 2017, described from the western Alps, but later also found in the Apennine Mts. (Oláh et al. 2022). Some species are only known from the forelands or lowlands of the Alps, but do not occur beyond altitudes of 1000 m. Examples are *Anabolia lombarda* Ris, 1897 from the southern margin, *Chaetopteryx clara* McLachlan, 1876 from the eastern side and *Rhyacophila valliclausae* Guidicelli & Botosaneanui, 1999 from the western forelands. These species form a separate group which can be termed pre-alpine endemics.

According to table 1, a total of 59 species were identified as being alpine endemics, i. e. occurring only in the Alps and above the 1000 m contour line. Among the alpine countries Italy has the highest number of endemic species, followed by Switzerland, Austria and France. The numbers are smallest in Slovenia and Germany, which may be due to their small alpine portion and its minor extension on the periphery of the Alps. In terms of regional endemism, the western Alps are home to 25 species, followed by the eastern Alps with 14 species. The southern and central Alps have the smallest numbers with 6 and 3 species respectively. Eleven species were identified as being distributed more or less completely throughout the Alps (Tab. 2). In conclusion, the highest number of endemic species are observed in the western Alps, which indeed, is in congruence with the pattern of plant endemism. Presumed differences in pattern of endemism between terrestrial and aquatic biota are thus not recognizable in Trichoptera.

Tab. 2: The endemic caddisfly species of the Alps and their distribution according to the regions of table 1 (w – western Alps, s = southern Alps, c = central Alps, e = eastern Alps, A = widely distributed in the Alps)

Region	w	s	c	e	A	
Species number	25	6	3	14	11	59

The number of endemic genera is quite low in the Alps. It was reduced further down by synonymising *Monocentra* Rambur, 1872, *Metanoea* McLachlan, 1880 and *Cryptothrix* McLachlan, 1867 of Drusinae with *Drusus* Stephens, 1837 (Oláh et al. 2017). Today, only three genera of Limnephilidae have ranges confined to the Alps: *Alpopsyche* Botosaneanu & Giudicelli, 2004, *Leptopsyche* Schmid, 1955, and *Consorophylax* Schmid, 1955.

An important issue in the study of endemism is the recognition of particular areas with a certain concentration of endemic species (centres of endemism). Once such an area is recognised explanations must be sought as to how they may have arisen and how they are being maintained? This knowledge is important for understanding the origin, dispersal and speciation of endemics, and is essential for the development of strategies for biological conservation. The present article, however, has not the intention to define those areas nor to provide hypotheses on their formation and age. This should be the subject of a future analysis when more distributional and molecular data are available. The fine scale distribution of many endemics is imperfectly known, and new data are necessary to define specific ranges, which are the basic units of centres of endemism. In addition, there is still a need for a better taxonomic knowledge of endemic species and their sister-species. This has become a demanding task since J. Oláh and co-workers have started to describe new species, mostly by splitting well-known ones into separate entities on the basis of minor morphological differences which are often hard to distinguish from cases of natural variation (Oláh et al. 2017, 2019, 2020). The validity of these new species, many of them from the Alps, needs to be con-

firmed using molecular methods. If all of these new species should indeed turn out to be different taxa, the endemism of Trichoptera in the Alps and its proportion of the total fauna was clearly higher and more pronounced than that shown in this article. The endemics included in table 1 must be regarded as a conservative arrangement of species. It is by no means a fixed list. New records, data, new taxonomic results or even new species descriptions will certainly continue to arise, necessitating updates to the list from time to time.

The author has unfortunately overlooked the record of *Anisogamus difformis* from the Apennine Mts in Oláh et al. (2022). The species must be deleted from the list of alpine endemics, thus reducing its number to 58.

Acknowledgements

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