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Butterflies and bees fly faster when plants feed them more nectar

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The flight speed of foraging animals has been a focus of interest for physiologists (1-2) and foraging ecologists alike (3-4). To test if the flight speed in flower-visiting insects is influenced by the nectar offerings of flowers, we observed foragers in two different periods (1 week each) , which differed in the mean nectar amounts found in flowers. Two species of Lepidoptera (*Ochlodes venatus* and *Melitaca cinxia*) and one species of Hymenoptera (*Bombus pascuorum*) were observed foraging on flowers of *Anchusa officinalis* (Boraginaceae). Additionally, data from honeybees (*Apis mellifera*) were collected for flights between flowers of *Cynachium vincetoxicum* (Asclepiadacea). In *Anchusa*, mean nectar per flower dropped to one third between the first and the second period (from 0.066 to 0.022 μl / flower); in *Cynanchium*, it fell to about 50% (from 0.026 to 0.014 μl / flower). In all of the tested insect species, the mean flight speed between flowers was lower when nectar offerings were poor (*Apis*, first week: 105cm/sec, second week: 58cm/sec; *Bombus*: 50 and 37cm/sec; *Ochlodes*: 142 and 123cm/sec; *Melitaca*: 42 and 28cm/sec). This in accordance with findings of honeybees foraging at a single location; their flight speed between hive and feeding station increases with reward amount (1). There are several possible explanations for these findings. (1) proposed "motivation" as the state that changes when nectar offerings are altered, and which is expressed in an increased flight speed. Ecologists, on the other hand, have used arguments from optimal foraging theory. For example, when forager density (and thus, competition) is high, it should pay for the forager to move faster so as to capture maximal numbers of rewards before competitors do (3). Moreover, the optimal flight speed may increase directly with patch quality, even independently of the activities of other foragers (4). We confirm this interpretation here, but only for conditions in which flower handling time increases with reward amount, and energy expenditure increases with flight speed. However, the energy expenditure vs. speed curve in bees is U-shaped (2), and the flight speed values measured here fall below the minimum, so that decreases in speed will likely provoke increases in energy investment. Thus, the adaptive significance of flight speed adjustment as a function of nectar reward remains a puzzle.

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