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Scientific note

A scientific note on the association of *Haptoncus luteolus* (Coleoptera: Nitidulidae) with colonies of multiple stingless bee species

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Haptoncus luteolus **/ stingless bee /** ***Trigona thoracica*** **/ parasite**

Different Nitidulid beetles can be found in social bee colonies (Ellis et al. 2008) and may range from harmless associates (e.g., *Cychramus luteus*, Neumann and Ritter 2004) to damaging parasites (e.g., *Aethina tumida*, Neumann and Elzen 2004). *Haptoncus luteolus* (Coleoptera: Nitidulidae, Figure 1a, b) is a fruit pest (Yunus and Ho 1980; Audisio et al. 1990) and has been reported as an associate of honeybee, *Apis mellifera*, colonies (Atkinson and Ellis 2011a, b). Here, we report for the first time its association with colonies of multiple stingless bee species.

In July 2013, beetle larvae ($N=6$) were manually collected using entomological forceps from a thriving colony of the local stingless bee *Trigona thoracica* in Kelantan, Malaysia. The larvae were only found near and in multiple-punctured pollen pots in a bottom corner (Figure 1c). The pollen pots looked distorted oval and collapsed, which contrasts to the normal elongated oval shape in this stingless bee species (Michener 2013). No adult beetles were observed.

In December 2013, adult beetles ($N=21$) were manually collected using entomological forceps from a thriving *Heterotrigona itama*, another local stingless bee. These beetles were hiding in the corners or under the brood comb of the colony. No beetle larvae was found.

In January 2014, adult beetles ($N>100$), larvae (>100), and pupae ($N>100$) were manually collected using entomological forceps from the colony of a different local stingless bee, *Tetragonula laeviceps*. Several brood, honey, and pollen pots were infested by the larvae and adults (see Michener 2013 for respective details on the nesting biology of stingless bees). Interestingly, we observed distinct bulges on the surface of the nesting material. Careful dissections revealed that those apparently served as pupation sites (Figure 1d). This heavily infested *T. laeviceps* colony collapsed.

All beetle samples were transported to the Biology Laboratory, Universiti Malaysia Kelantan. The adults were identified as *H. luteolus* (Coleoptera: Nitidulidae) [synonym—*Epuraea luteola*] based on definitive morphological characteristics (see Gillogly 1982; Figure 1a). Then, a successful standard laboratory-rearing program for small hive beetles was established using plastic containers [18×12×6 cm, with a pin-holed lid (Ø=~1 mm), allowing for sufficient air circulation] and a diet consisting of pollen/honey/protein powder (Nutrilite®, Amway) in a 1:1:2 volume ratio (Neumann et al. 2013), thereby confirming that *H. luteolus* is able to successfully reproduce on bee products.

Our observations show that *H. luteolus* can be associated with colonies of at least three different species of stingless bees. Taken together with earlier reports in honeybee, *A. mellifera*, colonies (Atkinson and Ellis 2011a, b), this suggests that this beetle species can exploit a variety of different social bee species. This is similar to the small hive beetle, which can infest colonies of honeybees (Neumann and Elzen 2004), bumblebees *Bombus impatiens* (Spiewok and Neumann 2006),

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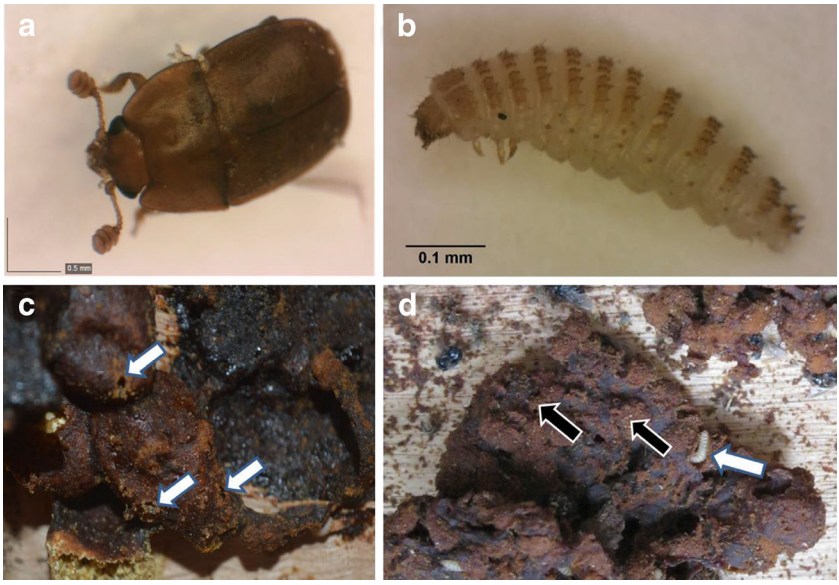

Figure 1 Beetle life stages and clinical signs of infestation: **a** adult *H. luteolus*, **b** *H. luteolus* larvae, **c** damaged pollen pots of *T. thoracica* (*white arrows*), and **d** *H. luteolus* larvae boring into the nesting material for pupation (*white arrow*) and pupation bulges (*black arrows*).

as well as stingless bees *Trigona carbonaria* (Greco et al. 2010) and *Austroplebeia australis* (Halcroft et al. 2011).

The present study also suggests that *H. luteolus* can complete an entire life cycle in association with stingless bee colonies while feeding on pollen and pupating in nesting material. While some beetles only seek shelter and/or food in social bee colonies (e.g. *C. luteus* in *A. mellifera*, Neumann and Ritter 2004), others also reproduce in the colonies (e.g. *Cryptophagus hexagonalis* in *A. mellifera*, Haddad et al. 2008). However, all of these beetle species have not been reported to pupate in the host colonies. Therefore, *H. luteolus* represents a novel degree of beetle association with social bee colonies (see Ellis et al. 2008) because it apparently can pupate within colonies, thereby separating this species from the previously reported cases.

Our observations further indicate that heavy infestations with this beetle can cause colony collapse in *T. laeviceps*. Even though this was a single observation only, it nevertheless suggests that heavily infested colonies of this and other stingless bee species and maybe even of honeybees may be damaged. We therefore raise caution that *H. luteolus* may cause damage to the Meliponini industry as well as colonies of wild and other managed bees. This creates demand for more studies on this beetle species ranging from the basic life cycle over behavioral host-parasite interactions to possible control measures.

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Une note scientifique sur l'association d'*Haptoncus luteolus* (Coleoptera: Nitidulidae) avec des colonies de diverses espèces d'abeilles sans aiguillon

Eine wissenschaftliche Notiz zu *Haptoncus luteolus* (Coleoptera: Nitidulidae) als Nestparasit von stachellosen Bienen

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