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# *Limnebius asperatus* KNISCH, 1922 – rediscovered almost a century after its original description (Coleoptera: Hydraenidae)

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**Abstract**

*Limnebius asperatus* KNISCH, 1922 (Coleoptera: Hydraenidae), originally described from "Italia" (without any precise locality information) and not found again since then, was surprisingly rediscovered by the first author in the northeastern Apennines (Emilia-Romagna and Tuscany) in 2020 and 2023. Twenty-four of the 25 specimens collected, were found in two small seepages close to a waterfall in the Province of Arezzo (Tuscany). Photographs of the male and female habitus, the aedeagus, the female pygidial sclerites as well as photographs of the habitats, and a distribution map are provided.

**Key words**: Coleoptera, Hydraenidae, *Limnebius asperatus*, rediscovery, female pygidial sclerites, *Limnebius gracilipes* group, habitat, seepage water, Italy, Apennines.

## Introduction

*Limnebius asperatus* KNISCH, 1922 is certainly one of the most enigmatic species among the European Hydraenidae. It was described after two specimens, a male and a female, found in the collection of Friedrich August Clemens Müller (1828–1902). Both specimens are labelled "Italia" without any further geographical details. Although the Hydraenidae of Italy can be regarded as relatively well explored, this species has never been collected since then.

After its description, this species has not been treated for several decades until CHIESA (1959) provided a short diagnosis based on the two syntypes. Remarkably, this species was not included in the otherwise rather complete key to the Palpicornia of Italy by PIRISINU (1981). Finally, JÄCH (1993) designated a lectotype and provided an illustration of the aedeagus.

In any case, the rediscovery of this species in July 2020 and August 2023 in the northeastern Apennines is to be regarded as a real surprise (TOLEDO & JÄCH 2023).

## Material and methods

All specimens of *Limnebius asperatus* known so far, are deposited in the following collections:

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| DBP | coll. David T. Bilton, Plymouth, UK |
| MTB | coll. Mario E. Toledo, Brescia, Italy |
| NMW | Naturhistorisches Museum Wien, Vienna, Austria |
| PMB | coll. Paolo Mazzoldi, Irma, Brescia Prov., Italy |
| ZSM | Zoologische Staatssammlung, Munich, Germany |

Specimens of water beetles were collected with a sampling net in running water or directly on sight with the help of soft tweezers, checking the wet seepages. Part of the material was killed in small vials with few drops of ethyl acetate, then mounted; some specimens were killed and preserved in absolute ethanol for molecular studies. Specimens were studied and dissected under an Amscope SM-4T stereo microscope, with ring led illumination. Measurements were taken with a millimetre microscope slide. Aedeagi and female pygidial sclerites were clarified for few days in lactic acid before being studied with an Amscope SME-F8BH compound microscope.

Photographs of the habitus, aedeagus and female pygidial sclerites were taken by the first author using an Amscope MU100 digital camera, mounted on the two microscopes. Images were stacked with CombineZP® software program. The distribution maps were taken from SimpleMapper® and Google Earth®. All illustrations were retouched with Adobe Photoshop Elements 2021® software.

### *Limnebius asperatus* KNISCH, 1922

*Limnebius asperatus* KNISCH 1922: 88. – KNISCH 1924: 53; CHIESA 1959: 75; JÄCH 1993: 109; AUDISIO et al. 1995: 8; HANSEN 1998: 64; JÄCH 2004: 111; AUDISIO & DE BIASE 2006: CD-ROM; JÄCH & SKALE 2015: 144; RUDOY, BEUTEL & RIBERA 2016: supporting information (table S1, fig. S3).

TYPE LOCALITY: "Italia", no further details known.

TYPE MATERIAL: **Lectotype** ♂ (ZSM), designated by JÄCH (1993): "♂ \ Italia. \ Sammlung Cl.Müller \ Holotypus Limnebius asperatus Knisch Staatssamml.München \ asperatus Knisch \ Limnebius asperatus Knisch". **Paralectotype** ♀ (ZSM): "Italia \ Sammlung Cl.Müller". This specimen is probably not conspecific with the lectotype (JÄCH 1993: 109); according to CHIESA (1959: 75), it indisputably belongs to *L. nitidus* MARSHAM, 1802.

ADDITIONAL MATERIAL EXAMINED:

ITALY: Emilia-Romagna: 1 ♂ (PMB): Forli-Cesena Prov., Rocca San Casciano Municipality, San Zeno, River Rabbi, ca. 270 m a.s.l., 44°1.273'N 11°52.830'E, 4.VII.2020, leg. M.E. Toledo & P. Mazzoldi; Tuscany: 20 exs. (MTB: 5 ♂♂, 4 ♀♀, NMW: 2 ♂♂, 2 ♀♀, PMB: 3 ♂♂, 4 ♀♀): Arezzo Prov., ca. 1.5 km SSE of Badia Tedalda, small seepage near the base of the Presalino Waterfall [Cascata del Presalino], ca. 5 m east of the waterfall itself, ca. 570 m a.s.l., 43°41.885'N 12°11.546'E, 4.VII.2020, leg. M.E. Toledo & P. Mazzoldi; 4 exs. (MTB: 1 ♀, DBP: 1 ♂, 2 ♀♀): same locality, but seepage lying west (left) of the waterfall, 27./31.VIII.2023, leg. M.E. Toledo.

DIAGNOSIS: Habitus as in Fig. 1. Size: Males 1.52–1.65 mm, females 1.45–1.48 mm (n = 6 ♂♂, 4 ♀♀).

Males: Body form sub-parallel (Fig. 1a). Protibiae apically broadened. The aedeagus of the newly collected specimens (Fig. 2) fits very well the illustration of the aedeagus of the lectotype provided by JÄCH (1993: fig. 67).

Females: Body form more oval (Fig. 1b). Protibiae less broad apically.

Gonocoxite (Fig. 3a) transverse, trapezoidal; basal apophyses distinct; lateral sides strongly rounded subbasally, weakly concave in apical half, apical margin slightly convex, posterior corners weakly rounded; cavea small and strongly transverse; ventral surface of gonocoxite reticulate, especially in lateral parts, meshes irregular, moderately large; sparsely setose, setae becoming a little denser toward posterior corners, lacking in basal third.

Tergite IX (Fig. 3b): Posterior corners strongly produced posteriad, with several strong short spine-like bristles and a few longer trichoid setae along lateral margins. Tergite X (Fig. 3b–c) wider than long, disc subsemicircular, apically hardly noticeably emarginate; basal apophyses very large, rounded, right one larger than left one; apical margin with numerous trichoid setae, especially medially, not forming distinct tufts, and with about four strong short subapical spine-like bristles on each side; integument of disc reticulate.

PHYLOGENETIC PLACEMENT: RUDOY et al. (2016) placed *Limnebius asperatus* in the *L. gracilipes* group together with *L. canariensis* ORCHYMONT, 1938, *L. cordobanus* ORCHYMONT, 1938, *L. fallaciosus* GANGLBAUER, 1904, and *L. gracilipes* WOLLASTON, 1864. But the authors did not provide any morphological or molecular evidence to support this placement.

HABITAT: All specimens of *Limnebius asperatus* collected in 2020 and 2023 have been found in two localities in the northeastern Apennines some 40 km from each other (Figs. 4–6, 8–9). This region, comprising parts of Emilia-Romagna, Tuscany, Marche and Umbria, is an important

biogeographical region, where several protected areas have been established, and it is known for the occurrence of two endemic species of *Hydraena* KUGELANN, 1794 (Hydraenidae): *H. bononiensis* CHIESA, 1959 and *H. plumipes* REY, 1886.

The River Rabbi is a typical Apennine river with a stony bed, about 10 m wide, and banks of flat rocks (Fig. 6). Unfortunately, we are not able to say in which microhabitat (e.g., seepages at the banks, benthos) the single specimen of *Limnebius asperatus* was collected.

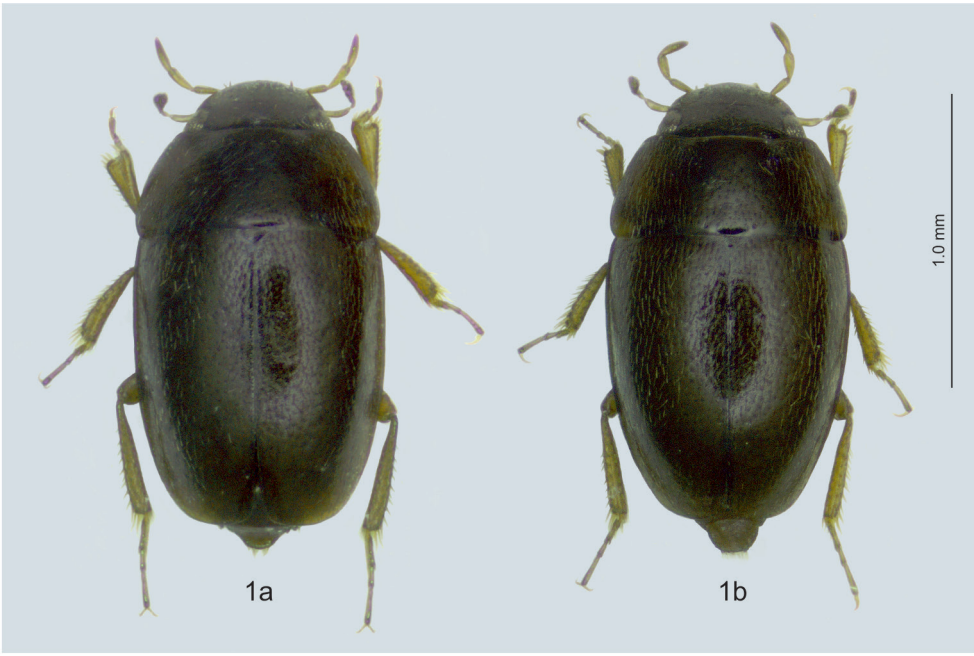
In this river, the following species of water beetles were found: *Bidessus delicatulus* (SCHAUM, 1844), *Deronectes moestus inconspectus* (LEPRIEUR, 1876) (Dytiscidae), *Hydraena andreinii* ORCHYMONT, 1934, *H. devillei* GANGLBAUER, 1901, *H. minutissima* STEPHENS, 1829, *H. plumipes* REY, 1884, *H. similis* ORCHYMONT, 1930, *H. subimpressa* REY, 1885, *Limnebius mucronatus* BAUDI, 1872, *L. nitiduloides* BAUDI, 1872, *L. perparvulus* REY, 1884, *Ochthebius crenulatus* MULSANT & REY, 1850 (Hydraenidae), *Coelostoma hispanicum* (KÜSTER, 1848), *Laccobius albescens* ROTTENBERG, 1874, *L. neapolitanus* ROTTENBERG, 1874 (Hydrophilidae), *Limnichus incanus* KIESENWETTER, 1851 (Limnichidae), *Dryops subincanus* (KUWERT, 1890), *D. viennensis* (CASTELNAU, 1840), *Pomatinus substriatus* (MÜLLER, 1806) (Dryopidae), *Elmis maugetii* LATREILLE, 1768, *E. rioloides* (KUWERT, 1890), *Esolus berthelemyi* OLMI, 1975, *Limnius* cf. *intermedius* FAIRMAIRE, 1881, *Riolus nitens* (MÜLLER, 1817) (Elmidae).

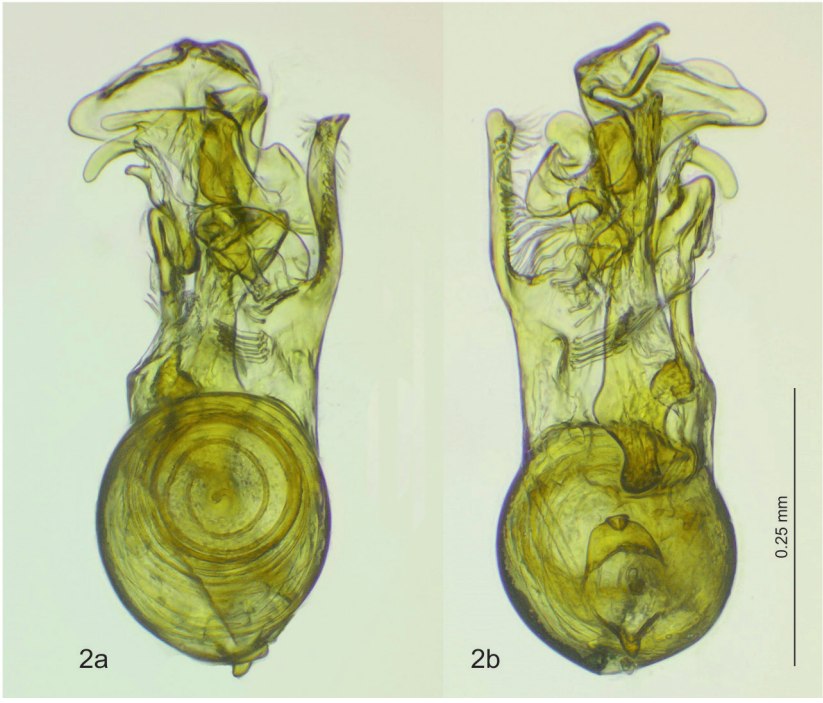
All the other specimens of *Limnebius asperatus* were found in the second locality, ca. 40 km southeast of the River Rabbi, at the northern slopes of the Alpe della Luna. The beetles were collected in two small seepages (Figs. 8–9), close to the Presalino Waterfall (Fig. 7) formed by the Stream Presalino, which joins the Stream Presale just a few meters below the waterfall. The Presale is a right tributary of the River Marecchia, which empties into the northern Adriatic Sea at the town of Rimini.

One of the seepages lies near the western (right) side and one lies near the eastern (left) side of the waterfall. The seepage on the western (right) side was examined in July 2020 and originates from a grass-covered springlet, placed few meters from the right side of the waterfall (Fig. 8), and flows mostly almost horizontally; it is colonized by thin algal mats. *Limnebius asperatus* was rather abundant; most of the specimens were found by carefully removing the algal mats from the rocky surface, though some individuals were observed outside the algal mats, crawling in the film of water. Obviously, this small hygropetric habitat is temporary, because it was found completely dry at the end of August 2023, when the first author focused mainly on an almost vertical cliff with seepage water, very close to the eastern (left) side of the waterfall (Fig. 9). This thin film of water was obviously not directly connected with the water of the waterfall, and it had almost no algal mats or other vegetation. Although a rather rich community of water beetles was observed clinging on the wet rock or creeping among the wet gravel and debris at the base, very few specimens of *L. asperatus* were found in the seepage.

The following species of water beetles were found in the two seepages of the waterfall in association with *Limnebius asperatus*: *Limnebius mucronatus*, *Ochthebius crenulatus*, *O. opacus* STEPHENS, 1882, *O. morettii* PIRISINU, 1974 (Hydraenidae), *Helophorus brevipalpis* BEDEL, 1881 (Helophoridae), *Laccobius neapolitanus*, *L. gracilis* MOTSCHULSKY, 1855 (Hydrophilidae), *Elodes* sp. (larvae) (Scirtidae), *Riolus subviolaceus* (MÜLLER, 1817) (Elmidae) and *Eubria* cf. *palustris* (GERMAR, 1818) (Psephenidae). In both seepages, *Ochthebius morettii* was dominant.

In the Stream Presalino, a few meters downstream of the waterfall (Fig. 10), the following species were found: *Hydraena truncata* REY, 1885, *Limnebius myrmidon* REY, 1883, *L. nitiduloides* (Hydraenidae), *Hydrocyphon deflexicollis* (MÜLLER, 1821) (Scirtidae), *Dryops lutulentus* (ERICHSON, 1847) (Dryopidae), and *Riolus cupreus* (MÜLLER, 1806) (Elmidae).




Figs. 1–2: *Limnebius asperatus*: 1) habitus of a) male and b) female, 2) aedeagus in a) dorsal and b) ventral view.

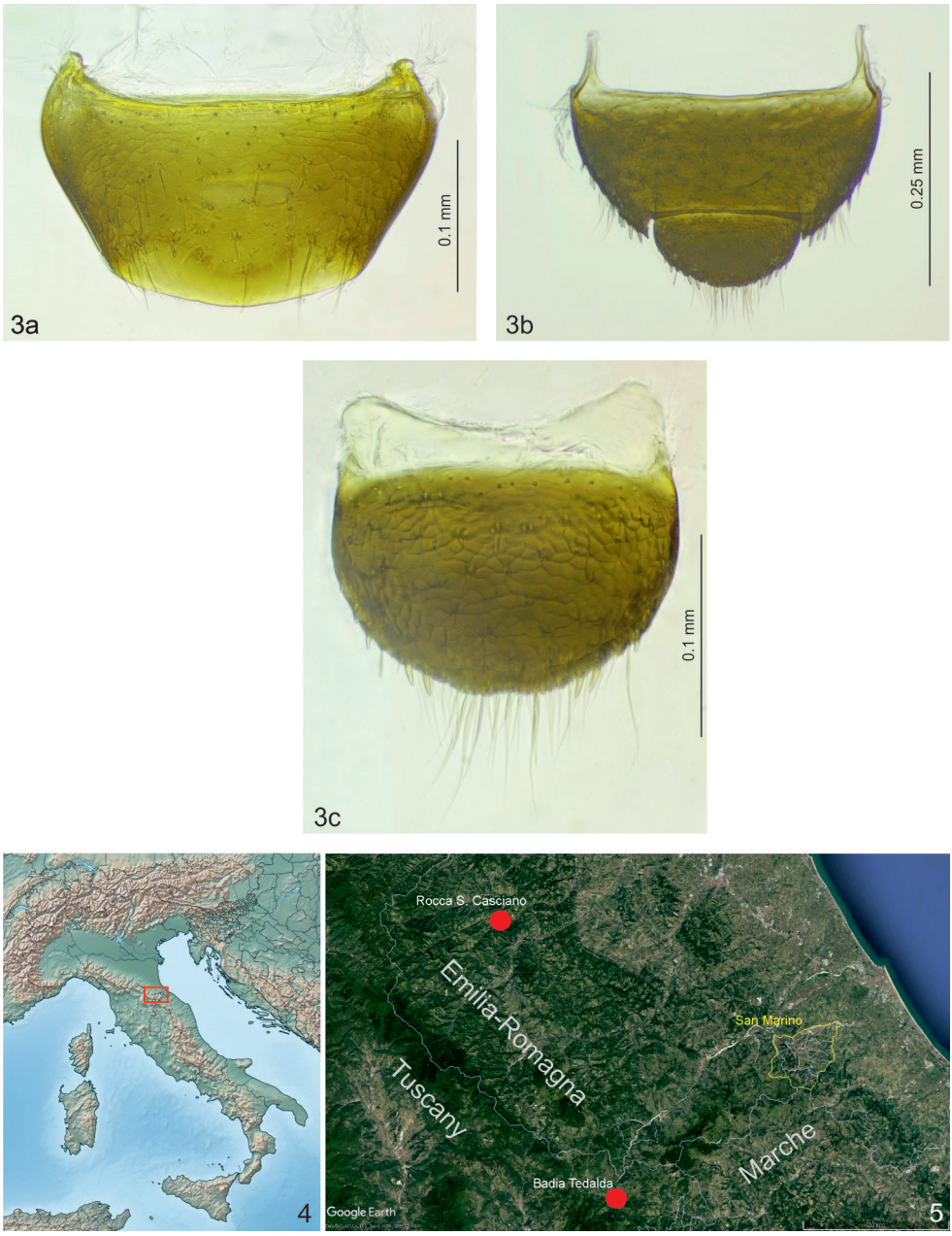



Fig. 3: *Limnebius asperatus*, female pygidial sclerites: a) gonocoxite, b) tergites IX–X, c) tergite X.
Figs. 4–5: Distribution of *Limnebius asperatus* in the northeastern Apennines.

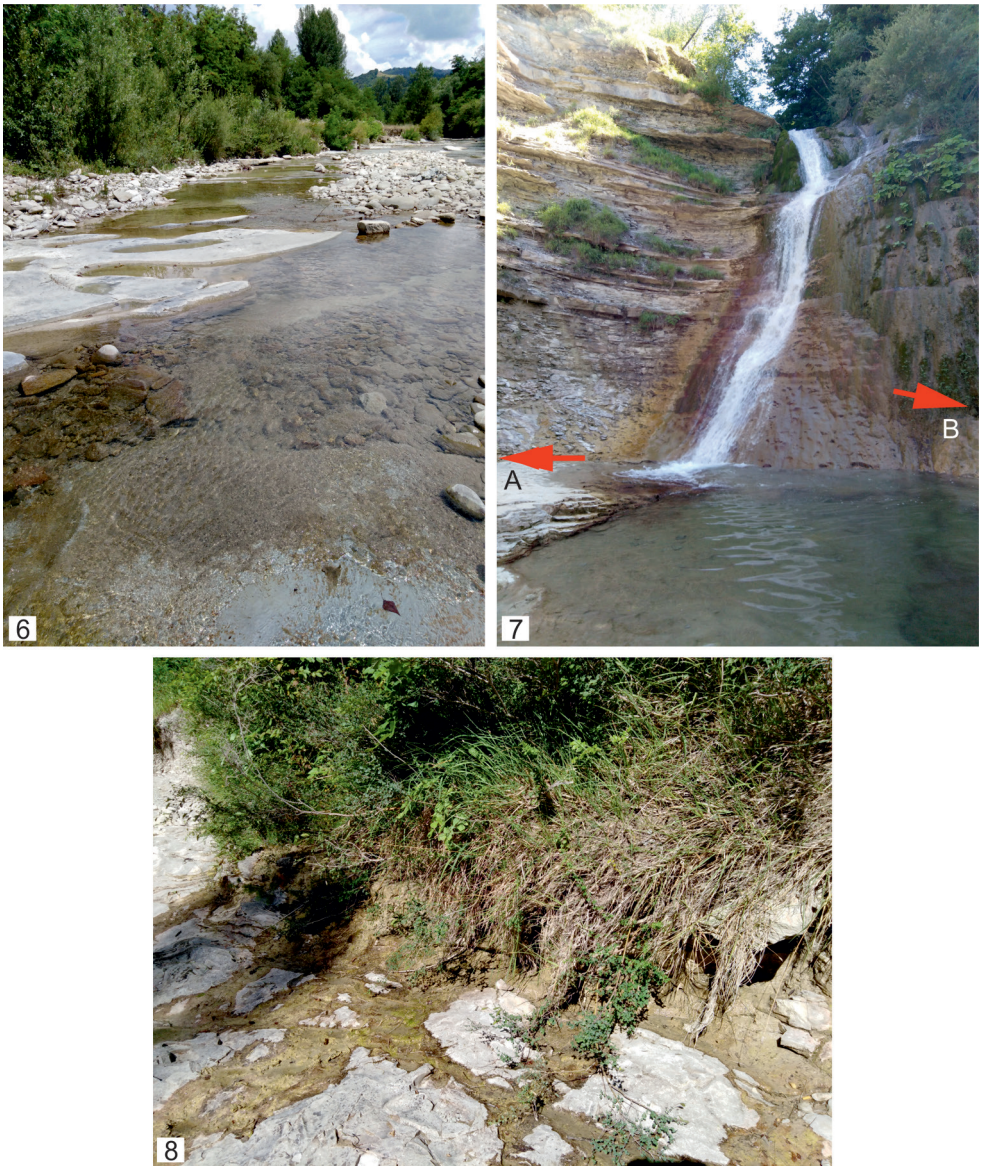



Fig. 6: River Rabbi at Strada San Zeno (Emilia-Romagna), where *Limnebius asperatus* was found.

Fig. 7: Presalino Waterfall (Tuscany). Arrow A points at the seepage lying east of the waterfall, and arrow B points at the seepage lying west of the waterfall. Both seepages are not visible on the photograph.

Fig. 8: Seepage, lying ca. 5 m east of the Presalino Waterfall.




Fig. 9: Seepage, lying west of the Presalino Waterfall. Arrows: A) main course of the waterfall, B) seepage, where *Limnebius asperatus* was picked up, C) area with wet gravel and debris at the base of the cliff.

Fig. 10: Presalino Stream, downstream of Presalino Waterfall, few meters before it flows into the Presale Stream.

Fig. 11: Upper part of Presalino Waterfall, showing several hitherto unexamined seepages.

We assume that *Limnebius asperatus* lives more or less exclusively in seepages. It was not found on the wet cliffs directly adjacent to the waterfall itself or in the Stream Presalino or in the close Stream Presale. Besides, during the same collecting trips in 2020 and 2023, the senior author sampled in various kinds of habitats (including also some hygropetric sites) at 18 different localities, covering the territory formed by the triangle between San Benedetto in Alpe, Pennabilli (both in Emilia-Romagna) and Mercatello sul Metauro (Marche), where *L. mucronatus* was found almost everywhere, but, besides the 24 specimens of *L. asperatus* collected in the two seepages near the base of the Presalino Waterfall, only a single specimen was found, i.e., in the River Rabbi (microhabitat unknown).

The waterfall of the Stream Presalino, where almost all the specimens of *Limnebius asperatus* were collected, is not part of the nearby Alpe della Luna Natural Reserve. The seepages, where *L. asperatus* was found, is to be regarded as vulnerable as they are exposed to bathers and tourists, who are able to move around freely around the rocky base of the waterfall. However, it is to be noted that the seepage examined in 2023 is scarcely accessible and other, even less accessible, similar microhabitats were found to exist (but not examined) near the upper part of the waterfall (Fig. 11), where *L. asperatus* might also occur.

DISTRIBUTION: The original description and the lectotype labels of *Limnebius asperatus* do not provide any detailed data about the type locality, except "Italia". The name of the collector and the year of collecting are unknown as well. AUDISIO & DE BIASE (2006: CD-ROM) assumed that the type specimens might have been collected in the southern Apennines ("Specie nota esclusivamente di una non specificata località italiana, probabilmente nell'Appennino meridionale"), but they did not provide any explanation for their assumption. At present, the only two known localities for this species are in the northeastern Apennines (Figs. 4–5), near the borders of Emilia-Romagna, Tuscany, Marche and Umbria.

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