Social trait correlations and phylogenetic patterns in sweat bees

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The remarkable flexibility of sweat bee sociality makes these little bees ideal subjects for comparative analyses aimed at revealing the nature of evolutionary transitions between solitary and social behaviour. We assembled a comprehensive dataset summarizing observations on 335 sweat bee populations representing 228 species whose behaviour has been described since the 1920s. For the species whose colony social organisation has been categorized, 75 species are described as monotypically solitary, 63 as eusocial, 20 as communal, and 2 as semisocial. Among species that are socially polymorphic, facultatively expressing a mix of social phenotypes, 9 are solitary and eusocial, 15 are solitary and communal, 17 are solitary and semisocial, and 4 species exhibit an intriguing mix of egalitarian (communal) and caste-based sociality (semi and eusocial). For quantitative analyses of behavioural traits, we initially focus on 3 taxa representing two independent origins of eusociality in Halictini (the common ancestor of *Halictus* and *Lasioglossum*) and Augochlorini. The independent origins of eusociality provide a comparison for how social trait correlations evolved in the two lineages. Surprisingly, social traits of Halictus contrast markedly with those of the other two groups. First, Halictus includes few or no communal species, and very few socially polymorphic species, whereas communal and polymorphic species are frequent in Lasioglossum and Augochlorini. Second, principal components analyses of 6 behavioural traits in 28 obligately or facultatively eusocial species suggest that large colony size leads to low queen-worker reproductive skew in *Halictus*, but high skew in *Lasioglossum*. This implies a major difference in the evolution of queen control between lineages. We will further test predictions about trait correlations by phylogenetic mapping of quantitative and qualitative traits related to social interactions, nest architecture, lecty, and season length.