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NOTES AND COMMENTS

The association of multiple sap beetle species (Coleoptera: Nitidulidae) with western honey bee (*Apis mellifera*) colonies in North America .

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The association of nitidulid beetles (Coleoptera: Nitidulidae) with western honey bees (*Apis mellifera*) is better understood due to research emphases on *Aethina tumida* Murray as an applied problem, and the discovery of *Cychramus luteus* (Fabricius) in bee colonies in Germany (Neumann and Ritter, 2004). *Aethina tumida* is a damaging nest invader of European honey bee colonies in the USA and Australia (Ellis and Munn, 2005) while *C. luteus* is presumed to be innocuous to bee colonies in Germany (Neumann and Ritter, 2004).

In general, highly developed associations between arthropods and social bees, as occur between honey bees and *A. tumida* (Ellis and Hepburn, 2006), are uncommon when compared to the quantity of similar associations between arthropods and other social insects such as ants and termites (Kistner, 1982). However, nitidulids enjoy a long standing association with social insect colonies, being one of few insect taxa found repeatedly in social bee nests (cf. Ellis and Hepburn, 2006). Despite nitidulids' success at integrating into social bee colonies, only *A. tumida* and *C. luteus* have been documented in honey bee nests. Herein, we report the first discovery of additional nitidulid species repeatedly captured in honey bee colonies in North America.

We discovered *Glischrochilus fasciatus* Olivier in honey bee colonies in five locations in Georgia, USA, from March to June, 2004, and May, 2005. We found 2 – 20 adults in ~20 sampled colonies and in leaf litter in front of bee colonies. *Glischrochilus fasciatus* were always found in colonies hosting *A. tumida* (the reciprocal was not necessarily true), possibly because of *A. tumida*'s widespread distribution in bee colonies in the southeastern USA. More often, we found adults in colony debris (old brood, pollen, honey comb) left unprotected in apiaries. In these instances, we collected > 25 adults alongside *A. tumida* adults. We never found *G. fasciatus* larvae in bee colonies, possibly because they are mycetophagous (Parsons, 1943, Majka and Cline, 2006) and unable to mature on foodstuffs located in bee colonies. All colonies where *G. fasciatus* were discovered were associated with woodland, the habitat this species prefers (Blackmer and Phelan, 1995).

To discover if *G. fasciatus* is capable of reproducing on foodstuffs located in bee colonies, we collected 20 adults and put them into a plastic container (23.5 × 23.5 × 9.5 cm, 3.07 l) with two, 10 cm^2 sections of comb containing pollen, honey, and bee brood. In a second container, we put 10 adults and a foodstuff used to rear *A. tumida in vitro* [¼ honey, ¼ pollen, ½ Brood Builder™ (protein supplement manufactured by Dadant and Sons, Inc.; Hamilton, IL, USA) by volume, about 400 g total wt.]. We maintained both containers at 25°C and checked them daily for the presence of eggs or larvae. All adults died within two weeks and we never observed eggs or larvae, suggesting that *G. fasciatus* is not attracted to bee colonies for reproduction.

We found *Lobiopa insularis* Laporte deCastelnau and *Epuraea corticina* Erichson in bee colonies less frequently than *G. fasciatus* (≤ 5% of sampled colonies). We found *L. insularis* under framed screen devices used to detect the parasitic mite *Varroa destructor* Anderson & Trueman in bee colonies or in other places well protected from bees, where *A. tumida* and *C. luteus* are often found (Neumann and Ritter, 2004). We also found this species

in colony debris left unprotected in apiaries. The greatest concentrations of *L. insularis* we have seen in colonies (>25/colony) occurred adjacent to a large tomato farm in coastal South Carolina, USA, where the colonies were heavily infested with *A. tumida* (>250/colony). *Lobiopa insularis* is one of the most widespread New World nitidulid species, with a range extending over most of the Nearctic and into Central and South America (Blackwelder, 1945). This species has a broad diet, being collected from fermenting substrates, in subcortical spaces, at sap flows, and even on plant inflorescences (i.e. *Annona* sp. – Annonaceae).

We have found *E. corticina* on pollen patties (sugar/water + soy-based product used as a bee food) placed under the lids of hives, but never in abandoned colony debris. This species is known to occur in flowers of various plants (e.g. *Gleditsia triacanthos* L. – Fabacaeae, and *Craetegus* spp. – Rosaceae) as well as at sap flows of *Quercus* (Fagaceae) and *Liquidambar styraciflua* L. (Altingiaceae)(Parsons, 1943; Connell, 1956). We have also collected hundreds of specimens at fermenting brown sugar and fruit traps throughout southeastern USA.

Carpophilus dimidiatus F. was found in one colony in pollen cells from a small piece of comb. A total of ten specimens were collected for identification from the comb. This *Carpophilus* species is one of the most ubiquitous members of the genus in the New World, and perhaps globally. The species is widely known to be associated with all manner of fermenting substrates (Hinton, 1945).

Although these nitidulids appear innocuous to honey bee colonies (no damage attributable to them was observed), they may be able to mechanically transmit pathogens between hives. For example, both *G. fasciatus* and *E. corticina* are associated with oak wilt mats and are primary vectors of the oak wilt pathogen *Ceratocystis fagacearum* (Bretz) Hunt (Cease and Juzwik, 2001), acquiring the pathogen on their bodies and transmitting it to fresh wounds on healthy oaks. This raises the possibility that they, as well as *A. tumida*, may be able to transport pathogens on their bodies between hives, but this hypothesis needs quantitative evaluation.

Although at least one other beetle species besides *A. tumida* has recently been shown to reproduce in bee colonies (*Cryptophagus hexagonalis*; Haddad *et al*., 2008), we find it unlikely that the species we report here were attracted to bee colonies as a place to reproduce (all are mycetophagous or saprophagous) but rather inadvertently as a place to feed or seek shelter. All four species naturally feed and reproduce on rotten fruit or other fermenting substrates (Parsons, 1943; Hinton, 1945; Connell, 1956; Blackmer and Phelan, 1995). Because *A. tumida* promotes the fermentation of hive products (Torto *et al*., 2007), other nitidulid species may be attracted secondarily. It is also possible, although untested, that secondary species may be attracted to yeasts associated with and attractive to *A. tumida* (Torto *et al*., 2007). If true, *A. tumida* may have opened an ecological niche in bee colonies that other nitidulids are beginning to exploit. However, due to their mycetophagous habits and the low frequency of occurrence in colonies, we believe the species discussed here pose little risk to honey bee colonies.

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