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Notes on the identity and occurrence of *Geron mystacinus* Bezzi, 1924 (Bombyliidae: Toxophorinae: Gerontini) in Iran

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ABSTRACT. The genus *Geron* belongs to the monotypic tribe Gerontini Hesse within the subfamily Toxophorinae Schiner. *Geron* occurs on all continents and is divided into four subgenera, of which only *Geron sensu stricto* is known from the Old World. Previously, three species of *Geron* were known from Iran: *Geron kozlovi* Zaitzev, 1972; *Geron krymensis* Paramonov, 1929; and *Geron olivierii* Macquart, 1840. Here, *Geron mystacinus* Bezzi, 1924 is newly recorded from Iran. The adult genitalia are illustrated, and the species identity is briefly discussed.

Keywords: Diagnosis, dimorphism, new record, taxonomy, WIP

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INTRODUCTION

Geron mystacinus Bezzi, 1924, is a unique and rare species distinguished by a sexually variable autapomorphic character from the rest of the species in the Palaearctic Region. This character is the color of the hairs on the face and antennae. Male adults have long black hairs on the face, frons, and the two basal segments of the antennae. In contrast, females have white hairs on the face and frons, and only the two basal segments of the antennae bear short black hairs. All other described species of the genus *Geron* have white hairs or scales on the face, which differentiates *Geron mystacinus* from them (Bezzi, 1924; Greathead, 2001). This character, the presence of black hairs on the face, is observed in some species in the Afrotropical Region but not in the Palaearctic Region.

This species was originally described based on a single male specimen collected from an unknown locality in Syria, and the original description included two characters in a key to species of *Geron* in the Ethiopian (now Afrotropical) Region (Bezzi, 1924). Bezzi (1924) separated his new species by the completely black hairs on the face, which in his view form a mystax, and by the shape of the antennae, which are basally ovate and suddenly narrow toward the apex, becoming styliform. Theodor (1983) was the first to clearly illustrate both the female and male genitalia of this species, but he did not add to the morphological description of adults. This seems reasonable because, in the genus *Geron*, there are few external morphological characters, and accurate identification relies primarily on the shape of the male genitalia. Zaitzev (1996), in his study of the Bombyliidae fauna of Israel, collected six specimens of *Geron mystacinus* (four males and two females) and illustrated for the second time the male genitalia. His illustration differed somewhat from that of Theodor (1983), particularly in the shape of the phallic process, which Zaitzev (1996) showed as thin and pointed apically, in contrast to Theodor (1983), who illustrated this structure as narrow, twisted, and bifurcate at the apex, and he clearly mentioned this character in the text. Zaitzev (1966), in his work on the bee flies of Transcaucasia, also provided a

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description of the male genitalia for *Geron intonsus*, whose phallic complex, similarly to *Geron mystacinus*, has two long, apically pointed processes. Greathead (2001) reviewed the genus *Geron* in the Palaearctic Region and examined a single specimen of *Geron mystacinus* from Spain. Without illustrating his dissection and by referring to Theodor's (1983) illustration, he clearly noted that the phallosome in his specimen lacked the long processes, and therefore recorded this species from Europe as doubtful. Subsequently, *Geron mystacinus* was recorded from Algeria based on two males, but no additional morphological characters or genitalia features were described (Katbeh-Bader & Arabiat, 2004).

Here, we briefly discuss the identity of this species based on the type specimen and several newly collected specimens from western Iran.

MATERIAL AND METHODS

Specimens were collected from an oak forest in western Iran (Kermanshah province) using Malaise traps. A few specimens were dried using HMDS following the method of Brown (1993). Photographs were produced by stacking and editing images taken with a Nikon D5300 camera equipped with a Mitutoyo Plan Apo 5× objective lens. Terminology follows Greathead (2001). Examined specimens are deposited in the collection of Qazvin Research Center for Agriculture and Natural Resources (BGC). The Wing Interface Pattern (WIP) is photographed by placing the wing on a dark substrate.

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Diptera Linnaeus, 1758

Family Bombyliidae Latreille, 1802

Subfamily Toxophorinae Schiner, 1867

Tribe Gerontini Hesse, 1938

Genus *Geron* Meigen, 1820

Type species. *Geron gibbosus* Meigen, 1820 [= *Bombylius gibbosus* Olivier, 1789].

Geron mystacinus Bezzi, 1924 (Figs 1–5)

Material examined. 11 ♂♂ and 2 ♀♀, Kermanshah province, oak forest, 34°22'N. 47°16'E, Malaise trap, leg. M. Zardouei Heydari.

Diagnosis. *Geron mystacinus* was originally described based on a single male specimen (Fig. 1A–C). As with other species in the genus, the adults of this species exhibit a few diagnostic morphological features. In the holotype, the eyes are in contact for a long distance, approximately 2.3 times the length of the frons (Fig. 1A–B). The frons bears a few white scales, and the antennae are typical of members of the genus: the basal half is ovoid, while the apical segment is long and styliform. The only notable diagnostic character is the presence of black hairs on the face, a feature also noted by Bezzi (1924).

Dissections of specimens collected from western Iran reveal that the apex of the phallic process bifurcates into very narrow and fragile projections (Fig. 3B). Our observation confirms that the phallic process is consistently present in this species, as previously described by Zaitzev (1966) and Theodor (1983). Our illustrations of the gonocoxite and gonostyli (Figs 3A, 3C) closely match those provided by Theodor (1983). Based on these findings, we suggest that the Spanish specimen examined by Greathead (2001) may represent a closely related but distinct species. We also emphasize that dissections must be performed with great care, as the delicate apex of the phallic process can easily break during preparation—a detail clearly visible in the illustrations by Zaitzev (1996) and Theodor (1983). If damaged, the structure may resemble that of *Geron krymensis*, in which the phallic process is similarly long but lacks bifurcation. To verify this distinction, we examined the syntypes of *G. krymensis* housed in the Berlin collection and, by chance, observed that in one male specimen, the phallic processes were exerted from the tip of the abdomen as long and narrow projections (Fig. 4).

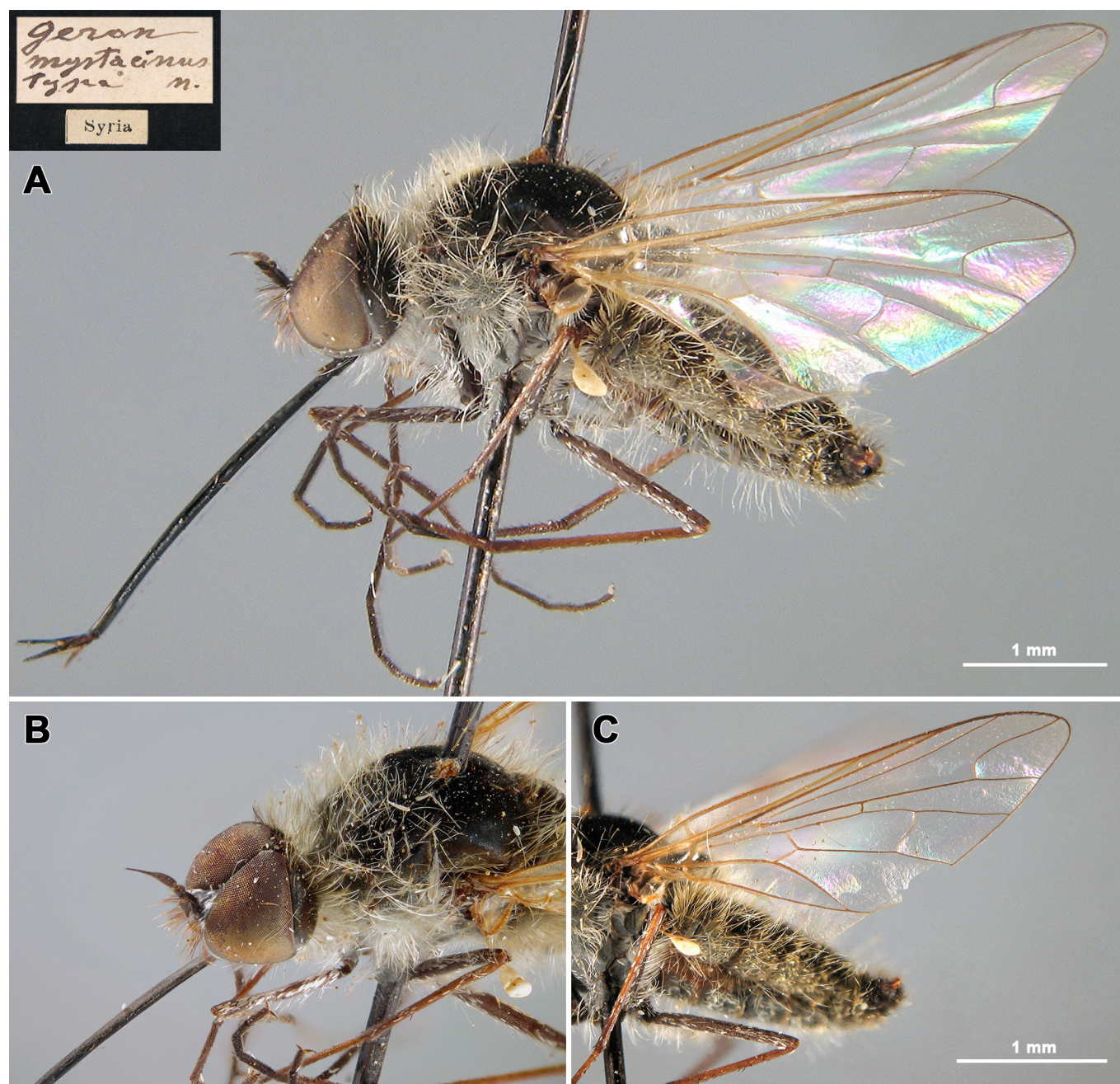


Figure 1. *Geron mystacinus* Bezzi, 1924, holotype. **A.** General habitus, lateral view; **B.** Head and thorax, laterodorsal view; **C.** Wing.

To differentiate the female *Geron mystacinus* from two closely related species, *Geron krymensis* Paramonov, 1929 (Fig. 4A–C), and *Geron intonsus* Bezzi, 1925, the most reliable distinguishing character is the morphology of the genitalia. Theodor (1983) was the first to illustrate the female genitalia of *G. mystacinus*, and the genitalia of Iranian specimens correspond well with his illustration (Fig. 5A–E). Interestingly, Greathead (2001) provided an illustration of the female genitalia of a non-type specimen of *G. krymensis* from an unknown locality, which closely resembles Theodor’s (1983) illustration for *G. mystacinus*. Although Greathead’s (2001) illustration is not entirely precise, he did note that the two species have very similar genitalia. Based on this evidence, we believe that the specimen dissected by Greathead (2001) is actually a member of *G. mystacinus*, and that *G. krymensis* should be re-evaluated based on its type material, a process that is currently underway. It is worth noting that the wing interface patterns (WIP) in male and female adults of *G. mystacinus* from Iranian specimens exhibit noticeable sexual dimorphism (Fig. 2C–D).

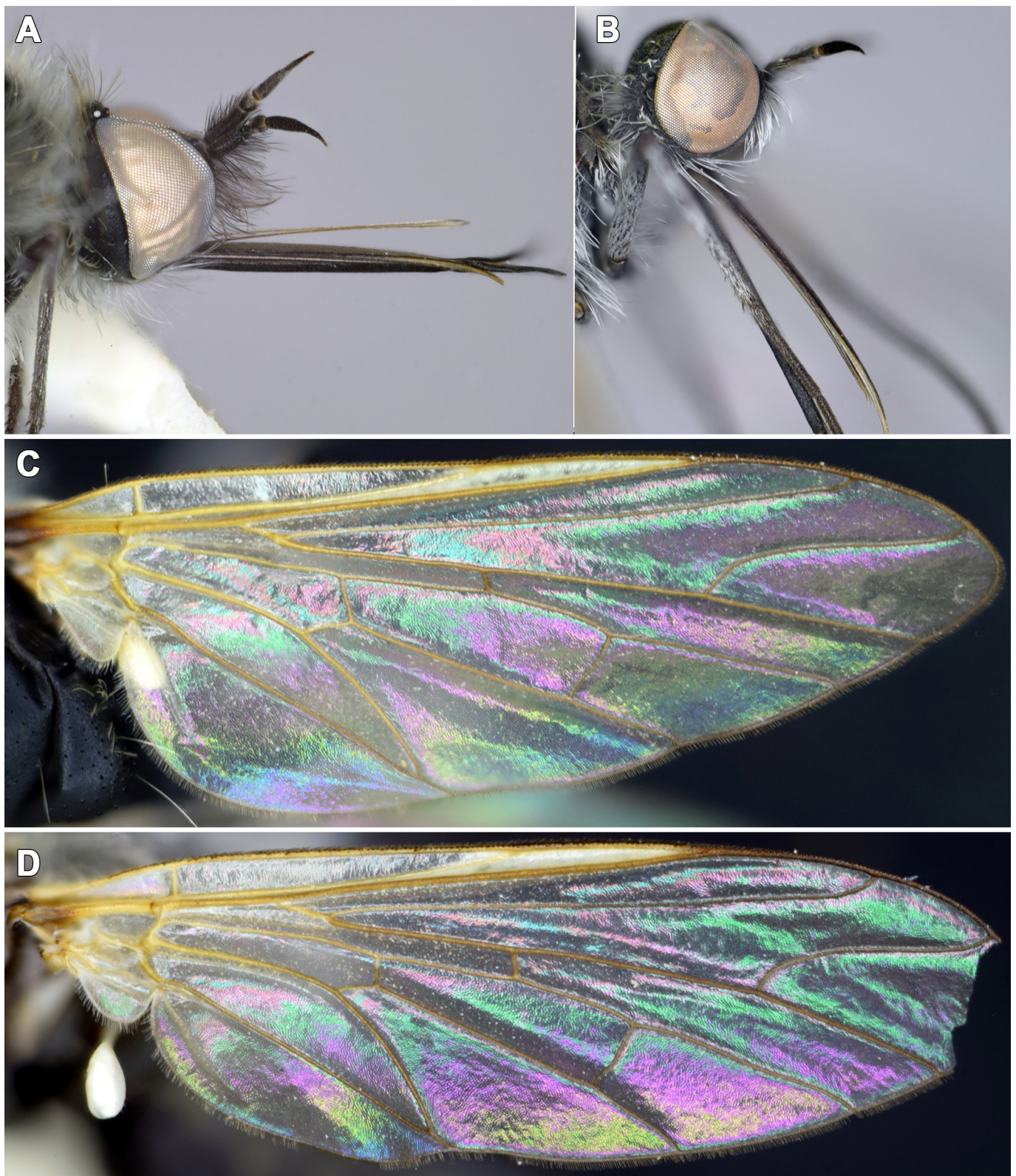


Figure 2. *Geron mystacinus* Bezzi, 1924, specimens from Iran. **A.** Head of male, lateral view; **B.** Head of female, lateral view; **C.** WIP of male wing; **D.** WIP of female wing.

Distribution. The distribution range of the species, previously known from northern Africa and the western Palaearctic (Evenhuis & Greathead, 2015), is here expanded to include Iran (**new record**). Spain is here excluded from the distribution, as the specimen described by Greathead (2001) shows significant differences in genitalia, suggesting it does not belong to the same species.

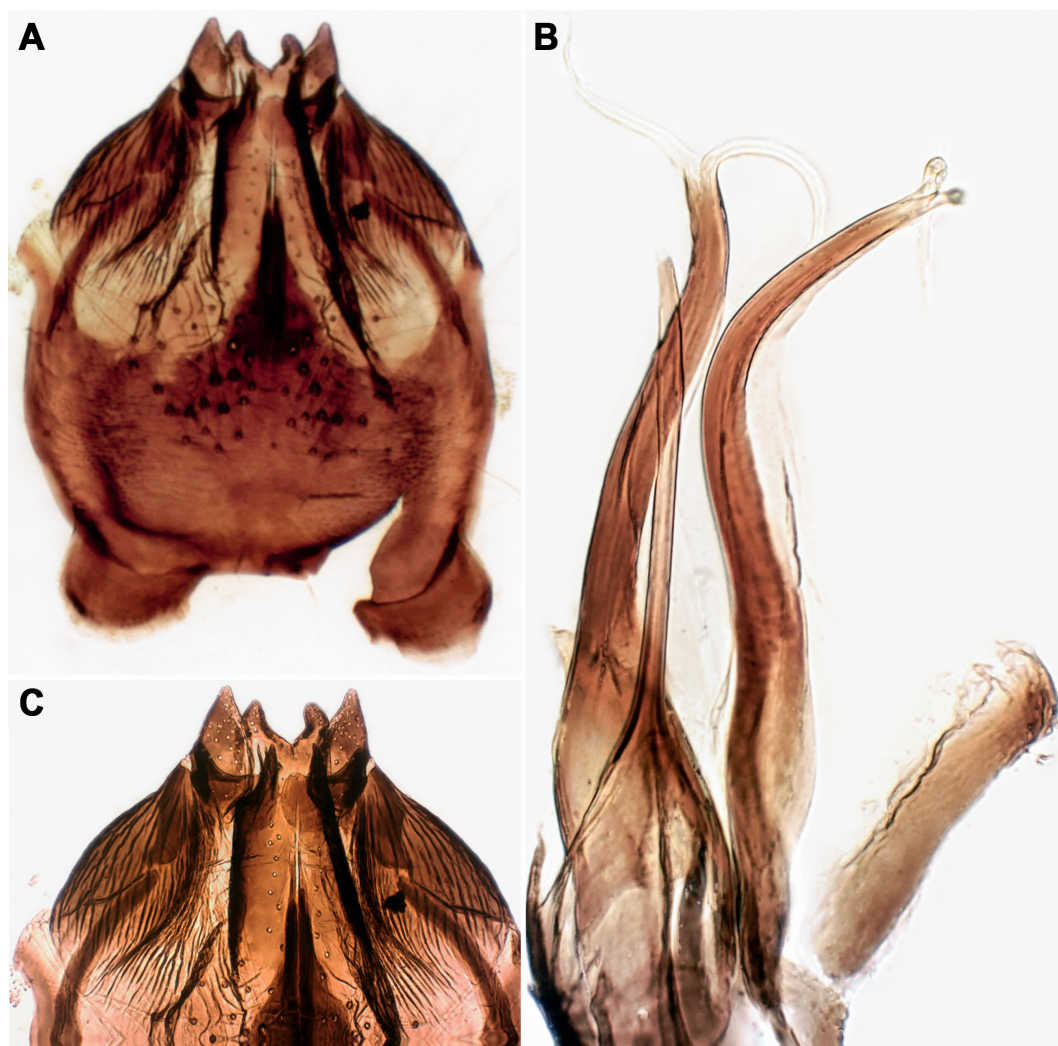


Figure 3. *Geron mystacinus* Bezzi, 1924, male genitalia. **A.** Gonocoxites and gonostyli, ventral view; **B.** Gonocoxites and gonostyli, a closer view; **C.** Phallic complex

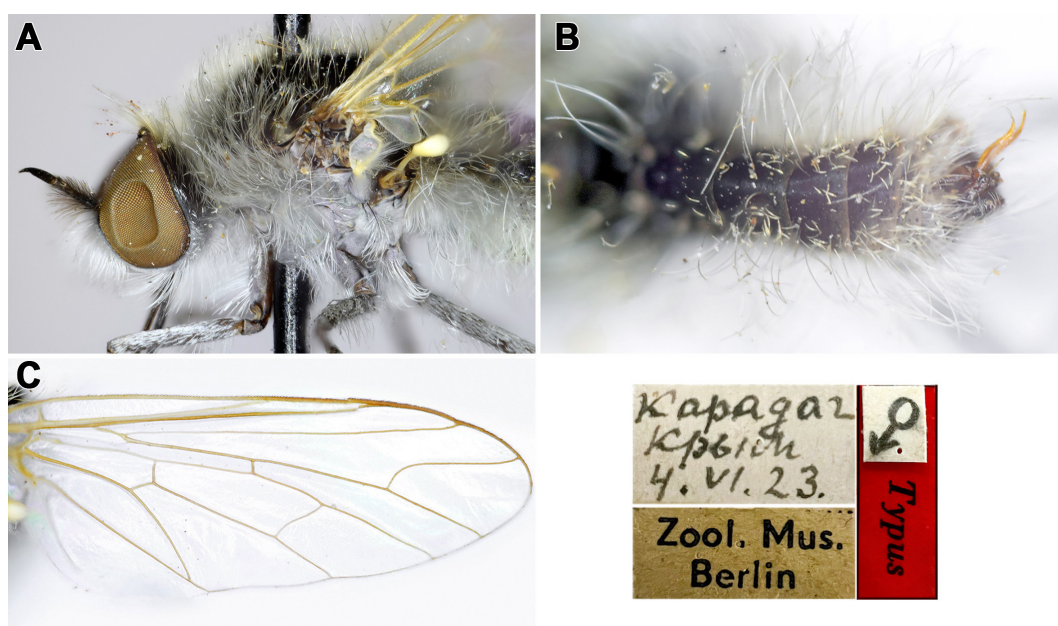


Figure 4. *Geron krymensis* Paramonov, 1929, syntype. **A.** Head and thorax, lateral view; **B.** Abdomen, lateral view; **C.** Wing.

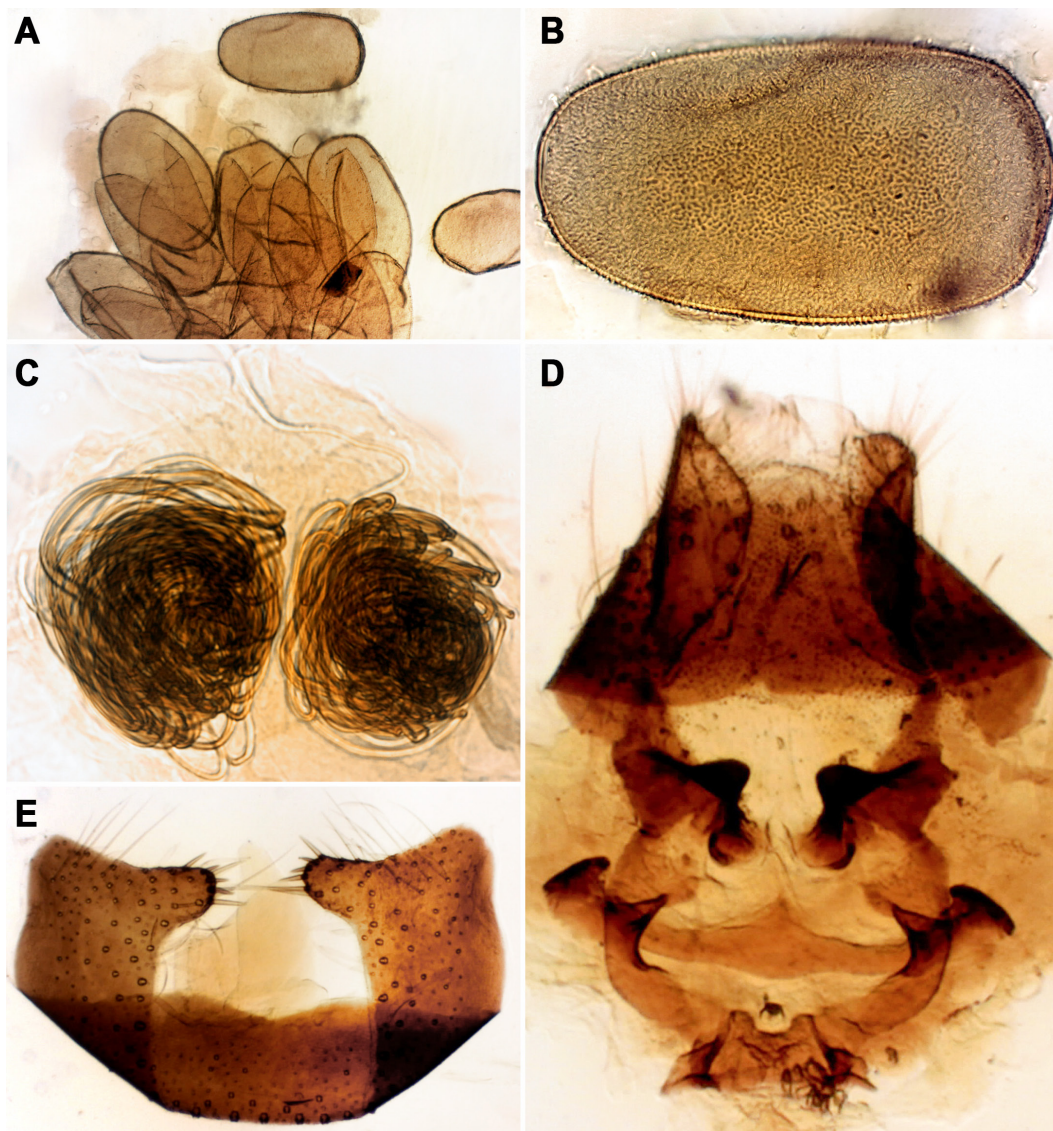


Figure 5. *Geron mystacinus* Bezzi, 1924, specimen from Iran. **A.** Egg mass; **B.** Egg, in closer view; **C.** Spermathecal reservoirs; **D.** Female genitalia; **E.** Tergite VIII.

DISCUSSION

The tribe Gerontini is a monotypic tribe within the subfamily Toxophorinae. The genus *Geron* comprises four subgenera, of which only *Geron sensu stricto* is known from the Old World. Previously, three species of this genus were recorded from Iran: *Geron kozlovi* Zaitzev, 1972; *Geron krymensis* Paramonov, 1929; and *Geron olivierii* Macquart, 1840 (Evenhuis & Greathead, 2015). *Geron mystacinus* Bezzi, 1924 is newly added to the Iranian fauna. Distinguishing male and female *Geron mystacinus* from closely related species poses certain challenges. The primary diagnostic character in males, the presence of black facial hairs (Figs 1A & 2A), is absent in females, which instead exhibit entirely white facial hairs, similar to those of females in related species (Fig. 2B). However, even in males, two main issues complicate identification.

First, some Afrotropical species also possess black facial hairs, suggesting that closely related species may also be present in the southern Palaearctic region. Greathead (2001) was the first to highlight this possibility. He dissected the genitalia of a male *Geron* specimen from Spain with black facial hairs and found that it differed from the published illustrations of *G. mystacinus*, supporting the hypothesis of additional, closely related species in the region. Second, inconsistencies in published illustrations of the male genitalia across different authors further contribute to uncertainty in the identification of species.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: B. Gharali: preparation of specimens, Illustration and photography, original draft preparation; N. Evenhuis: writing, revisions, and editing. They have read and approved the final version.

FUNDING

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the collection of Qazvin Research Center for Agriculture and Natural Resources (BG) and are available from the curator upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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یادداشتی بر هویت و حضور *Geron mystacinus* Bezzi, 1924 (Bombyliidae: Toxophorinae: Gerontini) در ایران

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چکیده: جنس *Geron* به قبیله تکجنسی Gerontini Hesse در زیرخانوادهی Toxophorinae Schiner تعلق دارد. گونه‌های جنس *Geron* در تمام قاره‌ها پراکندگی دارند. این جنس به چهار زیرجنس تقسیم می‌شود که از میان آن‌ها، تنها زیر جنس *Geron* از منطقه دنیای قدیم گزارش شده است. پیش‌تر، سه گونه از *Geron* از ایران به شرح زیر شناخته شده بودند: *Geron kozlovi* Zaitzev, 1972؛ *Geron krymensis* Paramonov, 1929؛ و *Geron olivierii* Macquart, 1840. در اینجا، *Geron mystacinus* Bezzi, 1924 برای نخستین بار از ایران گزارش می‌شود. دستگاه تناسلی بالغین ترسیم شده و هویت گونه به‌طور مختصر بررسی شد.

واژگان کلیدی: صفات افتراقی، دوشکلی، گزارش جدید، تاکسونومی، الگوی تداخل بال