An updated check-list of Italian amphibians and reptiles

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Abstract - This paper represents an update of the list of Italian amphibians and reptiles published 15 years ago by Razzetti *et al*. (2006) and of the checklist published in 1993 by the late Benedetto Lanza. At present, the Italian herpetofauna includes 100 species (41 amphibians and 59 reptiles) and an amphibian taxon of hybrid origin. Seven species and one subspecies are allochthonous and became naturalized within the last century. Since the last published list, a new species has been described (*Vipera walser*), five taxa have been raised to species rank (*Salamandrina perspicillata*, *Speleomantes sarrabusensis, Zootoca carniolica, Malpolon insignitus* and *Natrix helvetica*) while three taxa have been downgraded to subspecies. All the relevant taxonomic changes based upon new research have been discussed, including tentative revisions and controversial taxa. Nine species reported or listed dubitatively in Lanza's 1993 list are excluded here.

Key words: Amphibians, Italy, reptiles, subspecies, taxonomic inflation, taxonomy.

Riassunto - Una check-list aggiornata degli anfibi e dei rettili italiani.

Gli autori presentano un aggiornamento dell'erpetofauna italiana rispetto all'elenco pubblicato 15 anni or sono da Razzetti *et al*. (2006) e alla lista di Benedetto Lanza del 1993. L'erpetofauna italiana è costituita da 100 specie (41 anfibi e 59 rettili) e un taxon di anfibi di origine ibrida. Sette specie e una sottospecie sono alloctone naturalizzate nel corso degli ultimi 100 anni. Da quando è stato pubblicato l'ultimo elenco italiano è stata descritta una nuova specie, *Vipera walser*, cinque taxa, *Salamandrina perspicillata*, *Speleomantes sarrabusensis*, *Zootoca carniolica*, *Malpolon insignitus* e *Natrix helvetica*, sono stati elevati al rango di specie e altri tre taxa sono stati portati al rango di sottospecie. Tutte le variazioni tassonomiche sono discusse alla luce delle più recenti evidenze scientifiche, così come sono presentate le differenti opinioni degli autori al riguardo di taxa la cui validità è ancora oggetto di dibattito. Nove specie riportate per il territorio italiano o elencate in modo dubitativo nell'elenco del 1993 sono qui escluse.

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Parole chiave: Anfibi, inflazione tassonomica, Italia, rettili, sottospecie, tassonomia.

INTRODUCTION

"Checklists of species are invaluable tools in the fields of natural science. They serve to consolidate our level of knowledge and at the same time reveal areas in need of further investigation" (Parenti & Randall, 2000).

The last checklist of the Italian herpetofauna (with taxonomic remarks) dates back to fifteen years ago (Razzetti *et al*., 2006) and represents the updating of previous lists (e.g. Lanza in Amori *et al*., 1993). Since then, several taxonomic changes have occurred and markedly modified the picture of the species distributed in Italy.

Some of the name changes are updates resulting from taxonomic revisions, while some others represent just nomenclature amendments. A few species occurring in areas adjacent to the study area and included in previous Italian checklists have been excluded, whereas a number of alien taxa are now naturalised in the country.

However, most of the changes are the result of the considerable contributions given by the publication of phylogenetic and phylogeographic studies. The use of DNA in phylogenetic reconstructions allowed to distinguish cryptic taxa that were difficult to identify on the sole morphological basis, thus significantly increasing the number of recognized species (e.g. in the genera *Bufotes, Hyla, Anguis*, etc.), and the knowledge on the genetic structure of the various taxa, with an impact on taxonomy, biogeography and conservation biology.

In recent decades, on a global level, the number of recognized taxa (including amphibians and reptiles) have increased to such an extent to speculate about a "taxonomic inflation" (Isaac *et al*., 2004). In support of this, a recent study on Eurasian vipers recognizes "15 taxa as valid species, three taxa which likely represent species complexes, 17 taxa of doubtful validity as species, and five taxa for which species status is maintained but further research is highly recommended to assess taxonomic arrangements" (Freitas *et al*., 2020).

The "taxonomic inflation" might be due to the tendency of recognizing as species the clades emerging from phylogenetic trees, and to the fact that the description of a "new" species has a greater "impact" than a subspecies.

Moreover, when negotiating with agencies deciding on conservation policies and their funding, species-targeted interventions are more likely to be funded than those targeting subspecies or local populations. This encourages the elevation to species rank of populations that need protection, regardless of whether there is scientific support for this status (Isaac *et al.,* 2004). Although the conservation aims are acceptable, in our opinion the vulnerability of a not very diversified population cannot be the criterion for elevating it to a species.

To estimate species boundaries more precisely, many authors adopt an "integrative taxonomy" approach (Dayrat, 2005), which combines "different lines of evidence (e.g. genetic, morphological, ecological) and methodologies (e.g. phylogenetic inference, ordination methods, ecological modelling) to objectively identify taxa".

Other than increasing knowledge about cryptic taxa and the genetic structure of species, phylogenetic studies have challenged the idea of "rigid" taxonomic categories of genus, species and subspecies in view of the continuum of differentiation that we observe in nature. Modern genetic studies not only provide elements of classification (taxa) but also hypotheses on the clades (lineages) and the phylogeny (relations between clades); therefore, the traditional taxonomic categories (e.g. taxa, genera, species) are often replaced by the terms "clades", "lineages" and "Evolutionarily Significant Units" (ESUs).

Above all, the concept of subspecies has fallen into disuse, as currently many studies tend to raise subspecies to a specific rank (especially if geographically allopatric) if they show some genetic differentiation, even small, as long as it is statistically supported. On the other hand, many "classic" subspecies, described based on morphological variations or discrete distribution ranges (in particular the micro-island subspecies) have not been supported by the results of genetic studies and are therefore to be considered synonyms. Nonetheless, it is believed that the taxonomic category of subspecies is very useful, not only for describing the geographical peculiarities of populations, but also for highlighting the stages of incomplete speciation, which can be reversible when two only partially differentiated populations come into contact; the use of subspecies is beneficial both for communication among scientists and for conservation (Kindler & Fritz 2018).

MATHERIALS AND METHODS

This checklist is an updated picture of all the amphibians and reptile taxa naturally occurring, or introduced and naturalized within the Italian political territory. Two species of marine turtles have been listed here despite limited records of vagrant individuals in the study area. The checklist includes also several taxonomic and nomenclatural remarks about status and distribution of many taxa.

The present paper represents the subjective point of view of the authors. We are well aware that the recognition of a taxon is a scientific hypothesis and not an absolute truth, and therefore a taxon can, in some cases, be assessed differently based on the knowledge and opinions of each author.

At the species level, we mostly adopted the published results of the Taxonomic Committee of the Societas Europaea Herpetologica (Speybroeck *et al*., 2020), composed of 12 international experts. Any opinions diverging from those of the Taxonomic Committee of the S.E.H., as well as all the discrepancies with respect to the previous Italian check-lists (Lanza in Amori *et al*., 1993; Razzetti *et al*., 2006), are explained in the notes.

As for the subspecies, not covered by Speybroeck *et al*. (2020), we generally adopted geographically isolated populations (populations with disjoint or island ranges) showing some genetic differentiation, provided statistically supported, or populations of those "semi-species" showing restricted introgression areas.

Moreover, we refrained to list subspecies of highly variable species for which the available studies have only tentatively revised the infraspecific taxonomy (e.g. *Podarcis siculus, P. muralis*).

DISCUSSION

According to the present checklist, the Italian herpetofauna is represented by 100 species (41 amphibians and 59 reptiles) and an amphibian taxon of hybrid origin (*Pelophylax* kl. *esculentus*). Five species are marine turtles, of which only *Caretta caretta* breeds regularly (although in relatively small numbers) on Italian beaches; *Dermochelys coriacea* and *Chelonia mydas* are regularly observed along Italian coasts, while *Lepidochelys kempii* and *Eretmochelys imbricata* occur in the Mediterranean only with vagrant individuals.

Six species and a subspecies are aliens naturalized within the last century (*Lithobates catesbeianus, Pelophylax ridibundus kurtmuelleri*, *Pelophylax* cf. *bedriagae, Xenopus laevis, Trachemys scripta, Chamaeleo chamaeleon, Indotyphlops braminus* and, probably, *Eryx jaculus*). More difficult is to ascertain if some well-established species are really autochthonous or if their presence is due to ancient man-mediated introductions (the so-called "parautochthonous" species cf. VV.AA., 2007). Even if biogeographic and genetic data strongly support the introduction of some species in ancient times (i.e. *Testudo marginata*, *T. graeca* and *Emys orbicularis* in Sardinia), for other (*Chalcides chalcides, C. ocellatus, Podarcis siculus, Natrix maura* and *Hemorrhois hippocrepis* in Sardinia, *Podarcis filfolensis* on Linosa and Lampione, *Mediodactylus kotschyi* in Apulia and Basilicata) the last word has yet to be said.

Some species, native or putatively native in some regions of Italy, are present as alien species in other areas: it is the case of *Tarentola mauritanica*, *Hemidactylus turcicus* and *Mediodactylus kotschyi* in northern Italy, *Podarcis siculus siculus* near the Garda Lake, *Proteus anguinus* in Veneto, *Speleomantes strinatii* in Venezia Giulia, *Speleomantes ambrosii* and *S. italicus* in Siena province (Tuscany), *Bufo bufo* in Sardinia etc., and very likely of *Algyroides nigropunctatus* in Apulia. As for *Hyla meridionalis*, which is believed to be introduced in historical times in Europe, although with no definitive evidence (Recuero *et al*., 2007), its presence in Italy is probably due to its subsequent spontaneous expansion from southern France.

Comparing the new checklist with those of Lanza in Amori *et al*. (1993) and Razzetti *et al*. (2006), *Vipera walser* has been described, *Salamandrina perspicillata, Speleomantes sarrabusensis, Zootoca carniolica, Malpolon insignitus* and *Natrix helvetica,* have been raised to species rank, *Bombina pachypus, Pelophylax bergeri* and *P. kurtmuelleri* have been downgraded to subspecies.

Besides some species listed dubitatively by Lanza in Amori *et al*. (1993) have never been recorded in Italy (i.e. *Rana arvalis, Pelophylax perezi, Pseudopus apodus*, *Lacerta trilineata, Platyceps najadum*), some other, reported by Lanza as belonging to the Italian fauna, are here excluded: *Mauremys caspica* and *M. leprosa* since naturalized populations are unknown, *Hierophis gemonensis* (reported in Italy on the basis of misidentified juveniles of *H. viridiflavus*), and *Zamenis scalaris* (reported once in Italy close to the French border, but never confirmed again).

To better understand the origin of dubiously native species (cryptogenic species) and the taxonomic status of some Italian populations further investigations are needed, especially for the following taxa:

- the specific allocation of *Speleomantes ambrosii bianchii* alternatively regarded as a subspecies of *S. italicus* or of *S. ambrosii* by different authors;
- the taxonomic status of the Italian populations of *Proteus anguinus*;
- the infraspecific taxonomy of *Rana temporaria* in Italy;
- the taxonomy of *Tarentola* from Lampedusa Island and the nearby Isola dei Conigli;
- the actual specific distinction between *Lacerta viridis* and *L. bilineata*, and the status and taxonomy of the Adriatic lineage of the *Lacerta viridis* complex;
- the infraspecific taxonomy of *Podarcis muralis*;
- the infraspecific taxonomy of *Podarcis siculus*;
- the infraspecific taxonomy of *Zootoca vivipara* in Italy;
- the relationships of *Psammodromus algirus* from Isola dei Conigli;
- the origin of Sicilian *Eryx jaculus*;
- the specific allocation of the *Macroprotodon* population of Lampedusa;
- the infraspecific taxonomy of *Coronella austriaca*;
- the taxonomic status of *Natrix helvetica* and *N. natrix*, due to the wide hybridization area observed in northeastern Italy;
- the taxonomic status of Aesculapian snakes (*Zamenis*) from Apulia.

CHECKLIST

Class Amphibia Linnaeus 1758

Order Urodela Duméril 1805

Family Salamandridae Goldfuss 1820
Genus *Euproctus* Gené 1839
Euproctus platycephalus (Gravenhorst 1829)
Genus *Ichthyosaura* Sonnini & Latreille 1801
Ichthyosaura alpestris (Laurenti 1768)
  Ichthyosaura alpestris alpestris (Laurenti 1768)
  Ichthyosaura alpestris apuana (Bonaparte 1839)
  Ichthyosaura alpestris inexpectata (Dubois & Breuil 1983)[1]
Genus *Lissotriton* Bell 1839
Lissotriton italicus (Peracca 1898)
Lissotriton vulgaris (Linnaeus 1758)
  Lissotriton vulgaris vulgaris (Linnaeus 1758)
  Lissotriton vulgaris meridionalis (Boulenger 1882)[2]
Genus *Salamandra* Garsault 1764[3]
Salamandra atra (Laurenti 1768)
  Salamandra atra atra (Laurenti 1768)
  Salamandra atra aurorae (Trevisan 1982)
  Salamandra atra pasubiensis (Bonato & Steinfartz 2005)
Salamandra lanzai (Nascetti, Andreone, Capula & Bullini 1988)
Salamandra salamandra (Linnaeus 1758)
  Salamandra salamandra salamandra (Linnaeus 1758)
  Salamandra salamandra gigliolii (Eiselt & Lanza 1956)[4]
Genus *Salamandrina* Fitzinger 1826
Salamandrina perspicillata (Savi 1821)[5]
Salamandrina terdigitata (Bonnaterre 1789)
Genus Triturus Rafinesque 1815
Triturus carnifex (Laurenti 1768)[6]

Family Plethodontidae Gray 1850
Genus *Speleomantes* Dubois 1984[7]
Speleomantes ambrosii (Lanza 1955)
  Speleomantes ambrosii ambrosii (Lanza 1955)
  Speleomantes ambrosii bianchii Lanza, Cimmaruta, Forti, Bullini & Nascetti 2005[8]
Speleomantes flavus (Stefani 1969)
Speleomantes genei (Temminck & Schlegel 1838)[9]
Speleomantes imperialis (Stefani 1969)
Speleomantes italicus (Dunn 1923)[10]
Speleomantes sarrabusensis Lanza, Leo, Forti, Cimmaruta, Caputo & Nascetti 2001[11]
Speleomantes strinatii (Aellen 1958)
Speleomantes supramontis (Lanza, Nascetti & Bullini 1986)

Family Proteidae Gray 1825
Genus *Proteus* Laurenti 1768
Proteus anguinus Laurenti 1768[12]

Order Anura Duméril 1805

Family *Alytidae* Fitzinger 1843
Genus *Discoglossus* Otth 1837
Discoglossus pictus Otth 1837[13]
Discoglossus sardus Tschudi in Otth 1837

Family Bombinatoridae Gray 1825
Genus *Bombina* Oken 1816
Bombina variegata (Linnaeus 1758)

Bombina variegata variegata (Linnaeus 1758)
Bombina variegata pachypus (Bonaparte 1838)[14]

Family Pipidae Gray 1825
Genus *Xenopus* Wagler 1827
Xenopus laevis (Daudin 1802)[15]

Family Pelobatidae Bonaparte 1850
Genus *Pelobates* Wagler 1830
Pelobates fuscus (Laurenti 1768)[16]

Family Pelodytidae Bonaparte 1850
Genus *Pelodytes* Bonaparte 1838
Pelodytes punctatus (Daudin 1802)

Family Bufonidae Gray 1825
Genus *Bufo* Garsault 1764[17]
Bufo bufo (Linnaeus 1758)[18]
Bufo spinosus (Daudin 1803)[19]
Genus *Bufotes* Rafinesque 1815
Bufotes boulengeri (Lataste 1879)
Bufotes boulengeri boulengeri (Lataste 1879)
Bufotes boulengeri siculus (Stöck, Sicilia, Belfiore, Buckley, Lo Brutto, Lo Valvo & Arculeo 2008)[20]
Bufotes viridis (Laurenti 1768)
Bufotes viridis viridis (Laurenti 1768)
Bufotes viridis balearicus (Boettger 1880)[21]

Family Hylidae Rafinesque 1815
Genus *Hyla* Laurenti 1768
Hyla arborea (Linnaeus 1758)[22]
Hyla intermedia Boulenger 1882
Hyla intermedia intermedia Boulenger 1882
Hyla intermedia perrini Dufresnes, Mazepa, Rodrigues, Brelsford, Litvinchuk, Sermier, Lavanchy, Betto-Colliard, Blaser, Borzée, Cavoto, Fabre, Ghali, Grossen, Horn, Leuenberger, Phillips, Saunders, Savary, Maddalena, Stöck, Dubey, Canestrelli & Jeffries 2018[23]
Hyla meridionalis Boettger 1874
Hyla sarda (de Betta 1857)

Family Ranidae Batsch 1796
Genus *Pelophylax* Fitzinger 1843[24]
Pelophylax cf. *bedriagae* (Camerano 1882)[25]
Pelophylax lessonae (Camerano 1882)
Pelophylax lessonae lessonae (Camerano 1882)
Pelophylax lessonae bergeri (Günther 1986)[26]
Pelophylax kl. *esculentus* (Linnaeus 1758)
Pelophylax ridibundus (Pallas 1771)
Pelophylax ridibundus ridibundus (Pallas 1771)
Pelophylax ridibundus kurtmuelleri (Gayda 1940)[27]
Genus *Lithobates* Fitzinger 1843
Lithobates catesbeianus (Shaw 1802)[28]
Genus *Rana* Linnaeus 1758
Rana dalmatina Fitzinger in Bonaparte 1838
Rana italica Dubois 1987
Rana latastei Boulenger 1879
Rana temporaria Linnaeus 1758[29]

Class Reptilia Laurenti 1768

Order Testudines Linnaeus 1758

Family Cheloniidae Oppel 1811
Genus *Caretta* Rafinesque-Schmaltz 1814
Caretta caretta (Linnaeus 1758)
Genus *Chelonia* Brongniart 1800
Chelonia mydas (Linnaeus 1758)
Chelonia mydas mydas (Linnaeus 1758)
Genus *Eretmochelys* Fitzinger 1843
Eretmochelys imbricata (Linnaeus 1766)[30]
Genus *Lepidochelys* Fitzinger 1843
Lepidochelys kempii (Garman 1880)[31]

Family Dermochelyidae Fitzinger 1843
Genus *Dermochelys* de Blainville 1816
Dermochelys coriacea (Vandelli 1761)

Family Testudinidae Batsch 1788
Genus *Testudo* Linnaeus 1758
Testudo graeca Linnaeus 1758
Testudo graeca nabeulensis (Highfield 1990)[32]
Testudo hermanni Gmelin 1789[33]
Testudo hermanni hermanni Gmelin 1789
Testudo hermanni boettgeri Mojsisovics 1889
Testudo marginata Schoepff 1792

Family Emydidae Rafinesque 1815
Genus *Emys* Duméril 1805
Emys orbicularis (Linnaeus 1758)[34]
Emys orbicularis galloitalica Fritz 1995[35]
Emys orbicularis hellenica (Valenciennes 1832)
Emys orbicularis trinacris Fritz, Fattizzo, Guicking, Tripepi, Pennisi, Lenk, Joger & Wink 2005
Genus *Trachemys* Agassiz 1857
Trachemys scripta (Thunberg in Schoepff 1792)[36]
Trachemys scripta elegans (Wied 1838)
Trachemys scripta scripta (Thunberg in Schoepff 1792)

Order Squamata Oppel 1811

Family Chamaeleonidae Rafinesque 1815
Genus *Chamaeleo* Laurenti 1768
Chamaeleo chamaeleon (Linnaeus 1758)[37]

Family Sphaerodactylidae Underwood 1954
Genus *Euleptes* Fitzinger 1843
Euleptes europaea (Gené 1839)

Family Gekkonidae Oppel 1811
Genus *Hemidactylus* Oken 1817
Hemidactylus turcicus (Linnaeus 1758)[38]
Genus *Mediodactylus* Szczerbak & Golubev 1977
Mediodactylus kotschyi (Steindachner 1870)
Mediodactylus kotschyi kotschyi (Steindachner 1870)[39]

Family Phyllodactylidae Gamble, Bauer, Greenbaum & Jackman 2008
Genus *Tarentola* Gray 1825
Tarentola mauritanica (Linnaeus 1758)[40]

Family Lacertidae Batsch 1788
Genus *Algyroides* Bibron & Bory de Saint-Vincent 1833
Algyroides fitzingeri (Wiegmann 1834)
Algyroides nigropunctatus (Duméril & Bibron 1839)
Algyroides nigropunctatus nigropunctatus (Duméril & Bibron 1839)[41]
Genus *Archaeolacerta* Mertens 1921
Archaeolacerta bedriagae (Camerano 1885)[42]
Genus *Iberolacerta* Arribas 1997
Iberolacerta horvathi (Méhely 1904)
Genus *Lacerta* Linnaeus 1758
Lacerta agilis Linnaeus 1758
Lacerta agilis agilis Linnaeus 1758[43]
Lacerta bilineata Daudin 1802[44]
Lacerta bilineata bilineata Daudin 1802
Lacerta bilineata chloronota Rafinesque 1810
Lacerta sp.[45]
Genus *Podarcis* Wagler 1830
Podarcis filfolensis (Bedriaga 1876)[46]
Podarcis melisellensis (Braun 1877)
Podarcis melisellensis fiumanus (Werner 1891)[47]
Podarcis muralis (Laurenti 1768)[48]
Podarcis raffonei (Mertens 1952)[49]
Podarcis siculus (Rafinesque-Schmaltz 1810)[50]
Podarcis tiliguerta (Gmelin 1789)[51]
Podarcis waglerianus Gistel 1868[52]
Podarcis waglerianus waglerianus Gistel 1868
Podarcis waglerianus marettimensis (Klemmer 1956)
Genus *Psammodromus* Fitzinger 1826
Psammodromus algirus (Linnaeus 1758)[53]
Genus Timon Tschudi 1836
Timon lepidus (Daudin 1802)
Timon lepidus lepidus (Daudin 1802)
Genus *Zootoca* Wagler 1830
Zootoca carniolica Mayer, Böhme, Tiedemann & Bischoff 2000[54]
Zootoca vivipara (Lichtenstein 1823)[55]

Family Scincidae Oppel 1811
Genus *Chalcides* Laurenti 1768
Chalcides chalcides (Linnaeus 1758)
Chalcides chalcides chalcides (Linnaeus 1758)
Chalcides chalcides vittatus (Leuckart 1828)[56]
Chalcides ocellatus (Forskål 1775)
Chalcides ocellatus linosae Boulenger 1920
Chalcides ocellatus tiligugu (Gmelin 1789)
Chalcides ocellatus zavattarii Lanza 1954
Chalcides striatus (Cuvier 1829)

Family Anguidae Gray 1825
Genus *Anguis* Linnaeus 1758[57]
Anguis veronensis Pollini 1818[58]

Family Typhlopidae Merrem 1820
Genus *Indotyphlops* Hedges, Marion, Lipp, Marin & Vidal 2014
Indotyphlops braminus (Daudin 1803)[59]

Family Erycidae Bonaparte 1840
Genus *Eryx* Daudin 1803
Eryx jaculus (Linnaeus 1758)[60]

Family Psammophiidae Boie 1827
Genus *Malpolon* Fitzinger 1826
Malpolon insignitus (Geoffroy Saint-Hilaire 1827)[61]
Malpolon insignitus insignitus (Geoffroy Saint-Hilaire 1827)
Malpolon monspessulanus (Hermann 1804)[62]
Malpolon monspessulanus monspessulanus (Hermann 1804)

Family Natricidae Bonaparte 1840
Genus *Natrix* Laurenti 1768
Natrix helvetica (Lacépède 1789)[63]
Natrix helvetica cetti Gené 1839
Natrix helvetica sicula (Cuvier 1829)[64]
Natrix maura (Linnaeus 1758)
Natrix natrix (Linnaeus 1758)
Natrix natrix persa (Pallas 1814)[65]
Natrix tessellata (Laurenti 1768)

Family Colubridae Oppel 1811
Genus *Coronella* Laurenti 1768
Coronella austriaca Laurenti 1768
Coronella austriaca austriaca Laurenti 1768[66]
Coronella girondica (Daudin 1803)
Genus *Elaphe* Fitzinger 1833
Elaphe quatuorlineata (Bonnaterre 1790)[67]
Elaphe quatuorlineata quatuorlineata (Bonnaterre 1790)
Genus *Hemorrhois* Boie 1826
Hemorrhois hippocrepis (Linnaeus 1758)[68]
Genus *Hierophis* Fitzinger in Bonaparte 1834
Hierophis viridiflavus (Lacépède 1789)[69]
Hierophis viridiflavus viridiflavus (Lacépède 1789)
Hierophis viridiflavus carbonarius (Bonaparte 1833)
Genus *Macroprotodon* Guichenot 1850
Macroprotodon cf. *cucullatus* (Geoffroy Saint-Hilaire 1827)[70]
Genus *Telescopus* Wagler 1830
Telescopus fallax (Fleischmann 1831)
Telescopus fallax fallax (Fleischmann 1831)
Genus *Zamenis* Wagler 1830[71]
Zamenis lineatus (Camerano 1891)[72]
Zamenis longissimus (Laurenti 1768)
Zamenis situla (Linnaeus 1758)

Family Viperidae Oppel 1811
Genus *Vipera* Garsault 1764
Vipera ammodytes (Linnaeus 1758)[73]
Vipera ammodytes ammodytes (Linnaeus 1758)
Vipera aspis (Linnaeus 1758)[74]
Vipera aspis aspis (Linnaeus 1758)
Vipera aspis francisciredi (Laurenti 1768)
Vipera aspis hugyi (Schinz 1834)
Vipera berus (Linnaeus 1758)
Vipera berus marasso (Pollini 1818)[75]

Vipera berus walser Ghielmi, Menegon, Marsden, Laddaga & Ursenbacher 2016[76]
Vipera ursinii (Bonaparte 1835)
Vipera ursinii ursinii (Bonaparte 1835)

NOTES

[1] ***Ichthyosaura alpestris inexpectata*** - The taxonomic status of *I. a. inexpectata* (Dubois & Breuil 1983) from Calabria is debated: Speybroeck *et al*., (2010), Sotiropoulos *et al*. (2007) and Recuero *et al*. (2014) considered *I. a. inexpectata* as a synonym of *I. a. apuana*, while Chiocchio *et al*. (2017) consider it a valid taxon.

[2] ***Lissotriton vulgaris meridionalis*** - The subspecific rank is confirmed by Pabijan *et al*. (2015, 2017).

[3] ***Salamandra*** - Dubois & Bour (2010) proved that the genera *Salamandra, Bufo* and *Vipera* created by Garsault (1764) have priority over the genera with the same name created by Laurenti (1768). Therefore, *Salamandra* Laurenti 1768 and *Salamandra* Garsault 1764 should be considered different genera and brackets around the author's name and date of description (if before Dubois & Bour paper) should be used accordingly, see also article 51.3 of the code of nomenclature (ICZN, 1999).

[4] ***Salamandra salamandra gigliolii*** - The Apennine populations (usually considered *S. s. gigliolii*), between the eastern Liguria and Campania, are introgressed, with a geographic discordance exceeding 600 km between groups identified with mtDNA and nuDNA. "Pure" populations of *S. s. salamandra* inhabit the Alps and western Liguria, while "pure" *S. s. gigliolii* are confined to Calabria (Bisconti *et al*., 2018).

[5] ***Salamandrina perspicillata*** - Species status according to Mattoccia *et al*. (2005) and Romano *et al*. (2009).

[6] ***Triturus carnifex*** - Monotypic if *T. macedonicus* is recognised at species rank (Arntzen *et al*., 2007). Recent mtDNA-based phylogeographic study observed a basal split between the Italian and the Balkan populations with a restricted admixture at the contact and an admixture over a broader area at the contact between the northern and southern Italy lineages (Wielstra *et al.,* 2014, 2021).

[7] ***Speleomantes*** - American authors support the use of *Speleomantes* as a subgenus of *Hydromantes*, while many European authors support the generic rank for *Speleomantes*. For a summary of the debate, see Frost (2020).

[8] ***Speleomantes ambrosii bianchii*** - Taxonomic assessment uncertain. According to the phylogenetic study by Carranza *et al*. (2008) *S. a. bianchii* would be closer to *S. italicus* than to *S. ambrosii*. On the contrary, *S. ambrosii* would be closer to *S. italicus* than to *S. a. bianchii* in the phylogeny by van der Meijden *et al*. (2009).

[9] ***Speleomantes genei*** - Some authors assigned this species to the genus *Atylodes* (Vieites *et al*. 2007), but later they re-assigned it to the genus *Speleomantes* (Vieites *et al*. 2011).

[10] ***Speleomantes italicus*** - Ruggi (2007) has shown that *S. italicus* populations introgressed with genes of *S. ambrosii bianchii* occur in Tuscany (Florence, Lucca and Pistoia provinces) and Emilia-Romagna (Modena and Bologna provinces); pure populations of *S. italicus* are present in Emilia-Romagna (Reggio Emilia province), Marche, Umbria, Latium and Abruzzo.

[11] ***Speleomantes sarrabusensis*** - Elevated to species rank by Carranza *et al*. (2008).

[12] ***Proteus anguinus*** - The status of the subspecies of *Proteus anguinus*, including *P. a. parkelj* Sket & Arntzen 1994, is still uncertain. Gorički & Trontelj (2006), Gorički *et al*. (2017) and Trontelj *et al*. (2009) found six lineages but refrained from assigning them scientific names.

[13] ***Discoglossus pictus*** - Monotypic according to Zangari *et al*. (2006): "The little genetic differentiation detected among Algerian and Tunisian *D. p. auritus* with respect to Maltese and Sicilian *D. p. pictus* suggested a very recent isolation of Sicilian populations and did not support the necessity of a subspecific rank for *D. p. auritus*". Also, Stöck *et al*. (2015) recorded very close relationships between Sicilian and North African populations.

[14] ***Bombina variegata pachypus*** - The specific rank of *Bombina pachypus* is not supported by phylogenetic studies (Hofman *et al*., 2007; Zheng *et al*., 2009; Fijarczyk *et al*., 2011), while Hofman *et al*. (2007) and Fijarczyk *et al*. (2011) consider it as a subspecies.

[15] ***Xenopus laevis*** - Taxonomy of Italian populations according to Lillo *et al*. (2013).

[16] ***Pelobates fuscus*** - The validity of the ssp. *insubricus* Cornalia 1873 is not supported by phylogenetic studies (Crottini *et al*., 2007; Litvinchuk *et al*., 2013) based on allozyme, genome content and mtDNA data.

[17] ***Bufo*** - For the brackets around authors names see note 3.

[18] ***Bufo bufo*** - Monotypic if *B. b. verrucosissimus* Pallas 1814 is regarded at the species rank (Arntzen *et al*., 2013). The recently discovered Sardinian population (Cossu *et al*., 2018) is likely introduced.

[19] ***Bufo spinosus*** - The Western Ligurian populations of the genus *Bufo*, from the French border up to Calice Ligure, have been recently assigned to this species based on genetic evidence (Recuero *et al*., 2012; Arntzen *et al*., 2020).

[20] ***Bufotes boulengeri siculus*** - Subspecific status according to Speybroeck *et al*. (2020) and Dufresnes *et al*. (2019).

[21] ***Bufotes viridis balearicus*** - We follow Speybroeck *et al*. (2020) to consider *B. balearicus* as a subspecies of *B. viridis*, due to the wide hybrid zone in north-east Italy (Dufresnes *et al*., 2014).

[22] ***Hyla arborea*** - Verardi *et al*. (2009) found neither F_1 and F_2 hybrids nor backcrosses between *H. intermedia* and *H. arborea* in north-east Italy.

[23] ***Hyla intermedia perrini*** - Subspecific status of *Hyla perrini* according to Speybroeck *et al*. (2020).

[24] ***Pelophylax*** - A single genetically identified specimen of *Pelophylax shqipericus* (Hotz, Uzzell, Günther, Tunner & Heppich 1987) was recorded in Umbria in syntopy with *P. ridibundus* (Domeneghetti *et al.* 2013). At the moment it is not known if there is a viable population, or if it is an ephemeral introduction that will not lead to a naturalization of the species.

[25] ***Pelophylax* cf. *bedriagae*** - Introduced in Sardinia, Tuscany and possibly in Emilia Romagna (Bellati *et al*., 2019) with at least two distinct lineages: "*P.* cf. *bedriagae* sensu stricto" (native to Anatolia, Greece, Russia) in Northern Sardinia and Tuscany and "*P.* cf. *bedriagae* Cilician West" (native to SE Anatolia) in Southern Sardinia.

[26] ***Pelophylax* kl. *esculentus*** - Subspecific status according to Canestrelli & Nascetti (2008). The hemiclonal hybrid of *P. bergeri* is called *Pelophylax* kl. *hispanicus* (Bonaparte 1839).

[27] ***Pelophylax ridibundus kurtmuelleri*** - Not recognised at the species rank by Speybroeck *et al*. (2010, 2020).

[28] ***Lithobates catesbeianus*** - Included in the genus *Lithobates* according to Amphibian Species of the World 6.0. Yuan *et al*. (2016) consider *catesbeiana* belonging to *Rana* (*Aquarana*), while Dubois (2007) considers *Aquarana* as a synonym of *Lithobates*.

[29] ***Rana temporaria*** - "The European common frog contains deep mitochondrial lineages, some of which are given the rank of subspecies (Veith *et al*., 2002, 2003, 2012; Palo *et al*., 2004; Teacher *et al*., 2009), but the exact geographic distribution of these lineages is unknown, as a range-wide comprehensive phylogeographic study for this species is missing so far" (Vences *et al*., 2013). The phylogenetic study by Stefani *et al*. (2012) does not support any taxonomic distinction at the subspecific level for *R. temporaria* in Italy.

[30] ***Eretmochelys imbricata*** - A very rare vagrant species in the Mediterranean; a single individual has been ascertained from Italian waters, close to the southern Sicilian coast (http://www.seaturtle.org/mtn/archives/mtn54/mtn54p12.shtml). The subspecific status of this vagrant individual is unknown.

[31] ***Lepidochelys kempii*** - A very rare vagrant species in the Mediterranean; it is known as a single individual from Italian waters, captured near Messina (Insacco & Spadola, 2010).

[32] ***Testudo graeca nabeulensis*** - Fritz *et al*. (2009) assigned specimens from Sardinia to "subspecies uncertain", although all examined Sardinian specimens belong to the Tunisian clade (ssp. *T. g. nabeulensis*), according the same authors.

[33] ***Testudo hermanni*** - In Italy *T. h. hermanni* is widespread in the peninsula and islands, except in two northern Adriatic populations (Bosco Nordio and Bosco Mesola), where *T. h. boettgeri* prevails (Perez *et al*., 2014; Biello *et al*., 2021).

[34] ***Emys orbicularis*** - The lack of genetic differentiation of pond turtles from Sardinia (and Corsica) supports the view that the subspecies described from these islands (respectively *E. o. capolongoi*

Fritz 1995 and *E. o. lanzai* Fritz 1995) are not valid (Pedall *et al*., 2010).

[35] ***Emys orbicularis galloitalica*** - *E. orbicularis ingauna* Jesu, Piombo, Salvidio, Lamagni, Ortale & Genta 2004 is a taxon of uncertain validity (Manfredi *et al*., 2013) occurring in western Liguria, within the range of *E. o. galloitalica*.

[36] ***Trachemys scripta*** - Several terrapin species and subspecies are distributed in natural environments in Italy but currently there is proof of naturalization for two subspecies only (Ficetola *et al*., 2003; Ferri & Soccini, 2010; Crescente *et al*., 2014).

[37] ***Chamaeleo chamaeleon*** - Populations from Apulia show genetic affinities both with the North African populations (*C. c. chamaeleon*) and with populations of two areas in the Middle East (*C. c. recticrista* Boettger 1980, and *C. c. musae* Steindachner 1901) (Basso *et al*., 2019). Specimens from Calabria are genetically similar to Tunisian ones (Andreone *et al*., 2016). Therefore we refrain from assessing the subspecific status of the introduced Italian populations.

[38] ***Hemidactylus turcicus*** - Monotypic, since *H. t. spinalis* Buchholz 1954 is a synonym (Šmíd *et al*., 2015) and other subspecies (e.g. *H. t. lavadeserticus* Moravec & Böhme 1997) have been raised to the species rank (Moravec *et al*., 2011).

[39] ***Mediodactylus kotschyi kotschyi*** - Italian populations have been attributed to *M. k. bibroni* (Beutler & Gruber 1977), recently put in synonymy with the nominate subspecies (Kotsakiozi *et al*., 2018).

[40] ***Tarentola mauritanica*** - The taxonomy of the *T. mauritanica* complex is debated. Harris *et al*. (2009) found that specimens from Lampedusa and the adjacent Conigli islet belong to two clades, one occurring on Lampedusa and Conigli islet, related to Libyan specimens [where *T. fascicularis* (Daudin 1802) and *T. deserti* Lataste 1891 occur] and the other representing "a further subclade, distinct from all other known mtDNA lineages", found only in Conigli island. Conversely Stöck *et al*. (2016) found that Lampedusa specimens are closely related to Cap Bon specimens, where *T. mauritanica* occurs (Tlili *et al*., 2012).

[41] ***Algyroides nigropunctatus nigropunctatus*** - The population of Venezia Giulia belongs to the nominal subspecies, as well as the Apulian introduced populations (Carlino & Pauwels, 2016).

[42] ***Archaeolacerta bedriagae*** - The validity of the ssp. *A. b. sardoa* (Peracca 1903), *A. b. paessleri* (Mertens 1927), and *A. b. ferrerae* (Stemmler 1962) is not supported by genetic (Salvi *et al*., 2009, 2010) nor by morphological data (Salvi *et al*., 2008).

[43] ***Lacerta agilis agilis*** - According to morphology (Bischoff, 1988), populations from western Alps are assigned to *L. a. agilis*, while those of eastern Alps to *L. a. argus* (Laurenti 1768). The cytochrome-b trees did not recover the subspecies *L. a. agilis* and *L. a. argus* as separate evolutionary lineages (Kalyabina *et al*., 2001; Andres *et al*., 2014).

[44] ***Lacerta bilineata*** - The study of Marzhan *et al*. (2016) "could not answer whether *L. bilineata* and *L. viridis* represent distinct species without extensive gene flow". Infraspecific taxonomy according to Marzhan *et al*. (2016). The same authors support the validity of two subspecies only: *L. b. bilineata* and *L. b. chloronota*.

[45] ***Lacerta sp.*** - Based on genetic evidence, Marzhan *et al*. (2016) assigned three specimens from Pordenone and Udine provinces to the 'Adriatic' (or 'Western Balkan') lineage. Joss *et al*. (2021) included in this lineage also an enigmatic specimen from Calambrone (Pisa, Tuscany). According to Jauss *et al*. (2021) "the lineages [of the *L. viridis complex*] have reached the level of distinct taxa, but to determine whether they have become fully independent lineages on the species level requires further research". In both the mentioned studies the Adriatic clade seems closer to *L. bilineata* than to *L. viridis*. Therefore *L. viridis* s.s. is not a member of the Italian fauna, and at present the status of Italian populations formerly assigned to *L. viridis* is uncertain. The possible available name for the Adriatic lineage are *L. v. istriensis* Werner 1897 or *L. v. intermedia* Méhelÿ 1905 (Marzhan *et al*., 2016).

[46] ***Podarcis filfolensis*** - Capula (1994a), Salvi *et al*. (2014) and Rodrıguez *et al*. (2014) suggest that *P. filfolensis* colonized the Pelagian islands from the Maltese archipelago in historical times, therefore the Pelagian ssp. *P. f. laurentiimuelleri* (Fejérváry 1924) is not valid.

[47] ***Podarcis melisellensis fiumanus*** - The subspecies *fiumanus* is supported by mtDNA (Podnar *et al*., 2004), electrophoretic data (Gorman *et al*., 1975), as well as with morphological analysis (Thorpe, 1980).

[48] ***Podarcis muralis*** - The observed phylogeographic structure of *P. muralis* does not match the current subspecific division of this species in Italy (Giovannotti *et al*., 2010; Salvi *et al*., 2013). Pending a comprehensive revision of the status of the Italian populations, at the moment we refrain from adopting any subspecies.

[49] ***Podarcis raffonei*** - Taxonomic status according to Capula (1994b). The genetic distance found between *P. raffonei* and *P. waglerianus* is relatively small for *Podarcis* species (Podnar & Mayer, 2005; Senczuk *et al*., 2019). Depending on the markers used the divergence between *raffonei* and *waglerianus* is not that different than for other sister species of *Podarcis* (e.g. *lilfordi* and *pityusensis*, *tauricus* and *ionicus*) (Salvi *et al*., 2021). The validity of the subspecies *raffonei* (Mertens 1952), *alvearioi* (Mertens 1955), *cucchiarai* Di Palma 1980 and *antoninoi* (Mertens 1955) is not supported by genetic data (Capula, 2004).

[50] ***Podarcis siculus*** - This species shows many mitochondrial lineages both in the continent and in some large islands (Podnar *et al*., 2005; Silva-Rocha *et al*., 2012; Senczuk *et al*., 2018) whose ranges and extent of hybridization are not known (D. Salvi in litt.). One of the main branches includes specimens from Sicily, Sardinia and part of Calabria, the other branch the remnant Italian populations (both with *campestris* or *siculus* phenotypes). According to Podnar *et al*. (2005) *P. s. cettii* (Cara 1872) from Sardinia was introduced in historical times and originated from Sicily, and it is therefore a synonym of *P. s. siculus*. Recently the populations of *P. siculus* from western Pontine Islands have been raised to species rank *Podarcis latastei* (Bedriaga 1879) by Senczuk *et al*. (2019). This proposal has been rejected by Speybroeck *et al*. (2020) but defended by Castiglia *et al*. (2021). Pending a thorough revision of the species, we adopt the more conservative opinion by Speybroeck *et al*. (2020).

[51] ***Podarcis tiliguerta*** - The identity of ssp. *ranzii* (Lanza 1967) from Molarotto Island doesn't seem supported by mtDNA (Vasconcelos *et al*., 2006).

[52] ***Podarcis waglerianus*** - The subspecies *P. w. marettimensis* is supported by having only private haplotypes (Senczuk *et al*., 2018).

[53] ***Psammodromus algirus*** - According to Carretero *et al*. (2009) a single individual from Conigli Islet near Lampedusa grouped with those from Morocco (ssp. *algirus*) and not with the closer Tunisian ones, suggesting a recent, human-mediated, colonization, although a transport between Morocco and the uninhabited Conigli islet seems unlikely. Moreover, the taxonomic value of the two other North African subspecies, *P. a. nollii* (Fischer 1887) and *P. a. doriae* (Bedriaga 1866) has not yet been tested by genetic studies.

[54] ***Zootoca carniolica*** - Species rank after Cornetti *et al*. (2015a, 2015b).

[55] ***Zootoca vivipara*** - Authorship according to Schmidtler & Böhme (2011). The phylogeographic study by Horreo *et al*. (2018) seems not to support the current infraspecific taxonomy. The authors identified six clades of *Zootoca* (one of which is currently *Z. carniolica*); the Italian populations belong to the clade E, while the type locality is inhabited by the clade C. Waiting for further studies resolving the complicated relationships of the subspecies we do not adopt any subspecific name for the Italian populations.

[56] ***Chalcides chalcides vittatus*** - The Sardinian populations would have colonized this island in historical times, by passive transportation, starting from Tunisian or Libyan populations, as is suggested by the morphological and genetic resemblance between these populations (Caputo, 1993).

[57] ***Anguis*** - A hybrid *A. fragilis* x *A. cinerea* (= *veronensis*) is reported in Friuli - Venezia Giulia by Gvoždík *et al*. (2013). The occurrence of *A. fragilis* is expected in north-east Italy, but has yet to be demonstrated.

[58] ***Anguis veronensis*** - Italian *Anguis* have been recognized as a full species under the name *Anguis veronensis* by Gvoždík *et al*. (2013). An early version "in press" of the same paper listed the species as *A. cinerea* Risso 1826.

[59] ***Indotyphlops braminus*** - Recently discovered on Ischia island (Naples province) and in Sicily, near Paceco (Trapani province) (Faraone *et al*., 2019, Paolino *et al*., 2019).

[60] ***Eryx jaculus*** - The morphological characters of the Sicilian population resemble those of African populations (ssp. *jaculus*), but molecular studies are needed to confirm this hypothesis (Faraone *et al*., 2019). According to Tokar (1991) the species is monotypic.

[61] ***Malpolon insignitus*** - Species rank after Carranza *et al*. (2006). The date of publication of the description is listed here according to Opinion 1416 (ICZN, 1987).

[62] ***Malpolon monspessulanus*** - Besides the nominate subspecies, *M. m. saharatlanticus* Geniez, Cluchier & de Haan 2006 has been described on morphological basis, but its validity has not yet been tested by genetic data.

[63] ***Natrix helvetica*** - Species rank and infraspecific taxonomy according to Schultze *et al*. (2020). Moreover, the paper does not report any *Natrix helvetica helvetica* in Italy albeit at least one sample (MSNVE 684) from Taggia (IM) shows *Natrix helvetica helvetica* introgression (cf. supplementary materials).

[64] ***Natrix helvetica sicula*** - Including *calabra* Vanni & Lanza, in Lanza 1983 and *lanzai* Kramer 1970. See Fritz & Schmidtler (2020) for a complete discussion about scientific names erected for *N. natrix* and *N. helvetica.*

[65] ***Natrix natrix persa*** - Italian populations are tentatively attributed to *N. n. persa* according to Kindler *et al*. (2017). Schultze *et al*. (2020) found in northeastern Italy a hybrid zone 70-90 km wide between *N. natrix* and *N. helvetica*, already observed by Thorpe (1979) based on morphology. The westernmost records come from close to the Po estuary and Ferrara (Emilia-Romagna).

[66] ***Coronella austriaca austriaca*** - "The current taxonomy of *C. austriaca* […] requires a thorough revision" (Jablonski *et al*., 2019). The subspecies described from Sicily, *C. a. fitzingeri* (Bonaparte 1840), is not generally accepted, but the phylogenetic studies by Santos *et al*. (2008) and Jablonski *et al*. (2019) place the Sicilian specimens in a separate mtDNA clade. Its taxonomic status can only be clarified by analyzing enough material from all over the Italian range.

[67] ***Elaphe quatuorlineata*** - *Coluber quatuor-lineatus* Lacépède 1789 was declared nomen conservandum in Opinion 490 (ICZN, 1957) but later the species was not explicitly excluded by effects of Opinion 1463 (ICZN, 1987) that ruled Lacépède, 1789 as a non-binomial work.

[68] ***Hemorrhois hippocrepis*** - Probably introduced in Sardinia and possibly also in Pantelleria (Luiselli *et al.,* 2010 [2011]). According to Luiselli *et al.* (2010) the species is monotypic. A recent study shows that specimens of Pantelleria (ssp. *nigrescens* Cattaneo 1985) and Sardinia belong to the "eastern mitochondrial clade", and it supports the hypothesis of an ancient human-mediated introduction in Sardinia, and a recent colonization (human-mediated or through a recent passive dispersion mechanisms) in Pantelleria (Faraone *et al*., 2020).

[69] ***Hierophis viridiflavus*** - Mezzasalma *et al*. (2015) raised *H. carbonarius* to the species rank. Speybroeck *et al*. (2020) recommend maintaining *Hierophis viridiflavus carbonarius* as a subspecies for the time being, since the amount of divergence in mtDNA between *H. v. carbonarius* and *H. v. viridiflavus* is much lower than between the closely related *H. gemonensis* and *H. viridiflavus* (Rato *et al*., 2009).

[70] ***Macroprotodon cucullatus*** - The specific assignment of the Italian population (Lampedusa island) of *Macroprotodon*, usually referred to *M. cucullatus*, is still uncertain according to Faraone *et al*. (2020).

[71] ***Zamenis*** - A specimen of *Zamenis scalaris* (Schinz 1822) was reported in Italy close to France (Calmonte & Ferri, 1987), but despite intensive research it was not possible to confirm the presence of the species in Italy, which is therefore excluded from the Italian fauna.

[72] ***Zamenis lineatus*** - There is "pervasive introgressive hybridization with *Z. longissimus* in the eastern contact zone." (Salvi *et al*., 2017, 2018); therefore the status of Apulian populations remains to be evaluated.

[73] ***Vipera ammodytes*** - Intraspecific taxonomy follows Ursenbacher *et al*. (2008), according to which *V. a. ruffoi* Bruno 1968 is a synonym of the nominate subspecies.

[74] ***Vipera aspis*** - Intraspecific taxonomy according to Ursenbacher *et al*. (2006) and Barbanera *et al.* (2009). For the brackets around author names see note 3.

[75] ***Vipera berus marasso*** - According to Schmidtler (2019) the available name for the Alpine (and Italian) populations is *Vipera berus marasso* (Pollini, 1818), with type locality Legnago, province of Verona, in the Po plain.

[76] ***Vipera berus walser*** - Species status debated. Previously considered an isolated population of *V. berus* (Capra, 1954; Sindaco *et al*., 2006), according to the phylogeny by Ghielmi *et al*. (2016) *V. walser* seems surprisingly related to the Caucasian species of the *V. ursinii* complex. Speybroeck *et al*. (2020) consider premature the acceptance of the new species due to the possible existence of cito-nuclear discordance and tentatively regard it as a subspecies of *Vipera berus*. Freitas *et al*. (2020) consider *V. walser* a valid species (Boettger 1889). Doniol-Valcroze *et al*. (2021) confirm the cito-nuclear discordance suspected by Speybroeck *et al*. (2020). Therefore, following these authors, we consider *V. walser* as a subspecies of *V. berus*.

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