Final Report on the Australian Flora Foundation Funded Project

Significance of floral odours to bat pollinators.

Anthony C. Oldfield

Centre for Resource and Environmental Studies, Australian National University, Canberra, ACT Australia

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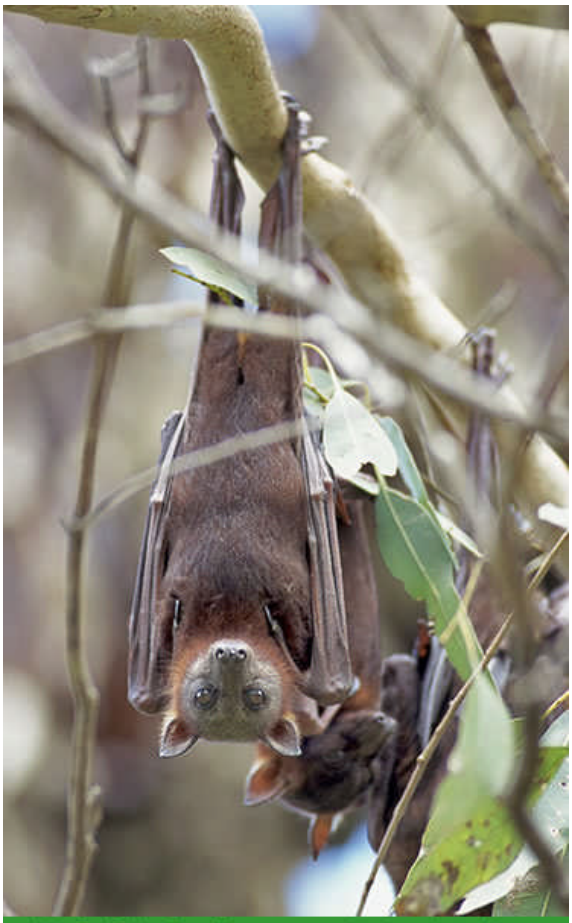
This project was an investigation into the olfactory preferences of three Australian Megachiropteran (bat) species, *Pteropus poliocephalus*, *P. scapulatus* and *P. alecto*, for a variety of plant-derived odours. In particular it outlines a preliminary field study on the variation in *Eucalyptus gummifera* headspace volatiles in relation to *P. poliocephalus* and other pollinator activity.

Grey-headed Flying Fox (*Pteropus poliocephalus*) A species found along the eastern seaboard where it often co-habits with people in urban situations. The population has been declining for many years and it is now recognized as a threatened species by the Australian Government. (c) B.G. Thomson, auswildlife.com



Little Red Flying Fox (*Pteropus scapulatus*)- smallest of the common *Pteropus* species and has the widest distribution of all species. It is predominantly a nectar feeding bat and recent research suggests that these bats may be key pollinators of Myrtaceae. (c) B.G. Thomson, auswildlife.com

Methodologies were devised for investigating odour preference behaviour, involving equipment design, development of new applications for existing statistical techniques for the analysis of preference data, and analysis of odorous headspace in test mixtures and from flowers in the field.

Initially, preliminary behavioural observations indicated that all three bat species exhibited positive approach behaviours in response to fruit-derived odours and that they responded both within and between species to different quantities of test odour, 0.5mL of test odour distillate at a decision distance of 125mm producing the optimal responses in *P. poliocephalus* and *P. scapulatus*, with *P. alecto* responding with equal intensity to all odour quantities. A common behavioural ethogram was devised for *Pteropus*, and applied to more detailed analyses of preference responses. These revealed that within each species, bats expressed different degrees of preference for different odours under controlled conditions. When odour preferences within a species were ranked on a decision axis, odour pairs with low separation values were more likely to change in rank position than those further apart. Thus not only was each species of bat able to detect fruit odours, but they could also discriminate between different odour types.

The existence of preference intransitivities in all three species indicated that these bats employ a comparative method of odour evaluation as opposed to an absolute utility method often described for foragers with transitive preferences. Thus for these bats the 'value' of odours is dependent upon the context within which the odour comparisons are made. Those odours with low levels of separation on the preference hierarchies were more frequently associated with preference intransistivities. Furthermore, the more generalist feeder *P. alecto* appeared to have the highest sensitivity to variation in odour concentrations, suggesting that dietary specialisation does not necessarily coincide with olfactory acuity.

These bats did not select odours on the basis of absolute concentration or intensity, but on qualitative characteristics. In addition, evidence from the field suggests that rhythmical variations in floral volatiles emissions from a bat-preferred flower, *E. gummifer*a, are correlated with bee activity, with bats working trees with significantly lower volatiles

concentrations.

The potential for the development of odour-active agents to interfere with bats' odour preference behaviour in relation to reducing bat damage is substantial. Continuation of Gas Chromatographic - Olfactometric (GCO) investigation into odours involved with high incidences of preference intransitivities is strongly recommended, as is further study of bat-flower volatile interactions.

Until now it has not been possible to state with absolute confidence that non-echolocating Megachiropterans are capable of detecting and discriminating between food-related odours. The speculation regarding *Pteropus* using their sense of smell to locate food odours, and the potential for developing odour deterrents can now end. Further studies on these topics are now warranted and feasible with the use of the techniques developed here.