

# On the phylogenetic relationships of *Elbasania* Schileyko et Fehér, 2017 (Pulmonata, Helicoidea, Hygromiidae)

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**ABSTRACT.** The genus-group taxon *Elbasania* Schileyko et Fehér, 2017 has recently been introduced as a subgenus of *Metafruticicola* Ihering, 1892 for a species occurring in north-western Greece and Albania. Using mitochondrial and nuclear markers, the phylogenetic relationships of *Elbasania* within Metafruticicolini (Hygromiidae) are reconstructed. The results of these analyses suggest that *Elbasania* is more closely related to *Hiltrudia* Nordsieck, 1993, which has a range adjacent to that of *Elbasania* from Croatia to northern Albania, than to *Metafruticicola*. *Elbasania* shares with *Hiltrudia* and also *Cyrnotheba* Germain, 1929 a very characteristic microsculpture of the shell and an overall similar genital system, which however differs among these three taxa with regard to its internal structures, especially those of the penis. Therefore, it is suggested regarding *Elbasania* as a distinct genus here.

## Introduction

The systematics of the Hygromiidae Tryon, 1866 has traditionally been based mainly on characters of the genital system, especially on characters of the dart apparatus. The systematic importance of these genital characters has been controversially discussed and different classification schemes have been proposed for the family and related groups [Hesse, 1921, 1931; Schileyko, 1970, 1972a, b, 1978a, b, 1991, 2004, 2005; Nordsieck, 1987, 1993, 2017] resulting in an intricate history of classifications [for an overview, see Neiber *et al.*, 2017: Supplementary Text 1 and Supplementary Table S1]. The molecular genetic studies of Steinke *et al.* [2004] (see also Groenenberg *et al.* [2011] for corrections), Koene and Schulenburg [2005] and Manganeli *et al.* [2005] hinted at the possibility that the basic premise of the systems of Schileyko [1972b, 1978b, 1991, 2004, 2005] and Nordsieck [1987, 1993] may be too simplistic, i.e. to group species

mainly on the basis of similarities of the dart apparatus.

In a comprehensive molecular phylogenetic study of western Palearctic Helicoidea Rafinesque, 1815, Razkin *et al.* [2015] classified the clade to which hygromiids and related groups belong into three newly delimited families: Canariellidae Schileyko, 1991, Geomitridae Boettger, 1909 and Hygromiidae. The Hygromiidae were classified into three subfamilies, Hygromiinae (including Trochulinae Lindholm, 1927 and Monachainae Wenz, 1930 (1904)), Ciliellinae Schileyko, 1970 and Leptaxinae Boettger, 1909. However, the sampling of Hygromiidae was focused on West European taxa and representatives of several family-group taxa were not included in the analyses. Neiber *et al.* [2017], on the basis of a sampling of almost all genus-group taxa, analysed the phylogenetic relationships of the Hygromiidae in the sense of Razkin *et al.* [2015] and showed that homoplasies are frequent and widespread in the family, but also that several geographically largely coherent, although morphologically diverse, radiations can be recognized. On the basis of their results, Neiber *et al.* [2017] proposed to divide the Hygromiidae into three subfamilies: Hygromiinae (with the tribes Hygromiini and Perforatellini Neiber, Razkin et Hausdorf, 2017), Trochulinae (with the tribes Trochulini, Archaicini Schileyko, 1978, Ashfordiini Neiber, Razkin et Hausdorf, 2017, Caucasigenini Neiber, Razkin et Hausdorf, 2017, Ciliellini, Ganulini Neiber, Razkin et Hausdorf, 2017, Halolimnoheliciini Nordsieck, 1986, Monachaini and Urticicolini Neiber, Razkin et Hausdorf, 2017) and Leptaxinae (with the tribes Leptaxini, Cryptosaccini Neiber, Razkin et Hausdorf, 2017 and Metafruticicolini Schileyko, 1972).

Schileyko [1972b] originally proposed Metafruticicolinae for *Metafruticicola* Ihering, 1892, *Cretigena* Schileyko, 1972 and the Caucasian to north-

east Anatolian genus *Caucasocressa* Hesse, 1921 with a completely reduced dart apparatus, i.e. without dart sac and accessory sac and without glandulae mucosae. Nordsieck [1993] included additionally *Fruticocampylaea* Kobelt, 1871, *Shileykoa* Hudec, 1969 (= *Fruticocampylaea*; see Walther *et al.* [2016]), *Kalitinaia* Hudec et Lezhawa, 1967, *Circassina* Hesse, 1921 and *Hiltrudia* Nordsieck, 1993 in the Metafruticicolini, although *Fruticocampylaea*, *Kalitinaia* and some *Circassina* have a single dart sac with accessory sac and glandulae mucosae. According to Neiber *et al.* [2017] *Fruticocampylaea* and *Circassina* belong to the Caucasigenini (see also Neiber and Hausdorf [2013, 2015], Walther *et al.* [2016, 2018], Neiber *et al.* [2018]) and *Kalitinaia* to the Geomitridae. The Metafruticicolini, as delimited by Neiber *et al.* [2017], include aside from *Metafruticicola* (incl. *Cretigena*, *Westerlundia* Kobelt, 1904 and *Rothifruticicola* Bank, Gittenberger et Neubert, 2013) also *Hiltrudia* and *Cyrnotheba* Germain, 1929. A relationship of *Hiltrudia* with *Metafruticicola* has previously been supposed by Maassen [1979], Pintér and Szigethy [1979], Nordsieck [1993] and recently also by Schileyko and Fehér [2017], whereas in other studies *Hiltrudia* species were included in *Ashfordia* Taylor, 1917, which also has a completely reduced dart apparatus [Hesse, 1934; Maassen, 1978] but was proposed to represent a tribe, Ashfordiini, in the Trochulinae by Neiber *et al.* [2017]. *Cyrnotheba* and *Metafruticicola* have been shown to form a mostly well-supported clade by Neiber *et al.* [2017] and a close relationship with *Metafruticicola* has also been supposed independently by Schileyko and Fehér [2017] on the basis of similarities of the genital system (penial papilla and flagellum) and the shell, whereas previous authors either suggested a possible relationship of *Cyrnotheba* with *Monachoides* or *Hygromia* [Giusti, Manganelli, 1987], the Hygromiini [Nordsieck, 1993] or Monachinae [Schileyko, 2005].

Several questions with regard to the position of the Metafruticicolini within the Hygromiidae, its generic composition and the relationships of taxa are at present not well-resolved or need further investigations. Preliminary results by Caro *et al.* [2017] based on an increased molecular sampling suggest however that *Hiltrudia*, *Cyrnotheba* and *Metafruticicola* indeed form a well-supported clade, which may represent the sister group of all other Hygromiidae.

Bank *et al.* [2013] revised the genus *Metafruticicola* and recognized four subgenera, i.e. *Metafruticicola* s.str., *Westerlundia*, *Cretigena* and *Rothifruticicola*, which were characterized by differences in the sculpture of the shell. The system of Bank *et al.* [2013] is not congruent with the results of the molecular genetic analyses presented by Neiber *et al.*

[2017] that included representatives of all four subgenera and was also questioned by Schileyko and Fehér [2017] and Bitzilekis *et al.* [2017] who observed incongruencies with regard to anatomical and/or conchological characters. However, Bank *et al.* [2013] expressly acknowledged that their revision should be seen as a framework for testing molecular versus morphological data and that their extensive distributional data may be used as the basis for biogeographical research programmes.

Recently, Schileyko and Fehér [2017] described *Elbasania* as another subgenus of *Metafruticicola*, with the disjunctly distributed nominal taxon *Metafruticicola occidentalis* Subai, 1999 from Albania and north-western Greece [Subai, 1999; Bank *et al.*, 2013] as type species, which differs from all other anatomically known *Metafruticicola* species by a very long vagina that has a very thick, well-muscularized wall, a very short free oviduct and a rather long, tubular penial papilla. In the present contribution, previously published data from Neiber *et al.* [2017] and newly generated mitochondrial and nuclear sequences are used to test the proposed classification of *Elbasania* as a subgenus of *Metafruticicola*.

## Material and methods

As representatives of the Metafruticicolini in the sense of Neiber *et al.* [2017], published nuclear and mitochondrial sequences belonging to the nominal taxa *Metafruticicola* (*Metafruticicola*) *pellita* (Férussac, 1832), *Metafruticicola* (*Rothifruticicola*) *nicosiana freytagi* (Maltzan, 1883), *Metafruticicola* (*Westerlundia*) *noverca* (Pfeiffer, 1853), *Metafruticicola* (*Westerlundia*) *naxiana* (Férussac, 1832), *Metafruticicola* (*Cretigena*) *sublecta* (Maltzan, 1884), *Cyrnotheba corsica* (Shuttleworth, 1843), *Hiltrudia mathildae* (Westerlund, 1881) and *Hiltrudia kusmici* (Clessin, 1887) from the study of Neiber *et al.* [2017] were included in the analyses. Additionally, nuclear and mitochondrial sequences were newly generated from a specimen of the type species, *Metafruticicola* (*Elbasania*) *occidentalis* Subai, 1999, of the recently described subgenus *Elbasania* from Albania and from another specimen from Albania, here referred to as *Metafruticicola* (*Elbasania*) cf. *occidentalis* because of anatomical differences. A specimen belonging to *Hygromia* (*Hygromia*) *cinctella* (Draparnaud, 1801) was used as outgroup for rooting phylogenetic trees. Data on sampling sites, voucher numbers, GenBank accession numbers and the classification of the specimens used are compiled in Tables 1–2.

Total genomic DNA was extracted from the tissue samples following a slightly modified version of the protocol of Sokolov [2000] as detailed in Neiber *et al.* [2018]. Partial sequences of the mito-

Table 1. Museum registration numbers and locality data for the specimens used in the molecular phylogenetic analyses.

Табл. 1. Музейные регистрационные номера и данные о местах сбора экземпляров, использованных в молекулярно-филогенетическом анализе.

Taxon	Collection No.	Latitude	Longitude	Country	Locality
<b>Hygromiidae Tryon, 1866</b>					
<b>Hygromiinae Tryon, 1866</b>					
<b>Hygromiini Tryon, 1866</b>					
<i>Hygromia (Hygromia) cinctella</i> (Draparnaud, 1801)	ZMH 96006	47°21'17"N	8°33'08"E	Switzerland	Zurich, Chinese Garden
<b>Metafruticicolinae Schileyko, 1972</b>					
<i>Cyrtoscheba corsica</i> (Shuttleworth, 1843) (1)	SMNS ZI0105001	42°06'46"N	8°48'51"E	France	Corsica, Truggia, Vallée du Liamone, stone oak forest southwest of camping area
<i>Cyrtoscheba corsica</i> (Shuttleworth, 1843) (2)	SMNS ZI0105002	41°59'40"N	8°40'47"E	France	Corsica, Ajaccio, Colline de St. Antoine, brambles under stone oak
<i>Cyrtoscheba corsica</i> (Shuttleworth, 1843) (3)	SMNS ZI0105003	41°59'20"N	9°02'31"E	France	Corsica, Bastelica-Vassalacci, track at the southern outskirts of village
<i>Cyrtoscheba corsica</i> (Shuttleworth, 1843) (4)	SMNS ZI0105004	42°06'57"N	9°06'55"E	France	Corsica, Vizzavona, track to Cascade des Anglais
<i>Elbasania occidentalis</i> (Subai, 1999)	NHMW 110430	41°00'01"N	20°14'51"E	Albania	Elbasan, ca. 3 km east of Pashtresh
<i>Elbasania</i> cf. <i>occidentalis</i> (Subai, 1999)	MN HYG-0218	41°09'59"N	20°14'13"E	Albania	Scree field near western end of railway tunnel west of Mirakë
<i>Hiltrudia kusmici</i> (Clessin, 1887)	HNHM 98877	42°02'54"N	19°29'35"E	Albania	Shkodër, N side of the castle hill
<i>Hiltrudia mathildae</i> (Westerlund, 1881) (1)	MN HYG-0126	43°18'34"N	16°53'10"E	Croatia	Brač Island, environment of Sumartin, Rasotica between bay and village
<i>Hiltrudia mathildae</i> (Westerlund, 1881) (2)	MN HYG-0127	43°21'51"N	16°31'06"E	Croatia	Brač Island, environment of Mirca, valley of dry brook Murvica
<i>Metafruticicola (Cretigena) sublecta</i> (Maltzan, 1884)	ZMH 50023	35°28'12"N	24°02'09"E	Greece	Crete, Chaniá, Nerokouros 2.4 km from junction towards Malaxa, road border
<i>Metafruticicola (Metafruticicola) pellita</i> (Férussac, 1832)	ZMH 50281	35°04'46"N	25°39'46"E	Greece	Crete, Lasithi, Kalamafka 0.5 km towards Kalo Chorio, road border at sandstone rocks
<i>Metafruticicola (Rothifruticicola) nicosiana freytagi</i> (Maltzan, 1883)	ZMH 29164	35°34'19"N	24°07'53"E	Greece	Crete, Moni Gouverneto 1.7 km towards Chania, rocks in canyon (Akrotiri)
<i>Metafruticicola (Westerlundia) naxiana</i> (Férussac, 1832) (1)	ZMH 29313	35°20'03"N	25°13'01"E	Greece	Crete, Tombrouk 0.5 km towards Vathianos Kampos, rocky slope
<i>Metafruticicola (Westerlundia) naxiana</i> (Férussac, 1832) (2)	ZMH 36522	35°19'55"N	25°13'40"E	Greece	Crete, Vathianos Kampos 1.2 km towards Tombrouk, rocks in small valley
<i>Metafruticicola (Westerlundia) noverca</i> (Pfeiffer, 1853)	ZMH 29012	35°35'06"N	24°08'22"E	Greece	Crete, Moni Gouvernetou, rocky slope north of (Akrotiri)

chondrial cytochrome c oxidase subunit 1 (*coxI*) and the 16 S rRNA (16S) genes as well as part of the nuclear ribosomal RNA-coding cluster including the 3' end of the 5.8 S rRNA (5.8S) gene, the complete internal transcribed spacer 2 (ITS2) and the 5' end of the 28 S rRNA (28S) gene were amplified by polymerase chain reaction (PCR) using the primer pairs LCO1490 plus HCO2198 [Folmer *et al.* 1994], 16Scs1 plus 16Scs2 [Chiba, 1999], LSU1 plus LSU3 [Wade, Mordan, 2000] and

LSU2 plus LSU4 [Wade, Mordan, 2000], respectively.

Amplifications were performed in 25 µl volumes containing 2.5 µl 10× Dream Taq Green buffer (Thermo Fisher Scientific, Waltham, MA, USA), 1 µl dNTP mix (5 mM each, biolabproducts, Benzen, Germany), 1 µl of each primer (10 µM), 0.2 µl Dream Taq DNA polymerase (Thermo Fisher Scientific), 1 µl template DNA and 18.3 µl ddH<sub>2</sub>O under the following reaction conditions: an initial

Table 2. GenBank accession numbers of mitochondrial and nuclear sequences used in the molecular phylogenetic analyses. For locality data and information on vouchers, see Table 1.

Табл. 2. Регистрационные номера Генбанка митохондриальных и ядерных последовательностей, использованных в филогенетических анализах. Места сбора и информация о ваучерах приведены в Табл. 1.

Taxon	<i>cox1</i>	16S	5.8S + ITS2 + 28S
<b>Hygromiidae Tryon, 1866</b>			
<b>Hygromiinae Tryon, 1866</b>			
<b>Hygromiini Tryon, 1866</b>			
<i>Hygromia (Hygromia) cinctella</i> (Draparnaud, 1801)	KX622025	KX622001	KX622054
<b>Metafruticolinae Schileyko, 1972</b>			
<i>Cyrnotheba corsica</i> (Shuttleworth, 1843) (1)	KX507212	KX495401	KX495454
<i>Cyrnotheba corsica</i> (Shuttleworth, 1843) (2)	KY818352	KY818455	KY818567
<i>Cyrnotheba corsica</i> (Shuttleworth, 1843) (3)	KY818353	KY818456	KY818568
<i>Cyrnotheba corsica</i> (Shuttleworth, 1843) (4)	KY818354	KY818457	KY818569
<i>Elbasania occidentalis</i> (Subai, 1999)	-	MK192879	MK192905
<i>Elbasania cf. occidentalis</i> (Subai, 1999)	MK189461	MK192878	MK192904
<i>Hiltrudia kusmici</i> (Clessin, 1887)	KY818355	KY818478	KY818587
<i>Hiltrudia mathildae</i> (Westerlund, 1881) (1)	KY818356	KY818479	KY818588
<i>Hiltrudia mathildae</i> (Westerlund, 1881) (2)	KY818357	KY818480	KY818589
<i>Metafruticola (Cretigena) sublecta</i> (Maltzan, 1884)	KY818358	KY818506	KY818615
<i>Metafruticola (Metafruticola) pellita</i> (Férussac, 1832)	KY818359	KY818507	KY818616
<i>Metafruticola (Rothifruticola) nicosiana freytagi</i> (Maltzan, 1883)	KY818360	KY818508	KY818617
<i>Metafruticola (Westerlundia) naxiana</i> (Férussac, 1832) (1)	KY818361	KY818509	KY818618
<i>Metafruticola (Westerlundia) naxiana</i> (Férussac, 1832) (2)	KY818362	KY818510	KY818619
<i>Metafruticola (Westerlundia) noverca</i> (Pfeiffer, 1853)	KY818363	KY818511	KY818620

denaturation step at 94°C for 2 min, 35–40 PCR cycles (94°C for 30 s, 50–55°C for 30 s, 72°C for 30 s) and a final extension step at 72°C for 5 min. Prior to sequencing, PCR products were enzymatically cleaned up by adding 0.65 µl FastAP thermo-sensitive alkaline phosphatase (Thermo Fisher Scientific) and 0.35 µl exonuclease I (Thermo Fisher Scientific) to a 5 µl volume of undiluted PCR mixture followed by an incubation step at 37°C for 15 min. The enzymes were inactivated at 85°C for 15 min. Both strands of the amplified products were sequenced at Macrogen Europe Laboratory (Amsterdam, The Netherlands).

ChromasPro version 1.7.1 (Technelysium, Tewantin, Australia) was used to assemble forward and reverse sequence reads. Sequences were aligned with MAFFT [Katoh, Standley, 2013] using the Q-INS-i iterative refinement algorithm and otherwise default settings. Putatively ambiguously aligned positions were excluded with gblocks [Castresana, 2000] as implemented on the gblocks server ([http://molevol.cmima.csic.es/castresana/Gblocks\\_server.html](http://molevol.cmima.csic.es/castresana/Gblocks_server.html)) with options for a more stringent block selection.

To select an appropriate partitioning scheme and

evolutionary models, the sequence data set was analysed with PartitionFinder version 2 [Lanfear *et al.*, 2012] running an exhaustive search that allowed for separate estimation of branch lengths for each partition. The Bayesian information criterion was used to select among models and partitioning schemes. Models were selected for the aligned nuclear and mitochondrial data sets separately.

The nuclear data set was divided initially into three partitions (5.8S, ITS2 and 28S), while the mitochondrial data set was initially divided into four partitions (1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> codon positions of *cox1* and 16S). The PartitionFinder analysis suggested dividing the data set into four partitions: 1) 1<sup>st</sup> and 2<sup>nd</sup> codon positions of *cox1* (GTR+I model), 2) 3<sup>rd</sup> codon positions of *cox1* (HKY+G model), 3) 16S (GTR+I+G model), and 4) 5.8S plus ITS2 plus 28S (HKY+I model).

Heuristic maximum likelihood (ML) analyses were performed with the Garli [Zwickl, 2006] allowing for independent estimation of parameters for individual partitions using best-fit models as suggested by PartitionFinder. Support values were computed by bootstrapping with 1,000 replications.

Bayesian Inference (BI) was performed using

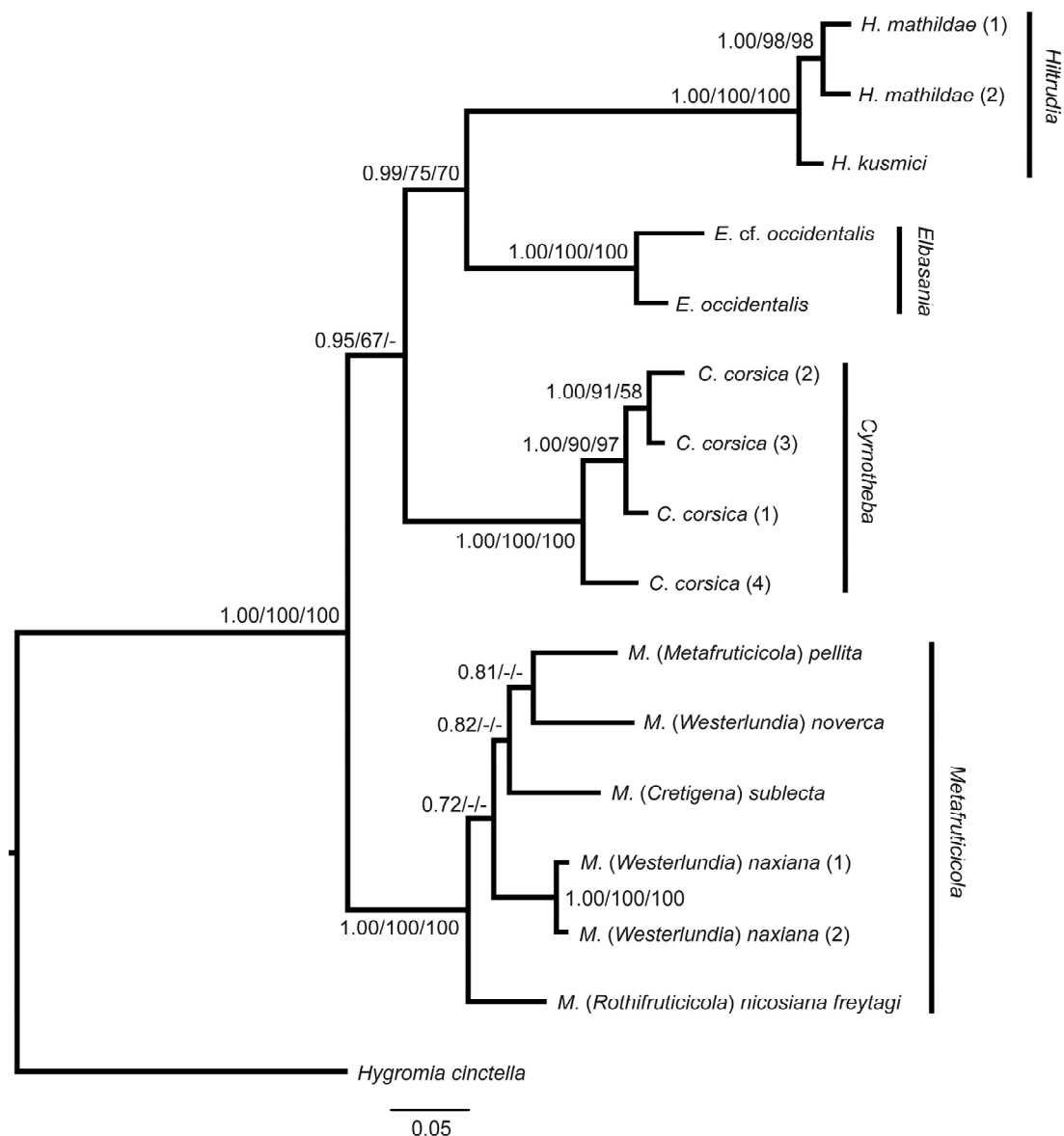


FIG. 1. Bayesian 50% majority-rule consensus tree showing the relationships of Metafruticolini. Numbers at the nodes refer to Bayesian posterior probabilities (left), maximum likelihood bootstrap values (middle) and maximum parsimony bootstrap values (right).

РИС. 1. Байесовское (50% majority-rule) консенсусное дерево, демонстрирующее родственные отношения Metafruticolini. Поддержки узлов соответствуют Байесовской апостериорной вероятности/величине бутстрап поддержки наибольшего правдоподобия/величине бутстрап поддержки максимальной парсимонии.

MrBayes version 3.2.6 [Ronquist *et al.*, 2012]. Metropolis-coupled Monte Carlo Markov chain (MC<sup>3</sup>) searches were run with four chains in two separate runs for 50,000,000 generations with trees sampled every 1,000 generations under default heating using best-fit models as suggested by the PartitionFinder output. To ensure that the MC<sup>3</sup> searches had reached stationarity and convergence, potential scale reduction factors close to 1 and estimated sample sizes above 200 from the MrBayes

output were used as diagnostics and the first 5,000,000 generations of each run were discarded as burn-in.

Heuristic searches on combined nuclear and mitochondrial data were conducted with PAUP\* [Swofford, 2002] under the maximum parsimony (MP) criterion with unordered characters, 100 random sequence addition replicates, the TBR branch-swapping, and gaps treated as missing data. Support for internal branches was assessed in PAUP\*

by bootstrapping with 1,000 replications using full heuristic searches with 10 random addition sequence replicates, TBR branch swapping, and one tree held at each step during stepwise addition.

Bootstrap support (BS) values from the ML and MP analysis as well as posterior probabilities (PP) from the Bayesian analysis were mapped onto the BI 50% majority consensus tree with SumTrees version 3.3.1, which is part of the Dendropy 3.8.0 package [Sukumaran, Holder, 2010].

## Results

The results of the phylogenetic analyses are presented in Fig. 1. *Elbasania* was recovered with significant support in the BI analysis and positive, but rather low support in the ML and MP analyses as the sister group of *Hiltrudia* (PP: 0.99, BS (ML): 75, BS (MP): 70) and not, as implied by the classification of Schileyko and Fehér [2017], as part of *Metafruticicola*. *Elbasania* including *E. occidentalis* and *E. cf. occidentalis* was recovered with maximal support in all three analyses. Likewise, *Hiltrudia*, including *H. kusmici* and *H. mathildae*, was recovered as a monophyletic group with maximal support. *Cyrnotheba*, also maximally supported in all three analyses, was recovered as the sister group of the clade joining *Hiltrudia* and *Elbasania* (albeit only supported in the BI analysis; PP: 0.95 but not in the ML and MP analyses), which in turn was sister to *Metafruticicola*. The latter genus was represented by *M. pellita* (the type species of the genus), *M. sublecta* (the type species of *Cretigena*), and three taxa classified in *Westerlundia* (*M. naxiana* and *M. noverca*) and *Rothifruticicola* (*M. nicosiana freytagi*) by Bank *et al.* [2013]. *Metafruticicola* (incl. its subgenera) was recovered as a monophyletic group with maximal support. *Westerlundia* was not recovered monophyletic as was also the case in the study of Neiber *et al.* [2017]. The relationships within *Metafruticicola* could, however, not be resolved in the analyses presented here.

## Discussion

*Elbasania* has been introduced as a subgenus of *Metafruticicola*. However, the phylogenetic analyses presented here do not support a monophyletic group including *Metafruticicola* and *Elbasania*, but probably a closer relationship of *Elbasania* and *Hiltrudia* and possibly also *Cyrnotheba* (Fig. 1). While the geographic ranges of *Hiltrudia* and *Elbasania* are adjacent, with the former occurring along the Adriatic coast from Croatia to northern Albania and the latter from north-western Greece to central Albania [Maassen, 1978, 1979, 1995; Pintér, Szigethy, 1979; Dhora, Welter-Schultes, 1996; Subai, 1999, 2009; Fehér, Eröss, 2009a, b; Welter-

Schultes, 2012; Bank *et al.*, 2013; Schileyko, Fehér, 2017], *Cyrnotheba* is restricted to Corsica [Giusti, Manganelli, 1987; Falkner *et al.*, 2002].

All three genus-group taxa, *Cyrnotheba*, *Hiltrudia* and *Elbasania*, share a peculiar microsculpture of the shell consisting of radially arranged, sickle-shaped periostracal scales, with very fine spiral lines in between (Fig. 2D, see also Giusti and Manganelli [1987], Maassen [1995] and Bank *et al.* [2013]), a microsculpture which is otherwise only known from *Metafruticicola berytensis* (Pfeiffer, 1841) [Bank *et al.*, 2013] within Metafruticicolini. With regard to genital morphology, *Elbasania* shares with *Cyrnotheba* and *H. kusmici* (Clessin, 1887) the long, well-muscularised vagina (Fig. 2B, see also Büttner [1926], Hesse [1931, 1934], Pintér and Szigethy [1979], Giusti and Manganelli [1987], Maassen [1995], Schileyko [2005], Subai [2009] and Schileyko and Fehér [2017]) that lacks, as in all Metafruticicolini, dart sacs and glandulae mucosae. However, *Elbasania* differs from *Cyrnotheba* and *Hiltrudia* in the structure of the penial papilla, which is narrow cylindrical with an apical pore in *Elbasania* (Fig. 2C, see also Subai [1999] and Schileyko and Fehér [2017]), but club-shaped in *Cyrnotheba* [Giusti, Manganelli, 1987; Schileyko, 2005] and *Hiltrudia* [Maassen, 1995; Schileyko, 2005; Schileyko, Fehér, 2017]. Considering the anatomical differences and the results of the phylogenetic analyses, it is suggested regarding *Elbasania* as a distinct genus here.

Already Subai [1999] when describing the nominal taxon *Metafruticicola occidentalis* remarked upon the variability of the shell in Albanian populations where aside from typical specimens also larger and more flattened specimens with a wider umbilicus occur. The specimen figured by Schileyko and Fehér [2017] corresponds to this larger form and the genitalia figured by these authors correspond well with those of the paratype figured by Subai [1999]. The specimen here referred to as *Elbasania cf. occidentalis* (Fig. 2 A–D) from Albania, scree field near western end of railway tunnel west of Mirakë (41°09'59"N, 20°14'13"E, ~220 m), has a comparatively higher shell than that figured by Schileyko and Fehér [2017] and does not show an angulation on the penultimate whorl as does the holotype [Subai, 1999]. The flagellum is very short in relation to the length of penis plus epiphallus in this specimen. Whether this may be indicative of more than a single species of *Elbasania* in the Balkan Peninsula can currently not be answered because only a single preserved specimen of this form was available for study. However, these differences ought to be studied in more detail in the future. To facilitate this, the following measurements of parts of the genitalia were taken: length of flagellum – 4.5 mm, length of penis – 3.6 mm,

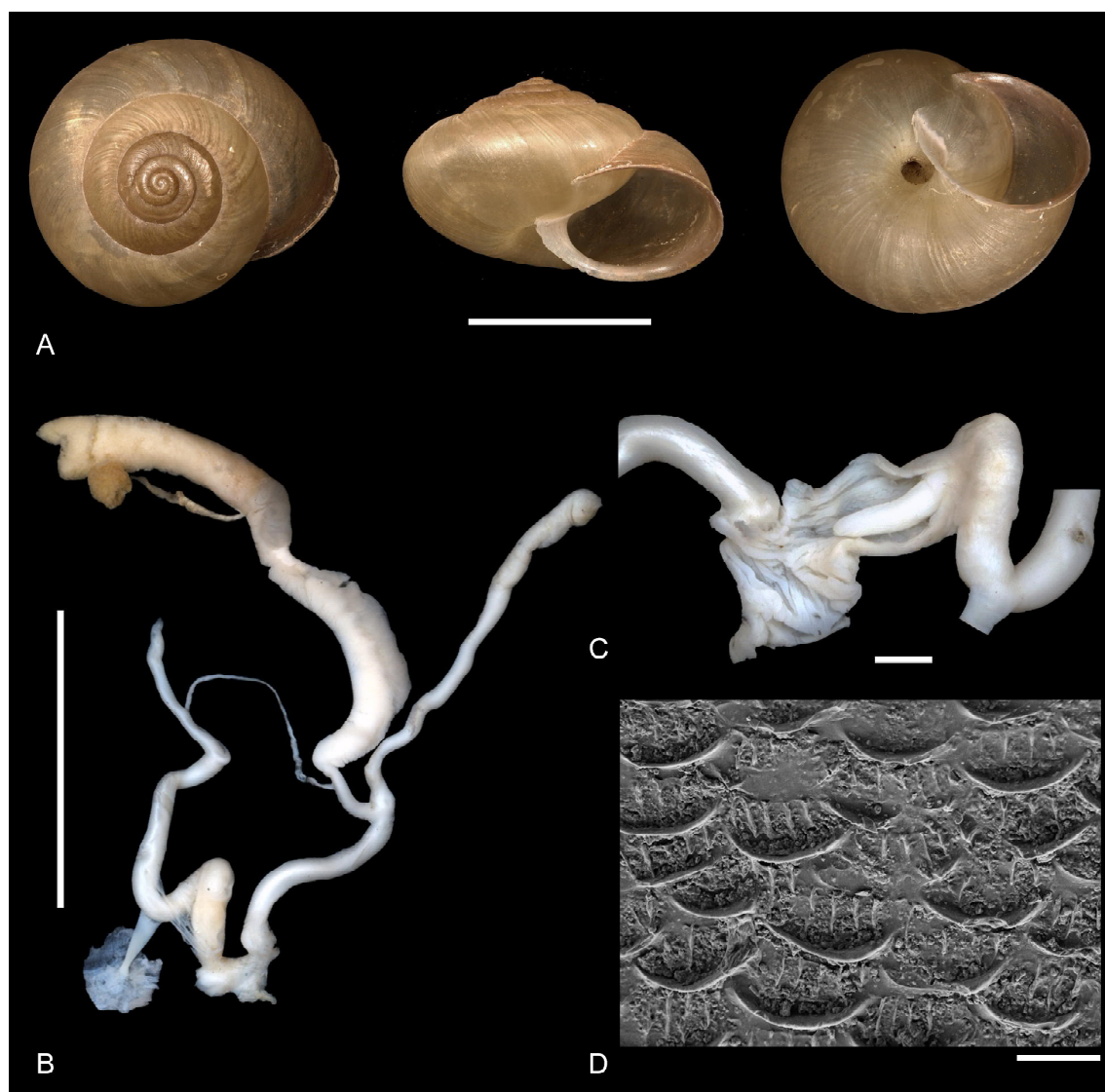


FIG. 2. *Elbasania* cf. *occidentalis* (Subai, 1999) from Albania, scree field near western end of railway tunnel west of Mirakë (41°09'59" N, 20°14'13" E, ~220 m, leg. A. Reischütz and P. L. Reischütz). **A.** Shell, scale bar: 10 mm. **B.** Genitalia, scale bar: 10 mm. **C.** Dissected distal genitalia (with genital atrium, penis and distal vagina opened), scale bar: 1 mm. **D.** Microsculpture of the shell, scale bar: 25 mm.

РИС. 2. *Elbasania* cf. *occidentalis* (Subai, 1999) из Албании, осыпь около западного входа железнодорожного туннеля к западу от Миракë (41°09'59" N, 20°14'13" E, ~220 м, leg. A. Reischütz и P. L. Reischütz). **A.** Раковина, масштаб: 10 мм. **B.** Половая система, масштаб: 10 мм. **C.** Вскрытая дистальная часть половой системы (с открытым половым атриумом, пенисом и дистальной частью вагины), масштаб: 1 мм. **D.** Микроскульптура раковины, масштаб: 25 мкм.

length of penial papilla – 2.1 mm, length of epiphallus 7.5 mm, length of proximal epiphallus (from insertion point of the vas deferens to the insertion point of the retractor muscle) – 5.3 mm, length of distal epiphallus (from insertion point of the retractor muscle to penis/epiphallus boundary) – 2.2 mm, length of vagina – 6.3 mm, length of free oviduct – 2.6 mm, length of bursa copulatrix (incl. reservoir) – 11.7 mm, length of the reservoir of the bursa copulatrix – 4.4 mm, length of the stalk of the bursa copulatrix – 7.3 mm.

As in the previous analysis of Neiber *et al.* [2017], *Metafruticicola* excl. *Elbasania* was re-

covered as a well-supported monophyletic group (Fig. 1), the relationships of species and/or proposed subgenera (see Bank *et al.* [2013] and the discussions in Schileyko and Fehér [2017]) was, however, largely not supported and needs further investigation, ideally based on a taxon sampling covering the entire distribution range and morphological diversity of the group. Especially, the position of the nominal taxon *Helix andria* Martens, 1889 from Andros, Seriphos, Tinos and Mykonos (Cyclades, Greece) [Bank *et al.*, 2013], which was tentatively included in *Elbasania* by Schileyko and Fehér [2017], should be tested.

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К филогенетическим связям *Elbasania* Schileyko et Fehér, 2017 (Pulmonata, Helicoidea, Hygromiidae)

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**РЕЗЮМЕ.** Таксон родовой группы *Elbasania* Schileyko et Fehér, 2017 был недавно предложен как

подрод *Metafruticicola* Ihering, 1892 для вида, обитающего в северо-западной Греции и Албании. С использованием митохондриальных и ядерных маркеров реконструировано филогенетическое положение *Elbasania* в пределах Metafruticicolini (Hygromiidae). Результаты анализов предполагают, что *Elbasania* родственнее ближе к *Hiltrudia* Nordsieck, 1993, ареал которой прилегает к области распространения *Elbasania* от Хорватии до северной Албании, чем к *Metafruticicola*. Общими признаками *Elbasania* с *Hiltrudia* и также *Cyrnotheba* Germain, 1929 являются очень характерная микроскульптура раковины и в целом схожая половая система, которая, однако, различается у этих трех таксонов внутренней структурой, особенно пениса. Таким образом, предложено считать *Elbasania* самостоятельным родом.

