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## Toward a revision of the genus *Chelidura* Latreille, 1825: designation of the Neotype for *Chelidura aptera* (Megerle in Charpentier, 1825) (Dermaptera: Forficulidae)

**Abstract:** Since it is not possible, after several years of research, to locate the type material of *Chelidura aptera* (Megerle in Charpentier, 1825), type species of the genus *Chelidura* Latreille, 1825, and not being able to define in any way, even vaguely, the *terra typica*, it was decided to fix a neotype. This neotype is here selected on the basis of its matching with the original description and with the support of molecular data. Three Alpine populations, two Italian and one Swiss, of what is actually considered *C. aptera* were sampled and sequenced; COI sequences were then compared with *Chelidura pyrenaica arverna* David & Van Herrewege, 1973 from the Massif Central in France, and other species of the genera *Chelidurella*, *Mesochelidura* and *Forficula*. The separation between *C. aptera* and *C. pyrenaica* is strongly supported by DNA barcodes and substantial differences among the three Alpine populations have been detected. The genetically intermediate among the Alpine populations (Italy, Piedmont (Biella), Pennine Alps, Lago del Muçrone) is chosen as neotype of *Chelidura aptera*, furthermore largely matching the original description. Further genetic and morphological investigations will clarify the relations among the Alpine populations and in the early future we expect to extend the analyzes to the majority of the Alpine and non-Alpine populations of *Chelidura*. In addition, the updated view about the taxonomy and distribution of *Chelidura* and the first illustration of male genitalia of *Chelidura pyrenaica arverna* David & Van Herrewege, 1973 are provided.

**Riassunto:** Verso una revisione del genere *Chelidura* Latreille, 1825: designazione del Neotipus di *Chelidura aptera* (Megerle in Charpentier, 1825) (Dermaptera: Forficulidae.)

Non essendo possibile, dopo molti anni di ricerche, reperire materiale tipico della specie *Chelidura aptera* (Megerle in Charpentier, 1825), specie tipo del genere *Chelidura* Latreille, 1825, e non potendo definire in alcun modo, anche vago, la località di provenienza del materiale usato per la descrizione, si è deciso di fissare un neotipo per la specie e di sceglierlo sulla base della conformità alla descrizione originale e di alcune analisi molecolari. Sono state campionate e sequenziate tre popolazioni alpine, due italiane e una svizzera, di quella che attualmente è considerata *C. aptera*; le sequenze COI sono state quindi confrontate con *Chelidura pyrenaica arverna* David & Van Herrewege, 1973 dal Massiccio Centrale in Francia, e altre specie dei generi *Chelidurella*, *Mesochelidura* e *Forficula*. La separazione tra *C. aptera* e *C. pyrenaica* è fortemente supportata dal DNA barcoding e sono state rilevate differenze sostanziali tra le tre popolazioni alpine. Come neotipo di *Chelidura aptera* si è scelto un esemplare proveniente dalla popolazione alpina geneticamente intermedia e cioè quella italiana del lago Muçrone, nelle Alpi Pennine in Piemonte (Biella), che corrisponde inoltre ampiamente alla descrizione originale. Ulteriori indagini morfologiche e molecolari permetteranno di definire le differenze rilevate tra le popolazioni alpine e nei prossimi anni le stesse analisi saranno estese al maggior numero possibile di popolazioni alpine e non. Viene fatto inoltre il punto sulla distribuzione del genere *Chelidura* e sulla sua attuale tassonomia e si fornisce la prima illustrazione dei genitali maschili di *Chelidura pyrenaica arverna* David & Van Herrewege, 1973.

**Key words:** Dermaptera, earwig, *Chelidura*, *Chelidura aptera*, phylogeny, molecular systematics, distribution, Europe.

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### INTRODUCTION

Twenty-five years ago, the late Augusto Vigna Taglianti (1943-2019) and the first author proposed to carry out a systematic revision of the genus *Chelidura* Latreille, 1825 (Fig. 1). Augusto Vigna

Taglianti, in love with his Piedmont mountains, intensively collected material of this genus (now in the Museo Civico di Storia Naturale Giacomo Doria in Genoa, Italy) and, as a very learned zoologist and biogeographer, he deeply studied the few species of

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the genus from a biogeographical and phylogenetic point of view, considering *C. aptera* (Megerle in Charpentier, 1825) probably shifted into different taxa (Chemini & Vigna Taglianti, 2002). However, the revision of the *Chelidura* genus had never carried out, although it was always among the wishes of the great entomologist. The beginning of this same revision now, after his death, wants therefore to be an ongoing tribute to Augusto Vigna Taglianti, who will be in this way our travel companion in the coming years of study.

Regrettably, the type material of *Chelidura aptera*, type species of the genus, has been lost. Furthermore, at that time it was not possible to trace down the type locality, vaguely indicated in the original description as *Europa indigena* (Europe). Consequently, the only result was the discovery and redescription of the types (Fig. 2) of *Chelidura*

*alpina* (Bonelli in Gené, 1832), *Chelidura montana* (Bonelli in Gené, 1832), both considered synonyms of *C. aptera*, and of *Chelidura pyrenaica* (Bonelli in Gené, 1832) (Fontana, 1999). The careful revision of biography of Megerle De Muehlfeld, the collector and true describer of *C. aptera*, led to the impossibility to reconstruct the fate of the typical material and at the same time did not provide any further relevant information useful to trace back to the geographical origin of the material on which the species was described. Therefore, in order to proceed with the revision, a priority was to try to establish and designate the neotype for *Chelidura aptera*. However, the selection of the population within which to identify the neotype must be made carefully, basing the decision with the support of molecular data and not invalidating any other species (such as those of Bonelli) that could, in the light of the revision, be in some case resurrected at a specific or subspecific level. The recent confirmation of the validity of genus *Chelidura* and its clear separation from the genera that had been previously synonymized with it (*Chelidurella* Verhoeff, 1902 and *Mesochelidura* Verhoeff, 1902), obtained through molecular analysis (Kirstová *et al.*, 2020), gave new impetus to the study. On the basis of the large data collected by the first author, including images of specimens preserved in various museums and the extensive bibliography on the topic and thanks to the preliminary results of the review of the related genus *Chelidurella* Verhoeff, 1902 (Kirstová *et al.*, 2020) it was decided to start the approach on *Chelidura* with the support of DNA barcoding, starting from the Alpine populations so far recognized as *C. aptera*. The results of this preliminary investigation and the designation of the neotype are here presented.

#### MATERIALS AND METHODS

In September 2019 a field expedition across Italy, Switzerland and France was organized in Western Alps (Paolo Fontana and Federico Marangoni) to collect fresh specimens in localities known from collection labels or from literature. Given the not suitable season, individuals of *Chelidura* were found in only two of the over 15 localities visited, namely on Lago del Mucrone (Pennine Alps, Biella) and in the precise location from which Bonelli's *Forficula montana* was described, namely the Col du Grand



Fig. 1. a) Male of *Chelidura aptera*, Italy, Piedmont (Biella), Pennine Alps, Lago del Mucrone, Oropa, 1910 m (45°37'43.54" N, 7°56'38.24" E), 18.IX.2019, photo by Federico Marangoni; b) male of *Chelidura aptera* (type locality of *F. montana*) Switzerland, Valais, Col du Grand Saint-Bernard, Liddes, 2160 m, 18.IX.2019, photo by Federico Marangoni.

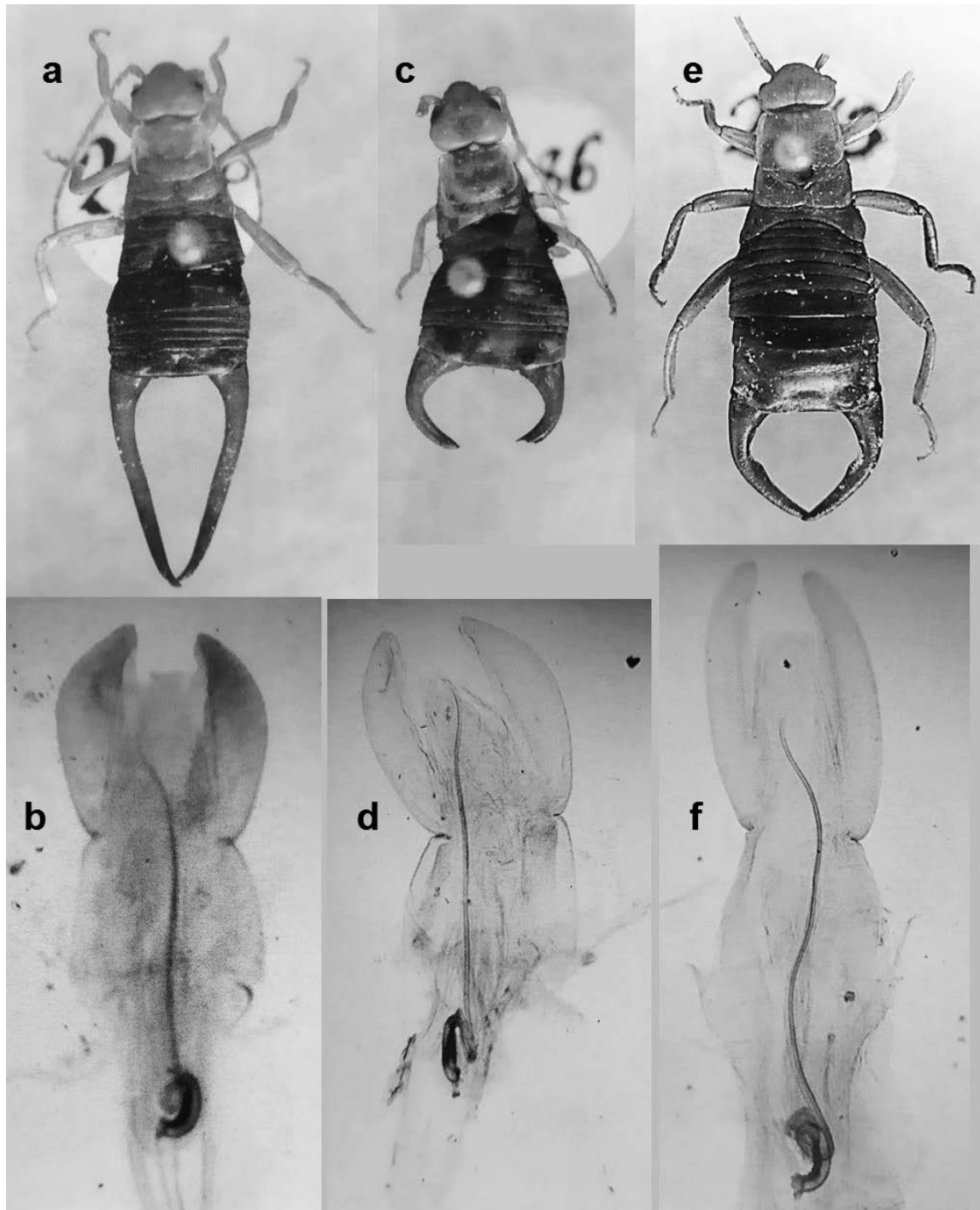


Fig. 2. The *Chelidura* specimens described by Genè (1832) preserved in the Museo Regionale di Scienze Naturali di Torino, Italy. a) Dorsal overview and b) genitalia of the male Lectotype of *F. montana*, Gran S. Bernardo, tra Lyde e l'Ospizio, (Switzerland, Valais). c) Dorsal overview and d) genitalia of the male Lectotype of *Forficula alpina*, Moncenisio, tra la Croce e l'Ospizio, dal lato che guarda settentrione (Italy, Piedmont). e) Dorsal overview and f) genitalia of the male Lectotype of *Forficula pyrenaica*, Pirenei. Original illustrations from Fontana (1999).

Saint-Bernard: *tra Lyde e l'Ospizio* and so *between Lyde and the Hospice* (Liddes, Valais, Switzerland). To these specimens were then added those provided by Petr Kočárek, namely the material relating to *C. pyrenaica arverna* David & Van Herrewege, 1973 and some specimens of a population, coming from the Western Rhaetian Alps (Sondrio). This last population is outside the current distribution of the genus *Chelidura* in Italy. Specimens for molecular studies were immediately stored in 90% ethanol as soon they have been collected in the field. Male genitalia of dry and in alcohol specimens have been mounted following the standard protocol provided by Fontana *et al.* (2002): they were removed, cleared immersing them for 20 minutes in 10% KOH solution at room-temperature; they were dehydrated by passages in alcohols of increasing concentration and in xylene and finally mounted in Canadian Balm on a microscope slide or on a transparent holder. The specimens and the male genitalia were measured with a micrometric lens (Meopta H 8 × 10 m) using a stereomicroscope (Optech). Nomenclatural and morphological terminology follows that used by Steinmann (1993) for general morphology and for the male terminalia and genitalia follows Kamimura (2014).

#### MOLECULAR ANALYSIS EXAMINED MATERIAL LOCALITIES

***Chelidura aptera*** (Megerle in Charpentier, 1825)  
Italy, Piedmont (Biella), Pennine Alps, Lago del Mucrone, Oropa, 1910 m (45°37'43.54" N, 7°56'38.24" E), 18.IX.2019, Paolo Fontana and Federico Marangoni leg.

Italy, Lombardy (Sondrio), Western Rhaetian Alps, Frascaia, Lanzada, 1480 m, (46°17'21.4" N, 9°54'41.14" E), 22.VII.2019, Mario Grosser leg.

Switzerland, Valais, Col du Grand Saint-Bernard, Liddes, 2160 m, (45°53'11.24" N, 7°11'24.35" E), 18.IX.2019, Paolo Fontana and Federico Marangoni leg.

***Chelidura pyrenaica arverna*** David & Van Herrewege, 1973  
France, Loire, Station de Chalmazel, Chalmazel, 1137 m, (45°40'33"N, 03°49'32"E), 31.VIII.2016, Christophe Girod leg.

**LABORATORY METHODS.** Each insect specimen was dissected, and the six legs were used for DNA extraction. After lyophilization, the total DNA was isolated using a commercial kit (NucleoSpin® Tissue; Macherey-Nagel, Düren, Germany). The cytochrome oxidase subunit I (COI) gene was amplified with the primer pair LCO1490 (5'-GGTCAACAAAT CATAAAGATATTGG-3') and HCO2198 (5'-TAAA CTTTCAGGGTGACCAAAAAATCA-3') (Folmer *et al.* 1994). Polymerase chain reaction (PCR) conditions were as reported in ("PM 7/129 (1) DNA barcoding as an identification tool for a number of regulated pests," 2016, p. 12). PCR products, after purification with illustra ExoProStar1-Step (GE Healthcare, Little Chalfont, UK), were sequenced with the Big Dye Terminator v3.1 cycle sequencing kit (Applied Biosystems, Foster City, CA, USA) on an Applied Biosystems 3130 xl Genetic Analyzer (Carlsbad, CA, USA). Sequences were manually checked using BIOEDIT (Hall 1999).

**PHYLOGENETIC ANALYSIS.** In order to have a COI dataset as much exhaustive as possible the barcodes obtained have been integrated with the complete sequences freely available in BOLD (Ratnasingham and Hebert 2007) namely: ARTNO058-17, GBMNB59325-20, GBMNB59325-20, NOORT128-13, NOORT074-12, NOORT131-13, NOORT130-13 and NOORT132-13 for *Chelidurella acanthopygia*; GBMNB59324-20 for *Chelidurella thaleri*; IBIDR004-20 for *Mesochelidura occidentalis* and AGMPN014-18, AGMPN015-18, AGMPP013-18 for *Forficula auricularia*. The COI sequence of *Chelidura pyrenaica arverna* was mined out of GENE BANK (GenBank: MH853428.1). Evolutionary analysis was conducted in MEGAX (Kumar *et al.* 2018) and the phylogeny was inferred by using the Maximum Likelihood method and Tamura-Nei model. The pairwise genetic distances between sequences were calculated using MEGA X software, under default settings.

#### THE GENUS *CHELIDURA* LATREILLE, 1825 AND ITS TYPE SPECIES

The genus *Chelidura* is attributed to the French entomologist Pierre André Latreille (1762-1833) who in 1825 divided the Dermaptera (*Forficulaires*) into two main groups specifying that "*Quelque espèces sont*

*aptères*” (“some species are wingless”). He gave the name of *Forficule* / *Forficésile* to the winged species and named *Chélidoure* the wingless group (Latreille, 1825). Two years later, in the German edition of Latreille’s work edited with notes by the German naturalist Arnold Adolph Berthold (1803-1861), the group (g.) *Chélidoure* of Latreille (1825) became the genus (*Geschl.*, abbreviation of *Geschlecht* that is genus in English) *Chelidura* (Berthold, 1827). Even in Berthold there is no further information except that the genus *Chelidura* is simply characterized by being wingless: “*Nicht mit flügeln versehene*” (not provided with wings). No species is attributed to *Chelidura* until 1831, when the French entomologist Jean Guillaume Audinet-Serville (1775-1858) assigned *Forficula aptera* of von Charpentier (von Charpentier, 1825) to the genus *Chelidura*. Unfortunately, in this taxonomic change Audinet-Serville refers to *F. aptera* as originating from the Pyrenees (Audinet-Serville, 1831). Audinet-Serville reports the genus with the name *Chelidoura* (SIC!) adopting a sort of intermediate name between the typically French one of *Chélidoure* of Latreille and the Latin one used by Berthold, *Chelidura*, which will have priority and will be maintained in future. In addition to assigning the first species to the genus, Audinet-Serville added some anatomical details by giving a sort of brief description of the genus; from this description it is evident that he could examine some wingless earwig quite matching von Charpentier’s description:

*“Point de pelote entre les crochets des tarsi. Corps aptère, allant en s’élargissant sensiblement de la base à l’extrémité. Yeux très-petits, point saillants, placés au milieu du bord latéral de la tête. Abdomen ayant le dessus de son avant-dernier segment étroit, transversal, coupé droit postérieurement; le dessous prolongé, semi-circulaire, recouvrant en partie le dernier segment.”*

“No sphere between the hooks of the tarsus. Wingless body, which widens considerably from base to tip [actually the males of the genus *Chelidura* have a body that gradually dilates proceeding from the head towards the back of the body]. Eyes very small, not protruding, placed in the center of the lateral edge of the head. Abdomen having the upper part of its penultimate segment narrow,

transverse, cut straight posteriorly; the extended lower part, semicircular, partially covering the last segment.”

Audinet-Serville (1831) established as type species of the genus, von Charpentier’s *Forficula aptera*, which was described the same year in which Latreille (1825) had described the group of wingless Dermaptera (*Chélidoure*) later transferred by Berthold (1827) into the genus *Chelidura*.

The Audinet-Serville’s indication of *C. aptera* for the Pyrenees, made Giuseppe Genè (1800-1847) doubt on the validity of the description of *F. pyrenaica* by Franco Andrea Bonelli (1784-1830), that Genè had published after Bonelli’s death (Genè, 1832), on the basis of his hand notes given in the general catalog of the collection at the Zoological Museum of the University of Turin and probably following other Bonelli’s documents (Fontana, 1999). In a subsequent publication on Dermaptera, Genè (1837) declared to be convinced that the two species are synonymous but to maintain the specific name *pyrenaica* of Bonelli because the specific name *aptera* would be too generic and misleading, due to the fact that there are several species presenting the same characteristics as the five species reported by Genè himself: *Forficula maritima* (now *Anisolabis maritima* Bonelli in Genè, 1832), *Forficula acanthopygia* (now *Chelidurella acanthopygia* Genè, 1832) and the three *Forficula* (*montana*, *alpina* and *pyrenaica*) now assigned to *Chelidura*. Actually, the description of Megerle (*F. aptera*) and that of Bonelli (*F. pyrenaica*) cannot refer to the same species, for the strongly characteristic internal tooth in the male cerci of the last one, and Bonelli, who was working on a monograph on Dermaptera (Fontana, 1999), must have immediately understood that the specimens he had received from a French entomologist (specimens collected in the Pyrenees by Mister Moncarel and sent to Bonelli by Mister Dupare of Paris) could not correspond to the *Forficula aptera* of Megerle.

We come therefore to the description of the *Forficula aptera*, which the German geologist and entomologist Toussaint von Charpentier (1779-1847) published in 1825 in his *Horae Entomologicae* (von Charpentier, 1825). This is a very detailed description for the time, which von Charpentier received from Johann Carl Megerle von Mühlfeld (1765-1840), a zoologist who worked extensively at the Naturhistorisches Museum

in Vienna. Megerle von Mühlfeld had become the curator of the museum in 1797 until 1835) and organized the natural history collection. In 1806 the museum acquired its collection of European insects and Megerle von Mühlfeld became the first curator of the entomology section. Tragically, the old collections of the Vienna Museum, including Megerle von Mühlfeld's specimens, were destroyed in October 1848 during a fire in the Hofburg palace. The extensive Latin description of *Forficula aptera* appears in the IV chapter (*De Orthopteris Europaeis*) and precisely on page 69 of von Charpentier's book:

***Forficula aptera***  
(Meg. De Muehlfeld)

*F. ferruginea, aptera, abdomine postico lato: forcipes valido, incurvo, inermi. A carissimo de Muehlfeld mecum communicata, Europae indigena. Absque omni elytrorum alarumque vestigio: F. biguttata paullo longior et multo latior, praecipue versus abdominis finem. Caput rufescens, macula inter antennis nigra: hae pallidae, duodecim articulorum, quorum tertius a basi reliquis paullo minor est. Thorax quadratus, lateribus paullulum reflexis, lucidioribus. Elytra nulla: eorum loco segmentum abdominale in medio nonnihil impressum, ita ut quodammodo suturam aemuletur; in segmento tertio puncta duo elevata; omnia segmenta punctis parvis impressis obsita. Ultimum segmentum fossulam habet parvam in medio et tuberculum ad latus utrumque. Forcispis (maris?) crura valida, non dentate, valde incurvata, fere semicircularia. Unum tantumodo insect hujus tam insignis vidi specimen.*

***Forficula aptera***  
(Meg. De Muehlfeld)

*Forficula* brown, wingless, with abdomen posteriorly wide and forceps sturdy, curved and unarmed. Received by dear Muehlfeld, European native. Any vestiges of elytra as well as wings are missing; much wider and a little longer than *Forficula biguttata*, especially towards the end of the abdomen. The head is reddish, with a black stain between the

antennae: these shall be pale, composed by twelve articles, of which the third form the base is a little less short of the other. Thorax is a square, with sides a little incurved and more lucid. Elytra are absent; in the abdominal segment of their usual position, there is a small impression, so that somehow mimics a suture; in the third segment there are two elevated signs; all segments are covered with small impressed points. The last segment with a small dimple in the middle and a tubercle on each side. The forceps (of male?) branches are stout, unarmed, strongly incurvated and almost semicircular. I observed only one specimen of this showy insect.

Megerle von Mühlfeld's description permits to restrict the number of candidate species to a few. The description reflects the anatomical features of the species now belonging to *Chelidura sensu* Kirstová *et al.* (2020), furthermore the detailed description of the cerci allows the exclusions of both *C. pyrenaica pyrenaica* (Bonelli in Gené, 1832) and *C. pyrenaica arverna* David & Van Herreweghe, 1973. These two taxa are so different from each other that they could be treated as two distinct species; overall they do not match with what Megerle von Mühlfeld described as *Forficula aptera*, an earwig characterized by male cerci almost semicircular and toothless. The male cerci of *C. p. pyrenaica* has a distinct obtuse tooth in the middle of the inner margin of male cerci (of the cyclolabia form) while *C. pyrenaica arverna* has cerci toothless but only slightly curved. As for the two species described by Gené (1832) and later synonymized with *C. aptera*, *Forficula montana* from Col du Grand Saint-Bernard, has cerci very different from those described by Megerle von Mühlfeld, while as regards *Forficula alpina* from Moncenisio Pass, the similarity is very evident even if Gené described a small tubercle at the base of the cerci of his species.

***Forficula aptera*** [original text and translation from von Charpentier (1825)]

*Forcispis (maris?) crura valida, non dentate, valde incurvata, fere semicircularia.*

The forceps (of male?) branches are stout, unarmed, strongly incurvated and almost semicircular.

***Forficula montana*** [original text and translation from Genè (1832)]

...*forficibus maris abdominis longitudinem aequantibus, validis, teretibus, subrectis, edentulis, basi supra obsolete unituberculatis...*

...*una robusta pinzetta, le cui branche nel maschio eguagliano in lunghezza l'addome. Queste sono quasi diritte, cilindriche, senza denti, fornite soltanto di un tubercolo poco elevato sul dorso della base...*

... male cerci as long as abdomen, stout, smooth, almost straight, toothless, with a small tubercle on the upper part of their basis...

... a sturdy tweezers, whose branches in the male equal the abdomen in length. These are almost straight, cylindrical, without teeth, provided only with a little high tubercle on the back of the base...

***Forficula alpina*** [original text and translation from Genè (1832)]

... *forficibus maris breviusculis, validis, lunatis, basi supra obsolete unidentatis...*

... *Le branche della pinzetta eguagliano appena in lunghezza la metà dell'addome, e sono perfettamente semilunari nel maschio, forti, riquadrate al lato interno, fornite di una dente piccolo e ottuso sul dorso della base, e propriamente sull'angolo superiore della riquadratura...*

... male cerci shorter, stout, lunate, with a small tubercle on the upper part of their basis...

... The branches of the tweezers barely equal half of the abdomen in length, and are perfectly semilunar in the male, strong, squared on the inside, equipped with a small and obtuse tooth on the back of the base, and properly on the upper corner of the squared side...

***Forficula pyrenaica*** [original text and translation from Genè (1832)]

... *forficibus maris, arcuatis, validis, medio intus obtuse dentatis...*

... *Le pinzette di questa bella forficula sono grosse nel maschio, robuste, arcuate, fornite di un dente ottuso alla metà del lato interno, e*

*lunghe quando la metà, quando due terzi del corpo...*

... male cerci, curved, stout, with an obtuse tooth in the middle of the inner side.

... The tweezers of this beautiful earwig are large in the male, robust, arched, provided with a dull tooth in the middle of the inner side, and long when half, when two thirds of the body ...

***Chelidura p. arverna*** [original text and translation from David & Van Herrewege (1973)]

*Le meilleur critère distinctif est constitué par la forme des cerques. Ceux-ci sont plus robustes, relativement plus larges, plus courts, moins aequés chez les individus du Mont Mézenc [...] On doit ajouter que le bord interne des cerques présente toujours, chez les individus pyrénéens, une sorte de dent très émoussée. Cette caractéristique est absente dans la population du Mont Mézenc.*

The best distinctive feature is the shape of the cerci. Those are more robust, relatively wider, shorter, less tight in the specimens of Mont Mézenc [...] We must add that the internal margin of the cerci always presents, in Pyrenean individuals, a kind of very blunt tooth. This characteristic is absent in the population of Mont Mézenc.

Although the original descriptions and types of the species presently preserved can be of great use, however, it must be considered that in Dermaptera the shape and size variability of male cerci is a very common phenomenon, so that for many species two cerci extreme forms are considered. The form with very developed cerci is called *macrolabia*, and that with small cerci is called *cyclolabia*. Between these two forms, several intermediate forms are normally present (Fig. 3). Examining specimens of *Chelidura* from different locations, however, it seems that not all populations are present with true *macrolabia* forms that seem to be missing in those with very arched and semicircular cerci (as in the original description of *F. aptera*).

In the same species, in addition to the shape of the cerci, even their possible indentation can be variable, as well as the shape of the pygidium, as can easily be observed in the related genus *Chelidurella* (Galvagni,

1994, 1995, 1996, 1997 and Kirstová *et al.*, 2020). This does not mean that the morphology, if studied on an adequate number of specimens, cannot be interpreted correctly, as demonstrated by the recent molecular analysis of the species of the genus *Chelidurella* (Kirstová *et al.* 2020) which has largely confirmed the studies on the morphological basis by Antonio Galvagni (1924-2015). As far as the genus *Chelidura* is concerned, exactly this great variability in the shape of the cerci, sometimes between populations not far away but often also within the same population (although apparently not always), created a certain confusion.

The variability within the genus *Chelidura* is not only restricted to cerci size and shape but it also involves the structure of male genitalia. While within the genus *Chelidurella*, this character is scarcely useful for species classification (Galvagni, 1994, 1995, 1996, 1997), except to separate *C. acanthopygia* (Gené, 1832) and *C. thaleri* Harz, 1980 (Kirstová *et al.* 2020), the few data concerning male genitalia of the known species of the genus *Chelidura* suggest that this anatomical character, and in particular the shape and size of the parameres, can be used to separate species or groups of species from each other. In the

redescription of the typical material of the *Chelidura* species described by Gené (1832), Fontana (1999) managed to extract, clarify, mount and illustrate the male genitalia of specimens that are almost two centuries old. Parameres of the type of *F. pyrenaica* are clearly more elongated and thinner than those of *F. alpina* and *F. montana*, which also show some differences between them (Fig. 2). The study of the male genitalia of other *Chelidura* males from the Pyrenees, the Central Massif and the Alps, has shown that the slender and gently curved shape and almost parallel margins of the parameres, would be typical of *C. pyrenaica pyrenaica* but also of *C. pyrenaica arverna* (Fig. 4). Alpine specimens, on the other hand, would be characterized by shorter and stockier parameres, with an arched external margin; this conformation could be useful to better define the Alpine populations, today prudently all assignable to *C. aptera* (Fig. 5).

This clear division between *C. aptera* and *C. pyrenaica* on the basis of the shape of the male genitalia's parameres, was already been clearly formulated by the Italian entomologist Teresita Maccagno (1900-1999) who was a pioneer in the study of this anatomical structure in Dermaptera

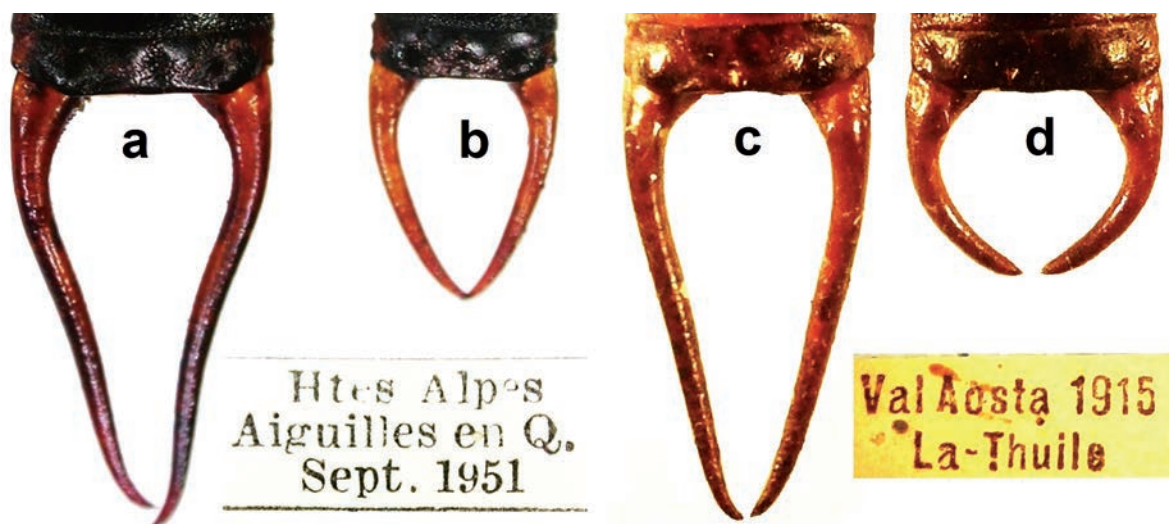


Fig. 3. a) Male cerci of the macrolabia and b) of the cyclolabia forms of two males of *Chelidura aptera* collected in the same locality and in the same date; France, Hautes Alpes, Aiguille, IX. 1951 (collection Museum National d'Histoire Naturelle of Paris), photo by Paolo Fontana. c) male cerci of the macrolabia and d) of the cyclolabia forms of two males of *Chelidura aptera* collected in the same locality and in the same date; Italy, Aosta Valley, La Thuile, 1915 (collection Museum National d'Histoire Naturelle of Paris), photo by Paolo Fontana.

(Maccagno, 1933). In the discussion on *C. aptera*, that she considered present only in the Alps, Teresita Maccagno (1933) writes in a footnote at page 276:

(1) *La forma ciclolabia corrisponde alla specie F. alpina Genè; la macrolabia alla F. montana Genè (loc.cit. pag. 14, 15). Della 2<sup>a</sup> si tentò di fare una varietà ma ne mancano gli elementi. La forficula simplex Lafresnaye (apud Germar), che Burr (Genera Ins. P. 69) mette in sinonimia con la Ch. aptera Meg., è invece la forma macrolabia della specie Ch. pyrenaica Bon.: l'apparato copulatore maschile offre un carattere diagnostico inequivocabile.*

(1) The cyclolabia form corresponds to the

species *F. alpina* Genè; the macrolabia to *F. montana* Genè (loc.cit. pages 14, 15). An attempt was made to make a variety of the 2<sup>nd</sup> but the elements are not strong enough. The *Forficula simplex* Lafresnaye (apud Germar), which Burr (Genera Ins. p. 69) puts in synonym with *Ch. aptera* Meg., is instead the macrolabia form of the species *Ch. pyrenaica* Bon.: the male copulatory apparatus offers a unambiguous diagnostic character.

The approach of Teresita Maccagno (1933) is also confirmed with great evidence by two apparently identical males of *Chelidura*, both of the macrolabia form, preserved in the collections of the Museum National d'Histoire Naturelle of Paris. The two specimens were both identified on the basis of the genitalia, mounted in a small slide attached to each of the two specimens, by the distinguished Italian entomologist Felice Capra (1896-1991), a great researcher on Dermaptera. The first specimen comes from the Alps and precisely from the Aosta Valley (Gressoney la Tr., 1600 m, 1935) and it has been iden-

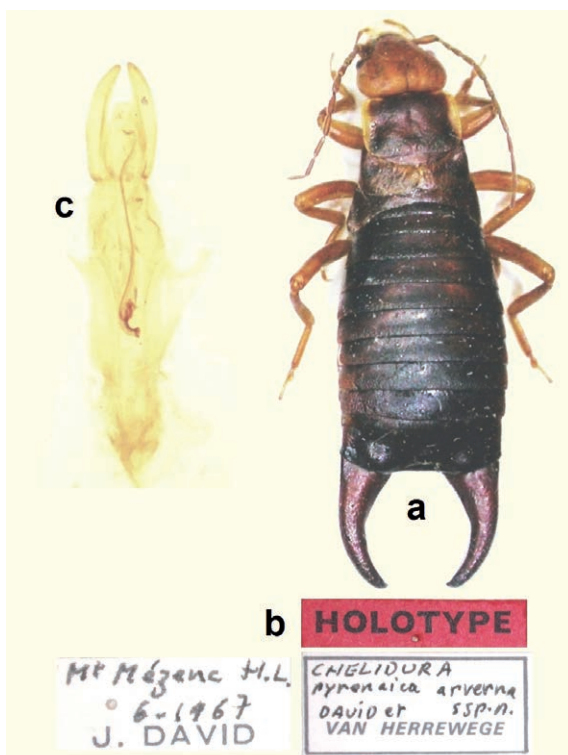


Fig. 4. a) Male Holotype of *Chelidura pyrenaica arverna* and relative labels (b); France, Massif Central, Mt. Mézenc H. L., VI.1967, J. David (collection of the Museum National d'Histoire Naturelle of Paris, France), photo by Paolo Fontana. c) Male genitalia of a specimen of *Chelidura pyrenaica arverna*, France, Ardeche, Satilleu surr., 1000 m, 13.VI.1994, leg. Andrei V. Gourov (collection Fontana at the Museo Civico di Rovereto, Italy), photo by Paolo Fontana.

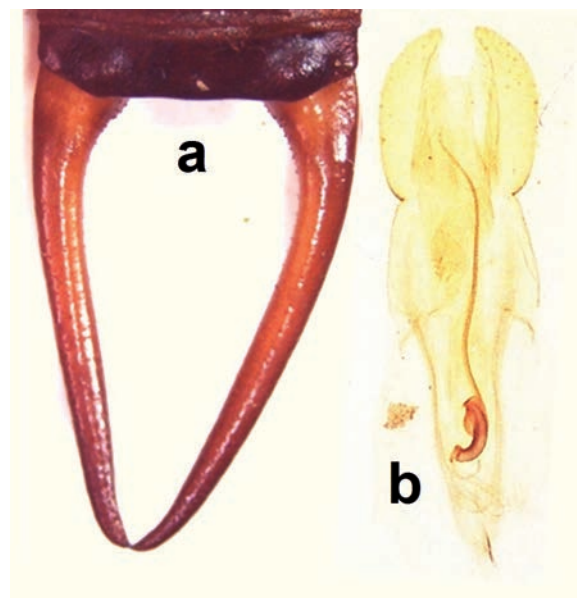


Fig. 5. a) Terminalia of a male of the form macrolabia and b) genitalia of the same specimen; *Chelidura aptera*, Italy, Piedmont (Torino), Val d'Ala di Lanzo, Balme, 1400 m, 10.VIII.1995, leg. Beppe Osella (collection Fontana at the Museo Civico di Rovereto, Italy), photo by Paolo Fontana.

tified by Capra as “*C. aptera* Charp. f. *macrolabia*”. The second specimen, coming from the Massif Central (Mt. Doré), has been identified as “*C. pyrenaica* Genè subsp. nova *arvernica* David *et al.*, f. *macrolabia*”. The shape and size of the parameres of the two specimens, examined directly by the first author, leave no doubt as to their attribution (Fig. 6).

For the moment, it is quite useless to chase after all the taxa described and synonymized within the genus *Chelidura*; this will be done in the future when it will

be possible to have molecular analyses on a greater number of populations. Remaining to the species nowadays universally accepted, namely *C. aptera* and *C. pyrenaica*, it should be noted that their identity and distribution are commonly misinterpreted. For example, in the 56<sup>th</sup> volume of the *Faune de France*, dedicated to the Orthopteroïdes (Chopard, 1951) but also later, in the 75<sup>th</sup> volume of the *Faune de France*, exclusively dedicated to the Dermaptera (Albouy & Caussanel, 1990), the two species are confused both

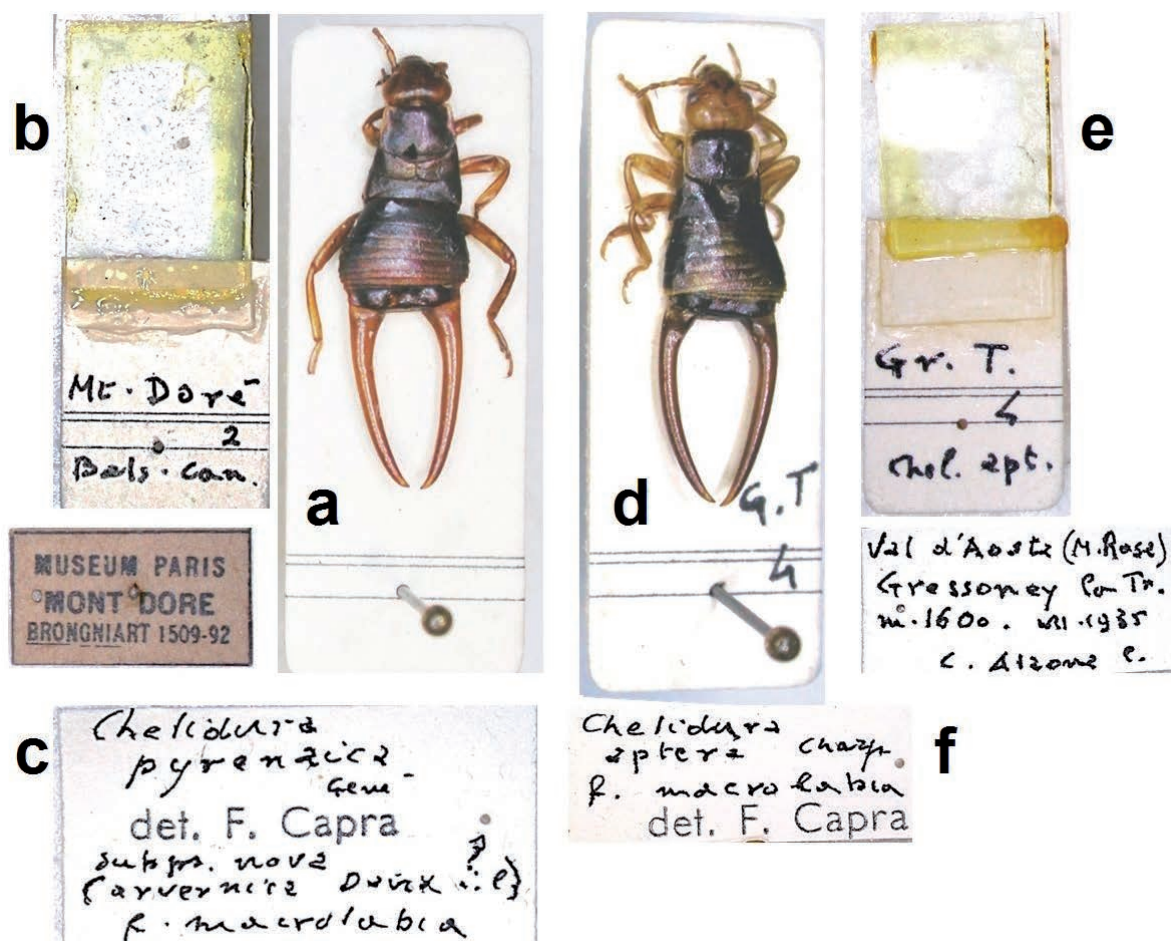


Fig. 6. Two *Chelidura* males identified by Felice Capra: a) mounted specimen, b) genitalia mounted on a small slide and c) original locality and identification labels of a male of *Chelidura pyrenaica arvernica* of the *macrolabia* form, France, Massif Central, Mt. Doré (collection of the Museum National d'Histoire Naturelle of Paris, France), photo by Paolo Fontana. d) Mounted specimen, e) genitalia mounted on a small slide and f) original locality and identification labels of a male of *Chelidura aptera* of the *macrolabia* form, Italy, Aosta valley, M. Rose, Gressoney la Tr., 1600 m, VII. 1935, C. Arzone Legit (collection Fontana at the Museum National d'Histoire Naturelle of Paris, France), photo by Paolo Fontana.

taxonomically as well in their distribution. In the last volume (Albouy & Caussanel, 1990), even the two subspecies of *C. pyrenaica*, namely *C. pyrenaica pyrenaica* and *C. pyrenaica arverna*, are both considered to be present in the Massif Central. In fact, David & Van Herrewege (1973), had considered only the material of one locality of the Massif Central (Mt. Mezenc) for the description of their new subspecies of *C. pyrenaica* and they seem not to have taken into consideration the existence of *C. aptera*. They suppose the presence of another subspecies of *C. pyrenaica* in the Alps, on the basis of specimens from Val d'Isère (Savoie) recorded by Amiet (1961) and of some others collected by one of the two authors (David) in Mont Cenis (Hautes Alpes). David & Van Herrewege (1973) specify that both the specimens of Amiet (1961) as those collected by David, do not have, in the middle of the inner side of the cerci, the obtuse tooth characteristic of the typical form of *C. pyrenaica* (which therefore they delimit only to the Pyrenees); however, they forget that Mont Cenis is the Locus typicus of the *Forficula alpina* of Genè, which is synonymous with *C. aptera*. An interesting aspect of the work of David & Van Herrewege (1973), is their morphometric approach, which could easily be applied to all populations of *Chelidura*. Also in the *Catálogo de los Dermapteros de España* (Herrera Mesa, 1999) *C. aptera* and *C. pyrenaica* are confused and both are recorded for the Spanish side of the Pyrenees. On the contrary, what was reported in the third volume of *The Orthoptera of Europe* (Harz & Kaltenbach, 1976) is much more convincing and the distribution that will be presented in this article in some way will confirm this approach.

From what has been briefly explained so far, it was considered fundamental, in order to undertake the revision of the genus *Chelidura*, to establish the geographical area of *Chelidura aptera* and later to fix the neotype for the species; thus, we need to begin from some molecular analyses and add some morphological considerations, on the basis of which to base the choice of the neotype and program subsequent studies.

#### CHELIDURA BARCODE AND PHYLOGENETIC ANALYSIS

The DNA barcoding performed on three Alpine populations (Fig. 7) resulted in eighteen sequences of COI gene fragment (Appendix 1). The genetic dis-

tances clearly show three different groups, representatives of the different localities sampled (*i.e.* Col du Grand Saint-Bernard, Lago del Mucrone, and Franscia). The population of the Col du Grand Saint-Bernard shows a mean genetic distance with Lago del Mucrone (8.2%) clearly higher than that between Lago del Mucrone and Franscia (mean distance 3.3%), despite the first two being the geographically closest to each other. The phylogenetic reconstruction, inclusive of the genera *Chelidura*, *Chelidurella*, *Mesochelidura* and *Forficula*, resulted in a consensus tree in which Alpine *Chelidura* monophyly is highly supported (99 bootstrap) with *C. pyrenaica arverna* recovering as sister taxon (84 bootstrap). The genus *Chelidurella* is confirmed as a sister group of the clade Alpine *Chelidura* + *C. pyrenaica arverna*, with *Mesochelidura* and *Forficula* clustering as a separate lineage (Fig. 8). The Alpine cluster presents a genetic divergence from *C. pyrenaica arverna* of 25%, while the latter species differs from *Chelidurella* of about 30%.

#### DESIGNATION AND DESCRIPTION OF THE NEOTYPE OF *C. APTERA* (MEGERLE IN CHARPENTIER, 1825)

On the basis of the genetic divergence among the three Alpine populations, considered prior to this contribution as belonging to *C. aptera* sensu lato, and their distance from *C. pyrenaica arverna*, it is now possible to clarify the separation among the Massif Central and the Alpine populations. Despite the genetic distances between at least a couple of populations, given the limited data available it is premature to propose any taxonomic separation among Central and Occidental alpine *Chelidura*; however, our preliminary results allow us to select the most suitable population from which to designate the neotype of *C. aptera*.

In order to designate the neotype of *C. aptera*, we decided to follow compliance with the original description as the first criterion and, secondly, to choose no population from the locality from which one of the species now synonymous with *C. aptera* has been described in the past. We then wanted to characterize the population from which the neotype was identified also according to the modern techniques of molecular biology. So, we identify in Monte Mucrone and Lago del Mucrone in the Pennine Alps (Biella), Piedmont, Italy, the best candidate for

the neotype designation. In fact, the male specimens of this population matches almost perfectly Megerle's description of *Chelidura aptera* and they are geographically and genetically separated from *C. pyrenaica arverna* (Massif Central, France) and from *Chelidura* sp. (Col du Grand Saint Bernard, type locality of Bonelli's *Forficula montana*). Monte Mucrone (2335 m) is a mountain in the Pennine Alps, lying between Italy (Piedmont and Valle d'Aosta) and Switzerland (Valais, Ticino and other Swiss cantons). In the geological conformation of Monte Mucrone there is a massive presence of jadeite meta-granite (called Mucronites). Its characteristic shape and its advanced position compared to the rest of the Alpine chain make it easily recognizable from the plain. On the north-western side of Mount Mucrone, at an altitude of about 1900 m, there is the alpine lake "Lago

Mucrone" from which the Oropa stream springs (Fig. 9).

The neotype (male) (Fig. 10) have been designated among those preserved in the Paolo Fontana collection now at the Museo di Scienze e Archeologia - Fondazione Museo Civico di Rovereto (Trento, Italy):

Italy, Piedmont (Biella), M. Mucrone, 30.VIII.1971, leg. Pace R., 1 male (Neotype) and 1 female.

Italy, Piedmont (Biella), Alpi Pennine, Lago Mucrone, 1902 m, VII.1911, leg. Burlini, 1 male.

Italy, Piedmont (Biella), Monte Mucrone, Lago Mucrone, 1903 m, 24.IX.2003, leg. Fontana P., Buzzetti F. M. & Tirello P., 1 male and 1 female.

The specimens collected in September 2019 have been used only for molecular analyzes:

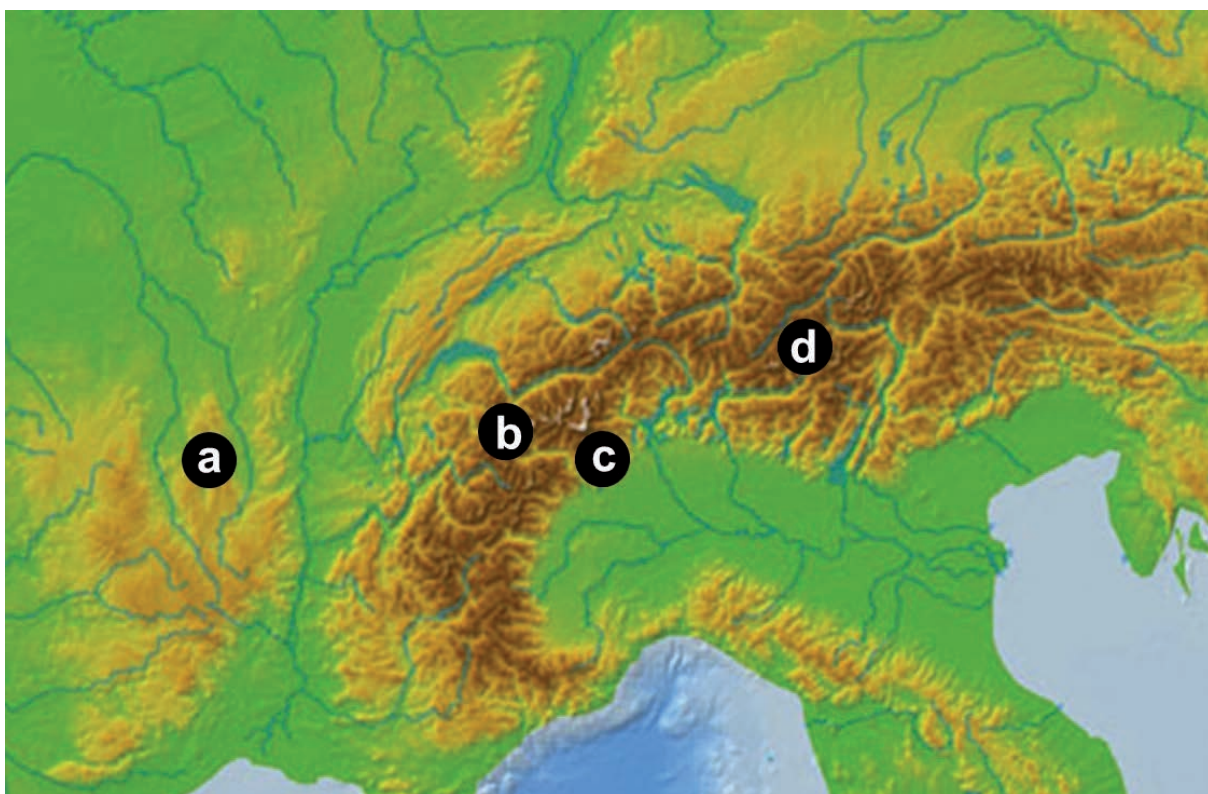


Fig. 7. Geographical positioning of the 4 populations of *Chelidura* used for molecular analyzes: a) *Chelidura pyrenaica arverna*, France, Loire, Station de Chalmazel, Chalmazel, 1137 m, (45°40'33" N, 03°49'32" E). b) *Chelidura aptera*, Switzerland, Valais, Col du Grand Saint-Bernard, Liddes, 2160 m, (45°53'11.24" N, 7°11'24.35" E). c) *Chelidura aptera*, Lago del Mucrone, 1910 m, Oropa (Biella), Pennine Alps, Italy (45°37'43.54" N, 7°56'38.24" E). d) *Chelidura aptera*, Franscia, 1480 m, Lanzada (Sondrio), Western Rhaetian Alps, Italy (46°17'21.4" N, 9°54'41.14" E).

Italy, Piedmont (Biella), Alpi Pennine, Lago del Mucrone, Oropa, 1910 m (45°37'43.54" N, 7°56'38.24" E), 18.IX.2019, Paolo Fontana and Federico Marangoni leg., 2 males and 1 female.

DESCRIPTION OF THE NEOTYPE OF *CHELIDURA APTERA* (MEGERLE IN CHARPENTIER, 1825)

MALE. General colour dark brown; head, legs and antennae light brown. Total length without forceps

(from head apex to ultimate tergite end) 18.66 mm; maximum length of the forceps (Fig. 10) 4.74 mm. Head broader than long; frons moderately convex, smooth; sutures shallow but visible. Eyes very small, only slightly protruding and just over half the length of the first antennomere. Antennae (partly missing); basal segment stouter, gently narrowed at base, shorter as the distance between antenna bases; 2<sup>nd</sup> short, a little longer than broad; 3<sup>rd</sup> long and slender, shorter than 4<sup>th</sup> and 5<sup>th</sup> combined. Pronotum transverse (ratio

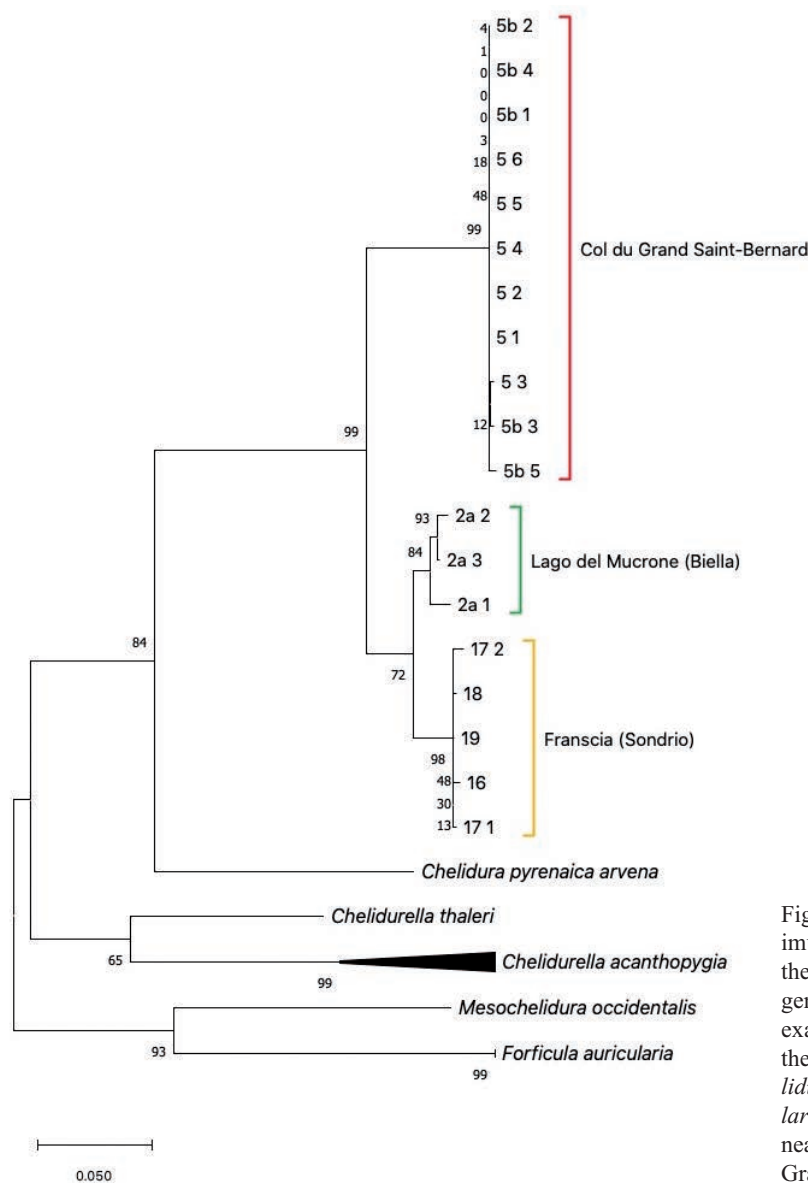


Fig. 8. Phylogenetic tree inferred by maximum likelihood (ML) method based on the cytochrome c oxidase subunit I (COI) gene fragment for *Chelidura* populations examined together with some species of the related genus *Chelidurella*. *Mesochelidura occidentalis* and *Forficula auricularia* were added as an outgroup. Numbers near the nodes represent bootstrap values. Graphic by Enrico Ruzzier.

pronotum width/length is 0.48), anteriorly straight, gently diverging posteriorly; hind angles and margin of the pronotum broadly rounded; median sulcus faintly marked; prozona almost smooth and metazona dotted. Scutellum not visible. Apparently apterous being tegmina rudimentary, dotted, touching each other medially; distal and internal edges of the temina broadly rounded. Wings absent. Femora slightly enlarged; tibiae thin. Abdomen dilated proceeding towards the terminalia; ratio between pronotum width and ultimate tergite width: 0.48. Posterior part of the abdominal tergites rugose, except in the last (10<sup>th</sup>), which is completely smooth. Ultimate tergite (10<sup>th</sup>) transverse, 3.8 times broader than long. Pygidium not visible from above, 3.09 mm wide, rugose, almost flat and with one shallow horizontal depression almost at middle. Cerci semicircular, stout and symmetrical, sparsely dotted; cerci enlarged at their base (2.45 mm), gradually tapering to the pointed apex. Total length of the cerci: 4.74 mm; maximum inner curvature of the cerci is 1.99 mm (Fig. 10). Cerci without any tooth in

the inner margin, while bearing a small tubercle in the inner upper part, in the proximity of the base (Tab. 1 and Fig. 11).

**MALE GENITALIA.** Parameres approximately 4.6 times longer than wide, crescent shaped, with an almost straight inner margin and a curved outer margin. Virga s-shaped, about twice as long as the parameres.

#### CURRENT KNOWLEDGE ON THE DISTRIBUTION AND ECOLOGY OF THE SPECIES OF THE GENUS *CHELIDURA*

Following the analysis on the four populations from Italy, Switzerland and France, an updated, albeit provisional, taxonomic arrangement of the genus *Chelidura* and its distribution on the basis of published and unpublished data are here proposed.

From a biogeographical point of view, *Chelidura* may be considered one of the oldest genera within the European Dermaptera fauna, possibly with Angarian origin (Vigna Taglianti, 1994). *C. aptera* and *C. p. pyrenaica* inhabit sub- and alpine environments,

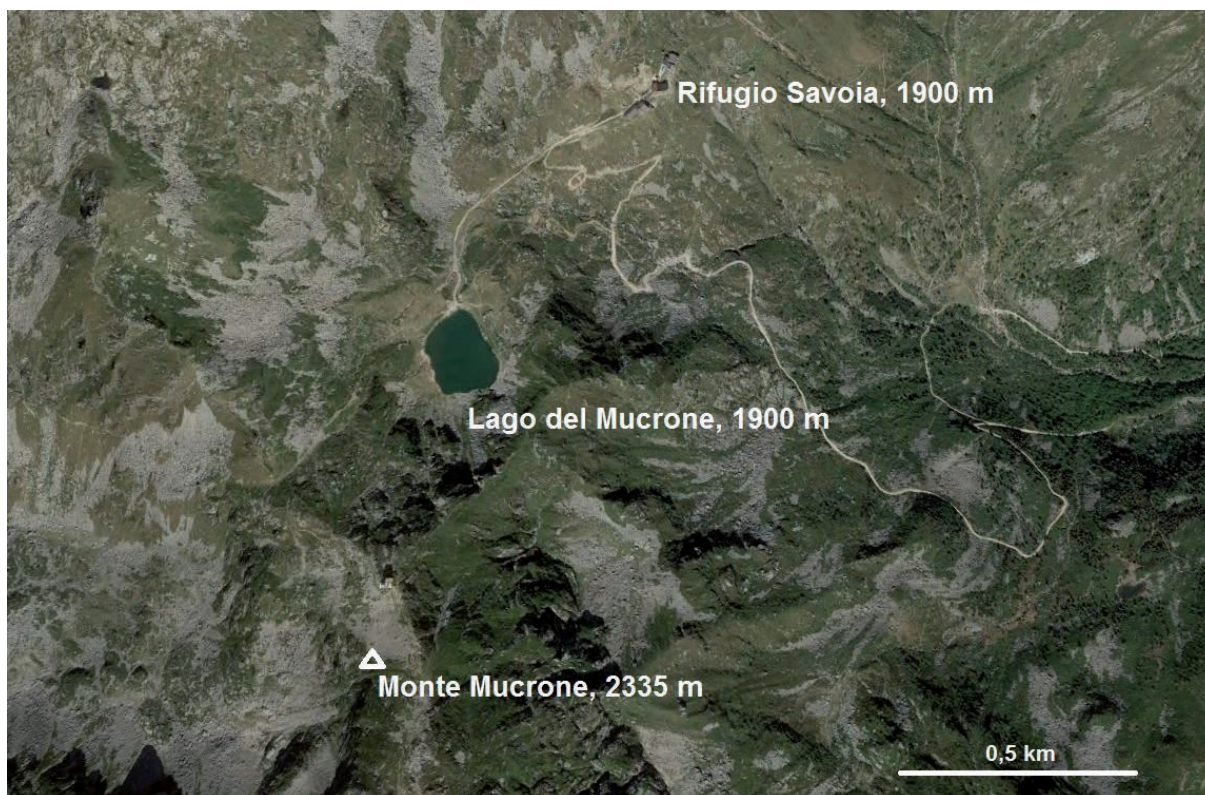


Fig. 9. Orthophoto of the Monte Mucrone area (Italy, Piedmont, Pennine Alps). Graphic elaboration by Paolo Fontana.

normally between 1400 m and 2000 m asl and in some cases, as on Mount Canigou (eastern Pyrenees), these earwigs live up to 2300 m asl of altitude. According to Chemini & Vigna Taglianti (2002), *C. aptera* is typical of the upper mountain and alpine plains, where it lives among raspberry bushes and the rocky substrate. In general, the species of the genus live in typical alpine grasslands with rocky outcrops where the individuals frequently recover under stones (Fig. 12). As for *C. p. arverna*, which probably lives on the Massif Central up to its highest peaks, populations are known even at an altitude of only 1000 m asl and living in forest environments.

On the basis of the present state of knowledge, the three taxa nowadays assignable to the genus *Chelidura*

Tab. 1. Main measures and ratios of the male neotype of *Chelidura aptera* from Monte Mucrone (Biella), 30.VIII.1971, leg. R. Pace. For male cerci measures see Fig. 11.

|                                             |          |
|---------------------------------------------|----------|
| Total body length (no cerci)                | 18.66 mm |
| Head width                                  | 7.65 mm  |
| Pronotum width in the middle                | 3.67 mm  |
| Pronotum length                             | 2.29 mm  |
| Ratio pronotum length/width                 | 0.62     |
| Ultimate tergite width                      | 7.65 mm  |
| Ultimate tergite length                     | 1.99 mm  |
| Ratio pronotum width/ultimate tergite width | 0.48     |
| Cerci total length                          | 4.74 mm  |
| Cerci basal width                           | 2.45 mm  |
| Cerci width at maximum curvature            | 0.92 mm  |
| Maximum curvature of the cerci              | 1.99 mm  |
| Pygidium width                              | 3.09 mm  |
| Paremeres length                            | 0.22 mm  |
| Parameres maxim width                       | 1.02 mm  |

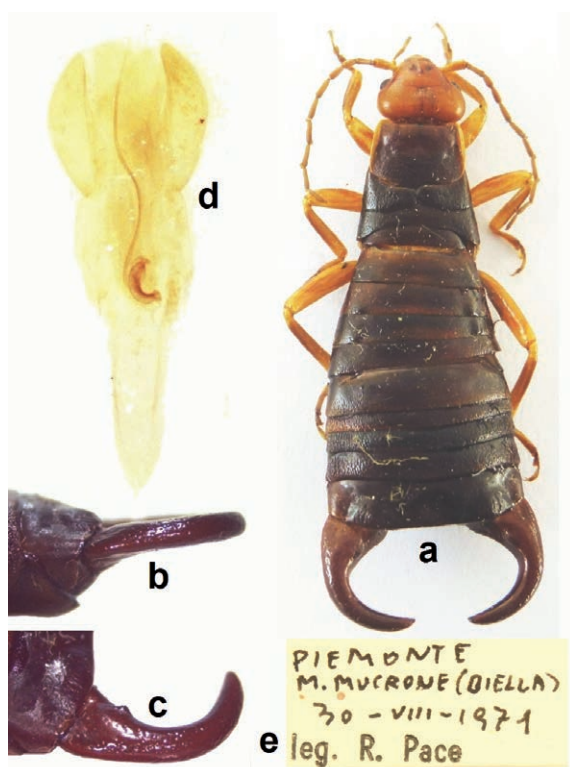


Fig. 10. Male neotype of *Chelidura aptera*, Italy, Piedmont (Biella), M. Mucrone, 30.08.1971, leg. Pace R. (collection Fontana at the Museo Civico di Rovereto, Italy), photo by Paolo Fontana. (a) Male dorsal overview, (b) terminalia form left lateral view, (c) three-quarter view from the left of left cercus and its small sub-basal small tubercle, (d) male terminalia, (e) original label. Photo by Paolo Fontana.

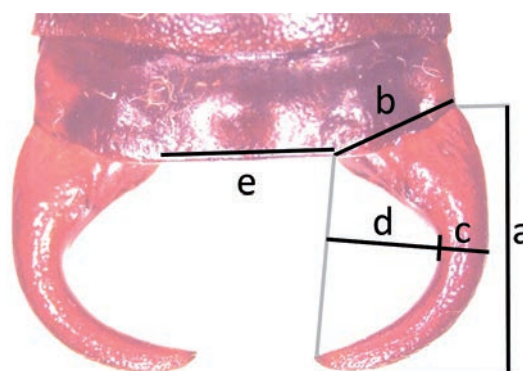


Fig. 11. Indication of the exact detection positions of the measurements of the terminalia of the Neotype of *Chelidura aptera*, according to David & Herrewége (1973). a) Cerci total length, b) cerci basal width, c) cerci width at maximum curvature, d) cerci maximum curvature and e) pygidium width. Graphic elaboration by Paolo Fontana.

sensu Kirstová *et al.* (2020), can be ecologically characterized and geographically distributed as follows:

***C. aptera***: exclusively alpine species, present on the Western and Central Alps. The Central Alps population, collected only in 2019 by M. Grosser,

substantially extends the distribution of the species towards the east. As previously shown in this paper, the alpine populations present a certain degree of genetic divergence, suggesting the existence of cryptic taxa under the present *C. aptera*. Chemini & Vigna Taglianti (2002) underline the presence of at least

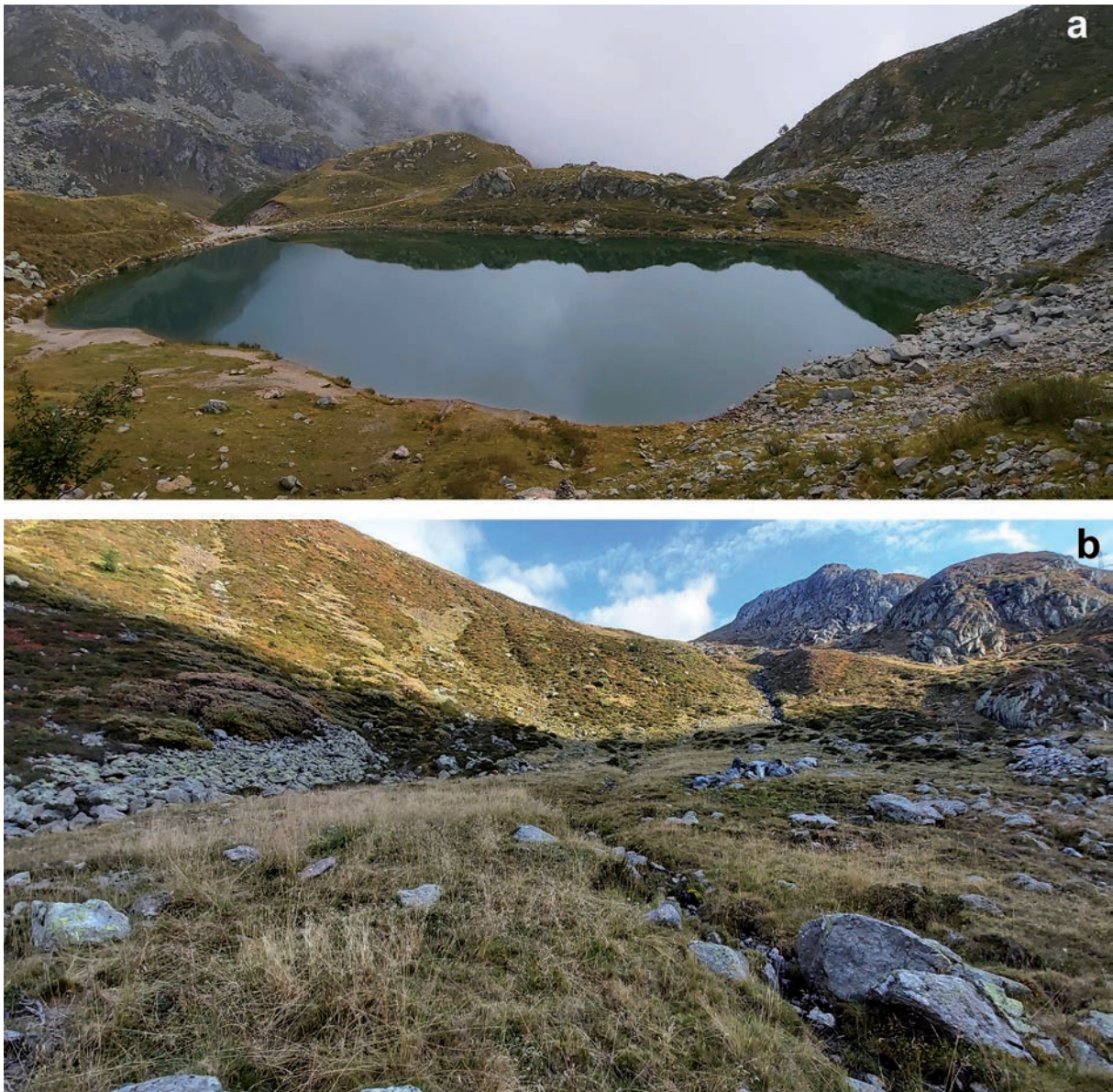


Fig. 12. a) Habitat of *Chelidura aptera*, Italy, Piedmont (Biella), Pennine Alps, Lago del Mucrone, Oropa, 1910 m, 18.IX.2019, photo by Federico Marangoni; b) habitat of *Chelidura aptera* (type locality of *F. montana*) Switzerland, Valais, Col du Grand Saint-Bernard, Liddes, 2160 m, 18.IX.2019, photo by Federico Marangoni.

some very distinct populations and in particular in the Ligurian, Maritime and Cottian Alps.

***C. pyrenaica pyrenaica*:** species recorded to date from the eastern Pyrenees, across France and Spain. In the collections of the Muséum national d'Histoire Naturelle (Paris, France) there is a male specimen from the Picacho de Veleta (Sierra Nevada) morphologically matching with the typical form (Fig. 13). Picacho de Veleta may refer to Pico del Veleta, a mountain in the Sierra Nevada (Spain). Pico del Veleta is the third highest mountain in the Iberian Peninsula (3392 m). This specimen, if really collected in the Sierra Nevada and not mislabelled, could considerably extend the range of the genus *Chelidura* to the south. The specimen of the Museum of Paris and any other specimens of this population outside its known distribution, definitely need to be re-examined (genitalia and barcoding) in order to dispel any doubts about their identity or the possibility of their accidental introduction from the Pyrenees.

***C. pyrenaica arverna*:** subspecies endemic from the Massif Central in France. DNA barcoding states it is a distinct entity from the alpine populations (*C. aptera*), however we still do not know its relations with *C. pyrenaica pyrenaica* from the eastern Pyrenees.

## CONCLUSIONS

The analysis on the four populations of *Chelidura*, together with the historical reconstruction and the morphological examination of a vast series of samples of very wide origin, allow us to further confirm, after the careful analysis carried out on the genus *Chelidurella* by Kirstová *et al.* (2020), the clear separation between the genera *Chelidura* Latreille, 1825, *Chelidurella* Verhoeff, 1902 and *Mesochelidura* Verhoeff, 1902. The genetic distance detected between the alpine populations of *Chelidura*, currently assigned to *C. aptera*, and those from the Massif Central resemble the divergence among the different genera mentioned above. Despite such genetic separation in two relatively close populations may suggest their separation in two genera, the establishment of any new name is premature. According to current knowledge it can therefore be concluded that the Alpine populations of *Chelidura* are clearly separated from those of the Massif Central, both as regards the molecular aspects and the morphology of the male genitalia. For now, only on a morphological basis, but entirely sufficient to support this distinction, even the populations from the Pyrenees can be considered clearly distinct from those of the Alps while further investigations are

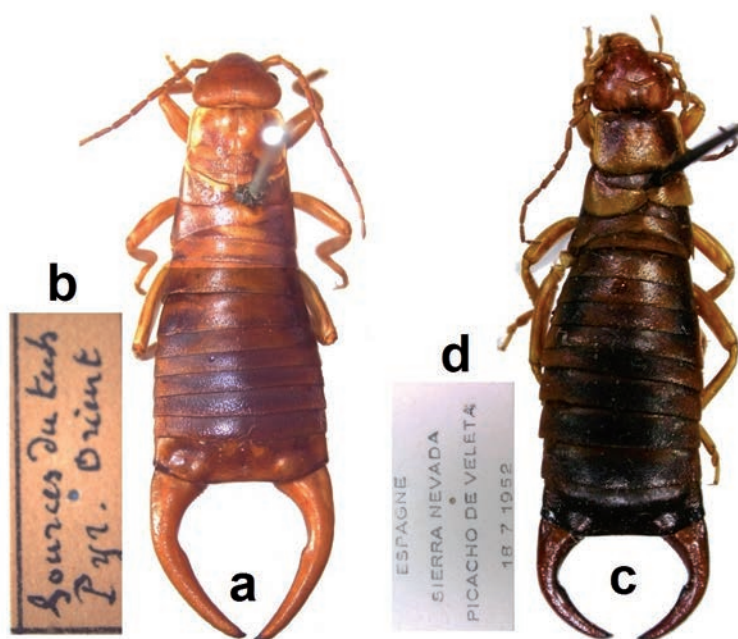


Fig. 13. a) Overview of a male and b) its relative label of *Chelidura pyrenaica*, cyclolabia form, France, Pyrenees Orientals, Sources du Tech (= Vallée superior du Tech), VII. 1904, leg. A. Borelli (collection Fontana at the Museo Civico di Rovereto, Italy), photo by Paolo Fontana. For locality and data see Borelli (1905). c) Overview of a male and d) its relative label of a specimen probably belonging to *Chelidura pyrenaica*, cyclolabia form, Spain, Sierra Nevada, Picacho de Veleta (= Pico de veleta), (collection of the Museum National d'Histoire Naturelle of Paris, France), photo Paolo Fontana.

needed in order to establish their affinity with the Pyrenean populations. DNA barcodes suggest that the Alpine *Chelidura* may be a species complex; for this reason, an integrated approach between fine morphology and DNA markers is strongly recommended in order to clarify what diversity hides under the name *C. aptera*.

We can therefore propose a distribution map of the genus *Chelidura* in relation to *Chelidurella* and *Mesochelidura* distributions (Fig. 14).

#### ACKNOWLEDGEMENTS

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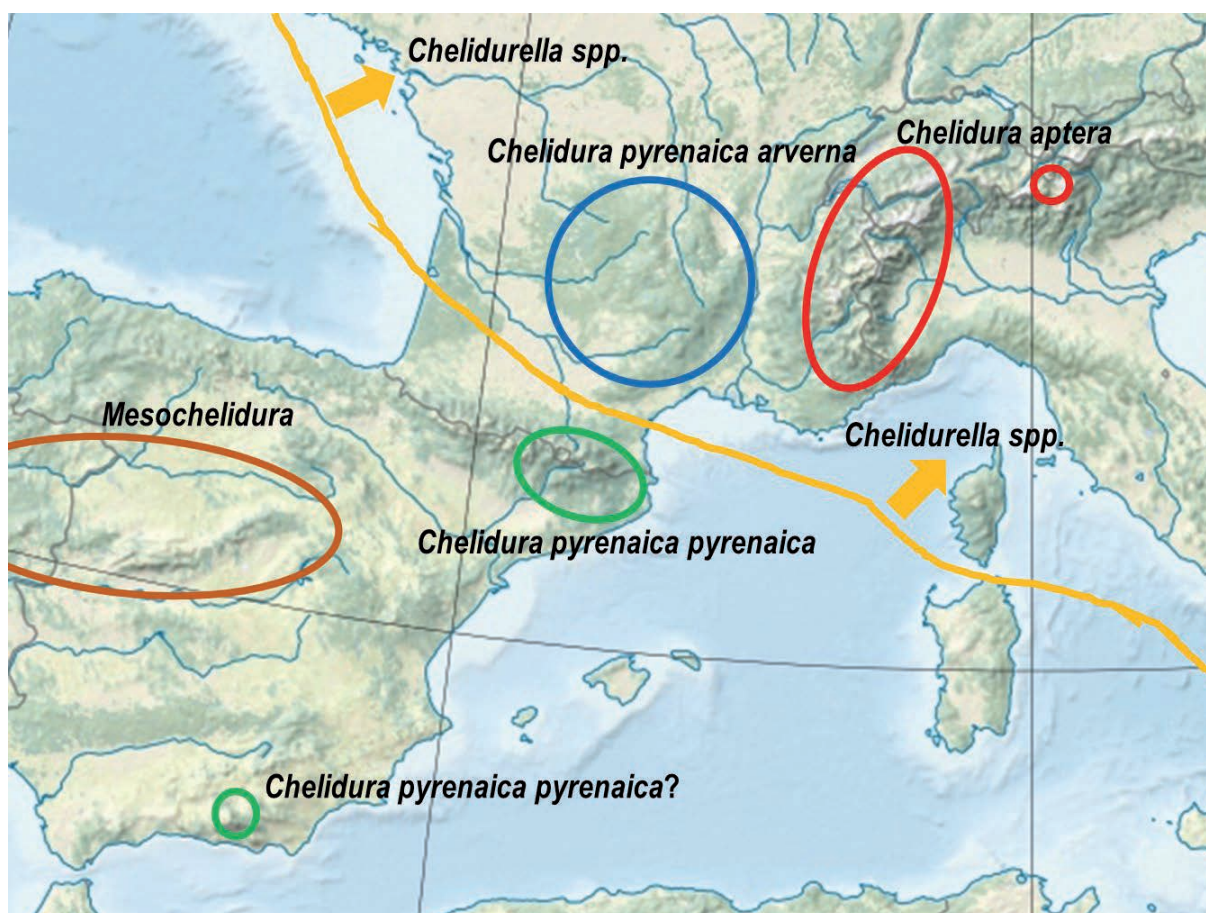


Fig. 14. Actual distribution map of the genus *Chelidura*, the genus *Mesochelidura* and the southwestern border of the known distribution of the genus *Chelidurella*, graphic by Paolo Fontana.

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# APPENDIX 1

| Code | Locality                                                                                                                                                                   | Barcode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2a-1 | Italy, Piedmont (Biella), Pennine Alps,<br>Lago del Mucrone, Oropa, 1910 m<br>(45°37'43,54" N, 7°56'38,24" E),<br>18.IX.2019, Paolo Fontana and<br>Federico Marangoni leg. | GGACTTTGTATTTTTGTTTGGGGCATGATCCGGAATGATTGGTACCTCT<br>CTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATTG<br>GGGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTTGTAAT<br>GATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGACT<br>TGTGCCCTTGATACTAAGAGCCCCGGATATAGCTTTCCACGTTTAAAT<br>AACATGAGATTCTGACTTCTCCCCCTTCGTTATTATTGTTACTATCTGG<br>GAGTATGGTAGATAGCGGGGCAGGAACAGGGTGAACAGTCTATCTCC<br>TTTGGCAGGATAATAGCTCATGCAGGTGCTTCGGTAGAITTAAGAATTT<br>TTTCTCTTCACTTGGCGGGGTATCATCAATTTAGGGGCTGTAACTT<br>TATTACTACTGTAATAAACATGCGTCCAGCAGGCTAAGACTAGAACGA<br>ATTCCACTATTTGTATGGTCCGTGGCAATTACAGCTTTATTGTTGTTGTT<br>GTCTCTTCCCGTGTGGCAGGGGCCATTACCATGTAATACTGATCGA<br>AATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGGTGATCCTATCT<br>ATACCAACATTTGCTT          |
| 2a-2 | Italy, Piedmont (Biella), Pennine Alps,<br>Lago del Mucrone, Oropa, 1910 m<br>(45°37'43,54" N, 7°56'38,24" E),<br>18.IX.2019, Paolo Fontana and<br>Federico Marangoni leg. | GACTTTGTATTTTTGTTTGGGGCATGATCCGGAATGATTGGTACCTCT<br>CTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATT<br>GGGGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTTGTA<br>ATGATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTG<br>ACTTGTGCCCTTGATACTAAGAGCCCCGGATATAGCTTTCCACGTTTA<br>AATAACATGAGATTCTGACTTCTCCCCCTTCGTTATTGTTGTTACTAT<br>CTGGGAGTATGGTGGATAGCGGGGCAGGAACAGGGTGAACAGTCTAT<br>CCTCCTTTGGCAGGATCCATAGCCCATGCGGGTGCTTCGGTAGATTTA<br>AGAATTTTTTCTCTTCACTTGGCGGGGGTATCATCAATTTTAGGGGCT<br>GTAAACTTTATTACTACTGTAATAAACATGCGTCCAGCAGGCCAAGA<br>CTAGAACGAATCCACTATTTGTATGGTCCGTGGCAATTACAGCTTTAT<br>TGTTGTTGTTGTCTCTTCCCGTGTGGCAGGGGCCATTACCATATTATT<br>AACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGG<br>TGATCCTATCTATACCAACACTTTGTTTT   |
| 2a-3 | Italy, Piedmont (Biella), Pennine Alps,<br>Lago del Mucrone, Oropa, 1910 m<br>(45°37'43,54" N, 7°56'38,24" E),<br>18.IX.2019, Paolo Fontana and<br>Federico Marangoni leg. | GGACTTTGTATTTTTGTTTGGGGCATGATCCGGAATGATTGGTACCTC<br>TCTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATT<br>GGGGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTTGTA<br>ATGATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTG<br>ACTTGTGCCCTTGATACTAAGAGCCCCGGATATAGCTTTCCACGTTTA<br>AATAACATGAGATTCTGACTTCTCCCCCTTCGTTATTGTTGTTACTAT<br>CTGGGAGTATGGTGGATAGCGGGGCAGGAACAGGGTGAACAGTCTAT<br>CCTCCTTTGGCAGGATCCATAGCCCATGCGGGTGCTTCGGTAGATTTA<br>AGAATTTTTTCTCTTCACTTGGCGGGGGTATCATCAATTTTAGGGGCT<br>GTAAACTTTATTACTACTGTAATAAACATGCGTCCAGCAGGCCAAGA<br>CTAGAACGAATCCACTATTTGTATGGTCCGTGGCAATTACAGCTTTAT<br>TGTTGTTGTTGTCTCTTCCCGTGTGGCAGGGGCCATTACCATATTATT<br>AACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGG<br>TGATCCTATTCTATACCAACACTTTGTTTT |

| Code | Locality                                                                                                                                               | Barcode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5-1  | Switzerland, Valais, Col du Grand Saint-Bernard, Liddes, 2160 m, (45°53'11,24" N, 7°11'24,35" E), 18.IX.2019, Paolo Fontana and Federico Marangoni leg | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGAGCTTTAATT<br>GGAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTA<br>CTGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTG<br>ACCCTATTTGTACCAACATTGTTT |
| 5-2  |                                                                                                                                                        | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGAGCTTTAATT<br>GGAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTGTACCAACATT    |
| 5-3  |                                                                                                                                                        | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGAGCTTTAATT<br>GGAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAA<br>ATAATATGAGATTCTGACTGCTTCCTCCTTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTGTACCAACATT    |
| 5-4  |                                                                                                                                                        | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGAGCTTTAATT<br>GGAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTGTACCAACA      |

| Code | Locality | Barcode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| 5-5  |          | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAATT<br>GGAGATGACCAAATTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTTGTACCAACATT |
| 5-6  |          | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAATT<br>GGAGATGACCAAATTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTTGTACCAACATT |
| 5b-1 |          | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAATT<br>GGAGATGACCAAATTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTTGTACCAACATT |
| 5b-2 |          | GACTTTATATTTTTGTTTGGAGCATGATCCGGAATGATCGGCACCTC<br>TCTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAAT<br>TGGAGATGACCAAATTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTGTAACCTTGATATTAAGAGCCCCGGACATAGCTTTCCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCCTCCTCACTGTTGTTGTTGCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTTGTCCCTTCCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTTGTACCAACATT |

| Code | Locality                                                                                                                                               | Barcode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| 5b-3 |                                                                                                                                                        | GAC TTTATAT TTTT TGT TTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAATT<br>GGAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGTTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTG TACCCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCTCTCTCACTGTTGTTGTGTCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTTGTCCCTTCTGTCTTAGCAGGGGCTATTACCATATGATTAA<br>CTGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTG<br>ACCCTATTTTGTACCAACATT |
| 5b-4 |                                                                                                                                                        | GAC TTTATAT TTTT TGT TTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>CTGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAATT<br>GGAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTA<br>ATAATTTTTTTATGTTTATACCTATTATAATTGGTGGTTTTGGTAATTGA<br>CTTG TACCCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAA<br>ATAATATGAGATTCTGACTTCTTCTCTCTCACTGTTGTTGTGTCTATCT<br>GGGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACC<br>CCCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAA<br>GAATTTTTTCTCTTCATTTGGCAGGGGTGTCATCAATTTAGGGGCTGT<br>AAACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCT<br>GGAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTG<br>TTGTTGTTGTCCCTTCTGTCTTAGCAGGGGCTATTACCATATTATTAAC<br>TGATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGA<br>CCCTATTTTGTACCAACATT |
| 5b-5 |                                                                                                                                                        | GCTTTATAT TTTT TGT TTTGGAGCATGATCCGGAATGATCGGCACCTCT<br>TGAGAATATTAATTCGAGCTGAGTTAGGCCACCCCGGAGCTTTAATTG<br>GAGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTCGTAAT<br>AATTTTTTTTATGTTTATACCTATTATAATTGGTGGTTTTGGTAATTGACT<br>TGTACCCTTGATATTAAGAGCCCCGGACATAGCTTTCCACGTTTAAAT<br>AATATGAGATTCTGACTTCTTCTCTCTCACTGTTGTTGTGTCTATCTG<br>GGAGAATGGTGGACAGCGGAGCAGGAACCGGGTGAACAGTTTACCC<br>CCCTTTGGCAGGATCAATAGCTCATGCGGGCGCTTCGGTAGATTAAAG<br>AATTTTTTCTCTTCATTTGGCAGGGGTGTCATCAATTTAGGGGCTGTA<br>AACTTTATTACTACTGTAATGAACATGCGTCCAGTAGGTCTAAGGCTG<br>GAGCGAATTCCCCTATTTGTGTGGTCCGTAGCAATTACAGCTTTATTGT<br>TGTTGTTGTCCCTTCTGTCTTAGCAGGGGCTATTACCATCTTATTAAC<br>GATCGAAATTTAAATACGTCATTCTTTGACCCTGCTGGAGGAGGTGAC<br>CCTATTTTGTACCAACATT    |
| 16   | Italy, Lombardy (Sondrio), Western Rhaetian<br>Alps, Franschia, Lanzada, 1480 m,<br>(46°17'21,4" N, 9°54'41,14" E),<br>22.VII.2019, Mario Grosser leg. | GAC TTTGTAT TTTT TGT TTTGGGCGATGATCTGGGATGATTGGTACCTCT<br>CTTAGAATATTAATTCGAGCTGAGTTAGGTACCCCGGAGCTTTAATT<br>GGGGATGACCAAATTTATAATGTAATTGTAACAGCCCACGCTTTTGTA<br>ATGATTTTTTTATGTTTATACCTATTATAATTGGTGGTTTTGGTAATTG<br>ACTTGTGCCCTTGATACTAAGAGCCCCGGATATGGCTTTCCACGTTT<br>AAATAACATGAGATTCTGACTTCTTCTCTCTCGTTACTGTTGTACTA<br>TCTGGAAGTATGGTGGATAGCGGGGAGGAACAGGGTGAACAGTTTAA<br>TCCTCTTTGGCAGGATCAATAGCTCATGCGGGGTGCTTCAGTAGATT<br>AAGAATTTTTTCTCTTCACTAGCAGGAGTATCATCAATTTAGGGGCT<br>GTAAACTTTATTACTACTGTAATAAATGCGTCCAGCAGGCCTAAGA<br>CTAGAACGAATTCCTACTATTTGTATGGTCCGTGGCAATTACAGCATTAT<br>TGTTGTTGTTGTCTCTCCCCGTGTTAGCAGGGGCTATTACCATTGTATT<br>AACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGG<br>TGATCTATTTTATACCAACATT      |

| Code | Locality                                                                                                                                     | Barcode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17-1 | Italy, Lombardy (Sondrio), Western Rhaetian Alps, Franscia, Lanzada, 1480 m, (46°17'21,4" N, 9°54'41,14" E), 22.VII.2019, Mario Grosser leg. | GACTTTGTATTTTTGTTTGGGGCATGATCTGGGATGATTGGTACCTCTCTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATTGGGGATGACCAAATTTATAATGTAATTGTAACAGCCACGCTTTTGTAATGATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGACTTGTGCCCTTGATACTAAGAGCCCCGGATATGGCTTTCCACGTTTAAATAACATGAGATTCTGACTTCTTCTCCTTCGTTACTGTTGTTACTATCTGGAAGTATGGTGGATAGCGGGGCAGGAACAGGGTGAACAGTTTATCCTCCTTTGGCAGGATCAATGGCTCATGCGGGTGCTTCAGTAGATTTAAGAATTTTTTCTTCACTTAGCAGGAGTATCATCAATTTAGGGGCTGTAAACTTTATTACTACTGTAATAAACATGCGTCCAGCAGGCCAAGACTAGAACGAATTCACATTTGTATGGTCCGTGGCAATTACAGCATTATTGTTGTTGTTGTCTCTCCCGTGTTAGCAGGGGCCATTACCATATTATTAACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGGTGATCCTATTTTATACCAACATTT     |
| 17-2 | Italy, Lombardy (Sondrio), Western Rhaetian Alps, Franscia, Lanzada, 1480 m, (46°17'21,4" N, 9°54'41,14" E), 22.VII.2019, Mario Grosser leg. | GACTTTGTATTTTTGTTTGGGGCATGATCTGGGATGATTGGTACCTCTCTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATTGGGGATGACCAAATTTATAATGTAATTGTAACAGCCACGCTTTTGTAATGATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGACTTGTGCCCTTGATACTAAGAGCCCCGGATATGGCTTTCCACGTTTAAATAACATGAGATTCTGACTTCTTCTCCTTCGTTACTGTTGTTACTATCTGGAAGTATGGTGGATAGCGGGGCAGGAACAGGGTGAACAGTTTATCCTCCTTTGGCAGGATCAATAGCTCATGCGGGTGCTTCCGTAGATTTAAGAATTTTTTCTTCACTTAGCAGGAGTATCATCAATTTAGGGGCTGTAAACTTTATTACTACTGTAATAAACATGCGTCCAGCAGGCCAAGACTAGAACGAATTCACATTTGTATGGTCCGTGGCAATTACAGCATTATTGTTGTTGTTGTCTCTCCCGTGTTAGCAGGGGCCATTACCATATTCTTAACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGGTGATCCTATTTTATACCAACAAT      |
| 18   | Italy, Lombardy (Sondrio), Western Rhaetian Alps, Franscia, Lanzada, 1480 m, (46°17'21,4" N, 9°54'41,14" E), 22.VII.2019, Mario Grosser leg. | GACTTTGTATTTTTGTTTGGGGCATGATCTGGGATGATTGGTACCTCTCTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATTGGGGATGACCAAATTTATAATGTAATTGTAACAGCCACGCTTTTGTAATGATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGACTTGTGCCCTTGATACTAAGAGCCCCGGATATGGCTTTCCACGTTTAAATAACATGAGATTCTGACTTCTTCTCCTTCGTTACTGTTGTTACTATCTGGAAGTATGGTGGATAGCGGGGCAGGAACAGGGTGAACAGTTTATCCTCCTTTGGCAGGATCCATAGCTCATGCGGGTGCTTCAGTAGATTTAAGAATTTTTTCTTCACTTAGCAGGAGTATCATCAATTTAGGGGCTGTAAACTTTATTACTACTGTAATAAACATGCGTCCAGCAGGCCAAGACTAGAACGAATTCACATTTGTATGGTCCGTGGCAATTACAGCATTATTGTTGTTGTTGTCTCTCCCGTGTTAGCAGGGGCCATTACCATATTATTAACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGGTGATCCTATTTTATACCAACATTTGTTT |
| 19   | Italy, Lombardy (Sondrio), Western Rhaetian Alps, Franscia, Lanzada, 1480 m, (46°17'21,4" N, 9°54'41,14" E), 22.VII.2019, Mario Grosser leg. | GACTTTGTATTTTTGTTTGGGGCATGATCTGGGATGATTGGTACCTCTCTTAGAATATTAATTCGAGCTGAGTTAGGTCACCCCGGAGCTTTAATTGGGGATGACCAAATTTATAATGTAATTGTAACAGCCACGCTTTTGTAATGATTTTTTTTATGGTTATACCTATTATAATTGGTGGTTTTGGTAATTGACTTGTGCCCTTGATACTAAGAGCCCCGGATATGGCTTTCCACGTTTAAATAACATGAGATTCTGACTTCTTCTCCTTCGTTACTGTTGTTACTATCTGGAAGTATGGTGGATAGCGGGGCAGGAACAGGGTGAACAGTTTATCCTCCTTTGGCAGGATCAATAGCTCATGCGGGTGCTTCAGTAGATTTAAGAATTTTTTCTTCACTTAGCAGGAGTATCATCAATTTAGGGGCTGTAAACTTTATTACTACTGTAATAAACATGCGTCCAGCAGGCCAAGACTAGAACGAATTCACATTTGTATGGTCCGTGGCAATTACAGCATTATTGTTGTTGTTGTCTCTCCCGTGTTAGCAGGGGCCATTACCATATTATTAACTGATCGAAATTTAAATACATCGTTCTTTGACCCTGCTGGAGGGGGTGATCCTATTTTATACCAACATTTGTTT |