

## Neural and behavioural sensitivity to characteristic floral scent components in *Andrena vaga* bees

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Specialized (oligolectic) bees rely on a small range of host plants for their pollen collection, in strong contrast to bees like honeybees which forage on a broad and generalized flower spectrum. As compared to generalists, the specialists might have evolved neural adaptations allowing them to effectively locate their specific host flowers. To investigate how host odours are processed in their brains, we used calcium imaging experiments and recorded odour-evoked activity patterns in the antennal lobe for the specialist *A. vaga* and, for comparison, in the generalist honeybee *Apis mellifera*. We recorded responses to synthetic compounds in serial solutions as well as to volatile compounds of the odour bouquet of *Salix* flowers separated by a gas chromatograph. We performed bioassays with specialized *Andrena vaga* bees to identify the relative importance of visual versus olfactory cues to locate *Salix* (willows) host plants and to test the attractiveness of neural active compounds.

Our behavioural experiments showed that *A. vaga* bees orientate mainly on olfactory cues to locate host flowers. In our physiological experiments, *A. vaga* bees, but not the honeybee *A. mellifera*, had a particularly high sensitivity for characteristic components of the host-flower odour. These floral scent components were also attractive for naïve *A. vaga* bees in bioassays. In conclusion, our experiments suggest that *A. vaga* females show correlates between neural organization and host-plant finding behaviour.

### References

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## Individual perfume dynamics in male orchid bees

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Whereas unraveling the evolutionary reasons for perfume signaling in orchid bees will ultimately require experimentation with females, the study of how perfume phenotypes are compiled during the life of males may add valuable background information on signal content. I will talk about the results from experiments conducted in La Gamba, Costa Rica,

addressing factors affecting the individual development of perfume phenotypes. How well are volatiles stored and preserved in hind leg pouches of males, and how is retention related to molecular characteristics? How much of their tibial perfume do males expose during display in relation to how much they have stored? What is the resulting relationship between individual age and perfume traits like volatile quantity, complexity, or the proportion of head and base not compounds? I discuss results in the context of the evolution of male perfume signals.

## Implications of the karyotypic study for integrative taxonomy and cytogenetics of parasitoid Hymenoptera

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Nowadays chromosomal characters are beginning to be used in integrative taxonomy of parasitoid Hymenoptera. For example, our karyotypic research of a supposedly well-known cosmopolitan parasitoid of a wide array of coleopteran stored-product pests, *Anisopteromalus calandrae* (Howard) (Pteromalidae), revealed that some strains of this species had  $n = 7$ , whereas the others had  $n = 5$ . Further study has demonstrated that this name harbored two different reproductively isolated species. These species also had alternative life-history strategies which were best interpreted in terms of the  $r/K$  continuum. Moreover, differences in life-history features between those parasitoids correlated with the corresponding characteristics of their preferred hosts. In addition, the species with  $n = 5$  appeared to be new to science and was later described as *A. quinarius* Gokhman & Baur. Analogously, two different species with  $n = 5$  and  $6$  were also found in another pteromalid, *Lariophagus distinguendus* (Förster) having similar biology. Nevertheless, these species are closer to each other in terms of karyotypic characters than those of the genus *Anisopteromalus*. Moreover, they can hybridize under certain conditions, and this situation therefore constitutes the first known case of hybridization between two parasitoid species with different chromosome numbers. The above-mentioned results, together with a number of similar cases, call for wider application of chromosomal analysis to parasitoid stocks cultivated for both industrial and laboratory use, and this kind of analysis can therefore provide means of express identification of particular strains.

Karyotypic study is very important for determining numbers of linkage groups in parasitoid Hymenoptera. This method is especially valuable when certain chromosomes are small or relatively inert in terms of genetics, e.g. B chromosomes. Recent data suggest that these elements are substantially more abundant among parasitic wasps than it was previously supposed. Specifically, a few years ago we detected up to six B chromosomes per diploid karyotype in *Pnigalio gyamiensis* Myartseva & Kurashev (Eulophidae). Chromosomes of that kind were also found in the chromosome sets of several other parasitoids including certain members of the genus *Pnigalio* and a particular strain of *Aphidius ervi* Haliday (Braconidae). Although these chromosomes sometimes carry sex-ratio distorters in parasitic wasps, this is probably not the case in *P. gyamiensis*, thus providing a possible explanation for the presence and accumulation of B chromosomes in this species as well as in a

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