

Genitalia structure examination for interspecific mating of *Helopeltis antonii* and *H. theivora*

Several insect pests have been recorded on cashew in India¹, prominent among them being the tea mosquito bug (TMB) *Helopeltis* spp. (Hemiptera: Miridae). The nymphs and adults of TMB feed on the leaves and stems of new shoots, the inflorescence panicles, and on the developing nuts, which can result in 30–50% yield loss^{2–4}. The mating process and oviposition behaviour of *Helopeltis antonii* Signoret have been described⁵. Presence of sex pheromone in virgin female of *H. antonii* has been demonstrated by observing attraction of males towards three/four-day-old virgin females. In plantations where all the three species co-existed, interspecific attraction of males of *Helopeltis theivora* Waterhouse and *Helopeltis bradyi* Waterhouse towards virgin females of *H. antonii* was not observed, while attraction of males of *H. theivora* and *H. bradyi* confined to intraspecific virgin females was observed, thus indicating highest intraspecific

specificity⁶. However, very rare interspecific matings between female of *H. antonii* and male of *H. theivora* were observed during the present survey (November 2009–December 2012). But no mating was observed between *H. antonii* and *H. bradyi* (Figure 1). *H. antonii* showed less morphological variation with *H. bradyi* than *H. theivora* (Figure 2). The description of leg colouration, particularly the hind femora without a pale annulus basally, clearly distinguishes *H. antonii* Signoret from the externally similar species *H. bradyi*.

The form of the female genital chamber and its associated structures and the shape of the lobal sclerite of the male vesicles are particularly useful taxonomic characters⁷. In this report we examine the possible reason for interspecific courtship from the perspective of *H. theivora* male and *H. antonii* female.

During the routine survey for *Helopeltis* spp. from the cashew plantations at the

Directorate of Cashew Research, Puttur, the mated pairs of male *H. theivora* and female *H. antonii* (Figure 3) were observed during the months of December–January when the pest population was abundant in cashew (Figure 1). The adults of *Helopeltis* spp. found were collected from the field and brought to laboratory for examination of the male and female genitalia. The structures of the male and female genitalia were dissected and examined in glycerine following maceration and subsequent washes with dilute acetic acid and water. All genitalic preparations were stored in glycerine in plastic microvials affixed to the pinned specimens. The specimens were deposited in the Division of Entomology, Indian Agricultural Research Institute, New Delhi.

Examination of the genitalia revealed that the compatibility of female chamber of *H. antonii* and *H. theivora* may be one of the factors for their interspecific

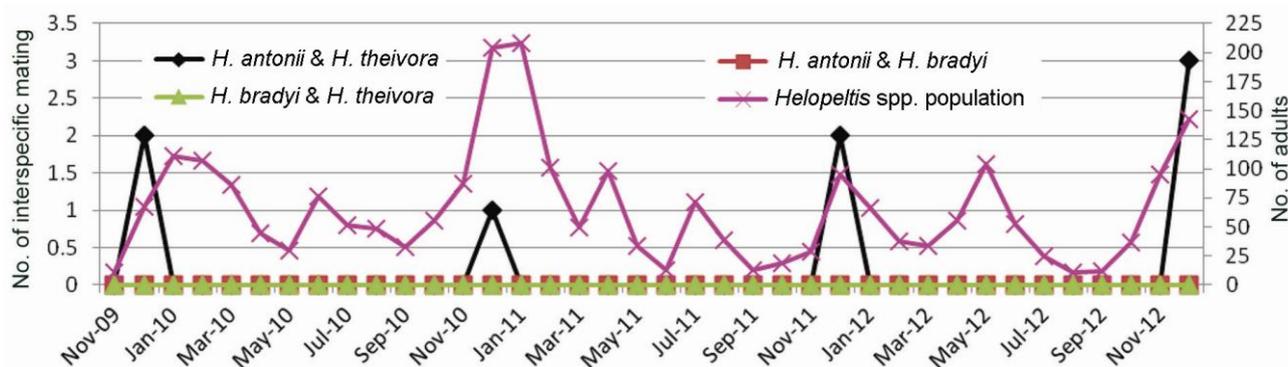


Figure 1. *Helopeltis* spp., interspecific mating and total population (2009–2013).



Figure 2. a, *H. antonii*; b, *H. bradyi*; c, *H. theivora*.

Table 1. Genitalia structure of *Helopeltis* spp.

Species	Genitalia structure	
	Male	Female
<i>H. antonii</i>	Lobal sclerite with dense distribution of tubercles distally.	Sclerotized rings of genital chamber not fused posteriorly*.
<i>H. bradyi</i>	Lobal sclerite with limited scattered tubercles at apex only.	Sclerotized rings of genital chamber fused posteriorly.
<i>H. theivora</i>	Lobal sclerite with dense distribution of tubercles distally.	Sclerotized rings of genital chamber not fused posteriorly*.

*Similarity in female genitalia structure.



Figure 3. *H. theivora* male and *H. antonii* female mating behaviour.

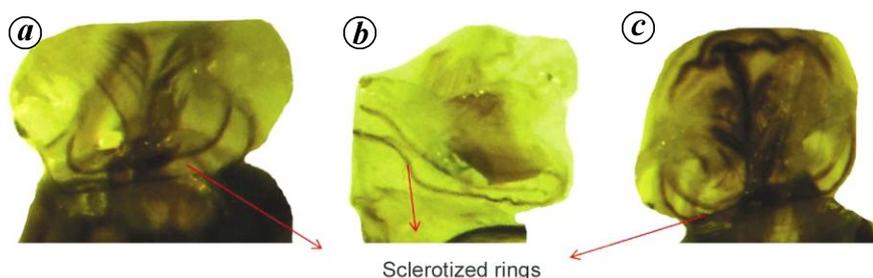


Figure 4. Sclerotized rings of female genital chamber. *a*, *H. antonii*; *b*, *H. theivora*; *c*, *H. bradyi*.

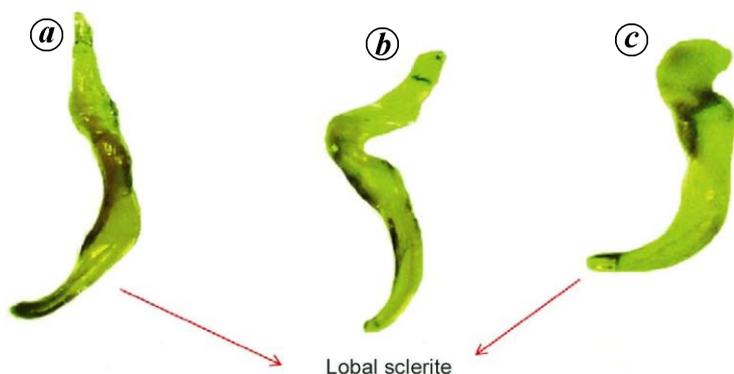


Figure 5. Lobal sclerite of male genitalia. *a*, *H. antonii*; *b*, *H. bradyi*; *c*, *H. theivora*.

mating (Table 1). The sclerotized rings of the genital chamber are not fused in *H. antonii* and *H. theivora*, whereas these are fused in *H. bradyi* (Figure 4). The male lobal sclerite structure also showed similarity between *H. antonii* and *H. theivora* (Figure 5). Even though *H. antonii* and *H. theivora* have been shown to engage in prolonged (1.07 ± 0.18 h with a range of 0.53–1.30 h) interspecific courtship, observed directly from the field (5 mated pairs), such interspecific mated females were found to lay unviable eggs. Interspecific courtship would appear to be a waste of time and energy and, if copulation ensued, gametes⁸. As reported in earlier studies, the two most common *Helopeltis* spp., *H. antonii* and *H. theivora* interact sexually despite their relatively distant taxonomic relationship and the fact that hybridization between these species does not lead to viable offspring⁶.

The ‘lock-and-key’ hypothesis proposes that genitalia play a crucial role in reproductive isolation: female genitalia function as a species-specific ‘lock’, whereas male genitalia are a species-specific ‘key’, preventing interspecific matings⁹. The theory has minimal support^{10–12}, in that male genitalia are typically much more variable across species than female genitalia; there are too many different keys and not enough different locks¹³. However, despite their apparent similarity across related species, female genitalia could diverge in subtle ways that contribute to reproductive isolation. The fused sclerotized rings of *H. bradyi* may prevent them from interspecific mating with extremely similar *H. antonii*. Earlier, interspecific matings were observed between the minute pirate bugs, *Orius insidiosus* (Say) and *Orius pumilio* (Champion) (Hemiptera: Anthocoridae), but matings did not result in viable prog-

eny. The compatibility of genitalia resulted in such kind of interspecific mating¹⁴.

This study provides evidence that the compatibility in male and female genitalia might have resulted in the mating of *H. antonii* with *H. theivora*, but not with *H. bradyi*.

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