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Short Communication

Sexual dimorphism in *Diabrotica speciosa* and *Diabrotica viridula* (Coleoptera: Chrysomelidae)

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ABSTRACT

Diabrotica speciosa (Germar) and *Diabrotica viridula* F. (Coleoptera: Chrysomelidae) are the two most abundant species of the genus in South America, and belong to the *fucata* and *virgifera* groups, respectively. Here, we characterize the dimorphism of the setae present on the basitarsi of males and females of these species. Dimorphism was confirmed in both species, and it was related to the presence of adhesive setae exclusively in males, which possess these structures on the basal tarsomeres of the pro- and mesothoracic legs.

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Sexual dimorphism in species of *Diabrotica* Chevrolat has been indicated as an important feature useful in morphologic, taxonomic and phylogenetic studies (Cabrera et al., 2008; Cabrera and Cabrera Walsh, 2010; Mohamedsaid and Furth, 2011; Prado, 2013). Besides the shape of abdominal tips and the length of antennomeres 2 and 3 in males, the adhesive setae of mesothoracic and metathoracic legs contribute to separate the sexes in some species (Cabrera et al., 2008; Cabrera and Cabrera Walsh, 2010; Gloyna et al., 2014).

In South America, the predominant species is *Diabrotica speciosa* (Germar), followed by *D. viridula* F. Although *D. speciosa* is the most abundant and most damaging to agricultural crops, *D. viridula* has expanded significantly from northern Argentina into southeastern Brazil (Cabrera Walsh, 2003). In the present work, we studied the morphology of the legs of males and females of *D. speciosa* and *D. viridula*, in order to characterize the adhesive setae as a feature to separate the sexes in those species.

The morphological analysis was performed after removal of the prothoracic, mesothoracic and metathoracic legs of male ($N=4$) and female ($N=4$) specimens of *D. speciosa* and *D. viridula*. The types of setae present on the tarsomeres and the length of the surface that they occupied were analyzed.

Setae of the filamentous, lanceolate, spatulate and discoid types were observed by using a light microscopy and described according to the nomenclature adopted by Gloyna et al. (2014).

Diabrotica speciosa and *D. viridula* show sexual dimorphism associated with the basal tarsomeres of the pro- and mesothoracic legs. These species have similar types and patterns of setae on the protarsus, mesotarsus and metatarsus. In females of *D. speciosa* and *D. viridula*, the first and second tarsomeres of the prothoracic, mesothoracic and metathoracic legs are covered with filamentous setae; the third tarsomere is covered with lanceolate setae on the basal third and with spatulate setae on the apical third. Fourth and fifth tarsomeres covered sparsely with filamentous setae (Figs. 1 and 2).

In males of *D. speciosa* and *D. viridula*, the prothoracic legs have discoid setae, covering 90% (0.241 mm) and 96% (0.282 mm) respectively of the rectangular area, from the base to the apical region of the first tarsomere. The margins of this patch are set with lanceolate and filamentous setae (Table 1, Figs. 1 and 2). At the base of the mesothoracic legs, 60% (0.206 mm) and 40% (0.119 mm) respectively, of the first tarsomere is covered with an oval patch of discoid setae, bordered by lanceolate setae; the apical third of the tarsomere is covered with filamentous setae (Table 1, Figs. 1 and 2). The remaining tarsomeres of the pro- and mesothoracic legs and those of the metathoracic legs present similar types and arrangements of setae as those of the *D. speciosa* and *D. viridula* females (Table 1).

As shown for *D. virgifera virgifera* Le Conte (Hammack and French, 2007), *D. collicola* (Cabrera and Cabrera Walsh, 2010) and other genera of Diabroticites and Phylletrites (Cabrera, 1999; Cabrera and Cabrera Walsh, 2004; Moura, 2010), we found that this dimorphism also occurs in the South American species

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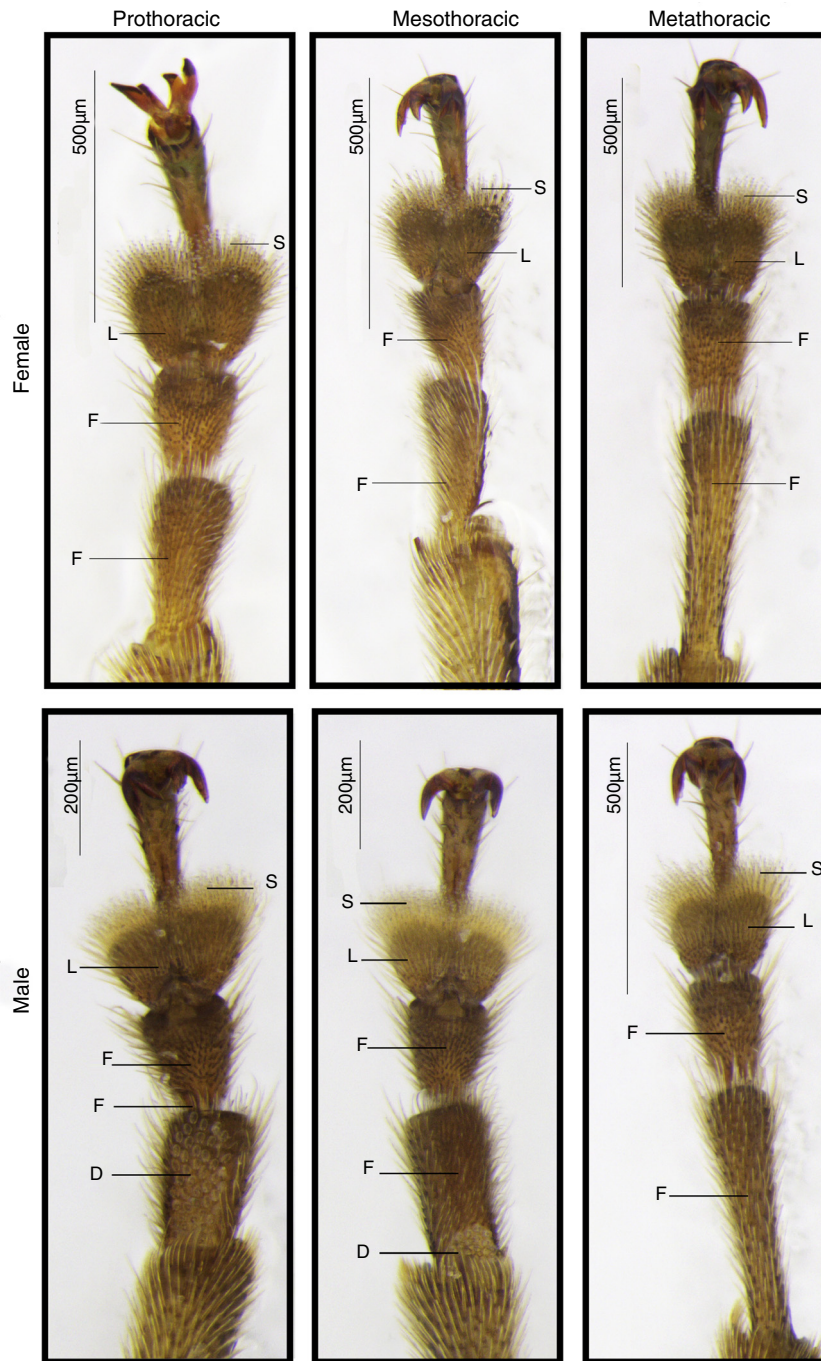


Fig. 1. Prothoracic, mesothoracic and metathoracic legs of male and female of *Diabrotica viridula*, showing the sexual dimorphism in the basal tarsomere of the pro- and mesothoracic legs. Setae: D, discoid; F, filamentous; L, lanceolate; S, spatulate.

Table 1

Length (mm) (\pm standard deviation) of tarsomers surface covered by each type of setae of *Diabrotica speciosa* and *D. viridula* males and females.

Species	Sex	Leg	Setae on the surface of tarsomers				
			I		II	III	IV+V
			Filamentous	Discoid	Filamentous	Lanceolated + Spatulated	Filamentous
<i>D. speciosa</i>	Female	Prothoracic	0.257 \pm 0.02	–	0.173 \pm 0.02	0.133 \pm 0.03	0.236 \pm 0.01
		Mesothoracic	0.328 \pm 0.03	–	0.209 \pm 0.03	0.157 \pm 0.01	0.248 \pm 0.02
		Metathoracic	0.476 \pm 0.09	–	0.242 \pm 0.00	0.146 \pm 0.02	0.302 \pm 0.05
	Male	Prothoracic	0.025 \pm 0.00	0.241 \pm 0.04	0.208 \pm 0.01	0.140 \pm 0.01	0.247 \pm 0.02
		Mesothoracic	0.131 \pm 0.02	0.206 \pm 0.05	0.224 \pm 0.02	0.128 \pm 0.01	0.262 \pm 0.01
		Metathoracic	0.527 \pm 0.04	–	0.232 \pm 0.04	0.173 \pm 0.02	0.277 \pm 0.04

Table 1 (Continued)

Species	Sex	Leg	Setae on the surface of tarsomers				
			I		II	III	IV+V
			Filamentous	Discoid	Filamentous	Lanceolated + Spatulated	Filamentous
<i>D. viridula</i>	Female	Prothoracic	0.288 ± 0.04	–	0.205 ± 0.02	0.187 ± 0.01	0.315 ± 0.04
		Mesothoracic	0.354 ± 0.03	–	0.208 ± 0.03	0.181 ± 0.02	0.340 ± 0.03
		Metathoracic	0.552 ± 0.04	–	0.262 ± 0.03	0.197 ± 0.02	0.368 ± 0.05
	Male	Prothoracic	0.01 ± 0.00	0.282 ± 0.05	0.183 ± 0.03	0.165 ± 0.02	0.284 ± 0.03
		Mesothoracic	0.180 ± 0.07	0.119 ± 0.04	0.171 ± 0.02	0.179 ± 0.03	0.286 ± 0.03
		Metathoracic	0.509 ± 0.01	–	0.255 ± 0.04	0.170 ± 0.01	0.331 ± 0.06

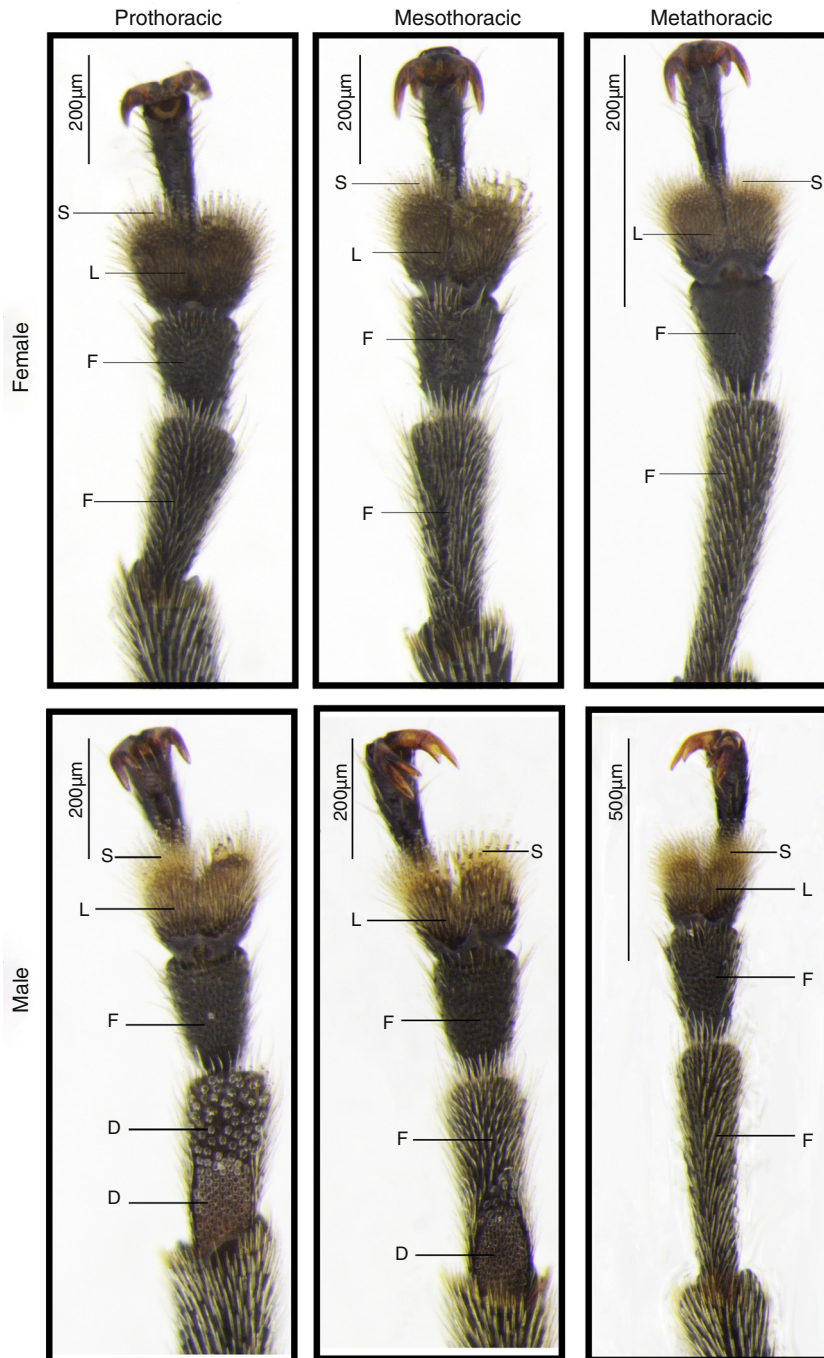


Fig. 2. Prothoracic, mesothoracic and metathoracic legs of male and female of *Diabrotica speciosa*, showing the sexual dimorphism in the basal tarsomere of the pro- and mesothoracic legs. Setae: D, discoid; F, filamentous; L, lanceolate; S, spatulate.

D. speciosa and *D. viridula*, with adhesive setae present exclusively in males.

The specialization of the tarsus for the sexual function has been described previously for chrysomelids, especially with regard to a tarsus that is dilated at the base (Crowson, 1981) and the discoid tips of the setae (Stork, 1983). The adhesive nature of the tarsi of males of *D. speciosa* and *D. viridula*, provided by the patch of short discoid setae, is probably related to sexual behavior. Nardi et al. (2012) demonstrated that males of *D. speciosa* support themselves on the elytra of the females during pre-copula, copula and post-copula. This sexual behavior was also observed in *D. virgifera virgifera* and *D. barberi* Smith & Lawrence (Lew and Ball, 1979; Medvedev and Pavlov, 1988; Tallamy et al., 2003). In addition, Hammack and French (2007) reported that males rub the basitarsi of the pro- and mesothoracic legs on the elytra of the females, which maintain them in a position above the females. In view of the importance attributed to the morphology of the basitarsus of males, it is important to determine whether the area provided with discoid setae varies in size in different individuals, which could influence the effectiveness and duration of copulation, male–male competition and sexual selection, culminating in an increase in the reproductive success of males with larger adhesive patches. Therefore, the size of the patch of discoid setae would be, beside the body size (French and Hammack, 2014), an additional factor in intraspecific competition. In this respect, Katsuki et al. (2014), studying *Sagra femorata* Drury (Chrysomelidae), observed that the sexual dimorphism in male metathoracic legs has implications for male–male competition and sexual selection. This suggestion emphasizes the importance for the genus of this dimorphism in the basitarsus.

Besides other related studies which describe attributes to distinguish the sexes in Diabroticina (Prado, 2013), our finding of adhesive setae, present in males of *D. speciosa* and *D. viridula*, also contribute to the knowledge of sexually dimorphic characters in this group.

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Conflicts of interest

The authors declare no conflicts of interest.

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