

# On the knowledge of *Bembecia hofmanni* with description of the female (Lepidoptera: Sesiidae)

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**Abstract.** During several expeditions in Turkey, in one locality, numerous specimens of *Bembecia hofmanni* Kallies & Špatenka, 2003 were lured with pheromones. A thorough search in the biotope resulted in the discovery of the hitherto unknown female of this species. The female is described here and depicted together with the genitalia structures of both sexes. Additionally, a second locality 450 km further to the west was discovered. A possible hostplant is given and illustrated.

**Samenvatting.** Over de kennis van *Bembecia hofmanni* met beschrijving van het wijfje (Lepidoptera: Sesiidae) Gedurende verscheidene expedities in Turkije werd in één bepaald biotoop een vrij groot aantal exemplaren van *Bembecia hofmanni* Kallies & Špatenka, 2003 verzameld met behulp van feromonen. Een grondige zoektocht in het biotoop leidde tot de ontdekking van het tot hier toe onbekende wijfje van deze soort. Het wijfje wordt hier beschreven en afgebeeld, samen met de genitaalstructuren van beide geslachten. Daarnaast werd ook een tweede biotoop ontdekt dat zich 450 km verder naar het westen bevindt. Een mogelijke voedselplant wordt vermeld en afgebeeld.

**Résumé.** Mise au point des connaissances concernant *Bembecia hofmanni* y compris la description de la femelle (Lepidoptera : Sesiidae)

Au cours de plusieurs expéditions en Turquie un assez grand nombre d'exemplaires de *Bembecia hofmanni* Kallies & Špatenka, 2003 a été capturé au moyen de phéromones. Une recherche approfondie dans le biotope a conduit à la découverte de la femelle de cette espèce qui était, jusque-là, inconnue. La femelle est décrite et illustrée ainsi que les génitalia des deux sexes. En outre, une deuxième localisation, 450 km à l'ouest a été découverte. Une plante hôte possible est décrite et représentée.

**Key words:** Turkey –Sesiidae – *Bembecia* – *hofmanni* – female – taxonomy.

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## Abbreviation

CTG – collection of T. & W. Garrevoet

## Introduction

The taxon *hofmanni* Kallies & Špatenka, 2003 is a peculiar species that, at present, is considered to belong in the genus *Bembecia* Hübner, 1819, one of the largest genera of the Clearwing moth family. However, it has remarkable characteristics, in both external morphology and genital structure, and has now been placed in its own subgroup within *Bembecia* (<http://www.sesiidae.net/Checklst.htm>, Pühringer & Kallies). *B. hofmanni* was described from specimens from localities in several Iranian Provinces and one specimen from eastern Turkey (Kallies & Špatenka, 2003).

Using pheromones, the authors captured a important considerable number of males at one specific biotope in eastern Turkey (Province Van). Because of the relative abundance of the species, the authors started to look for females and the second author succeeded in capturing two. Visits to the same locality in the following years led to the collection of more material, including females. A second locality for the species was discovered about 450 km further westwards.

The aim of this paper is to give additional distribution data on *B. hofmanni*, to describe the female and to provide illustrations of the external morphology and genital structures of both sexes. A possible host plant is suggested and the taxonomic position in the genus *Bembecia* and the DNA results are discussed.

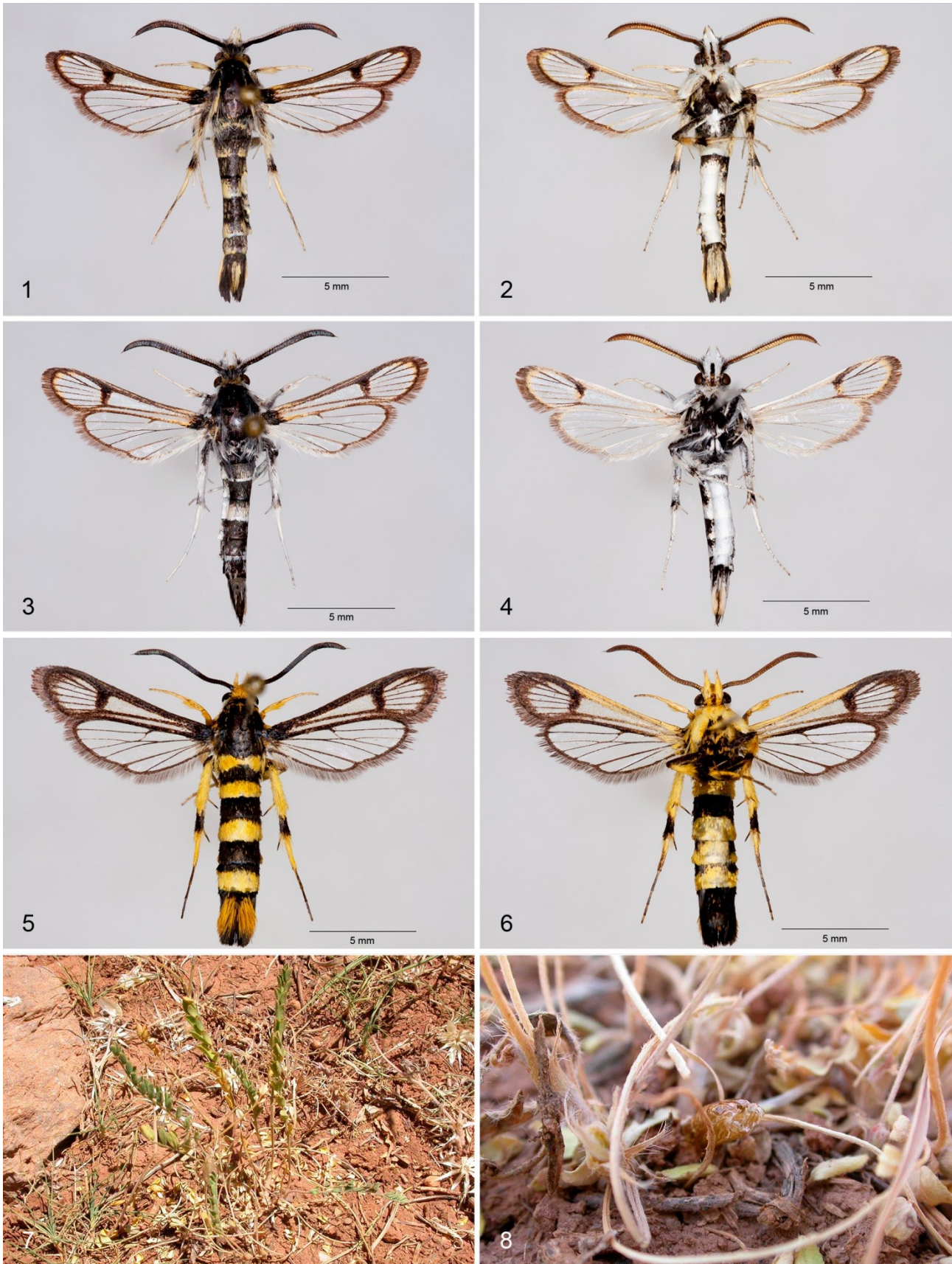
## Material

Turkey, Province Van, Yukarınarlıca, 2200 m, N 38° 07' 31.3" – E. 043° 04'27.2", 11♂, 2♀, 17.vii.2004; 10♂, 18.vii.2004; 1♂, 3♀, 13.vii.2005; 9♂, 8♀, 14.vii.2005; 6♂, 1♀, 16.vii.2006 (CTG).

Turkey, Province Adıyaman, Nemrut Dağı, 1500 m, N 38° 00' 35.3" – E 038° 45' 50.4", 7♂, 11.vii.2005 (CTG).

## Methods

All male specimens were collected using a synthetic pheromone originating from Pherobank B.V., Plant Research International, Wageningen, The Netherlands, which contains (Z,Z)-3,13-Octadecadienyl acetate and (E,Z)-2,13-Octadecadienyl acetate in a 3000 µg + 150 µg ratio. A few males and all females were netted without the use of pheromones. Preparations of genitalia of several specimens were made, using the standard techniques: maceration of the abdomen in 10% KOH, removal of the scales and cleaning in 70% ethanol. Genitalia of males were not stained, those of females were stained with Chlorazol Black, then mounted in Euparal on a cavity slide, males with opened valvae. DNA was extracted from a mid leg of set specimens. DNA analysis ("Barcode" = 658 base pair sequences of COX1 mitochondrial DNA) of several *B. hofmanni* specimens was carried out. The PCR-primers used were LepF1 and LepR1; the distance model was Kimura 2 Parameter. For details see on the "Barcode of Life Database (BOLD)" webpages (<http://www.barcodinglife.com/views/login.php>). The detailed data can be accessed with a login under the project "Global Sesiidae – Clearwing Moths of the World".



**Figs 1–8.** *Bembecia hofmanni* (all specimens in CTG).

**1–2.** Male, Turkey, Province Adiyaman, Nemrut Dağı, 1500 m, N 38° 00' 35.3" – E 038° 45' 50.4", 11.vii.2005, leg T., W. & J. Garrevoet.

**3–4.** Male, Turkey, Province Van, Yukarınarlıca, 2200 m, N 38° 07' 31.3" – E. 043° 04' 27.2", 14.vii.2005, leg T., W. & J. Garrevoet.

**5–6.** Female of *B. hofmanni*, scale bars 5 mm, Province Van, Yukarınarlıca, 2200 m, N 38° 07' 31.3" – E. 043° 04' 27.2", 14.vii.2005, leg T., W. & J. Garrevoet (CTG).

**7–8.** Probable host plant of *B. hofmanni* (fig. 7) with exuvium (fig. 8).

## Results

The discovery of two new localities for *B. hofmanni* in Turkey, especially at the one in Yukarınarlıca (Province Van) where the species was more abundant, offered the opportunity to search for females and the hostplant. Initially, in 2004, only two females were found. In 2005 eleven more females were captured, but only one in 2006. In 2005 the authors discovered the probable hostplant (see bionomics) but plans to revisit that biotope in order to confirm this host proved impossible because of the unstable political situation in the area. Hence, although the hostplant is not known with certainty, the information is given here to serve as a starting point for future investigations.

A male *B. hofmanni* of this locality is figured (Figs. 1–2).

The other Sesiidae species observed at this locality were *Microsphecia brosiiformis* (Hübner, [1813]), *Bembecia stiziformis stiziformis* (Herrich-Schäffer, 1851), *B. sanguinolenta* Lederer, 1853), *B. transcaucasica transcaucasica* (Staudinger, 1891), *Chamaesphacia turbida* Le Cerf, 1937, *Ch. doryceraeformis* (Lederer, 1853), *Ch. sefid* Le Cerf, 1938, *Ch. aurifera* (Romanoff, 1885) and *Ch. ruficoronata* Kallies, Petersen & Riefenstahl, 1998.

The second locality, about 450 km to the west of the first one, is situated on the north side of Nemrut Dağı, 40 km NE of Adyaman (Province Malatya). At this locality seven males were attracted with pheromones and no females could be found. There appears to be no difference in external morphology between specimens from the two localities (Figs. 3–4). In the Nemrut Dağı locality, other species of Sesiidae were observed: *Bembecia stiziformis stiziformis* (Herrich-Schäffer, 1851), *Pyropteron leucomelaena* (Zeller, 1847), *Chamaesphacia doryceraeformis* (Lederer, 1853), *Ch. blandita* Gorbunov & Špatenka, 2001, *Ch. proximata* (Staudinger, 1891) and *Ch. gorbunovi* Špatenka, 1992.

The m-DNA from several specimens was analysed (BOLD, University of Guelph, Ontario, Canada) (Fig. 9). As in the original description of the species (Kallies & Špatenka, 2003) the taxonomic position of *B. hofmanni* is considered to lie between species of the *Bembecia megillaeformis* group and Central Asian *Bembecia* species characterised by the absence of a crista medialis of the gnathos, specimens of respectively *B. megillaeformis megillaeformis* (Hübner, [1813]) and *B. lingenhoelei* Garrevoet & Garrevoet, 2011 are included in the DNA-tree. A sample of *B. syzjovi syzjovi* Gorbunov, 1990 is used as outgroup.

### Description of the female of *Bembecia hofmanni*

The female is strikingly more robust than the conspicuously slender male but apart from this, both sexes have the same wingspan range of 15.4–19.5 mm. A female *B. hofmanni* collected at the locality near Yukarınarlıca is figured (Figs. 5–6).

Head. Antenna black dorsally, orange-brown ventrally; labial palp completely yellow-orange; frons

with orange scales; vertex with long orange hairlike scales.

Thorax. Black with yellow scapular spot at forewing base; tegula black with ample yellow hair-like scales. Metathorax with long hairlike scales dorsally. Front leg yellow; femur with some black scales medially. Mid leg yellow; femur black laterally; tibia yellow with black distal area. Hind leg coxa yellow; femur yellow, black laterally; tibia yellow with black distal area; tarsus yellow, the distal four segments black dorsally, gray-black ventrally; spurs yellow, black distally.

Forewing. Transparent areas large and well developed; costa broad, black; anal area black; discoidal spot black, some sparse orange-red scales distally; posterior transparent area well developed, not covered with scales, reaching discoidal spot; anterior transparent area broad, completely transparent; external transparent area very large, round, divided in six cells, not speckled with scales, intersected with black scaled veins; apical area rather small, dark brown; outer margin rather broad, black; fringes also brown. Underside of wing almost uniform brown, base yellow, costal area yellow reaching discoidal spot; veins dark brown.

Hindwing. Veins dark brown; discoidal spot black, narrow, not reaching M3; fringes grey-brown. Underside discoidal spot black with some yellow scales; veins brown; outer margin brown-black with gray-brown fringes.

Abdomen. Black; distal half of tergite II, distal fourth of tergite IV and distal three quarters of tergite VI bright yellow; anal tuft black with long orange hairs dorsally. Sternite II yellow; sternite IV, V and VI almost completely trapezoid shaped coloured yellow, medially pale yellow-white.

Female genitalia (Fig. 9). Tergite VIII well sclerotised. Sternite VII less sclerotised; papillae anales well developed; lamella antevaginalis weakly sclerotised, with wrinkled surface; apophyses posteriores relatively long and significantly longer than apophyses anteriores; antrum rather short, weakly sclerotised, no clear transition with ductus bursae; corpus bursae oval, without signum.

The male genitalia (Fig. 10) are accurately described in the original description of this species (Kallies & Špatenka, 2003). The peculiar crista projecting ventrally from the proximal area of the crista lateralis is clearly visible on the picture.

### Variability

Apparently independent from the locality, the dorsal markings of the males vary from white to faint yellow while ventrally the pure white markings are preserved. The females do not vary in colour but worn ones tend to fade and their yellow markings become more pale yellow. The size varies from 15.4–19.4 mm for the males (17.41 mm ± 0.88 mm, n = 44) and from 15.4–19.3 mm for the females (17.45 mm ± 1.27 mm, n = 14). Hence, although the average size of both sexes is practically the same, the variability in size is apparently larger within the females.



Fig 9–10. Genitalia structures of *B. hofmanni* scale bars 1 mm. **9.** Female, Yukarınarlıca, 2200 m, N 38° 07' 31.3" – E. 043° 04' 27.2", 16.vii.2006 (Prep. TG2010-008). **10.** Male, Yukarınarlıca, 2200 m, N 38° 07' 31.3" – E. 043° 04' 27.2", 18.vii.2004 (Prep. TG2010-010).

### Diagnosis

*Bembecia hofmanni* resembles no other species of the genus. It is easily distinguished on external morphological characters alone, but the genitalia, especially in the males, are also very characteristic. This justifies the placement of the species in a separate subgroup within *Bembecia* as stated by Pühringer & Kallies (Pühringer & Kallies, 2004).

### Bionomics

In Turkey, *B. hofmanni* was found in open, stony areas and roadsides with predominantly herbaceous vegetation, at altitudes of 1500 m and 2200 m. A thorough search for the hostplant only resulted in the discovery of a small undetermined *Astragalus* or *Oxytropis* species (Fabaceae) (Fig. 7) with a protruding exuvia (Fig. 8). Unfortunately, some other members of the genus *Bembecia* live in the same areas and therefore it remains unclear whether the exuvia belongs to *B. hofmanni*. Nevertheless, considering the small size of the exuvia, the usually considerably larger size of the other *Bembecia* species and the relative abundance of *B. hofmanni* compared to the scarcity of other *Bembecia* species in the area, they most likely belong together. That being so, the pupal chamber is inside the upper part of the root. All specimens were observed in mid July regardless the difference in altitude of the two localities. Males are active from late morning to noon. Females were captured flying in early afternoon but were not observed ovipositing. Most likely, the development only takes one year.

### Distribution

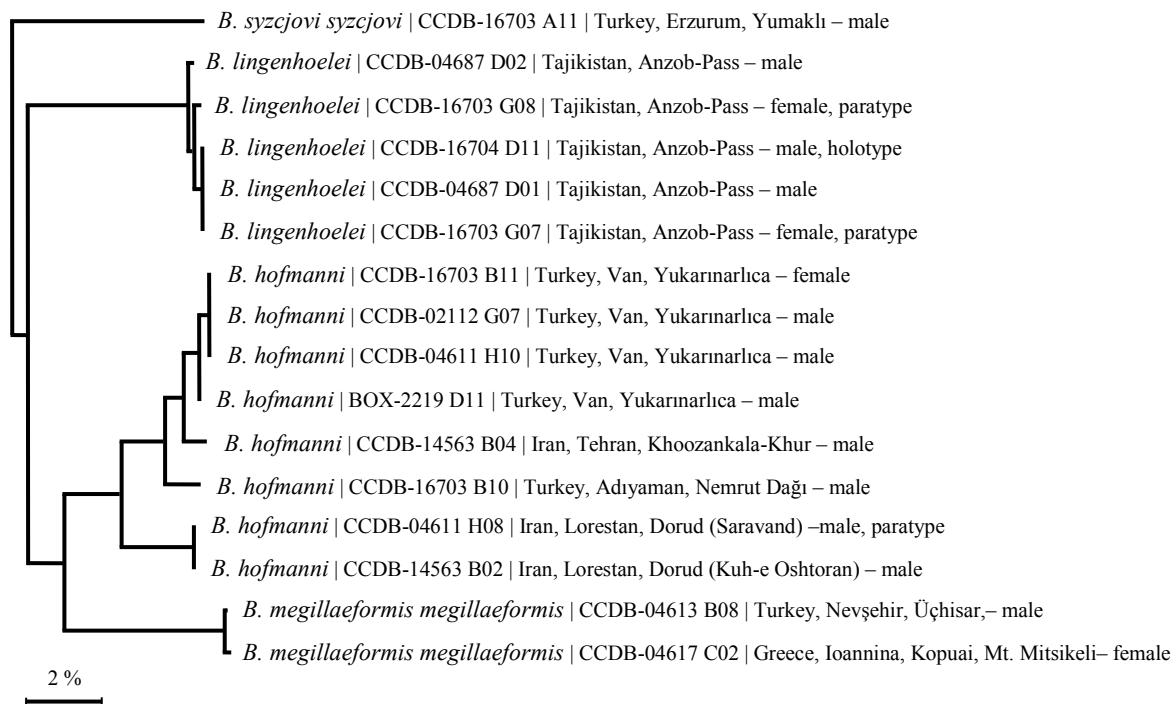
*Bembecia hofmanni* was originally only known from several Iranian Provinces and one locality in Turkey 40 km N of Van. The two new Turkish localities, mentioned in this publication, are respectively 100 km more to the south and about 450 km more to the west of the previously known Turkish locality.

### Conclusion

The external morphology of the hitherto unknown female of the taxon *hofmanni* as well as the DNA results confirm the taxonomic placement of *hofmanni* in the genus *Bembecia*, but in a separate subgroup, is justified. The presumed and undetermined host plant of this species needs confirmation. No differences in morphological characteristics between males from the different localities have been observed despite the considerable distance between both.

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**Fig. 11.** Neighbour joining tree of DNA barcodes of *Bembecia* species, showing specimen registry numbers and localities of origin. *Bembecia syzjovi syzjovi* Gorbunov, 1990 represents the outgroup.

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