Amphibian phylo.emf

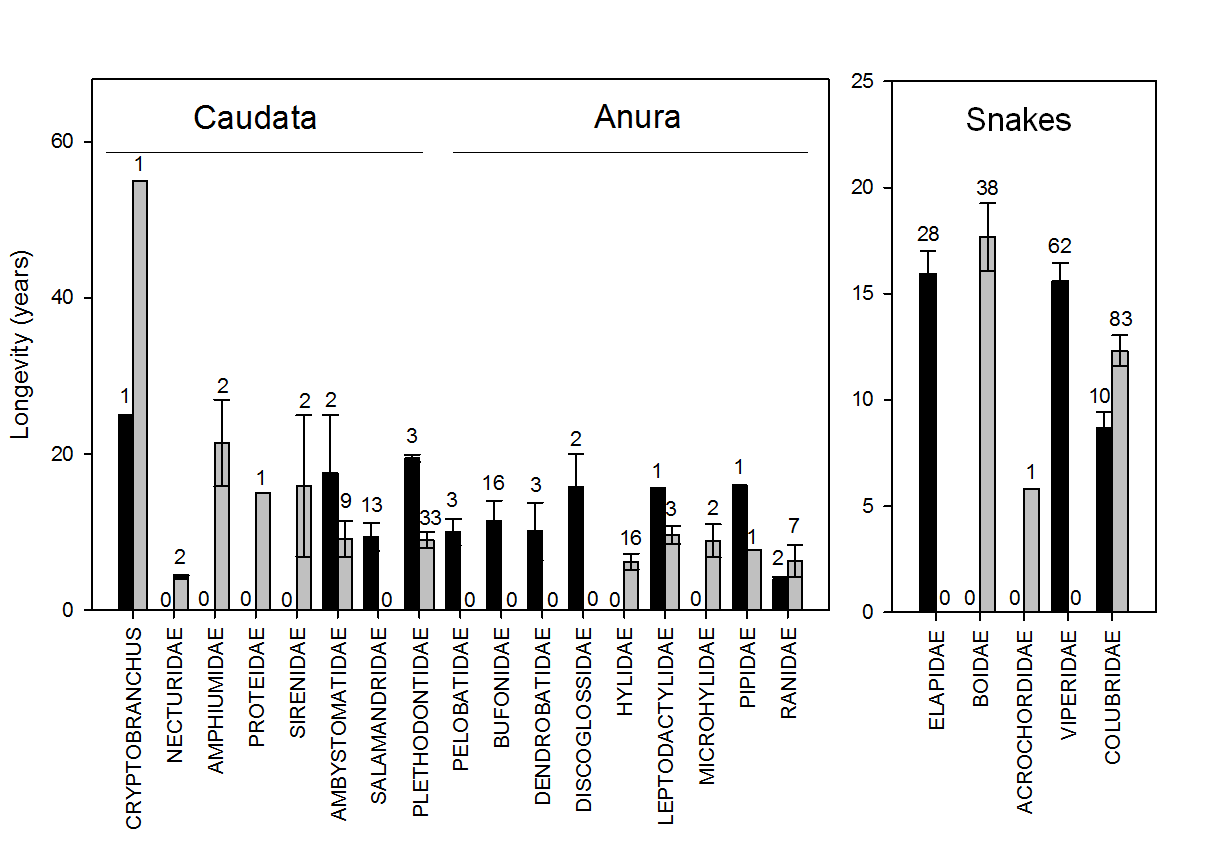
**Figure S1:** Amphibian phylogeny used in our analyses, reduced from Pyron et al. (2011). Branch lengths represent the number of substitutions per nucleotide position.

Snake phylo.emf

**Figure S2:** Snake phylogeny used in our analyses, reduced from Pyron and Wiens (2011). Branch lengths represent the number of substitutions per nucleotide position.

**Table S1:** Results from Phylogenetic Generalized Least Squares (PGLS), examining the effects of maximum body size and being chemically defended on longevity in amphibians (*n* = 106) and advanced snakes (*n* = 102) when the correlation structure based on a Brownian, Ornstein-Uhlenbeck, or Grafen model. Results from analyses with Type I sum of squares are shown. Akaike’s Information criterion (AIC) values were used to compare the parsimony of phylogenetic generalized least squares models that used different correlation structures.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Taxon** | **Model** | **Term** | **numDF** | **F-value** | **p-value** | **AIC** | **delta-AIC** |
| Amphibians | Brownian | (Intercept) | 1 | 1.126 | 0.291 | 801.493 | 85.286 |
|  |  | Size | 1 | 20.728 | <.0001 |  |  |
|  |  | Toxic | 1 | 5.249 | 0.024 |  |  |
|  |  |  |  |  |  |  |  |
|  | OU | (Intercept) | 1 | 261.373 | <.0001 | 716.207 | 0.000 |
|  | α=207 | size | 1 | 51.914 | <.0001 |  |  |
|  |  | toxic | 1 | 7.937 | 0.006 |  |  |
|  |  |  |  |  |  |  |  |
|  | Grafen | (Intercept) | 1 | 261.463 | <.0001 | 716.254 | 0.046 |
|  | λ<0.001 | size | 1 | 52.038 | <.0001 |  |  |
|  |  | toxic | 1 | 7.911 | 0.006 |  |  |
|  |  |  |  |  |  |  |  |
| Snakes | Brownian | (Intercept) | 1 | 8.159 | 0.005 | 676.806 | 18.495 |
|  |  | size | 1 | 18.156 | <.0001 |  |  |
|  |  | toxic | 1 | 0.051 | 0.822 |  |  |
|  |  |  |  |  |  |  |  |
|  | OU | (Intercept) | 1 | 74.657 | <.0001 | 663.061 | 4.750 |
|  | α=0.167 | size | 1 | 28.353 | <.0001 |  |  |
|  |  | toxic | 1 | 0.012 | 0.913 |  |  |
|  |  |  |  |  |  |  |  |
|  | Grafen | (Intercept) | 1 | 28.716 | <.0001 | 658.311 | 0.000 |
|  | λ=0.296 | size | 1 | 16.206 | 0.000 |  |  |
|  |  | toxic | 1 | 0.001 | 0.971 |  |  |



**Figure S3**: Mean (±SE) maximum longevities for chemically protected and unprotected species (as classified by Blanco and Sherman 2005) within families of amphibians (left), and snakes (right). Note that 11 out of 17 amphibian families and 4 out of 5 snake families contain representatives of only chemically protected or non-protected groups. Numbers above the error bars indicate the number of species used in calculating the mean. Data from Blanco and Sherman (2005).

**Table S2**: Raw data for maximum longevity, maximum size (body length), and presence/absence of chemical protection for amphibian species. See main text for data sources.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Family | Longevity (yrs) | Size (cm) | Toxic |
| *Ambystoma cingulatum* | Ambystomatidae | 6.4 | 12.9 | 0 |
| *Ambystoma gracile* | Ambystomatidae | 10.2 | 11.4 | 1 |
| *Ambystoma mabeei* | Ambystomatidae | 8.8 | 11.4 | 0 |
| *Ambystoma macrodactylum* | Ambystomatidae | 6.2 | 8.3 | 0 |
| *Ambystoma maculatum* | Ambystomatidae | 25 | 24.8 | 1 |
| *Ambystoma opacum* | Ambystomatidae | 11.3 | 12.7 | 0 |
| *Ambystoma talpoideum* | Ambystomatidae | 3.6 | 12.2 | 0 |
| *Ambystoma texanum* | Ambystomatidae | 13.8 | 17.8 | 0 |
| *Ambystoma tigrinum* | Ambystomatidae | 25 | 25 | 0 |
| *Amphiuma means* | Amphiumidae | 27 | 116.2 | 0 |
| *Amphiuma tridactylum* | Amphiumidae | 15.9 | 106 | 0 |
| *Bombina bombina* | Bombinatoridae | 20 | 5 | 1 |
| *Bombina orientalis* | Bombinatoridae | 11.6 | 5 | 1 |
| *Bufo alvarius* | Bufonidae | 15.4 | 15.2 | 1 |
| *Bufo americanus* | Bufonidae | 30 | 11.1 | 1 |
| *Bufo boreas* | Bufonidae | 6.2 | 12.7 | 1 |
| *Bufo bufo* | Bufonidae | 36 | 15 | 1 |
| *Bufo canorus* | Bufonidae | 5.4 | 7.6 | 1 |
| *Bufo cognatus* | Bufonidae | 10.7 | 11.4 | 1 |
| *Bufo debilis* | Bufonidae | 3.2 | 5.4 | 1 |
| *Bufo marinus* | Bufonidae | 24.8 | 23.8 | 1 |
| *Bufo punctatus* | Bufonidae | 11.3 | 7.6 | 1 |
| *Bufo quercicus* | Bufonidae | 1.9 | 3.3 | 1 |
| *Bufo retiformis* | Bufonidae | 3.3 | 5.7 | 1 |
| *Bufo speciosus* | Bufonidae | 4.3 | 9.2 | 1 |
| *Bufo valliceps* | Bufonidae | 3.6 | 9.5 | 1 |
| *Bufo viridis* | Bufonidae | 9.4 | 12 | 1 |
| *Bufo woodhousii* | Bufonidae | 4 | 9.5 | 1 |
| *Ceratophrys cornuta* | Ceratophryidae | 10.3 | 20 | 0 |
| *Ceratophrys ornata* | Ceratophryidae | 11.3 | 13 | 0 |
| *Conraua goliath* | Conrauidae | 4.3 | 40 | 1 |
| *Andrias japonicus* | Cryptobranchidae | 55 | 144 | 0 |
| *Cryptobranchus alleganiensis* | Cryptobranchidae | 25 | 74 | 1 |
| *Dendrobates auratus* | Dendrobatidae | 6.5 | 5 | 1 |
| *Dendrobates pumilio* | Dendrobatidae | 17.5 | 6 | 1 |
| *Acris crepitans* | Hylidae | 4.9 | 4 | 0 |
| *Agalychnis callidryas* | Hylidae | 4.1 | 7 | 0 |
| *Hyla andersonii* | Hylidae | 2.5 | 5.1 | 0 |
| *Hyla avivoca* | Hylidae | 2.5 | 5.2 | 0 |
| *Hyla chrysoscelis* | Hylidae | 7.8 | 6 | 0 |
| *Hyla cinerea* | Hylidae | 6.2 | 6.4 | 0 |
| *Hyla femoralis* | Hylidae | 4.5 | 4.4 | 0 |
| *Hyla gratiosa* | Hylidae | 10.3 | 7 | 0 |
| *Hyla squirella* | Hylidae | 8.5 | 4.1 | 0 |
| *Litoria caerulea* | Hylidae | 19.1 | 10 | 0 |
| *Smilisca baudinii* | Hylidae | 6.3 | 9 | 0 |
| *Smilisca phaeota* | Hylidae | 4.1 | 8 | 0 |
| *Leptodactylus pentadactylus* | Leptodactylidae | 15.7 | 22 | 1 |
| *Mantella aurantiaca* | Mantellidae | 3.7 | 3 | 1 |
| *Gastrophryne carolinensis* | Microhylidae | 6.8 | 3.8 | 0 |
| *Kaloula pulchra* | Microhylidae | 11 | 8 | 0 |
| *Pelobates fuscus* | Pelobatidae | 11 | 8 | 1 |
| *Pipa pipa* | Pipidae | 7.7 | 18 | 0 |
| *Xenopus laevis* | Pipidae | 16 | 13 | 1 |
| *Aneides aeneus* | Plethodontidae | 3.3 | 14 | 0 |
| *Aneides lugubris* | Plethodontidae | 5.3 | 9.5 | 0 |
| *Bolitoglossa mexicana* | Plethodontidae | 9.2 | 8.2 | 0 |
| *Desmognathus aeneus* | Plethodontidae | 4 | 5.7 | 0 |
| *Desmognathus fuscus* | Plethodontidae | 4.3 | 14.1 | 0 |
| *Desmognathus monticola* | Plethodontidae | 17.7 | 14.9 | 0 |
| *Desmognathus ochrophaeus* | Plethodontidae | 19.8 | 11.1 | 0 |
| *Desmognathus quadramaculatus* | Plethodontidae | 14 | 21 | 0 |
| *Desmognathus welteri* | Plethodontidae | 20 | 17 | 0 |
| *Eurycea wilderae* | Plethodontidae | 8 | 12.1 | 0 |
| *Gyrinophilus palleucus* | Plethodontidae | 3.9 | 18.4 | 0 |
| *Gyrinophilus porphyriticus* | Plethodontidae | 18.5 | 23.2 | 1 |
| *Haideotriton wallacei* | Plethodontidae | 1.7 | 7.6 | 0 |
| *Hemidactylium scutatum* | Plethodontidae | 8.9 | 10.2 | 0 |
| *Hydromantes italicus* | Plethodontidae | 10.6 | 30.5 | 0 |
| *Phaeognathus hubrichti* | Plethodontidae | 19.7 | 25.6 | 0 |
| *Plethodon cinereus* | Plethodontidae | 4 | 10.5 | 0 |
| *Plethodon dunni* | Plethodontidae | 11 | 7.6 | 0 |
| *Plethodon elongatus* | Plethodontidae | 13.3 | 7.6 | 0 |
| *Plethodon glutinosus* | Plethodontidae | 20.1 | 20.6 | 1 |
| *Plethodon jordani* | Plethodontidae | 19.8 | 18.4 | 1 |
| *Plethodon nettingi* | Plethodontidae | 3.1 | 11.1 | 0 |
| *Plethodon vehiculum* | Plethodontidae | 11.1 | 11.5 | 0 |
| *Plethodon welleri* | Plethodontidae | 3.8 | 7.9 | 0 |
| *Plethodon yonahlossee* | Plethodontidae | 5.8 | 22.1 | 0 |
| *Pseudotriton montanus* | Plethodontidae | 5.5 | 20.7 | 0 |
| *Necturus maculosus* | Proteidae | 4 | 50 | 0 |
| *Necturus punctatus* | Proteidae | 4.5 | 18.9 | 0 |
| *Proteus anguinus* | Proteidae | 15 | 30 | 0 |
| *Pyxicephalus adspersus* | Pyxicephalidae | 10.7 | 23 | 0 |
| *Rana aurora* | Ranidae | 1.2 | 10 | 0 |
| *Rana catesbeiana* | Ranidae | 16 | 20.3 | 0 |
| *Rana heckscheri* | Ranidae | 3.1 | 15.5 | 0 |
| *Rana pipiens* | Ranidae | 6 | 10.2 | 0 |
| *Rana sylvatica* | Ranidae | 1 | 7.6 | 0 |
| *Rana virgatipes* | Ranidae | 6.2 | 6.4 | 0 |
| *Rhyacotriton olympicus* | Rhyacotritonidae | 2.7 | 6.4 | 0 |
| *Cynops pyrrhogaster* | Salamandridae | 25 | 12 | 1 |
| *Notophthalmus perstriatus* | Salamandridae | 12.9 | 8.9 | 1 |
| *Notophthalmus viridescens* | Salamandridae | 9.4 | 14 | 1 |
| *Pachytriton brevipes* | Salamandridae | 4.4 | 18 | 1 |
| *Paramesotriton hongkongensis* | Salamandridae | 10.3 | 16 | 1 |
| *Salamandra salamandra* | Salamandridae | 17.8 | 28 | 1 |
| *Taricha granulosa* | Salamandridae | 3.5 | 8.9 | 1 |
| *Taricha rivularis* | Salamandridae | 9 | 8.3 | 1 |
| *Taricha torosa* | Salamandridae | 2.9 | 8.9 | 1 |
| *Triturus cristatus* | Salamandridae | 4 | 18 | 1 |
| *Tylototriton verrucosus* | Salamandridae | 9.8 | 18 | 1 |
| *Scaphiopus couchii* | Scraphiopodidae | 6.7 | 9 | 1 |
| *Scaphiopus holbrookii* | Scraphiopodidae | 12.3 | 7.3 | 1 |
| *Siren intermedia* | Sirenidae | 6.9 | 68.6 | 0 |
| *Siren lacertina* | Sirenidae | 25 | 97.8 | 0 |

**Table S3**: Raw data for maximum longevity, maximum size (body length), and presence/absence of chemical protection for snake species. See main text for data sources.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Family | Longevity (yrs) | Size (cm) | Toxic |
| *Boa constrictor* | Boidae | 40.4 | 400 | 0 |
| *Arizona elegans* | Colubridae | 10.1 | 99 | 0 |
| *Boiga dendrophila* | Colubridae | 13 | 250 | 1 |
| *Dasypeltis atra* | Colubridae | 5.2 | 100 | 0 |
| *Dasypeltis scabra* | Colubridae | 15.6 | 100 | 0 |
| *Dispholidus typus* | Colubridae | 8.7 | 200 | 1 |
| *Drymarchon corais* | Colubridae | 11.8 | 300 | 0 |
| *Elaphe quatuorlineata* | Colubridae | 5.2 | 250 | 0 |
| *Farancia abacura* | Colubridae | 18 | 137 | 0 |
| *Heterodon platirhinos* | Colubridae | 7.7 | 116 | 0 |
| *Hypsiglena torquata* | Colubridae | 9.3 | 51 | 0 |
| *Lampropeltis calligaster* | Colubridae | 23.7 | 143 | 0 |
| *Lampropeltis getula* | Colubridae | 21.8 | 208 | 0 |
| *Lampropeltis pyromelana* | Colubridae | 22.4 | 109 | 0 |
| *Lampropeltis triangulum* | Colubridae | 21.3 | 132 | 0 |
| *Lampropeltis zonata* | Colubridae | 26.3 | 102 | 0 |
| *Macroprotodon cucullatus* | Colubridae | 5.9 | 65 | 0 |
| *Masticophis flagellum* | Colubridae | 16.6 | 259 | 0 |
| *Natrix natrix* | Colubridae | 9 | 200 | 0 |
| *Natrix tessellata* | Colubridae | 2.3 | 100 | 0 |
| *Oxybelis aeneus* | Colubridae | 11.8 | 170 | 0 |
| *Pituophis melanoleucus* | Colubridae | 20.8 | 213 | 0 |
| *Ptyas mucosa* | Colubridae | 11.1 | 370 | 0 |
| *Rhinocheilus lecontei* | Colubridae | 18.3 | 104 | 0 |
| *Spalerosophis diadema* | Colubridae | 9.6 | 180 | 1 |
| *Spilotes pullatus* | Colubridae | 13.6 | 200 | 0 |
| *Storeria occipitomaculata* | Colubridae | 2.2 | 40 | 0 |
| *Thamnophis butleri* | Colubridae | 2 | 75 | 0 |
| *Thamnophis couchii* | Colubridae | 7.7 | 145 | 0 |
| *Thamnophis elegans* | Colubridae | 6.1 | 107 | 1 |
| *Thamnophis proximus* | Colubridae | 3.6 | 76 | 0 |
| *Thamnophis sauritus* | Colubridae | 3.9 | 97 | 0 |
| *Thamnophis sirtalis* | Colubridae | 14 | 124 | 0 |
| *Thrasops jacksonii* | Colubridae | 5.8 | 230 | 0 |
| *Aspidelaps scutatus* | Elapidae | 13.5 | 75 | 1 |
| *Bungarus caeruleus* | Elapidae | 17.4 | 170 | 1 |
| *Bungarus fasciatus* | Elapidae | 13.2 | 230 | 1 |
| *Bungarus multicinctus* | Elapidae | 13.7 | 107 | 1 |
| *Dendroaspis polylepis* | Elapidae | 20.4 | 350 | 1 |
| *Elapsoidea sundevallii* | Elapidae | 11.6 | 99 | 1 |
| *Hemachatus haemachatus* | Elapidae | 12.6 | 150 | 1 |
| *Micruroides euryxanthus* | Elapidae | 10 | 66 | 1 |
| *Micrurus fulvius* | Elapidae | 10.7 | 100 | 1 |
| *Naja atra* | Elapidae | 11.7 | 150 | 1 |
| *Naja kaouthia* | Elapidae | 25.4 | 230 | 1 |
| *Naja mossambica* | Elapidae | 16.7 | 150 | 1 |
| *Naja naja* | Elapidae | 20.9 | 170 | 1 |
| *Naja nigricollis* | Elapidae | 22.1 | 150 | 1 |
| *Naja nivea* | Elapidae | 26 | 170 | 1 |
| *Notechis scutatus* | Elapidae | 14.1 | 210 | 1 |
| *Ophiophagus hannah* | Elapidae | 22.5 | 500 | 1 |
| *Pseudechis australis* | Elapidae | 11.1 | 270 | 1 |
| *Pseudechis porphyriacus* | Elapidae | 11.6 | 270 | 1 |
| *Walterinnesia aegyptia* | Elapidae | 11.6 | 130 | 1 |
| *Enhydris chinensis* | Homalopsidae | 4.2 | 76 | 1 |
| *Atractaspis bibronii* | Lamprophiidae | 8.9 | 120 | 1 |
| *Leioheterodon madagascariensis* | Lamprophiidae | 3.4 | 150 | 0 |
| *Psammophis subtaeniatus* | Lamprophiidae | 5.8 | 130 | 1 |
| *Pseudaspis cana* | Lamprophiidae | 8.3 | 210 | 0 |
| *Agkistrodon bilineatus* | Viperidae | 24.3 | 130 | 1 |
| *Agkistrodon contortrix* | Viperidae | 23.2 | 132.1 | 1 |
| *Agkistrodon piscivorus* | Viperidae | 18.9 | 180 | 1 |
| *Agkistrodon taylori* | Viperidae | 15.62 | 96 | 1 |
| *Atheris squamigera* | Viperidae | 4.5 | 61 | 1 |
| *Bitis arietans* | Viperidae | 15.8 | 180 | 1 |
| *Bitis caudalis* | Viperidae | 5.3 | 50 | 1 |
| *Bitis gabonica* | Viperidae | 14.7 | 122 | 1 |
| *Bitis nasicornis* | Viperidae | 9.4 | 120 | 1 |
| *Bitis worthingtoni* | Viperidae | 6.5 | 50 | 1 |
| *Bothrops atrox* | Viperidae | 8.5 | 150 | 1 |
| *Bothrops jararaca* | Viperidae | 6.5 | 160 | 1 |
| *Causus rhombeatus* | Viperidae | 6.6 | 102 | 1 |
| *Cerastes cerastes* | Viperidae | 17 | 85 | 1 |
| *Cerastes vipera* | Viperidae | 6 | 49 | 1 |
| *Crotalus adamanteus* | Viperidae | 22.8 | 240 | 1 |
| *Crotalus atrox* | Viperidae | 25.8 | 210 | 1 |
| *Crotalus basiliscus* | Viperidae | 16.038 | 205 | 1 |
| *Crotalus cerastes* | Viperidae | 11.5 | 79 | 1 |
| *Crotalus durissus* | Viperidae | 12 | 180 | 1 |
| *Crotalus enyo* | Viperidae | 17.12 | 89.8 | 1 |
| *Crotalus horridus* | Viperidae | 30.2 | 180 | 1 |
| *Crotalus mitchellii* | Viperidae | 22 | 100 | 1 |
| *Crotalus molossus* | Viperidae | 20.7 | 126 | 1 |
| *Crotalus oreganus* | Viperidae | 19.055 | 165 | 1 |
| *Crotalus scutulatus* | Viperidae | 14.4 | 130 | 1 |
| *Crotalus tigris* | Viperidae | 15.3 | 91 | 1 |
| *Crotalus tortugensis* | Viperidae | 18.33 | 105.8 | 1 |
| *Crotalus totonacus* | Viperidae | 8.29 | 166.5 | 1 |
| *Crotalus viridis* | Viperidae | 19.3 | 145 | 1 |
| *Crotalus willardi* | Viperidae | 21.3 | 61 | 1 |
| *Echis carinatus* | Viperidae | 23.8 | 81 | 1 |
| *Echis coloratus* | Viperidae | 19.3 | 75 | 1 |
| *Eristicophis macmahoni* | Viperidae | 14.6 | 60 | 1 |
| *Lachesis muta* | Viperidae | 24.2 | 360 | 1 |
| *Sistrurus catenatus* | Viperidae | 14 | 100 | 1 |
| *Sistrurus miliarius* | Viperidae | 11.8 | 63.5 | 1 |
| *Trimeresurus gramineus* | Viperidae | 8.4 | 75 | 1 |
| *Vipera ammodytes* | Viperidae | 22 | 94 | 1 |
| *Vipera aspis* | Viperidae | 10.4 | 84 | 1 |
| *Vipera berus* | Viperidae | 2.1 | 89 | 1 |
| *Vipera latastei* | Viperidae | 9.7 | 75 | 1 |
| *Vipera xanthina* | Viperidae | 12.7 | 82 | 1 |