

New records of hanging flies (Mecoptera: Bittacidae: *Bittacus* LATREILLE, 1805) from Eastern Austria

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Abstract

New evidence of *Bittacus hageni* BRAUER, 1860 and *Bittacus italicus* (O. F. MÜLLER, 1766) is published from Austria's eastern provinces – Vienna and Lower Austria. The rediscovery of *B. hageni* after 163 years at the type locality appears to be particularly remarkable; the Waschberg is part of a forest habitat that is nowadays completely surrounded by intensively used agricultural land. In order to facilitate an easier distinction between the only two Central European species that have not received particular attention in Austria for several decades, the most important diagnostic features are summarised and illustrated.

Key words. *Bittacus hageni*, *Bittacus italicus*, type locality, new records, distinguishing characters.

Zusammenfassung

Aus dem Osten von Österreich, dem Wiener Stadtgebiet und Niederösterreich, werden neue Fundnachweise von *Bittacus hageni* BRAUER, 1860 und *Bittacus italicus* (O. F. MÜLLER, 1766) publiziert. Besonders bemerkenswert erscheint der Wiederfund von *B. hageni* nach 163 Jahren am Typenfundort, dem Waschberg, einem Waldgebiet, das mittlerweile komplett von intensiv genutzten Agrarflächen umgeben ist. Um die Unterscheidung dieser in Österreich in den vergangenen Jahrzehnten nicht besonders beachteten Arten zu erleichtern, werden die wichtigsten diagnostischen Merkmale zusammengefasst und abgebildet.

Introduction

Bittacidae was a previously little-noticed family of the order Mecoptera, but has received more attention during the last two decades, with new evidence from European countries (e. g., PRZYBYLOWICZ 2006, CARRIÈRES-KAM & JEITZ 2007, REZBANYAI-RESER 2007, TILLIER 2008, 2009, TILLIER et al. 2009, NIDERGAS 2014, HAHN et al. 2021, DEVETAK et al. 2022, DRUKKER et al. 2022). Two species occur in Austria: *Bittacus hageni* BRAUER, 1860 and *Bittacus italicus* (O. F. MÜLLER, 1766). The species of *Bittacus* were previously considered extremely rare; there are comparatively few faunistic reports from Austria (e. g., GEPP 1978, 1982).

In the course of a monitoring project in the southeastern part of Vienna (Lobau), both *Bittacus* species were found in large numbers, with *B. italicus* being observed much more frequently than *B. hageni*. In addition, the type locality of *B. hageni* was revisited to examine if this species still occurs there. In order to draw attention to this very interesting group and make it easier to distinguish between these two species, the most important diagnostic characters are listed below.

Material and methods

Most of the presented observations were results of a monitoring project performed along different transects of six meadows in the Lobau (22nd district of Vienna) between sunset and approximately 23:00 p.m. under various weather conditions. The meadows were either “Heißbländen” (xeric alluvial biotopes) or abandoned fields, which are kept free of bushes by mowing. Most specimens were observed or collected after 21:00 p.m. The specimens moved in rapid, unsteady flight, usually relatively close to the ground, but sometimes up to overhead-level. Only occasionally, specimens were observed hanging on the low bush vegetation that surrounds the meadows. In the field, no differences in flight behaviour could be detected between these two species.

All samples mentioned were identified by the author directly or indirectly on photographs according to BRAUER (1860) and SAVITSKY & TIMOKHOF (2021). Unless otherwise noted, all recent samples are in the author’s collection, the locality information is given as it is written on the labels. Historical labels are cited.

All investigations were performed with a Leica MZ16 binocular microscope with a Planapo 1.0× objective. Measurements were taken with a calibrated Leica ocular scale at absolute magnifications of 12.9×. Digital photographs were taken with a Leica Flexacam C1 or a Leica DFC camera attached to a Leica MZ16 binocular microscope with the help of Leica Application Suite V3, and stacked with Zerene Stacker 64-bit. Processing of images was performed with Adobe Photoshop 7.0.

Abbreviation: NHMW – Natural History Museum Vienna.

Taxonomy

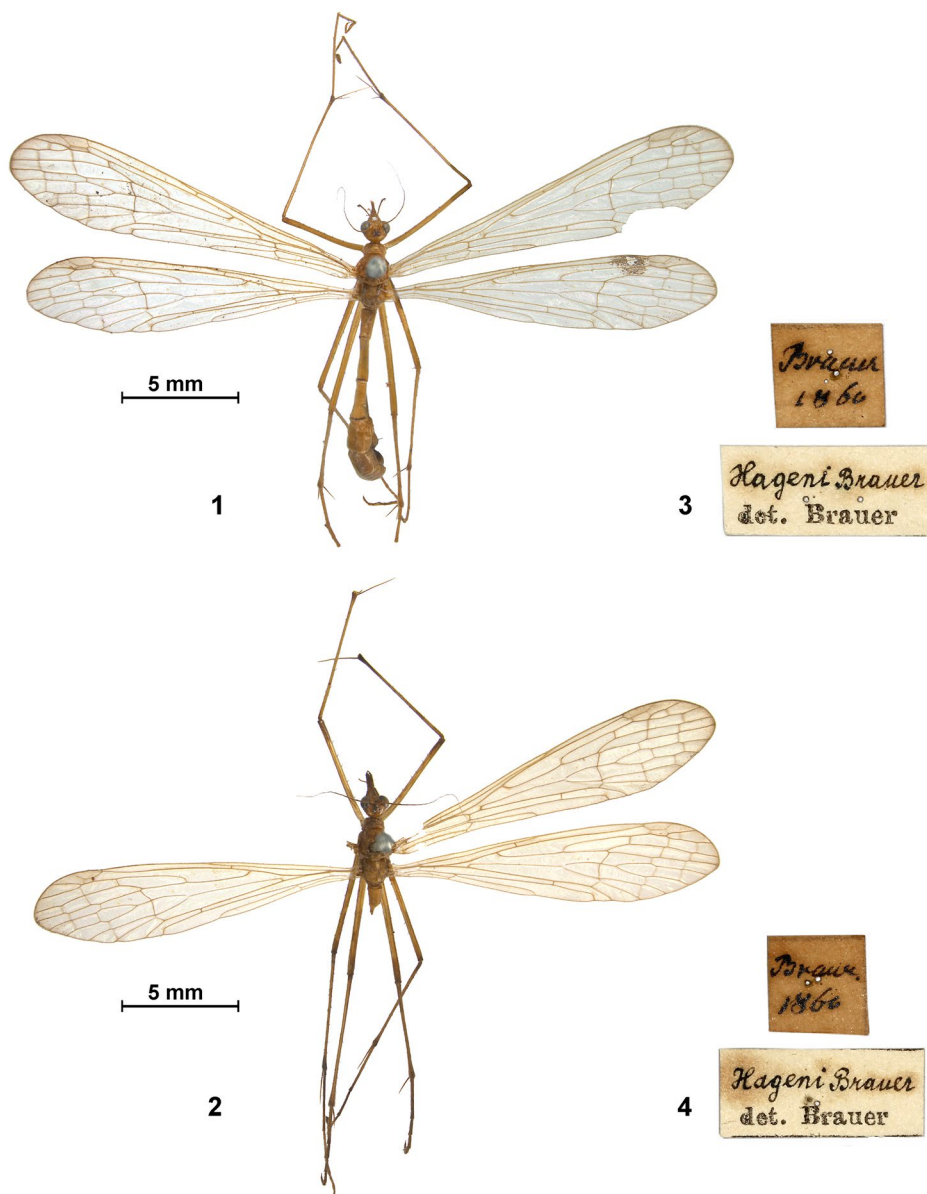
Bittacus hageni BRAUER, 1860 (Figs 1–5, 7, 9, 11)

New material examined. 1 ♂, Austria, Vienna, 22nd District, Obere Lobau, Forstmeistermais, N 48°10′53.8″, E 16°29′28.3″, 10.VII.2023 (together with *B. italicus*); 1 female, Austria, Vienna, 22nd District, Untere Lobau, Kothau, N 48°10′17.3″, E 16°32′01.6″, 13.VII.2023; (together with *B. italicus*); 2 ♀♀, Austria, Vienna, 22nd District, Obere Lobau, Esslinger Platte, N 48°11′55.0″, E 16°31′30.1″, 20.VII.2023 (together with *B. italicus*); 4 ♀♀, 4 ♂♂, Austria, Niederösterreich, Waschberg bei Stockerau (type locality), N 48°24′56.9″, E 16°16′41.2″, 21.VIII.2023.

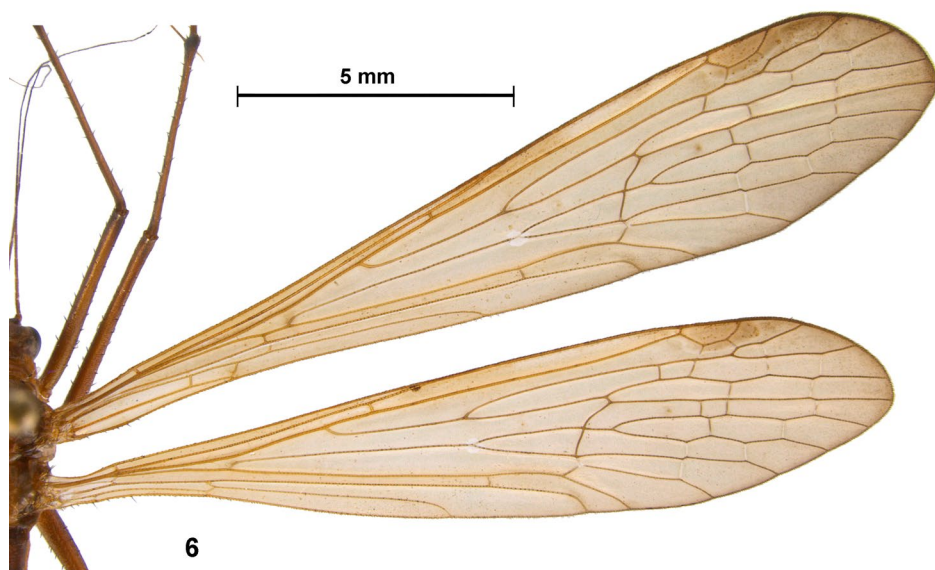
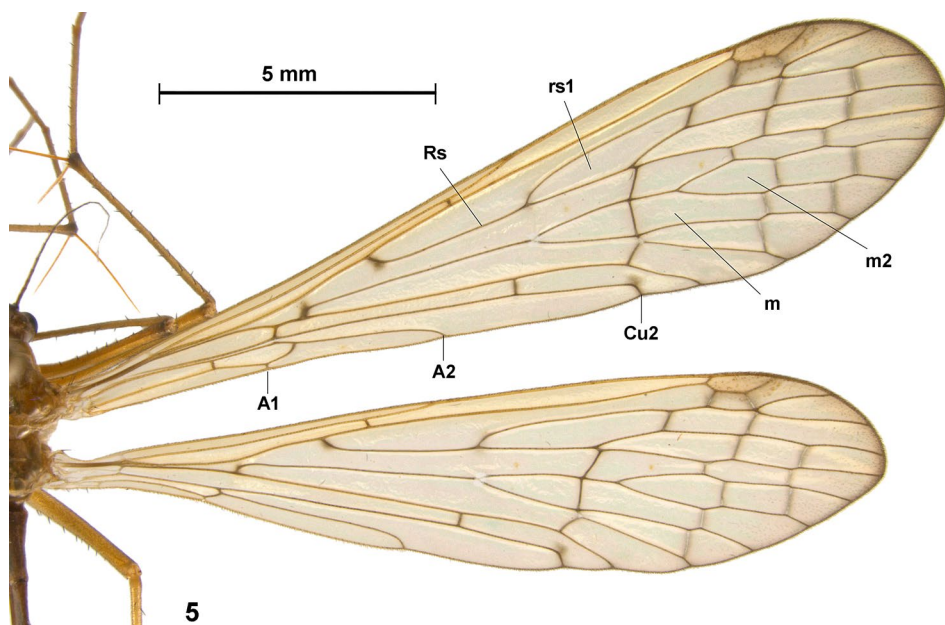
Historical specimens examined. 20 ♀♀, 21 ♂♂, “Wien, coll. Brauer”, “Hageni det. Brauer”; one ♂ with label “*Bittacus hageni* det. H. Aspöck”; 1 ♂, 1 ex. unsexed (abdomen missing) with labels “Brauer 1860” (handwritten), “Hageni Brauer, det. Brauer” (handwritten and printed); 1 ♂, 1 ex. unsexed (abdomen missing) with labels “Prater, Roghof, 17/7 862”, “Hageni Brauer, det. Brauer”; 1 ex. unsexed (abdomen missing) with labels “Prater, 7. August”, “Roghof, 1870”; 1 ex. unsexed (abdomen missing) with labels: “Brau 1884”, “Hageni Brauer, det. Brauer”.

Notes. BRAUER (1860) mentions in his original description that on August 23rd, 1860 he was able to catch eight specimens of the new species *Bittacus hageni* in a dense, very moist young forest on the “Waschberg bei Stockerau”. There, almost exactly to the day (August 21st), but 163 years later, this species was detected again in a similar habitat (Fig. 14).

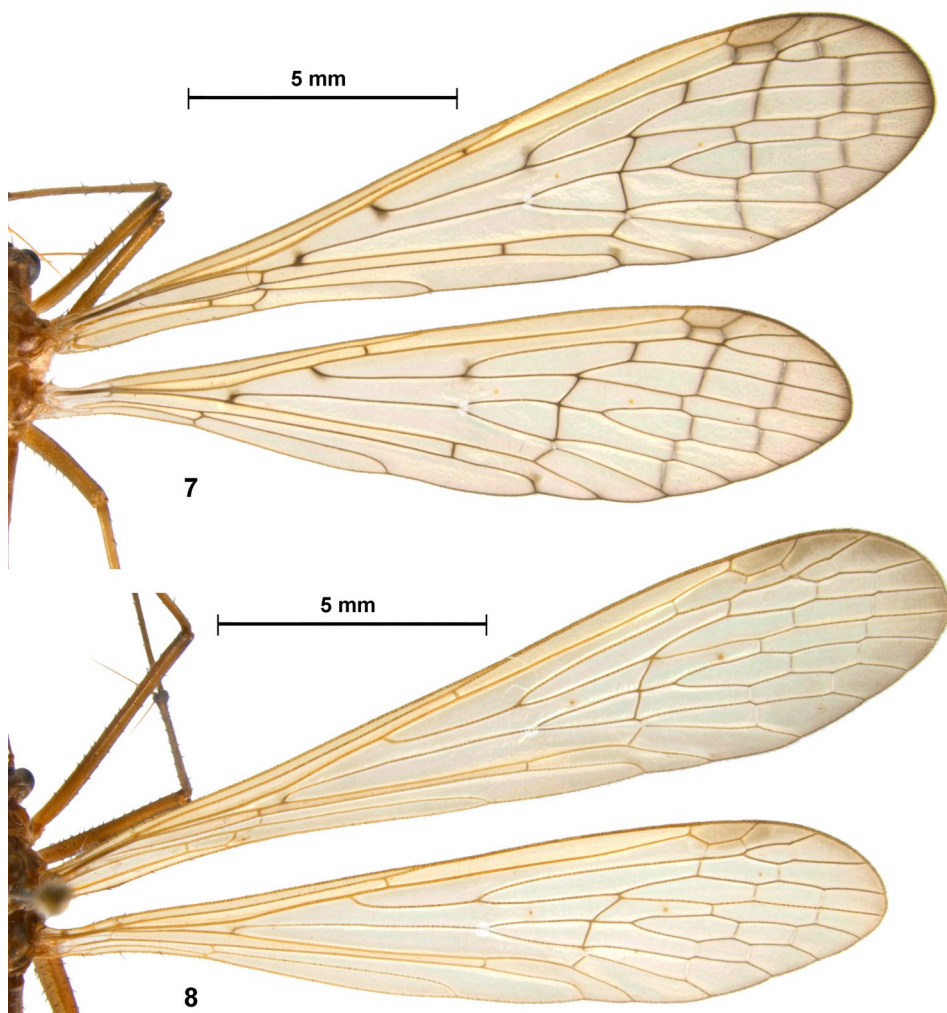
The site “Waschberg” is located in a limited, approximately 24 km² large forest area, the “Rohrwald”, and with its peak at 388 m a.s.l. it is the second highest elevation in the area (the highest being the neighboring Michelberg at 409 m a.s.l.). This forest area lies on an extension of the flysch zone on the edge of the Korneuburg Basin and is crossed by several streams, which is rather unusual for the region (WIKIPEDIA 2023). The “Rohrwald”



Figs 1–4. Habitus of (1) a 163-year-old female specimen of *B. hageni* and of (2) a 163-year-old unsexed specimen of *B. hageni*, both most likely from the type series. (3, 4) Labels of these specimens (labels not to scale). © NHMW / Harald Bruckner.



Figs 5–6. (5) Right wings of *B. hageni*, female from Lobau, Kothau. (6) Right wings of *B. italicus*, female from Lobau, Kreuzgrund, Versuchswiese. A1 = first anal vein, A2 = second anal vein, Cu2 = second cubital vein, Rs = common stem of first radial sector, rs1 = first cell of radial sector. © NHMW / Harald Bruckner.



Figs 7–8. (7) Right wings of *B. hageni*, male from Lobau, Forstmeistermais. (8) Right wings of *B. italicus*, male from Lobau, Königlwiese. © NHMW / Harald Bruckner.

is surrounded like an island by intensively used agricultural land, so that gene flow with other *Bittacus* populations seems rather unlikely (Fig. 15).

It is all the more gratifying that after such a long time the living conditions for the species continue to exist and the population has been able to maintain itself. The discovery area was visited twice; it was only on the second attempt that the species was found along forest paths. Only *B. hageni* was found in a balanced sex ratio at this site. In the Viennese Lobau, *B. hageni* was observed together with *B. italicus* in three places (Esslinger Platte, Forstmeistermais, Kothau), but much less frequently. The ratio of the species to each other was approximately 1 : 7.



Figs 9–12. Lateral view of abdomina of females of (9) *B. hageni* and (10) *B. italicus*, illustrating the basal black transversal stripes on tergites in *B. hageni* that are absent on tergites 6 and 7 in *B. italicus*. Genitalia of males of (11) *B. hageni* and (12) *B. italicus*; arrows indicate the characteristic spine fields. © A. Dostal.

When examining the collection material in the Natural History Museum Vienna, two specimens were identified that are most likely part of Brauer's original series (Figs 1, 2). They carry the labels "Brauer 1860" (handwritten) and "Hageni Brauer det. Brauer" (handwritten and printed) (Figs 3, 4). The female is in rather good condition, whereas the second one is unsexed as it is missing the abdomen and also the left anterior wing. None of the two specimens exactly corresponds to the figure in the original description. Despite this, both specimens should be considered as syntypes, as no other specimens documented to come from the type locality or mentioned in subsequent publications (BRAUER 1863, 1871) are available. However, a formal designation of types is not performed here.

Bittacus italicus (O. F. MÜLLER, 1766) (Figs 6, 8, 10, 12)

New material examined. 1 ♀, Austria, Vienna, 22nd District, Lobau at Groß-Enzersdorf, Franzosenfriedhof, 153 m a.s.l., N 48°11'18", E 16°31'55", 13.VIII.2020, leg., det. & coll. A. Link; 1 ♂, Austria, Vienna, 22nd District, Obere Lobau, Esslinger Platte, N 48°11'56.3", E 16°31'43.5", 20.VI.2023; 11 ♀♀, 5 ♂♂, same site, N 48°11'55.0", E 16°31'30.1", 20.VII.2023 (together with *B. hageni*); 6 ♀♀, 2 ♂♂, Austria, Vienna, 22nd District, Untere Lobau, Königlwiese, N 48°09'06.3", E 16°33'50.8", 21.VI.2023; 10 ♀♀, 9 ♂♂, 24 ex., same site, 27.VI.2023; (8 ♀♀, 1 ♂, coll. NHMW, 15 ex. coll. M. Fuchs, Rottenmann; 2 females, same site, 3.VII.2023, for barcoding, coll. NHMW; 1 ♀, Austria, Vienna, 22nd District, Untere Lobau, Kreuzgrund Nord, N 48°09'39.1", E 16°32'42.9", 28.VI.2023; 21 ex., same site, N 48°09'34.7", E 16°32'49.1", 12.VII.2023; 3 ♀♀, Austria, Vienna, 22nd District, Untere Lobau, Kreuzgrund West, Versuchswiese, N 48°09'40.8", E 16°32'29.1",



Fig. 13. *Bittacus italicus* in copula (female left) while feeding on prey together; Lobau, Küniglweise, 27 June 2023. © A. Dostal.

28.VI.2023; 10 ♀♀, 6 ♂♂, same site, N 48°09'41.3", E 16°32'30.4", 12.VI.2023; 1 ♀, 1 ♂, Austria, Vienna, 22nd District, Untere Lobau, Kothau, N 48°10'21.7", E 16°32'05.0", 29.VI.2023; 3 ♀♀, 5 ♂♂, same site, N 48°10'17.3", E 16°32'01.6", 13.VII.2023 (together with *B. hageni*); 6 ♀♀, Austria, Vienna, 22nd District, Obere Lobau, Forstmeistermais, N 48°10'47.9", E 16°29'37.6", 10.VII.2023 (together with *B. hageni*).

Historical specimens examined (in coll. NHMW). 1 ♂, "Braun, Prater, Juni"; 1 ♀, "Krems, 1873, Ferrari", "tipularius Fabr. det Brauer"; 1 ♀, "Nieder-Österreich, Unter-Waltersdorf, VIII.[19]02.5, Stockmayer"; 1 ♀, "Lit. Austr. Belvedere, 18.7.11", "Bittacus italicus Müll. det. H. Aspöck"; 1 ex. unsexed (abdomen missing), 2 females, "Jennersdorf - Raab, Bgld. 12.8.54", "coll. Fulmek"; 2 ex. unsexed (abdomen missing), "St. Martin - Bgld. 14. 8. 54", "coll. Fulmek"; 1 ex. unsexed (abdomen missing), "Burgenland 1954, Jennersdorf, 12.-23. VIII., Ebner"; 1 ex. unsexed (abdomen missing), "coll. R. Ebner, Burgenland, Jennersdorf, 12.-28. VIII. 1954".

Notes. BRAUER (1863) already mentioned that *B. italicus* was sometimes common in the Vienna area. The year 2023 seems to have provided optimal weather conditions for *B. italicus*, as it has never been observed so frequently before. A periodic pattern is rather unlikely, since larval development is annual (BRAUER 1863).

Species differentiation

Bittacus hageni and *B. italicus* are difficult to distinguish in the field; no differences in flight behaviour could be found. The morphological differences between these two species were already described by BRAUER (1860) and confirmed by SAVITSKY & TIMOKHOV (2021)



Figs 14–15. (14) Habitat of *B. hageni*: a forest path through damp young forest at the foot of Waschberg, with plenty of undergrowth, 20 September 2023. (15) Waschberg (left arrow) and Rohrwald, a forest island surrounded by intensively used agricultural land; habitat location approximate in the centre of the picture (right arrow); 20 September 2023. © A. Dostal.

and DEVETAK et al. (2022). The most important characters, which are also verified by the present sampling, are listed below:

On average, *B. italicus* is slightly larger (anterior wing length 17.9 mm, n = 46) than *B. hageni* (anterior wing length 16.7 mm, n = 8).

Wing venation is diagnostic and no sexual difference of wing characters could be found in either species. The diagnostic characters are illustrated in Figures 5–8 (labeling in Figs 5 and 6). In *B. italicus*, the pterostigma is enlarged distally, and the wing membrane is slightly darker than in *B. hageni*. The most striking difference between the two species is the dark lining of the wing veins of all wings in *B. hageni*. In *B. hageni*, the first cell in the radial sector of both wings (rsl) is shorter and wider, and approximately as long as the common vein (Rs), while in *B. italicus* it is narrower and significantly longer than the common vein. Cell m2 in the median sector of both wings is also significantly shorter and wider in *B. hageni* (greatest length : greatest width < 3) than in *B. italicus* (greatest length : greatest width > 3.9). This character appears to be more pronounced on the forewings than on the hindwings. The cross-vein m is more or less perpendicular to the longitudinal wing axis in *B. hageni*, while it is inclined in *B. italicus*. In *B. hageni*, the distance between the termination of anal vein A1 at the posterior margin of all wings to the wing base is similar to the distance between terminations of anal veins A1 to A2, and between A2 and Cu2; but in *B. italicus* the distance between A1 and A2 is conspicuously larger than the distance between the base and A1, and A2 and Cu2 respectively.

In *B. italicus*, the basal quarter of the posterior edge of all wings is usually covered with 4–8 long, thick, black bristles, as is the front edge with usually 3–5 bristles. In *B. hageni*, fewer elongated bristles are found on the posterior (0–4) and anterior edge (0–2).

Females of *B. hageni* have transverse black stripes on the bases of all tergites (Fig. 9), while they are missing on tergites 6 and 7 in *B. italicus* (Fig. 10).

The males of the two species can be easily distinguished by their genitalia (comp. Figs 11 and 12).

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