

Orophilic and crenophilic stoneflies (Insecta: Plecoptera) of the Italian region: new species, nomenclatural changes, updated and annotated checklist

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Abstract. An updated checklist of 191 Plecoptera species currently known from the Italian region is presented. Four new species are described: *Protonemura marilouae* sp. nov. from Calabria and Sicily, *P. olahi* sp. nov. from the central Apennines (Abruzzi), *Leuctra stronensis* sp. nov. from the Pennine Alps and *L. trecimensis* sp. nov. from the Dolomites. The males of *Protonemura hirpina* Consiglio, 1958b, and *Leuctra silana* Aubert, 1953b, are re-described, and their females are described for the first time. Four taxa are raised from subspecies to species rank: *Protonemura padana* Vinçon & Ravizza, 2005, *Leuctra aubertorum* Ravizza & Ravizza Dematteis, 1994a, *L. orsiera* Ravizza & Vinçon, 2003 and *L. incudensis* Vinçon & Ravizza, 2000b. *Nemoura banatica* Kis, 1965 is restored as a valid species, removed from synonymy with *N. marginata* Pictet, 1836, and its male is re-described. *Protonemura beatensis robusta* Berthélemy, 1963 is declared to be a junior synonym of *P. salfii* (Aubert, 1954c). Taxonomical notes on problematic species are added. The present checklist is the result of the compilation of published and unpublished data collected by the first three authors between 1974 and 2023. Distribution, altitudinal range and flight period of all species are summarized in table I. The altitudinal limits of nearly all orophilic Plecoptera species of the Italian Alps and Apennines are shown to have shifted to higher altitudes over a period of 30 or more years. An exhaustive bibliography of the original species descriptions of the Italian Plecoptera fauna is provided.

Keywords. Plecoptera, distribution, zoogeography, Italy, Catalogue.

INTRODUCTION

Compared to other European countries (Klapálek 1909, Despax 1951, Illies 1955, Aubert 1959), the interest for systematic studies of stoneflies in Italy is of rather recent origin. It was only in the late 1960s that Consiglio (1967b) published the first list of Italian Plecoptera, comprising 122 species and subspecies. Four years later, Consiglio (1971) improved his list, by removing two species that did not belong to the Italian stonefly fauna, but added three more, increasing the total number of taxa to 123. Consiglio (1979, 1980) then updated once more his inventory, and raised the number of stonefly species present in Italy to 130.

From the mid-1970s onwards, the knowledge of the stoneflies from the Italian region has significantly improved, due to the collecting efforts of the first three authors, as well as the taxonomical updates resulting from these findings, allowing the description of 39 new species during the last fifty years: *Isoperla orobica* Ravizza, 1975a, *Protonemura elisabethae* Ravizza, 1976a, *Leuctra brevipennis* Ravizza, 1978, *Nemoura pesarinii* Ravizza & Ravizza Dematteis, 1979a, *N. oropensis* Ravizza & Ravizza Dematteis, 1980b, *Leuctra vesulensis* Ravizza & Ravizza Dematteis, 1984, *L. elisabethae* Ravizza, 1985, *L. auberti* Ravizza & Ravizza Dematteis, 1985, *L. apenninicola* Ravizza, 1988, *L. queyrassiana* Ravizza & Vinçon, 1991b, *L. zwicky* Ravizza & Vinçon, 1991a, *L.*

canavensis Ravizza & Ravizza Dematteis, 1992, *Isoperla kir* Fochetti & Vinçon, 1993, *Leuctra vinconi* Ravizza & Ravizza Dematteis, 1993a, *L. ravizzai* Ravizza Dematteis & Vinçon, 1994, *L. aubertorum* Ravizza & Ravizza Dematteis, 1994a, *Nemoura rivorum* Ravizza & Ravizza Dematteis, 1995, *Leuctra subalpina* Vinçon, Ravizza & Aubert, 1995, *L. ameliae* Vinçon & Ravizza, 1996, *L. incudensis* Vinçon & Ravizza, 2000b, *L. orsiera* Ravizza & Vinçon, 2003, *Protonemura padana* Vinçon & Ravizza, 2005, *L. gardinii* Ravizza, 2005, *Nemoura sabina* Fochetti & Vinçon, 2009, *Rhabdiopteryx harperi* Vinçon & Murányi, 2009, *Leuctra juliettae* Vinçon & Graf, 2011, *L. muranyii* Vinçon & Graf, 2011, *L. delmastroi* Vinçon, 2012, *L. fochettii* Vinçon & Vitecek, 2017, *L. grafi* Vinçon & Vitecek, 2017, *Zwicknia gattolliati* Vinçon & Reding, 2018, *Protonemura bispina* Vinçon, Ravizza & Reding, 2021, *P. pennina* Vinçon, Ravizza & Reding, 2021, *Nemoura aprutiana* Vinçon & Ruffoni, 2021, *Perla ravizzaorum* Reding, 2023, *Dictyogenus julium* Reding, 2024, *D. nadigi* Reding, 2024, *D. padanum* Reding, 2024, *D. vinconi* Reding, 2024. Furthermore, *Leuctra biellensis* Festa, 1942 has been reinstated as a valid species, different from *L. nigra* with which it had formerly been synonymized (Vinçon, Boumans & Gattolliat 2018). *Nemoura banatica* Kis, 1965 is also reinstated, and removed from synonymy with *N. marginata* (Zwick 1970). Finally, 4 new species are described in the present contribution.

As a result of these collecting efforts and taxonomical updates, the number of stonefly species presently known from Italy and its adjacent territories has increased from 160 (Fochetti & Tierno de Figueroa 2008), 167 (Fochetti 2020), and 170 (Laini et al. 2024) to 191 in the present study.

Here we provide an updated checklist of the Italian stonefly fauna based on the compilation of both published and unpublished data, collected by the first three authors between 1974 and 2023, mainly in crenal and high-altitude habitats.

The stonefly fauna of large to middle-sized rivers has not been explored recently by the au-

thors since it is presumably well known by its use in biotic indices. Moreover, these biotopes are not the preferred habitat of stoneflies, since Plecoptera are much more abundant in springs and high-altitude brooks. Orophilic and crenophilic Plecoptera account for more than 90% of all inventoried species in the Italian region, and the number of species strictly subservient to medium to large rivers is only 17. Many potamal species are presently extinct, or endangered (Zwick 1992, Ravizza & Nicolai 1983), and we list these here only for convenience.

Distribution, altitudinal ranges and flight periods of all considered species are summarized in table I. For the more emblematic species, we add taxonomical notes and distribution maps as well. In table 2, we provide a list of the most common Plecoptera species of the Italian region. Table 3 presents a comparative chart of the changes in the altitudinal range of the most orophilic species by juxtaposing the figures of the studies of Ravizza & Ravizza Dematteis (1994b) and Fochetti & Tierno de Figueroa (2008) with more recent data. Furthermore, a detailed study of the steno-endemic species of the Italian Alps and Apennines is provided. Finally, we supply an exhaustive bibliography of all original species descriptions of the Italian Plecoptera fauna.

MATERIAL AND METHODS

Intensive collecting of Plecoptera in the Italian Alps and Apennines over the past 50 years by the first three authors has resulted in the accumulation of a vast amount of distribution data, both published and unpublished. More recently, 10 collecting trips were performed by the first author throughout the whole or a significant part of the Italian peninsula: 4 in 2020, 3 in 2021, 2 in 2022 and 1 in 2023, with the aim to collect additional data of several poorly known stonefly species and to resolve complex taxonomical issues.

The specimens were collected using a beating sheet and by searching in the riverine vegetation or under the stones in brooks. The material is preserved in ethanol (70%).

Holotypes and paratypes are deposited in the Naturéum (formerly: Muséum cantonal des sciences naturelles), Département de zoologie, Lausanne, Switzerland (MZL). Additional specimens are stored in the collections of Gilles Vinçon (VIN), Carlalberto Ravizza (RAV, now stored in the MZL), Jean-Paul G. Reding (RED) and MZL. DNA sequences of several species are available within the framework of the ongoing Swiss Barcoding of Life project on aquatic insects (Swiss BOL, www.swissbol.ch, Gattolliat *et al.* 2016; Vuataz *et al.* 2024).

Abbreviations: br. brook, R. River, spr. spring, tor. torrent, trib. tributary, V Valley, < below, > above, N. North, E. East, W. West, S. South. ♂b brachypterous male, ♀b brachypterous female. L♂ male larva.

Study area

The present study mostly covers territories belonging to the Italian Republic, but Corsica and

a few small areas of the internal Southwestern Alps, such as the upper part of the Roya valley, which belongs to France, are also considered. The high Ticino valley and a few side valleys of the Swiss Central Alps (Rhaetian Alps) and most of the far section of the Eastern Alps located in Slovenia and of the Northern extremity of the Dinaric Range in Croatia are also considered, since they belong to the same faunistic entity. On the other hand, we exclude the endemic species occurring only on the French slope of the Alps (external slope), such as *Leuctra marinettae* Ravizza & Vinçon, 1989, endemic of the Mercantour Massif and never collected on the Italian slope.

The study area is divided into three sections: - the mainland (Northern Italy), - the peninsula, which is long and slender protruding obliquely southward-eastward into the Mediterranean Sea, - the islands, the most important of which are Corsica, Sardinia and Sicily (Map 1).



Map 1. Schematic map of the study area with the Alps and Apennines both divided in three sections.

The northern borders of Italy are well defined geographically by the watershed of the arched chain of the Alps, which divides the internal slope belonging to Italy, from the external one. This watershed separates northwards the drainage basins of the Rhone River (France and western Switzerland), the Rein River (eastern Switzerland) and the Danube River (Austria and Slovenia), and southwards the ones of the Po River and of the Venetian Rivers, the most important of which are the Adige, Piave, Tagliamento and Isonzo.

UPDATED CHECKLIST OF SPECIES

In Table 1 are listed all the species presently known from the study area, with their distribution area in Italy (second column), subdivided in 8 regions: Sardinia + Corsica (S-C), Sicily (Si), Southern Apennines (S), Central Apennines (C), Northern Apennines (N), Western Alps (W), Central Alps (C), Eastern Alps (E), and with their altitudinal range and flight-period. Table 1 also mentions the 3 species excised from the list of

Plecoptera of the Italian region, marked in red color to differentiate them from the others.

CATALOGUE

The distribution of taxa outlined in Table 1 shows that there is a group of 29 common and widespread species, occurring in most of the Italian Region watercourses, from the Alps to the Apennines or part of it, with 11 of them reaching Sicily. In addition, there are 9 Alpine-Apennine species, widely distributed from the north to the south of the Italian Region: *I. carbonaria*, *D. ferreri*, *S. italica*, *N. cinerea selene*, *N. palliventris*, *L. elisabethae*, *L. hexacantha*, *L. subalpina*, *Z. gattolliati*, which, as the preceding ones, are widespread in most of the mentioned areas. These 38 species, which may be regarded as the basic elements of the stonefly fauna of the Italian Alps and Apennines, are not included in the commented section below, and are only shown here in Table 2, unless they require taxonomical or morphological comments.

Table 1. Distribution of stoneflies in the Italian region. Endemic species (+), steno-endemic species (*), species in danger of extinction (!) and questionable data (?) are distinguished by special marks; the more common species are simply marked by dots (•). In red color, species excised from the Italian fauna. S South, C Central, N North, W West, E East.

	Sardinia Corsica	Elba Sicily	Apennines S C N	Alps W C E	Altitudinal range (m)	Flight period
Perlodidae Klapálek, 1909						
<i>Perlodes</i> Banks, 1903						
<i>intricatus</i> (Pictet, 1841)	—	—	— • •	• • •	800–2850	VI–VIII
<i>microcephalus</i> (Pictet, 1833)	—	—	• • •	• • •	60–2000	IV–VIII
<i>Dictyogenus</i> Klapálek, 1904b						
<i>alpinum</i> (Pictet, 1841)	—	—	— — —	• • •	560–2300	VI–VIII
<i>fontium</i> (Ris, 1896)	—	—	— — —	* * —	1760–2280	VI–VIII
<i>julium</i> Reding, 2024	—	—	— — —	— — *	480–1200	VI–X
<i>nadigi</i> Reding, 2024	—	—	— — —	— * —	1670–2760	VI–IX
<i>padanum</i> Reding, 2024	—	—	— — —	* * —	700–2810	VI–IX
<i>vinconi</i> Reding, 2024	—	—	— — *	— — —	1450–1500	VI
<i>Besdolus</i> Ricker, 1952						
<i>ravizzarum</i> Zwick & Weinzierl, 1995	—	—	— — •	— — —	200–550	V–VI
<i>Isogenus</i> Newman, 1833						
<i>nubecula</i> Newman, 1833	—	—	— — —	— — !	300–500	IV–V
<i>Isoperla</i> Banks, 1906						
<i>andreinii</i> (Festa, 1938a)	—	—	+ + +	— + —	35–1480	V–VII
<i>carbonaria</i> Aubert, 1953b	—	+	+ + +	+ + —	350–1900	V–VIII
<i>grammatica</i> (Poda, 1761)	—	•	• • •	• • •	20–2500	IV–VII
<i>hyblaea</i> Consiglio, 1961a	—	*	— — —	— — —	180–850	IV–V

<i>illyrica</i> Tabacaru, 1971	—	—	—	—	—	—	—	—	70–600	IV–V
<i>ilvana</i> Consiglio, 1958c	—	Elba	—	—	—	—	—	—	20–400	IV–VI
<i>insularis</i> (Morton, 1930)	*	—	—	—	—	—	—	—	20–1900	IV–VII–X
<i>kir</i> Fochetti & Vinçon, 1993	*	—	—	—	—	—	—	—	0–1600	IV–VII
<i>lugens</i> (Klapálek, 1923)	—	—	—	—	—	•	•	•	1500–1900	VII–VIII
<i>obscura</i> (Zetterstedt, 1840)	—	—	—	—	!	—	!	—	60–350	III–VI
<i>oenotriæ</i> Consiglio, 1967a	—	—	—	*	—	—	—	—	950–1500	VI–VII
<i>orobica</i> Ravizza, 1975a	—	—	—	—	—	+	+	—	850–2030	VI–X
<i>oxylepis oxylepis</i> (Despax, 1936)										
<i>rivulorum</i> (Pictet, 1841)	—	—	•	•	•	•	•	•	400–2740	V–IX
<i>saccai</i> (Festa, 1939b)	—	—	+	+	+	—	—	—	300–1850	V–IX
<i>zwicki</i> Tierno & Fochetti, 2001	—	—	—	—	—	—	—	*	1700–1900	VIII
Perlidae Latreille, 1802										
<i>Dinocras</i> Klapálek, 1907										
<i>cephalotes</i> (Curtis, 1827)	—	•	•	•	•	•	•	•	60–1650	IV–VIII
<i>ferreri</i> (Pictet, 1841)	—	—	—	+	+	+	+	+	430–2000	V–VIII
<i>megacephala</i> (Klapálek, 1907)	—	—	—	—	—	—	—	•	900	V
<i>Perla</i> Geoffroy, 1762										
<i>abdominalis</i> Burmeister, 1839	—	—	—	—	—	•	—	•	200–400	V–VI
<i>bipunctata</i> Pictet, 1833	—	—	?	?	!	!	—	!	30–300	V–VII
<i>grandis</i> Rambur, 1842	—	•	•	•	•	•	•	•	800–2000	V–VIII
<i>illiesi</i> Braasch & Joost, 1973	—	—	—	—	—	—	—	•	300–1150	VI
<i>marginata</i> (Panzer, 1799)	—	—	•	•	•	•	•	•	230–1600	IV–VIII
<i>ravizzaorum</i> Reding, 2023	—	—	—	—	•	•	•	•	430–900	V–VI
Chloroperlidae Enderlein, 1909										
<i>Xanthoperla</i> Zwick, 1967										
<i>apicalis</i> (Newman, 1836)	—	—	!	—	—	—	—	!	200–250	V–VI
<i>apicalis hamulata</i> (Morton, 1930)	*	—	—	—	—	—	—	—	2–2000	V–VII
<i>Chloroperla</i> Newman, 1836										
<i>susemicheli</i> Zwick, 1967	—	—	—	•	•	•	•	•	400–2100	V–X
<i>tripunctata</i> (Scopoli, 1763)	—	—	•	•	•	•	•	•	100–1400	IV–VII
<i>Siphonoperla</i> Zwick, 1967										
<i>italica</i> (Aubert, 1953b)	—	+	+	+	+	+	+	+	350–1900	V–VIII
<i>montana</i> (Pictet, 1841)	—	—	—	•	•	•	•	•	850–2500	V–IX
Taeniopterygidae Klapálek, 1905										
<i>Brachyptera</i> Newport, 1848										
<i>auberti</i> Consiglio, 1957a	•	—	—	—	—	—	—	—	200–1050	III–VI
<i>calabrica</i> Aubert, 1953b	—	+	+	+	—	—	—	—	600–1910	IV–VI
<i>monilicornis</i> (Pictet, 1841)	—	—	—	•	•	•	—	•	150–400	I–III
<i>risi</i> (Morton, 1896)	—	•	•	•	•	•	•	•	150–1650	II–VI
<i>seticornis</i> (Klapálek, 1902a)	—	—	—	—	—	•	—	•	400–1600	III–VI
<i>trifasciata</i> (Pictet, 1832)	—	—	—	—	—	!	!	!	60–500	III–IV
<i>Rhabdiopteryx</i> Klapálek, 1902a										
<i>alpina</i> Kührtreiber, 1934	—	—	—	—	—	•	•	•	650–2200	IV–VII
<i>harperi</i> Vinçon & Murányi, 2009	—	—	—	—	—	•	•	—	1500–2600	IV–VII
<i>neglecta</i> (Albarda, 1889)	—	•	•	•	•	•	•	•	60–2440	II–VI
<i>Taeniopteryx</i> Pictet, 1841										
<i>kuehtreiberi</i> Aubert, 1950a	—	—	—	•	—	•	•	•	60–1800	I–IV
<i>mercuryi</i> Fochetti & Nicolai, 1996	—	—	—	*	—	—	—	—	650	X–VII
<i>nebulosa</i> (Linné, 1758)	—	—	—	—	!	—	—	!	30–200	II
<i>schoenemundi</i> (Mertens, 1923)	—	—	!	—	—	—	—	!	60–1200	III
<i>stankovitchi</i> Ikononov, 1978	—	—	—	!	—	—	—	—	20–300	I–IV

Nemouridae Billberg, 1820						
<i>Amphinemura</i> Ris, 1902						
<i>standfussi</i> (Ris, 1902)	—	—	—	—	—	750–2000 VIII–X
<i>sulcicollis</i> (Stephens, 1836)	—	•	•	•	•	100–2500 V–VIII
<i>triangularis</i> (Ris, 1902)	—	—	•	•	•	70–1300 IV–VIII
<i>Protonemura</i> Kempny, 1898a						
<i>algovia</i> Mendl, 1968b	—	—	—	—	—	1300–2200 IX–X
<i>auberti</i> Illies, 1954	—	—	—	—	—	350–1800 IV–VI
<i>ausonia</i> (Consiglio, 1955b)	—	—	+	+	+	160–1700 IX–XI
<i>austriaca</i> Theischinger, 1976	—	—	—	—	—	350–2200 III–X
<i>beatensis</i> Despax, 1929						
<i>bipartita</i> Consiglio, 1962b	—	—	—	—	—	350–1400 IV–VII–X
<i>bispina</i> Vin., Rav. & Reding 2021	—	—	—	—	—	200–1750 IV–X
<i>brevistyla</i> (Ris, 1902)	—	—	—	—	—	500–2840 VII–X
<i>bucolica</i> (Consiglio, 1957b)	*	—	—	—	—	700–1650 II–VI
<i>caprai</i> (Aubert, 1954b)	—	—	+	+	+	400–1900 IV–X
<i>consiglioi</i> (Aubert, 1953b)	—	—	*	—	—	800–1600 V–IX
<i>corsicana</i> (Morton, 1930)	*	—	—	—	—	300–2000 IV–X
<i>costai</i> (Aubert, 1953a)	—	—	—	*	—	400–1600 V–VII, X
<i>elisabethae</i> Ravizza, 1976a	—	—	—	—	—	1000–1550 III–IV
<i>helenae</i> Nicolai, 1985	—	*	—	—	—	300–450 II–V
<i>hirpina</i> (Consiglio, 1958b)	—	—	*	—	—	720–1150 V–VIII
<i>hrabei</i> Raušer, 1956	—	—	—	—	—	1100 IX
<i>ichnusae</i> (Consiglio, 1957a)	*	—	—	—	—	150–1650 III–V
<i>intricata intricata</i> (Ris, 1902)	—	—	•	•	•	200–1600 V–VII
<i>italica</i> (Aubert, 1954c)	—	—	*	—	—	1200–1400 IX
<i>julia</i> Nicolai, 1983a	—	—	—	—	—	500–1300 V–VI
<i>lagrecai</i> (Aubert, 1954c)	—	•	•	—	—	900–1420 IX–X
<i>lateralis</i> (Pictet, 1836)	—	—	—	—	—	300–2600 IV–XI
<i>macrura</i> (Aubert, 1953b)	—	+	+	—	+	480–1650 V–VII
<i>marilouae</i> sp. nov.	—	+	+	—	—	1420–1890 IX
<i>meyeri</i> (Pictet, 1841)	—	—	•	—	—	1000–1500 IV–V
<i>nimborella</i> (Mosely, 1930)	—	—	—	—	—	1100–2500 IX–XI
<i>nimborum</i> (Ris, 1902)	—	—	—	—	—	200–2500 IV–VII
<i>nitida</i> (Pictet, 1836)	—	—	—	—	—	350–2200 IX–XII
<i>olahii</i> sp. nov.	—	—	—	*	—	470 V
<i>padana</i> Vinçon & Ravizza, 2005	—	—	—	—	+	330–2000 IV, IX–XII
<i>pennina</i> Vin., Rav. & Reding 2021	—	—	—	—	*	500–1900 VI–XI
<i>praecox praecox</i> (Morton, 1894)	—	•	•	•	•	350–1570 II–IV
<i>ruffoi</i> Consiglio, 1961a	—	•	•	—	—	150–1910 III–VI
<i>salfii</i> (Aubert, 1954c)	—	—	+	+	+	470–1400 IX–XI
<i>sicula</i> Consiglio, 1961b	—	*	—	—	—	80–1600 IV–VI
<i>tyrrhena</i> (Festa, 1938b)	—	—	+	+	+	20–1700 IV–VI
<i>Nemoura</i> Latreille, 1796						
<i>aprutiana</i> Vinçon & Ruffoni, 2021	—	—	—	*	—	1110–1560 V–VII
<i>banatica</i> Kis, 1965	—	—	—	—	—	200–1750 IV–VII
<i>cinerea selene</i> Consiglio, 1959	—	+	+	+	+	30–2200 V–IX
<i>flexuosa</i> Aubert, 1949	—	—	•	•	•	170–1600 III–V
<i>fulviceps</i> Klapálek, 1902b	—	•	—	—	—	220–1400 V–VI
<i>hesperiae</i> Consiglio, 1960	—	+	+	+	+	570–1740 IV–VII
<i>illiesi</i> Mendl, 1968a	—	—	—	—	—	200–1750 IV–IX
<i>lucana</i> Nicolai & Fochetti, 1991b	—	—	*	—	—	1100–1650 V–VI
<i>marginata</i> Pictet, 1836	—	—	—	—	—	600–1750 V–VII

<i>minima</i> Aubert, 1946	—	—	—	—	—	•	•	•	350–2500	IV–IX
<i>mortoni</i> Ris, 1902	—	—	—	—	•	•	•	•	200–2780	IV–VII, IX
<i>obtusa</i> Ris, 1902	—	—	—	—	•	•	•	•	430–2200	IV–IX
<i>oropensis</i> Ravizza & Rav. Dem., 1980b	—	—	—	—	—	*	—	—	1800–1950	VI–VIII
<i>palliventris</i> Aubert, 1953b	—	•	•	•	•	•	—	—	200–2000	III–VII
<i>pesarinii</i> Ravizza & Rav. Dem., 1979a	—	—	—	—	—	+	+	—	750–2480	IV–X
<i>rivorum</i> Ravizza & Rav. Dem., 1995	—	—	—	—	+	+	—	+	350–1600	IV–VI, XII
<i>sabina</i> Fochetti & Vinçon, 2009	—	—	—	*	—	—	—	—	700	III
<i>sinuata</i> Ris, 1902	—	—	—	—	•	•	•	•	500–2630	V–X
<i>uncinata</i> Despax, 1934	—	—	—	—	—	•	•	—	400–1450	IV–VI
<i>undulata</i> Ris, 1902	—	—	—	—	—	+	+	+	2000–2550	VI–VII
<i>Nemurella</i> Kempny, 1898a										
<i>pictetii</i> (Klapálek, 1900)	—	—	—	—	•	•	•	•	400–2400	VI–XI
Leuctridae Klapálek, 1905										
<i>Leuctra</i> Stephens, 1836										
<i>albida</i> Kempny, 1899a	—	—	—	—	—	—	•	•	170–1400	VI–XI
<i>alpina</i> Kührtreiber, 1934	—	—	—	—	•	•	•	•	400–2300	III–VII, X
<i>ameliae</i> Vinçon & Ravizza, 1996	—	—	—	—	—	+	+	—	900–2480	IV–IX
<i>annae</i> Consiglio, 1975	*	—	—	—	—	—	—	—	850–1300	IX–X
<i>apennincola</i> Ravizza, 1988	—	—	+	+	+	—	—	—	400–1740	IV–VIII
<i>archimedis</i> Consiglio, 1968	—	*	—	—	—	—	—	—	180–1420	IX–II, VI
<i>armata</i> Kempny, 1899b	—	—	—	—	—	•	•	•	500–2530	IV–IX
<i>auberti</i> Rav. & Rav. Dem., 1985	—	—	—	—	—	+	+	—	700–1900	IV–VIII
<i>aubertorum</i> Rav. & Rav. Dem., 1994a	—	—	—	—	—	—	*	—	800–1270	IX–X
<i>autumnalis</i> Aubert, 1948	—	—	—	—	—	—	•	•	300–2330	VIII–XI
<i>biellensis</i> Festa, 1942	—	—	—	—	+	+	+	+	350–1900	IV–VIII
<i>boreoni</i> Aubert, 1962	—	—	—	—	+	+	—	—	500–2100	VIII–XII, IV
<i>braueri</i> Kempny, 1898b	—	—	—	—	—	•	•	•	200–2100	VIII–XII, II
<i>brevipennis</i> Ravizza, 1978	—	—	—	—	—	*	—	—	850–1900	VIII–XI
<i>budtzi</i> Esben-Petersen, 1912	*	—	—	—	—	—	—	—	30–1850	IX–X
<i>canavensis</i> Ravizza & Rav. Dem., 1992	—	—	—	—	—	*	—	—	850–950	IX–XI
<i>caprai</i> Festa, 1939a	—	—	—	—	—	*	—	—	600–2640	VII–XI
<i>cingulata</i> Kempny, 1899a	—	—	—	—	—	•	•	•	200–2000	IX–X
<i>concii</i> Consiglio, 1958a	—	—	—	+	+	+	—	—	400–1700	IX–XII, II
<i>costai</i> Aubert, 1953a	—	+	+	+	—	—	—	—	290–1890	VI, X–XII
<i>cyrnea</i> Consiglio & Giudicelli, 1965	*	—	—	—	—	—	—	—	1000–2000	IX–X
<i>delmastroi</i> Vinçon, 2012	—	—	—	—	—	*	—	—	1300–2050	VIII–IX
<i>dolasilla</i> Consiglio, 1955b	—	—	—	—	—	+	+	+	400–2200	V, VIII–XI
<i>dylani</i> Graf, 2007	—	—	—	—	—	—	—	*	800–1450	V, IX–XI
<i>elisabethae</i> Ravizza, 1985	—	—	+	+	+	+	+	—	200–1550	XI–VI
<i>festai</i> Aubert, 1954b	—	—	—	—	—	*	*	—	1880–2850	VI–IX
<i>fochetti</i> Vinçon & Vitecek, 2017	—	—	—	—	—	—	—	*	650–1450	V–VI, IX
<i>fraterna</i> Morton, 1930	*	—	—	—	—	—	—	—	550–2000	V–X
<i>fusca fusca</i> (Linné, 1758)	—	•	•	•	•	•	•	•	50–1700	IX–XII
<i>gardinii</i> Ravizza, 2005	—	—	—	—	—	*	—	—	1600–2000	XII–I
<i>geniculata</i> Stephens, 1836	•	—	—	—	—	•	—	—	3–1650	IX–X
<i>grafi</i> Vinçon & Vitecek, 2017	—	—	—	—	*	—	—	—	1300–1650	VI–VII–IX
<i>handlirschi</i> Kempny, 1898b	—	—	•	•	•	•	•	•	70–1500	IV–VIII
<i>helvetica</i> Aubert, 1956a	—	—	—	—	—	•	•	•	400–2250	II–V
<i>hexacantha</i> Despax, 1940	—	—	•	•	•	•	•	•	100–1650	VIII–XII
<i>hippopus</i> Kempny, 1899a	—	—	•	•	•	•	•	•	50–1800	IV–VI
<i>incudensis</i> Vinçon & Ravizza, 2000b	*	—	—	—	—	—	—	—	550–1900	X
<i>inermis</i> Kempny, 1899b	—	•	•	•	•	•	•	•	50–2100	IV–VI, X

<i>insubrica</i> Aubert, 1949	—	—	—	—	—	+	+	—	500–2350	V–IX
<i>juliettae</i> Vinçon & Graf, 2011	—	—	—	—	—	—	—	*	500–1400	IX–X
<i>leptogaster</i> Aubert, 1949	—	•	•	•	•	•	•	•	65–2000	VIII–XII
<i>ligurica</i> Aubert, 1962	—	—	—	—	*	*	—	—	300–1200	XII–V
<i>major</i> Brinck, 1949	—	—	•	•	•	•	•	•	140–2200	VIII–XI
<i>marinettae</i> Ravizza & Vinçon, 1989										
<i>meridionalis</i> Aubert, 1951	—	—	—	—	+	+	+	—	200–2100	VIII–XII
<i>mortoni mortoni</i> Kempny, 1899b	—	—	—	•	—	•	•	•	200–1500	VIII–XI
<i>moselyi</i> Morton, 1929	—	—	—	—	—	•	•	•	300–2300	VIII–XI
<i>muranyii</i> Vinçon & Graf, 2011	—	—	—	—	—	—	+	+	400–2260	VI, VIII–IX
<i>nigra</i> (Olivier, 1811)	—	—	—	—	—	—	—	•	700–1600	V–VII
<i>niveola</i> Schmid, 1947	—	—	—	—	•	•	•	•	440–2100	II–IV, V
<i>orsiera</i> Ravizza & Vin., 2003	—	—	—	—	—	*	—	—	1200–1900	IX–X
<i>pasquini</i> Consiglio, 1958a	—	—	—	+	+	—	—	—	500–1540	VII–X
<i>prima</i> Kempny, 1899a	—	—	—	—	—	—	—	•	200–1100	XII–II, V
<i>pseudorosinae</i> Aubert, 1954a	—	—	—	—	—	—	•	•	600–1750	IV–V
<i>pusilla</i> Krno, 1985	—	—	•	•	•	•	—	•	800–2100	V–IX
<i>queyrassiana</i> Ravizza & Vin., 1991b	—	—	—	—	—	*	—	—	1500–2700	IX–XI
<i>rauscheri</i> Aubert, 1957b	—	—	—	•	•	•	•	•	300–2500	IV–VII
<i>ravizai</i> Ravizza Dem. & Vinçon, 1994	—	—	—	—	—	*	—	—	1700–2630	V–VII
<i>rosinae</i> Kempny, 1900	—	—	—	•	—	•	•	•	300–2910	III–XI
<i>schmidi</i> Aubert, 1947	—	—	—	—	—	•	—	—	600–2200	VIII–XII
<i>sesvenna</i> Aubert, 1953c	—	—	—	—	—	—	*	—	1900–2700	VI–VII
<i>signifera</i> Kempny, 1899b	—	—	—	—	—	—	—	•	400–650	X
<i>silana</i> Aubert, 1953b	—	—	*	—	—	—	—	—	1300–1800	IV–V
<i>stronensis</i> sp. nov.	—	—	—	—	—	*	—	—	1700–1800	X
<i>subalpina</i> Vin., Rav. & Aub., 1995	—	—	•	•	•	•	—	—	400–1800	IV–VI
<i>teriolensis</i> Kempny, 1900	—	—	—	—	—	•	•	•	560–2740	VI–IX
<i>trecimensis</i> sp. nov.	—	—	—	—	—	—	—	*	1650	V–VI
<i>vesulensis</i> Ravizza & Rav. Dem., 1984	—	—	—	—	—	*	—	—	600–1600	IX–XII
<i>vinconi</i> Ravizza & Rav. Dem., 1993a	—	—	—	—	—	*	—	—	450–1400	IX–XI
<i>zwicki</i> Ravizza & Vinçon, 1991a	—	—	—	—	—	•	—	—	260–1800	VIII–XII
<i>Tyrrhenoleuctra</i> Consigl., 1957c										
<i>zavattarii</i> (Consiglio, 1956)	*	—	—	—	—	—	—	—	0–1100	I–V
Capniidae Klapálek, 1905										
<i>Capnia</i> Pictet, 1841										
<i>nigra</i> (Pictet, 1833)	—	•	•	•	•	•	•	•	60–1910	I–IV
<i>vidua vidua</i> Klapálek, 1904a	—	—	—	•	•	•	•	•	320–2600	II–VI
<i>Zwicknia</i> Murányi, 2014										
<i>bifrons</i> (Newman, 1838)	—	—	•	—	—	—	—	—	200–300	III
<i>gattolliati</i> Vinçon & Reding, 2018	—	—	+	+	+	+	+	+	20–1580	I–V
<i>Capnioneura</i> Ris, 1905										
<i>nemuroides</i> Ris, 1905	—	•	•	•	•	•	—	—	570–1740	III–VI
<i>petricola</i> Giudicelli, 1967	*	—	—	—	—	—	—	—	30–600	I–IV
<i>Capnopsis</i> Morton, 1896										
<i>schilleri schilleri</i> (Rostock, 1892)	—	—	•	—	•	—	—	—	470–1700	V–VII
	Sardinia Corsica	Elba Sicily	Apennines S C N			Alps W C E				
Total species and subspecies 191	15	29	56	61	69	106	37	98		
Total Italian endemic species 92	13	13	22	24	36	37	23	16		
Total steno-endemic species 59	13	5	5	6	4	17	6	8		

Table 2. List of the most common Plecoptera species in the Italian region. + endemic of the Italian region and close surroundings; • widespread, S South, C Central, N North, W West, E East.

	Sardinia Corsica	Sicily	Apennines S C N			Alps W C E			Altitudinal range (m)	Flight period
<i>Perlodes intricatus</i>	—	—	—	•	•	•	•	•	800–2850	VI–VIII
<i>Perlodes microcephalus</i>	—	—	•	•	•	•	•	•	60–2000	IV–VIII
<i>Isoperla carbonaria</i>	—	+	+	+	+	+	+	—	350–1900	V–VIII
<i>Isoperla grammatica</i>	—	•	•	•	•	•	•	•	20–2500	IV–VII
<i>Dinocras cephalotes</i>	—	•	•	•	•	•	•	•	60–1650	IV–VIII
<i>Dinocras ferreri</i>	—	—	—	+	+	+	+	+	430–2000	V–VIII
<i>Perla grandis</i>	—	•	•	•	•	•	•	•	800–2000	V–VIII
<i>Perla marginata</i>	—	—	•	•	•	•	•	•	230–1600	IV–VIII
<i>Chloroperla susemicheli</i>	—	—	—	•	•	•	•	•	400–2100	V–X
<i>Chloroperla tripunctata</i>	—	—	•	•	•	•	•	•	100–1400	IV–VII
<i>Siphonoperla italica</i>	—	+	+	+	+	+	+	+	350–1900	V–VIII
<i>Siphonoperla montana</i>	—	—	—	•	•	•	•	•	850–2500	V–IX
<i>Brachyptera risi</i>	—	•	•	•	•	•	•	•	150–1650	II–VI
<i>Rhabdiopteryx neglecta</i>	—	•	•	•	•	•	•	•	60–2440	II–VI
<i>Taeniopteryx kuehtreiberi</i>	—	—	—	•	—	•	•	•	60–1800	I–IV
<i>Amphinemura sulcicollis</i>	—	•	•	•	•	•	•	•	100–2500	V–VIII
<i>Amphinemura triangularis</i>	—	—	•	•	•	•	•	•	70–1300	IV–VIII
<i>Protonemura intric. intricata</i>	—	—	•	•	•	•	•	•	200–1600	V–VII
<i>Protonemura praecox praecox</i>	—	•	•	•	•	•	•	•	350–1570	II–IV
<i>Nemoura cinerea selene</i>	—	+	+	+	+	+	+	—	30–2200	V–IX
<i>Nemoura flexuosa</i>	—	—	•	•	•	•	•	•	170–1600	III–V
<i>Nemoura palliventris</i>	—	•	•	•	•	•	•	—	200–2000	III–VII
<i>Nemurella pictetii</i>	—	—	—	—	•	•	•	•	400–2400	VI–XI
<i>Leuctra elisabethae</i>	—	—	+	+	+	+	+	—	200–1550	XI–VI
<i>Leuctra fusca fusca</i>	—	•	•	•	•	•	•	•	50–1700	IX–XII
<i>Leuctra handlirschi</i>	—	—	•	•	•	•	•	•	70–1500	IV–VIII
<i>Leuctra hexacantha</i>	—	—	•	•	•	•	•	•	100–1650	VIII–XII
<i>Leuctra hippopus</i>	—	—	•	•	•	•	•	•	50–1800	IV–VI
<i>Leuctra inermis</i>	—	•	•	•	•	•	•	•	50–2100	IV–VI, X
<i>Leuctra leptogaster</i>	—	•	•	•	•	•	•	•	65–2000	VIII–XII
<i>Leuctra major</i>	—	—	•	•	•	•	•	•	140–2200	VIII–XI
<i>Leuctra pusilla</i>	—	—	•	•	•	•	—	•	800–2100	V–IX
<i>Leuctra rauscheri</i>	—	—	—	•	•	•	•	•	300–2500	IV–VII
<i>Leuctra subalpina</i>	—	—	•	•	•	•	—	—	400–1800	IV–VI
<i>Capnia nigra</i>	—	•	•	•	•	•	•	•	60–1910	I–IV
<i>Capnia vidua vidua</i>	—	—	—	•	•	•	•	•	320–2600	II–VI
<i>Zwicknia gattolliati</i>	—	—	+	+	+	+	+	+	20–1580	I–V
<i>Capnioneura nemuroides</i>	—	•	•	•	•	•	—	—	570–1740	III–VI

In the remaining part of this catalogue, we provide a detailed faunistic list of the most emblematic species occurring in the Italian region, or of those requiring faunistic or morphological comments. The distribution areas are illustrated by maps (Maps 2–13, at the end of the article) grouping several species according to their geographical distribution.

For other very common species in Italy, we only focus on their most elevated collection sites in order to report on how they presently react to global warming (Table 3).

***Perlodes intricatus* (Pictet, 1841)**

(Map 8)

Type locality. France, Haute-Savoie, Chamonix.

Morphological remarks. The description of the egg of *P. jurassicus* provided by Berthélemy (1964) corresponds to the egg of *P. intricatus*, an error that has subsequently induced much confusion (Consiglio 1971, Ravizza 1975a, Ravizza & Ravizza Dematteis 1990, 1991). *P. jurassicus* is strictly endemic to the Jura Mountains (Knispel et al. 2002, Lubini et al. 2012) and therefore all reports of *P. jurassicus* from the Alps or Apennines correspond to *P. intricatus*.

Previous data. Ligurian Alps (Ravizza & Ravizza Dematteis 1977, Consiglio 1971, Ravizza, Vinçon & Poggi 2022), Maritime Alps (Ravizza & Ravizza Dematteis 1994b), Cottian Alps (Consiglio 1971 sub nom. *P. jurassicus*, Ravizza & Ravizza Dematteis 1986, Ravizza Dematteis & Ravizza 1988), Graian Alps (Consiglio 1962a, 1967b sub nom. *P. jurassicus*, Ravizza & Ravizza Dematteis 1994b), Pennine Alps (Consiglio 1971 sub nom. *P. jurassicus*, Ravizza & Ravizza Dematteis 1990, 1991 sub nom. *P. jurassicus*), Lepontine Alps (Swiss Ticino, Aubert 1946, Swiss Grisons, Aubert et al. 1996), Orobic Alps (Ravizza 1975a sub nom. *P. jurassicus*), Trentino Alto Adige (Consiglio 1967b sub nom. *P. microcephalus*, Consiglio 1971 sub nom. *P. jurassicus*). Apennines: Ligurian Apennines (Ravizza, Vinçon

& Poggi 2022), Emilia-Romania (Festa 1949, Ravizza & Ravizza Dematteis 1978), Marche (Aubert 1956b, Fochetti & Nicolai 1987a), Abruzzi (Consiglio 1963b, 1967b sub nom. *P. microcephalus*, Consiglio 1971).

New records. **Italy, Maritime Alps:** Limonetto, 1600–1880 m, 44.155N, 7.533E, 12.06.1988, 1♂ 1♀ (VIN). **Cottian Alps:** Fenestre Pass, 1900 m, 45.082N, 7.057E, 5.08.2001, 1♀ (VIN); Fenestrelle, 2100 m, 45.011N, 7.0114E, 1.08.2000, 2♂ 1♀ (DEL); Pellice V., 2000–2100 m, spr. + br., 44.745N, 7.082E, 21.06.2019, 1♂ 1♀; 1700–1800 m, 44.752N, 7.08E, 21.06.2019, 1♂; Crissolo, Piano della Regina, 1710 m, 44.7N, 7.116E, 9.06.1999, 1♂ 2♀; Sampeyre, Pian delle Baracche, 2100 m, 44.551N, 7.134E, 11.08.2001, 1♀ (DEL); Varaita di Bellino, 2400–2600 m, spr. + br., 44.559N, 6.941E, 27.09.1988, 1♀ (VIN); Macra V., Saretto, spr., 1640 m, 44.498N, 6.921E, 9.09.2015, 3♀; Grana V. Chiappi, 1620 m, 44.397N, 7.173E, 21.05.1997, 1♀ (DEL); Vallon del Arma, spr., 1850 m, 44.37N, 7.147E, 6.09.2007, 4♂ 7♀ (VIN). **Graian Alps:** Aosta V., Nivolet Laghi, 2750 m, 45.504N, 7.144E, 30.07.1993, 1♀ (DEL); Locana, Scala di Telessio, 1740 m, 45.478N, 7.372E, 9.07.1996, 1♀ (DEL); Champdepraz, Gran Lago, br., 2500–2600 m, 45.639N, 7.546E, 12.07.2003, 2♀; Gimillan, > Corona Lake, spr., 2740 m, 45.649N, 7.415E, 5.07.2020, 1♀; Lanzo Torinese, Pian d’Audi, 1000–1400 m, 45.359N, 7.511E, 12.08.2005, 1♀; Val di Viu, Borgial, tor., 1700–1800 m, 45.189N, 7.287E, 20.06.2019, 1♂ (VIN). **Pennine Alps:** Ayas Valley, spr., 2380 m, 45.895N, 7.76E, 17.06.2023, 2♀; Domodossola, Val d’Antrona, 1400 m, 46.083N, 8.113E, 24.05.2003, 1♀; High Sesia V., Lago Verde outlet, 2850 m, 45.8215N, 7.8713E, 29.09.2021, 2 exuviae (VIN). **Lombard Prealps:** Valle di Concei, spr., 1100 m, 45.952N, 10.746E, 28.06.2009, 2♀ (VIN). **Trentino Alto Adige: Dolomites Alps:** > Nambino lake, tor., 2100 m, 46.247N, 10.793E, 28.05.2021, 1♂ (VIN). **Venetian Prealps:** Passo di Campogrosso, spr. + br., 1300 m, 45.745N, 11.16E, 21.06.2018, 1♀ (VIN). **Carnic Prealps:** S. Preone, Casali Chiampon, 760 m, 46.3416N, 12.8827E, 24.05.2022, 5♂ 7♀ (VIN). **Ligurian Apennines,**

> Casoni di Amborzasco, spr., 1440 m, 44.485N, 9.4893E, 16.05.2022, 2 exuviae (Vin). **Tuscany:** Passo di Cerreto: 1450 m spr. + br., 44.286N, 10.228E, 15.06.2020, 1♀; 30.06.2020, 2♂ 3♀; 1400 m, spr. + br., 44.291N, 10.229E, 30.06.2020, 1♀; 10.06.2022, 2♂ 6♀ (VIN). **Emilia-Romagna:** Lagdei di Corniglio, 1250 m, 44.413 N, 10.01E; Bosco di Corniglio, 950 m (RAV); S. Cerreto Laghi, spr., 1550 m, 44.28N, 10.25E, 11.06.2022, 2♀; Passo Croce Arcana, spr., 1550 m, 44.141N, 10.775E, 20.07.2009, 2♀ (VIN); **Marches:** Monti Sibillini, Panico V., spr., 1180 m, 42.945N, 13.1995E, 18.05.2022, 4♂ 3♀ (VIN).

Distribution area and biogeographical notes. This species, widespread in Europe from Spain to the Carpathians (Graf et al. 2009), should be revised since several different species are probably conflated under this name. In the Alps, it inhabits preferentially springs, brooks and torrents with nivo-glacial hydrological regime, most frequently above 1500 m. In the Italian Peninsula, it is disjunctly distributed over cold stenotopic islands along the northern Apennines (Emilia-Romagna – Tuscany), the Sibillin mountains (Aubert 1956b, Fochetti & Nicolai 1987a) and Gran Sasso massif in the Abruzzi (Consiglio 1971) (Map 8).

Dictyogenus alpinum (Pictet, 1841)

Type locality. None provided. French and Swiss Alps.

Previous data. Italy, Cottian Alps (Ravizza & Ravizza Dematteis 1986, Ravizza Dematteis & Ravizza 1988, Reding 2024), Graian Alps (Consiglio 1962a, Reding 2024), Pennine Alps (Consiglio 1962a, 1971), Orobic Alps (Ravizza 1975a), Rhaetian Alps (Reding 2024), Dolomites (Consiglio 1971), Julian Alps (Fochetti & Nicolai 1985). Switzerland, Lepontine Alps (Aubert 1946, Aubert et al. 1996), Rhaetian Alps (Aubert 1965).

New records. **Italy, Maritime Alps:** Limone Piemonte, CN, C. Soprano, 1460 m, 24.06.2010, 1♂, (Delmastro leg.); Stura di Demonte, Argentera, 1650 m, 44.39N, 6.96E, 12.05.1988, 1L. **Cottian Alps:** Crissolo, CN, Pian della Regina,

Fuente Po, 1710 m, 18.07.2002, 1♀ (Delmastro leg.) (VIN).

Distribution area and ecological notes. *D. alpinum* inhabits the whole Alpine Arc (Reding 2024, Fig. J.1). It mainly occurs in rivers and larger brooks (560–2300 m). The flight period extends from May to August.

Dictyogenus fontium (Ris, 1896)

In Italy, several species were conflated under the name *D. fontium* (Ris, 1896) before the revision of this group by Reding (2024), which splits the specimens from the Italian Alps into 3 new species: *D. padanum* Reding, 2024 in the western and central Alps, *D. nadigi* Reding, 2024 in the central Alps and *D. julium* Reding, 2024 in the eastern Alps. In this same work, two more species are described from the Austrian Alps: *D. austriacum* Reding, 2024 and *D. weigandi* Reding, 2024. Moreover, specimens of *Dictyogenus fontium*, *sensu lato* occurring in the higher part of the Pennine Alps, Lombardian and Venetian Prealps and in the Italian Dolomites could not be assigned with confidence to one of these new species, and complementary studies are needed to decide on their status. The distribution area of *D. fontium sensu stricto* is mainly limited to the inner alpine river valleys of Rhône and Reuss in the Swiss Alps, possibly extending also to the southern edge of the Alps (High Ticino) (Reding 2024, Figs. J.2, J.3). Though its presence in Italy is not yet ascertained, we consider that its occurrence in the Italian region is highly probable.

Previous data. Switzerland, Ticino (Reding 2024). All previous reports of *D. fontium* in Italy become obsolete, since they refer to one of the 3 new species *D. padanum*, *D. nadigi* or *D. julium* or to *Dictyogenus fontium sensu stricto sensu* Reding (2024).

Distribution area and ecological notes. In the Italian region *D. fontium* is limited to the high Ticino watersheds; its main distribution area is in the Swiss Valais belonging to the Pennine Alps (high Rhône Valley) (Reding 2024, Figs. J.2, J.3).

It occurs in high altitude torrents and springs (1500 – 2500 m); the flight period extends from June to August.

***Dictyogenus julium* Reding, 2024**

Dictyogenus fontium (Ris, 1896) pro parte (only specimens occurring in the eastern part of the Italian Alps).

Type locality. Italy, Sella Chiampon, karst spring, 760 m 46°22'23.6064"N, 12°52' 11.3448" E, 14.5.2010.

Previous data. Italy, Carnic Alps and Prealps, Julian Alps and Prealps (Reding, 2024)

Distribution area and ecological notes. *D. julium* occurs in the Julian Alps eastward the Piave and Tagliamento Rivers (Italy, Slovenia and Austria), in the Lavanttal Alps (Austria) and in the Karawanks (Austria and Slovenia) (Reding 2024, Fig. J.2). It mainly inhabits karst springs (480 - 1200 m). The adults fly at two different periods, in June and in October.

***Dictyogenus nadigi* Reding, 2024**

(Map 5)

Type locality. Switzerland. Graubünden. Road to Val Cluozza, spr., 1820 m, 46°39'59.1304"N, 10°6'45.6584"E, 13.09.2012 (Reding 2024).

Previous data (sub nom. *D. fontium*). Italy, Lombardy. Rivulet near Passo dello Stelvio, 2323 m, 46°32'00.636"N, 10°28'27.66"E, 20.07.2008, 1♂, 1♀, 1L♂. Passo dello Stelvio, torrente Bralio, 2300 m, 46°32'19.878"N, 10°25'05.9628"E, 23.7.1975, 3L, leg. C. Ravizza (MZL, CB-18640, GBIFCH00899377). Valtellina. Foscagno, torrente, 2200 m, 46°29'22.7292"N, 10°13'37.452"E, 22.7.1975, 1♂b (epiproct detached), 1L, leg. C. Ravizza (MZL, CB-18640, GBIFCH00899364). Passo di Gavia, Rio Gaviola, 2760 m, 46°20'36.546"N, 10°30'16.4268"E, 6.7.1988, 20♂, 20♀, leg. C. Ravizza (MZL, CB-18640, GBIFCH00899344). Sondrio. Santa Caterina Valfurva,

torrente dell'Alpe, 2400 m, 46°22'43.7736"N, 10°29'6.1584"E, 3.7.2011, 3♂b, leg. C. Ravizza (MZL, CB-18640, GBIFCH00899351).

Distribution area and ecological notes. *D. nadigi* is a steno-endemic species restricted to the Swiss and Italian Rhaetian Alps (Reding 2024, Figs. J.2, J.3, and Map 5). The species occurs in high-altitude brooks and springs (1670 – 2760 m). The flight period extends from June to July, and exceptionally to September.

***Dictyogenus padanum* Reding, 2024**

Dictyogenus fontium (Ris, 1896) pro parte (only specimens occurring in the western and central part of the Alps up to the Lepontine Alps).

Type locality. Switzerland. Canton of Valais. Gabi-Gstein, lower Chrummbach (Diveria), 1250 m, 46°11'07.89"N, 8°04'17.23"E, 19.6.2018, 1♂, leg. G. Vinçon (holotype, MZL, GBIFCH 01217065).

Previous data. Italy, Piemonte, Graian Alps (Ravizza & Ravizza Dematteis 1994b, sub nom. *D. fontium*); Pennine Alps (Ravizza & Ravizza Dematteis 1990, 1991, sub nom. *D. fontium*), Lepontine Alps (Aubert 1946, 1949, Aubert *et al.* 1996, sub nom. *D. fontium*).

Distribution area and ecological notes. *D. padanum* occurs in the western and central part of the Alps up to the Lepontine Alps (Reding 2024, Figs. J.2, J.3). It is a strongly orophilic species and can only be found in springs at lower altitudes. It is one of the most alticolous species inhabiting the Italian Alps. Its highest known locality is in the Graian Alps, Gran-Paradiso Massif: outlet of Lago superiore di Ciamousseretto, big torrent, 2830 m, 45.49N, 7.266E, 7.08.2020, 1♀ (VIN). In the Lepontine Alps (Ticino Basin), both species *D. padanum* and *D. fontium* are likely to occur. Whereas adult males of both species are difficult to separate, requiring microscopic preparations of the epiproct and lateral stylets of adult males, nymphs are more easily identifiable (Reding 2024).

***Dictyogenus vinconi* Reding, 2024**

(Maps 8, 9)

Type locality. Holotype male: Italy, Northern Apennines: Tuscany: Passo di Cerreto, La Nuda Glacial Cirque, 1500 m, br., 44.286N, 10.228E, 15.06.2020 (Reding, 2024).

Morphological notes. *Dictyogenus vinconi* is an isolated species, well separable from other members of the *D. fontium* group by its sickle shaped lateral stylets (Reding 2024, his fig. I.3). The female subgenital plate is short (Reding 2024, Figs. I.6, I.7) as it is in the *D. fontium* group but the male terminalia are clearly different from other members of this group.

Distribution area and ecological notes. The only known locality of *D. vinconi* is a pristine glacial cirque close to the Cerreto pass, below ‘La Nuda’ Mount, in the middle part of the Northern Apennines, far from the nearest locality of *D. padanum* or *D. alpinum* in the Alps (Reding 2024, Fig. J.2 and Map 8). ‘La Nuda’ glacial cirque is exceptionally rich with the presence of two further relict species: *Perlodes intricatus* and *Capnia vidua vidua*. In the Trichoptera, the richness is even more exceptional with 4 steno-endemic species: *Wormaldia marilouae* Oláh & Vinçon, 2021, *W. toscana* Oláh & Vinçon, 2021, *Drusus cerreto* Oláh & Vinçon, 2021 and *D. hatras* Oláh & Vinçon, 2021, and with the first mention of two mainly Alpine genera in the Apennines: *Consorophylax consors* (McLachlan, 1880) and *Anisogamus difformis* (McLachlan, 1867) (Oláh et al. 2021). *D. vinconi* occurs in high elevation brooklets (1450–1500 m). It is a very rare species of which only three specimens have been collected so far, in spite of several intensive collecting trips in this area. The flight period is in June.

***Isoperla andreinii* (Festa, 1938a)**

(Map 12)

Chloroperla andreinii Festa, 1938a.

Type locality. Italy, Perugia, Lippiano, Alta Valle Tiberina.

Remark. This species was synonymized with the Pyrenean *I. moselyi* (Despax, 1936) by Illies (1952). Subsequently, it had been conflated with *I. moselyi* and *I. ambigua* (Despax, 1936) (in Consiglio 1967b), but was restored as a valid species after a detailed comparison with *I. moselyi* and *I. ambigua* (Consiglio 1971).

Previous data. Lombardia (Consiglio 1971), Liguria (Consiglio 1971, Ravizza 1974b, 1976b, Ravizza, Vinçon & Poggi 2022), Emilia-Romagna (Ravizza 2011), Umbria (Consiglio 1971), Lazio (Consiglio 1971, Nicolai & Fochetti 1983b) and Abruzzi (Consiglio 1971).

New records. **Italy, Tuscany:** Melo – Cutigliano, 800 m, 44.113N, 10.747E, 10.07.2009, 4♂ 10♀ (VIN). **Marche:** Castelsantangelo, Nera spr., 780 m (RAV). **Lazio:** Abruzzi, Vallerotonda, Collelungo spr., 1480 m, 41.628N, 13.978E, 2.07.2020, 1♂ (VIN). **Molise:** Montenero V., Zittola tor. (RAV); **Basilicata:** Rifreddo br., 1200 m (RAV). **Puglia:** Celle S. Vito, Celone spr., 938 m (RAV).

Distribution area and biogeographical notes. *I. andreinii* inhabits the whole Apennines. Two doubtful reports from the Alps, which are in need of confirmation, are also assigned to this species - southward Garda Lake (Pozzolengo near Brescia) (Consiglio 1971), Lombardia, Briosco, 275 m, 30 Km north Milano (CO) torrente Bevera su *Filipendula ulmaria*, 10 adults, 17.05.1975, leg. Pesarini (MZL, catalogue number: GBIFCH 00967654). The species occurs in brooks and rivers of moderate elevation (35–1480 m). Flight period (V–VII).

***Isoperla illyrica* Tabacaru, 1971**

(Map 6)

Type locality. Slovenia: surroundings of Postojna, 21.05.1967 (Tabacaru 1971) (Capuse & Danielopol leg).

Previous data. Italy, Friuli-Venezia Giulia: Bagnoli della Rosandra, Rosandra tor., 70 m (Nicolai 1982), same locality, 22.04.1983, 1♂ (Fochetti & Nicolai 1985).

New records. Italy, Julian Prealps: N.E. Cividale del Friuli, Cepletischis, spr., 600 m, 46.179N, 13.568E, 15.05.2010, 2♂; 21.05.2022, 3♂; Cepletischis, spr., 340 m, 46.1703N, 13.5575E, 21.05.2022, 1♂ (VIN).

Distribution area and ecological notes. this species extends from the Dinaric Mountain range up to the eastern slopes of the Italian Alps (Graf *et al.* 2009). In Italy, it is present only close to the Slovenian border (Map 6). Our specimens were collected in the crenal zone of a hilly region. Its altitudinal range in Italy is 70–600 m. The flight period is in spring (IV–V).

***Isoperla obscura* (Zetterstedt, 1840)**

I. obscura is a very rare potamal species, extinct, as so many other lowland taxa, in large parts of Western Europe. Its last known records in Italy came from the surroundings of Verona (Consiglio 1966) and from the Adige River between Verona and Merano (Ravizza & Nicolai 1983). The species, however, has been rediscovered in 2009 and 2010, in the Po River near Casale Monferrato (Delmastro & Vinçon 2016).

***Isoperla oenotriae* Consiglio, 1967a**

(Map 10)

Type locality. Italy, Abruzzi, Opi, Val Fondillo, Fondillo spr., 1350 m, 1.07.1952.

Previous data. The species is reported from only two localities: Abruzzi: Val Fondillo (type locality) and Alfedena, Camosciara, 1100–1200 m, 3.07.1952, 2♀ (Consiglio 1967a).

New records. Italy, Abruzzi: Gran Sasso, Prati di Tivo, spr., 1500 m, 42.505N, 13.561E, 11.07.2009, 1♂ 1♀; SE. Opi, Fondillo V., "Grotte delle Fate", 1450 m, 41.739N, 13.882E, 12.07.2009, 10♂ 16♀; Fondillo V., "Sorgente Tornareccia", spr., 1100 m, 41.7713N, 13.857E, 13.06.2021, 8♂ 2♀ (VIN).

Morphological remarks. The two specimens collected in the Gran Sasso Massif (Prati di Tivo)

are slightly different from those collected in the type locality (Val Fondillo). The characteristic processes on the outer edge of meso- and meta-thorax are visible in both male and female but less pronounced than observed on the specimens from the type locality (Consiglio 1967a Fig. 2). The male ventral lamella is longer than wide while it is as long as wide in the specimens from the type locality (Consiglio 1967a Fig. 3–4). The posterior edge of the female subgenital plate is pale, not blackish, but this character is variable in the type locality (Consiglio 1967a Fig. 5). The male armature is triangular as it is in the type locality specimens (Consiglio 1967a Fig. 7). Further research is required to decide on the status of this Gran Sasso population which may also be considered as an isolated subspecies.

Distribution area and biogeographical notes. *I. oenotriae* is a steno-endemic species restricted to the Abruzzi Mountain (Map 10). It is a strongly orophilic, crenophilic, cold-water stenothermal species inhabiting the highest sites of the Abruzzi (1100–1500 m). The flight period is in summer (VII).

***Isoperla orobica* Ravizza, 1975a**

(Map 4)

Type locality. Italy, Lombardia, Orobie Alps, Val Brembana, Mezoldo, Ca' San Marco br., 1600 m, 24.07.1973.

Previous data. Italy, Pennine Alps (Ravizza 1975a, Ravizza & Ravizza Dematteis 1990). Lombardia, Alpi Orobie (Ravizza 1975a). Switzerland, Ticino, Lepontine Alps (Aubert *et al.* 1996). It is also reported (Lubini-Ferlin *et al.* 2023) from the northern slope of the Alps (Simplon Pass, spring Taferna).

New records. Italy, Graian Alps: Lis Pass, > Girardi, br., 1000 m, 45.169N, 7.365E, 12.08.2005, 3♂ 6♀; Val di Viu, Colombardo, 1400 m, 45.203N, 7.304E, 27.09.2005, 2♀; Tornetti, spr., 1200 m, 45.249N, 7.336E, 20.06.2019, 2♀; > Trione, 1250 m, 45.401N, 7.574E, 21.06.2019, 1♂ 8♀; Val Soana, > Ingria, 850 m, spr.,

45.462N, 7.567E, 21.06.2019, 4♂ 4♀; Pian d'Audi, 1200 m, 45.359N, 7.511E, 12.08.2005, 3♂ 5♀; Valchiussella, near Lago Gias del Prete, 2000 m, 45.52N, 7.644E, 20.06.2014, 1♂; 1700 m, 12.07.2012, 1♂ 4♀ (VIN). **Pennine Alps:** Val d'Ayas: near Frudiere Lake, 1900 m, 45.739N, 7.802E, 14.08.2005, 1♂ 6♀; Val Gressoney: Severoux, spr., 1450 m, 45.655N, 7.896E, 16.10.2015, 1♂ 2♀; Pillaz, 1340-1380 m, spr. + br., 45.642N, 7.875E, 17.10.2020, 7♂ 15♀; Trovinasse, 1900 m, 45.595N, 7.881E, 11.07.2003, 9♂ 8♀; spr., 1600 m, 45.579N, 7.868E, 11.07.2003, 3♂ 5♀; 31.08.2012, 6♂ 16♀; Oriomosso, br., 1000 m, 45.659N, 8.024E, 1.06.1991, 2♀; Civasco, br., 850 m, 45.822N, 8.313E, 13.08.2005, 2♀; Val Strona, Campello Monti, 1600 m, 45.928N, 8.228E, 11.07.2003, 1♂ 1♀; 1400 m, 13.05.2005, 2♀ (VIN). **Lepontine Alps:** Val Loana, 1400 m, 46.074N, 8.477E, 11.07.2003, 2♀ (VIN). **Orobic Alps:** Bergamo, Passo San Marco, 1740 m, 46.046N, 9.6425E, 24.09.2021, 1♀; 1650 m, spr., 46.0427N, 9.6431E, 18.06.2023, 1♂ 1♀; 1560-1590m, br. and spr., 46.0691N, 9.629E, 18.06.2023, 1♂ 11♀ (VIN). **Switzerland: Pennine Alps:** Zwischbergen, spr., 1450 m, 46.163N, 8.114E, 7.08.2019, 4♂ 12♀; spr., 1500 m, 46.149N, 8.103E, 22.08.2018, 2♂ 6♀; spr., 1890 m, 46.177N, 8.1E, 8.08.2019, 2♂ 8♀; Distrulgrabbe spr., 2030 m, 46.169N, 8.084E, 8.08.2019, 1♀ (VIN).

Distribution area and ecological notes. *I. orobica* is widely distributed in the western and central Italian Alps, from the Graian Alps to the Lombard Prealps (Map 4). It occurs in various kinds of mountain water courses (850–2030 m). The flight period widely extends from summer to autumn (VII–X).

Isoperla oxylepis oxylepis (Despax, 1936)

The only mention of this species from Italy refers to specimens collected in the Cottian Alps: Sanfront fiume Po, 550 m (Ravizza Dematteis & Ravizza 1988). As a result of the revision of these specimens stored in the MZL by the last author, it appeared that they belong to *I. carbonaria* Aubert, 1953b. The species is, therefore, removed from

the list of the Plecoptera occurring in the Italian region.

Isoperla rivulorum (Pictet, 1841)

(Table 3)

Ecological notes. *I. rivulorum* is a very common eurytopic species that can reach very high elevations; its highest known locality is in the Graian Alp: Gran Paradiso Massif, above Corona Lake, spr., 2740 m, 45.649N, 7.415E, 1♂ (VIN).

Isoperla saccai (Festa, 1939b)

(Map 12, Table 3)

Type locality. Italy, Abruzzi, Pescasseroli, 1167 m (Festa 1939b).

Previous data. Italy, Emilia-Romagna (Fochetti & Campadelli 1988, 1991), Tuscany (Aubert 1953a), Marche (Aubert 1956b, Fochetti & Nicolai 1987a), Lazio (Aubert 1953a, Consiglio 1967a, Nicolai & Fochetti 1983a), Abruzzi (Festa 1939b, Consiglio 1955a, Aubert 1953a, Nicolai 1983b, Nicolai, Fochetti & Marini 1988, Nicolai, Fochetti & Dell'Agata 1988). Campania (Consiglio 1958b), Basilicata (Aubert 1958), Calabria (Aubert 1954c, 1958).

New records. **Italy, Emilia-Romagna:** Balze, Tevere spr., 1300 m, 43.787N, 12.075E, 3.07.2020, 2♂ 1♀ (VIN). **Tuscany:** Pratomagno, 1300 m, spr. + br., 43.645N, 11.665E, 8.06.2020, 8♂ 2♀; Pratomagno, spr., 1180 m, 43.613N, 11.688E, 20.05.2021, 1♂ (VIN). **Marche:** Castelsantangelo, Nera spr., 780 m (RAV); Monti Sibillini, Panico spr., 1320 m, 42.9412N, 13.2022E, 18.05.2022, 5♂; Ussita, tor., 730 m, 42.943N, 13.138E, 18.05.2022, 3♂ 1♀ (VIN). **Umbria:** Colfiorito (RAV). **Lazio:** Prati di Mezzo, spr., 1560 m, 41.653N, 13.936E, 9.06.2020, 8♂ 6♀; 1700 m, 41.651N, 13.959E, 9.06.2020, 4♂ 9♀; 1.07.2020, 8♂ 10♀; spr. < water catchment, 1560-1580 m, 41.6524N, 13.9373E, 12.06.2021, 6♂ 6♀; Valle-rotonda, Collelungo spr., 1480 m, 41.628N, 13.978E, 2.07.2020, 2♂ 2♀ (VIN). **Abruzzi:** L'Aquila, Vera spr., 680 m, 42.370N, 13.458E,

14.06.2020, 3♂ 4♀; Prati di Tivo, spr. + br., 1580 m, 42.502N, 13.573E, 11.07.2009, 1♂ 2♀; 14.06.2020, 12♂ 10♀; 26.05.2021, 6♂; Prati di Tivo, spr., 1370 m, 42.514N, 13.573E, 9.09.2020, 1♂ 5♀; Val Fondillo, spr., 1100 m, 41.768N, 13.855E, 12.07.2009, 2♂ 2♀; 9.06.2020, 7♂ 12♀; "Sorgente Tornareccia", spr., 1100 m, 41.7713N, 13.857E, 13.06.2021, 8♂ 12♀; Maiella: > Santuario Santo Spirito, spr., 1350 m, 42.169N, 14.102E, 13.07.2009, 5♂ 1♀; 1200 m, 42.169N, 14.097E, 13.07.2009, 11♂ 16♀; Ateleta, Sangro R., 750 m; Palena, Aventino t., 780 m (RAV); Sorgenti dell'Aventino, SW Palena, 880 m, 41.964N, 14.12E, 25.05.2021, 2♂ 7♀; 20.05.2022, 7♂ (VIN). **Basilicata:** Pedarreto spr., 1400 m (RAV); Lagonegro, spr., 1300 m, 40.154N, 15.821E, 10.06.2020, 1♂ 2♀ (VIN). **Calabria:** Botte Donato, spr., 1850 m (RAV); Timpone, Bruno spr., 1700 m (RAV); Sila grande, spr., 1600 m, 39.32N, 16.401E, 11.06.2020, 3♂ 1♀; 7.09.2020, 1♂ (VIN); Aspromonte, Montalto, spr., 1750 m (RAV); Aspromonte, 1400 m, tor., 38.145N, 15.836E, 11.06.2020, 1♂; 1420 m, spr., 38.144N, 15.842E, 11.06.2020, 1♂ (VIN).

Distribution area and biogeographical notes. *I. saccai* is an Apennine endemic species with wide distribution in most of the Apennine cordillera, from Emilia-Romagna to Calabria (Map 12). It is rather crenophilic, occurring in mountains brooks and springs (700–1850 m). The flight period is in spring and early summer (V–VII).

***Isoperla zwicki* Tierno de Figueroa & Fochetti, 2001**

(Map 6)

Type locality. Italy, Trentino-Alto Adige, Val Gsies (= Valle di Casies) (Bolzano), Santa Madalena, 1800 m, 46.838N, 12.246E, leg. Vanin, 15.08.1998.

Previous data. Italy, Trentino-Alto Adige, br. Pull, Sesto-Bolzano, 46.659N, 12.415E, 8.08.1985, 21♂ 2♀ (Paratypes: in Tierno de Figueroa J.M. & Fochetti 2001).

New records. **Italy, Rhaetian Alps:** Livigno, Passo del Foscagno, spr. + br., 2180 m, 46.483N,

10.222E, 24.09.2021, 2♀, **Dolomites:** S.E. Moso, Biotop Patzenfeld-Moschermos, spr. + br., 1530 m, 46.669N, 12.393E, 26.09.2021, 8♀; 26.09.2021; Tre Cime di Lavaredo Massif, spr. < water capture, 1650 m, 46.6552N, 12.4063E, 2♀ (VIN).

Distribution area and ecological notes. Both collecting places are very near to the Austrian border (Map 6). *I. zwicki* is also reported from Austria (Murányi 2011), but without indication of collecting sites. It is a cold-water stenothermal species inhabiting the highest brooks and springs (1800 m).

Remarks. Specimens close to *I. zwicki* also occur in the western Italian Alps (VIN), but they differ conspicuously and require additional studies.

***Perla ravizzaorum* Reding, 2023**

Type locality. Italy, Emilia-Romagna, Piacenza. Tra Ponte dell'Olio e Bettola, torrente Nure, 200 m, 27.06.1977

Previous data. Italy, Northern Apennines: Emilia-Romagna, Alps: Maritime Alps, Graian Alps, Pennines Alps, Orobic Alps, Julian Alps (Reding 2023).

Distribution area and ecological notes. This species, previously conflated with either *P. bipunctata* or *P. grandis*, occurs widely in the Alpine Arc and extends into the Northern Apennines and eastward in the low Tatras (Slovakia). It is a cold-water stenothermal species inhabiting the main channel of larger rivers up to 900 m a.s.l. The flight period is at the end of spring (V–VI).

***Xanthoperla apicalis apicalis* (Newman, 1836) and *X. apicalis hamulata* (Morton, 1930)**

Xanthoperla apicalis hamulata (Morton, 1930)

Remarks. Fochetti and Tierno de Figueroa (2008), not admitting subspecies in their inventory, consequently did not consider the subspecies *hamulata*. The validity of the subspecies *Xanthoperla apicalis hamulata* had also been

questioned by Ravizza (1975b), who expressed some doubts about the validity of this subspecies. Among many adults of *Xanthoperla* collected in Sardinia in the Terramala streamlet, the shape of the tooth (or hook) of the male epiproct of 29 males exhibits a high degree of variability from the one of *apicalis* and that of *hamulata*. The situation is further complicated by the fact that Morton (1930), in his description of *X. hamulata*, did not provide any comments about morphological affinities with *Xanthoperla apicalis*. Despax (1941, 1951), too, had noticed that the morphological differences between *X. apicalis* and *X. hamulata* are inconspicuous, and did not exclude that the species described by Morton could be only an insular "form" of *X. apicalis*. This problem needs a critical taxonomical re-examination, by studying specimens of *X. apicalis* from the whole of its distribution area. Yet from a zoogeographical point of view, in regard of the peculiarity of the insular stonefly fauna of Corsica and Sardinia it cannot be excluded that *hamulata* is a subspecies of *Xanthoperla apicalis*. Zwick (2004) also mentions discrepancies in the larval descriptions of *Xanthoperla apicalis* from Fennoscandia and Calabria. Lillehammer (1988) and DeWalt et al. (2024) synonymize *Xanthoperla apicalis* with Morton's (1930) *Isopteryx hamulata* from Corsica.

Previous data for X. apicalis hamulata. Italy, Sardinia (Costa 1886 sub nom. *Isopteryx apicalis*, Consiglio 1957a, 1967b, 1975, Ravizza 1975b).

New records for X. apicalis hamulata. **Italy, Sardinia:** Bosa rio Mesu, 270 m, Arzachena rio S. Giovanni 46 m, Passo Caravai r. Madau 1050 m (RAV). **France, Corsica: Cap Corse:** Conchiglio, Marine de Giottani, 2 m, 42.866N, 9.343E, 29.05.1992, 16♂ 14♀; Olmetta di Capocorso, 300 m, 42.774N, 9.377E, 29.05.1992, 16♂ 14♀ (VIN). **Haute-Corse:** Cinto Massif, Astradella spr., Erco trib., 1600 m, 42.359N, 8.972E, 5.07.2008, 3♂ 3♀; 1750 m, br., 42.368N, 8.956E, 5.07.2008, 6♂ 7♀; spr., 2000 m, 42.367N, 8.946E, 5.07.2008, 2♀; Porto Ota, Porto R., 50 m, 42.259N, 8.717E, 1.06.1992, 2♂ 1♀; N. Cargèse, Chiuni br., 60 m, 42.181N, 8.614E, 1.06.1992, 7♂

2♀; Restonica V., < Melo Lake, br., 1400-1600 m, 42.222N, 9.025E, 16.07.2008, 3♂ 1♀; Monte d'Oro, 1700 m, 42.132N, 9.086E, 13.07.2008, 1♂ 3♀; 1500 m, 42.126N, 9.088E, 13.07.2008, 5♂ 5♀; spr., 1250 m, 42.12N, 9.104E, 13.07.2008, 3♀ (VIN). **Corse-du-Sud:** Coccione Plateau, br., 1400 m, 41.812N, 9.138E, 8.07.2008, 1♂ 2♀; Vaccia Pass, 1100-1250 m, 41.799N, 9.135E, 8.07.2008, 16♂ 25♀; Arinella, 1500 m, 41.863N, 9.158E, 8.07.2008, 4♂ 2♀; Monacia d'Aullène, 220 m, br., 41.545N, 9.023E, 4.06.1992, 4♂ 8♀; Homo di Cagna Mount, 700 m, 41.57N, 9.056E, 4.06.1992, 6♂ 2♀ (VIN).

Distribution area and biogeographical notes. *X. apicalis hamulata* is endemic to Corsica and Sardinia. It is eurytopic, occurring from nearly the sea level in the Cap Corse up to 2000 m in the Cinto Massif. The flight period is in spring and early summer (V–VII).

Siphonoperla italica (Aubert, 1953b)

(Table 3)

Siphonoperla torrentium italica (Aubert, 1953b).

Morphological remarks. In Fochetti and Tierno de Figueroa (2008, Fig. 61), male epiprocts and female subgenital plates of *Siphonoperla italica* (sub nom. *S. torrentium*) and *S. montana* are mismatched.

Previous data. In Italy, it is one of the most common species occurring in the whole of the Alps, the Apennines as well as in Sicily.

New records. First reports from France. **France, Alpes-Maritimes:** Turini Pass, 1400 m, 43.977N, 7.376E, 12.06.1988, 5♂ 5♀; Bollène-Vésubie, 1200 m, 43.985N, 7.367E, 12.06.1988, 2♀; Caramagne tor., 1300 m, 44.125N, 7.553E, 12.06.1988, 1♀; Caïros tor., 1600 m, spr., 44.021N, 7.426E, 31.07.2009, 1♂ 1♀; 2000 m, spr., 44.025N, 7.415E, 31.07.2009, 1♀; Tende Pass, spr., 1900 m, 44.146N, 7.588E, 4.08.2009, 3♂ 2♀; Tende Pass, 1400 m, 44.143N, 7.575E, 12.06.1988, 6♂ 1♀; Perle Pass, spr., 2050 m, 44.155N, 7.626E, 9.08.2009, 3♂ 2♀ (VIN).

Remarks. Fochetti and Tierno de Figueroa (2008: 123) question the validity of the subspecies *italica*. This subspecies was described by Aubert (1953b) and separated from the type species only by the different shape of the heavily sclerified tooth (or hook) of the male epiproct. This problem has been solved in a molecular phylogenetic study by Weiss *et al.* (2012), showing that *S. italica* Aubert is a valid species, separable from the closely related *S. torrentium* (Pictet). Recently Fochetti (2020) agreed to this point of view registering *S. italica* among the Italian endemic species. We therefore consider that all previous mentions of *S. torrentium* from Italy correspond to *S. italica*.

Distribution area and biogeographical notes. *S. italica* inhabits the whole Italian Peninsula and Sicily and is widespread in the Italian Alps; it is slightly extensive into the French Maritime Alps between the Roya and Vésubie valleys. It occurs in different kinds of mountain watercourses (350–2000 m). In the Apennines, its highest known locality is in the Abruzzi Massif: Maiella, top of San Spirito Valley, spr., 1700 m, 42.1664N, 14.118E, 13.06.2020, 6♂; 2.07.2020, 6♂ 4♀ (VIN).

***Siphonoperla montana* (Pictet, 1841) (Map 8)**

(Table 3)

Type locality. Bex, Switzerland (Pictet 1841).

Morphological remarks. As noted above, the figures in Fochetti and Tierno de Figueroa (2008, Fig. 61), for *S. montana* and *S. italica* (*sub nom. S. torrentium*) are mismatched.

Previous data. Italy, Ligurian Alps (Ravizza & Ravizza Dematteis 1977, Ravizza, Vinçon & Poggi 2022), Maritime Alps (Consiglio 1971, Ravizza & Ravizza Dematteis 1994b), Cottian Alps (Ravizza & Ravizza Dematteis 1986, Ravizza Dematteis & Ravizza 1988), Pennine Alps (Consiglio 1971, Ravizza & Ravizza Dematteis 1990, 1991), Lepontine Alps and Grisons (Aubert 1949, Aubert *et al.* 1996), Orobic Prealps (Ravizza 1975a), Rhaetian Alps (Aubert

1965, Consiglio 1971, Ravizza & Ravizza Dematteis 1994b), Apennines: Ligurian Apennines (Ravizza, Vinçon & Poggi 2022), Emilia-Romagna (Ravizza & Ravizza Dematteis 1978), Abruzzi (Fochetti 1994).

New records. Italy, Cottian Alps: Vallon del Arma, spr., 1850 m, 44.37N, 7.147E, 6.09.2007, 2♀; Macra valley, spr., 2300 m, 44.426N, 7.143E, 9.08.2020, 4♀; Varaita V., spr. + br., 2500 m, 44.677N, 7.046E, 12.07.2007, 2♂ 1♀; Pellice V., 1820 m, spr. + br., 44.745N, 7.082E, 21.06.2019, 1♂; Germagnasca V., Ribba, 2100 m, 44.846N, 7.026E, 5.08.2001, 1♂ 1♀ (VIN). **Graian Alps:** Borgial, br., 1920 m, 45.189N, 7.287E, 12.08.2005, 2♂ 2♀; spr., 1400 m, 45.12N, 7.304E, 20.06.2019, 1♂ 3♀; Noasca, 2240 m, spr. + br., 45.473N, 7.288E, 7.08.2020, 1♀; Valchiusella, near Gias del Prete lake, 2170 m, 45.52N, 7.644E, 12.07.2012, 1♂ 3♀; 20.06.2014, 5♂; 1750 m, 45.518N, 7.655E, 20.06.2019, 1♂ 2♀; Scalero, spr., 1375 m, 45.549N, 7.772E, 11.07.2012, 3♀; Valsavaranche, La Tsante, 2000 m, 45.515N, 7.208E, 14.07.1992, 2♂ 2♀; Gimillan, br., 2350 m, 45.637N, 7.405E, 5.07.2020, 1♂ 1♀; Petit St Bernard Pass, 1530 m, 45.699N, 6.96E, 1.06.1991, 2♂; Champdepraz V., Gran Lago, br., 2450 m, 45.644N, 7.565E, 12.07.2003, 5♂ 3♀; 2250 m, 45.644N, 7.575E, 12.07.2003, 1♂ 6♀ (VIN). **Pennine Alps:** Val d'Ayas, 2050 m, 45.732N, 7.815E, 5.07.2004, 1♂ 1♀; 1900 m, 45.739N, 7.802E, 19.06.2004, 5♂ 1♀; 6.07.2004, 2♂ 1♀; 1800 m, 45.738N, 7.791E, 6.07.2004, 1♂ 4♀; > Blanchard, 1870 m, 45.87N, 7.73E, 17.06.2023, 2♂ 1♀; > Pillaz, 1410 m, spr. + br., 45.641N, 7.8774E, 29.05.2021, 2♂ 2♀; Trovinasse, 1700 m, spr., 45.592N, 7.872E, 24.05.2003, 1♀; Biella, Oropa, spr., 1800 m, 45.6435N, 7.969E, 4.07.2020, 1♂ 2♀; Mucrone Lake, 1930 m, 45.629N, 7.942E, 4.07.2020, 2♂; Panoramica Zegna, br., 1300 m, 45.669N, 8.055E, 1.06.1991, 4♂ 1♀; < Lago Bianco, spr., 2260 m, 45.8072N, 7.888E, 12.07.2021, 3♂ 2♀; Civiasco, spr., 850 m, 45.822N, 8.313E, 2.06.1991, 1♂; Cervarolo, 1400 m, 45.885N, 8.27E, 2.06.1991, 1♀; Val Strona, 1620 m, 45.928N, 8.228E, 11.07.2003, 2♂ 11♀; 1430 m, 45.933N, 8.23E, 18.06.2018, 1♂ 1♀ (VIN). **Lepontine Alps:** Val Vigezzo, Arvogno, 1400 m, 46.184N, 8.465E, 23.05.2003, 1♂ (VIN).

Venetian Prealps: Campogrosso Pass, spr., 1320 m, 45.746N, 11.161E, 21.06.2018, 3♀; 14.06.2021, 2♂ 3♀; Camposilvano, spr., 1200 m, 45.757N, 11.17E, 21.06.2018, 1♀; spr., 1050 m, 45.754N, 11.149E, 27.05.2021, 3♂ 4♀; 14.06.2021, 8♀ (VIN). **Dolomites:** S.E. Moso, spr., Rio Bianco, 1650 m, 46.656N, 12.406E, 24.05.2022, 1♂; 19.06.2023, 4♂ 5♀; S.E. Moso, near Biotop Patzenfeld-Moschermos, spr., 1530 m, 46.669N, 12.393E, 24.05.2022, 1♀ (VIN). **Carnic Alps:** Sella Ciampigotto, spr. + br., 1750 m, 46.487N, 12.589E, 22.06.2018, 6♀ (VIN). **Julian Alps:** Sella Nevea, 1100 m, 46.395N, 13.494E, 15.05.2010, 9♂ 2♀; W. Sella Nevea, brook, 1040 m, 46.3897N, 13.4693E, 24.05.2022, 7♂ 1♀; S. Fusine, spr., 910 m, 46.4857N, 13.6735E, 23.05.2022, 1♀ (VIN). **Emilia-Romagna:** S. Cerreto Laghi, spr., 1550 m, 44.28N, 10.25E, 11.06.2022, 4♀ (VIN). **Abruzzi:** Prati di Tivo, Arno spr., 1450-1500 m, 42.486N, 13.542E, 26.05.2021, 1♂ 1♀; Val Fondillo, Tornareccia spr., 1140 m, 41.771N, 13.856E, 5.09.2020, 1♀; Maiella, Santo Spirito V., spr., 1600 m, 42.164N, 14.114E, 25.05.2021, 1♀ (VIN).

Distribution area and biogeographical notes. This species has a Central European distribution and is one of the most orophilic taxa in the Alps (850–2500 m) (Ravizza & Ravizza Dematteis 1994b); at lower collection sites, it is only found in springs. In the Apennines it is disjunctly distributed in high elevation biotopes (1140–2500 m). The flight period extends from spring to early autumn (V–IX).

***Brachyptera auberti* Consiglio, 1957a**

Brachyptera mussardi Aubert, syn. fide Zwick (1971).

Previous data. Italy, Sardinia (Consiglio 1957a, Ravizza 1975b).

New records. Italy, **Sardinia:** Cuglieri r. di Sennariolo 350 m, M. Ferru, sorgente Badde, Urbara 870 m, Gallura La Maciona Piatu b., 210 m, M. Limbara spr. 1000 m (RAV). France, **Southern Corsica,** above Monacia d'Aullène, Bonifacio, Bridge, 220 m, 41.545N, 9.023E, 4.06.1992, 1♂, 1 exuviae (VIN).

Distribution area and ecological notes. *B. auberti* is a west Mediterranean species extending to central and southern Spain (Tierno de Figueroa et al. 2003), the whole of Maghreb, from Morocco to Tunisia (Errochdi et al. 2014), Sardinia and Corsica. It is an orophilic species which occurs in mountain brooks and torrents (210–1020 m) in Sardinia. In Morocco it occurs between 170 and 1800 m in the Rif (Errochdi et al. 2014), up to 2150 m in the High-Atlas (Vinçon, El Alami & Errochdi 2014). The adults emerge during winter and spring (II–VI).

***Brachyptera calabrica* Aubert, 1953b**

(Table 3, Map 12)

Type locality. Italy, Calabria, Sila Massif, Neto brook, 1200 m, 16.05.1952 (Aubert 1953b).

Previous data. Italy, Marche (Consiglio 1967b), Abruzzi (Consiglio 1958a, 1967b), Campania (Consiglio 1958b), Basilicata (Aubert 1953b, 1958, Nicolai & Fochetti 1991a), Calabria (Aubert 1953a, 1953b, 1958, Consiglio 1967b, Nicolai & Fochetti 1991a), Sicily (Consiglio 1961a, Fochetti & Nicolai 1987b, Ravizza & Gerecke 1991).

New records. Italy, **Abruzzi:** Gran Sasso Massif: > Pietracamela, spr. + br., 1150 m, 42.517N, 13.549E, 4.04.2015, 1♂; tor., 1000 m, 42.522N, 13.55E, 4.04.2015, 1♀; Intermesoli, tor., 42.53N, 13.549E, 4.04.2015, 1♂; Prati di Tivo: spr. + br. 1550-1580 m, 42.502N, 13.573E, 14.06.2020, 1♀; 1370 m, 42.51N, 13.574E, 14.06.2020, 1♀; spr., 1320 m, 42.515N, 13.573E, 26.05.2021, 1♂; NW Aquila, tor., 1100 m, 42.504N, 13.415E, 4.04.2015, 1♂ 1♀; Maiella, NE Rivisondoli Pizzi, spr. + br., 1270-1300 m, 41.9205N, 14.1283E, 25.05.2021, 4♂ 8♀; Sorgenti dell'Aventino, SW Palena, 880 m, 41.964N, 14.12E, 20.05.2022, 3♂; Val Fondillo: < grotte delle Fate, 1450 m, 41.739N, 13.882E, 12.07.2009, 15♀; 4.04.2015, 4♂; 9.06.2020, 2♂ 10♀; br., 1300 m, 41.749N, 13.865E, 9.06.2020, 6♀ (VIN). **Lazio:** Prati di Mezzo, spr., 1560 m, 41.653N, 13.936E, 10.06.2020, 2♀; 21.05.2021, 3♂ 3♀ 12 la., 12.06.2021, 1♀ (VIN). **Molise:**

Campitello Matese, Campanacia, spr. + br., 1300 m, 41.469N, 14.39E, 5.04.2015, 2♂ 3♀; Roccamendolfi, 1000 m, spr., 41.494N, 14.339E, 5.04.2015, 1♀; > Pescopennataro, spr., 1420 m, 41.8547N, 14.2932E, 18.05.2022, 3♀; Fonte Gelata, 1230 m, 41.8477N, 14.261E, 18.05.2022, 1♀ (VIN). **Campania:** Matese Regional Parc, spr., 1120 m, 41.402N, 14.46E, 13.06.2020, 1♀ (VIN). **Basilicata:** NE Lagonegro: spr., 1350 m, 40.152N, 15.808E, 22.05.2021, 3♀; spr., 1300 m, 40.154N, 15.822E, 22.05.2021, 2♀; Fecile hamlet, br., 980 m, 40.152N, 15.765E, 22.05.2021, 1♀; Pollino Massif: spr. of Frido River, 1910 m, 39.921N, 16.206E, 24.05.2021, 1♂ 1♀; 1740 m, br., 39.924N, 16.195E, 24.05.2021, 1♂ 3♀; 1650 m, spr. + br., 39.922N, 16.187E, 24.05.2021, 3♂ 2♀; 1500–1600 m, spr. + br., 39.925N, 16.177E, 11.06.2020, 1♂ 2♀; 1600–1650 m, spr., 39.916N, 16.177E, 11.06.2020, 1♀ (VIN). **Calabria:** Sila Grande: spr. + br., 1700–1750 m, 39.292N, 16.445E, 22.05.2021, 4♂; spr., 1650–1700 m, 39.32N, 16.401E, 11.06.2020, 3♀; spr., 1580–1650 m, 39.32N, 16.401E, 11.06.2020, 2♂ 9♀; spr., 1320 m, 39.32N, 16.385E, 22.05.2021, 1♀; Aspromonte: < Montalto, 1760–1800 m, spr. + br., 38.1649N, 15.916E, 23.05.2021, 1♀; 1470 m, 38.1456N, 15.8423E, 23.05.2021, 2♂; tor., 1400 m, 38.145N, 15.836E, 12.06.2020, 3♀; spr., 1420 m, 38.144N, 15.842E, 12.06.2020, 1♀; SE Gambarie, riv., 1430 m, 38.143N, 15.845E, 23.05.2021, 3♂; NE Gambarie, tor., 1400 m, 38.175N, 15.854E, 23.05.2021, 4♀; Sant' Eufemia d'Aspromonte, br., 1150 m, 38.204N, 15.855E, 23.05.2021, 1♀ (VIN).

Distribution area and ecological notes. *B. calabrica* is endemic to the southern half of the Apennines and extends into Sicily (Map 12). It is very common in mountain brooks and springs, up to 1910 m of elevation in the Pollino Massif. The flight period is in spring (IV–VI).

***Rhabdiopteryx harperi* Vinçon & Murányi, 2009**

(Table 3, Map 7)

R. harperi had generally been confused with *R.*

alpina Kührtreiber, 1934 by previous authors, except by Kührtreiber (1934), who listed the species as a high-altitude variant of *R. neglecta* (Albarda, 1889).

Type locality. France, Savoie: Bonneval sur Arc, below Iseran pass, Arc trib., 2300 m, 21.06.1991.

Previous data. Italy, Rhaetian, Pennine, Cottian and Graian Alps (Vinçon & Murányi 2009).

New records. **Italy, Pennine Alps:** Ayas Valley, 2600 m, 45.902N, 7.763E, 17.06.2023, 1♂ 3♀; br. 2440 m, 45.8975N, 7.7625E, 17.06.2023, 1♂ 2♀ (VIN). **Lombardia:** Rhaetian Alps, Passo di Gavia N. slope, Gavia River, 2560 m, 46.35N, 10.496E, 15.06.2021, 1♂; Gavia River and tributary, 2530–2550 m, 46.36N, 10.4995E, 15.06.2021, 3♀; Gavia trib., above Ponte dell' Alpe, brook, 2330 m, 46.383N, 10.494E, 15.06.2021, 1♂ (VIN).

Distribution area and ecological notes. *R. harperi* has a wide distribution area that extends from the Alpine arc to the Carpathians. In the Alps, it is strongly orophilic (1300–2600 m) and occurs in brooks and torrents in open grass land; the adults are often seen walking on the snow. In the Carpathians, it occurs at much lower elevations (850–1600 m) in forest streams. The flight period is mainly in spring and early summer (IV–VII).

***Rhabdiopteryx neglecta* (Albarda, 1889)**

(Table 3)

Ecological notes. *R. neglecta* occurs in various kinds of water courses in the Italian Alps, Apennines and Sicily. Its highest known locality in the Apennines is in Basilicata: Pollino Massif, 1740 m, Frido River, 39.924N, 16.195E, 24.05.2021, 1♀ (VIN); in the Italian Alps, it is found in the Ayas Valley (Pennine Alps), above Blanchard, 2440 m, 45.8975N, 7.7625E, 17.06.2003, 1♂ 1♀ (VIN).

***Amphinemura triangularis* (Ris, 1902)**

Type locality. Taubenloch Gorges; River Suze near Biel, Bernese Jura, Switzerland.

Previous data. Italy, Cottian Alps (Ravizza & Ravizza Dematteis 1986), Orobic Alps (Ravizza 1975a), Dolomites (Consiglio 1967b), Julian Alps and Pre-Alps (Fochetti & Nicolai 1985), Ligurian Apennines (Ravizza 1974b), Emilia-Romagna (Fochetti & Campadelli 1991), Lazio (Consiglio 1958a), Abruzzi (Consiglio 1958a), Campania (Nicolai & Fochetti 1991a), Calabria (Aubert 1953b, 1958, Nicolai & Fochetti 1991a).

New records. **Italy, Molise,** Volturno River at Colli a Volturno, 360 m, 41.608N, 14.097E, 21.05.2021, 2♂, 13♀; Castel San Vincenzo, River Volturno, 530 m, 41.654N, 14.077E, 19.05.2022, 1♂ 4♀, River Volturno, 330 m, 41.5957N, 14.1025E, 19.05.2022, 1♂ 4♀; Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594N, 14.0783E, 19.05.2022, 3♀ (VIN). **Lazio,** Abruzzi Massif, Sorgente del valloni Fiume Volturno, 550 m, 41.6377N, 14.0733E, 21.05.2021, 1♀ (VIN).

Morphological remarks. Specimens of *Amphinemura triangularis*, in pre-copulatory phase, have their epiproct strongly modified, and thus appear very alike *A. arcadia* (Aubert, 1956c), suggesting that the holotype of *A. arcadia* might also be in pre-copulatory phase and that *A. sperchiana* Berthélemy, 1970 could belong to the very same species as *A. arcadia*, but not in pre-copulatory phase. In a separate study we will compare these 3 species and consider the hypothesis that *A. arcadia* and *A. sperchiana* could be synonyms of *A. triangularis*.

Distribution area and biogeographical notes. *A. triangularis* is widely distributed in the West Palaearctic, except in Fennoscandia and the British-Irish Isles.

***Protonemura algovia* Mendl, 1968b**

(Map 7)

Type locality. Germany: Allgäuer Alpen, Oytal, 1100 m, 22–24.09.1996 (Mendl 1968b).

Previous data. In Italy, the species was known only from one valley in the Lepontine Alps (Swiss Ticino) (Aubert et al. 1996) and two valleys in the Rhaetian Alps (Ravizza & Ravizza Dematteis 1981).

New records. **Italy, Maritime Alps:** Stura di Demonte, Argentera, 1650 m, 44.391N, 6.957E, 5.09.2007, 1♂ (VIN). **Cottian Alps:** Varaita di Bellino, 2000 m, spr., 44.575N, 6.96E, 27.09.1988, 1♂; Agnel Pass, 2200 m, 44.669N, 7.009E, 26.09.1988, 1♀; 1900 m, 44.657N, 6.991E, 27.09.1988, 1♂ (VIN).

Distribution area and biogeographical notes. *P. algovia* has a wide, but very scattered distribution area in the Alps. In Italy and France (Vinçon 1996) it is always found in few numbers. Our new data widely enlarge its range in the Italian Alps, from the Rhaetian to the Maritime Alps (Map 7). It occurs in high elevation brooks (1300–2200 m). The flight period is in autumn (IX–X).

***Protonemura auberti* Illies, 1954**

Type locality. Germany: Fulda Spring in the Rhön Mountains (Hesse).

Previous data. The distribution area of this species in the Italian Alps is detailed and commented in Vinçon et al. (2021), where a new description of this species is also found.

New records. **Italy, Dolomites:** above Madonna di Campiglio, br., 1650 m, 46.237N, 10.827E, 28.05.2021, 1♂ (VIN). **Slovenia, Julian Alps:** E. Srednji Vrh, spr., 1060 m, 46.4952N, 13.8518E, 23.05.2022, 2♂ 1♀ (VIN). **Austria, Carinthia:** S. Bad Vellach, Vellach Ursprung, spr., 970 m, 46.4035N, 14.5651E, 22.05.2022, 1♂ (VIN).

Distribution area. The species has a wide distribution area between the Carpathians and the eastern part of the Alps. In Italy, it only occurs in the central part of the Italian Alps (Vinçon et al. 2021, Fig. E1) and it is replaced westwards by a first sister species *P. pennina* occurring in the Pennine and Graian Alps (Map 4) and eastwards

by two other sister species: *P. bipartita* in the Venetian Prealps (Map 5) and *P. bispina* in the Carnic and Julian Alps (Map 6).

***Protonemura ausonia* Consiglio, 1955b stat. rest.**

(Map 13)

Protonemura ausonia ausonia Consiglio, 1955b (Vinçon & Ravizza 2005)

Remarks. *Protonemura ausonia* and *P. padana* are now considered as two different species (see paragraph concerning *P. padana*).

Type locality. Italy, Abruzzi, Camosciara National Parc, 10.09.1954 (Consiglio 1955b).

Illustrations. The illustrations of *P. ausonia* provided by Fochetti & Tierno de Figueroa (2008, Fig. 96) correspond to *P. padana*. Appropriate drawings of *P. ausonia* are given in the original description (Consiglio 1955b).

Previous data. Italy, Tuscany (Consiglio 1967b), Marche (Fochetti & Nicolai 1987a), Lazio (Consiglio 1958a, 1967b, Nicolai & Fochetti 1983b), Abruzzi (Consiglio 1955b, 1958a, 1967b, Nicolai, Fochetti & Dell'Agata 1988, Basilicata (Consiglio 1955b, Aubert 1958, Consiglio 1967b), Puglia (Nicolai & Fochetti 1991a).

New records. **Italy, Emilia-Romagna:** Passo Croce Arcana, spr., 1550 m, 44.141N, 10.775E, 19.09.2009, 2♂ 6♀; Tevere spr., Balze, 1300 m, 43.787N, 12.076E, 13.10.2014, 3♂ 2♀ (VIN). **Tuscany:** Badia Prataglia, spr., 1050 m, 43.802N, 11.866E, 13.10.2014, 2♀; Passo Croce Arcana, spr., 1600 m, 44.126N, 10.781E, 19.09.2009, 1♂ 1♀; Val di Luce, 1400 m, spr. + br., 44.15N, 10.635E, 4.09.2020, 2♂ 1♀; 1700 m, br., 44.122N, 10.628E, 4.09.2020, 1♀; Pratomagno, 1300 m, spr. + br., 43.65N, 11.655E, 10.09.2020, 2♂ 1♀ (VIN). **Umbria:** Nocera Umbra, Fergia br., 600 m, 43.187N, 12.803E. Norcia marcite, 570 m. Foligno-Rasiglia, Menotre R., 900 m, 42.892N, 12.83E. Colfiorito, br., 750 m, 43.024N, 12.885E. Gualdo Tadino, Feo tor., 550 m,

43.228N, 12.799E (RAV). **Marche:** Monti Sibillini, > Casali, spr., 1080 m, 42.9506N, 13.177E, 18.05.2022, 2♂ 2♀; Panico spr., 1320 m, 42.941N, 13.202E, 18.05.2022, 1♂ 4♀; E. Puerello, spr., 530 m, 43.32N, 12.7733E, 20.05.2022, 2♀ (VIN). **Abruzzi:** Prati di Tivo, spr., 1550 m, 42.503N, 13.572E, 14.10.2014, 1♂ 2♀; 9.09.2020, 7♂ 5♀; 1500 m, 42.505N, 13.561E, 14.10.2014, 5♂ 10♀; Pietracamela, br., 1150 m, 42.517N, 13.549E, 14.10.2014, 1♂ 2♀; Casale San Nicola, 1050 m, 42.48N, 13.595E, 14.10.2014, 2♂ 2♀; L'Aquila, Vera spr., 680 m, 42.370N, 13.458E, 9.09.2020, 3♂ 3♀; Val Fondillo: spr. + br., 1270 m, 41.749N, 13.865E, 5.09.2020, 1♂; 1300 m, 41.741N, 13.881E, 5.09.2020, 4♂ 2♀; 1140 m, Tornareccia spr., 41.771N, 13.856E, 5.09.2020, 20♂ 5♀; > Roccamorice, Santo Spirito, br., 1350 m, 42.169N, 14.102E, 14.10.2014, 2♂ 1♀; Sorgenti dell'Aventino, SW Palena, 880 m, 41.964N, 14.12E, 25.05.2021, 2♂ 2♀ (VIN). **Lazio:** Prati di Mezzo: spr., 41.652N, 13.952E, 5.09.2020, 2♂ 3♀; 1700 m, 41.651N, 13.959E, 5.09.2020, 1♂; 20.05.2022, 1♂ 5♀ (VIN). **Molise:** S. Maiella, br., 780 m, 41.882N, 14.25E, 13.06.2020, 1♀; Castel San Vincenzo, River Volturmo, 530 m, 41.654N, 14.077E, 19.05.2022, 2♂ 2♀ (VIN).

Distribution area and biogeographical notes. The species inhabits nearly the whole Italian Peninsula, except the western part of the northern Apennines (Map 13). It is rather crenophilic and occurs preferentially in mountain brooks and springs (550–1700 m). The flight period is in autumn (IX–XI).

***Protonemura austriaca* Theischinger, 1976**

(Map 6)

Type locality. Austria: Oberösterreich, Hintertoder, brook around 800 m, 12.10.1975.

Previous data. Italy, Julian Alps, Fusine Valromana, Rio del Lago (Nicolai 1983a).

New records. **Italy, Julian Alps:** S. Fusine, spr., 910 m, 46.4857N, 13.6735E, 23.05.2022, 1♂ (VIN). **Slovenia: Julian Alps:** Vrsic Pass, spr.,

1500 m, 46.431N, 13.743E, 23.06.2018, 2♂ 1♀; br., 1300 m, 46.411, 13.749, 15.05.2010, 1♂; 1040 m, 46.407N, 13.756E, 15.05.2010, 2♂ 1♀ (VIN); **Pohorje Mountains:** Kranj, Travertine spr., 850 m, 46.3993N, 14.4698E, 22.05.2022, 1♂ (VIN); **Switzerland:** Val Müstair, Fuorn Pass, Ova da Buffalora, 2200 m, spr., 46.642N, 10.254E, 20.06.2018, 1♂, leg. G. Vinçon (MZL).

Distribution area and ecological notes. This species, described from Austria, is widely distributed in this country (not shown on Map 6 except the holotype locality). Its distribution area extends into the southern slopes of the eastern Alps from Slovenia and Austria up to eastern Switzerland (Val Müstair). In Italy, it is only found within a narrow area along the Austrian border. It inhabits mountain springs and brooks (350–2200 m). It has an extended flight period (III–X) (Theischinger 1976). This is the first report for Switzerland.

***Protonemura bipartita* Consiglio, 1962b**

(Map 5)

Type locality. Italy, Venetian Prealps: Monte Baldo, Acque Negre spr., 1300 m (Consiglio 1962b).

Previous data. Italy, Venetian Prealps: Ferrara di Monte Baldo, Novezzina (Consiglio 1971).

New records. **Italy, western Venetian Prealps:** Monte Baldo: Madonna della Neve, 1100 m, 45.74N, 10.887E, 21.04.2008, 1♂; Bocca di Navene, br., 1400 m, 45.788N, 10.872E, 7.06.2008, 1♂ 1♀; 11.09.2008, 3♂ 9♀; Bellori, br., 350 m, 45.593N, 10.985E, 14.05.2010, 1♀; Progno di Val Pantana, spr., 440 m, 45.593N, 10.983E, 20.04.2008, 8♂ 4♀; San-Antonio, spr., 850 m, 45.762N, 11.197E, 29.06.2009, 2♂ 5♀; Fugazze, spr., 950 m, 45.755N, 11.187E, 2.05.2009, 1♂ 2♀; Camposilvano: 1000–1050 m, 45.754N, 11.149E, 27.05.2021, 2♂ 2♀; spr. + br., 1170 m, 45.757N, 11.158E, 18.10.2020, 1♀; spr., 1200 m, 45.757N, 11.17E, 8.06.2008, 2♂; Campogrosso, spr., 820 m, 45.735N, 11.201E, 8.06.2008, 1♂ 1♀; 11.09.2008, 4♂ 3♀; Campogrosso, spr., 1450 m, 11.09.2008, 4♂ 5♀; spr., 1320 m, 45.746N,

11.161E, 11.09.2008, 5♂ 19♀; 18.10.2020, 2♀; 14.06.2021, 1♀; E. Malga Ravo, spr., 1020 m, 45.7162N, 11.183E, 27.05.2021, 12♀; 14.06.2021, 1♂ 2♀; Valle dei Ronchi, spr., 750 m, 45.741N, 11.071E, 19.04.2008, 2♂; Speccheri, spr., 700 m, 45.77N, 11.126E, 2.05.2009, 3♂ 2♀; Passo di Xomo, 1050 m, 45.778N, 11.237E, 5.11.2015, 1♀; Folgaria, 800 m, 45.909N, 11.154E, 18.09.2009, 4♂; San Sebastiano, spr., 1300 m, 45.925N, 11.208E, 10.10.2008, 1♂ 1♀; Vattaro, spr., 900 m, 46.011N, 11.214E, 10.10.2008, 1♀ (VIN).

Distribution area and ecological notes. in Italy, *P. bipartita*, a steno-endemic species, extends into the western Venetian Prealps, including the Monte Baldo up to Folgaria (Map 5). It is strongly crenophilic and occurs in springs and brooks of moderate altitudinal range (350–1400 m). The flight period extends from spring to autumn (IV–X).

***Protonemura bispina* Vinçon, Ravizza & Reding, 2021**

(Map 6)

Type locality. Italy, Carnic Alps: S.E. Auronzo di Cadore, Passo di Rezzo, below Sella Ciampigotto, spr. + br., 1750 m, 46.487N, 12.589E, 22.06.2018.

New records. **Italy, Trentino Alto Adige, Atesine Alps:** below San Salvatore ai Bagni, br., 1230 m, 46.7282N, 12.2945E, 19.06.2023, 1♂; Rio Bianco, 1650 m, 46.6557N, 12.4062E, 19.06.2023, 6♂ 2♀ (VIN). **Venetie, Dolomites:** Val Popena, spr. 1750 m, 46.5939N, 12.241E, 20.06.2023, 1♂; above Ortisei, 2100 m, br. and spr., 46.5486N, 11.804E, 20.06.2023, 5♂ 4♀ (VIN). **Carnic Alps:** S. Valpicetto, Rio Molini, br., 720 m, 46.5358N, 12.862E, 24.05.2022, 4♂ 1♀ (VIN). **Carnic Prealps,** S. Preone, Casali Chiampon, spring, 780 m, 46.3445N, 12.8785E, 26.09.2021, 1♂; spr., 760 m, 46.3416N, 12.8827E, 26.09.2021, 2♂ 26♀ (VIN). **Julian Alps:** W. Sella Nevea, br., 1040 m, 46.3897N, 13.4693E, 26.09.2021, 1♂ 4♀; br., 1050 m, 46.3967N, 13.4995E, 26.09.2021, 2♂ 8♀ (VIN). **Julian**

Prealps: Cepletischis, spr., 350 m, 46.17N, 13.558E, 28.09.2021, 1♂ 1♀; 21.05.2022, 1♂; Cepletischis, spr., 580 m, 46.18N, 13.57E, 21.05.2022, 1♂ 5♀ (VIN). **Slovenia: Julian Alps:** N. Vrsic Pass, Pišnica trib., nice spring, 1390 m, 46.44N, 13.754E, 22.05.2022, 1♂; **Pohorje Mountains:** Kranj, Travertine spr., 850 m, 46.4N, 14.47E, 27.09.2021, 13♂ 7♀; 22.05.2022, 1♂ 1♀ (VIN).

Distribution area and biogeographical notes. This species is endemic to the south-eastern part of the Alps, covering the Italian Carnic Alps and Prealps and the Italian and Slovenian Julian Alps (Map 6). It is a strongly crenophilic species like those of the *P. risi* group (200–1750 m). The flight period extends from spring to autumn (IV–X).

***Protonemura brevistyla* (Ris, 1902)**

(Table 3)

Ecological notes. *P. brevistyla* is a common, high altitude, alpine species, frequently occurring even above 2500 m. Its highest collection site is to be found in the Graian Alps, Gran Paradiso Massif: above Lago superiore di Ciamousseretto, 2840 m, 45.49N, 7.262E, 7.08.2020, 1♀ (VIN).

***Protonemura caprai* (Aubert, 1954b)**

(Table 3)

Morphological notes. *P. caprai* is a sister species of *P. lateralis*, and its females are difficult to separate from those of the latter species.

Distribution area and ecological notes. *P. caprai*, is an orophilic species, occurs both in the western part of the Italian Alps and in the Apennines. It is very common in various kinds of mountain brooks and springs. Its highest locality in the Apennines is in Tuscany: Val di Luce, 1750 m, brook, 44.123N, 10.628E, 7.06.2020, 1♂ (VIN), and in the Alps, the highest locality is in the Graian Alps, Val di Viu, Colla del Colombardo, above Borgial, 1900 m, 45.189N, 7.287E, 20.06.2019, 2♂ (VIN).

***Protonemura consiglioi* (Aubert, 1953b)**

(Figures 1a–d, Map 11)

Type locality. Italy, Calabria: southern slope of Pollino massif, Santicelli, 900 m, 30.05.1952 (39.891N, 16.139E) (Aubert 1953b).

Morphological remarks. The study of newly collected specimens from the type locality and from neighboring mountainous massifs of Abruzzi, Campania, Basilicata and Calabria shows that 4 sister species of the *Protonemura tuberculata* group (*sensu* Vinçon & Ravizza 2005) occur in southern Italy. *P. consiglioi* is only one of them, and the three others are *P. hirpina* Consiglio, 1958b, *P. marilouae* sp. nov. and *P. olahi* sp. nov., requiring detailed comparative descriptions of each of them. The drawings adduced by Aubert (1954c, his Figs. 1–11) to illustrate *Protonemura consiglioi*, in fact, correspond to the new species *P. marilouae* sp. nov., described below. The conflation of these two species thus has severely hampered previous identifications of *P. consiglioi*. We consider that all the mentions from Calabria outside the Pollino massif (Aubert 1954c, 1958) and from Sicily (Ravizza & Gerecke 1991) very probably refer to *P. marilouae* sp. nov., as our revision of several specimens from the Aubert, Ravizza and Gerecke collections has shown (see the description of *P. marilouae* sp. nov. below).

Previous data. Italy, Calabria, southern slope of Pollino massif: Santicelli at 900 m, Mazzicanina near 800 m (Aubert 1954c), Gaudolino Vallone, Coscile Morano (Aubert 1958).

New records. **Italy, Basilicata:** Lagonegro, < Riserva regionale Lago Laudemio, br., 1340 m, 40.157N, 15.803E, 6.09.2020, 1♂; Lagonegro, spr., 1350 m, 40.152N, 15.808E, 22.05.2021, 1♂; < Reserva regionale Lago Laudemio, spr., 1300 m, 40.154N, 15.822E, 22.05.2021, 1♂ (VIN); Lagonegro, Lago Sirino, 1.05.1982, 1♂ (AUB); Pollino massif, spr. + br., Frido trib., > Piani di Vaquarro Alto, 1500–1600 m, 39.925N, 16.177E, 6.09.2020, 4♂ 6♀ (VIN). **Calabria:** Pollino, Cerchiara, Fagosa, Vascello spring, 1490 m, 2.10.1990, 1♂ 1♀, Gerecke leg. (AUB).

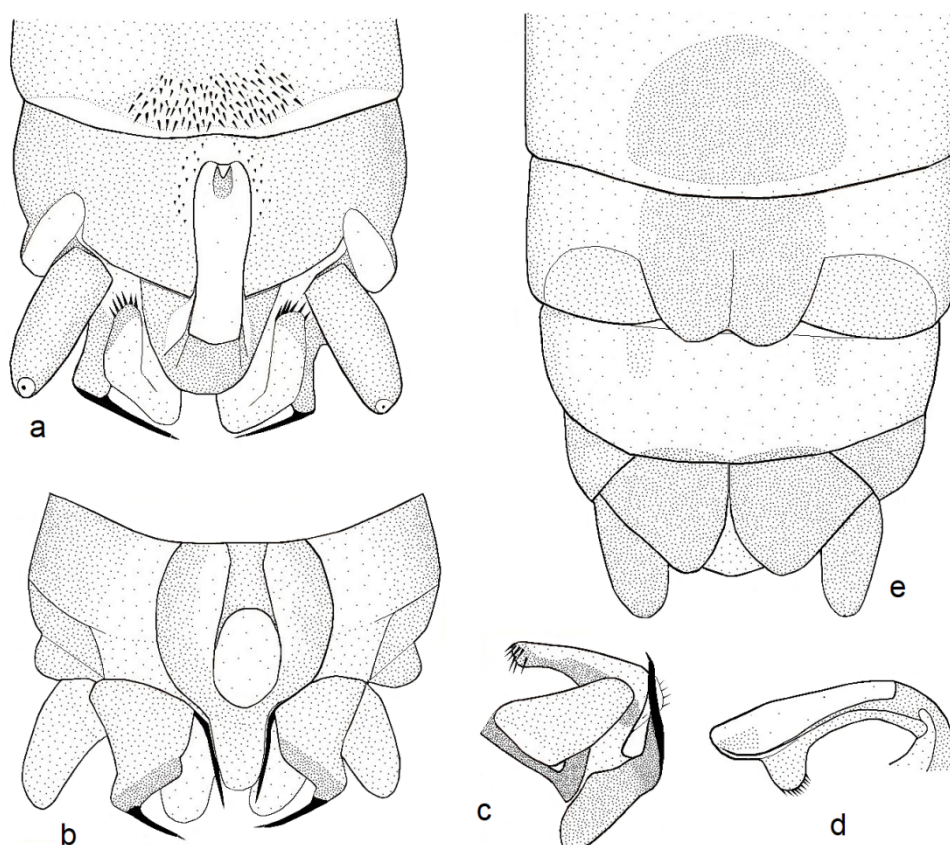


Figure 1. *Protonemura consiglioi*, a–d male genitalia: a = dorsal view, b = ventral view, c = paraproct and cercus lateral view, d = epiproct lateral view, e = female ventral view.

Male genitalia: Paraprocts inner lobes long and thin, slightly visible along the sides of the posterior expansion of the hypoproct (Fig. 1b); median lobe with subtriangular base strongly sclerotized on its inner edge, prolonged by a long and sharp expansion (style), nearly rectilinear and perpendicularly projecting inward from the base (Figs. 1a–c); outer lobe strongly bent medially with its half apical part projecting frontwards and carrying several spines at the tip; these spines are oriented frontwards (Figs. 1a, 1c). Epiproct with a slight widening before the apex in dorsal view (Fig. 1a); tip of the epiproct with a median notch; in lateral view the ventral sclerite of the epiproct has a very protruding spiny bulge, covered by a set of short spines at its apex (Fig. 1d). Cercus about twice as long as wide and slightly narrowing towards its tip (Figs. 1a–c). Ventral vesicle racket shaped (Fig. 1b).

Female. Sternite VII with a median pregenital plate (Fig. 1e). Sternite VIII: tongue shaped subgenital plate with a median furrow and a notch at its tip; the vaginal lobes are very wide and nearly reaching the edge of the sternite (Fig. 1e). Paraprocts sub-triangular and cercus twice as long as wide (Fig. 1e).

Affinities. In the *tuberculata* group, *P. consiglioi* belongs to a well separated subgroup including 3 other sister species, *P. hirpina*, *P. mari-louae* sp. nov. occurring in the southern part of the Apennines, and *P. olahi* sp. nov. occurring in the Abruzzi. They share several features: strong spiny bulge protruding backwards on the outer edge of tergites VIII and IX (Figs. 1a, 2a, 3a, Aubert 1953b Fig. 29), outer lobe of the paraproct bent upwards and frontwards, ending in a set of strong spines (Figs. 1c, 2c, 3c); epiproct with a

highly protruding bulge on the ventral sclerite, typical of the *P. tuberculata* group (Figs. 1d, 2f, 3e); female with a tongue shaped subgenital plate, and two wide globulous vaginal lobes on each side of the plate (Figs. 1e, 2g, 3f). *P. consiglioi* mainly differs from *P. hirpina* and *P. marilouae* sp. nov. by the lack of an apical filament on the epiproct (Fig. 1d, compared with Figs. 2f, 3e). It differs from *P. marilouae* sp. nov. by the ventral sclerite of the epiproct much narrower and protruding (Figs. 1d, 3e). The median lobe of the paraprocts (Figs. 1a–c) is also very different from that of *P. hirpina* (Figs. 2a, 2b, 2e) as explained in the following redescription of *P. hirpina*. It differs from *P. olahi* sp. nov. mainly by the very different shape of the paraproct's median lobe (Fig. 1c, 4c). These 4 species are also related to 2 other Italian species, *P. ausonia* and *P. padana*, that however clearly differ by the bulge of the ventral sclerite of the epiproct that is split in 2 parts in apical view (Consiglio 1955b Fig. 7, Vinçon & Ravizza 2005, Fig. 1n) while it is not split in *P. consiglioi*, *P. hirpina*, *P. marilouae* sp. nov. and *P. olahi* sp. nov. (Fig. 2e, Fig. 3d, Aubert 1955 Fig. 7).

Distribution area and biogeographical notes. *P. consiglioi* can be considered as endemic to the Laudemio Regionale Reserve and Pollino massif (Basilicata and northern Calabria). Other studies are required to improve the knowledge of its distribution area in the southern part of the Italian peninsula, where it was confused with *P. marilouae* sp. nov. It occurs in various types of water-courses but preferentially in the crenal zone (800–1600 m). The flight period is very extended, but mainly in autumn (V–IX).

***Protonemura costai* (Aubert, 1953a)**

(Map 10)

Type locality. Italy, Calabria (without any detailed locality).

Morphological and zoogeographical remarks. This species is very close to *P. caprai* (Aubert, 1954b), from which it mainly differs by the much lower number of spines at the tip of the outer lobe of the paraprocts (Aubert 1953a, Figs. 1–4). The

female is so close to the one of *P. caprai* that it is not possible to identify it without males. The reports of *P. costai* from the Alps and the northern Apennines refer to *P. caprai* (Consiglio 1960, 1962a, 1967b, 1971) as it was established by Consiglio (1979) and confirmed by Nicolai & Fochetti (1983a) and Fochetti & Nicolai (1987a).

Previous data. Italy, Lazio: (Consiglio 1958a, 1967b, Nicolai & Fochetti 1983a), Abruzzi (Consiglio 1955a, 1955b, Nicolai, Fochetti & Dell'Agata 1988). Calabria (Aubert 1953a).

New records. **Italy, Marche:** Monti Sibillini, Panico spr., 1320 m, 42.9412N, 13.2022E, 18.05.2022, 2♂ 1♀; Ussita, tor., 730 m, 42.943N, 13.138E, 18.05.2022, 3♂ 5♀ (VIN); **Abruzzi:** Prati di Tivo, Arno spr., 1450–1500 m, 42.486N, 13.542E, 26.05.2021, 7♂ 8♀; spr., 1320 m, 42.515N, 13.573E, 26.05.2021, 1♂ 1♀; L'Aquila, Vera spr., 680 m, 42.370N, 13.458E, 14.06.2020, 1♂ 1♀; 26.05.2021, 8♂ 8♀; Fondillo V: Grotte delle Fate, 1450 m, 41.739N, 13.882E, 12.07.2009, 2♂ 6♀; tor., 1300 m, 41.741N, 13.881E, 5.09.2020, 2♂; 1140 m, Tornareccia spr., 41.771N, 13.856E, 5.09.2020, 6♂ 9♀; 20.05.2021, 3♂ 1♀; 13.06.2021, 1♂ 3♀; Maiella: San Spirito V., 1530 m, br., 42.166N, 14.113E, 2.07.2020, 3♂ 6♀; 1300–1400 m, 42.169N, 14.102E, 13.07.2009, 5♂ 10♀; 1200 m, 42.169N, 14.0965E, tor., 13.07.2009, 2♀; 1600 m, 42.1642N, 14.1136E, 25.05.2021, 2♂ 2♀ (VIN).

Distribution area and biogeographical notes. This species is restricted to the southern part of the Italian Peninsula (Map 10) but is probably a species endemic to the Abruzzi massif. Its supposed presence in Calabria is questionable since the only specimen (holotype) supposed to come from Calabria was not collected in the field by Aubert during his collecting trips in Basilicata and Calabria, but found, pinned on a decorative frame given by A. Costa to the Napoli Museum of Zoology, without any detailed locality mention, except Calabria. Other specimens of *P. costai* were subsequently collected, but only in the central part of the Apennines (Lazio and Abruzzi), which also corresponds to our own findings. Therefore, it is preferable to consider this species

as endemic to the Abruzzi massif and to confirm its presence in southern Italy by new data. In the Abruzzi Mountains, it mainly occurs in high elevation brooks and springs (1140–1600 m), or in crenal and hypocrenal habitats at lower elevations, as it is the case in the Vera spring (680 m). The flight period extends from spring to autumn (V–X).

***Protonemura elisabethae* Ravizza, 1976a**

(Map 9)

Type locality. Italy, Emilia: Piacenza Province, Ferriere, > Moo Lake, 1150–1200 m. 2.04.1975 (Ravizza 1976a).

Morphological remarks. This taxon is a sister species of *P. nimborum*, which is frequent in the Alps, whereas *P. elisabethae* is restricted to a small part of the northern Apennines.

Previous data. Italy, Ligurian Apennines (Ravizza & Ravizza Dematteis 1978, Ravizza 2011, Ravizza, Vinçon & Poggi 2022), Tuscan Apennines (Ravizza, Vinçon & Poggi 2022), Emilian Apennines (Ravizza 1976a, 1977, Ravizza & Ravizza Dematteis 1978, Ravizza Dematteis & Ravizza 1994, Ravizza 2011).

New records. **Italy, Tuscan Apennines:** Apuane Mountains, Vinca, spr., 1250 m, 44.117N, 10.175E, 5.04.2015, 1♂ (VIN).

Distribution area and biogeographical notes. *P. elisabethae*, a steno-endemic species, inhabits the north-western Apennines. It extends from the Lombard Apennine to the Apuane Mountains (Map 9). This crenophilic, cold-water stenothermal species occurs in high elevation brooks and springs (1000–1550 m). The flight period is in spring (III–IV).

***Protonemura hirpina* (Consiglio, 1958b)**

(Figures 2a–g, Map 11)

Type locality. Italy, Campania: Monti Picentini, Montella, Valle Acque Nere, 1150 m, 40.816N, 14.975E, Conci leg., 24.08.1956.

Previous data. Prior to its rediscovery by the first author, this species was only known by a single specimen, the holotype, collected by Conci in 1956 and described by Consiglio (1958b). Since the original description by Consiglio (1958b) is incomplete and confusing, we here provide a redescription of the male and also a description of the hitherto unknown female.

New reord. **Italy, Campania:** Monti Picentini: N. Giffoni Valle Piana, 720–820 m, spr. + br., 40.781N, 14.924E, 10.06.2020, 2♂ 3♀; 21.05.2021, 2♂ 1♀ (VIN).

Male genitalia. Paraprocts inner lobes long and thin, hidden by the posterior expansion of the hypoproct; median lobe with their base much longer than wide, nearly conical; its apical expansion (style), is hardly visible since it projects inward along the inner side of the paraproct, requiring an extraction to see it. It is exceptionally strong, dark, like a blade ending in blunt apex (Figs. 2a–b, 2d–e); outer lobe hammer-shaped, with its half apical part projecting frontward and carrying several spines at the tip (Fig. 2c). Epiproct with a median widening in dorsal view (Fig. 2a); tip of the epiproct with an upraised small filament at its tip, more visible in lateral view (Fig. 2f). The ventral sclerite of the epiproct has a very protruding spiny bulge covered by a set of long spines at its apex (Figs. 2e–f). Cercus conical, about twice as long as wide (Figs. 2b–c). Ventral vesicle racket shaped (Fig. 2b).

Female. Sternite VII with a median pregenital plate covering nearly half the sternite's width (Fig. 2g). Sternite VIII: tongue shaped subgenital plate with a median furrow and a notch at its tip; on each side of the plate, the vaginal lobes are wide and rounded (Fig. 2g). Paraprocts subtriangular and cerci nearly conical and twice longer than wide (Fig. 2g).

Affinities. The very exceptional shape of the median lobe of the paraproct separates *P. hirpina* from all known *Protonemura* since it ends in a very stout, blade shaped, expansion lying along the inner side of the paraproct (Figs. 2a–b, 2d–e).

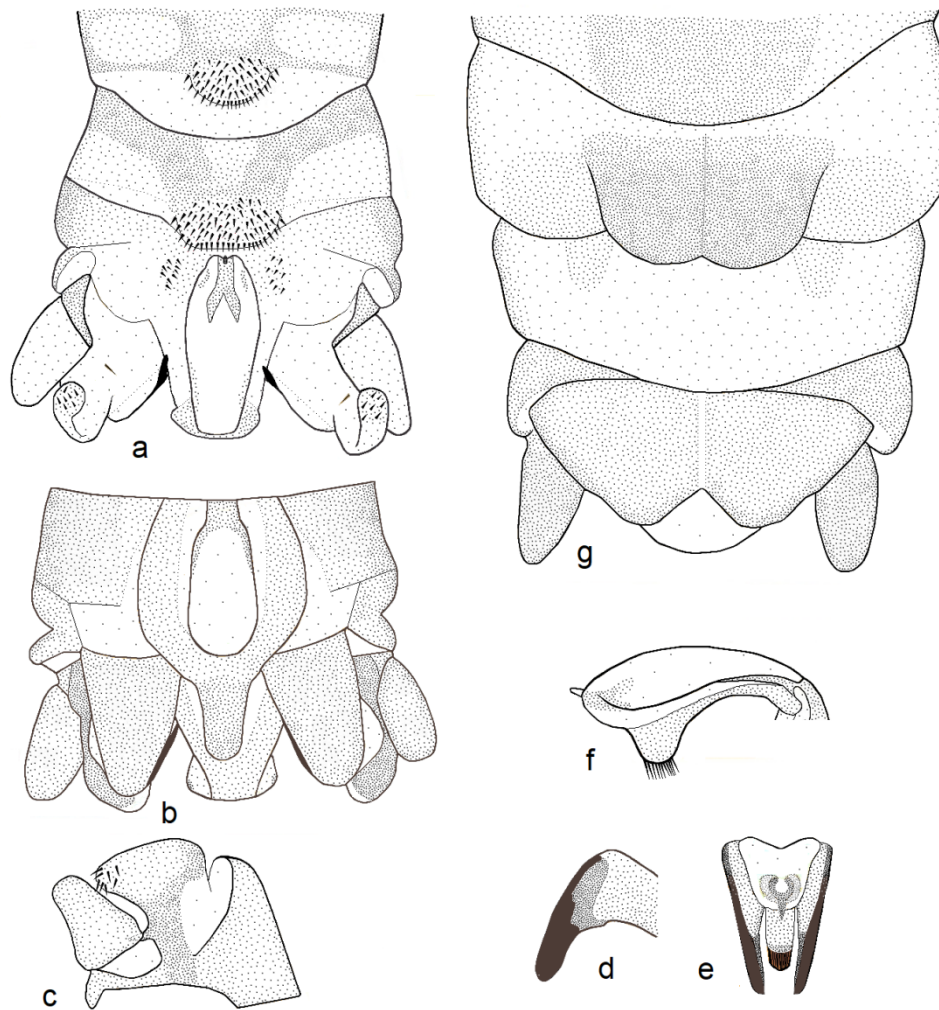


Figure 2. *Protonemura hirpina*, a–f male genitalia: a = dorsal view, b = ventral view, c = paraproct and cercus lateral view, d = median lobe of the paraproct lateral view, e = epiproct between median lobes of paraprocts, apical view, f = epiproct, lateral view, g = female ventral view.

This expansion is missing from the drawing of Consiglio (1958b). It also differs from *P. consign-lioii* by the presence of a tiny filament slightly oriented upwards at the tip of the epiproct and also hardly visible in the Consiglio's drawing (1958b, Fig. 1). It differs from *P. marilouae* sp. nov. by the spiny bulge of the ventral sclerite of the epiproct much protruding and narrow, with shorter spines (Fig. 2f) compared with that of *P. marilouae* sp. nov. (Fig. 3e).

Distribution area and biogeographical notes. *P. hirpina* is steno-endemic of the Picentini

Massif, eastward Napoli (Map 11). The adults were collected along a brooklet close to its spring. The flight period extends from late spring to summer (V–VIII).

***Protonemura julia* Nicolai, 1983a**

(Map 6)

Type locality. Italy, Friuli-Venezia Giulia, right tributary of Ucea stream near Ucea (Udine), 600 m, 46.304188N, 13.419847E, 11.06. 1981 (Nicolai 1983a).

Previous data. In Italy, this species is known only from its type locality (Nicolai 1983a). In Slovenia it is mentioned from more than 20 localities, but these data have not yet been published (Popijač & Sivec 2009b). In Croatia it is reported from two karst springs of north-western Croatia, Gorski kotar region (Popijač & Sivec 2009a). A single record is also mentioned from Carinthia (Graf & Hutter 2002).

New records. **Italy, Carnic Prealps:** Prèone, Casali Chiampon, spr., 800 m, 46.355N, 12.875E, 14.05.2010, 2♂; 24.05.2022, 2♂ (VIN). **Slovenia, Julian Alps:** Vrsic Pass, 1040 m, 46.407N, 13.756E, 15.05.2010, 1♂; br., 1300 m, 46.411N, 13.749E, 15.05.2010, 1♂ (VIN); **Pohorje Mountains:** Kranj, Travertine spr., 850 m, 46.34N, 14.47E, 22.05.2022, 1♂ (VIN).

Distribution area and ecological notes. *P. julia* extends from north-eastern Italy and southern Austria through a large part of Slovenia (Map 6), up to the northern border of Croatia (Popijač & Sivec 2009b). It is a crenophilic species occurring in mountainous regions (600–1300 m). The flight period is in spring (V–VI).

***Protonemura lagrecai* (Aubert, 1954c)**

(Map 11)

Type locality. Italy, Calabria, Sila, Mucone.

Previous data. Italy, Calabria: Pollino and Sila (Aubert 1954c). Sicily (Consiglio 1968, Ravizza & Gerecke 1991).

New records. **Italy, Calabria:** Aspromonte, above Gambarie, 1400 m, tor., 38.144N, 15.841E, 8.09.2020, 1♂ (VIN).

Distribution area and biogeographical notes. *P. lagrecai* occurs from Calabria to Sicily and was also reported from Greece (Pardo & Zwick 2004). It inhabits various kinds of mountain water courses (900–1420 m). The flight period is in autumn (IX–X).

***Protonemura lateralis* (Pictet, 1836)**

(Table 3)

Distribution area and ecological notes. *P. lateralis* is one of the most common and eurytopic species in the Italian and French Alps. It is replaced in the Apennines by two sister species, *P. caprai* (Aubert, 1954b) (also occurring in the Alps) and *P. costai* (Aubert, 1953a). In the eastern Alps, it is replaced by 2 other sister species, *P. austriaca* and *P. julia*. It can reach very high elevations; its highest known locality is in the Pennine Alps, high Sesia Valley, above Sant' Antonio, spring below Lago Nero, 2630 m, 45.814N, 7.88E. Its mention at 2700 m in Fochetti & Tierno de Figueroa (2008) is a mistake and refers to the Passo di Gavia at 2600 m (Ravizza & Ravizza Dematteis 1994b).

***Protonemura macrura* (Aubert, 1953b)**

(Map 12)

Type locality. Italy, Calabria, Sila, Mucone.

Previous data. Italy, Calabria (Aubert 1953b, 1958, Consiglio 1961a, Nicolai & Fochetti 1991a). Sicily (Pardo & Zwick 2004).

New records. **Italy, Tuscany:** Reggello, spr. + br., 850 m, 43.696N, 11.585E, 8.06.2020, 4♀; Pratomagno, 1350 m, spr. + br., 43.645N, 11.665E, 8.06.2020, 1♂ 1♀ (VIN). **Basilicata:** Lagonegro, Riserva regionale Lago Laudemio, br., 1340 m, 40.157N, 15.803E, 10.06.2020, 1♂ 1♀; spr., 1300 m, 40.154N, 15.821E, 10.06.2020, 1♂ 1♀ (VIN). **Calabria:** Sila Grande, spr., 1580–1650 m, 39.32N, 16.401E, 11.06.2020, 3♂; SW Cosenza, Rizzuto, br., 935 m, 39.25N, 16.163E, 11.06.2020, 1♀; Aspromonte, SE Gambarie, spr. + br., 1470 m, 38.1456N, 15.8423E, 23.05.2021, 2♂ 2♀; 1400 m, tor., 38.145N, 15.836E, 11.06.2020, 3♂ 5♀; 1420 m, spr. + br., 38.144N, 15.842E, 11.06.2020, 2♂ 4♀; SE Gambarie, river, 1430 m, 38.143N, 15.845E, 23.05.2021, 3♂ 1♀; 1260 m, br., 38.206N, 15.945E, 11.06.2020, 1♀; Sant' Eufemia d'Aspromonte, 1150 m, br., 38.204N, 15.855E, 23.05.2021, 2♂ 2♀ (VIN).

Distribution area and biogeographical notes. *P. macrura*, previously known from southern Italy (Calabria and Sicily), extends far northwards up to the southern edges of Tuscany (Pratomagno massif). Its distribution area is split into two parts since it remains unknown in the central part of the Italian Peninsula (Abruzzi) (Map 12). It occurs mainly in high altitude springs and brooks (400–1650 m). The flight period is in spring and early summer (V–VII).

***Protonemura marilouae* sp. nov.**

(Figures 3a–f, Map 11, Table 3, Photo 1)

[urn:lsid:zoobank.org:act:0475A21B-8DC9-4EED-B77E-5C0FCB95FB28](https://zoobank.org/act:0475A21B-8DC9-4EED-B77E-5C0FCB95FB28)

Protonemura consiglioi (Aubert, 1953): Aubert 1954c, Figs. 1–11, specimens from Calabria, La Sila.

Protonemura consiglioi: Aubert 1958, pro parte, specimens from Calabria outside the Pollino massif.

Protonemura consiglioi: Ravizza & Gerecke 1991, specimens from Sicily.

Holotype. Italy, Calabria: Sila Grande: below Monte Sorbello, 1800 m, 39.284N, 16.44E, 7.09.2020, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH00660526); *Paratypes.* Same locality and date 2♂ 2♀, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH00660527). *Additional specimens.* Italy, Calabria: Sila Grande: spr., 1630 m, S. Monte Scuro, spr., 39.32N, 16.401E, 7.09.2020, 3♂; spr. + br., 1650–1700 m, 39.32N, 16.401E, 7.09.2020, 2♂ 4♀; spr., 1780 m, 39.288N, 16.434E, 7.09.2020, 1♀; Sila, Mucone 6, 39.334N, 16.457E, 24.05.1953, 5♂ 5♀ (AUB); **Aspromonte:** < Montalto, 1870–1890 m, spr. + br., 38.159N, 15.917E, 8.09.2020, 1♂; Gambarie, 1420–1450 m, spr. + br., 38.145N, 15.842E, 8.09.2020, 3♂ (VIN). Sicily: Nebrodi, Portella Femmina Morta, 6.07.1991, 11♀, Pesarini Sabadini leg. (AUB); br., SW Case Scansanento, 565 m, 13.11.1987, 1♂ 1♀, Ravizza + Gerecke leg. (AUB).

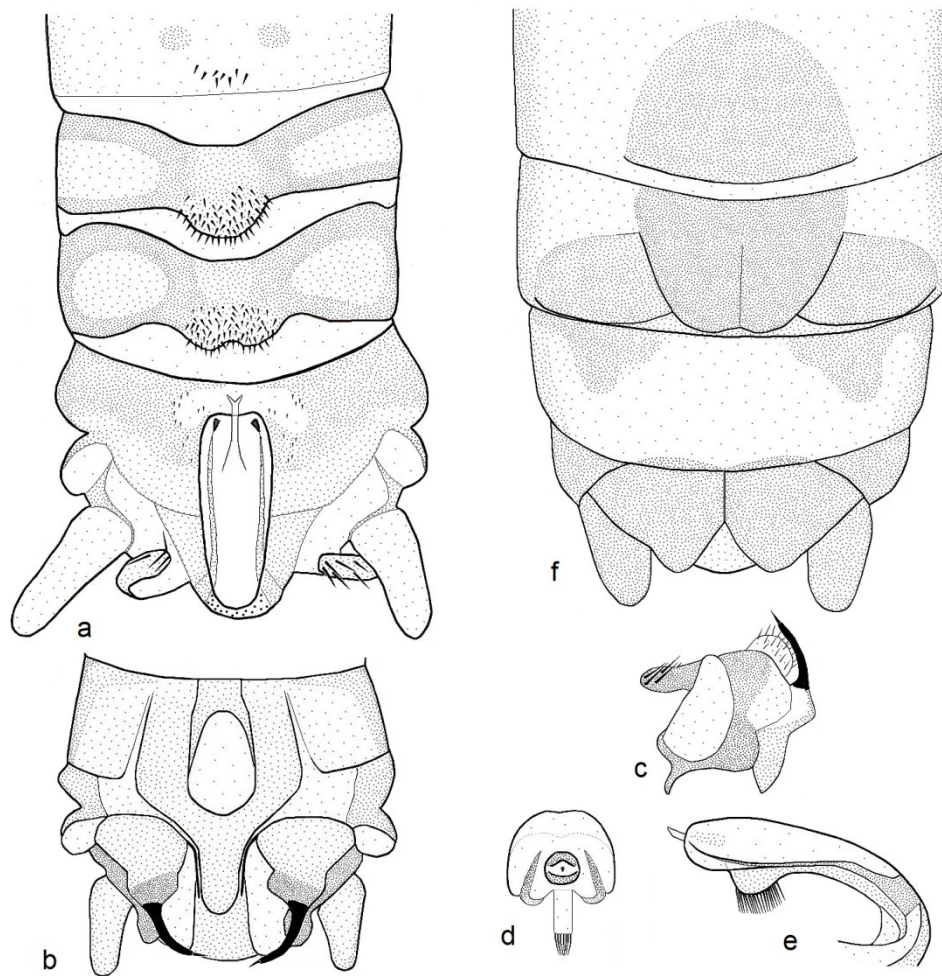
Diagnosis. Medium-sized *Protonemura* species. Males and females macropterous. Body length of males 6 to 7 mm, females 9 to 11 mm.

Cervical gills medium-sized, with one slight pre-apical constriction on the two central gills. Sister species of *P. consiglioi* from which it mainly differs in the male by the shape of the epiproct ventral sclerite, by the presence of a long filament at the tip of the epiproct and by the shape of the outer lobe of the paraproct. It was conflated with *P. consiglioi* by Aubert (1954c) and Ravizza & Gerecke (1991), and corresponds to the new drawings given for *P. consiglioi* by Aubert (1954c, Figs. 1–6).

Description. Male genitalia. Paraprocts: inner lobes thin, hardly visible since they are hidden by the posterior expansion of the hypoproct; median lobe with subtriangular base strongly sclerotized on its posterior edge, prolonged by a long and sharp expansion (style), regularly curved and projecting frontward from the base (Figs. 3b–c); outer lobe strongly bent medially with its half apical part projecting frontwards and carrying several spines at the tip; these spines are oriented rearward (Figs. 3a, 3c). Epiproct with a slight widening before the apex in dorsal view (Fig. 3a); tip of the epiproct with a long, forked filament (Fig. 3a); in lateral view the ventral sclerite of the epiproct has a wide protruding spiny bulge, covered by a set of long spines at its apex (Figs. 3d–e). Cercus about twice as long as wide, nearly conical (Figs. 3a–c). Ventral vesicle racket shaped (Fig. 3b).

Female. Sternite VII with a median pregenital plate covering nearly half the sternite's width (Fig. 3f). Sternite VIII: tongue shaped subgenital plate with a median furrow and a shallow notch at its tip; on each side of the plate, the vaginal lobes are wide and rounded, nearly reaching the segment's edge (Fig. 3f). Paraprocts sub-triangular and cerci nearly conical, rather short, less than twice as long as wide (Fig. 3f).

Affinities. It mainly differs from its sister species, *P. consiglioi*, by the shape of the epiproct with a larger and less prominent bulge on the ventral sclerite (Fig. 3e, Fig. 1d), by the presence of a long and well visible forked filament at the tip of the epiproct that is lacking in *P. consiglioi* (Fig. 3e, Fig. 1d) and by the shape of the outer



Figures 3. *Protonemura marilouae* sp. nov., a-e male genitalia: a = dorsal view, b = ventral view, c = paraproct and cercus lateral view, d = epiproct, apical view, e = epiproct, lateral view, f = female ventral view.

lobe of the paraproct with the spines oriented frontward in *P. consiglioi* (Figs. 1a, 1c) and rearward in *P. marilouae* sp. nov. (Figs. 3a, 3c). It is also related with *P. hirpina* but easily distinguishable by the shape of the median and outer lobes of the paraproct (see previous description of *P. hirpina*), and to *P. olahi* sp. nov. that is mainly distinguished by the spiny apex of the median lobe of the paraprocts, and with two other Italian species of the same *P. tuberculata* group: *P. ausonia* and *P. padana* from which it is also easily distinguishable by the ventral sclerite of the epiproct that is split in 2 parts in apical view in these 2 species, as explained in the affinities of *P. consiglioi* (see above). The females of *P.*

marilouae sp. nov., *P. hirpina*, *P. consiglioi*, *P. ausonia* and *P. olahi* sp. nov. are very alike, with a tongue shaped subgenital plate between the two strong vaginal lobes, moreover, both have a wide median pregenital plate on sternite VII, therefore it is not recommended to identify them without confirmation by male capture.

Distribution area and biogeographical notes. Presently, this species is known from the Sila massif and the Aspromonte region in Calabria (Map 11) and from NE Sicily. The adults occur in high elevation brooklets and springs (1420-1890 m) but also in lower elevation water courses, according to previous reports of *P. consiglioi*

from Calabria by Aubert (1954c, 1958) and from Sicily by Ravizza & Gerecke (1991). The flight period is extended (V–XI).

Derivatio nominis. This species is dedicated to Marilou, the youngest daughter of the first author. She was pleased to help her father during field-work, but always said ‘sorry’ to each insect before putting it in the alcohol vial!

***Protonemura nimborella* (Mosely, 1930)**

(Table 3)

Ecological notes. *P. nimborella* is a crenophilic, orophilic species that occurs preferentially in high altitudes springs and brooks (1100 – 2500 m). Nevertheless, its report at 2900 m (Fochetti & Tierno de Figueroa 2008) is doubtful since it is undocumented and far above our own data. The highest known report of this orophilic species in Italy is in the Cottian Alps: Varaita di Bellino Valley, Grange dell Autaret, 2500 m, 44.559N, 6.941E, 27.09.1988, 1♂ (VIN).

***Protonemura nimborum* (Ris, 1902)**

(Table 3)

Ecological notes. *P. nimborum*, eurytopic species, occurs in various kinds of water courses in the Italian Alps and is not known from the Apennines where it is replaced by its sister species *P. elisabethae*, which is limited to the central part of the northern Apennines. The most elevated collecting site of *P. nimborum* is in the Graian Alps: Ceresole Reale, Orco tor., 2500 m (Ravizza & Ravizza Dematteis 1994b).

***Protonemura olahi* sp. nov.**

(Figs 4a–g, Map 10, Photos 2, 3)

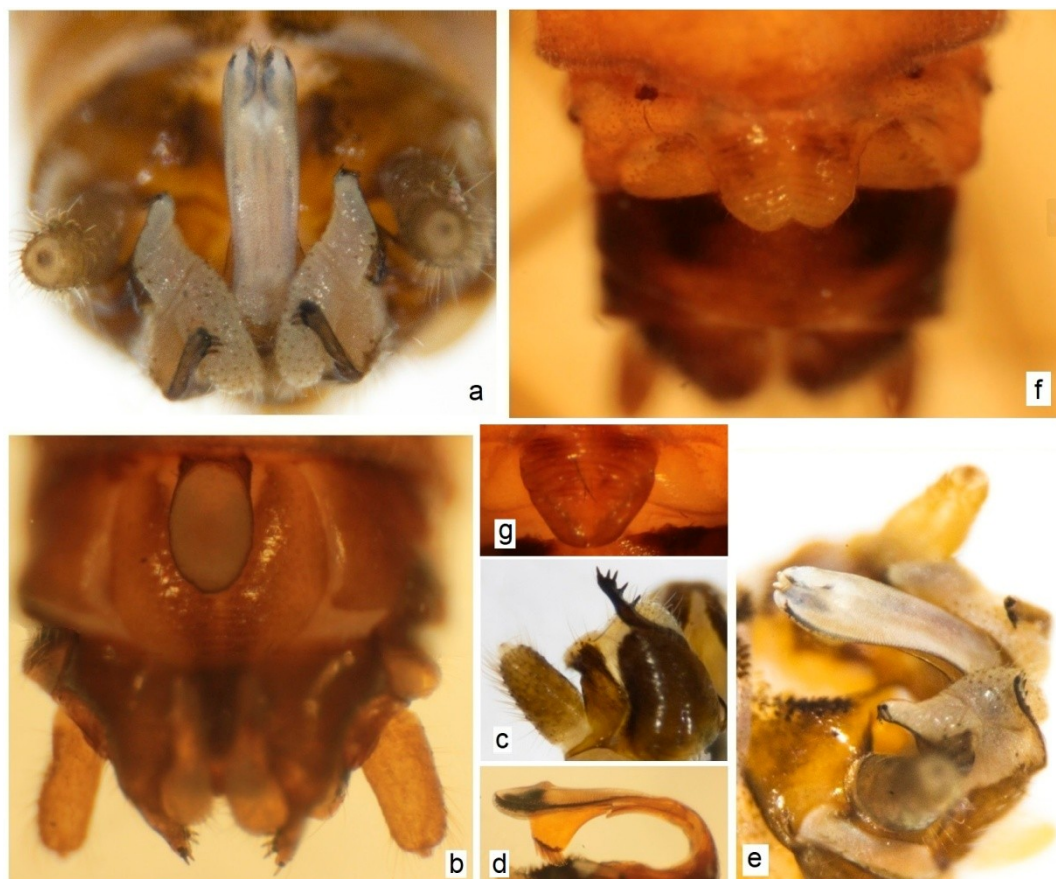
[urn:lsid:zoobank.org:act:E7A449EB-DC34-4CB8-8877-D8289ABC5E35](https://zoobank.org/urn:lsid:zoobank.org:act:E7A449EB-DC34-4CB8-8877-D8289ABC5E35)

Holotype. Italy, Molise, Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594N, 14.0783 E, 19.05.2022, 1♂, abdomen detached, in separate vial, leg. G. Vinçon (deposited in the MZL,

catalogue number: GBIFCH01118496). *Paratypes.* Same locality and date 2♂ 2♀, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH01118495). *Additional specimens.* Same locality and date 1♂ 1♀ (VIN).

Diagnosis. Medium-sized *Protonemura* species. Males and females macropterous. Body length of males 6.5 to 8 mm, females 10 to 12 mm. Cervical gills short and stout, without any constrictions. Sister species of *P. consiglioi*, *P. hirpina* and *P. marilouae* from which it mainly differs in the male by the shape of the median lobe of the paraprocts that carries 4–5 strong spines near its tip (Fig. 4c), instead of only one apical spine in the 3 other species (Figs. 1a–c, Figs. 2d–e, Figs. 3b–c). It also differs from *P. marilouae* by the very short bifid filament at the tip of the epiproct (Figs. 4a, 4e) while it is much longer in *P. marilouae* (Fig. 3a) and by the shape of the outer lobe of the paraproct, with only 2 spines at its tip (Figs. 4a, 4e) instead of more than 4 spines in the 3 other species (Figs. 1a, 1c, Figs. 2a, 2c, Figs. 3a, 3c).

Description. Male genitalia. Paraprocts: inner lobes thin, hardly visible since they are hidden by the posterior expansion of the hypoproct; median lobe with long globular base, prolonged by a rather short strong expansion (style), less long than the base, projecting frontward from the base and carrying 4–5 strong bristles near its tip and on the inner edge (Figs. 4a, 4c); outer lobe with strong base bent medially with its half apical part projecting frontwards and carrying 2 spines at its tip; these spines are oriented outward and rearward (Fig. 4e). Epiproct rather long and thin, with parallel edges in dorsal view (Fig. 4a); tip of the epiproct with a very short, hardly visible, forked filament (Figs. 4a, 4e); in lateral view the ventral sclerite of the epiproct has a wide protruding spiny bulge, covered by a set of long spines at its apex; the spines are oriented rearward (Fig. 4d). Cercus about twice as long as wide, sausage-shaped, just slightly wider at their base (Figs. 4b, 4c). Ventral vesicle racket shaped with short rod (Fig. 4b).



Figures 4. *Protonemura olahi* sp. nov., a-e male genitalia: a = dorsal view, b = ventral view, c = paraproct and cercus lateral view, d = epiproct, lateral view, e = epiproct, paraproct and cercus $\frac{3}{4}$ view slightly from above, f = female ventral view.

Female. Sternite VII with a short median pregenital plate, hardly sclerotized, and covering nearly one fifth of the sternite's width (Fig. 4f). Sternite VIII: tongue shaped subgenital plate with a median furrow and a triangular notch at its tip, clearly protruding other sternite IX; on each side of the plate, the vaginal lobes are strong and rounded, not reaching the segment's edge (Fig. 4f). Paraprocts sub-triangular and cerci nearly conical, nearly twice as long as wide (Fig. 4f). In one female, the subgenital plate is ogival-shaped and has no triangular notch at the tip (Fig. 4g).

Affinities. *Protonemura olahi* belongs to the *P. tuberculata* group characterized by the strong spiny bulge of the ventral sclerite of the epiproct. Within this group, it is close to 3 other Italian species *P. consilioi*, *P. hirpina* and *P. marilouae*.

However, it differs from all of them, in the male, by the median lobe of the paraproct carrying 4–5 spines at its tip and by the outer lobe of the paraproct carrying only 2 spines at its tip as explained in the diagnosis. Females, belonging to this species group are not distinguishable with confidence.

Distribution area and biogeographical notes. This species is only known from a strong spring “Sorgente Acquaruolo”, tributary of the Volturno River, on the southern slope of the Abruzzo Massif. This spring, partially captured for human requirements, should be surveyed to protect this patrimonial species in great danger of extinction.

Derivatio nominis. This species is named in honor of our friend and colleague János Oláh, for his merits in the study of the Italian Trichoptera.

***Protonemura padana* Vinçon & Ravizza, 2005
stat. prom.**

(Map 13)

Protonemura ausonia padana Vinçon & Ravizza, 2005

Remarks. *P. ausonia* was first described by Consiglio (1955b) from specimens collected in the Abruzzi Apennine. Afterwards this species was reported from many other sites of both Apennines and Western Alps (Ligurian, Maritime and Cottian Alps up to the Susa Valley). While working on the redaction of our review of the French *Protonemura* (Vinçon & Ravizza 2005), we have assigned the specimens occurring in the north of Italy (Northern Apennines and Western Alps) to a new subspecies, *P. ausonia padana*, since they are clearly distinct in both sexes from those occurring in the central and southern Apennines (*P. ausonia ausonia*). At that time, we considered them as two subspecies, since we found that the number of spines on the outer lobe of the paraprocts was variable. A complete revision and new collecting trips undertaken in both the Italian Alps and the northern and central Apennines, now has enabled us to check again the variability of both taxa. It appeared that, indeed, the number of spines on the outer lobe of the paraprocts is very variable, around 4 in *P. padana*, and around 12 in *P. ausonia* but this variability is even visible within different specimens from a same locality or even between the right and left paraproct of one specimen. On the other hand, the two other distinctive characters in the male are very constant. In *P. padana* the median lobe of the paraprocts has a long, thin, regularly curved, sclerotized expansion (Vinçon & Ravizza 2005, Fig. 2 k, l) while in *P. ausonia* this expansion is shorter, thicker, and nearly rectilinear (Consiglio 1955b, Fig. 2–4). Moreover, in *P. padana* there is a well-developed forked expansion at the tip of the epiproct (Vinçon & Ravizza 2005, Fig. 2m, o); while in *P. ausonia* there is no forked expansion at the tip of the epiproct (Consiglio 1955b, Fig. 1, 6). The female subgenital plates are also different in the two species as shown in Vinçon & Ravizza (2005). For these reasons, we consider that *P. padana* is a species distinct from *P. ausonia*.

Type locality. Italy, Cottian Alps, Chisone Valley, Fenestrelle, brook between Usseaux and Balboutet, 1500 m, 45.051N, 7.020E, 1.11.1999.

Previous data. Italy, Ligurian Alps and Apennines (Ravizza, Vinçon & Poggi 2022), Western Alps and northern Apennines (Vinçon & Ravizza 2005).

New records. Italy, Cottian Alps: Susa V.: Cesana Torinese, br., 1600 m, 44.945N, 6.765E, 12.10.2008, 4♂ 5♀; Fontana della Batteria, 1310 m, 45.111N, 7.031E, 23.10.2000, 2♂ 8♀; Fontana Gelassetta, 1200 m, 45.113N, 7.039E, 15.10.2015, 6♂ 16♀; Chisone V.: Colle delle Finestre, spr., 1800 m, 45.061N, 7.043E, 28.09.2002, 3♂ 3♀; spr., 1950 m, 45.053N, 7.079E, 19.10.2020, 1♀; Sestrière, 2000 m, 44.956N, 6.865E, 28.10.2002, 1♂; Balboutet, 1500 m, 45.051N, 7.02E, 1.11.1999, 11♂ 13♀; Ruata, 1200 m, 44.909N, 7.1785E, 26.12.1994, 1♂ 5♀; Borgata Selvaggio, br., 1250 m, 44.966N, 7.147E, 17.10.2015, 1♂ 3♀; Cesana Torinese, br., 1600 m, 44.945N, 6.765E, 12.10.2008, 4♂ 5♀; Germagnasca V.: Chiotti, spr., 1400 m, 44.903N, 7.053E, 28.09.2002, 1♂ 2♀; Bobbio Pellice, Pralapia, 1230 m, 44.769N, 7.097E, 1.11.1999, 2♀; 800 m, br., 44.794N, 7.126E, 1.11.1999, 2♀; Varaita V.: Lemma, 900 m, 44.517N, 7.39E, 27.12.1994, 1♂; Pian Munè, 1530 m, 44.6434N, 7.243E, 7.10.2002, 7♂ 7♀ (DEL); Sampeyre Pass, San Martino, 1550 m, 44.508N, 7.104E, 2.11.2019, 8♀; Grana V., Piatta, 1000 m, 44.441N, 7.325E, 27.12.1994, 2♂ 4♀; 2.11.1999, 1♂ 3♀; Vallon dell Arma, 1650 m, 44.362N, 7.152E, 20.09.2001, 9♂ 5♀ (DEL). **Tuscany:** Passo del Cerreto: 1500 m, 44.285N, 10.230E, 2.12.2019, 1♀; spr. + br., 1460 m, 44.286N, 10.228E, 18.10.2020, 3♂ 5♀; Gramolazzo, Val Serenaia, spr., 1280 m, 44.126N, 10.201E, 19.09.2009, 1♂; Vinca, spr., 330 m, 44.15N, 10.135E, 5.04.2015, 1♂ 2♀ (VIN). **Emilia - Romagna:** Passo delle Radici, 1500 m, spr., 44.194N, 10.502E, 3.09.2020, 3♂ 1♀ (VIN).

Distribution area and biogeographical notes. The species inhabits the western Alps (Maritime and Cottian Alps, up to the Susa Valley) and the northern Apennines (Liguria, Emilia - Romagna

and Tuscany) (Map 13). It is a crenophilic, cold-water stenothermal species, occurring in mountain springs and brooklets (330–2000 m). The flight period is in autumn but exceptionally we collected it in April in a spring of Tuscany (IV, IX–XII).

***Protonemura pennina* Vinçon, Ravizza & Reding, 2021**

(Map 4)

Type locality. Italy, Pennine Alps: Gressoney valley: Pillaz, 1340–1380 m, spr. + br., 45.642N, 7.875E, 17.10.2020.

Previous data. Pennine and Graian Alps (Vinçon et al. 2021).

Distribution area and biogeographical notes. This steno-endemic species occurs in the whole of the Pennine Alps and in the eastern part of the Graian Alps (Map 4). It is a strongly crenophilic species, like others of the *P. risi* group (500–1900 m). The flight period extends from early summer to autumn (VI–XI).

***Protonemura ruffoi* Consiglio, 1961a**

(Map 11, Table 3)

Nemoura (Protonemura) tyrrhena (Festa, 1938): Aubert 1953b, 1957a, 1958.

Type locality. Italy, Sicily: Petralia Sottana, Portella dei Manderini; 1250 m, 9.05.1961.

Previous data. Italy, Sicily, Basilicata, Calabria: (Aubert 1953b, 1957a, 1958 sub nom. *Nemoura (Protonemura) tyrrhena*, Consiglio 1961a, 1967b, Nicolai & Fochetti 1991a, Ravizza & Gerecke 1991).

Morphological remark. *P. ruffoi* is a sister species of *P. tyrrhena* and both can easily be confused.

New records. **Italy, Southern Apennines, Abruzzi:** Alfedena, spr., 1220 m, 41.705N, 14.009E, 19.05.2022, 3♂ 5♀ (VIN), **Molise:** Campitello

Matese, Campanacia, spr. + br., 1300 m, 41.469N, 14.39E, 5.04.2015, 10♂ 5♀; Sant Angelo del Pesco, br., 750 m, 41.882N, 14.25E, 19.05.2022, 1♂ 1♀ (VIN); **Basilicata:** Lagonegro, Reserva regionale Lago Laudemio, spr., 1300 m, 40.154N, 15.822E, 22.05.2021, 2♂ 4♀; Pollino, 1650 m, spr. + br., 39.922N, 16.187E, 24.05.2021, 1♂; 1740 m, Frido River, 39.924N, 16.195E, 24.05.2021, 1♂; Frido spr., 1910 m, 39.921N, 16.206E, 24.05.2021, 4♂ 2♀ (VIN).

Distribution area and biogeographical notes. *P. ruffoi* occurs in the southern Apennines and Sicily. It is also reported from Algeria: Aubert 1956b (sub nom. *Nemoura (Protonemura) tyrrhena*); in the Kabylia Djurdjura it occurs up to 1680 m (Lounaci & Vinçon 2005, Yasri-Cheboubi et al. 2016) and in Sicily it is found up to 1600 m (Consiglio 1961a). In southern Italy (Pollino Massif Calabria) it lives at very high elevations (1740–1910 m). We found it farther north from its known distribution area, in the Molise region (Map 11). It occurs in mountain brooks and can survive in both intermittent and saline streams. The flight period is in spring (III–VI).

***Protonemura salfi* (Aubert, 1954c)**

(Map 12)

nec Protonemura beatensis Despax, 1929 (not present in Italy).

Protonemura beatensis robusta Berthélemy, 1963 **new synonym.**

Remarks. Consiglio (1955c, 1962a) mentioned the presence of *P. beatensis* Despax, 1929 in Italy. Berthélemy (1963) stated that the specimens collected by Consiglio in the Ligurian Apennine belong to a new race and he described *P. beatensis robusta*. Unfortunately, Berthélemy did not noticed that nine years before, Aubert (1954c) had described several new species collected by himself in two entomological collecting trips in Calabria (Southern Apennine, Italy). *Protonemura salfi*, one of these new species (Aubert 1954c, Figs. 18 to 22), appears to be identical to *P. beatensis robusta*. The supposed female of *P. salfi* illustrated by Aubert (1954c, Fig. 23) and

reproduced by Fochetti & Tierno de Figueroa (2008, Fig. 123c) is wrongly attributed to this species, as also confirmed by Consiglio (1958a). The drawing provided by Aubert probably corresponds to the female of *P. lagrecai* Aubert, 1954c. The correct drawing of the female of *P. salfii* is therefore the one provided by Consiglio (1958a, Fig. 1).

Fochetti & Tierno de Figueroa (2008) were the first to suspect that *P. salfii* and *P. robusta* are the same species, but they did not establish formally the synonymy between them: *P. robusta* Berthélemy, 1963 = *P. salfii* (Aubert, 1954c). In his recent paper Fochetti (2020) still lists *P. beatensis*, a species to be removed from the Italian stonefly fauna because it is a Pyrenean species that only extends into the French Massif Central and Brittany.

We confirm that *P. beatensis robusta* Berthélemy, 1963 (or *P. robusta* Berthélemy, 1963) is a synonym of *P. salfii* (Aubert, 1954c). In the table 1, we list only *P. salfii* Aubert and leave out *P. beatensis* Despax, 1929, not present in Italy.

Previous data. Italy, Ligurian Apennines (Ravizza 1974b, sub nom. *P. robusta*, Consiglio 1955c, sub nom. *N. (Protonemura) beatensis*, Consiglio 1967b, sub nom. *P. beatensis robusta*, Ravizza, Vinçon & Poggi 2022), Emilia-Romagna (Ravizza & Ravizza Dematteis 1979b, sub nom. *P. robusta*, Consiglio 1960), Marche (Fochetti & Nicolai 1987a), Lazio (Consiglio 1958b, Nicolai & Fochetti 1983a), Abruzzi (Consiglio 1958b, Nicolai, Fochetti & Dell' Agata 1988, Nicolai, Fochetti & Marini 1988), Basilicata (Aubert 1958), Calabria (Aubert 1958).

New records. **Italy, Tuscany:** Cerreto Pass, 1400 m, spr., and br., 44.291N, 10.229E, 18.10.2020, 1♀; Passo Croce Arcana, 800 m, 44.113N, 10.747E, 19.09.2009, 2♂ (VIN). **Emilia-Romagna:** Tevere spr., Balze, 1300 m, 43.787N, 12.075E, 13.10.2014, 1♀ (VIN). **Abruzzi:** Gran Sasso, Intermesoli, tor., 800 m, 42.53N, 13.549E, 14.10.2014, 3♀ (VIN); Scanno 22, S. Liborio, 15.10.1955, 1♂ 3♀, Consiglio leg. (AUB);

Sorgenti dell'Aventino, SW Palena, 880 m, 41.964N, 14.12E, 25.05.2021, 2♀; 20.05.2022, 7♀ (VIN). **Calabria:** Pulitrea, Tacina spr, 1350 m (RAV).

Distribution area and biogeographical notes. *P. salfii* inhabits the whole Apennines Cordillera (Map 12). It is an orophilic species (550–1600 m).

***Protonemura tyrrhena* (Festa, 1938b**

(Map 12, Table 3)

Type locality. Italy, Liguria, Casella, 407 m, 11.04.1932.

Morphological remark. *P. tyrrhena* is a sister species of *P. ruffoi* and both can be easily confused as it was the case in Italy (Aubert 1953b, 1957a, 1958) and in Algeria (Aubert 1956b).

Previous data. Ligurian Apennines (Festa 1938b, Ravizza 1974b, 1976, Ravizza, Vinçon & Poggi 2022), Emilia-Romagna (Consiglio 1960, 1971, Fochetti & Campadelli 1988, 1991), Tuscany (Festa 1938b, Consiglio 1958c, 1963b), Marche (Fochetti & Nicolai 1987a), Lazio (Consiglio 1963b, 1967b, Nicolai & Fochetti 1983b), Abruzzi (Consiglio 1958a, 1963b), Campania (Aubert 1953a, Nicolai & Fochetti 1991a), Basilicata (Aubert 1958, Consiglio 1967b), Puglia (Nicolai & Fochetti 1991a), Calabria (Aubert 1953b, 1958).

New records. **Emilia-Romagna:** Prato Spilla, nice brook and spring, 1220 m, 44.3678N, 10.127E, 16.05.2022, 2♀; **Tuscany:** Vinca, spr. + br., 1200–1300 m, 44.117N, 10.175E, 2.04.2017, 1♂ 2♀; Reggello, spr. + br., 800 m, 43.691N, 11.575E, 8.06.2020, 1♂; 19.05.2021, 1♂ 1♀; 11.06.2021, 1♂; 920 m, 43.691N, 11.582E, 11.06.2021, 4♂ 4♀; 1220–1400 m, 43.688N, 11.621E, 11.06.2021, 17♂ 10♀; Pratomagno, 1300, spr. + br., 43.645N, 11.665E, 8.06.2020, 1♂ 2♀; (VIN); **Marches:** Acera spr., 1190 m, 43.463N, 12.694E, 20.05.2022, 1♂ 4♀ (VIN); **Abruzzi:** Prati di Tivo, spr., 1700 m, 42.495N, 13.579E, 14.06.2020, 4♂ 6♀; 1050 m, 42.527N, 13.565E, 26.05.2021, 2♂ 1♀; Palena, spr. + br.,

1270 m, 41.921N, 14.128E, 25.05.2021, 1♂ 1♀ (VIN); **Lazio**: Prati di Mezzo, spr. + br., 1560 m, 41.653N, 13.936E, 21.05.2021, 1♂ (VIN); **Molise**: S. Maiella, br., 780 m, 41.882N, 14.25E, 13.06.2020, 1♂ 5♀; 19.05.2022, 3♂ 3♀; Rio Verde spr., 1050 m, 41.863N, 14.331E, 18.05.2022, 2♂; Fonte della Gallina, 1420 m, 41.855N, 14.293E, 18.05.2022, 4♂ 1♀; Fonte Campogli-ona, 1250 m, 41.679N, 13.991E, 19.05.2022, 5♂ 2♀ (VIN); **Basilicata**: Lagonegro, spr. + br., 1300 m, 40.152N, 15.808E, 22.05.2021, 3♂ 2♀; Pollino: 950 m, br., 39.984N, 16.163E, 24.05.2021, 2♂ 2♀; Fontana Impieso, 1210 m, 39.964N, 16.189E, 24.05.2021, 3♂ 6♀ (VIN).

Ecological notes. *P. tyrrhena* is endemic to the whole of the Apennines. It is rather common from Liguria to Calabria, occurring preferentially in hilly regions of moderate elevation (20–1700 m). The adults fly in spring and early summer (IV–VI).

Nemoura aprutiana Vinçon & Ruffoni, 2021

(Map 10)

Type locality. Italy, Abruzzi, Val Fondillo, Tornareccia spring, 1110–1120 m, 41.771N, 13.857E, 20.05.2021.

Previous data. Italy, Abruzzi (Vinçon & Ruffoni 2021).

Distribution area and biogeographical notes. *N. aprutiana* is a steno-endemic species found in the southern range of the Abruzzo Massif from the Fondillo Valley near Opi, up to Prati di Mezzo, covering the southern part of the ‘Parco Nazionale d’Abruzzo Lazio e Molise’. It is strongly crenophilic and orophilic (1100–1560 m). The flight period is in spring and early summer (V–VII).

Nemoura banatica Kis, 1965 stat. restit.

(Figures 5 a–i)

[urn:lsid:zoobank.org:act:BA10641E-2B1A-4E60-9D19-155942D140AC](https://zoobank.org/act:BA10641E-2B1A-4E60-9D19-155942D140AC)

Nemoura marginata: Kis (1974).

Nemoura marginata: Fochetti (1992, Figs. 1b, 2b, 3b).

Nemoura marginata: auctt. pro parte

New records. Italy, Lombarde Prealps: NE. Brescia, > Forno d’Ono, > Pertica Bassa, 800 m, 45.774N, 10.371E, 22.04.1999, 2♂; N. Salò, N. Eno, spr., 980 m, 45.722N, 10.506E, 28.05.2021, 6♂ (VIN); **Venetia and Trentino Alto Adige**: Trento, > Vattaro, spr. + br., 900 m, 46.011N, 11.214E, 14.05.2010, 8♂ 9♀; > San Sebastiano, spr. + br., 1300 m, 45.925N, 11.208E, 14.05.2010, 1♂; > Zoréri, sp. And br., 1000 m, 45.853N, 11.202E, 14.05.2010, 6♂ 4♀; > Camposilvano, spr., 1000–1050 m, 45.754N, 11.149E, 27.05.2021, 1♂ 4♀; Passo di Fugazze, sp. And tor., 900–1000 m, 45.757N, 11.19E, 2.05.2009, 17♂ 4♀; Campogrosso Pass, spr., 820 m, 45.735N, 11.2E, 8.06.2008, 1♂ 1♀; E. Malga Ravo, spr., 1020 m, 45.7162N, 11.183E, 27.05.2021, 2♂; > San-Antonio, spr., 850 m, 45.762N, 11.197E, 2.05.2009, 4♂, 13.05.2010, 4♂; > Bellori, br., 350 m, 45.593N, 10.985E, 14.05.2010, 1♂ 3♀; > Bellori, spr., 440 m, 45.593N, 10.983E, 20.04.2008, 1♂, 13.05.2010, 1♂; < Fosse, spr., 900 m, 45.646N, 10.949E, 20.04.2008, 1♂, 13.05.2010, 2♂; Séren del Grappa, 650–750 m, 45.923N, 11.811E, 20.04.2008, 1♂, 8.06.2008, 1♂ 4♀; > Lentiai, br., 300 m, 46.039N, 12.042E, 5.04.2009, 15♂ 3♀; Canzoi V., sp. And br., 46.143N, 11.951E, 5.04.2009, 3♂ 4♀; > Limana, Tassei, 400 m, 46.102N, 12.23E, 6.04.2009, 3♂; Levego, Sagrogn, br., 400 m, 46.154N, 12.266E, 24.04.1999, 3♂; Passo Manghen, br., 1000 m, 46.115N, 11.49E, 14.05.2010, 2♂; Sella Ciampigotto, spr. + br., 1750 m, 46.486N, 12.592E, 22.06.2018, 1♂; Passo Mauria, 1220 m, br., 46.46N, 12.509E, 14.05.2012, 1♂; below San Salvatore ai Bagni, mineral spr., 1320 m, 46.7213 N, 12.2947E, 19.06.2023, 1♂ (VIN); **Friulia-Venezia Giulia**: Passo Mauria, spr. + br., 1100 m, 46.446N, 12.539E, 14.05.2010, 3♂ 2♀; Préone, Casali Chiampon, sp. And br., 750–800 m, 46.355N, 12.875E, 14.10.2010, 4♂ 4♀; Uccia, Zaga, tor. And br., 600–700 m, 46.307N, 13.418E, 21.04.2008, 6♂ 4♀; Cepletischis, spr., 580 m, 46.1795N, 13.5696E, 15.05.2010, 4♂ 4♀, 21.05.2022, 4♂ 1♀; crossroad Stregna – Podgora, spr. + br., 300 m, 46.127N, 13.57E, 21.04.2008, 7♂ 5♀; Stregna, Zamir, 200 m, 46.122N, 13.55E, 21.04.2008, 10♂ (VIN); **Julian Alps**: S. Fusine,

spr., 840 m, 46.492N, 13.669E, 23.05.2022, 2♂ (VIN). **Slovenia: Julian Prealps:** Livek, spr., 600 m, 46.212N, 13.594E, 15.05.2010, 3♂ 4♀, 22.06.2018, 2♂ 3♀, 21.05.2022, 3♂ 1♀ (VIN); **Julian Alps:** N.E. Bovec, spr., 430 m, 46.3399N, 13.5745E, 21.05.2022, 1♂; Passo del Predil, 1100 m, 46.419N, 13.586E, 15.05.2010, 2♂ 1♀; Vrsic Pass, spr., 1480 m, 46.4279N, 13.743E, 23.06.2018, 1♂, 22.05.2022, 4♂ 2♀; Vrsic Pass, S. slope: spr., 1300 m, 46.411N, 13.749E, 15.05.2010, 3♂; spr., 1040 m, 46.407N, 13.756E, 15.05.10, 1♂; E. Srednji Vrh, spr., 1060 m, 46.4952N, 13.8518E, 23.05.2022, 1♂ (VIN). **Switzerland:** LU, Fischebach, Entlebuch, 650685/204000, 1047 m, 20.04.2011, 1♂ (Bur & Knispel leg.); ZH, Winterthur Sädelrain, Tuffquelle, 630 m, 5.06.2001, 2♂; same place, 17.04.2006, 1♂ (Lubini coll.); Zurich Albisrieden, 17.04.2006, 1♂ (Lubini coll.); VD, Veveyse, Mauguette, 1220 m, 8.07.1978, 1♂ (Aubert coll.); Veveyse, Fontaine David, 1200 m, 28.08.1978, 1♂ (Aubert coll.); LU, Napf, Hergiswil V., br. < the Napf, 7.07.1981, 1♂ (Aubert coll.). BL, temporary spring, Gerstelflue, 47.380161, 7.756891, 646 m, 07.05.2022, 3♂ 5♀; 11.05.2022, 1♂ 3♀ (RED); Vordere Frenke, Gerstelflue, 47.376245, 7.771062, 840 m, 11.05.2022, 1♂ 2♀ (RED); NE, temporary spring, Côte de la Forge, 47.109414N, 6.747515E, 690 m, 05.04.2014, 1♂ (RED). **France:** Doubs dpt., temporary spring, Gorges de Nouailles, 47.020673N, 6.286923E, 500 m, 10.04.2013, 3♂ 2♀ (RED).

Complementary description and comparison with N. marginata. *Nemoura banatica* belongs to the *marginata* group *sensu* Murányi *et al.* (2023). This group is characterized by the presence of cerci with a single apical hook on the outer lateral portion, and by an epiproct with an erect apical sclerite, in lateral view. The apical sclerite always bears lateral spines, visible at higher (400 – 600 x) magnification. *N. banatica* had been synonymized with *N. marginata* by Zwick (1970), on the basis of an imprecise drawing of the apical sclerite of the epiproct of *N. marginata*. The drawing provided by Zwick (1970, Fig. 1m) to characterize the apical sclerite of the epiproct of *N. marginata* is, indeed, closer to the one of *N. banatica*, though the other two drawings by Zwick (1970, Figs. 1k,

1l) rather reproduce *N. marginata*. These illustrations had been made after older specimens collected by Jacques Aubert from the River Flon near Lausanne in 1943 and were designated as neotype by Zwick (1970), in the absence of a holotype. The type locality of *N. marginata*, as indicated by Pictet (1836), are high altitude brooks from the region of Chamonix (France, Haute-Savoie).

After comparative studies of numerous specimens from the eastern Alps (Slovenia, Austria, Italy), Switzerland and the Carpathians, we propose to restore the species *Nemoura banatica*. Males of *N. banatica* differ from those of *N. marginata* by the shape of the apical sclerite of their epiproct in dorsal view, which is wider, with thin sclerotized expansions inward (Kis 1974, Fig. 83C and Figs. 5a, b), while it is nearly triangular in *N. marginata* (Fig. 5i; Aubert 1959, Fig. 132). At a higher magnification (400 x), the two apical sclerites of the epiproct appear nearly rectangular in dorsal view, carrying a small stronger spine on the apical outer edge (red line on Fig. 5e), followed by a row of small spines (blue line on Fig. 5e). The apical sclerite of *N. banatica* is thus similar to the drawing of *N. marginata* by Zwick (1970, Fig. 1m), which might explain why this author did not see any differences between both taxa. More accurate illustrations of *N. marginata* are provided by Aubert (1959, Fig. 132) and Lubini *et al.* (2012, Figs. 399, 404). On the other hand, the drawings of Kis (1974, Fig. 83C) and the illustrations of Fochetti (1992, Figs. 1b, 2b, 3b) correspond to *N. banatica* and the drawing of Roesti (2021, p. 343) could also be assigned to *N. banatica* though the second drawing given by the same author rather corresponds to *N. marginata* (Roesti 2021, p. 345). Females of *N. banatica* are not separable from those of *N. marginata*. Further investigations, based on multilocus genetic analyses, are under way to clarify the status of both taxa.

Distribution area and biogeographical notes. *N. banatica* mainly occurs in the crenal and rhithral zones in hilly regions (200–1750 m). It has a wide distribution area from the Carpathians to the eastern part of the Alps (Slovenia, Austria,

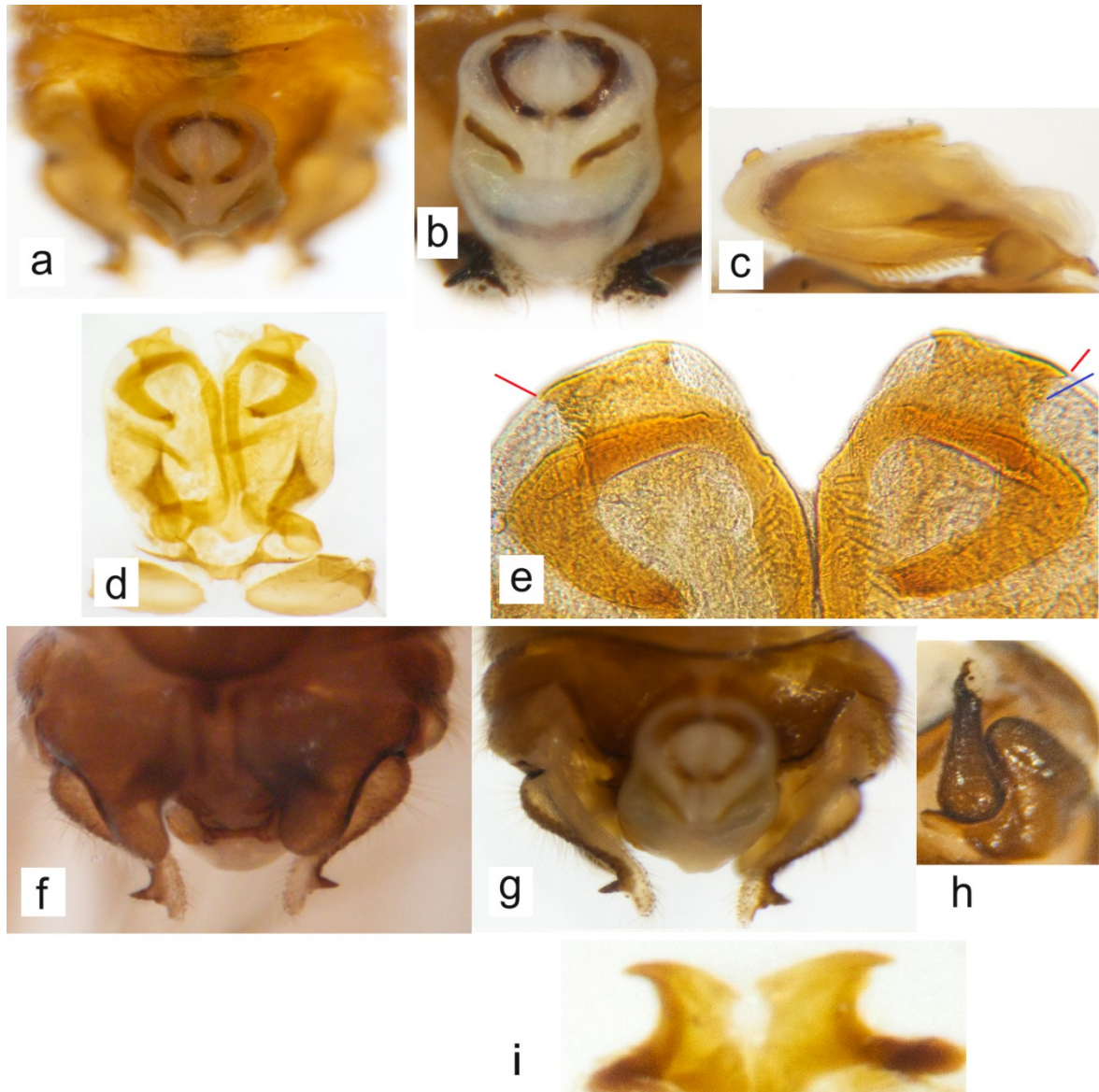


Figure. 5 *Nemoura banatica* Kis, 1965, male genitalia: a = dorsal view, b = epiproct, dorsal view, tip of cerci also visible, c = epiproct, lateral view, d = epiproct, dorsal view, e = epiproct tip, dorsal view, with strong spine marked by red line and small, hardly visible, spines marked by blue line, f = paraprocts and cerci, ventral view, g = idem, dorsal view, h = idem, lateral view. *Nemoura marginata* Pictet, 1836, i = male genitalia: apical sclerite of epiproct, dorsal view.

Italy, Switzerland) and Jura Massif. In the Jura Mountains of France and Switzerland, the species has, up to now, only been found in the poorly prospected biotopes of temporary springs and hygropetric habitats. The adults fly in spring and early summer (IV–VII). New for Italy, Austria, Slovenia, France, and Switzerland.

Nemoura cinerea selene Consiglio, 1959

(Table 3)

Ecological notes. This Italian subspecies of *N. cinerea* is very eurytopic, occurring in various kinds of water courses even in muddy springs polluted by cattle. In the Apennines, its highest

locality is in Basilicata: Pollino Massif, spring of Frido River, 1910 m, 39.921N, 16.206E, 24.05.2021, 29♂ 17♀ (VIN); in the Italian Alps, its highest locality is in the Val d'Ayas, above Estoul, below Literan Lake, 2200 m, 45.774N, 7.7688E, 6.07.2004, 13♂ 14♀ (VIN).

Nemoura hesperiae Consiglio, 1960

(Table 3)

Type locality. Italy, Abruzzi, Lecce del Marsi, Le Prata di Lecce, 1540 m, 22.06.1954 (Consiglio coll.).

Morphological notes. *N. hesperiae* can easily be confused with its sister species *N. palliventris* and *N. aprutiana*; comparative photos of their genitalia are given in Vinçon & Ruffoni (2021).

Previous data. Italy, Ligurian Alps (Ravizza & Ravizza Dematteis 1977, Ravizza, Vinçon & Poggi 2022), Ligurian Apennines: (Ravizza 1974b, Vinçon & Ruffoni 2021, Ravizza, Vinçon & Poggi 2022). Emilia-Romagna (Consiglio 1960, Fochetti & Campadelli, 1988, 1991, Vinçon & Ruffoni 2021). Marche (Fochetti & Nicolai 1987a). Umbria (Consiglio 1958a sub nom. *N. erratica*, Consiglio 1967b). Lazio (Nicolai & Fochetti 1983a). Abruzzi (Consiglio 1958a sub nom. *N. erratica*, Consiglio 1967b, Nicolai 1983b, Nicolai, Fochetti & Dell'Agata 1988, Vinçon & Ruffoni 2021). Basilicata (Vinçon & Ruffoni 2021). Calabria (Vinçon & Ruffoni 2021). Sicily (Ravizza & Gerecke 1991).

New records. **Emilia-Romagna:** Riana, spr., 1020 m, 44.418N, 10.093E, 16.05.2022, 4♂; Prato Spilla, 1450 m, 44.358N, 10.106E, 16.05.2022, 2♂; N.E. Passo Lagastrello, spr., 1110 m, 44.356N, 10.156E, 17.05.2022, 3♂ 7♀ (VIN); **Tuscany:** Passo di Cerreto, La Nuda Glacial Cirque, spr. + br., 1450 m, 44.287N, 10.227E, 10.06.2022, 2♂ (VIN). **Marche:** Monti Sibillini: Casali, spr., 1080 m, 42.951N, 13.177E, 18.05.2022, 4♂ 3♀; Panico V., spr., 1180 m, 42.945N, 13.1995E, 18.05.2022, 1♂ 2♀; Panico spr., 1320 m, 42.941N, 13.202E, 18.05.2022, 7♂ 6♀; Ussita, tor., 730 m, 42.943N, 13.138E, 18.05.2022, 1♂;

Frontale, spr., 720 m, 43.345N, 10.071E, 20.05.2022, 3♂ 3♀ (VIN); **Molise:** Pescopennataro, Fonte Gelata, 1230 m, 41.848N, 14.261E, 18.05.2022, 1♂ (VIN).

Distribution area and biogeographical notes. *N. hesperiae* extends into the whole Italian Peninsula from the Ligurian Apennines up to Calabria (Aspromonte) and Sicily. It occurs preferentially in crenal and epirhithral biotopes (570–1740 m). The flight period is in spring and early summer (IV–VII). A precise distribution map is given in Vinçon & Ruffoni (2021, Fig. 6).

Nemoura illiesi Mendl, 1968a

(Map 6)

Type locality. Austria, Feistritz an der Drau, Kärnten, 28.05.1966, Lübenau leg. (Mendl 1968a).

Previous data. Friulia-Venezia Giulia (Nicolai 1982, Fochetti & Nicolai 1985).

New records. **Italy, Venetian Prealps:** Zoreri, spr. + br., 1000 m, 45.853N, 11.202E, 5.04.2009, 2♂ 1♀; 14.05.2010, 2♂ 2♀; Passo di Borcola, Bettale, 700 m, 45.792N, 11.239E, 13.05.2010, 1♂; 27.05.2021, 1♂ 7♀; Passo di Campogrosso: spr. + br., 1320 m, 45.746N, 11.161E, 8.06.2008, 1♂ 6♀; 2.05.2009, 5♂ 6♀; 14.06.2021, 6♂ 7♀; spr., 1420 m, 45.73N, 11.18E, 8.06.2008, 7♂ 8♀; 11.09.2008, 1♂ 9♀; br., 1200 m, 45.733N, 11.186E, 12♂ 4♀; Camposilvano, spr., 1000–1050 m, 45.754N, 11.149E, 27.05.2021, 6♂ 7♀; 14.06.2021, 1♂ 1♀; Camposilvano, spr., 1200 m, 45.757N, 11.17E, 8.06.2008, 2♂; Passo di Fugazze, spr. + br., 950 m, 45.757N, 11.19E, 5.04.2009, 1♂; 2.05.2009, 3♂ 4♀; 13.05.2009, 10♂ 11♀; 29.06.2009, 3♂ 9♀; San-Antonio, spr., 850 m, 45.762N, 11.197E, 29.06.2009, 1♂ 1♀; 13.05.2010, 2♂ 1♀ (VIN). **Dolomites:** Passo Manghen, br., 1000 m, 46.115N, 11.49E, 14.05.2010, 3♀ (VIN). **Carnic Alps:** Passo di Rezzo, Sella Ciampigotto, spr. + br., 1750 m, 46.487N, 12.589E, 22.06.2018, 1♂ (VIN). **Carnic Prealps:** Préone, Casali Chiampon, spr., 800 m, 46.355N, 12.875E, 14.05.2010, 3♂ 1♀; 22.06.

2018, 1♂; 24.05.2022, 2♂ 2♀ (VIN). **Julian Alps:** Studena Alta, 830 m (RAV); Sella Nevea, 1100 m, 46.395N, 13.494E, 15.05.2010, 7♂ 6♀; Uccia, Zaga, tor. and br., 650 m, 46.307N, 13.418E, 21.04.2008, 6♂ 4♀; Stregna - Podgora, spr. + br., 300 m, 46.127N, 13.57E, 21.04.2008, 4♀; **Julian Prealps:** Zamir, 200 m, 46.122N, 13.55E, 21.04.2008, 1♂; Cepletischis, spr., 340 m, 46.1701N, 13.5581E, 21.05.2022, 1♂ 1♀ (VIN); **Julian Alps:** S. Fusine, spr., 910 m, 46.486N, 13.673E, 23.05.2022, 4♀ (VIN). **Slovenia:** Passo del Predil, 1100 m, 46.419N, 13.586E, 15.05.2010, 2♂ 7♀; Vrsic Pass, 1400–1550 m, 46.431N, 13.743E, 1550 m, 23.06.2018, 7♂ 5♀; 1300 m, 46.411N, 13.749E, 15.05.2010, 5♀; 1040 m, 46.407N, 13.756E, 15.05.2010, 1♀; Breginj, Bela R., 600 m, 46.264N, 13.425E, 11.10.2018, 1♀; Livek, br., 600 m, 46.192N, 13.591E, 15.05.2010, 2♂ 4♀; Livek, spr., 600 m, 46.211N, 13.592E, 15.05.2010, 3♂; Bovec, spr., 430 m, 46.34N, 13.575E, 21.05.2022, 2♂; Srednji Vrh, spr., 1060 m, 46.495N, 13.852E, 23.05.2022, 5♂ 1♀ (VIN); **Pohorje Mountains:** Kranj, Travertine spr., 850 m, 46.399N, 14.47E, 22.05.2022, 4♂ (VIN). **Austria, Carinthia:** Seebergsattel Pass, spr., 1220 m, 46.421N, 14.528E, 22.05.2022, 1♂ (VIN).

Distribution area and ecological notes. *N. illiesi* has a wide distribution area extending from the eastern Austrian and Italian Alps down to the Dinaric Mountains (Graf et al. 2009). In Italy it is known from the Julian Alps and Prealps, where it is a common species (Fochetti & Nicolai 1985). Its Italian distribution is much wider than previously known since it extends westward up to the Adige River (Map 6). It occurs in various types of watercourses, and within a wide range of elevation (200–1750 m). The flight period is mainly in spring but extends exceptionally also to autumn (IV–IX).

***Nemoura lucana* Nicolai & Fochetti, 1991b**

(Map 11)

Type locality. Italy, Basilicata, small tributary of Riofreddo Stream (1100 m) near Rifreddo

(Potenza), 21.05.1984 (Nicolai & Fochetti 1991b).

Morphological notes. *N. lucana* is a close sister species of *N. hesperiae*, *N. palliventris* and *N. aprutiana*; comparative photos of their genitalia are given in Vinçon & Ruffoni (2021).

Previous data. Reported only from its type locality.

New records. **Italy, Basilicata:** Pollino, 1600–1650 m, spr. + br., 39.916N, 16.177E, 10.06.2020, 1♂ 4♀ (VIN).

Distribution area and biogeographical notes. This species is known only from high altitude brooklets and springs in the southern Apennines (Basilicata) (1100–1650 m) (Map 11). Its flight period is in spring (V–VI).

***Nemoura minima* Aubert, 1946**

(Table 3)

Ecological notes. *N. minima* is an orophilic and crenophilic species that mainly occurs above 1000 m in the Italian Alps; its highest known locality is in the Cottian Alps: Varaita Valley, Agnel Pass, Vallone del Giarus, spr., 2500 m, 44.677N, 7.046E, 12.07.2007, 8♂ 6♀ (VIN).

***Nemoura mortoni* Ris, 1902**

(Table 3)

Ecological notes. *N. mortoni* is a common, rather eurytopic, species. As already noticed by Ravizza & Ravizza Dematteis (1994b), it can colonize the highest places. Its highest known locality is in the Graian Alp: Gran Paradiso Massif, above Corona Lake, spr., 2780 m, 45.6512N, 7.4172E, 16.06.2021, 3♂ 5♀ (VIN).

***Nemoura oropensis* Ravizza & Ravizza Dematteis, 1980b**

(Map 2)

Type locality. Italy, Piedmont, Pennine Alps: Sesia V., Oropa, stream headwater, 1850 m.

Previous data. Ravizza & Ravizza Dematteis (1990) identified the specimens (1♂ 1♀), collected in the Upper Po Valley (2000 m) as *N. oropensis* (Ravizza Dematteis & Ravizza 1988). Subsequently the same authors (Ravizza & Ravizza Dematteis 1993b), after re-examining these specimens, corrected their identification (confirmed by Vinçon 1996) in *N. undulata* Ris, 1902.

Remark. This species was not reported again with confidence after its original description.

***Nemoura palliventris* Aubert, 1953b**

(Table 3)

Nemoura silana Aubert, 1953, syn. fide Aubert (1958).

Type locality. Italy, Calabria, Sila, Mucone, 19.05.1952 (Aubert 1953b).

Morphological notes. *N. palliventris* can be easily confused with its sister species *N. hesperiae*. Comparative photos of their genitalia are given in Vinçon & Ruffoni (2021).

Previous data. Switzerland, Lepontine Prealps, Ticino (Aubert et al. 1996). Italy, Pennine Alps (Vinçon & Ruffoni 2021); Graian Alps (Vinçon & Ruffoni 2021); Cottian Alps (Ravizza & Ravizza Dematteis 1986, Ravizza Dematteis & Ravizza 1988). Ligurian Alps (Aubert 1986, Consiglio 1967b, Ravizza & Ravizza Dematteis 1977 sub nom. *N. hesperiae*, Ravizza, Vinçon & Poggi 2022). France, Maritime Alps (Aubert 1986, Vinçon 1996). Italy, Ligurian Apennines (Ravizza 1974b sub nom. *N. hesperiae*, Ravizza 1976b sub nom. *N. hesperiae*, Ravizza & Ravizza Dematteis 1983, Vinçon & Ruffoni 2021, Ravizza, Vinçon & Poggi 2022). Emilia-Romagna (Fochetti & Campadelli 1991). Tuscany (Vinçon & Ruffoni 2021). Marche (Aubert 1956b, Fochetti & Nicolai 1987a). Lazio (Nicolai & Fochetti 1983a). Abruzzi (Consiglio 1958a, Vinçon & Ruffoni 2021). Campania (Nicolai & Fochetti 1991a). Basilicata (Aubert 1953b, 1959, Nicolai & Fochetti 1991a, Vinçon & Ruffoni 2021). Calabria (Aubert 1953b, ex parte sub nom. *N. silana*, Nicolai & Fochetti

1991a, Vinçon & Ruffoni 2021). Sicily (Aubert 1957a, Consiglio 1961a, Ravizza & Gerecke 1991).

New records. Italy, Tuscany: Passo di Cerreto, spr. + br., 1440–1500 m, 44.287N, 10.227E, 10.06.2022, 1♂ (VIN). **Emilia-Romagna:** S. Cerreto Laghi, spr., 1550 m, 44.28N, 10.25E, 11.06.2022, 7♂ (VIN).

Distribution area and biogeographical notes. *N. palliventris* is widely distributed in the western Alps, including the French Prealps, the whole Apennine Cordillera and Sicily. It is rather common and occurs preferentially in the epirhithral and crenal (200–2000 m). Its highest localities are in the southern Apennines: Aspromonte below Montalto, 1760–1800 m, spr., 38.1649N, 15.916E, 23.05.2021, 7♂ 7♀, and Sila Grande: spr., 1650–1700 m, 39.32N, 16.401E, 11.06.2020, 16♂ 30♀ and 22.05.2021, 9♂ 8♀ (VIN). The flight period is in spring and early summer (III–VII). A precise distribution map is given in Vinçon & Ruffoni (2021, Fig. 6).

***Nemoura pesarinii* Ravizza & Ravizza Dematteis, 1979a**

(Map 4)

Type locality. Italy, Pennine Alps: Sesia V., Oropa V., Fenereccio br., 1200 m, 24.04.1978.

Previous data. Italy, Pennine Alps (Ravizza & Ravizza Dematteis 1979a, 1990).

New records. Italy, Graian Alps: Val Soana, Ingria, spr., 900 m, 45.462N, 7.567E, 3.04.2017, 5♂ 6♀; br., 900 m, 45.463N, 7.560E, 16.10.2015, 8♂ 8♀; Valchiusella, near Lago Gias del Prete, spr., 2100 m, 45.52N, 7.644E, 12.07.2012, 4♂ 4♀; 20.06.2014, 10♂ 4♀; Alpe Strup, 1700 m, 45.518N, 7.655E, 12.07.2012, 1♂; 20.06.2014, 7♂; Scalero, 1500 m, 45.548N, 7.762E, 29.06.2009, 16♂ 8♀; 1000 m, 45.555N, 7.792E, 1.05.2009, 29♂ 29♀; Champorcher V., Lago Vernouille, 2100 m, 45.633N, 7.591E, 28.08.2005, 2♂ (VIN). **Pennine Alps:** Gressoney V.: Trovinasse, 1900 m, 45.595N, 7.881E, 24.05.2003, 1♂

1♀; spr., 1600 m, 45.579N, 7.868E, 24.05.2003, 2♂; above Pillaz, 1410 m, spr. + br., 45.641N, 7.8774E, 29.05.2021, 2; 1400 m, spr. + br., 45.65N, 7.881E, 29.05.2021, 2♂ 2♀; > Vargno Lake, 1720 m, spr. + br., 45.65N, 7.911E, 29.05.2021, 5♂ 3♀; Pillaz, 1230 m, spr. + br., 45.6468N, 7.8735E, 29.05.2021, 1♂; Sesia V.: < Lago Nero, spr., 2480 m, 45.81N, 7.875E, 12.07.2021, 2♂; Rima, 1900 m, 45.901N, 7.994E, 1.06.1991, 2♂; Civiasco, br., 850 m, 45.822N, 8.313E, 2.06.1991, 1♂; Cervarolo, 1500 m, 45.885N, 8.27E, 2.06.1991, 1♂; Val Strona: Campello Monti, 1700 m, 45.928N, 8.228E, 19.06.2018, 1♂ 2♀; 29.05.2021, 9♂ 1♀; 1400 m, 45.933N, 8.230E, 24.05.2003, 7♂ 10♀; 29.05.2021, 7♂; Massiola, spr., 750 m, 45.914N, 8.312E, 26.04.1999, 1♂ (VIN). **Lepontine Alps:** Val Vigizzo, Toceno, 1600 m, 46.189N, 8.47E, 23.05.2003, 2♂ 3♀ (VIN). **Lombard Prealps:** E. Vantone, spr. + br., 770 m, 45.748N, 10.529E, 28.05.2021, 7♂ 10♀ (VIN).

Distribution area and ecological notes. *N. pesarinii* is widely distributed in the western Alps (Graia Alps – W. Lepontine Alps) and we have discovered it for the first time far eastwards, in the Lombard Prealps, close to the Garda Lake (Map 4). It is rather crenophilic and inhabits mountain springs and brooks (750–2100 m). The flight period extends from spring to summer (IV–VIII).

***Nemoura rivorum* Ravizza & Ravizza
Dematteis, 1995**

(Map 9)

Type locality. Italy, Ligurian Apennines, Savona, Porassino br., 700–750 m, 25.05.1982.

Previous data. Italy, Ligurian Alps (Ravizza, Vinçon & Poggi 2022), Ligurian Apennines (Ravizza & Ravizza Dematteis 1995, Ravizza, Vinçon & Poggi 2022), Lombard Apennines (Ravizza & Ravizza Dematteis 1995), Emilian Apennines (Ravizza & Ravizza Dematteis 1995). French Maritime Alps (Vinçon 1996).

New records. **Switzerland, Grisons:** Fuorn Pass, < Tscherv, br., 1700–1900 m (Funtana

Grossa), 46.624N, 10.322E, 21.06.2018, 2♂ (VIN). **Italy, Carnic Alps:** N. Maranza, spr., 1590 m, 46.835N, 11.648E, 25.05.2022, 3♂ 1♀ (VIN). **Austria,** Saualpe, Offnerhütte, 25.06.2007, 1♂ (Graf coll.) (VIN); **Carinthia:** S. Bad Vellach, Muri-Quelle, 930 m, 46.42N, 14.545E, 22.05.2022, 1♂ 1♀; Bad Vellach, Vrnik-Quelle, spr., 1380 m, 46.421N, 14.572E, 2♂ 1♀; Seebertsattel Pass, Steinerbach spr., 1220 m, 46.421N, 14.528E, 22.05.2022, 1♂ (VIN). **Slovenia:** Trzic, Kofce Jelendol reka Dolzanka, 1250 m, 27.05.1993, 1♂; Zgornje Jezersko Roblek potok Jezernica, 970 m, 26.07.90, 2♂, 3♀ (Sivec leg) (VIN). **France, Maritime-Alps:** Caïros, 900 m, 44.009N, 7.475E, 13.05.1988, 3♂ 1♀ (VIN). **Italy, Ligurian Alps:** Rezzo, br., 560 m, 44.026N, 7.873E, 28.12.1994, 1♂; Vignolo, br., 1090 m, 44.14N, 7.994E, 15.05.2022, 1♂ 4♀ (VIN). **Ligurian Apennines:** Rocca d'Aveto, spr., 1400 m, 44.555N, 9.4767E, 15.05.2022, 5♂; Casoni di Ambozasco, spr., 1440 m, 44.485N, 9.489E, 16.05.2022 (VIN). **Emilia-Romagna:** > Lago Santo Parmense, spr., 1530 m, 44.402N, 10.006E, 16.05.2022, 1♂ 1♀; > Riana, spr., 1020 m, 44.418N, 10.093E, 16.05.2022, 1♂; Rigoso, Prato Spilla, spr., 1220 m, 44.368N, 10.127E, 16.05.2022, 3♂ 1♀ (VIN). **Tuscany:** > Vinca, spr., 1000 m, 44.127N, 10.175E, 2.04.2017, 1♂; spr., 1250, 44.117N, 10.175E, 5.05.2015, 1♂ 2♀; 2.04.2017, 12♂ 3♀; Passo del Cerreto, 1400–1500 m, spr. + br., 44.29N, 10.228E, 18.05.2021, 5♂; La Gabelina, 950 m, spr., 44.318N, 10.238E, 18.05.2021, 5♂; Passo della Pradarena, 1450 m, spr., 44.27N, 10.318E, 18.05.2021, 2♂ 3♀; Passo di Radici, spr., br., 1480 m, 44.206N, 10.491E, 18.05.2021, 3♂; Val di Luce, 1560–1600 m, spr., br., 44.131N, 10.628E, 19.05.2021, 2♂ (VIN).

Distribution area and biogeographical notes. *N. rivorum* has its distribution area split in two parts: a first one covering the north-western Apennines and French Roya Valley, and a second one covering the eastern Alps (Slovenia, Austria, Italy and Switzerland) (Map 9). The specimens from the eastern Alps are illustrated by Roesti (2021: 346–347), under the name *Nemoura* sp.; they slightly differ from those of the Apennines and Maritime Alps, but complementary studies

are required to decide whether they should be assigned to a new species. *N. rivorum* is a strongly crenophilic, cold-water stenothermal species, inhabiting springs and brooklets of moderate elevation range (350–1600 m). The flight period is in winter and spring (XII–V). First mention for Switzerland, Austria and Slovenia.

***Nemoura sabina* Fochetti & Vinçon, 2009**

(Map 10)

Type locality. Italy, Central Apennine: Velino River, 700 m, March 1964.

Previous data. This species, previously confused with *Nemoura flexuosa* Aubert, 1949, is known only from its type locality.

Distribution area and biogeographical notes. This steno-endemic species inhabits the Central Apennines. It is probably in great danger of extinction since it occurs at a moderate altitude (700 m) in a densely populated area (Velino surroundings) (Map 10). The flight period is in spring (III).

***Nemoura sinuata* Ris, 1902**

(Table 3)

Ecological notes. *N. sinuata* is eurytopic and very common in the Italian Alps. It is able to reach very high elevations; its highest known locality is in the Pennine Alps: high Sesia Valley, above Sant'Antonio, spring below Lago Nero, 2630 m, 45.814N, 7.88E, 12.07.2021, 1♂ 2♀ (VIN).

***Nemoura undulata* Ris, 1902**

(Map 7, Table 3)

Type locality. Switzerland, Grisons: Albula Pass, 46.586N, 9.856E, 2300–2400 m (Aubert 1950b).

Previous data. Italy, Cottian Alps: High Po V., 2000 m, 44.7N, 7.097E (Ravizza Dematteis & Ravizza 1988, Ravizza & Ravizza Dematteis 1993b, sub nom. *N. oropensis*). Orobic Alps:

Valbondione, Trobio tor., 2000 m, 46.071N, 10.063E, 3.07.1994, 1♂ (Tierno de Figueroa *et al.* 2000). Dolomites: Cima della Rosetta, E. San Martino di Castrozza, 2000 m, 46.273N, 11.822E (Consiglio 1967b, 1971).

New records. Italy, Pennine Alps: Gressoney V., near Netscio Lake, 2550 m, 45.823N, 7.849E, 20.07.2003, 1♂ 2♀; 2400 m, 45.827N, 7.848E, 20.07.2003, 1♀ (VIN). **Lombardia: Orobic Alps,** Branzi, br. > Laghi Gemelli, 2000 m (RAV).

Distribution area and ecological notes. This Alpine endemic species has a wide distribution area covering nearly the whole of the Alps but always close to the Italian border so that we can consider it as endemic of the Italian region (Map 7). In Italy, like in Switzerland and France, it is scarce, strictly orophilic, occurring in high altitude cold springs and brooklets (2000–2550 m). The specimens inhabiting the eastern Alps probably correspond to an undescribed species since they differ in conspicuous features; complementary studies are required to define its status and appreciate its distribution area. The flight period is in late spring and early summer (VI–VII).

***Leuctra ameliae* Vinçon & Ravizza, 1996**

(Map 4)

Type locality. France, Vanoise, Mont Ceniz Pass, Cenischia spring, 1800 m, 20.06.1991.

Remark. In previous studies, *L. ameliae* was generally confused with *L. rauscheri* or *L. teriolensis*.

Previous data. Italy, Maritime, Cottian and Pennine Alps (Vinçon & Ravizza 1996). Switzerland, Lepontine Alps (Aubert *et al.* 1996: sub nom. "*Leuctra* proche de *kempnyi* Mosely, 1932").

New records. Italy, Cottian Alps: Vallon del Arma, spr., 1600 m, 44.360N, 7.157E, 6.09.2007, 8♂ 2♀; Macra valley, spr., 2460 m, 44.419N, 7.143E, 9.08.2020, 7♂ 7♀; Varaita di Bellino,

2000 m, spr., 44.575N, 6.960E, 6.08.2014, 7♂ 4♀; Agnel Pass, 2100 m, 44.669N, 7.009E, 10.04.2007, 6♂ 16♀; 12.07.2007, 1♀; Pellice V., 2100 m, 44.745N, 7.082E, 21.06.2019, 1♂ 2♀; 1700 m, tor., 44.752N, 7.081E, 21.06.2019, 2♂ 10♀; Germagnasca V., Ribba, 1800 m, 44.853N, 7.031E, 29.09.2002, 2♀; Ghigo, 1500 m, 44.875N, 7.039E, 5.08.2001, 18♂ 36♀; Prali, 1500 m, 44.876N, 7.038E, 5.08.2001, 1♂ 3♀. Chisone V., Finestre Pass, spr., 1800 m, 45.061N, 7.043E, 5.08.2001, 9♂ 10♀ (VIN). **Graian Alps:** Val di Viu, Borgial, br., 1500 m, 45.202N, 7.297E, 12.08.2005, 2♂ 6♀; Tornetti, tor., 1300 m, 45.249N, 7.332E, 20.06.2019, 2♂ (VIN). **Pennine Alps:** Valle Gressoney, Niel, 1800 m, 45.726N, 7.913E, 19.07.2003, 8♂ 54♀; Trovinasse, 1900 m, 45.595N, 7.881E, 11.07.2003, 1♂ 1♀; spr., 1600 m, 45.579N, 7.868E, 11.07.2003, 1♂ 1♀; high Sesia Valley, < Lago Nero, spr., 2480 m, 45.81N, 7.875E, 12.07.2021, 8♂ 10♀; < Lago Bianco, Alpe Rissuolo, spr., 2260 m, 45.8072N, 7.888E, 12.07.2021, 1♂ 1♀; Val Strona: Campello Monti, 1600 m, 45.928N, 8.228E, 11.07.2003, 2♂ 4♀; br., 1400 m, 45.933N, 8.23E, 11.07.2003, 3♂ 7♀ (VIN). **Lepontine Alps:** Val Vigezzo, Sta Maria Maggiore, 1400 m, 46.074N, 8.477E, 11.07.2003, 9♂ 17♀ (VIN). **Orobic Alps:** Passo San Marco, 1650 m, spr. and br., 46.0427N, 9.6431E, 18.06.2023, 1♂ 8♀; 1920 m, br. and spr., 46.052N, 9.628E, 18.06.2023, 1♀; 1800 m, br., 46.0581N, 9.63E, 18.06.2023, 7♂ 11♀; 1560 m, 46.0691N, 9.629E, 18.06.2023, 2♀ (VIN). **Switzerland, Pennine Alps:** Guggiligrabbe spr., 2060 m, 46.164N, 8.08E, 22.08.2019, 2♀; **Lepontine Alp:** Gondo, Schwarzi Balma, 2100 m, spr., 46.22N, 8.118E, 23.08.2019, 13♂ 10♀; Gstein Gaby, 1200 m, 46.186N, 8.078E, 11.07.2003, 1♂ (VIN). **Ticino:** Passo San Bernardino, Mesocco, 1500 m, 17.09.2009, 4♀ (VIN); Blenio, Brenno trib., 1800 m (Roesti Coll.).

Distribution area and ecological notes. *L. ameliae* is widely distributed in the western Italian Alps, from the Maritime Alps to the Swiss Ticino and Lombard Prealps (Brembana Valley). It slightly extends into the French Alps close to

the Italian border (Vinçon & Ravizza 1996) (Map 4). It is strongly crenophilic and inhabits high mountain springs and brooks (900–2480 m). The flight period extends from spring to autumn (IV–IX).

***Leuctra apennincola* Ravizza, 1988**

(Figures 6f–k, Table 3)

Morphological notes. *L. apennincola* is a sister species of *L. insubrica* and *L. grafi* and in the past these 3 species were often confused. To help male and female identification, a morphological comparison is provided below (Figs. 6a–p).

Distribution area and ecological notes. *L. apennincola* is a crenophilic species widely occurring in the whole Apennines. Its highest locality is in Tuscany: Val di Luce, 1750 m, br., 44.123N, 10.628E, 7.06.2020, 13♂ 9♀ (VIN).

***Leuctra armata* Kempny, 1899b**

(Table 3)

Ecological notes. *L. armata* is eurytopic, occurring in various kinds of watercourses and even in mountain lakes. It can reach very high elevations; its highest known locality is in the Carnic Alps: Rio di Pusteria, Mülbach, Wildersee outlet, 2532 m, 46.896N, 11.591E (RAV).

***Leuctra auberti* Ravizza & Ravizza Dematteis, 1985**

(Map 4)

Type locality. Italy, Pennine Alps: Sesia V., Oropa V., Fenereccio br., 1200 m, 7.05.1978.

Previous data. Italy, Pennine Alps: (Ravizza & Ravizza Dematteis 1985, 1990). Lombardia: (Tierno de Figueroa *et al.* 2000, Ravizza & Vinçon 1998).

New records. **Italy, Graian Alps:** Trione, spr., 1250 m, 45.401N, 7.574E, 21.06.2019, 1♀; Pian d'Audi, br., 1300 m, 45.359N, 7.511E, 12.08.2005, 1♂; Valchiusella, spr., 1150 m,

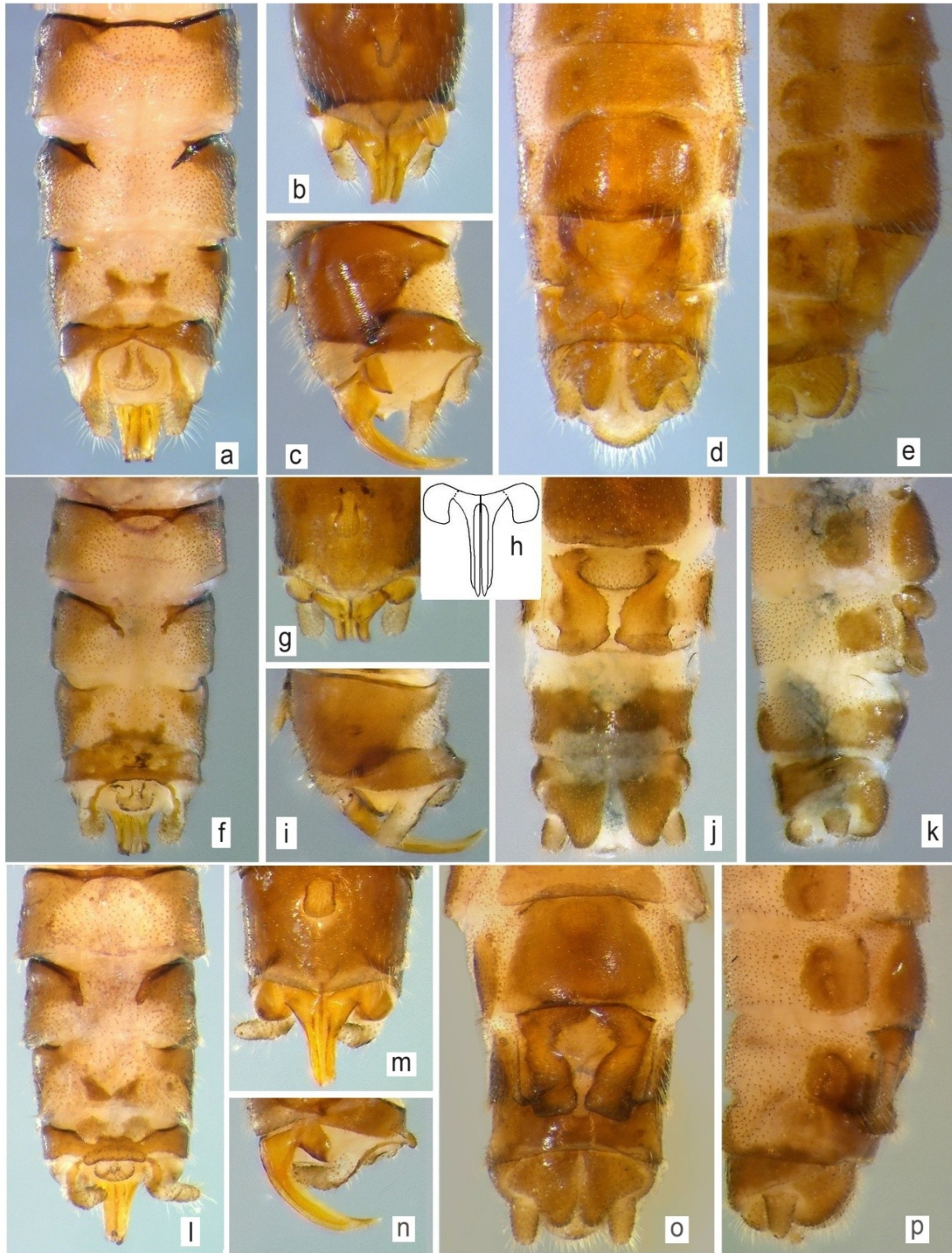


Figure 6. Comparative study of *L. insubrica* (a–e), *L. apennincola* (f–k) and *L. grafi* (l–p). a, f, i = male abdomen dorsal view, b, g, h, m = male abdomen ventral view, c, i, n = male abdomen lateral view, d, j, o = female abdomen ventral view, e, k, p = female abdomen lateral view (photos from Simon Vitecek, already used in Vitecek *et al.* 2017).

45.530N, 7.679E, 3.04.2017, 3♂ 1♀ (VIN). **Pennine Alps:** Trovinasse, 1900 m, 45.595N, 7.881E, 24.05.2003, 9♂ 2♀; Oriomosso, 1000 m, 45.659N, 8.024E, 1.06.1991, 2♀; Alberge, 1350 m, 45.657N, 8.052E, 1.06.1991, 3♀; Cervarolo, 1500 m, 45.885N, 8.270E, 2.06.1991, 2♀ (VIN). **Lombard Prealps:** Lecco, Maggio, 900 m, 45.917N, 9.429E, 22.04.1999, 1♂; Peghera, br., 850 m, 45.870N, 9.557E; **Orobic Alps:** Passo San Marco, tor., 1557 m, 46.040N, 9.643E, 20.06.2018, 2♂ 1♀ (VIN); Valtorta, 1000 m, 45.979N, 9.531E; Roncobello 900 m, 45.953N, 9.737E; 1600 m, 45.966N, 9.803E; Valbondione, 1150 m, 46.050N, 10.030E (Ravizza 1975a sub nom. *L. armata* (RAV)).

Distribution area and ecological notes. *L. auberti* widely extends into the western and central Italian Alps, from the Graian Alps up to the Lombard Prealps (Brembana Valley) (Map 4). It is rather crenophilic and inhabits mountain springs and brooklets (700–1900 m). The flight period is in spring and summer (IV–VIII).

***Leuctra aubertorum* Ravizza & Ravizza Dematteis, 1994a stat. prom.**

(Map 3)

Leuctra vinconi aubertorum Ravizza & Ravizza Dematteis, 1994a.

Remark. Ravizza & Ravizza Dematteis (1993a) described *L. vinconi*, a new species endemic to the mountains between the Sesia River and the Ticino River. A subspecies, *L. vinconi aubertorum* Ravizza & Ravizza Dematteis, 1994a was described shortly afterwards. Since this subspecies differs from the type species by a series of morphological features in both males and females, we propose to elevate *L. vinconi aubertorum* to species rank. Both, *L. vinconi* and *L. aubertorum* are shortwinged with reduced dispersal capabilities. Their distribution areas are also sharply delimited, probably by the huge Ticino glacier during the LGM, and presently by Lake Maggiore. The species level separation of the two taxa is also supported by analysis of COI sequences (Gattolliat et al. 2016).

Type locality. Switzerland, Ticino, N. slope of Tamaro Mount, Vira V., 970–1190 m, 46.122N, 8.846E, 1.10.1990.

Previous data. Switzerland, Ticino: Ravizza & Ravizza Dematteis (1994a), Aubert et al. (1996).

New records. **Switzerland, Ticino:** Vira, Tamaro Mt, 800 m, 46.125N, 8.85E, 12.10.2014, 5♂ 7♀ (VIN).

Distribution area and ecological notes. *L. aubertorum* is a steno-endemic species known only from its type locality (Tamaro Mount) (Map 3). It is strongly crenophilic and occurs in mountain brooks and springs of moderate elevation (800–1270 m). The flight period is in autumn (IX–X).

***Leuctra biellensis* Festa, 1942**

Taxonomic remarks. *Leuctra biellensis* Festa, 1942 was synonymized with *L. nigra* both by Aubert (1954a) and by Consiglio (1962a). Vinçon, Boumans & Gattolliat (2018), as a result of examining both DNA and morphological characteristics of putative *L. nigra* specimens from the Italian region, reinstated *L. biellensis*. The distribution area of *L. biellensis* in Italy mainly corresponds to the one formerly indicated for *L. nigra* in the Po River drainage basin, from the Ligurian Apennine and the Ligurian Alps to the Rhaetian Alps. *L. nigra*, on the other hand, seems to be restricted to the Eastern Italian Alps.

Type locality. Italy, Alpe Finestre, Val Chiobbia, Piemonte (altitude 1700 m) (Festa 1942).

Neotype. Italy, Pennine Alps: Biellese mountains, Oropa, tor. + br., 1200–1900 m, 06.1978–07.1978.

Previous data. Italy, Pennine, Graian and Cottian Alps, Ligurian Alps and Apennines (Vinçon et al. 2018), Ligurian Alps and Apennines (Ravizza, Vinçon & Poggi 2022); Switzerland, Rhaetian and Lepontine Alps (Ticino) (Vinçon et al. 2018).

New records. Italy, **Pennine Alps:** Civiasco, spr., 770 m, 45.8104N, 8.2973E, 27.05.2022, 10♂ 11♀; Val Strona, 1700 m, spr. + br., 45.927N, 8.225E, 29.05.2021, 1♂; Val Strona, between Forna and Marmo, 740 m, br., 45.917N, 8.301E, 29.05.2021, 3♂; Gressoney Valley, Pillaz, 1400 m, spr. + br., 45.65N, 7.881E, 29.05.2021, 1♂ (VIN).

Distribution area and ecological notes. *L. biellensis* occurs in the western part of the Italian Alps from the Rhaetian Alps to Ligurian Alps and in the Ligurian Apennines (Vinçon, Boumans & Gattolliat 2018, Fig. 4). It is a crenophilic species with wide elevation range (260–1900 m). The flight period extends from spring to early summer (III–VII) and is exceptionally found also in autumn (VIII–X).

***Leuctra boreoni* Aubert, 1962**

(Map 9)

Type locality. France: Alpes-Maritimes, Vésubie V., between Boréon Cascade and 'Vacherie du Boréon', 1460–1540 m, 2.10.1959.

Previous data. Italy, Ligurian Alps (Ravizza 1980, Ravizza, Vinçon & Poggi 2022), Ligurian Apennines (Ravizza 1976b, 1977, 1980, Ravizza & Ravizza Dematteis 1983, Ravizza, Vinçon & Poggi 2022), Lombard Apennines (Ravizza 1974b, 1980, Fochetti & Campadelli 1991), Emilia-Romagna (Ravizza & Ravizza Dematteis 1978, Ravizza 1980, Ravizza Dematteis & Ravizza 1994, Ravizza 2011).

New records. Italy, **Cottian Alps:** Maïra V., Sampeyre Pass, 1400 m, 44.523N, 7.125E, 2.11.1999, 2♂ 2♀ (VIN); Grana V., Pradeleves, 1100 m, 44.412N, 7.234E, 18.09.2003, 1♂ 1♀ (DEL); Vallon del Arma, spr., 1600 m, 44.36N, 7.157E, 6.09.2007, 33♂ 31♀ (VIN). **Maritime Alps:** Roccaforte Mondovi, 1200 m, 44.249N, 7.72E, 13.09.2006, 4♂ 2♀; Chiusa Di Pesio, 1180 m, 44.206N, 7.667E, 11.10.2006, 3♂ 5♀ (DEL). **Ligurian Alps:** Andagna, 850 m, 44.02N, 7.835E, 28.12.1994, 1♂ 2♀; Briga Alta, 1900 m, 44.127N, 7.68E, 10.09.2007, 3♂; Mendatica, 1240 m,

44.096N, 7.749E, 11.09.2007, 11♂ 9♀ (DEL). **Ligurian Apennines:** Pianpaludo, 880 m, 44.467N, 8.58E, 7.04.2015, 3♀ (VIN). **Tuscany:** Cerreto Pass: 1550 m, spr., 44.285N, 10.23E, 2.12.2019, 2♀; 1460 m, 44.286N, 10.228E, 3.09.2020, 4♂ 8♀; 18.10.2020, 4♂ 5♀; 1400 m, spr. + br., 2♂ 4♀; 44.291N, 10.229E, 18.10.2020, 1190 m, 44.298N, 10.218E, 3.09.2020, 2♂ 3♀; Rosario spr., 1630 m, 44.284N, 10.232E, 3.09.2020, 1♀ (VIN); Val di Luce, 1400 m, spr. + br., 44.15N, 10.635E, 4.09.2020, 10♀; 1620 m, spr. + br., 44.124N, 10.635E, 4.09.2020, 15♂ 12♀; Badia Prataglia, spr., 1100 m, 43.802N, 11.866E, 13.10.2014, 3♂ 14♀; Pratomagno, 1300 m, spr. + br., 43.65N, 11.655E, 10.09.2020, 2♂ 1♀ (VIN). **Emilia-Romagna:** Passo Croce Arcana, spr., 1550 m, 44.141N, 10.775E, 19.09.2019, 5♂ 8♀; Passo delle Radici, 1500 m, spr., 44.194N, 10.502E, 3.09.2020, 5♂ 5♀; Tevere spr., Balze, 1300 m, 43.787N, 12.076E, 13.10.2014, 2♂ 2♀ (VIN). **France: Alpes-Maritimes:** Roya V., Tende Pass, spr., 1800 m, 2.09.1988, 42♂ 46♀; spr., 2050 m, 44.155N, 7.626E, 2.09.1988, 28♂ 27♀; spr., 1900 m, 44.146N, 7.588E, 6.09.2007, 6♂ 2♀; Caïros tor., 1000 m, 44.01N, 7.46E, 28.09.1988, 2♂ 6♀; Valmasque V., 2050 m, 13.07.2004, 27♂ 19♀; Bollène Vésubie, 1400 m, 43.977N, 7.376E, 28.09.1988, 10♂ 11♀; 1900 m, 44.097N, 7.362E, 28.09.1988, 4♂ 5♀; Tinée V., 2050 m, 44.19N, 7.026E, 30.08.1988, 1♂ (VIN).

Distribution area and biogeographical notes. *L. boreoni* inhabits the northern Apennines, from the Tevere spring (Balze) to the Ligurian Apennines. It extends westwards into the French Maritime Alps up to the High Tinée Valley (Var trib.) and northwards up to the Maïra valley in the Cottian Alps (Map 9). It inhabits springs and brooks in a wide altitudinal range (850–2100 m). The flight period is mainly in autumn and winter (VIII–XII, IV).

***Leuctra brevipennis* Ravizza, 1978**

(Map 3)

Type locality. Italy, Pennine Alps: Biella, Oro-pa, Furia br., 1200–1300 m, 10.09.1977.

Previous data. Reported only from the Pennine Alps (Ravizza 1978, Ravizza & Ravizza Dematteis 1990).

New records. Italy, Graian Alps: Quincinetto, Scalero, spr., 1900 m, 45.547N, 7.744E, 17.09.2009, 39♂ 36♀; 11.10.2014, 4♂ 3♀; 1500 m, 45.548N, 7.761E, 17.09.2009, 14♂ 12♀; spr., 1375 m, 45.549N, 7.772E, 17.09.2009, 11♂ 9♀; 11.10.2014, 19♂ 28♀ (VIN). **Pennine Alps:** Val Gressoney: Colombit, spr., 850 m, 45.655N, 7.863E, 16.10.2015, 13♂ 7♀; Pillaz, 1200 m, spr., 45.646N, 7.873E, 17.10.2020, 4♂ 4♀; 1380 m, spr. + br., 45.642N, 7.875E, 17.10.2020, 10♂ 10♀; Trovinasse, spr., 1600 m, 45.579N, 7.868E, 26.10.2004, 49♂ 54♀; Andrate, Moschetta, 1500 m, 22.10.2010, 10♂ 2♀ (DEL); Panoramica Zegna, br., 1300 m, 45.669N, 8.055E, 4.11.1990, 3♂ 2♀ (VIN).

Distribution area and ecological notes. The range of *L. brevipennis* extends from the eastern edge of the Graian Alps up to the western edge of the Sesia valley in the Pennine Alps, while its sister species, *L. vinconi*, inhabits the eastern edge of the Sesia valley (Map 3). *L. brevipennis* is strongly crenophilic and inhabits mountain springs and brooklets (850–1900 m). The flight period is in late summer and autumn (IX–XI).

***Leuctra canavensis* Ravizza & Ravizza
Dematteis, 199**

(Map 3)

Type locality. Italy, Graian Alps: Soana V., Ingria, spr. + br. trib. Ingria br., 850 m, 16.10.1989.

Previous data. Italy, Graian Alps (Ravizza & Ravizza Dematteis 1992).

New records. Italy, Graian Alps: Val Soana, Ingria, spr. + br., Soana trib., 950 m, 45.462N, 7.567E, 16.10.2015, 1♂ 4♀ (VIN).

Distribution area and ecological notes. This steno-endemic species is known only from the type locality (Ingria brook in the Soana valley)

(Map 3). Our new data also come from the type locality. This species is probably restricted to this very local area since further collecting trips to the surrounding springs of the same Soana valley and in the neighbouring Ribordone and Malone valleys (southern edge of the Gran Paradiso Massif) did not yield any new findings. It is therefore in great danger of extinction, even if the type locality is not affected by human impacts. It is also interesting to note that in the eastern slope of the same Gran Paradiso Massif (near Quincinetto) occurs *Leuctra brevipennis*, another species of the same *brevipennis* group (Map 3). *L. canavensis* is a crenophilic species occurring in steep crenal and hypocrenal habitats with mosses, aquatic vegetation and surrounding ferns in a dense forest area of moderate elevation range (850–950 m). The flight period is in autumn (IX–XI).

***Leuctra caprai* Festa, 1939a**

(Map 2, Table 3)

Type locality. Italy, Pennine Alps: Montesinaro, Val Chiobbia, Alpe Finestre, 1700 m, 45.715N, 7.971E, August 1938 (Capra leg) (Festa 1939a).

Previous data. Italy, Pennine Alps (Festa 1939a, Ravizza & Ravizza Dematteis 1990).

New records. Italy, Graian Alps: Valchiusella: near Lago Gias del Prete, 2200 m, 45.52N, 7.644E, 1.09.2012, 3♂; 1900 m, 45.522N, 7.65E, 16.08.2015, 6♂ 6♀; Alpe Las, 1700 m, 45.518N, 7.655E, 1.09.2012, 2♂ 1♀ (VIN). Locana, Piantonetto br., 1710 m, 45.479N, 7.373E, 9.09.2008, 1♀ (DEL). **Pennine Alps:** Val d'Ayas: near Frudiere Lake, 2050 m, 45.732N, 7.815E, 27.10.2004, 4♂ 13♀; 14.08.2005, 5♂ 4♀; 1900 m, 45.739N, 7.802E, 27.10.2004, 2♂ 3♀; Val Gressoney: Piatta, spr., 45.637N, 7.827E, 17.10.2015, 1♂ 11♀; Pillaz, 1640 m, spr. + br., 45.651N, 7.905E, 17.10.2020, 6♂ 26♀; 1720 m, spr. + br., 45.65N, 7.911E, 17.10.2020, 18♂ 5♀; Trovinasse, spr., 1650 m, 45.579N, 7.868E, 31.08.2012, 5♂ 1♀ (VIN); Oropa, 1 Km N Santuario, 1340 m, 24.09.2009, 14♂ 18♀ (DEL); Sessera

trib., br., 1300 m, 45.669N, 8.055E, 4.11.1990, 11♂ 32♀; Val Strona, Campello Monti: 2100 m, 45.925N, 8.219E, 13.08.2005, 11♂ 13♀; 1700 m, 45.928N, 8.228E, 11.07.2003, 5♂ 4♀; 12.10.2014, 47♂ 41♀; Sant'Antonio, spr., 2310 m, 45.808N, 7.887E, 29.09.2021, 32♂ 22♀, < Lago Nero, spr., 2640 m, 45.8142N, 7.88E, 29.09.2021, 6♂ 5♀ (VIN). **Switzerland: NE Pennine Alps:** Zwischbergen, spr., 1500 m, 46.149N, 8.103E, 22.08.2018, 1♂; spr., 1500 m, 46.146N, 8.103E, 22.08.2018, 17♂ 24♀; Distrulgrabbe spr., 2030 m, 46.169N, 8.084E, 22.08.2019, 1♂; Guggigrabbe spr., 2060 m, 46.164N, 8.080E, 22.08.2019, 4♂; **Lepontine Alps:** Gondo, Schwarz Balma, spr., 2130 m, 46.22N, 8.118E, 23.08.2019, 4♂ 3♀ (VIN).

Distribution area and ecological notes. *L. caprai*, a steno-endemic species, was known only from the Pennine Alps. In fact, it extends from the eastern edge of the Graian Alps up to the western edge of the Lepontine Alps (Map 2). It is strongly crenophilic and orophilic and inhabits high mountain springs and brooklets (1200–2200 m). The flight period is in summer and autumn (VII–XI). This is the first mention for Switzerland.

***Leuctra concii* Consiglio, 1958a**

(Map 9)

Type locality. Italy, Central Apennines, Lazio, Leonessa, Riofuggio (Tascino trib.), 1070 m, 6.09.1955 (Consiglio 1958a).

Previous data. Italy, Cottian Alps (Vinçon 2012), Maritime Alps (Vinçon 2012), Ligurian Alps (Vinçon 2012, Ravizza, Vinçon & Poggi 2022), Ligurian Apennines (Ravizza 1976b, Ravizza & Ravizza Dematteis 1977, 1983, Vinçon 2012, Ravizza, Vinçon & Poggi 2022), Lombard Apennines (Ravizza 1974b), Toscan Apennines (Vinçon 2012), Northern Apennines: Emilia-Romagna (Ravizza & Ravizza Dematteis 1978, Fochetti & Campadelli 1991, Ravizza Dematteis & Ravizza 1994, Ravizza 2011, Vinçon 2012), Marche (Fochetti & Nicolai 1987a), Central Apennines: Lazio (Consiglio 1958a).

New records. **Italy, Maritime Alps:** Rastello, 1150 m, 44.249N, 7.72E, 13.09.2006, 1♂ 14♀; Chiusa Di Pesio, 1430 m, 44.195N, 7.671E, 11.10.2006, 1♀ (DEL); Limonetto, 1750 m, 44.155N, 7.533E, 18.10.1987, 14♂ 14♀; 2.09.1988, 24♂ 26♀ (VIN). **Cottian Alps:** Ruata, 1140 m, 44.666N, 7.194E, 8.10.2004, 1♂ (DEL); Sampeyre, Colle del Prete Cumbal Cialancia, 1630 m, 16.10.2007, 5♂ 5♀ (DEL). **Ligurian Alps:** Loano, 500 m, 44.168N, 8.219E, 18.02.2010, 1♀ (DEL). **Tuscany:** Cerreto Pass: 1550 m, 44.289N, 10.23E, 2.12.2019, 10♂ 11♀; spr. + br., 1460 m, 44.286N, 10.228E, 18.10.2020, 1♂ 1♀; spr. + br., 1400 m, 44.291N, 10.229E, 18.10.2020, 7♂ 6♀; 1190 m, 44.298N, 10.218E, 3.09.2020, 17♂ 4♀; Rosario spr., 1630 m, 44.284N, 10.232E, 3.09.2020, 8♂ 2♀; Val di Luce: 1400 m, spr. + br., 44.15N, 10.635E, 4.09.2020, 12♂ 7♀; 1620 m, spr. + br., 44.124N, 10.635E, 4.09.2020, 15♂ 11♀; 1700 m, br., 44.122N, 10.628E, 4.09.2020, 10♂ 7♀; Badia Prataglia, spr., 1100 m, 43.802N, 11.866E, 13.10.2014, 21♂ 17♀; Pratomagno, 1300 m, spr. + br., 43.65N, 11.655E, 10.09.2020, 8♂ 5♀ (VIN). **Emilia-Romagna:** Passo delle Radici, 1500 m, spr., 44.194N, 10.502E, 3.09.2020, 13♂ 14♀; Tevere spr., Balze, 1300 m, 43.787N, 12.076E, 13.10.2014, 7♂ (VIN). **Abruzzi:** Pescasseroli, Sangro R., 1200 m (RAV). Prati di Tivo, spr., 1550 m, 42.503N, 13.572E, 14.10.2014, 10♂ 7♀; 9.09.2020, 30♂ 16♀; 1500 m, 42.505N, 13.561E, 14.10.2014, 29♂ 14♀; Pietracamela, spr., 1150 m, 42.517N, 13.549E, 14.10.2014, 1♂; Casale San Nicola, 1100 m, 42.48N, 13.6E, 14.10.2014, 4♂ 6♀ (VIN).

Distribution area and biogeographical notes. *L. concii* has a wide distribution in the central and northern Apennines and extends into the Maritime and Cottian Alps (Vinçon 2012). The species is mentioned here for the first time from the Abruzzi (Map 9). It inhabits preferentially brooklets and springs in a high altitudinal range (400–1750 m). The flight period is in autumn and winter (IX–II).

***Leuctra costai* Aubert, 1953a**

(Table 3, Map 12)

Type locality. Italy, Calabria, Sila Massif, Piccola (Aubert 1953a).

Previous data. Italy, Lazio (Nicolai & Fochetti 1983a), Abruzzi-Molise (Consiglio 1958a, Nicolai 1983b), Campania (Aubert 1954c), Basilicata (Aubert 1954c), Calabria (Aubert 1953a, 1954c), Sicily (Consiglio 1968, Ravizza & Gerecke 1991).

New records. **Italy, Abruzzi:** Gran Sasso Massif: Pietracamela, spr. + br., 1150 m, 42.517N, 13.549E, 14.10.2014, 1♂ 5♀; Prati di Tivo, spr. + br., 1500 m, 42.505N, 13.561E, 14.10.2014, 1♂; Isola del Gran Sasso, 1050 m, 42.48N, 13.595E, 14.10.2014, 3♀; Val Fondillo: spr., 1270 m, 41.749N, 13.865E, 5.09.2020, 1♀; tor., 1300 m, 41.741N, 13.881E, 5.09.2020, 11♂ 9♀; Tornareccia spr., 1140 m, 41.771N, 13.856E, 5.09.2020, 39♂ 13♀; Fondillo R., 1100 m, 41.768N, 13.855E, 5.09.2020, 3♂ 2♀; Maiella: Roccamorice, Santuario Santo Spirito, tor. 1200 m, 42.169N, 14.097E, 12♀; spr., 1300-1400 m, 42.169N, 14.102E, 14.10.2014, 8♂ 19♀ (VIN). **Lazio:** Prati di Mezzo: spr., 1560 m, 41.653N, 13.935E, 29.11.2019, 10♂ 20♀; 5.09.2020, 5♂ 1♀; spr., 1650 m, 41.652N, 13.952E, 5.09.2020, 14♂ 6♀; spr., 1700 m, 41.651N, 13.959E, 29.11.2019, 10♂ 20♀; 5.09.2020, 8♂ (VIN). **Basilicata:** Lagonegro, br., 1340 m, 40.157N, 15.803E, 6.09.2020, 27♂ 11♀; Pollino, spr. + br., Piani di Vaquarro Alto, 1500-1600 m, 39.925N, 16.177E, 7.09.2020, 9♂ 6♀ (VIN). **Calabria: Sila Grande:** spr., 1580-1650 m, 39.32N, 16.401E, 11.06.2020, 1♀; 7.09.2020, 19♂ 8♀; spr., 1650-1700 m, 39.32N, 16.401E, 7.09.2020, 12♂ 11♀; spr., 1780 m, 39.288N, 16.434E, 7.09.2020, 3♂; spr., 1800 m, 39.284N, 16.44E, 7.09.2020, 3♂ 2♀; **Aspromonte:** br., 850-900 m, 38.25N, 15.853E, 7.09.2020, 11♂ 5♀; spr. + br., 1260 m, 38.189N, 15.846E, 7.09.2020, 2♂ 1♀; Montalto, 1870-1890 m, spr., 38.159N, 15.917E, 8.09.2020, 18♂ 16♀; Gambarie, 1420-1450 m, spr. + br., 38.145N, 15.842E, 8.09.2020, 11♂ 8♀; tor., 38.144N, 15.841E, 8.09.2020, 3♂ 3♀ (VIN).

Distribution. *L. costai* is endemic to the southern half of the Apennines and extends into Sicily (Map 12). It is rather common in brooks and springs of various elevations, up to 1890 m in the Montalto Massif (Aspromonte).

***Leuctra cyrnea* Consiglio & Giudicelli, 1965 stat. restit.**

(Map 13)

Leuctra cyrnea cyrnea Consiglio & Giudicelli, 1965: Vinçon & Ravizza 2000b.

Taxonomic note. *Leuctra cyrnea* and *L. incudensis* are now considered as two different sister species (see the following paragraph for *L. incudensis*).

Type locality. France, Corse-du-Sud: Restonica, 1500 m, 42.222N, 9.025E (Consiglio & Giudicelli, 1965).

Previous data. France, Corsica, Haute-Corse (Consiglio & Giudicelli 1965, Vinçon & Ravizza 2000b).

New records. **France, Corsica, Haute-Corse:** Monte d'Oro, Vizzavona, Agnone trib., 1500 m, 42.126N, 9.087E, 13.07.2008, 1♂ (VIN).

Distribution area and ecological notes. This steno-endemic species inhabits the northern and central mountain ranges of Corsica, from Cinto Massif to Monte d'Oro, while its sister species *L. incudensis* Vinçon & Ravizza, 2000b, only occurs in southern Corsica (Map 13). It is strongly crenophilic and orophilic (1100–2000 m). The flight period is in autumn (X).

***Leuctra delmastroi* Vinçon, 2012**

(Map 2)

Type locality. France: Alpes-Maritimes (Ligurian Alps), Marguareis Massif, E. Tende Pass, Perle Pass, 'Vacherie de Valmaurina', Refrei spr., Roya trib., 2050 m, 5.09.2007 (VIN).

Previous data. A small series of specimens of this species, collected in the high Tanaro River valley, were first considered as an isolated population of *Leuctra concii* Consiglio, 1958a, settled on the western limit of its distribution area

(Ravizza & Ravizza Dematteis 1977). Vinçon (2012), however, showed that it did not correspond to *L. concii* but represents a closely related vicariant allopatric new species.

Distribution area and ecological notes. *L. delmastroi* is a steno-endemic species inhabiting the Ligurian Alps (France and Italy), on both slopes of the Saccarello-Marguareis Massif (Ravizza, Vinçon & Poggi 2022) (Map 2). It occurs in brooks and springs of high elevation range (1300–2050 m). The flight period is in late summer and autumn (VIII–IX).

***Leuctra dylani* Graf, 200**

(Map 5)

Type locality. Italy, western Venetian Prealps, Camposilvano, S.E. Rovereto, 45°45.391'N, 11°09.445'E, 1171 m, 15.10.2006 (leg W. Graf & A. Schmidt-Kloiber).

Previous data. Reported only from its type locality (Graf 2007).

New records. Italy, Venetian Prealps: Vattaro, spr. + br., 900 m, 46.011N, 11.214E, 10.10.2008, 26♂ 11♀; San Sebastiano, spr., 1300 m, 45.925N, 11.208E, 10.10.2008, 17♂ 2♀; Folgaria, Molini, br., 800 m, 45.909N, 11.154E, 18.09.2009, 1♂ 1♀; Zoreri, spr., 1000 m, 45.853E, 11.202N, 27.10.2008, 3♂ 1♀; 5.11.2015, 3♂ 2♀; Speccheri, 700 m, spr., 45.767N, 11.128E, 10.09.2020, 3♀; Camposilvano, tor., 1010 m, 45.753N, 11.149E, 18.10.2020, 8♂ 2♀; Camposilvano, spr. + br., 45.757N, 11.158E, 1170 m, 11.09.2008, 9♂ 25♀; 18.10.2020, 9♂ 3♀; Campogrosso: spr., 1320 m, 45.746N, 11.161E, 11.09.2008, 8♂ 9♀; 2.05.2009, 3♂ 7♀; 10.09.2020, 1♀; 18.10.2020, 6♂ 5♀; spr., 1450 m, 11.09.2008, 30♂ 32♀; 5.11.2015, 2♂ 2♀; spr., 1420 m, 45.73N, 11.181E, 10.09.2020, 6♀; 1360 m, spr., 45.725N, 11.175E, 18.10.2020, 2♂ 2♀; spr., 1060 m, 45.716N, 11.183E, 18.10.2020, 4♀; spr., 820 m, 45.735N, 11.201E, 11.09.2008, 11♂ 5♀ (VIN).

Distribution area and ecological notes. *L. dylani* is steno-endemic of the western part of the Venetian Prealps, where it occurs rather widely from the northern part (Folgaria) to the southern part (San Antonio) (Map 5). It is strongly crenophilic and occurs in springs and brooklets of high altitudinal range (800–1450 m). The emergence period is mainly in autumn (IX–XI) but in a large spring near Campogrosso, numerous adults were collected both in September and May.

***Leuctra elisabethae* Ravizza, 1985**

(Table 3)

Morphological notes. *L. elisabethae* is a sister species of *L. hippopus* with which it can be easily confused. It is often brachypterous or even micropterous as it is the case in this locality: SO. Parma, below Passo del Cerreto, near Uglianfreddo ai Cerri, 44.243N, 10.1815E, 700 m, 2.12.2019, 31♂ 23♀ (VIN).

Distribution area and ecological notes. *L. elisabethae* is an Italian endemic species. It is more crenophilic than its sister species *L. hippopus*. It mainly occurs in hilly regions of moderate elevation, reaching its highest localities in the southern Apennines: Aspromonte, below Montalto, 1760–1800 m, spr., 38.1649N, 15.916E, 23.05.2021, 1♂; Sila Grande, spr., 1700–1750 m, 39.292N, 16.445E, 22.05.2021, 4♂ 2♀ (VIN). The adults are very common in winter and early spring.

***Leuctra festai* Aubert, 1954b**

(Map 2, Table 3)

Type locality. Italy, Pennine Alps: Montesinaro, Val Chiobbia, Monte Bo, 2400 m (Capra leg.). The female was described by Ravizza & Ravizza Dematteis (1980a).

Previous data. Italy, Pennine Alps (Aubert 1954b, Ravizza & Ravizza Dematteis 1980a, 1990).

New records. Italy, Pennine Alps: Val d'Ayas, near Frudiere Lake, 2050 m, 45.732N, 7.815E, 13.07.2003, 2♂ 1♀; Valle Gressoney, near Netscio Lake, 2550 m, 45.823N, 7.849E, 20.07.2003, 16♂ 17♀; 2100 m, 45.828N, 7.839E, 20.07.2003, 3♂ 2♀; Sant'Antonio: spr., < Nero Lake, 2630 m, 45.814N, 7.88E, 12.07.2021, 8♂; Lago Verde outlet, 2850 m, 45.8215N, 7.8713E, 29.09.2021, 1♂ 2♀ (VIN). **Switzerland, Pennine Alps:** Distrulgrabbe spr., 2030 m, 46.169N, 8.084E, 8.08.2019, 4♂ 8♀; Guggiligrabbe spr., 2060 m, 46.164N, 8.080E, 22.08.2019, 3♂ 10♀ (VIN). **Lepontine Alps:** Gondo, Innri Alpa, spr., 2130 m, 46.22N, 8.118E, 23.08.2019, 1♀ (VIN).

Distribution area and ecological notes. *L. festai* is a steno-endemic species of the Pennine Alps (Map 2), slightly extensive into the western edge of the Lepontine Alps (Switzerland). Westwards in the Aosta valley, it extends up to the Ayas valley, left tributary of the Dora Baltea. It is a crenophilic and strictly orophilic species, inhabiting brooks and springs of very high elevation (1880–2630 m). The flight period is during the hot season (VI–IX).

***Leuctra fochettii* Vinçon & Vitecek, 2017**

(Map 5)

Taxonomic remark. Closely related to *L. rauscheri*.

Type locality. Italy, western Venetian Prealps, Campogrosso Pass, northern slope, 1300–1350 m, 45.751912°N 11.186812°E, 08.06.2008 (VIN).

Previous data. Italy, western Venetian Prealps (Vitecek et al. 2017).

New records. Italy, Venetian Prealps: above Camposilvano, spr., 1000–1050 m, 45.754N, 11.149E, 27.05.2021, 6♂ 7♀; 14.06.2021, 7♂ 8♀; Campogrosso Pass, spr., 1310 m, 45.745N, 11.161E, 27.05.2021, 4♂ 3♀; 14.06.2021, 5♂ 8♀ 3 larvae; Malga Ravo, spr., 1020 m, 45.7162N, 11.183E, 14.06.2021, 1♂ (VIN).

Distribution area and ecological notes. this steno-endemic species is widely distributed in the western Venetian Prealps, from the hill of Camposilvano and the Fugazze Pass, up to San Sebastiano near Folgaria (Map 5). It is an orophilic, cold-water stenothermal species inhabiting springs and brooks in the highest part of this mountainous region (650–1450 m). The emergence period is mainly in late spring (V–VI), but it also occurs in autumn (IX) in the spring below the water capture (Campogrosso, 1320 m, 45.746N, 11.161E, 11.09.2008).

***Leuctra gardinii* Ravizza, 200**

(Map 2)

Type locality. Italy, Cottian Alps: Sampeyre, Becetto, between Meire Ruà and Prete pass, 1650–1700 m (Gardini leg.).

Previous data. Italy, Cottian Alps (Ravizza 2005, Ravizza & Vinçon 2007).

New records. Italy, Cottian Alps: Sampeyre (C), Serre Superiore, Rio Cantarane, 44°35'50"N 7°12'22"E, 1420 m, 10.02.2017, 2♂ (Gardini leg, RAV).

Distribution area and ecological notes. *L. gardinii* is a steno-endemic, apterous species inhabiting a very restricted area on the southeastern edge of the Viso Mountain range (southern Cottian Alps) (Map 2). It occurs in high altitude cold springs and brooklets (1600–2000 m). The emergence period is in winter (XII–I).

***Leuctra geniculata* Stephens, 1836**

Leuctra geniculata Stephens, 1836.

Euleuctra geniculata: Illies 1966.

Euleuctra geniculata: Zwick 1973.

Leuctra geniculata: Consiglio 1975.

Type locality, Great Britain and Scotland (sec. Illies 1966).

Previous data. Italy, Sardinia: (Consiglio 1957a), Corsica (Consiglio 1957b).

New records. Italy, Liguria: Rialto, SV, loc Calvi, Rio Porra, 190 m, 2.11.2005, 1♂ 1♀; Vezzi Portio, SV, Confluent dei Rio Barelli e l'Arma, 200 m, 2.11.2005, 5♂ 8♀; Rochetta Nervina, IM, tor. Barbaira, 210 m, 22.09.2007 (Delmastro leg., VIN). **Sardinia:** Rio Pirastreddu, 620 m, 03.11.1992, 1 adult, leg. Pau (RAV, MZL, catalogue number: GBIFCH00968742); Gennargentu, rio Correboi, 1150 m, 25.10.1982, 1 adult, leg. Pirrellas. (RAV, MZL, catalogue number: GBIFCH00968741); Gennargentu, spring lo Bruncu Spina, 15.10.1988, 2 adults, leg. Botosaneanu (RAV, MZL, catalogue number: GBIFCH00968744). **France, Corsica:** Cap Corse: Miomo, 260 m, 42.745N, 9.421E, 8.10.1995, 1♀; Figarella, 150 m, 42.743N, 9.432E, 8.10.1995, 1♂; Golo: Ponto Leccia, Francardo, 275 m, 42.394N, 9.184E, 8.10.1995, 14♂ 15♀; Scala di Santa Regina, 600 m, 42.358N, 9.061E, 8.10.1995, 2 exuviae; Vergio Pass, Ciatarrinu br., 130 m, 42.292N, 8.889E, 9.10.1995, 1♂ 2♀; Verghio Pass, Luzzichelli br., 1130 m, 42.264N, 8.844E, 9.10.1995, 1♂; Porto d'Ota, Fium Porto Ota, 50 m, 42.259N, 8.717E, 10.10.1995, 1♂ 1♀; Monte Incudine, Arinella, 1500 m, 41.863N, 9.158E, 11.10.1995, 3♂ 3♀; Plateau de Coccione, 1400 m, 41.812N, 9.138E, 11.10.1995, 3♂; Vaccia Pass, 1100–1250 m, 41.799N, 9.135E, 11.10.1995, 2♂ 1♀; Vaccia Pass, Chiuvonne tor., 1050 m, 41.827N, 9.11E, 11.10.1995, 7♂ 10♀; Aullène, Chiuvonne br., 700 m, 41.761N, 9.076E, 12.10.1995, 3♂ 4♀; Monacia d'Aullène, Bonifacio, Bridge, 220 m, 41.545N, 9.023E, 13.10.1995, 1♂; Pero Longo, S. Sartène, Ortole River, 30 m, 13.10.1995, 4 exuviae; Monte Renoso, Ghisoni, Chigheri tor., 750 m, 42.112N, 9.206E, 15.10.1995, 1♀; Ghisoni, 550 m, 42.104N, 9.244E, 15.10.1995, 1♂ 1♀; Capanelle, Bergeries de Traggette, 1650 m, 42.077N, 9.149E, 15.10.1995, 1♀ (VIN).

Distribution area and biogeographical notes. *L. geniculata* is a west European and Maghrebin species mainly occurring in lowland watersheds, but it is able to reach high elevation brooks in Corsica (up to 1650 m). The adults fly in autumn (IX–X).

***Leuctra grafi* Vinçon & Vitecek, 2017**

(Figures 6l–p, Map 9)

Type locality. Italy, northern Apennines, Tuscany, Apuane Mountains, N.E Carrara, Vinca, 44.133N, 10.179E, 17.07.2007.

Morphological notes. It is a sister species of *L. apennincola* and *L. insubrica* with which it can be easily confused. To help male and female identification, a morphological comparison is provided (Figs. 6a–p).

Previous data. Italy, Northern Apennine: Tuscany (Vitecek et al. 2017).

New records. Italy, Tuscany: Apuane Alps, Vinca, spr. + br., 1180–1210 m, 44.119N, 10.180E, 11.06.2021, 6♂ 14♀; Passo Cerreto: Secchia spr., 1620 m, 44.322N, 10.192E, 30.06.2020, 9♂ 9♀; 11.07.2021, 1♂ 3♀; spr., 1650 m, 44.327N, 10.198E, 30.06.2020, 2♂ 3♀; La Nuda glacial cirque: 1400 m, spr. + br., 44.291N, 10.229E, 6.06.2020, 14♂ 18♀; 30.06.2020, 4♂ 5♀; 11.07.2021, 6♂ 12♀; 1460 m, 30.06.2020, 2♂ 11♀; 18.05.2021, 9♂ 13♀; 11.06.2021, 3♂ 13♀; 11.07.2021, 7♂ 17♀; 10.06.2022, 7♂; Rosaria spr., 1630 m, 30.06.2020, 8♂ 18♀; 3.09.2020, 1♀; Crocetta Hamlet, 1280 m, spr., 44.2975N, 10.2268E, 18.05.2021, 4♂ 7♀; Passo della Pradarena: 1570 m, spr., 44.288N, 10.301E, 18.05.2021, 1♀; 1570 m, spr, 44.282N, 10.304E, 18.05.2021, 4♂ 4♀; 1450 m, spr., 44.27N, 10.318E, 18.05.2021, 6♂ 3♀; Capanne di Sillano, 1070 m, br., 44.254N, 10.31E, 18.05.2021, 3♂ 5♀ (VIN); **Emilia-Romagna:** Passo Lagastrello, spr., 1110 m, 44.356N, 10.156E, 17.05.2022, 1♀; Cerreto Laghi, spr., 1550 m, 44.28N, 10.25E, 11.06.2022, 4♂ 4♀ (VIN).

Distribution area and biogeographical notes. *L. grafi* is restricted to a narrow area in the northern Apennines, from the Lagastrello Pass to the Pradarena Pass, including the Apuane Mountains (Map 9). The mention from the Venetian Prealps (Fochetti 2020) is mistaken. *L. grafi* is a

crenophilic, cold-water stenothermal species, inhabiting springs and brooklets of high altitudinal range (1300–1650 m). The flight period extends from late spring to early autumn (VI–IX).

***Leuctra handlirschi* Kempny, 1898b**

(Map 13)

Type locality. Radstädter Tauern, oberhalb Tauernhauses, Austria (August 1897).

Previous data. Italy, Aubert (1958), Consiglio (1958a, 1961a, 1967b), Nicolai & Fochetti (1983b, 1991a), Fochetti & Nicolai (1985), Ravizza (1974b, 1975a, 1976b), Ravizza & Ravizza-Dematteis (1977, 1978, 1979b, 1983), Ravizza-Dematteis & Ravizza (1994), Ravizza, Vinçon & Poggi (2022). Older mentions of *L. handlirschi* from Italy need to be treated with caution, since confusions with *L. pusilla* or, to a lesser degree, with *L. inermis*, cannot be excluded. Aubert (1958), in his article on the Calabrian stoneflies, notes: “j’ai confondu *L. inermis* avec une autre espèce décrite autrefois par Kempny, *L. handlirschi* qui était en général considérée comme une espèce douteuse; en 1957, j’ai pu montrer que toutes deux sont des formes nettement distinctes”. His confusion probably arises from the fact that some of his specimens probably belonged to *L. pusilla* and not to *L. handlirschi*.

New records. **Italy, Maritime Alps:** Cunico – Pallarea, 800 m, 44.282N, 7.962E, 11.06.2004, 5♂ 2♀ (DEL, VIN). **Cottian Alps:** Maïra V., Sampeyre Pass, 1400 m, 44.523N, 7.125E, 5.07.2004, 4♂ 9♀ (VIN); Bellino, 1420 m, 44.585N, 7.041E, 20.07.2001, 1♂ 2♀ (DEL, VIN); Casalborgone, S. Antonio, 250 m, 45.104N, 7.94E, 9.05.2008, 2♂ 1♀ (VIN). **Graian Alps:** Coassolo Torinese, Vanda, 650 m, 45.309N, 7.472E, 9.06.2004; Balangero, San Biagio, 470 m, 45.28N, 7.476E, 9.06.2004, 3♂ 6♀ (DEL, VIN). **Lombard Prealps:** Brembana V., Bracca, 600 m, 45.827N, 9.711E, 17.05.1973, 7♂ 6♀ (RAV, VIN); NE Brescia, Forno d’Ono, 800 m, 45.774N, 10.371E, 22.04.1999, 1♂ 2♀ (VIN). **Venetian Prealps:** Monte Baldo, St Valentino, br., 1353 m,

45.787N, 10.898E, 7.06.2008, 1♀; Aviana br., 1012 m, 45.766N, 10.911E, 2.06.2008, 1♀; Caldonazzo, br., 600 m, 45.787N, 10.898E, 14.05.2010, 1♀; San-Antonio, spr., 850 m, 45.762N, 11.197E, 29.06.2009, 1♀; Casarotti, tor., 500 m, 45.745N, 11.227E, 13.05.2010, 2♂; Progno di Val Pantana, spr., 440 m, 45.593N, 10.983E, 13.05.2010, 1♀; Passo di Campogrosso: spr., 820 m, 45.735N, 11.201E, 8.06.2008, 1♂ 1♀; spr., 1420 m, 45.73N, 11.18E, 8.06.2008, 1♀ (VIN). **Julian Prealps:** Savogna, spr., 230 m, 46.161N, 13.541E, 21.05.2022, 1♂ (VIN). **Apennines:** **Tuscany:** Vinca, spr., 500 m, 44.14N, 10.146E, 27.06.2016, 1♀; Passo di Cerreto: Secchia spr., 1620 m, 44.322N, 10.192E, 30.06.2020, 1♂ 3♀; 1460 m, spr. + br., 44.286N, 10.228E, 3.09.2020, 1♀; 1400 m, spr. + br., 44.291N, 10.229E, 30.06.2020, 1♂ 1♀; 10.06.2022, 3♂; riv., 1100 m, 44.296N, 10.208E, 30.06.2020, 1♀; 1020 m, 44.28N, 10.202E, 28.06.2016, 3♂ 11♀; Lago del Cerreto, 1450 m, 44.294N, 10.243E, 6.08.2001, 3♂ 2♀; S. Passo delle Radici, 1550 m, 44.2145N, 10.4875E, 30.06.2020, 1♂ 1♀; Abetone, spr. + br., 1360 m, 44.139N, 10.673E, 7.06.2020, 1♂ 2♀; 1.07.2020, 1♀; Reggello, Pratomagno, 1350 m, spr. + br., 43.645N, 11.665E, 8.06.2020, 16♂ 13♀ (VIN). **Emilia-Romagna:** Monte Cimone, br., 1400 m, 44.193N, 10.674E, 1.07.2020, 2♀ (VIN). **Marche:** Monti Sibillini, Casali, spr., 1080 m, 42.9506N, 13.177E, 18.05.2022, 1♂ 1♀ (VIN). **Abruzzi,** Pietracamela, br., 1000 m, 42.522N, 13.550E, 14.06.2020, 1♀; Maiella, spr. + br., 1700 m, 42.1664N, 14.118E, 2.07.2020, 4♂ 1♀; Santuario Santo Spirito, spr., 1350 m, 42.169N, 14.102E, 13.07.2009, 1♂ 7♀; br., 1200 m, 42.169, 14.097E, 1♂ 52♀ (VIN). **Basilicata:** Pignola, Basento, spr., 1250 m, 40.508N, 15.728E, 10.06.2020, 2♂ 2♀ (VIN). **Aspromonte,** 1420 m, spr. + br., 38.144N, 15.842E, 11.06.2020, 4♂ (VIN).

Distribution area and ecological notes. According to Graf et al. (2009), *L. handlirschi* has a wide distribution area in the middle part of Europe, from the Alps to the Carpathians and Balkans, including the whole Italian Peninsula. The mentions from the Carpathians and Balkans, however, are doubtful (Murányi *in litt.*) and

should be checked, since the species is often confused with the less well-known *L. pusilla*, which has a much wider distribution area than previously admitted. *L. handlirschi* occurs more frequently in the lower reaches (200–1500 m). The flight period is in spring and summer (IV–VIII).

***Leuctra hippopus* Kempny, 1899a**

(Table 3)

Morphological note. *L. hippopus* can easily be confused with its sister species *L. elisabethae*.

Distribution area and ecological notes. *L. hippopus* is widely distributed in the West Palearctic. It mainly occurs in hilly regions. In the southern Apennines it is more crenophilic and reaches its highest known locality in Italy, Calabria: Sila Grande, spr., 1720 m, 39.2915N, 16.439E, 22.05.2021, 4♂ 3♀ (VIN).

***Leuctra incudensis* Vinçon & Ravizza, 2000
stat. prom.**

(Map 13)

Leuctra cyrnea incudensis Vinçon & Ravizza, 2000b.

Remarks. Consiglio & Giudicelli (1965, 1966) described *L. cyrnea*, a cold-water stenothermal and orophilic species living in the central range of mountains, in northern Corsica. In the autumn 1995, one of us (Vinçon) collected in many high-altitude sites of Corsica numerous specimens of *L. cyrnea*, but all the ones inhabiting the southern mountain ranges were morphologically dissimilar from those inhabiting the northern ranges. Though the differences between the two taxa were important and stable, without hybridism, we described *L. incudensis* as a subspecies of *L. cyrnea* since at that time we did not know which of the two species was occurring in the contact zone. A complementary investigation was carried out in 2008, confirming that the only species inhabiting the central part of Corsica, around the Monte d'Oro, was *L. cyrnea* and that *L. incudensis* is

restricted to southern Corsica. Since both species are always very stable without hybridism and since they occur just a few kilometers from one another without a firm geographical barrier, we consider that they belong to two different species. The characters differentiating them are of the same degree as those adopted to distinguish other sister species belonging to the same *hippopus* group, for instance *L. hippopus* Kempny, 1899a and *L. elisabethae* Ravizza, 1985 (Ravizza 1985). Therefore, all specimens previously ranged under the name *L. cyrnea incudensis* Vinçon & Ravizza, 2000b, should now be considered as belonging to the species *L. incudensis* Vinçon & Ravizza, 2000b.

Type locality. France, Corsica, Haute-Corse: SW Ghisoni, < Bastani Lake, spr., 1800 m, 42.072N, 9.142E, 15.10.1995 (VIN).

Distribution area and ecological notes. *L. incudensis* is a steno-endemic species inhabiting the southern mountain ranges of Corsica, from Monte Renoso to Monte Incudine (Map 13) (Vinçon & Ravizza 2000b). It is strongly crenophilic and exhibits a wide altitudinal range (550–1900 m). The flight period is in autumn (X).

***Leuctra inermis* Kempny, 1899b**

(Table 3)

Morphological notes. *L. inermis* is closely related to *L. pusilla* with which it has been often confused (see the comments given for *L. pusilla*).

Distribution area and ecological notes. This very common eurytopic species occurs in the whole of the Italian Alps, Apennines and Sicily. Its highest known locality in the Apennines is in Basilicata: Pollino Massif, 1740 m, Frido River, 39.924N, 16.195E, 24.05.2021, 2♂ 2♀ (VIN). In the Italian Alps, its highest known locality is in the Graian Alps, Champorcher Valley, near Lago Muffe, 1900–2100 m, 45.634N, 7.602E, 24.05.003, 2♂ 6♀ (VIN).

***Leuctra insubrica* Aubert, 1949**

(Figures 6a–e)

Morphological notes. *L. insubrica* is a sister species of *L. apennincola* and *L. grafi* and in the past, these 3 species were often confused. To help male and female identification, a morphologic comparison is given (Figs. 6a–p).

Distribution area and ecological notes. *L. insubrica* is endemic to the western and central Italian Alps and Swiss Ticino, extending from the Maritime Alps up to the prealpine mountain ranges westward the Lago di Garda; its easternmost locality known is in Lombardia, E. Vantone, spring and brooklet, 770 m, 45.7483N, 10.5287E, 28.05.2021, 2♂ (VIN). It is a common species very frequent in various mountain watercourses of moderate elevation (700–1700 m) and very scarce at higher elevations; its highest known locality is in the Pennine Alps: Torgnon, Valtournanche trib., 45.866N, 7.561E, 2350 m (RAV). The flight period is mainly in spring (IV–VI) and, exceptionally, also in autumn (X).

***Leuctra juliettae* Vinçon & Graf, 2011**

(Map 5)

Type locality. Italy, western Venetian Prealps, Raossi, Speccheri, 650 m, small river and brook, 11.09.2008.

Morphological notes. *L. juliettae* had previously been confused with its sister species, *L. braueri*.

Previous data. Italy, Venetian Prealps (Vinçon & Graf 2011).

New records. **Italy, Venetian Prealps:** Speccheri, 700 m, spr., 45.767N, 11.128E, 10.09.2020, 10♂ 1♀; Speccheri, 680 m, br., 45.765N, 11.132E, 10.09.2020, 9♂ 2♀; Camposilvano: spr., 1010 m, 45.754N, 11.148E, 10.09.2020, 1♂ 3♀; 18.10.2020, 2♂ 2♀; spr. + br., 1170 m, 45.757N, 11.158E, 18.10.2020, 2♂ 4♀; 27.05.2021, 1♀; Campogrosso Pass, spr., 1320 m, 45.746N, 11.161E, 10.09.2020, 1♂ 11♀; 18.10.2020, 2♂

7♀; spr., 1420 m, 45.73N, 1.181E, 10.09.2020, 1♂ 1♀; spr., 1360 m, 45.725N, 11.175E, 18.10.2020, 1♂ 2♀; 1060 m, 45.716N, 11.183E, 18.10.2020, 2♂ 2♀ (VIN).

Distribution area and ecological notes. *L. juliettae* is a steno-endemic species distributed in a wide range of the western Venetian Prealps scattered from the southern edge of the Campogrosso Pass and Pasubio Massif, to Zoreri (Vinçon & Graf 2011) (Map 5). It occurs in mountain watercourses of different sizes (springs, brooks and torrents), and of moderate altitudinal range (500–1400 m). The flight period is in autumn (IX–X).

***Leuctra ligurica* Aubert, 1962**

(Map 2)

Type locality. Italy, Ligurian Alps: Melogno Pass, 1000 m.

Previous data. Italy, Ligurian Alps and Apennines (Aubert 1962, Ravizza & Ravizza Dematteis 1983, Ravizza Dematteis & Ravizza 1984, Ravizza, Vinçon & Poggi 2022).

Distribution area and ecological notes. *L. ligurica* is a steno-endemic apterous species inhabiting a very restricted area between the Ligurian Alps and Ligurian Apennines (Map 2). It is a crenophilic species occurring in cold springs and brooklets of this hilly region (300–1200 m). The emergence period is in winter and early spring (XII–V).

***Leuctra muranyii* Vinçon & Graf, 201**

(Map 5)

Type locality. Italy, Lombard Prealps: Erba, San Primo Mount, Magreglio, 1400 m, 26.10.2008.

Remark. This species had previously been confused with its sister species, *L. braueri*.

Previous data. Italy, Lombard and Venetian Prealps, Rhaetian Alps (Vinçon & Graf 2011).

New records. Italy, Orobic Alps: Passo San Marco, 1740 m, 46.046N, 9.6425E, 24.09.2021, 7♂ 10♀; spr. + br., 1820 m, 46.058N, 9.63E, 24.09.2021, 5♀ (VIN). **Lombard Prealps:** Val di Concei: 1130 m, spr., 45.954N, 10.747E, 11.09.2020, 2♂ 1♀; 1270 m, tor., 45.95N4, 10.744E, 11.09.2020, 13♂ 10♀; 1400 m, br., 45.959N, 10.7413E, 11.09.2020, 1♀; 1520 m, spr., 45.962 N, 10.75E, 11.09.2020, 4♂ 2♀ (VIN). **Rhaetian Alps:** Livigno, Passo del Foscagno, spr., 2180 m, 46.483N, 10.222E, 24.09.2021, 7♂ 7♀; Passo dello Stelvio, spr., 2030 m, 46.515N, 10.406E, 25.09.2021, 8♂ 12♀ (VIN). **Dolomites:** Madonna di Campiglio, spr., 1700 m, 46.241N, 10.806E, 11.09.2020, 5♂ 4♀; br. > Nero lake, 2260 m, 46.245E, 10.782N, 11.09.2020, 2♂ (VIN).

Distribution area and ecological notes. *Leuctra muranyii* is widespread in both the internal slopes of the Rhaetian Alps as well as in the Lombard and Venetian Prealps (Map 5). Northwards it occurs just beyond the Resia Pass in Austria, in two brooklets belonging to the Inn basin. It also occurs in the Swiss Engadin and Val Müstair (Roesti 2021). It is a crenophilic species inhabiting springs and brooklets of moderate elevation (400–2260 m). The flight period is mainly in autumn (VIII–XI) but exceptionally also in June (Swiss Müstair valley).

Leuctra nigra (Olivier, 1811)

Remarks. The presence of this species in Italy had been questioned when re-establishing the species status of *L. biellensis* (Vinçon, Boumans & Gattolliat 2018). Here we confirm, however, its presence also in the Italian eastern Alps.

New records. Italy, Carnic Alps: N. Maranza, Hexenhütte, br., 1750 m, 46.8562N, 11.6637E, 25.05.2022, 1♂ 6♀; N. Maranza, spring and brook, 1590 m, 46.8345N, 11.6479E, 25.05.2022, 3♂ 1♀ (VIN). **Austria, Carinthia:** S. Bad Vellach, Muri-Quelle, 930 m, 46.4201N, 14.5454 E, 22.05.2022, 12♂ 6♀ (VIN).

Distribution area and ecological notes. In Italy, this species is restricted to the eastern Alps,

close to the Austrian border. It is replaced by its sister species *L. biellensis* in the central and western Alps and in the Ligurian Apennines. In Italy, it is crenophilic and occurs at moderate elevations (1590–1750 m). The flight period is in May.

Leuctra orsiera Ravizza & Vinçon, 2003 stat. prom.

(Map 2)

Leuctra queyrassiana orsiera Ravizza & Vinçon, 2003.

The first author collected in a few high-altitude brooks of the Queyras Massif, on the Western slopes of the French Alps, an abundant series of adult and full-grown nymphal specimens belonging to a new species that was described under the name *L. queyrassiana* Ravizza & Vinçon (1991b). In the autumn of the years 1999 and 2000, Vinçon collected this same species also on the internal slopes of the Cottian Alps in the Pellice valley. In addition, northwards, at lower altitudes in a few springs and brooklets of the Sangone and Susa valleys, he collected a number of adult specimens close to *L. queyrassiana*, but showing morphological differences in both sexes, which were subsequently described as a subspecies named *L. queyrassiana orsiera* Ravizza & Vinçon (2003). Presently, we estimate that these differences in the morphological features of both taxa, occurring in both males and females, are sufficient to raise *L. queyrassiana orsiera* to species rank. We propose, hence, to consider *L. orsiera* as a separate species.

Type locality. Italy, Cottian Alps: Sangone V.: Giaveno, Aquila ski Station, spr., 1200 m, 45.03N 7.267E, 9.10.1999 (VIN).

Distribution area and ecological notes. *L. orsiera*, a steno-endemic species, inhabits the Orsiera Massif between the Chisone and Susa valleys (northern Cottian Alps) Map 2). This strongly crenophilic, cold-water stenothermal species inhabits mountain springs and brooklets (1200–1900 m). The flight period is in autumn (IX–X).

***Leuctra pasquinii* Consiglio, 1958a**

(Map 9)

Type locality. Italy, Abruzzi, Villetta Barrea, Vallone Profluo, 1250 m, 15.10.1955 (Consiglio 1958a).

Previous data. Italy, Ligurian Apennines (Consiglio 1967b sub nom. *L. meridionalis*, Ravizza 1974b, Ravizza, Vinçon & Poggi 2022), Emilia-Romagna (Ravizza & Ravizza Dematteis 1979b, Fochetti & Campadelli 1991), Abruzzi (Consiglio 1958a, Nicolai, Fochetti & Dell'Agata 1988).

New records. **Italy, Emilia-Romagna:** S. Passo del Cerreto, 1200 m, 44.305N, 10.226E, 6.08.2001, 10♂ 5♀; Balze, Tevere spr, 1300 m, 43.787N, 12.075E, 13.10.2014, 2♂ 1♀ (VIN). **Tuscany:** Badia Prataglia, br., 1050 m, 43.802N, 11.866E, 13.10.2014, 1♂ (VIN). **Umbria:** Collemancio, Arone tor., 500 m (RAV). **Abruzzi:** Gran Sasso, Prati di Tivo, spr. + br., 1500 m, 42.505N, 13.561E, 14.10.2014, 1♀; Pietracamela, spr. + br., 1150 m, 42.517N, 13.549E, 14.10.2014, 1♂ (VIN).

Distribution area and biogeographical notes. *L. pasquinii* is an endemic species occurring in the northern and central Apennines from Liguria to Abruzzi (Map 9). It occurs preferentially in brooks and springs of moderate altitude (500–1500 m). The flight period is in late summer and autumn (VII–X).

***Leuctra pseudorosinae* Aubert, 1954a**

(Map 6)

Type locality. Austria: Krenngraben, Enns V., near Admont, 15.04.1949 (Franz coll.).

Previous data. The previous mentions of this species from Italy (Ravizza 2002, Fochetti & Tierno de Figueroa 2008, Fochetti 2020) are based on unpublished data from the Vinçon col

lection. We provide here the first detailed collection sites for Italy.

New records. **Italy, Lombard Prealps:** Riva di Garda, Valle di Concei, spr., 1300 m, 45.957N, 10.744E, 23.04.1999, 35♂ 33♀ (VIN). **Venetian Prealps:** San Sebastiano, spr., 1300 m, 45.925N, 11.208E, 14.05.2010, 1♂ 1♀; Zoreri, spr., 1000 m, 45.853N, 11.202E, 5.04.2009, 2♂ 1♀; Camposilvano, spr., 1200 m, 45.757N, 11.17E, 2.05.2009, 2♀; Fugazze, spr, 1000 m, 45.757N, 11.19E, 5.04.2009, 2♂; Campogrosso Pass, spr., 1310 m, 45.745N, 11.161E, 27.05.2021, 3♀ (VIN). **Dolomites:** Cernadoi - Falzarego, 1650 m, 46.498N, 11.988E, 24.04.1999, 1♂; Falzarego Pass, 1700 m, 46.497N, 11.988E, 23.04.1999, 1♀; S.E. Moso, spr., 1650 m, 46.656N, 12.406E, 24.05.2022, 5♀ (VIN). **Carnic Alps:** Sella Ciampigotto, spr., 1750 m, 46.487N, 12.589E, 22.06.2018, 1♀; Lavardet Pass, 1450 m, 46.5N, 12.637E, 24.04.1999, 3♂ 3♀ (VIN). **Carnic Prealps:** Piancavallo, 720 m, tor., 46.082N, 12.544E, 24.04.1999, 1♂; Preone, Casali Chiampon, spr., 750 m, 46.355N, 12.875E, 5.04.2009, 1♂ 1♀ (VIN). **Julian Alps:** Sella Nevea, 1100 m, 46.395N, 13.494E, 15.05.2010, 1♂ 3♀; br., 1040 m, 46.39N, 13.469E, 24.05.2022, 1♂ 2♀; Zaga, tor., 600 m, 46.307N, 13.418E, 21.04.2008, 7♂ 6♀ (VIN). **Slovenia: Julian Alps:** Predil Pass, 1100 m, 15.05.2010, 1♀; Vrsic Pass: 1300 m, 46.411N, 13.749E, 15.05.2010, 1♂ 2♀; 1390 m, 46.44N, 13.754E, 22.05.2022, 1♂ 3♀; spr., 1300 m, 46.4113N, 13.7515E, 21.05.2022, 5♂ 2♀; spr., 1480 m, 46.4279N, 13.743E, 22.05.2022, 2♂ 2♀; Ukanc, Mala Savica R., 670 m, 46.2899N, 13.8E and Velika Savica R., 760 m, 46.293N, 13.798E, 23.05.2022, 3♂ 7♀ (VIN).

Distribution area and ecological notes. *L. pseudorosinae*, an alpine species, has a wide distribution area in the eastern Italian Alps, from the Lombard Prealps to the Julian Alps (Map 6); it is not known from the western part of the Italian Alps. Its distribution area is mainly located in the northern part of the alpine arc. The species occurs in high altitude brooks and springs (600–1750 m). The flight period is in spring (IV–V).

***Leuctra pusilla* Krno, 1985**

(Map 13, Table 3)

Type locality. Slovakia: Tatra mountains: Abfluss Nizné Temnosmrecinské pleso, 1674 m, 10.07.1981.

Previous data. The first mentions of *L. pusilla* from Italy are recent (Vitecek et al. 2017), but the species was most probably confused with *L. handlirschi* or *L. inermis* in older records, since it shares some morphological features with both. Ligurian Alps and Apennines (Ravizza, Vinçon & Poggi 2022).

New records. **Italy, Cottian Alps:** Maïra V., San Martino, 1400 m, 44.523N, 7.125E, 5.07.2004, 10♂ 4♀; Borgata Selvaggio, br., 1200 m, 44.966N, 7.147E, 24.06.2018, 5♂ 4♀ (VIN). **Dolomites:** Alto-Adige: Val d'Eores, 1800-1900 m, 46.666N, 11.762E, 9.08.1953, 1♂ (sub nom. *L. handlirschi*, Consiglio det, Ravizza leg.); Campo-longo Pass, Alta Badia, 1850 m, 46.521N, 11.874E, 19.07.1999, 26♂ 15♀ (Ravizza leg.) (VIN); **Atesine Alps:** Maranza, spr., 2400 m, 46.8827N, 11.6597E, 19.06.2023, 3♂ 4♀; 2000-2120 m, from 46.8733N, 11.6635E to 46.8743N, 11.659E, 19.06.2023, 2♂ 5♀ (VIN). **Venetie, Dolomites,** Falzarego Pass, 1970 m, br., 46.5177N, 12.0289E, 20.06.2023, 8♂ 8♀ (VIN). **Apennines:** **Tuscany:** Vinca, br., 1250 m, 44.117N, 10.175E, 28.06.2016, 3♂ 4♀; Secchia spr., 1620 m, 44.322N, 10.192E, 11.07.2021, 1♀; Passo del Cerreto, 1400 m, spr. + br., 44.291N, 10.229E, 6.06.2020, 2♂ 2♀; 30.06.2020, 3♀; 1480-1500 m, 11.07.2021, 1♂ 1♀; Passo Croce Arcana, spr., 1600 m, 44.126N, 10.781E, 10.07.2009, 2♀; Melo - Cutigliano, br., 800 m, 44.113N, 10.748E, 10.07.2009, 1♀; Reggello, spr. + br., 850 m, 43.696N, 11.585E, 8.06.2020, 1♂ 1♀ (VIN). **Emilia-Romagna:** Lago del Cerreto, br., 1450 m, 44.294N, 10.243E, 28.06.2016, 8♂; Cerreto Laghi, spr., 1550 m, 44.28N, 10.25E, 11.06.2022, 2♀, Cerreto Pass, spr., 1200 m, 44.305N, 10.226E, 28.06.2016, 1♂; Passo delle Radici, 1430 m, br., 44.197N, 10.501E, 4.06.2020, 1♀; Canevare, spr., 1150 m, 44.211N, 10.746E, 10.07.2009, 1♀; Passo Croce Arcana, spr., 1550

m, 44.141N, 10.775E, 20.07.2009, 6♂ 13♀; Monte Cimone, br., 1400 m, 44.193N, 10.674E, 1.07.2020, 1♂ 1♀; Balze, Tevere spr., 1300 m, 43.787N, 12.075E, 3.07.2020, 2♂ 4♀ (VIN). **Abruzzi:** Prati di Tivo, spr. + br., 1560 m, 42.502N, 13.573E, 14.06.2020, 2♂ 1♀; 1720 m, 42.495N, 13.579E, 14.06.2020, 36♂ 23♀; Arno spr., 1450-1500 m, 42.486N, 13.542E, 26.01.2021, 3♂ 1♀; Val, Fondillo: 1450 m, 41.739N, 13.882E, 12.07.2009, 1♂ 18♀; 9.06.2020, 8♂ 9♀; br., 1200 m, 41.755N, 13.859E, 12.07.2009, 3♂ 6♀; spr. + br., 1300 m, 41.749N, 13.865E, 9.06.2020, 11♂ 23♀; 20.05.2021, 4♂ 1♀; br. > Scanno, 1240 m, 41.866N, 13.893N, 12.07.2009, 1♂ 1♀; Maiella, spr., 1720 m, 42.164N, 14.116E, 13.06.2020, 4♂; S. Maiella, spr. + br., 1280 m, 41.92N, 14.128E, 25.05.2021, 3♂ 1♀ (VIN); **Molise:** Maiella surroundings, br., 780 m, 41.882N, 14.25E, 13.06.2020, 1♀; Sant Angelo del Pesco, br., 750 m, 41.882N, 14.25E, 19.05.2022, 9♂ 12♀; Valle Fiorita, 1250 m, 41.679N, 13.991E, 19.05.2022, 12♂ 7♀ (VIN). **Lazio:** Prati di Mezzo: spr., 1560 m, 41.653N, 13.935E, 9.06.2020, 10♀; 1.07.2020, 3♂ 11♀; 21.05.2021, 1♂ 1♀; Vallerotonda, Collelungo spr., 41.628N, 13.978E, 2.07.2020, 11♂ 15♀; Pescopennataro, Fonte Gelata, 1230 m, 41.8477N, 14.261E, 18.05.2022, 1♀ (VIN). **Campania:** Monte Picentini, N. Giffoni Valle Piana, 850 m, spr. + br., 40.781N, 14.924E, 10.06.2020, 2♂ 10♀; 21.05.2021, 2♂ 6♀; Matese Regional Parc, 1120 m, spr. + br., 41.402N, 14.46E, 13.06.2020, 10♂ 23♀ (VIN). **Basilicata:** Basento, spr. + br., 1150 m, 40.523N, 15.734E, 10.06.2020, 1♂ 1♀; 1250 m, 40.508N, 15.728E, 2♂ 5♀; Lagonegro: br., 1340 m, 40.157N, 15.803E, 10.06.2020, 10♂ 15♀; spr., 1300 m, 40.152N, 15.808E, 22.05.2021, 3♂ 3♀; spr., 1300 m, 40.154N, 15.821E, 10.06.2020, 6♂ 5♀; 22.05.2021, 10♂ 8♀; Fecile hamlet, 980 m, 40.152N, 15.765E, 22.05.2021, 1♂ 3♀; Pollino: 1550 m, spr. + br., 39.925N, 16.177E, 10.06.2020, 10♂ 13♀; 24.05.2021, 6♂ 5♀; 1650 m, spr. + br., 39.916N, 16.177E, 5♂ 9♀; Frido spr., 1910 m, 39.921N, 16.206E, 24.05.2021, 1♂ 3♀ (VIN). **Calabria:** Sila Grande: spr., 1600 m, 39.32N, 16.401E, 11.06.2020, 6♂ 11♀; Cosenza, Rizzuto, br., 935 m, 39.25N, 16.163E, 12.06.2020, 1♀;

Aspromonte, 1420 m, spr. + br., 38.144N, 15.842 E, 11.06.2020, 1♂ (VIN). **France: Maritime Alps:** Caïros, spr., 1600 m, 44.021N, 7.426E, 31.07.2009, 19♂ 20♀; Tende Pass, 1900 m, 44.146N, 7.588E, 4.08.2009, 44♂ 36♀; Perle Pass, spr., 2050 m, 44.154N, 7.626E, 9.08.2009, 10♂ 12♀ (VIN).

Morphological notes. *L. pusilla* is a sister species of *L. handlirschi* and, at a lesser degree, also of *L. inermis*; therefore, it can be confused easily with both.

Distribution area and ecological notes. *L. pusilla*, described from the Tatras Mountain chains, widely extends into the Alps: Austria (Graf coll., not published), Italy and French Maritime Alps. It could also extend into the Balkans and Carpathians, where it could, however, be confused with *L. handlirschi* (Murányi *in litt.*). Moreover, its distribution extends far into the Apennines, up to Calabria (Map 13). A full revision of different Italian collections is required since it is frequently confused with *L. handlirschi* or *L. inermis*. It is a crenophilic species, inhabiting a wide altitudinal range (800–2100 m). Sometimes, it is syntopic with its sister species *L. handlirschi* Kempny, 1898b, which, however, has a lower altitudinal range (200–1500 m). The flight period of *L. pusilla* extends from late spring to summer (V–IX). We here report this species for the first time from France.

***Leuctra queyrassiana* Ravizza & Vinçon, 1991b**

(Map 2, Table 3)

Taxonomic remark. *Leuctra queyrassiana* and *L. orsiera* are presently considered as two distinct sister species (see previous paragraph for *L. orsiera*).

Distribution area and ecological notes. *L. queyrassiana* is a strongly crenophilic and orophilic species, occurring most often above 2000 m on both the French and Italian slopes of the Cottian Alps, where it is rather common in the highest places. Its highest known locality is in France: Queyras Massif, Echalp, above Egourgeou Lake,

Guil trib., 2700 m, 44.7124N, 6.9663E, 4.09.1988, 9♂ 9♀ (VIN); in Italy, its highest locality is in the Cottian Alps: Ribba, Miando bont du col, 2000–2300 m, 44.846N, 7.026E, 29.09.2002, 10♂ 6♀ (VIN).

***Leuctra rauscheri* Aubert, 1957b**

(Table 3)

Morphological notes. *L. rauscheri* is a sister species of *L. ameliae*, *L. fochettii* and *L. teriolensis*.

Ecological notes. It is a very common species occurring in various kinds of mountain water courses above 1000 m. Its highest report is in the Graian Alps: Ceresole Reale, Orco tor., 2500 m (Ravizza & Ravizza Dematteis 1994b). In the Apennines, its highest known locality is in the Abruzzi: Maiella, top of San Spirito Valley, spr., 1700 m, 42.1664N, 14.118E, 13.06.20, 4♂; 2.07.2020, 2♀ (VIN).

***Leuctra ravizzai* Ravizza Dematteis & Vinçon, 1994**

(Map 4, Table 3)

sub nom. Leuctra sesvenna Aubert, 1953c in Ravizza Dematteis & Ravizza (1985, Figs. 3, 4) (the 2 females from High Po valley do not belong to *L. sesvenna* but to *L. ravizzai*).

sub nom. Leuctra helvetica Aubert, 1953c in Ravizza Dematteis & Ravizza (1985, Fig. 22) (several males from High Po valley do not belong to *L. sesvenna* but to *L. ravizzai*).

sub nom. Leuctra sesvenna pro parte in Aubert (1957b, female specimens from Valais: Binn and Ticino: Cristallina).

Type locality. France, Savoie department, La Lenta brook, below Iseran Pass, 45.3978N, 7.0367E, 2300 m, 31.05.1991.

Previous data. Italy, Cottian Alps: Ravizza Dematteis & Ravizza 1985 (sub nom. *Leuctra sesvenna*), Ravizza Dematteis & Vinçon 1994, Ravizza & Vinçon 1998, Malicky, Vinçon & Delmastro 2007).

New records. Italy, Pennine Alps: Sant'Antonio, spr. < Lago Nero, 2630 m, 45.814N, 7.88E, 12.07.2021, 1♂; 26.05.2022, 12♂ 1♀; < Lago Nero, spr., 2480 m, 45.81N, 7.875E, 1♀; Aosta Valley: Valpelline, Comba Arpisson, 2200 m, 45.804N, 7.372E, 20.07.2003, 2♂ 1♀; Val d'Ayas, near Perrin Lake, 2600 m, 45.808N, 7.763E, 19.07.2003, 1♀; Biellese Mts, Rima, Lanciole tor., 1900 m, 45.901N, 7.994E, 1♂ (VIN). **Switzerland: Ticino:** Cristallina, 2300–2500 m, July 1944, 1♀ (Aubert 1957b, sub nom. *Leuctra sesvenna*); Blenio, Brenno della Greina br., 2250 m, 46°36'33 N 8°56'40 E (Roesti Coll.). **Valais:** Binn V, 2300–2500 m, July 1944, 1♀ (Aubert 1957b sub nom. *Leuctra sesvenna*); **Uri,** Furka Pass, 2400 m, 46.5797N, 8.4228E (Roesti Coll.).

Distribution area and ecological notes. *L. ravizai* is distributed over a wide part of the Cottian and Pennine Alps and extends up to the High Ticino and Lepontine Alps (Map 4). It is a crenophilic and strictly orophilic species inhabiting brooks and springs at very high altitudes (1800–2630 m). The flight period is in spring and early summer (V–VII).

***Leuctra rosinae* Kempny, 1900**

(Map 8, Table 3)

Type locality. Italy, Atesine Alps, (Alto Adige, South Tyrol), San Candido-Innichen.

Previous data. Italy, Maritime Alps (Consiglio 1967b), Ligurian Alps (Ravizza & Ravizza Dematteis 1977, Ravizza, Vinçon & Poggi 2022), Cottian Alps (Consiglio 1962a), Ravizza & Ravizza Dematteis 1986, Ravizza Dematteis & Ravizza 1988), Graian Alps (Consiglio 1971, Ravizza & Ravizza Dematteis 1994b), Pennine Alps (Aubert 1954b, Consiglio 1962a, 1971, Ravizza & Ravizza Dematteis 1990), Lepontine Alps (Aubert et al. 1996), Lombard Alps and Prealps (Ravizza 1975a), Rhaetian Alps (Festa 1945, Ravizza & Ravizza Dematteis 1994b), Julian Alps (Fochetti & Nicolai 1985), Atesine Alps (Kempny 1900), Dolomites (Consiglio 1967b).

New records. Italy, Maritime Alps: Ponte Bernardo, 1800 m, 44.316N, 6.98E, 2.11.1999, 3♀ (VIN). **Cottian Alps:** Vallon del Arma, spr., 1850 m, 44.37N, 7.147E, 6.09.2007, 6♂ 4♀; Macra V., spr., 2460 m, 44.419N, 7.143E, 9.08.2020, 4♂ 1♀; 2300 m, 44.426N, 7.143E, 9.08.2020, 8♂ 18♀; Varaita di Bellino, 2100 m, spr., 44.575N, 6.96E, 6.08.2014, 5♂ 1♀; Agnel Pass, 2200 m, 44.669N, 7.009E, 27.09.1988, 1♀; Bobbio Pellice, 2100 m, spr. + br., 44.745N, 7.082E, 21.06.2019, 3♂ 1♀; Ribba, 2300 m, 44.846N, 7.023E, 5.08.2001, 12♂ 4♀; Ghigo, 1500 m, 44.875N, 7.04E, 5.08.2001, 12♂ 5♀; Sestrière Pass, br., 2200 m, 44.964N, 6.864E, 28.09.2002, 5♂ 3♀; Fenestre Pass, 1900 m, 45.082N, 7.057E, 5.08.2001, 8♂ 10♀; 28.09.2002, 2♂ 7♀ (VIN). **Graian Alps:** Borgial, br., 1500 m, 45.202N, 7.297E, 12.08.2005, 1♀; 27.08.2005, 1♂; Valchiusella, < Lago Gias del Prete, 2300 m, 45.52N, 7.644E, 12.07.202, 2♂; 1.09.2012, 1♀; Scalaro, spr., 2000 m, 45.547N, 7.744E, 17.09.2009, 2♂ 2♀; > Lago sup. di Ciamousseretto, spr., 2840 m, 45.49N, 7.262E, 7.08.2020, 6♂ 1♀; < Lago sup. di Ciamousseretto, 2830 m, 45.49N, 7.266E, 7.08.2020, 36♂ 12♀; Valle della Legna, 1400 m, 45.611N, 7.633E, 6.05.2000, 3♂ 3♀; Dondenaz, 2400 m, spr, 45.612N, 7.523E, 11.09.2020, 15♂ 15♀; 2200 m, 45.612N, 7.559E, 7.05.2000, 6♂ 7♀; Lago Vernouille, 2200 m, 45.633N, 7.591E, 24.05.2003, 1♀; > Gran Lago, br., 2600 m, 45.639N, 7.546E, 12.07.2003, 7♂ 3♀; Barbustel Ref., 2240 m, 45.646N, 7.588E, 30.05.2021, 1♂; 2250 m, 45.65N, 7.572E, 30.05.2021, 1♂ 1♀; Gimillan: spr., 1900 m, 45.625N, 7.376E, 23.09.2021, 2♂ 4♀; br., 2370 m, 45.642N, 7.403E, 23.09.2021, 1♂ 8♀; > Corona lake, spr., 2740 m, 45.649N, 7.415E, 12.09.2020, 3♂ 6♀; < Lussert Lake, 2810 m, 45.655N, 7.401E, 12.09.2020, 15♂ 13♀; < Lussert Lake, 2910 m, 45.658N, 7.396E, 12.09.2020, 6♂ 9♀; 23.09.2021, 8♂ 13♀; Valsavaranche, Victor Emmanuel II ref., 2700 m, 45.517N, 7.23E, 14.07.1992, 4♂; Pila, 2300 m, 45.661N, 7.319E, 28.08.2005, 15♂ 31♀ (VIN). **Pennine Alps:** Aosta Valley: Petit St Bernard Pass, 1900 m, 45.705N, 6.915E, 1.06.1991, 2♂ 4♀; Arpisson lake, 2300 m, 45.803N, 7.373E, 52♂ 21♀; Combi di Livournea, 2500 m, 45.88N,

7.51E, 21.07.2003, 31♂ 26♀; 2300 m, 45.892N, 7.503E, 21.07.2003, 19♂ 8♀; Lago Perrin, 2400 m, 45.805N, 7.760E, 14.08.2005, 1♂ 1♀; > Pont-St-Martin, 400 m, 45.605N, 7.806E, 31.03.2000, 1♂; Lago di Frudiere, 2200 m, 45.728N, 7.813E, 18.07.2003, 1♂ 1♀; 1900 m, 45.739N, 7.802E, 27.10.2004, 1♀; Netscio Lake, 2400 m, 45.827N, 7.848E, 20.07.2003, 3♀; Gaby, 1900 m, 45.726N, 7.913E, 19.07.2003, 9♂ 7♀; Val Strona, 1800 m, 45.928N, 8.228E, 13.08.2005, 3♂ 1♀ (VIN). **Rhaetian Alps:** Passo della Spluga, 2000 m, 46.496N, 9.33E, 17.09.2009, 3♀; Passo del Foscagno: spr., 2250 m, 46.5N, 10.205E, 24.09.2021, 2♂ 4♀; spr., 2350 m, 46.4757N, 10.214E, 24.09.2021, 9♂ 8♀; Passo di Gavia: 2700 m, 46.356N, 10.4876E, 24.09.2021, 1♀; Ponte dell'Alpe, br., 2330 m, 46.383N, 10.494E, 24.09.2021, 2♀; Passo dello Stelvio, spr., 2030 m, 46.5152N, 10.4057E, 25.09.2021, 1♀; 25.05.2022, 1♂; spr., 2630 m, 46.5314N, 10.4435E, 25.09.2021, 2♀ (VIN). **Lombard Prealps:** Maggio, 900 m, 45.914N, 9.46E, 22.04.1999, 1♂; Vestone, 800 m, 45.765N, 10.355E, 22.04.1999, 1♂; Valle di Concei, spr., 1300 m, 45.957N, 10.744E, 23.04.1999, 8♂ 3♀ (VIN). **Venetian Prealps:** San-Antonio, spr., 850 m, 45.762N, 11.196E, 2.05.2009, 1♂ (VIN). **Dolomites:** Madonna di Campiglio, 1400 m, 46.208N, 10.754E, 23.04.1999, 1♂, Passo Manghen, 1950 m, 46.17N, 11.44E, 10.10.2008, 5♂ 8♀; **Venetie, Dolomites:** Falzarego Pass, 1970 m, br., 46.5177N, 12.0289E, 20.06.2023, 1♀; Val Popena, 1750 m, 46.5939N, 12.241E, 20.06.2023, 1♀ (VIN). **Carnic Prealps:** Préone, spr., 800 m, 46.355N, 12.875E, 14.05.2010, 1♀; Passo Mauria, 1400 m, 46.424N, 12.521E, 11.10.2008, 2♀ (VIN). **Julian Prealps:** Moggio, Fella R., 300 m (RAV). **Central Apennines:** **Abruzzi:** Maiella, spr., 1720 m, 42.164N, 14.116E, 13.06.2020, 6♂; 2.07.2020, 19♂ 15♀; 25.05.2021, 5♂ 1♀; spr., Santo Spirito V., 1600 m, 42.1642N, 14.1136E, 25.05.2021, 2♂ 4♀ (VIN).

Distribution area and biogeographical notes. *L. rosinae* is the most strongly orophilic species in the Alps (Ravizza & Ravizza Dematteis 1994b) (1200–2910 m). Its presence in a high elevation spring below a water catchment (1720 m), in the Maiella Massif (Southern Abruzzi) is very sur-

prising since it is the only place where specimens of *L. rosinae* were collected in the whole of the Apennines (Map 8). The flight period is very extended (III–XI). The adults are brachypterous in one of the highest alpine places (surroundings of the Ciamousseretto Lake in the Gran Paradiso massif, 2840 m).

Leuctra sesvenna Aubert, 1953c

(Map 5, Table 3)

Morphological remark. Identifications of this species based only on female specimens without corresponding males are very problematic, since the genital plate of *L. sesvenna* is very similar to the one of *L. ravizzai*, inducing several confusions; indeed, the specimens mentioned by Aubert (1957b) from females collected in the Ticino (Cristallina) and Valais (Binn) belong to *L. ravizzai*, according to recent samplings (Roesti in litt.).

Type locality. Switzerland: Grisons: Sesvenna V., Marangun, 2300–2400 m, 21.06.1952 (Aubert 1953c). The female described in this article is wrongly assigned to *L. sesvenna* and belongs to *L. helvetica* Aubert, 1956a. Aubert (1957b) describes the true female of *L. sesvenna*.

Previous data. Italy, Lombardia, Rhaetian Alps (Ravizza Dematteis & Ravizza 1985, Ravizza & Ravizza Dematteis 1994b).

New records. **Italy, Rhaetian Alps:** Piano del Braulio, 2320 m, 46.543N, 10.361E, 2.07.1986, 1♂; Foscagno, 2200 m, 2.07.1986, 1♂ (RAV); Passo di Gavia, Ponte dell'Alpe, br., 2330 m, 46.383N, 10.494E, 15.06.2021, 1♂ 2♀ (VIN). **Switzerland: Grisons:** Fluëla Pass, spr., 2300 m, 46.756N, 9.942E, 29.06.2009, 3♂ 3♀ (VIN).

Distribution area and ecological notes. *L. sesvenna* inhabits only the eastern part of the Swiss Alps and extends into the Italian Rhaetian Alps close to the Swiss border. We consider it as an endemic species of the Italian region since it occurs on both slopes of the huge mountain range extending in the central part of the Alpine arc, on both sides of the Swiss-Italian border (Map 5).

This crenophilic, cold-water stenothermal species inhabits brooks and springs of very high elevation (1900–2600 m). The flight period is in late spring and early summer (VI–VII).

***Leuctra signifera* Kempny, 1899b**

(Map 6)

Type locality. Gutenstein, Austria.

New records. **Italy, Julian Prealps:** Cividale del Friuli, Cepletischis, spr., 600 m, 46.179N, 13.568E, 11.10.2008, 13♂ 13♀ (VIN) (+ 3♂ 3♀ leg to Sivec). **Slovenia:** Kobarid, Breginj, Bela River, 600 m, 46.264N, 13.425E, 11.10.2008, 1♂ 1♀; Stanovisce, Breginj, spr., 46.261N, 13.417E, 650 m, 11.10.2008, 2♀; Kobarid, < Livek, tor., 400 m, 46.220N, 13.590E, 11.10.2008, 1♂ 2♀ (+ 3♂ 3♀ 1 larva leg to Sivec); < Livek, spr., 600 m, 46.211N, 13.592E, 11.10.2008, 4♀ (VIN).

Morphological variability. In the male, the shape of the median process on tergite VIII is somewhat variable, with its two triangular apical extensions more or less widely separated (Reding et al. 2023, Figs. C10–C13). In the Italian and Slovenian females, the subgenital plate has a hardly raised median bulge in lateral view, while this bulge is much more prominent in the Austrian females (Reding et al. 2023, Figs. C9 and C15).

Distribution area and ecological notes. In Italy, *L. signifera* inhabits the eastern edge of the Italian Julian Alps, between the Isonzo valley (Slovenia) and the Po Plain. It also inhabits the other side of this hilly mountain range, in Slovenia (Map 6), and is also found in Hungary (Reding et al. 2023). It occurs in brooks and springs of moderate altitudinal range (400–650 m). The adults fly in late autumn (X). New to the Italian fauna.

***Leuctra silana* Aubert, 1953b**

(Figures 7a–e, Map 11, Table 3)

Remarks. We provide here the first description of the female of *L. silana*, and, complementing a

previous work (Vitecek et al. 2017) adding a comparative study of its 3 sister species: *L. insubrica*, *L. apenninicola* and *L. grafi* (Figs. 6a–p).

Type locality. Italy, Calabria, Sila Grande (Aubert 1953b).

Previous data. Sila Grande (Aubert 1953b, 1958).

New records. Italy, **Calabria:** Sila Grande, spr. + br., 1700–1750 m, 39.292N, 16.445E, 22.05.2021, 1♂ 1♀ (VIN); Aspromonte, < Montalto, 1760–1800 m, spr. + br., 38.1649N, 15.916E and 38.165N, 15.

Description of the female. Sternite VII with wide trapezoidal median sclerite (Fig. 7d), slightly bulged in lateral view (Fig. 7e). Sternite VIII: subgenital plate dark brown with light brown median swelling (Fig. 7e). The two wide posterior lobes have an inner rounded lobule and an outer rounded expansion projecting toward the lateral edges of segment VIII (Fig. 7d). The two lobules touch themselves medially and a narrow membranous field is present between the median bulge and the 2 lobules (Fig. 7e).

Morphological affinities of females. The female subgenital plate (Fig. 7d) is closer to the one of *L. insubrica* (Fig. 6d) and *L. inermis* (Aubert 1957 Fig. 13), with the two strong lobes having a well-defined inner lobe; nevertheless, *L. silana* differs from both by the more pronounced median bulge in lateral view (Fig. 7e, compared to Fig. 6e).

Morphological affinities of males. Aubert (1953b) had separated the adult males of *L. silana* from all remaining species of the *inermis* group by the two teeth present on the posterior edge of tergite X (Aubert 1953b Fig. 43 and Fig. 7a), and therefore assumed that their closest relative is *L. insubrica*, both characterized by the strongly sclerotized inner edges of tergite VIII. However, in *L. insubrica*, these sclerotized edges end in a strong spine (Fig. 6a), which is lacking in *L. silana* (Aubert 1953b Fig. 43 and Fig. 7a). Presently, *L.*



Figure 7. *Leuctra silana* Aubert, 1953b: a = male abdomen dorsal view, b = male abdomen lateral view, c = paraproct and specillum lateral view, d = female abdomen ventral view, e = female abdomen lateral view.

silana appears much closer to two other species, not known by Aubert: *L. apenninicola* and *L. grafi*, which also have two small teeth on the posterior edge of tergite X, though these are less protruding (Ravizza 1988 Fig. 8 and Figs. 6f, 6l).

Distribution area and biogeographical notes. *L. silana* was previously only known from the Sila Grande. Its distribution area covers the whole of Calabria, from Sila Grande to the Aspromonte Massif (Map 11). It is an orophilic and crenophilic species (1300–1800 m). The flight period is in spring (V–VI).

***Leuctra stronensis* sp. nov.**

(Figs. 8a–f, Map 3, Photo 4)

[urn:lsid:zoobank.org:act:81A60FC4-26E7-4C50-8AB0-3FDE7400FA64](https://zoobank.org/act:81A60FC4-26E7-4C50-8AB0-3FDE7400FA64)

Type material. *Holotype* male: Italy, Pennine Alps: Omegna, Val Strona, above Campello Monti, 1700–1800 m, 45.925N, 8.225E, 12.10.2014, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH00660530). *Para-*

types: same locality and date, 3♂ 3♀, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH00660531). **Additional material.** Additional specimens are stored in the collections of Gilles Vinçon (VIN): Italy, Pennine Alps: Val Strona, above Campello Monti, 1700–1800 m, 45.925N, 8.225E, 9.10.1999, 2♀; 12.10.2014, 13♂ 12♀, leg. G. Vinçon.

Diagnosis. Small to medium-sized short winged species. Body length: males 6.3 to 7.2 mm, females 7.4 to 8.2 mm. Males and females brachypterous, wings nearly reaching abdominal segment VIII in both sexes. Body blackish, head and legs dark brown. This species of the *brevipennis* group is a sister species of *L. vinconi* from which it differs in the male by the presence of a digitiform expansion at the tip of the epiproct and a hardly visible vesicle on sternite IX and in the female by the stronger lobules of the subgenital plate lobes and by the lack of rounded vesicle at the base of the two lobules.

Description. Male abdomen (Figs. 8a–c): Tergite VII with slim sclerotized anterior margin

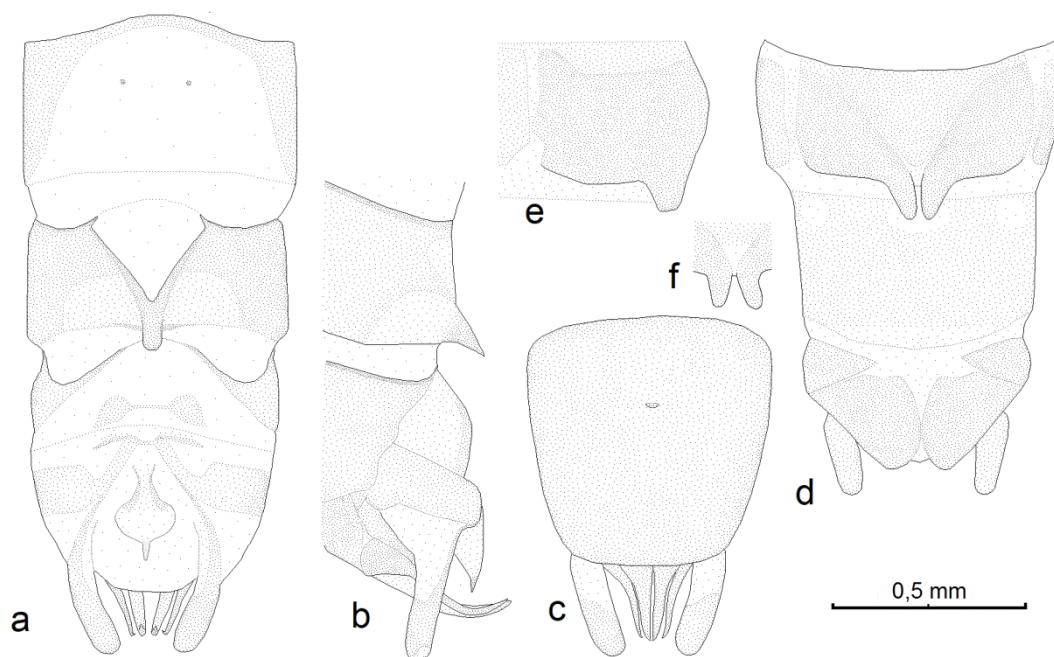


Figure 8. *Leuctra stronensis* sp. nov.: a = male abdomen dorsal view, b = male abdomen lateral view, c = male abdomen ventral view, d = female abdomen ventral view, e = female subgenital plate and lobes lateral view, f = female lobules of the subgenital plate (hybrid specimen).

and wide median bell-shaped membranous area (Fig. 8a). Tergite VIII with median Y-shaped process rose upwards and backwards in lateral view (Figs. 8a–b). Tergite IX with two rounded pigmented spots connected by a narrow strip medially; lateral plates with the inner anterior corners thinned and gently curved inward and forward towards the center of 8th tergite hind margin where they meet themselves, forming a hardly sclerotized, more or less visible, anterior margin. Sternite IX: vesicle hardly visible. Tergite X: posterior margin with deep V-shaped median notch from the center of which the epiproct projects. Epiproct racket-shaped with strong stalk sclerotized on its edges; its rounded membranous tip carries a well-developed finger-shaped apical expansion (Figs. 8a–b). Paraprocts with styles slightly shorter than specilla, styles of paraprocts and specilla strongly curved frontwards in lateral view (Fig. 8b). Cerci normal.

Female abdomen (Figs. 8d–f): Terga I–VII membranous, tergite VIII membranous but with a triangular sclerotized spot on its posterior edge medially. Subgenital plate wide and slightly

bulged medially in lateral view (Fig. 8e), with two wide contiguous posterior lobes each one bearing a sub-triangular lobule on the inner side (Fig. 8d). These two lobules are nearly parallel (Fig. 8d) or diverging (Fig. 8f). Plate and lobes covered by long hairs.

Morphological affinities. *L. stronensis* sp. nov., placed in the *Leuctra brevipennis* group, is a sister species of *L. vinconi* from which it differs by the following features: in the male, the epiproct carries a well-developed finger-shaped expansion (Figs. 8a, 8b), which is lacking in *L. vinconi* (Ravizza & Ravizza-Dematteis 1993a, Fig. 1); the vesicle of sternite IX is hardly visible (Fig. 8c) while it is short but well developed in *L. vinconi* (Ravizza & Ravizza-Dematteis 1993a, Fig. 3). In the female, the two apical lobules of the subgenital plate lobes are parallel, finger-shaped and connected at their base in *L. vinconi* (Ravizza & Ravizza-Dematteis 1993a, Fig. 7) while they are much stronger and clearly separated in *L. stronensis* sp. nov. (Fig. 8d). In *L. vinconi* a small, rounded vesicle is visible on the

hind margin between the two lobes (Ravizza & Ravizza-Dematteis 1993a, Fig. 7), while this vesicle is lacking in *L. stronensis* sp. nov. (Figs. 8d, 8f). In the contact zone of *L. stronensis* sp. nov. and *L. vinconi*, around 1500 m in the Strona Valley, a few males having a reduced expansion at the tip of the epiproct and a few females having slightly dissymmetric lobes on the subgenital plate (Fig. 8f) were found. The species level separation of the two taxa was not supported by analysis of COI sequences (Gattolliat *et al.* 2016), and species status should be confirmed by the study of more genes. These facts are in favour of considering *L. stronensis* sp. nov. as an incipient sister species of *L. vinconi*. Since both species occur in the same valley they cannot be considered as subspecies and are better characterized as ecological sister species. Similar ecological vicariant species also occur in the Pyrenees where *L. alticola* Despax, 1929 is considered as an orophilic sister species of *L. albida* Kempny, 1899a, both occurring in the same mountainous massif at different elevations.

Distribution and ecological notes. *L. stronensis* sp. nov. is known only from the highest watersheds of the Strona Valley, on the eastern edge of the Pennine Alps (Map 3). *L. stronensis* sp. nov. and *L. vinconi* are sympatric but no cohabiting species since they occur in the same Strona valley, that is exceptional in the *Leuctra brevipennis* group where all previously known species are allopatric (Map 3). *L. stronensis* sp. nov. and *L. vinconi* have different ecological preferences, which could explain the origin of *L. stronensis* sp. nov. by orophilic isolation in high elevation springs and brooklets while *L. vinconi* prefers to live in springs and brooklets of the foothills (600–1400 m). *L. stronensis* sp. nov. is a crenophilic and orophilic species, occurring in spring and brooklets (1700–1900 m). The adults emerge in autumn (X).

Derivatio nominis. This species is named after the region where it was collected, namely the Strona Valley. The epithet is formed by adding the Latin toponymic suffix *-ensis* to the place name Strona and is to be treated as an epicene

Latin adjective in the nominative case combined with *Leuctra*.

***Leuctra subalpina* Vinçon, Ravizza & Aubert, 1995**

(Table 3)

Morphological remark. *Leuctra subalpina* is a sister species of *L. alpina*, with which it had previously been conflated (Vinçon *et al.* 1995).

Distribution and ecological notes. *L. subalpina* has a wide distribution area in the western French Prealps up to the Swiss Prealps and the Jura Mountains; it extends into the Italian Maritime Alps and the whole Apennines. It is common in various types of water courses and in a wide range of elevations. Its highest known locality in Italy is in the Maritime Alps: Tende Pass, spr., 1700–1800 m, 44.158N, 7.586E, 13.07.2007, 1♀ (VIN). In the Apennines, its highest locality is in Basilicata: Pollino Massif, Frido River, 1740 m, 39.924N, 16.195E, 24.05.2021, 1♂ 1♀ (VIN).

***Leuctra teriolensis* Kempny, 1900**

(Table 3)

Morphological remark. In the Alps, *L. teriolensis* has often been confused with its two sister species *L. ameliae* and *L. rauscheri*.

Ecological notes. *L. teriolensis* is a crenophilic, orophilic species, very common in the Alps, where it mainly occurs above 2000 m. Its highest known locality in Italy is in the Graian Alp: Gran Paradiso Massif, above Corona Lake, spr., 2740 m, 45.649N, 7.415E, 1♂ (VIN). It has not been recorded from the Apennines.

***Leuctra trecimensis* sp. nov.**

(Figures 9a–g, Map 6, Photos 5, 6)

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Type material. Holotype male: **Italy, Dolomites**, S.E. Moso, Parco Naturale Tre Cime

di Lavaredo, many springs below water captures, trib. Rio Bianco, 1650 m, 46.656N, 12.406E, 24.05.2022, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH01118540). *Paratypes*: same locality and date, 6♀, leg. G. Vinçon (deposited in the MZL, catalogue number: GBIFCH01118541). *Additional material*. Additional specimens (same locality and date, 3♀) are stored in the collections of Gilles Vinçon (VIN).

Diagnosis. Dark brown *Leuctra* species of medium size. Body length of males 5.5 to 6 mm, females 6 to 7 mm. Males and females macropterous. This species is closely related to two Alpine steno-endemic species: *L. festai* Aubert, 1954b and *L. astridae* Graf, 2005 (Styrian limestone Alps, Austria). The males of these 3 species are characterized by tergite VI–VIII with median membranous field but without tergal ornamentations except anterior margin of tergites VI and VII not interrupted in the middle. Tergite VI anterior margin carrying two hardly visible lateral enlargements in both 3 species. Tergite VII similar but anterior margin carrying two more pronounced lateral enlargements somewhat looking like short teeth in *L. trecimensis* (Fig. 9a) and in *L. astridae* (Graf 2005, Fig. 1), not in *L. festai* (Aubert 1957b Fig. 89). *L. trecimensis* differs from *L. astridae* by the lateral lobes of the paraproct, which are dorsally elongated and two and a half times longer than wide in *L. astridae* (Graf 2005, Fig. 2), while they are not dorsally elongated and nearly rounded, as long as wide, in *L. trecimensis* (Fig. 9b, 9c), quite similar to those of *L. festai* (Graf 2005, Fig. 5). The females of *L. trecimensis* are conspicuously different from those of the two sister species; the lobes of the subgenital plate are long, finger-shaped (Figs. 9d–e) and much shorter in *L. astridae* (Graf 2005, Fig. 3) and in *L. festai* (Graf 2005, Fig. 6).

Description. Male abdomen (Figs. 9a–c, 9g): Tergite VI and VII: wide bell-shaped median membranous field. Anterior margin not interrupted in the middle but with a strong median shrinkage between the two enlargements somewhat looking like short teeth. Tergite VIII: anterior margin interrupted for one fourth of the segment

width, inner free parts getting sharper medially. Wide bell-shaped median membranous field between the sclerotized lateral edges. Tergite IX similar, with two dark triangular median spots close to the outer edge (à verifier). Tergite X with wide median trapezoidal notch. Epiproct mushroom-shaped with short rod. Paraprocts: styles clearly shorter than the specilla (Fig. 9b), getting thinner regularly toward their tip, and strongly curved at their tip in lateral view (Fig. 9c); lateral lobes rounded, nearly as long as wide, projecting ventrally (Fig. 9b). Specilla long and thin, with their tip slightly curved dorsally (Fig. 9c), Cerci cylindric, nearly 3 times longer than wide (Fig. 9c). Sternite IX with racket-shaped vesicle about twice longer than wide (Fig. 9g).

Female abdomen (Figs. 9d–f): Sternite I–VI: median sclerite trapezoidal wider than long, two small sclerites close to the anterior margin. Sternite VII: median sclerite trapezoidal longer than wide, extending up to the anterior margin of sternite VIII (Figs. 9d–e). Sternite VIII: subgenital plate nearly rectangular extending backward in two digitiform lobes twice longer than wide and separated by a gap as wide as the width of one lobe (Fig. 9d). Posterior part of the plate with a thin membranous field medially and anterior part of the plate with a strong bulge more visible in lateral view (Fig. 9e). Cerci slightly conic, nearly twice longer than wide (Fig. 9f). Paraprocts normal, nearly triangular-shaped (Fig. 9f).

Affinities. In the *hippopus* group, *occitana* subgroup, it is a sister species of both *L. festai* (Pennine and Lepontine Alps, Italy and Switzerland) and *L. astridae* (Styrian limestone Alps, Austria), differing from them in both sexes as explained in the diagnosis.

Distribution and ecological notes. This species is known only from its type locality in the eastern Dolomites (Tre Cime di Lavaredo Massif), in an intermediate geographical position between the distribution areas of *L. festai* and *L. astridae*. It occurs in the crenal area of a rich network of springs flowing from its north slope on a limestone substratum. The adults fly in spring (V–VI).

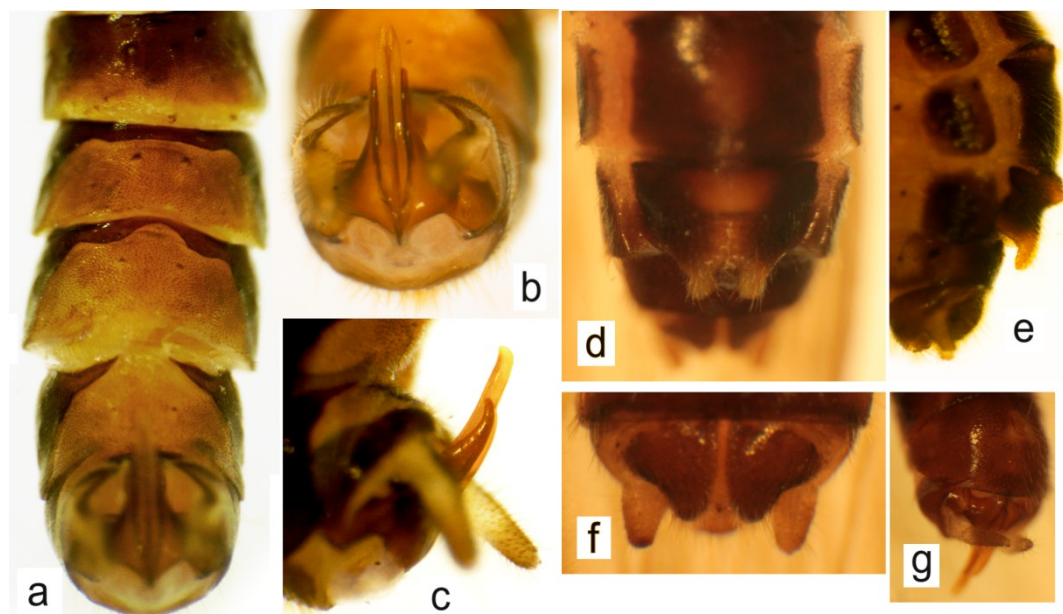


Figure 9. *Leuctra trecimensis* sp. nov.: a = male abdomen dorsal view, b = male abdomen lateral view, c = male abdomen ventral view, d = female abdomen ventral view, e = female abdomen lateral view, f = female paraprocts and cerci ventral view, g = male abdomen 3/4 view.

Derivatio nominis. This species is named after the region where it was collected, namely the wonderful and mythic mount “Tre Cime di Lavaredo” also named “Drei Zinnen”. The epithet is formed by adding the Latin toponymic suffix *-ensis* to the place name Tre Cime and is to be treated as an epicene Latin adjective in the nominative case combined with *Leuctra*.

***Leuctra vesulensis* Ravizza & Ravizza
Dematteis, 1984**

(Map 3)

Type locality. Italy, Cottian Alps, High Po V., Crissolo, Rio Martino, 1380–1400 m, 28.09.1982.

Previous data. Reported only from the Upper Po V. (Crissolo, Oncino, Paesana) (Ravizza & Ravizza Dematteis 1984, Malicky, Vinçon & Delmastro 2007).

New records. **Italy, Cottian Alps:** Brondello, 600 m, 44.594N, 7.393E, 27.12.1994, 1♀ (VIN). Paesana, Pian Muné, 1530 m, 44.637N, 7.240E, 10.10.2005, 7♂ 4♀ (DEL); Montoso, spr., 1200

m, 44.758N, 7.228E, 1.11.1999, 1♂ 1♀; Villaro, spr., 1000 m, 44.751N, 7.248E, 1.11.1999, 29♂ 17♀; Germagnasca V.: Chiotti, spr., 1400 m, 44.903N, 7.053E, 53♂ 32♀; Chiabreno, spr., 1200 m, 44.927N, 7.070E, 28.09.2002, 2♂ 3♀; Combagarino, 1600 m, 44.903N, 7.152E, 28.09.2002, 8♂ 7♀; Chisone V.: Borgata Selvaggio, br., 1300 m, 44.966N, 7.147E, 29.09.2002, 16♂ 17♀; 17.10.2015, 3♂ 1♀ (VIN).

Distribution area and ecological notes. *L. vesulensis* is a steno-endemic species of the Cottian Alps. Its distribution area extends from the Brondello Valley to the Chisone Valley (Map 3). It is a strongly crenophilic, and cold-water stenothermal species, occurring in springs and brooklets of moderate altitudinal range (600–1600 m). The flight period is in autumn and winter (IX–XII)

***Leuctra vinconi* Ravizza & Ravizza Dematteis,
1993a stat. rest.**

(Map 3)

Leuctra vinconi vinconi Ravizza & Ravizza Dematteis, 1993a: Ravizza & Ravizza Dematteis 1994a.

Taxonomic remark. *Leuctra vinconi* and *L. aubertorum* are presently considered as two distinct species (see previous paragraph concerning *L. aubertorum*).

Type locality. Italy, Pennine Alps: N. Varallo, Erbareti, Sabbiola trib., br., 1100 m, 45.879N, 8.234E, 8.10.1990 (VIN).

Previous data. Italy, Pennine Alps: Sesia V. (Ravizza & Ravizza Dematteis 1993a).

New records. **Italy, Pennine Alps:** Colma Pass, br., 850 m, 45.819N, 8.333E, 11.10.2014, 40♂ 26♀; Val Strona, > Campello Monti, br., 1400 m, 45.933N, 8.230E, 12.10.2014, 4♂ 10♀; Rosarolo, spr., 750 m, 45.914N, 8.312E, 10.10.1999, 21♂ 14♀; 12.10.2014, 12♂ 11♀; Omegna, spr., 450 m, 45.884N, 8.393E, 12.10.2014, 4♂ 3♀ (VIN). **Lepontine Alps:** Premeno (NO), Pian del Sole, br., 900 m, 21.10.1991, 1♀; Aurano (NO), val Intrasca, spr., San Giovanni trib., 1000 m, 21.10.1991, 1♂ 1♀ (RAV).

Distribution area and ecological notes. *L. vinconi* is a steno-endemic species inhabiting the eastern part of the Pennine Alps between the Sesia and Toce rivers and part of the Zeda Mount between Lake Maggiore, Toce River and Vigizzo Valley (Map 3). It is a strongly crenophilic species and occurs in a wide altitudinal range (450–1400 m), in crenal and hypocrenal biotopes. The flight period is in autumn (IX–XI).

Leuctra zwicki Ravizza & Vinçon, 1991a

(Map 4)

Type locality. France: Alpes-de-Haute-Provence, Mercantour Massif, Verdon trib., La Foux d'Allos, "La Baume", 1650 m (Ravizza & Vinçon 1991a).

Previous data. Ligurian Alps (Ravizza, Vinçon & Poggi 2022).

New records. **France, Alpes-Maritimes:** Monti, 260 m, 43.817N, 7.487E, 21.09.2007, 4♂ 2♀ (DEL); Clars, spr., 1090 m, 43.747N, 6.74E,

5.01.2022, 11♂ 11♀; Courmes, br., 570 m, 43.753N, 7.005E, 6.01.2022, 1♀ (VIN). **Alpes-de-Haute-Provence:** Lecques Pass, br., 1220 m, 43.875N, 6.464E, 5.01.2022, 4♂ 11♀; La Bâtie, spr. + br., 900 m, 43.817N, 6.594E, 5.01.2022, 1♂ 1♀ (VIN).

Distribution area and biogeographical notes. *L. zwicki* is a pre-alpine species with a wide distribution area scattered along the pre-alpine western range: Italian and French Maritime Pre-alps, southern edge of French Mercantour, Devoluy and Baronnies, Vercors Massif, Chartreuse Massif, up to the Swiss southwestern edge of Jura Massif (Ravizza & Vinçon 1991a, Knispel *et al.* 1998). It occurs in various kinds of brooks and springs on limestone substrate and in a wide altitudinal range (260–1800 m). The flight period is mainly in autumn (VIII–XII).

Capnia nigra (Pictet, 1833)

(Table 3)

Distribution area and ecological notes. This eurytopic species inhabits the whole of the Italian Alps and Apennines. Its highest known locality is in Basilicata, Pollino, spring of Frido River, 1910 m, 39.921N, 16.206E, 24.05.2021, 7♂ 11♀ (VIN).

Capnia vidua vidua Klapálek, 1904a

(Map 8, Table 3)

Type locality. Slovakia, High Tatras, Veľké Hincovo Lake.

Morphological remarks. The specimens collected in the Alps and Apennines differ from the topotypical specimens of the High Tatras by their macropterous males, and by the fact that the slit on tergite 6 is medially widened and angled. The topotypical specimens, on the other hand, have micropterous or strongly brachypterous males, and the slit of tergite 6 is regularly arched. Additional studies are required to ascertain the taxonomical status of alpine specimens of the species.

Previous data. Italy, Cottian Alps (Ravizza & Ravizza Dematteis 1986, Ravizza Dematteis & Ravizza 1988), Graian Alps (Ravizza & Ravizza Dematteis 1994b), Pennine Alps (Ravizza 1974a, Ravizza & Ravizza Dematteis 1990), Lepontine Alps; CH, Ticino (Aubert *et al.* 1996), Lombard Alps (Ravizza & Ravizza Dematteis 1994b, Ravizza 1975a), Carnic Alps (Consiglio 1971), Julian Alps (Fochetti & Nicolai 1985). Ligurian Apennines (Ravizza, Vinçon & Poggi 2022), Central Apennines: Abruzzi (Consiglio 1963b).

New records. **Italy, Cottian Alps:** Bobbio Pellice, 1750 m, 44.752N, 7.081E, 1.04.2000, 3♀; 7.05.2000, 1♂ 2♀; Agnel Pass, 1900 m, 44.657N, 6.991E, 30.04.1990, 1♂; Varaita di Bellino, 2000 m, spr. + br., 44.575N, 6.96E, 30.04.1990, 1♂ (VIN). **Graian Alps:** Champorcher, 1300 m, 45.611N, 7.633E, 31.03.2000, 2♂ 1♀; 1150 m, 45.619N, 7.64E, 31.03.2000, 3♂; Sclararo, 1500 m, 45.548N, 7.762E, 1.05.2009, 1♂; Val di Viu, 1950 m, 45.21N, 7.125E, 7.05.2000, 4♂ 5♀ (VIN). **Pennine Alps:** Rima, 1900 m, 45.9N, 7.994E, 1.06.1991, 1♀; Trovinasse, 1900 m, 45.595N, 7.881E, 24.05.2003, 6♀, Lago di Frudiere, 2050 m, 45.732N, 7.815E, 25.05.2003, 1♀; Estoul, 1850 m, 45.761N, 7.765E, 1.03.2000, 1♂ 2♀; 6.05.2000, 2♀; 25.05.2003, 2♀; 1500 m, 45.763N, 7.744E, 31.03.2000, 2♂; Ayas Valley, 2600 m, 45.902N, 7.763E, 17.06.2023, 6♀; 2440 m, 45.8975N, 7.7625E, 17.06.2023, 1♀ (VIN). **Rhaetian Alps:** Ponte di Legno, Frigidolfo, 1600 m (RAV); Passo di Gavia, 2560 m, 46.35N, 10.496E, 15.06.2021, 1♀; 2530 m, 46.36N, 10.5 E, 15.06.2021, 6♀; Ponte dell'Alpe, br., 2330 m, 46.383N, 10.494E, 15.06.2021, 1♀ (VIN). **Venetian Prealps:** Borgo Valsugana, 1900 m, 46.17N, 11.44E, 14.05.2010, 1♂ (VIN). **Dolomites:** Madonna di Campiglio, 1400 m, 46.208N, 10.754E, 23.04.1999, 1♂ 1♀; 1700 m, 46.24N, 10.807E, 23.04.1999, 3♂; Nambino lake, tor., 2100 m, 46.247N, 10.793E, 28.05.2021, 6♂ 12♀; Serotoli lakes, tor., 2350 m, 46.246N, 10.780E, 14.06.2021, 1♀; Falzarego br., 1700 m, 46.497N, 11.988E, 23.04.1999, 6♂ (VIN). **Carnic Alps:** Sella Ciampigotto, spr. + br., 1750 m, 46.487N, 12.589E, 24.04.1999, 3♂ 4♀ (VIN). **Apennines:** **Tuscany:** Passo del Cerreto, 1500 m, 44.285N, 10.23E, 20.04.2019, 1♂; 18.05.2021, 1♀ (VIN).

Abruzzi: Prati di Tivo, spr., 1550 m, 42.504N, 13.572E, 4.04.2015, 1♂; Arno spr., 1450 m, 42.486N, 13.542E, 26.05.2021, 2♀ (VIN).

Distribution area and biogeographical notes. *Capnia vidua*, represented by several subspecies, has a wide distribution in Europe (Graf *et al.* 2009). In Italy, it observes a scattered distribution over the entire alpine region. In the Apennines, it is known from only two localities of high elevation: glacial cirque (1500 m) near the Cerreto Pass in the central part of the northern Apennines, and Gran Sasso massif (1500 m), in the southern Abruzzi (Map 8). It is a strongly orophilic (1000–2560 m) species, occurring exceptionally also at lower elevations. It inhabits various kinds of watercourses in the Alps. The main flight period is in winter and early spring, but more extended in the highest locations (II–IV–VI).

Zwicknia bifrons (Newman, 1838)

(Map 13)

Remarks. The establishment of the new genus *Zwicknia* Murányi, 2014 and the partial revision of the genus *Capnia* Pictet, 1841 by Murányi *et al.* (2014) have induced important nomenclatural changes in the Capniidae family. Specimens from the West Palearctic, formerly identified as *Capnia bifrons* (Newman, 1838), hence were reassigned to different species of the genus *Zwicknia*. Since the specimens of *Zwicknia* from Italy previously identified as *C. bifrons* cannot be classified in any of the previously known species of *Zwicknia*, they were identified as a new species, named *Zwicknia gattolliati* Vinçon & Reding, 2018. The revision of the specimens labelled *Capnia bifrons* from the Ravizza's collection (RAV), stored in the MZL since 2016, by the last author (Reding 2021), revealed that most of them, as expected, belonged to *Zwicknia gattolliati* (see below), except an isolated, cave dwelling, population of the nominal *Z. bifrons* in the Molise region, in southern Italy (Guglionesi, Grotta dei Gessi, 10.03.1985, 1♂, leg. A. Antonucci, MZL, catalogue number: GBIFCH00899051).

Type locality. Scotland.

Previous data. Italy, Molise (Reding 2021).

Distribution area and ecological notes. In the Italian region, *Z. bifrons* is known only from southern Italy, Molise and probably Apulia (Reding 2021). Its dispersal in the Italian region could have occurred during the Messinian Salinity Crisis (5.96 to 5.33 Ma, desiccation of the Mediterranean Sea), by allowing specimens of *Z. bifrons* to cross the Adriatic Sea from the Balkan Peninsula up to the surroundings of the Gargano Massif (Reding 2021). The flight period is in March.

***Zwicknia gattolliati* Vinçon & Reding, 2018**

(Map 13)

Type locality. Italy, Piedmont, Ligurian Apennines, Tanaro tributaries, Rio Angetta, San Giovanni, near Cherasco, 295 m, 25.02.2015.

Previous data. Italy, Graian and Maritime Alps (Vinçon & Reding 2018, Reding 2021), Ligurian Alps and Apennines (Ravizza, Vinçon & Poggi 2022), Central Apennines, Abruzzi (Vinçon & Reding 2018).

New records. **Abruzzi:** Prati di Tivo, spr. + br., 1550–1580 m, 42.502N, 13.573E, 26.05.2021, 1♀ (VIN).

Distribution area and ecological notes. This species occurs in low elevation brooks and springs in the western Alps while it occurs at much higher elevations in the Abruzzi Massif (1550–1580 m) (Map 13). The flight period is in winter and spring (I–V).

***Capnioneura nemuroides* Ris, 1905 (male); Ris 1913 (female)**

(Table 3)

Ecological note. *C. nemuroides* inhabits various kinds of brooks and springs in the whole Italian Alps, Apennines and Sicily. Its highest known locality is in the Apennines: Basilicata, Pollino Massif, 1740 m, Frido River, 39.924N, 16.195E, 24.05.2021, 4♂ 4♀ (VIN).

STENO-ENDEMIC SPECIES

In this section, we provide a survey of the steno-endemic species of the Italian Plecoptera fauna.

Steno-endemism in the Western Alps. The stonefly fauna of this region comprises 106 species, of which 37 are Italian endemic species and 17 steno-endemic species. The most conspicuous set of steno-endemic species is found in the *Leuctra brevipennis* group, with an array of mostly brachypterous species, disjunctly distributed in the western Italian Alps, from the south-western to the northern ranges: *Leuctra vesulensis* between Stura di Demonte and Chisone valleys (Cottian Alps), *L. canavensis* between Dora Riparia and Dora Baltea valleys (Graian Alps), *L. brevipennis* between Dora Baltea and Sesia (eastern edge of Graian Alps and Pennine Alps), *L. vinconi* and *L. stronensis* sp. nov. between Sesia and Ticino (eastern Pennine Alps). Another species of the same group *L. aubertorum* occurs in the central part of the Alps (see next paragraph) (Map 3). Additional steno-endemic species are also found in a restricted part of the western Italian Alps, from the Ligurian to the Pennine Alps: *Leuctra delmastroi* in the Maritime Alps, *L. gardinii*, *L. queyrassiana* and *L. orsiera* in the Cottian Alps, *Dictyogenus padanum*, *Protoneura pennina* and *Leuctra caprai* in the Graian and Pennine Alps, *Nemoura oropensis* and *Leuctra festai* in the Pennine Alps (Maps 2, 4), *Dictyogenus fontium* in the Pennine Alps (Swiss Valais) and Lepontine Alps (Ticino) (Reding 2024, Figs. J.2, J.3). A similar tendency towards steno-endemism is also observed in the trichopteran fauna, where the genus *Conosorophylax* comprises no less than seven steno-endemics in the Italian western Alps: *C. corvo* Malicky, 2008 in the Maritime Alps, *C. delmastroi* Malicky, 2004 and *C. piemontanus* Botosaneanu, 1967 (in Kimmins & Botosaneanu 1967) in the Cottian Alps, *C. vinconi* Graf & Malicky, 2015 (in Graf et al. 2015) in the Graian Alps, *C. juliae* Oláh & Vinçon, 2021, *C. lagoverde* Oláh & Vinçon, 2022 and *C. lepontiorum* Graf & Vitecek, 2016 in the

Pennine Alps. Casale & Vigna Taglianti (1992) discovered a similarly scattered distribution in their careful study of the ground beetles (Coleoptera, Carabidae) of the Western Alps.

In this western part of the Italian Alps, the most prolific biodiversity hotspots in Plecoptera species are, respectively, the surroundings of the Monte Rosa (Pennines Alps), the Gran Paradiso Massif (Graian Alps) and the surroundings of the Viso Massif (Cottian Alps). Two main ecological factors contribute to the establishment of steno-endemic species in these mountain ranges, of which the most known is 'crenophilic isolation', favoured by a wet climate often inducing species adaptations like apterism or brachypterism (*Leuctra gardinii* and *L. brevipennis* group), as already observed in other humid regions of western Europe: Atlantic Pyrenees (Vinçon & Pardo 1994) and Spanish Cantabrian Cordillera (Vinçon & Ravizza 2000a, Vinçon & Sánchez-Ortega 2002). Another factor favouring steno-endemism is orophilic isolation in high altitude refugia that remained ice-free during the climatic oscillations of the Pleistocene due to their position close to the Po plain.

Steno-endemism in the Central Alp. The stonefly fauna of this region comprises 87 species, of which 23 are Italian endemic species. This central part of the Alps has a wide pre-alpine sector (Lombard Prealps) while in the Western Alps, the pre-alpine sector is narrow, located near the Po Plain at the border of vast mountain ranges, and is widely separated by deep glacier valleys, more favorable for stonefly isolation. Only three steno-endemic species are found in this region: *Leuctra aubertorum* settled in a pre-alpine very restricted area (Map 3), *Dictyogenus nadigi* and *Leuctra sesvenna* orophilic elements occurring in the Rhaetian Alps both in high Valtellina and beyond the Alps in the Swiss Engadine (Map 5). *Leuctra muranyii* covers the central Alps and extends eastwards into the Dolomites (Map 5).

Steno-endemism in the Eastern Alps. The stonefly fauna of this region comprises 98 species, of which 16 are Italian endemics and 8 of them are steno-endemics: *Leuctra trecimensis* sp. nov.

and *Isoperla zwicki* occur in the eastern Dolomites, close to the Austrian border (Map 6); *Protonemura bipartita*, *Leuctra fochettii*, *L. juliettae* and *L. dylani* are restricted to the western Venetian Prealps, a biodiversity hotspot where also occurs a yet undescribed species of *Isoperla*, now disappeared due to a fatal pollution of its habitat; the exceptional richness of this mountainous range can be explained by the fact that it is rather isolated from the rest of the Alps by the Garda Lake and the wide Adige and Brenta valleys. *Dictyogenus julium*, *Protonemura bispina* and *P. julia*, inhabit the Julian Alps and extend eastward into Slovenia or Austria (Map 6).

Steno-endemism in the Northern, Central and Southern Apennines

The richness in stoneflies decreases from north to south along the huge Apennine Cordillera, from 70 species in the Northern Apennines, 61 in the Central Apennines to 56 in the Southern Apennines. This reduction is linked to the decreasing occurrence of Alpine species and probably, at a lesser degree, to increasing dryness and less elevated mountain ranges. However, the number of steno-endemic elements is nearly the same: 5 in the Northern Apennines, 6 in the central part and 5 in the southern part.

Northern Apennines (Map 9). The Ligurian hills, main faunistic barrier between the Alps and the Apennines, is characterized by its own rich insect fauna with the emblematic apterous crenophilic species *L. ligurica* occurring on both sides of the Ligurian depression. The central part of the Northern Apennines is also a biodiversity hotspot for stoneflies, with three further steno-endemic species: *Dictyogenus vinconi*, *Protonemura elisabethae* and *Leuctra grafi* mainly occurring in the highest cold stenotopic biotopes and in crenal regions (Map 9). *Leuctra grafi* is allopatric with two crenal sister species, the Apennine *Leuctra apenninicola* and the South-Alpine *Leuctra insubrica*.

Central Apennines (Maps 8, 10, 12). Six species are steno-endemic of the Central Apennines: *Isoperla oenotriae*, *Taeniopteryx mercuryi*,

Protonemura costai, *P. olahi* sp. n., *Nemoura aprutiana*, and *N. sabina*. Among them, *Protonemura costai* could be considered as an endemic species of the Abruzzi Massif since its occurrence in Calabria is questionable, as explained previously. *Isoperla oenotriae* is also widely present in the whole Abruzzi. In contrast, *Nemoura aprutiana* and *Protonemura olahi* sp. nov. are endemic of the southern part of the Abruzzi, and *Taeniopteryx mercuryi* and *Nemoura sabina* are endemic of the northern part; both are very localized and in danger of extinction.

Southern Apennines (Maps 11, 12. The Southern Apennines are probably the less well investigated territory of the Italian Region, in particular the watercourses belonging to Apulia and in part the Lucan and Calabrian ones. Three species: *Protonemura marilouae* sp. nov., *Brachyptera calabrica* and *Leuctra costai* have their distribution area covering the Southern Apennines and Sicily (Maps 11, 12). Furthermore, five species: *Protonemura consiglioi*, *P. hirpina*, *P. italica*, *Nemoura lucana* and *Leuctra silana* are steno-endemic of the Southern Apennines (Map 11). *L. silana* is the most widespread of them, extending from La Sila to Aspromonte, *P. italica* is up to now only known from two localities in the Sila Massif, *P. hirpina* is known from 2 localities in a very narrow area (Picentini mountains in Campania); *N. lucana* is known from only 2 localities of Basilicata, and *P. consiglioi* seems to be restricted to the mountainous area between Lagonegro and the Pollino Mount. These last four species may be considered as in danger of extinction, since they occur in a narrow distribution area, in regions submitted to higher human impacts on water resources.

Cryptic southern refugia in the Apennines

(Map 8)

Four species widely distributed in the Alps, *Perlodes intricatus*, *Siphonoperla montana*, *Capnia vidua vidua*, *Leuctra rosinae* and one genus, *Dictyogenus* are found to be very disjunctly distributed in high elevation brooks and springs of the Apennines. We list these cryptic

southern refugia (*sensu* Stewart et al. 2010), from north to south:

In the northern Apennines:

- high Parma valley (Lagdei di Corniglio, 1250 m): *Siphonoperla Montana*
- glacial cirque of “La Nuda” (S.E. Cerreto Pass): *Perlodes intricatus*, *Dictyogenus vinconi* and *Capnia vidua vidua*.
- high Lecca valley (Bedonia-Cordolo, 1450 m): *Perlodes intricatus* and *Siphonoperla montana*

In the Central Apennines:

- Marche: Tenna spring: *Perlodes intricatus* and *Siphonoperla Montana*
- Northern Abruzzi, Gran Sasso Massif (Pietracamela - Prati di Tivo): *Perlodes intricatus*, *Siphonoperla montana* and *Capnia vidua vidua*
- Southern Abruzzi, Maiella Massif: *Leuctra rosinae*
- Southern Abruzzi, Val Fondillo: *Siphonoperla montana*

The isolated occurrence of these four widely distributed alpine species and of the genus *Dictyogenus* in the Apennines points to the presence of scattered cryptic refugia (Stewart et al. 2010), mainly located in cold stenotopic mountain ranges that can be assimilated to climatic islands. These species had, probably, a much wider distribution in the Apennines during the climatic oscillations of the Pleistocene, but were forced to retreat in these cryptic refugia at the beginning of the Holocene (Map 8). They will probably become extinct in these refugia in the decades to come, as a consequence of global warming.

Endemism in the island of Sicily and Elba

Sicily. The Sicilian stonefly fauna is closely related to that of the Southern Apennines (Aubert 1957a, Consiglio 1961a, 1961b, 1968, Nicolai 1985, Fochetti & Nicolai 1987b, Ravizza & Gerecke 1991). Presently, the total number of species occurring in Sicily is 28 with 23 in common with the Southern Apennines. This feature may be partly due to the fact that the mountain ridges located in the northern part of the island are

an extension of the Apennine chain and that their separation from the peninsula is a rather recent geological event, explaining the low number of only four steno-endemic species: *Isoperla hyblaea*, *Protonemura helenae*, *P. sicula*, *Leuctra archimedis*.

Isoperla hyblaea may be considered as an insular sister-species of the morphologically closely related *I. rivulorum*, whose distribution area reaches down to the southern Apennines.

Protonemura helenae belongs to the well-studied (Fochetti 1991; Vinçon & Murányi 2009) *Protonemura corsicana* group sensu Aubert (1964), which has a circum-mediterranean distribution, and includes the Corsican *P. bucolica* and *P. corsicana*, as well as the Sardinian *P. ichnusae*. Since these species predate the Apennine orogeny (Nicolai 1985), the presence of *P. helenae* in Sicily must be considered as a result of a subsequent speciation.

Moreover, the Sicilian stonefly fauna is also partly related to the Maghrebin fauna with two species in common: *Protonemura ruffoi* (see above) and *Nemoura fulviceps*; this last one having a west mediterranean distribution area extending over the Iberian Peninsula (Tierno de Figueroa et al. 2003), Morocco (Errochdi, Vinçon & El Alami 2014), Algeria (Lounaci & Vinçon 2005) and Sicily (Ravizza & Gerecke 1991).

Elba. In the island of Elba, belonging to Tuscany, lives the steno-endemic species *Isoperla ilvana*.

INSULAR ENDEMISM OF THE CORSO-SARDINIAN MICROPLATE

Sardinia and Corsica have a peculiar stonefly fauna wholly different from the one of the Alps, the Apennines as well as Sicily (Consiglio 1956, 1957a, 1957b, 1975, Consiglio & Giudicelli 1965, Giudicelli 1967, Ravizza 1975b, Fochetti & Nicolai 1987b, Fochetti & Vinçon 1993, Vinçon & Ravizza 2000b, Ruffoni 2019). Corsica is

already known for possessing an extremely high proportion of endemic aquatic insects (Giudicelli 1975). The complicated tectonic history of the Corso-Sardinian microplate is outlined in Gattolliat et al. (2015), identifying its insular endemics mostly as species whose origin is to be placed before the Alpine and Apennine orogenies, since the separation of the Corso-Sardinian microplate from the European continent occurred some 30 Mya (Fochetti et al. 2004).

The present Sardinian-Corsican Stonefly fauna comprises, therefore, almost only endemics, except, perhaps, the insular variety of *Xanthoperla apicalis* (ssp *hamulata*), *Brachyptera auberti* and *Leuctra geniculata*.

The six steno-endemic species mentioned from Corsica are rheophilic and orophilic elements: *Isoperla kir*, *Protonemura bucolica*, *Pr. corsicana*, *Leuctra cyrnea*, *L. fraterna* and *L. incudensis*. Four additional species, *Isoperla insularis*, *Leuctra budtzi*, *Tyrrhenoleuctra zavattarii* and *Capnioneura petricola* occur in both Corsica and Sardinia. Two more steno-endemic rheophilic species occur in Sardinia: *Protonemura ichnusae* and *Leuctra annae*.

OROPHILIC STONEFLIES AND ALTITUDINAL RANGES IN THE ITALIAN ALPS AND APENNINES (Table 3)

In this section, we provide a comparative chart of the highest altitudinal reports for selected Plecoptera species from the Italian Alps and Apennines over a period of 30 years.

Compared to recent data (2020 to 2023), the highest collecting sites for Plecoptera recorded in former studies (Ravizza & Ravizza Dematteis 1994b; Fochetti & Tierno de Figueroa 2008, Appendix I) are shown to be consistently located at lower altitudes (Table 3).

For the Alps, the data are limited to species found above 2500 m and above 1700 m for the Apennines.

Table 3. Altitudinal limits of orophilic stoneflies in the Italian Alps and Apennines. Data in bold characters are quoted from Ravizza & Ravizza Dematteis (1994b), those in italic from Fochetti & Tierno de Figueroa (2008). Questionable data are marked by a ?, and are explained below. Previous reports of *D. fontium* in Italy refer to *D. padanum*.

Alps (>= 2500 m)			Apennines (>= 1700 m)		
	Previous Alpine data	Recent data		Previous Apennine data	Recent data
<i>L. rosinae</i>	2780	2910	<i>P. ruffoi</i>	<i>1700</i>	1910
<i>Pl. intricatus</i>	<i>2700</i>	2850	<i>B. calabrica</i>	<i>1650</i>	1910
<i>D. padanum</i>		2850	<i>N. cinerea selene</i>		1910
<i>L. festai</i>	<i>2400</i>	2850	<i>L. pusilla</i>		1910
<i>P. brevistyla</i>	2600	2840	<i>C. nigra</i>		1890
<i>D. nadigi</i>		2760	<i>P. marilouae</i>	<i>1450</i>	1890
<i>N. mortoni</i>	2500	2780	<i>L. costai</i>	<i>1750</i>	1890
<i>I. rivulorum</i>	2300	2740	<i>I. saccai</i>	<i>1750</i>	1800
<i>L. teriolensis</i>	2350	2740	<i>N. palliventris</i>		1800
<i>L. queyrassiana</i>	<i>2700</i>	2700	<i>L. elisabethae</i>	<i>1250</i>	1800
<i>L. sesvenna</i>	2700	2700	<i>L. silana</i>	<i>1250</i>	1800
<i>L. caprai</i>	<i>1850</i>	2640	<i>L. subalpina</i>	<i>1450</i>	1800
<i>P. lateralis</i>	2600	2630	<i>P. caprai</i>		1750
<i>N. sinuata</i>	<i>2250</i>	2630	<i>L. apenninicola</i>	<i>1700</i>	1750
<i>L. ravizzai</i>	<i>2400</i>	2630	<i>R. neglecta</i>	<i>1650</i>	1740
<i>R. harperi</i>		2600	<i>P. tyrrhena</i>	<i>1600</i>	1740
<i>C. vidua vidua</i>	2500	2560	<i>N. hesperiae</i>	<i>1540</i>	1740
<i>N. undulata</i>	<i>2000</i>	2550	<i>L. inermis</i>		1740
<i>L. armata</i>	<i>2530</i>	2532	<i>C. nemuroides</i>	<i>1500</i>	1740
<i>S. montana</i>	2300	2500	<i>L. hippopus</i>	<i>1600</i>	1720
<i>P. nimborella</i>	2350 <i>2900 ?</i>	2500	<i>S. italica</i>		1700
<i>P. nimborum</i>	2500	2500	<i>L. rauscheri</i>		1700
<i>N. minima</i>	2300	2500	<i>L. rosinae</i>		1700
<i>L. rauscheri</i>	2500	2500			
<i>D. fontium</i>		2500			

Table 3 exhibits that nearly all orophilic species reported here have presently been found at higher altitudes than those previously recorded (Ravizza & Ravizza Dematteis 1994b, Fochetti & Tierno de Figueroa 2008).

These findings are in tune with many recent studies of the effects of global warming on aquatic insects in alpine regions (Niedrist & Füreder 2021, 2023), and show that even the Plecoptera species living at high altitudes are now also caught in what is called the “summit trap” (Sauer et al. 2011; Sheldon & Grubbs 2014). To compensate for the rising water temperatures induced

by the effects of global warming, orophilic and crenophilic Plecoptera are forced to migrate to ever cooler aquatic biotopes, which are only found at ever higher altitudes. But this cycle eventually comes to a halt once the most elevated aquatic biotopes are reached.

We have also noted that the effects of global warming have had, up to now, a greater impact in the Apennines than in the Alps. Several species occurring both in the Alps and Apennines already reach their altitudinal limits in the Apennines (*Rhabdiopteryx neglecta*, *Nemoura palliventris*, *Leuctra elisabethae*, *L. hippopus*, *L. subalpina*,

Capnioneura nemuroides, *Capnia nigra*), which is probably linked to the more severe impact of global warming in the drier and less elevated parts of southern Italy.

RESULTS

A total of 191 species of Plecoptera representing 7 families and 23 genera are presently recorded from the Italian region.

Four new species are described in the present study: *Protonemura olahi* sp. nov. from the southern edge of the Abruzzo Massif, *Protonemura marilouae* sp. nov. from Calabria and Sicily, *Leuctra stronensis* sp. nov. from the Pennine Alps and *L. trecimensis* sp. nov. from the Dolomites in the eastern Alps.

Comparative descriptions are given for 4 sister species belonging to the *P. consiglioi* group: *P. marilouae* sp. nov., *P. olahi* sp. nov., *P. consiglioi* Aubert, 1953b and *P. hirpina* Consiglio, 1958b. The hitherto unknown females of *Protonemura hirpina* and *Leuctra silana* are also described.

In the last few years, 8 additional species occurring in the Italian region have been described in separate studies: *Protonemura bispina* Vinçon, Ravizza & Reding, 2021 (eastern Italian Alps), *P. pennina* Vinçon, Ravizza & Reding, 2021 sp. nov. (western Italian Alps), *Nemoura aprutiana* Vinçon & Ruffoni, 2021 (Abruzzi), *Perla ravizzorum* Reding, 2023, *Dictyogenus julium* Reding, 2024 (Julian Alps), *D. nadigi* Reding, 2024 (Rhaetian Alps), *D. padanum* Reding, 2024 (Graian, Pennine and Lepontine Alps) and *D. vinconi* Reding, 2024 (northern Apennines).

Perla bipunctata Pictet, 1833, *P. grandis* Rambur, 1842, *Dictyogenus alpinum* (Pictet, 1841) and *D. fontium* (Ris, 1896) were redescribed (Reding 2023 and 2024).

The taxonomical status of 4 taxa is upgraded from subspecies to species level: *Protonemura padana* Vinçon & Ravizza, 2005, *Leuctra aubertorum* Ravizza & Ravizza Dematteis, 1994a, *L.*

orsiera Ravizza & Vinçon, 2003 and *L. incudensis* Vinçon & Ravizza, 2000b.

Protonemura beatensis robusta Berthélemy, 1963 is declared to be a synonym of *P. salffii* (Aubert, 1954c) and three species previously reported from Italy are removed from the Italian region: *Isoperla oxylepis oxylepis* (Despax, 1936), *Protonemura beatensis* Despax, 1929 and *Leuctra marinettiae* Ravizza & Vinçon, 1989.

Nemoura banatica Kis, 1965 is restored as a valid species widely distributed in the West Palearctic.

Several of the species mentioned in our catalogue are also new for adjacent countries: *Protonemura austriaca* Theischinger, 1976, *Nemoura banatica* Kis, 1965, *N. rivorum* Ravizza & Ravizza Dematteis, 1995 and *Leuctra caprai* Festa, 1939a are new for Switzerland. *N. banatica* and *N. rivorum* are new for Slovenia and Austria, *Siphonoperla italica* (Aubert, 1953b), *N. banatica* and *Leuctra pusilla* Krno, 1985 are new for France.

For many species, their known distribution area is widely enlarged, and is illustrated by distribution maps.

CONCLUSION

Even if the Alpine and Apennine stonefly fauna is presently reasonably well explored and documented in numerous studies, there are probably many more steno-endemic species that await to be discovered and described. For several of them, however, it may already be too late, and they will have become extinct before even being discovered and described (Audisio 2017). These remarks particularly apply to the less well investigated regions, such as the southern part of the Italian peninsula, from where several steno-endemic species, such as *Taeniopteryx mercuryi*, *Nemoura lucana*, *N. sabina*, *Protonemura hirpina*, *P. italica*, and *P. olahi* sp. nov., presently in great danger of extinction, are already known. Moreover, we have noted that most orophilic species

reported here now live at higher altitudes than those recorded some 30 years ago.

Another issue, complicating the delimitation of the genetic identity of steno-endemic species, is the fact that many, even common species, have become reproductively isolated in crenal habitats during the climatic oscillations of the Pleistocene, and have started to diverge from ancestral lineages, and have evolved into separate species, often hardly separable from their ancestors by morphological analysis and COI divergence. Typical examples are *Protonemura bispina* and *P. pennina*, obviously related to the much more widely distributed *P. auberti* (Vinçon et al. 2021). During the postglacial recolonization process, or as a result of global warming, the secondary contact between these formerly fragmented populations then likely produces hybrids, especially in the Alps (Schmitt 2007), and further complicates their morphological identification (Vinçon et al. 2021).

Finally, we may also point out that, due to the high number of rare steno-endemic species in the Italian region, and the taxonomic revisions mentioned in the present article, the initiative for compiling a barcode catalogue of the Plecoptera for this region will meet additional hurdles (Laini et al. 2024).

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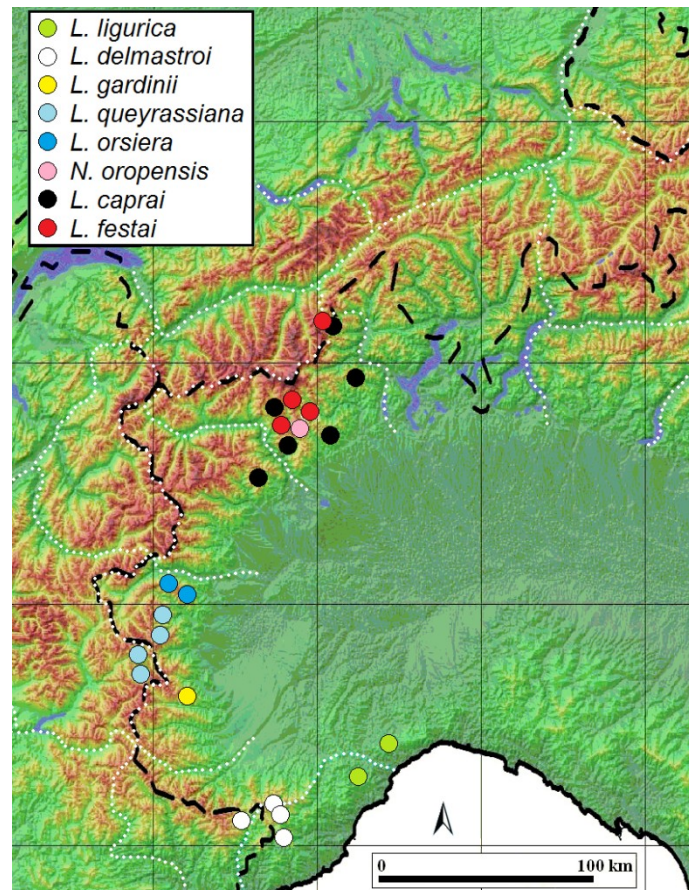
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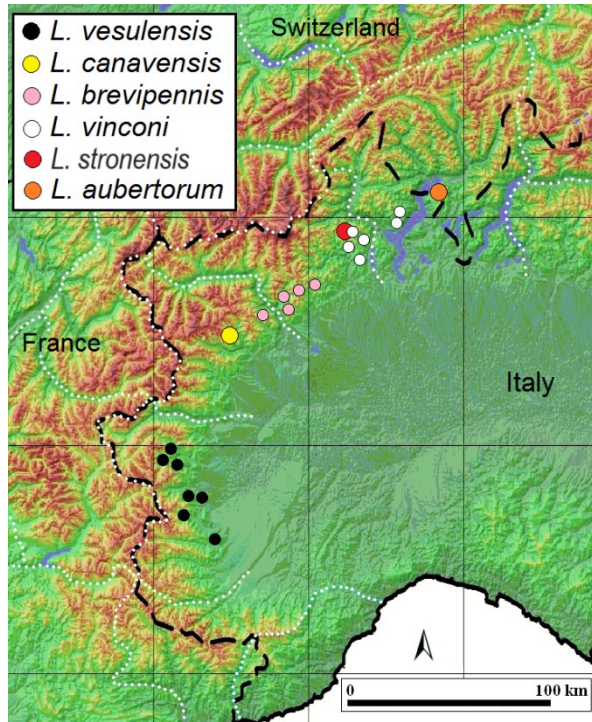
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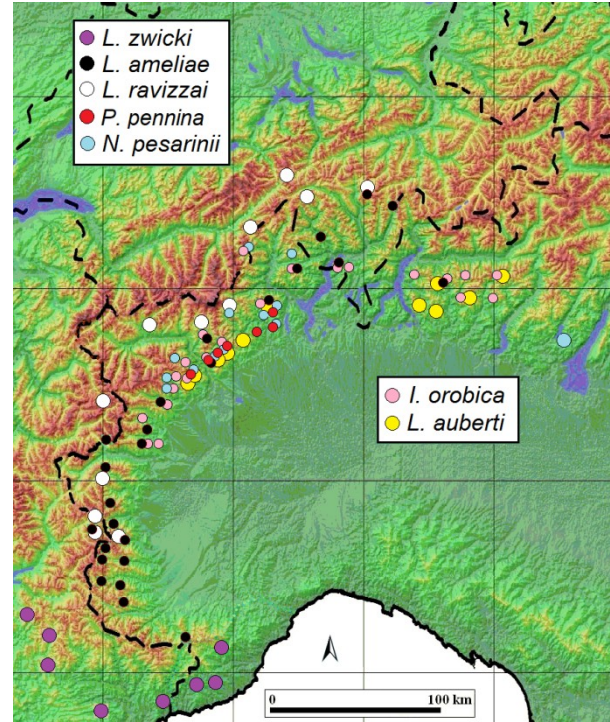
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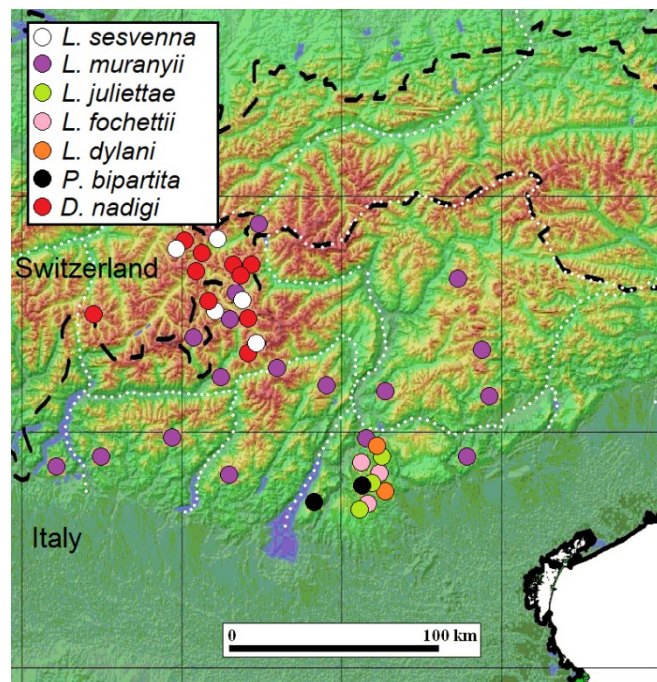
Map 2. Steno-endemic species in the western Alps, from southwest to northeast: *Leuctra ligurica*, *L. delmastroi*, *L. gardinii*, *L. queyrassiana*, *L. orsiera*, *Nemoura oropensis*, *Leuctra caprai*, *L. festai*.



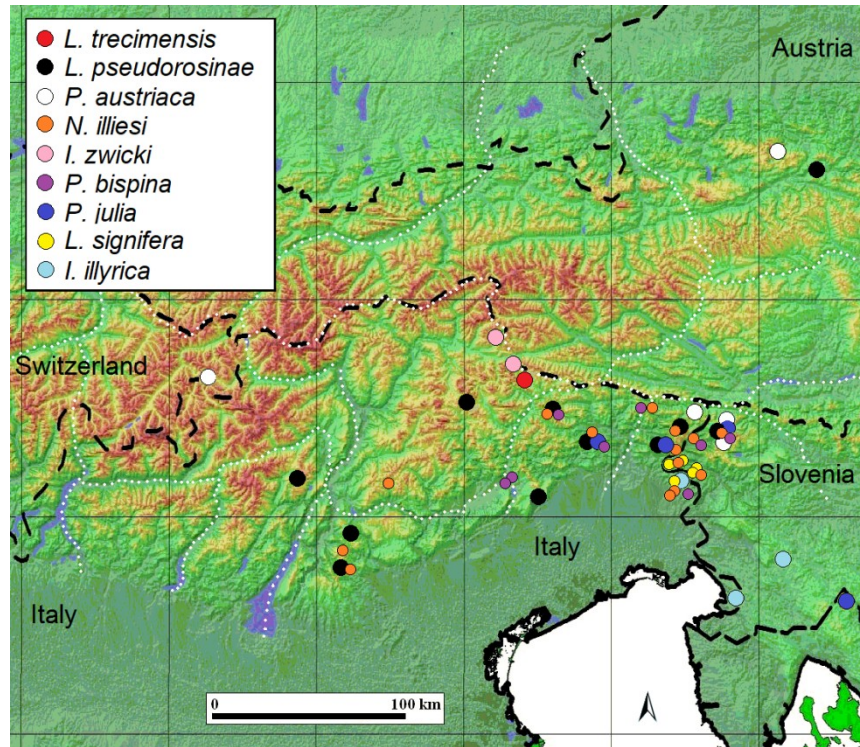
Map 3. Steno-endemic species of the *brevipennis* group in the western Alps: from southwest to northeast: *Leuctra vesulensis*, *L. canavensis*, *L. brevipennis*, *L. vinconi*, *L. stronensis* sp. nov., *L. aubertorum*.



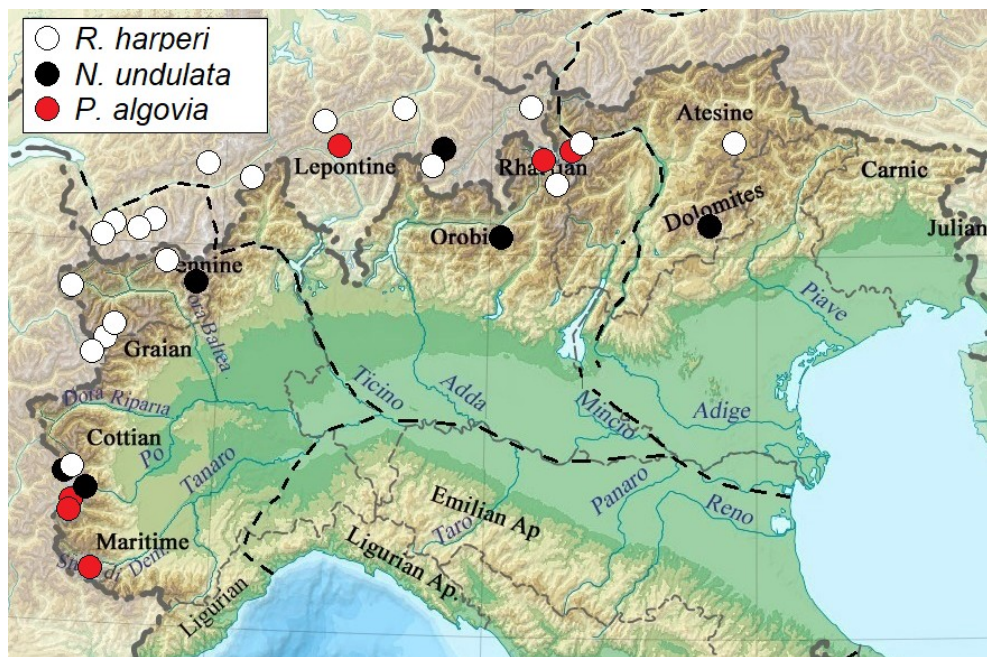
Map 4. Plecoptera species with wide distribution in the western Alps (endemic or slightly extensive) from southwest to northeast: *Leuctra zwicki*, *L. ameliae*, *L. ravizzai*, *Protonemura pennina*, *Nemoura pesarinii*, *Isoperla orobica*, *Leuctra auberti*.



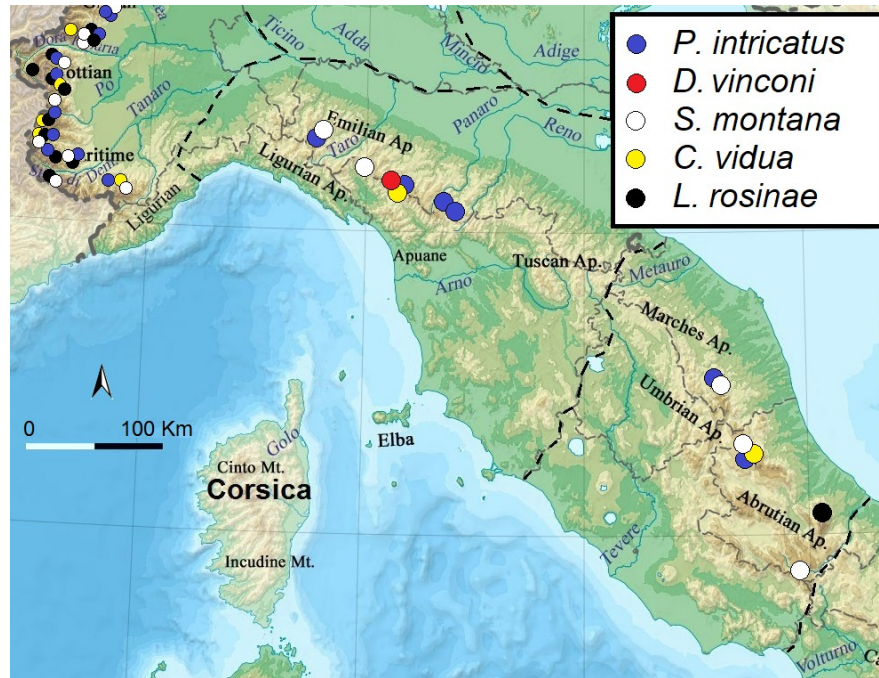
Map 5. Steno-endemic species in the central Alps and Venetian Prealps, from west to east: *Leuctra sesvenna*, *L. muranyii*, *L. juliettae*, *L. fochettii*, *L. dylani*, *Protonemura bipartita*.



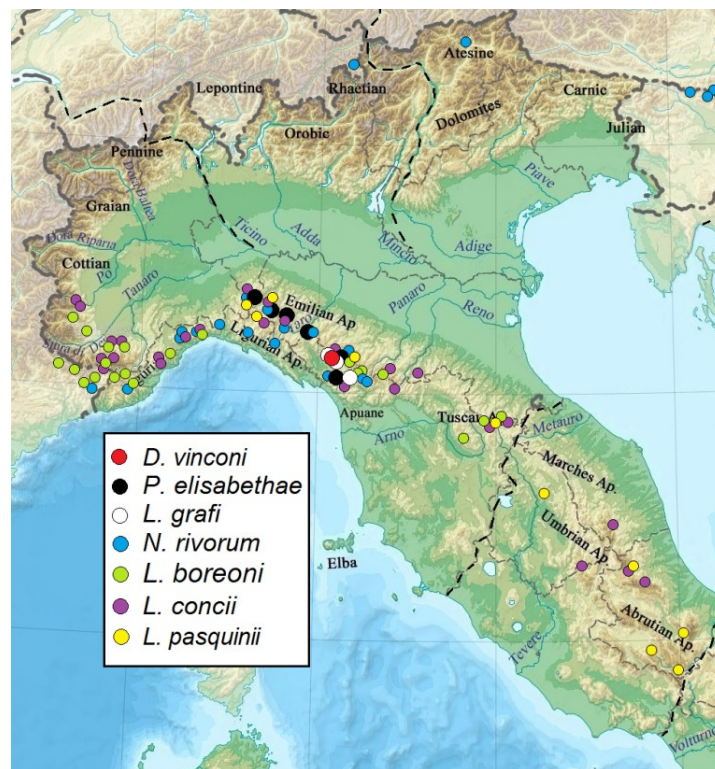
Map 6. Plecoptera species in the oriental Alps (endemic or extensive) from west to east: *Leuctra trecimensis* sp. nov., *L. pseudorosinae*, *Protonemura austriaca*, *Nemoura illiesi*, *Isoperla zwicki*, *Protonemura bispina*, *P. julia*, *Leuctra signifera*, *Isoperla illyrica*.



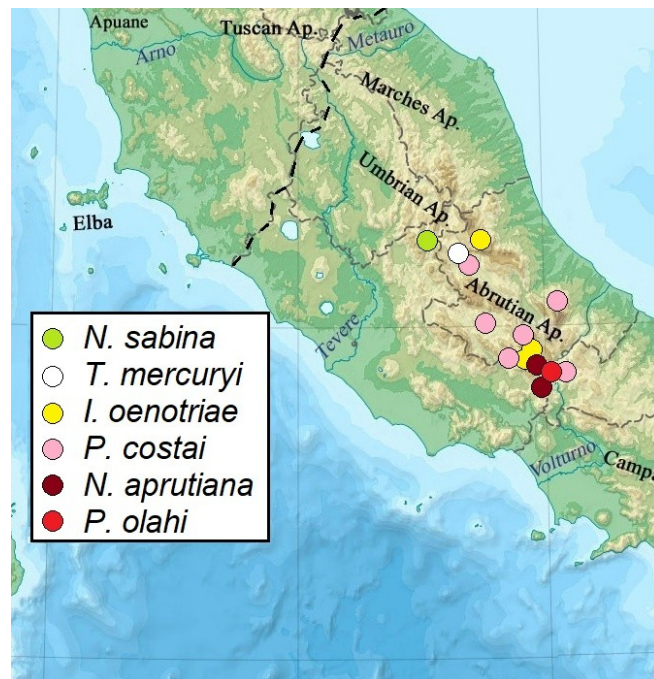
Map 7. Rare species with wide alpine distribution: from southwest to northeast: *Protonemura algovia*, *Nemoura undulata*, *Rhabdiopteryx harperi*.



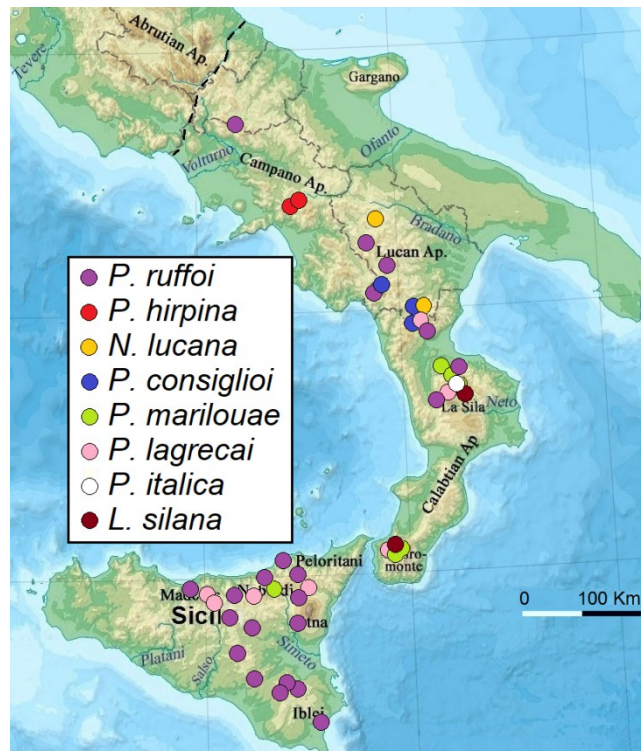
Map 8. Glacial relicts in the Apennines: *Perlodes intricatus*, *Dictyogenus vinconi*, *Siphonoperla montana*, *Capnia vidua*, *Leuctra rosinae*.



Map 9. Plecoptera species of the northern Apennines (endemic or extensive) from north to south: *Dictyogenus vinconi*, *Protonemura elisabethae*, *Leuctra grafi*, *Nemoura rivorum*, *Leuctra boreoni*, *L. concii*, *L. pasquinii*.



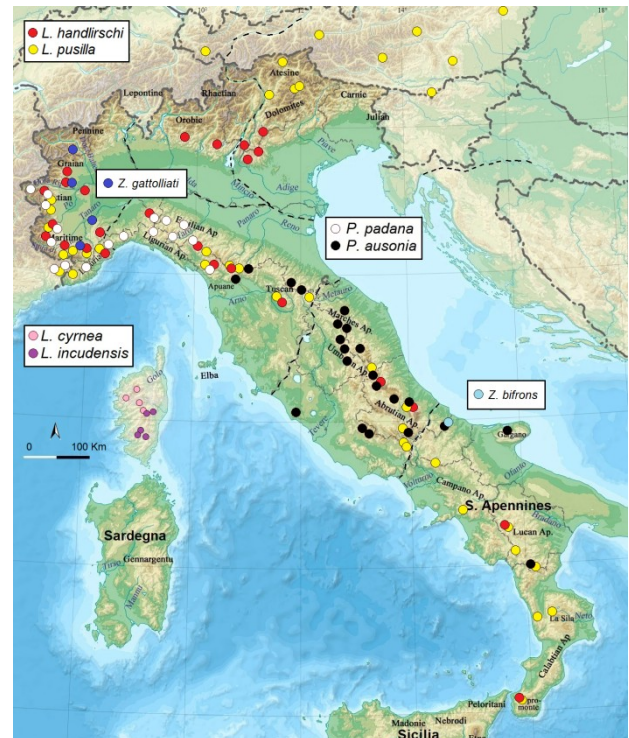
Map 10. Endemic species of the central Apennines from north to south: *Nemoura sabina*, *Taeniopteryx mercuryi*, *Isoperla oenotriae*, *Protonemura costai*, *Nemoura aprutiana*, *Protonemura olahi* sp. nov.



Map 11. Plecoptera species of the southern Apennines (endemic or extensive) from north to south: *Protonemura ruffoi*, *P. hirpina*, *Nemoura lucana*, *Protonemura consighioi*, *P. marilouae* sp. nov., *P. lagrecai*, *P. italica*, *Leuctra silana*.



Map 12. Endemic species with wide distribution in the Apennines from north to south: *Isoperla andreinii*, *I. saccai*, *Protonemura saltii*, *P. macrura*, *P. tyrrhena*, *Brachyptera calabrica*, *Leuctra costai*.



Map 13. Sister species in Italy and Corsica: *Leuctra handlirschi* and *L. pusilla*; *Leuctra cyrnea* and *L. incidensis*; *Protonemura padana* and *P. ausonia*; *Zwicknia bifrons* and *Z. gattolliati*



Photo 1. Italy, Calabria, Sila grande, below Monte Sorbello, springs, 1800 m, 39.284N, 16.44E (G. Vinçon) (*Protonemura marilouae* sp. nov.).



Photo 2. Italy, Molise, Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594N, 14.0783E (G. Vinçon) (*Protonemura olahi* sp. nov.).



Photo 3. Italy, Molise, Castel San Vincenzo, Sorgente Acquaruolo, 470 m, 41.6594N, 14.0783E (G. Vinçon) (*Protonemura olahi* sp. nov.).



Photo 4. Italy, Pennine Alps: Omegna, Val Strona, above Campello Monti, 1700–1800 m, brook and spring, 45.925N, 8.225E (G. Vinçon) (*Leuctra stronensis* sp. nov.).



Photo 5. Italy, Dolomites, S.E. Moso, Parco Naturale Tre Cime di Lavaredo, springs and brook, 1650 m, 46.656N, 12.406E, (G. Vinçon) (*Leuctra trecimensis* sp. nov.).

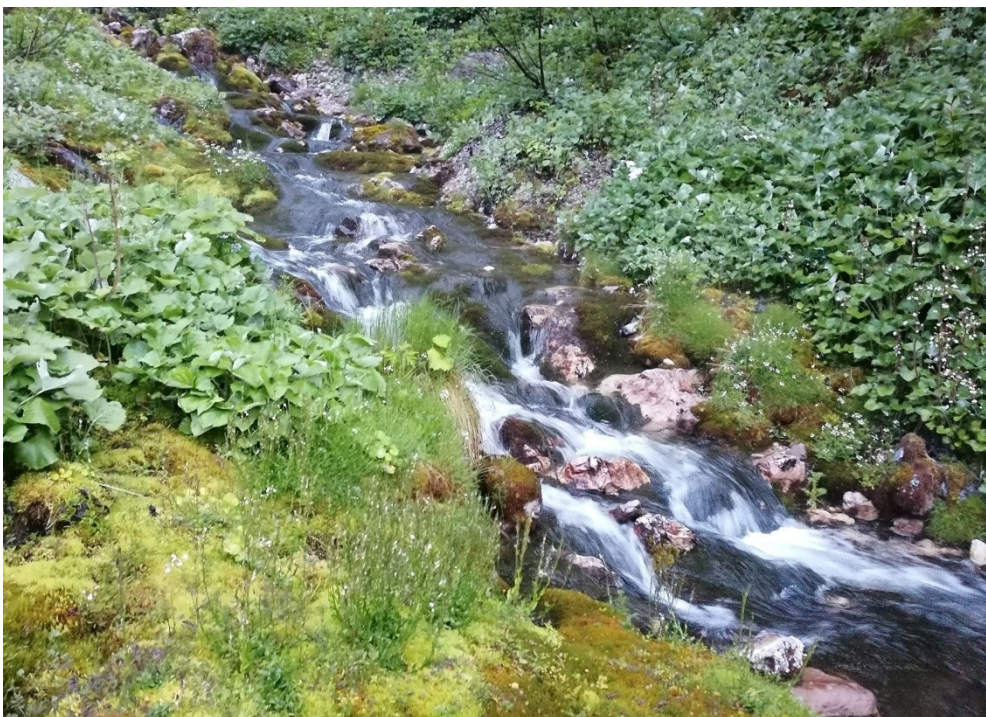


Photo 6. Italy, Dolomites, S.E. Moso, Parco Naturale Tre Cime di Lavaredo, torrent, 1650 m, 46.656N, 12.406E, (G. Vinçon) (*Leuctra trecimensis* sp. nov.).