About the validity of *Alloxysta turcica* Tataroğlu & Katılmış, 2023 (Hymenoptera: Cynipoidea: Figitidae: Charipinae)

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Running title: New synonymy of *Alloxysta minuscula*

Abstract

Alloxysta turcica Tataroğlu & Katılmış, 2023, a species recently described from Turkey, is now being synonymyzed with *A. minuscula* Andrews, 1978. This decision is based on morphological analysis, which has revealed significant similarities between the two species. The reasons and supporting illustrations for this synonymy are provided.

Keywords. Charipinae, *Alloxysta*, Turkey, morphological features

The Charipinae is a very complex subfamily, with many species described (Ferrer-Suay *et al*., 2012, 2023) and few diagnostic features to characterize them (Ferrer-Suay *et al*., 2021). *Alloxysta* Förster, 1869 is a cosmopolitan genus within the subfamily Charipinae. Currently, there are around 200 species described (Ferrer-Suay *et al*., 2023). It is the most numerous genus of Charipinae and also it is the most usually collected on the field and affecting the aphid biological control programs. Especially, within *Alloxysta* there are

only five features to focus on identification: size and shape of the radial cell, presence/absence of pronotal carinae, presence/absence and shape of propodeal carinae, relative size of flagellomeres and starts of rhinaria and club shape (Ferrer-Suay *et al*., 2021). Following these features a key based on *Alloxysta* for worldwide species was prepared (Ferrer-Suay *et al*., 2019).

Recently, a new species of *Alloxysta* has been described, *Alloxysta turcica* Tataroğlu & Katılmış, 2023, from Turkey. The authors were aware of the similarity of its new species with a previous one. According with the diagnosis of this species, *Alloxysta turcica* Tataroğlu & Katılmış, 2023 is closely related with *A. minuscula* Andrews, 1978 because the two species have a partially open radial cell, absence of propodeal carinae, presence of pronotal carinae and first flagellomere subequal to pedicel (Ferrer-Suay *et al*., 2019).

Despite these similarities, the authors force the description of the new species based on few characteristics (Tataroğlu & Katılmış, 2023). However, comments about these differences are presented below. Diagnostic characters of *A. turcica* in the original description, followed by a comparison with the description of *A. minuscula*, along with the reasons for proposing their synonymy.

MORPHOLOGY

Alloxysta turcica	***Alloxysta minuscula***	**Comments**	**Result decisive**
Presence of few scattered setae on vertex and above toruli (Fig. 1a)	The head of *A. minuscula* holotype has very few setae on vertex and denser in lower face, above toruli (Fig. 1b)	There is no difference between this character in *A. turcica* and *A. minuscula*	Identical character
Transfacial line equal to compound eye height (Fig. 1b)	Transfacial line equal to compound eye height 1.2x (Fig. 1a)	Measuring the image of the publication we have obtained that the transfacial line/compound eye ration in *A. turcica* is about 1.16, thus is close to 1.2 in *A. minuscula*	Intraspecific variation.

F1–F2 thinner and smoother than subsequent flagellomeres; rhinaria and club-shaped begins in F3 (Fig. 1b)	F1–F3 thinner and smoother than subsequent flagellomeres; rhinaria and club-shaped begins in F4 (Fig.2a)	According to the original description of *A. minuscula* club shape begin in F3, as occurs in *A. turcica*	Identical character
F1 slightly shorter than F2	*F1 subequal to F2*	The description is not supported by the figure as F1 is not shorter than F2 in *A. turcica* (Fig. 2b). According with the images available of the *A. turcica* antennae, F1 is only very few longer than F2 (3/2.8), with this similarity is better to stablish that they are subequal as occurs in *A. minuscula* (Fig 2a).	Intraspecific variation
Relative F2/F3 length ratio 0.9x	*F2 slightly longer than F3*	According with the figure of *A. minuscula* description (Fig. 2a), the two antennae are very similar (Fig. 2), thus it is not enough to differentiate these two species. Moreover, the proportion between flagellomeres to separate between *Alloxysta* species is a character that is being revising to check if it is robust enough to delimit two species or it could be part of intraspecific variation (Ferrer-Suay *et al*., in prep).	Intraspecific variation
Radial cell 2.3 times as long as wide	Radial cell 2.5 times as long as wide	According with the figures the ratio in *A. turcica* (Fig. 3b) is 2.4 (= 8,4/3,5) then, identical to *A. minuscula.*	Identical character

DISTRIBUTION

Alloxysta minuscula is a Nearctic species (Ferrer-Suay et al., 2013), while A. turcica is a Palaearctic species (Tataroğlu & Katılmış, 2023).

It is common for some species to occur in both the Nearctic and Palaearctic regions, as has been widely registered previously (Ferrer-Suay *et al*., 2012). This large distribution is mentioned for example in *Alloxysta brevis* (Thomson, 1862), which initially described in Europe but later identified in USA as *Alloxysta megourae* (Ashmead, 1887). Therefore, distribution is not considered as an important character within the subfamily Charipinae.

According to our analysis, we conclude that the differences mentioned in the original description of *A. turcica* are neither sufficient nor some of them valid to differentiate *A. turcica* and *A. minuscula*. As a result, we synonymized here both species: *A. turcica* **new synonymy** of *A. minuscula.* Although we recommend that conducting molecular and phylogenetic studies in the future can assist in clarifying the taxonomic status of these two species.

References

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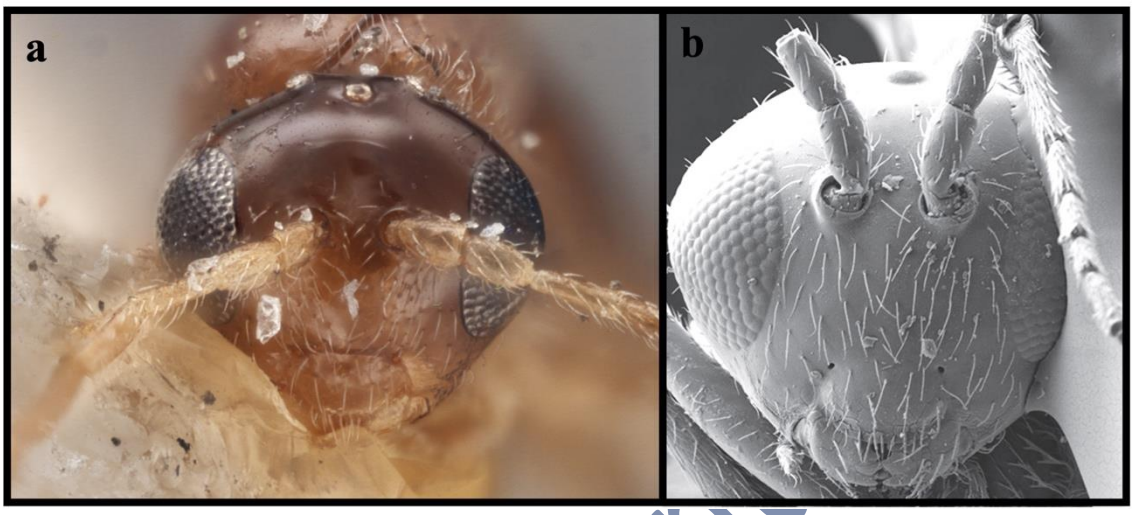

Figure 1. a) *Alloxysta minuscula*, head (holotype); b) *Alloxysta turcica*, head (extracted from Tataroğlu & Katılmış 2023).

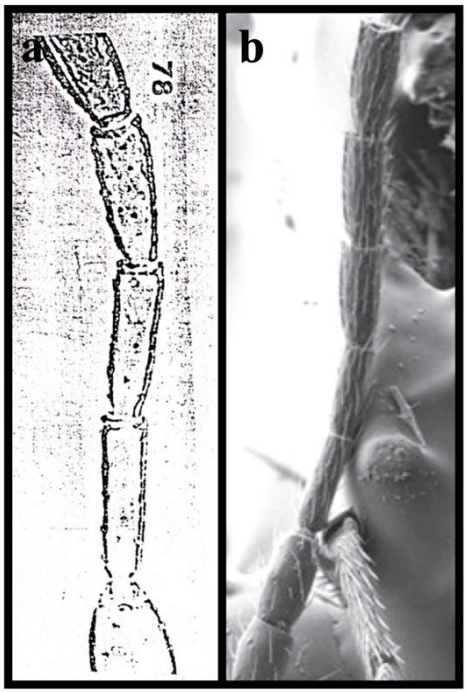

Figure 2. a) *Alloxysta minuscula*, antennae female (Andrews, 1978); b) *Alloxysta turcica*, antennae female (extracted from Tataroğlu & Katılmış 2023).

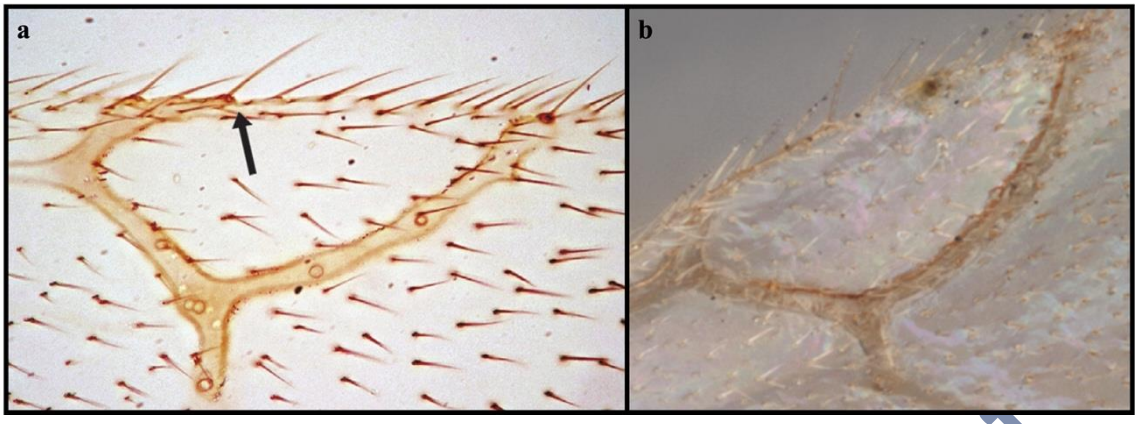

Figure 3. a) *Alloxysta minuscula*, radical cell (holotype); b) *Alloxysta turcica*, radial cell (extracted from Tataroğlu & Katılmış 2023).