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Article

BUMBLE BEES FEEDING ON NON-PLANT FOOD SOURCES

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Insects characterized by monotonously phytophagous diets occasionally feed on non-plant material. Adler & Wheeler[1], for example, reported non-plant food sources for a variety of phytophagous Heteroptera (Hemiptera), including bird droppings, dung, and carrion. Some tropical butterflies (Lepidoptera: Nymphalidae) follow army ants to feed on antbird droppings[9]. Among bees (Apoidea), the only records of non-plant food known to me involve members of the tropical subfamily Meliponinae (stingless bees). These occasionally collect faeces and carrion, and *Trigona hypogea* is an obligate necrophage, using carrion instead of pollen as a protein source[4, 10]. Honeybees may sometimes use non-floral resources such as honeydew or bacterially-induced plant exudates[6], but these are to be considered just barely modified plant products. Given this scarcity of non-plant feeding records for bees other than Meliponinae, I report here on several observations of temperate (*Bombus terrestris*) and tropical (*Bombus ephippiatus*) bumble bees feeding on carrion, bird droppings, human urine and mammalian faeces (nomenclature for bumble bees follows Prŷs-Jones & Corbet[8] and Heithaus[5]).

Two *B. ephippiatus* workers were observed on 1 February 1986 feeding on a semi-dried coyote (*Canis latrans*) dropping near Villa Mills (3100 m elevation) at Cerro de la Muerte, a tropical highland locality in the Cordillera de Talamanca, Costa Rica. The vegetation was a mosaic of *Quercus costaricensis*-dominated forest patches and successional scrub (a description of the region is presented by Wolf[11]).

Observations on *B. terrestris* were conducted at three localities in the Sierra de Cazorla, a mountain range in Jaén province, south-eastern Spain, at elevations of 1100–1300 m. Along this altitudinal range, the vegetation is characterized by dense Mediterranean forest dominated by *Quercus ilex* (Polunin & Smythies[7] describe the region). On 28 April 1985, up to seven *B. terrestris* workers were seen feeding for a long period on a rotting carcase of Wild goat (*Capra pyrenaica*). Bumble bees were feeding close together on the fluids available through a hole in the goat's skin. On 30 July 1987, a single *B. terrestris* worker was observed feeding on a dried bird dropping, profusely coated with white urates, for more than 20 minutes. On 10 December 1986, up to 55 *B. terrestris* individuals (queens and workers) congregated simultaneously to feed in a small ground area where human urine had been deposited a few hours before. To ascertain whether urine was actually the attractive agent, further urine was deposited on a second area 2 m away where no bumble bees were feeding at the time. On the next day, a similar concentration of bumble bees was observed feeding at this new spot.

The behaviour of bumble bees was similar in all the cases reported above. They did not

beat their wings, and remained rather inactive on the same spot for long periods. The antennae were bent down, with the tips gently touching the substrate. The mouthparts were fully extended, with the glossa in close contact with the substrate and displaying a slow, rhythmic back and forth movement between the galeas. I failed to ascertain whether regurgitation of some fluid took place during feeding. This most likely occurred in the case of the hard dry bird dropping, but it probably involved too small amounts to be readily noticed.

A high nitrogen content is the only feature common to all non-plant materials noted above (carnivore droppings often have substantial nitrogen levels; see, e.g. Aldama[2]). It thus seems reasonable to suggest that bumble bees were using carrion, faeces and urine as sources of nitrogenous substances. As pollen is the usual source of nitrogen for bees the above observations might suggest that bumble bees shifted to unusual nitrogen sources because of a shortage of floral resources. If a shortage of this sort actually occurred, however, it did not involve flower numbers. At all observation sites and dates, flowers of at least one plant species were abundant over large areas around the observation spot, and bumble bees foraged actively on them (*Senecio oerstedianus* and *Cirsium subcoriaceum* in Cerro de la Muerte; *Rosmarinus officinalis, Lavandula latifolia* and *Arbutus unedo* for the Cazorla April, July and December observations, respectively). The possibility that pollen was in short supply, despite the abundance of flowers, cannot be ruled out. Further observations are needed before the possible causes and ecological correlates of bumble bee behaviour reported here can be elucidated.

The observation of bumble bees feeding on carrion deserves a final comment. Several species of carrion beetles (Coleoptera: Silphidae) seem to be Mullerian mimics of bumble bees and cuckoo bumble bees (*Psithyrus*) in North America and Europe[3]. This rather unusual mimicry system, involving ecologically and taxonomically disparate organisms, would perhaps be better understood in relation to bumble bee necrophagy. If the necrophagous behaviour of bumble bees is not uncommon in those undisturbed temperate habitats where carcases are still frequently available, one would expect bumble bees to coincide frequently at these food sources with diurnal necrophagous beetles. This predictable spatial coincidence would have provided an ecological basis for the evolution of the bee-beetle mimicry system.

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References

1. Adler, P H; Wheeler, A G (1984) Extra-phytophagous food sources of Hemiptera-Heteroptera: bird droppings, dung, and carrion. *Journal of the Kansas Entomological Society* 57: 21–27
2. Aldama, J J (1986) Ecología energetica del Lince Ibérico, *Lynx pardina* (Temminck, 1824), en el Parque Nacional de Doñana. *Unpublished thesis, Universidad Complutense, Madrid*
3. Fisher, R M; Tuckerman, R D (1986) Mimicry of bumble bees and cuckoo bees by carrion beetles (Coleoptera: Silphidae). *Journal of the Kansas Entomological Society* 59: 20–25
4. Gilliam, M; Buchmann, S L; Lorenz, B J; Roubik, D W (1985) Microbiology of the larval provisions of the stingless bee, *Trigona hypogea*, an obligate necrophage. *Biotropica* 17: 28–31
5. Heithaus, R (1983) *Bombus ephippiatus* (Chiquiza de Montaña, Bumblebee). Pp. 700–701. *In* Costa Rican Natural History, *ed* D H Janzen. *Chicago, USA: University of Chicago Press*

6. Kevan, P G; Helens, S S; Baker, I (1983) Honeybees feeding from honeydew exudate of diseased gambel's oak in Colorado. *Journal of Apicultural Research* 22: 53–56
7. Polunin, O; Smythies, B E (1973) Flowers of southwest Europe. *London, UK: Oxford University Press*
8. Prŷs-Jones, O E; Corbet, S A (1987) Bumblebees. *Cambridge, UK: Cambridge University Press*
9. Ray, T S; Andrews, C C (1980) Antbutterflies: butterflies that follow army ants to feed on antbird droppings. *Science* 210: 1147–1148
10. Roubik, D W (1982) Obligate necrophagy in a social bee. *Science* 217: 1059–1060
11. Wolf, L L (1976) Avifauna of the Cerro de la Muerte region, Costa Rica. *American Museum Novitates* 2606: 1–37