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Scientific note

A scientific note on trail pheromone communication in a stingless bee, *Scaptotrigona pectoralis* (Hymenoptera, Apidae, Meliponini)

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Foragers of eusocial stingless bees use a variety of communication mechanisms to inform their nestmates about the presence of valuable food sources and to recruit workers to the task of food collection (e.g., Barth et al. 2008). Recruitment to food sources at specific locations is particularly effective in species that use pheromones deposited by foragers at the resource and at various spots on the substrate along their flight root back towards the nest (Lindauer and Kerr 1960). Among these species are bees of the genus *Scaptotrigona*, which are said to produce the respective marking pheromones in their mandibular glands (Lindauer and Kerr 1960). However, an experimental proof for this assumption was never provided and recent experiments have shown that labial gland secretions of *Scaptotrigona pectoralis* foragers release trail following behaviour in recruited workers (Reichle et al. 2011). In addition, experiments testing the effect of natural gland extracts on recruited workers of three *Trigona* species (Jarau et al. 2006, 2010; Schorkopf et al. 2007) and of *Geotrigona mombuca* (Stangler et al. 2009) have unequivocally demonstrated that their trail pheromones are exclusively secreted from the foragers' labial glands. Therefore, it is reasonable to assume that mandibular gland secretions of *Scaptotrigona* workers are not involved in trail pheromone communication, as stated in earlier works. We tested this assumption in bioassays using artificial scent trails baited with gland secretions, extracted in organic solvent, in bioassays carried out with a colony of *S. pectoralis* in Heredia, Costa Rica between July and November 2007 (gland extraction procedure, concentration of gland extracts and experimental set-up as described by Jarau et al. 2006). We trained foragers to sugar water feeders and allowed them to recruit additional workers in their nest. We then observed whether the recruited bees were attracted to scent trails that branched off from the bees' natural trails when we baited them with (a) mandibular gland extract, (b) labial gland extract or (c) the pure solvent hexane (control experiments). Each recruit was captured and colour marked for identification in later experiments. For the analyses, we only used unmarked bees, which were naive in respect to both experimental set-up and foraging site. Neither hexane-baited trails nor trails made with mandibular gland extracts released trail following behaviour in the recruits (Figure 1). By contrast, compared to the hexane control trails, a significantly larger proportion of the bees followed trails baited with labial gland extracts and reached the test feeders at their end rather than the recruitment feeders, at which the recruiting foragers collected sugar solution (Figure 1). Thus, as in *Trigona* and *Geotrigona* species, the trail pheromone of *S. pectoralis* is exclusively secreted from the foragers' labial glands and compounds from the bees' mandibular glands play no role in scent trail communication in this species. Our experiments also showed that trails baited with the pheromone extracted from nestmate foragers were more attractive to the recruits than trails baited with the pheromone from conspecific workers collected from a different

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colony (Figure 1; foreign labial glands vs. parental labial glands). A similar observation was recently reported for *Trigona corvina* (Jarau et al. 2010). However, in this aggressively foraging species, in which encounters between workers from different colonies at food sources lead to fierce fights ending in the death of the involved individuals (Biesmeijer and Slaa 2004), foreign trail pheromones were completely avoided. In our experiments with *S. pectoralis*, a foreign trail pheromone still attracted recruited bees, although it was less attractive than their nestmates' pheromone. *S. pectoralis* foragers from different colonies do not fight with each other when they meet at food sources (Biesmeijer and Slaa 2004). Following the scent trail of non-nestmate foragers and reaching a food source exploited by foreign workers, therefore, is not as disastrous in this species as it would be in *T. corvina*. We, therefore, conclude that the use of nest-specific information in trail pheromone communication in stingless bees is strongly influenced by a species' aggressiveness and foraging ecology.

Note scientifique: Communication par une phéromone de marquage de piste chez une abeille sans aiguillon, *Scaptotrigona pectoralis* (Hymenoptera, Apidae, Meliponini)

Eine wissenschaftliche Notiz über die Kommunikation mittels Spurpheromonen bei der stachellosen Biene *Scaptotrigona pectoralis* (Hymenoptera, Apidae, Meliponini)

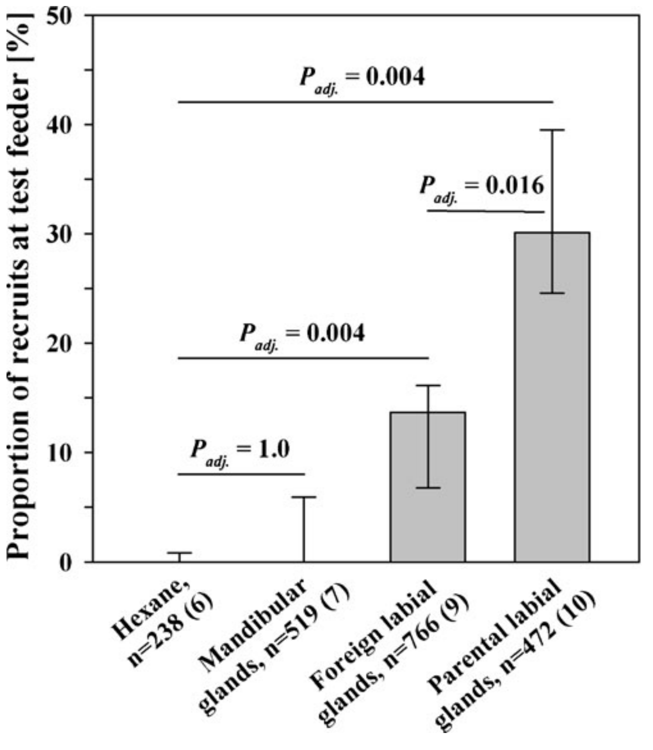

Figure 1. Percentage of *S. pectoralis* recruits that followed artificial scent trails baited with different test substances (*x*-axis; 100%=sum of recruits at the feeder at the end of the test trail and at the feeder to which their nestmates were recruited). Extracts of parental labial glands were prepared from nestmates of the tested bees. Extracts of foreign labial glands were prepared from the foragers of another *S. pectoralis* colony. *Boxes* include the median, *whiskers* give the 25th and 75th percentiles. Significance levels were calculated with Mann–Whitney tests and adjusted according to the Bonferroni method. Total numbers of individual bees tested (*n*) and number of conducted experiments (*in brackets*) are given for each test substance.

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