

## **An updated dichotomous key to the snakes of Europe**

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**SUPPLEMENTARY MATERIAL**

**Table S1:** species list of European snakes according to Speybroeck et al. (2020) and with the updates indicated in this work.

Suborder: Serpentes Linnaeus, 1758

Superfamily: Typhlopoidea Gray, 1845

Family: Typhlopidae Merrem, 1820

Genus: *Indotyphlops* Hedges, Marion, Lipp, Marin and Vidal, 2014

Species: *Indotyphlops braminus* (Daudin, 1803)

Genus: *Xerotyphlops* Hedges, Marion, Lipp, Marin and Vidal, 2014

Species: *Xerotyphlops vermicularis* (Merrem, 1820)

Superfamily: Booidea Gray, 1825

Family: Erycidae Bonaparte, 1840

Genus: *Eryx* Daudin, 1803

Species: *Eryx jaculus* (Linnaeus, 1758)

Species: *Eryx miliaris* (Pallas, 1773)

Superfamily: Elapoidea Boie, 1827

Family: Psammophiidae Boie, 1827

Genus: *Malpolon* Fitzinger, 1826

Species: *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827)

Species: *Malpolon monspessulanus* (Hermann, 1804)

Superfamily: Colubroidea Oppel, 1811

Family: Natricidae Bonaparte, 1840

Genus: *Natrix* Laurenti, 1768

Species: *Natrix astreptophora* (Seoane, 1884)

Species: *Natrix helvetica* (Lacépède, 1789)

Species: *Natrix maura* (Linnaeus, 1758)

Species: *Natrix natrix* (Linnaeus, 1758)

Species: *Natrix tessellata* (Laurenti, 1768)

Family: Colubridae Oppel, 1811

Genus: *Coronella* Laurenti, 1768

Species: *Coronella austriaca* Laurenti, 1768

Species: *Coronella girondica* (Daudin, 1803)

Genus: *Dolichophis* Gistel, 1868

Species: *Dolichophis caspius* (Gmelin, 1789)

Species: *Dolichophis jugularis* (Linnaeus, 1758)

Species: *Dolichophis schmidti* (Nikolsky, 1909)

Genus: *Eirenis* Jan, 1863

Species: *Eirenis collaris* (Ménétries, 1832)

Species: *Eirenis levantinus* Schmidtler, 1993

Species: *Eirenis modestus* (Martin, 1838)

Genus: *Elaphe* Fitzinger, 1833

Species: *Elaphe dione* (Pallas, 1773)

Species: *Elaphe quatuorlineata* (Bonnaterre, 1790)

Species: *Elaphe sauromates* (Pallas, 1814)

Species: *Elaphe schrenckii* Strauch, 1873

Species: *Elaphe taneiura* Cope, 1861

Species: *Elaphe urartica* Jablonski, Kukushkin, Avci, Bunyatova, Ilgaz, Tuniyev and Jandzik, 2019

Genus: *Hemorrhois* Boie, 1826

Species: *Hemorrhois algirus* (Jan, 1863)

Species: *Hemorrhois hippocrepis* (Linnaeus, 1758)

Species: *Hemorrhois nummifer* (Reuss, 1834)

Species: *Hemorrhois ravigieri* (Ménétries, 1832)

Genus: *Hierophis* Fitzinger in Bonaparte, 1834

Species: *Hierophis gemonensis* (Laurenti, 1768)

Species: *Hierophis viridiflavus* (Lacépède, 1789)

Species: *Hierophis cypriensis* (Schätti, 1985)

Genus: *Lampropeltis* Fitzinger, 1843

Species: *Lampropeltis getula* (Linnaeus, 1766)

Genus: *Macroprotodon* Guichenot, 1850

Species: *Macroprotodon brevis* (Günther, 1862)

Species: *Macroprotodon cucullatus* (Geoffroy Saint-Hilaire, 1827)

Genus: *Platyceps* Blyth, 1860

Species: *Platyceps collaris* (Müller, 1878)

Species: *Platyceps najadum* (Eichwald, 1831)

Genus: *Rhynchocalamus* Günther, 1864

Species: *Rhynchocalamus melanocephalus* (Jan, 1862)

Genus: *Telescopus* Wagler, 1830

Species: *Telescopus fallax* (Fleischmann, 1831)

Genus: *Zamenis* Wagler, 1830

Species: *Zamenis hohenackeri* (Strauch, 1873)

Species: *Zamenis lineatus* (Camerano, 1891)

Species: *Zamenis longissimus* (Laurenti, 1768)

Species: *Zamenis scalaris* (Schinz, 1822)

Species: *Zamenis situla* (Linnaeus, 1758)

Superfamily: Not assigned\*

Family: Viperidae Opperl, 1811

Genus: *Macrovipera* Reuss, 1927

Species: *Macrovipera lebetinus* (Linnaeus, 1758)

Species: *Macrovipera schweizeri* (Werner, 1935)

Genus: *Montivipera* Nilson, Tuniyev, Andrén, Orlov, Joger and Herrmann, 1999

Species: *Montivipera xanthina* (Gray, 1849)

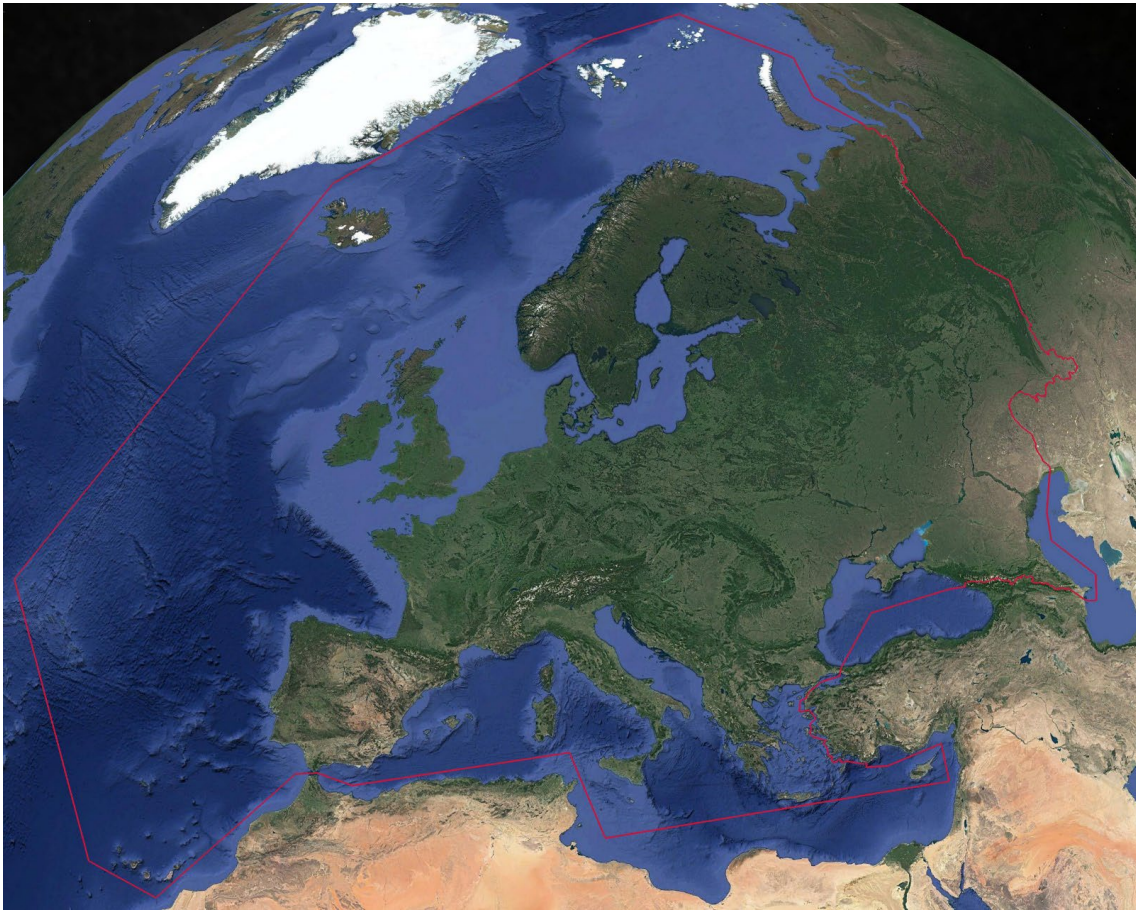
Genus: *Vipera* Garsault, 1764

Species: *Vipera ammodytes* (Linnaeus, 1758)  
Species: *Vipera aspis* (Linnaeus, 1758)  
Species: *Vipera berus* (Linnaeus, 1758)  
Species: *Vipera dinniki* (Nikolsky, 1913)  
Species: *Vipera graeca* Nilson and Andrén, 1988  
Species: *Vipera kaznakovi* (Nikolsky, 1909)  
Species: *Vipera latastei* (Boscá, 1878)  
Species: *Vipera renardi* (Christoph, 1861)  
Species: *Vipera seoanei* (Lataste, 1879)  
Species: *Vipera ursinii* (Bonaparte, 1835)

\*According to Zaher *et al.* (2019)



**Figure S1:** Geographical area considered in the key, according to SPEYBROECK *et al.* (2020). Image credits: Google Earth Pro, v. 7.3.4.8248, modified.



**Figure S2:** dorsal (left) and head profile (right) photographs of European snakes. The numbering and order of presentation of the species is based on the dichotomous key provided in this work. Note: examples of adult colourations are shown here, but each species may present a more or less high chromatic variability and for some taxa the colouration of the juveniles is different from that of the adults.



2a. *Indotyphlops braminus*. Photo credits: Matteo R. Di Nicola.



2b. *Xerotyphlops vermicularis*. Photo credits: Doru Panaitescu.



4a. *Eryx jaculus*. Photo credits: Matteo R. Di Nicola.





**4b.** *Eryx miliaris*. Photo credits: Matthias Rechter.



**7a.** *Malpolon insignitus*. Photo credits: Matteo R. Di Nicola



**7b.** *Malpolon monspessulanus*. Photo credits: Matteo R. Di Nicola.



**10a.** *Natrix astreptophora*. Photo credits: Jordi Ribó Ferrer (left); Eduardo Fernandez Melendez (right).





11a. *Natrix helvetica*. Photo credits: Matteo R. Di Nicola.



11b. *Natrix natrix*. Photo credits: Matteo R. Di Nicola.



12a. *Natrix maura*. Photo credits: Matteo R. Di Nicola.



12b. *Natrix tessellata*. Photo credits: Matteo R. Di Nicola.





13a. *Telescopus fallax*. Photo credits: Matteo R. Di Nicola.



14a. *Lampropeltis getula*. Photo credits: Brian Hinds (left); Chad M. Lane (right).



16a. *Macroprotodon brevis*. Photo credits: Pedro Verdejo Díaz



17a. *Macroprotodon cucullatus*. Photo credits: Jordi Ribó Ferrer.





17b. *Macroprotodon* Lampedusa/Tunisia clade. Photo credits: Matteo R. Di Nicola.



19a. *Elaphe schrenckii*. Photo credits: Andrei Kotkin.



20a. *Elaphe taeniura*. Photo credits: Laura & Bobby Bok.



21a. *Elaphe quatuorlineata*. Photo credits: Matteo R. Di Nicola.





22a. *Elaphe dione*. Photo credits: Wang Xiaohu & Ryabov Sergei.



23a. *Elaphe sauromates*. Photo credits: Oleksandr Zinenko.



23b. *Elaphe urartica*. Photo credits: Diego Reggianti.



26a. *Eirenis collaris*. Photo credits: Hendrik Pempelfort.





26b. *Rhynchocalamus melanocephalus*. Photo credits: Avigail Sella.



27a. *Eirenis levantinus*. Photo credits: Rani Sturm.



27b. *Eirenis modestus*. Photo credits: Robin Gloor (left); Konstantinos Kalaentzis (right).



29a. *Hierophis cypriensis*. Photo credits: Doru Panaitescu.





31a. *Platyceps collaris*. Photo credits: Ehab K. Eid.



31b. *Platyceps najadum*. Photo credits: Robin Gloor (left); Mirko Galuppi (right).



32a. *Coronella austriaca*. Photo credits: Matteo R. Di Nicola.



33a. *Hierophis viridiflavus*. Photo credits: Matteo R. Di Nicola.





34a. *Hierophis gemonensis*. Photo credits: Mirko Galuppi.



35a. *Dolichophis jugularis*. Photo credits: Konstantinos Kalaentzis.



36a. *Dolichophis caspius*. Photo credits: Doru Panaitescu.



37b. *Dolichophis schmidtii*. Photo credits: Laura & Bobby Bok.





38a. *Coronella girondica*. Photo credits: Matteo R. Di Nicola.



39a. *Zamenis scalaris*. Photo credits: Antonio J. Garcia Franco.



41a. *Zamenis hohenackeri*. Photo credits: Robin Gloor.



41b. *Zamenis situla*. Photo credits: Matteo R. Di Nicola.





42a. *Zamenis lineatus*. Photo credits: Matteo R. Di Nicola.



42b. *Zamenis longissimus*. Photo credits: Matteo R. Di Nicola.



44a. *Hemorrhois nummifer*. Photo credits: Konstantinos Kalaentzis.



44b. *Hemorrhois ravergieri*. Photo credits: Laura & Bobby Bok.





45a. *Hemorrhois algirus*. Photo credits: François Rancon.



45b. *Hemorrhois hippocrepis*. Photo credits: Matteo R. Di Nicola.



47a. *Montivipera xanthina*. Photo credits: Matteo R. Di Nicola.



48a. *Macrovipera schweizeri*. Photo credits: Matteo R. Di Nicola.





48b. *Macrovipera lebetinus*. Photo credits: Renato Massa.



51a. *Vipera seoanei*. Photo credits: Matthieu Berroneau.



51b. *Vipera berus*. Photo credits: Matteo R. Di Nicola.



52a. *Vipera graeca*. Photo credits: Robin Gloor.





53a. *Vipera renardi*. Photo credits: Gregoire J. Meier.



54a. *Vipera ursinii*. Photo credits: Matteo R. Di Nicola.



55a. *Vipera dinniki*. Photo credits: Robin Gloor.



55b. *Vipera kaznakovi*. Photo credits: Robin Gloor.





56a. *Vipera aspis*. Photo credits: Matteo R. Di Nicola.



57a. *Vipera ammodytes*. Photo credits: Matteo R. Di Nicola.



57b. *Vipera latastei*. Photo credits: Matthieu Berroneau.



## REFERENCES

- SPEYBROECK, J.; BEUKEMA, W.; DUFRESNES, C.; FRITZ, U.; JABLONSKI, D.; LYMBERAKIS, P.; MARTINEZ-SOLANO, I.; RAZZETTI, E.; VAMBERGER, M.; VENCES, M.; VÖRÖS, J. & CROCHET, P.A. (2020). Species list of the European herpetofauna – 2020 update by the Taxonomic Committee of the Societas Europaea Herpetologica. *Amphibia-Reptilia* 41(2): 139-189.
- ZAHER, H.; MURPHY, R.W.; ARREDONDO, J.C.; GRABOSKI, R.; MACHADO-FILHO, P.R.; MAHLOW, K.; MONTINGELLI, G.G.; BOTTALLO QUADROS, A.; ORLOV, N.L.; WILKINSON, M.; ZHANG, Y.P. & GRAZZIOTIN, F.G. (2019). Large-scale molecular phylogeny, morphology, divergence-time estimation, and the fossil record of advanced caenophidian snakes (Squamata: Serpentes). *PLoS ONE* 14(5): e0216148.