Evolution of bee dances

SIR — von Frisch[1] and his students are famous for their descriptions of the highly evolved dance 'language' in *Apis* which is used by worker bees throughout this genus to communicate the distance and direction of sources of food, water and nest sites. Because only minor variation in dance biology exists across the genus, hypotheses for the evolution of dance language are problematic. The classical theory[1] suggests that the excited movements of foraging workers became fixed as a stylized round dance. Evolutionary refinements then produced additional dance elements encoding more precise information.

A. andreniformis is an Asian species of honey bee only recently recognized as biologically distinct from its sister species, *A. florea*[2]. Like *A. florea*, *A. andreniformis* constructs a nest comprising a single wax comb suspended from a branch. The comb surrounds a section of the supporting branch and the portion of the nest above the branch is used for honey storage. Worker bees cover the comb in a protective curtain. During a study of reproductive isolation of sympatric *A. florea* and *A. andreniformis* through the temporal separation of mating flights[3], we observed the behaviour of drones before mating flights, recording several hundred flights and many tens of dances using a video camera.

Other than during or somewhat before the time of drone flight, drones of both species are hard to detect among the bees of the protective curtain. During the half hour before flight begins, drones of both species appear on the protective curtain, walk upward and eventually begin flights from the honey storage area at the crown of the nest. Before flying, some drones of *A. andreniformis* run, with wings somewhat extended to the side, in circling loops. Some runs, but not all, end with the drone taking flight. These runs are visually identical in form and tempo to the round dances of *A. mellifera* workers. The dances of drones stimulate other drones in two ways: (1) after encountering a dancing drone, other drones will often follow the dance; and (2) when a dance ends in flight, the following drones often take flight with the lead dancer. This results in groups of two to ten drones taking flight together. Dances and group flights occurred every 2–7 minutes in the three colonies we observed.

We can think of three hypotheses to explain the adaptive value of drone dancing. First, the dance may warm muscles before flight; second, it may help orientate the dancer to celestial cues; or third, it may synchronize group flight by drones. The first two hypotheses lack appeal as most drones do not dance. Mating flights by small groups of *A. andreniformis* may enhance mate location, mating or avoidance of predation. Interestingly, *A. florea* drones also fly in groups but do not dance[3].

Thomas E. Rinderer
Benjamin P. Oldroyd
H. Allen Sylvester
USDA Agricultural Research Service,
1157 Ben Hur Road,
Baton Rouge, Louisiana 70820, USA
Siriwat Wongsiri
Department of Biology,
Chulalongkorn University,
Bangkok 10330, Thailand
Lilia I. de Guzman
Department of Entomology,
Louisiana State University,
Baton Rouge, Louisiana 70893, USA

1. von Frisch, K. *The Dance Language and Orientation of Bees* (Harvard University Press, 1967).
2. Wongsiri, S. *et al. Apidologie* **21**, 47–52 (1990).
3. Rinderer, T. E. *et al. J. apic. Res.* (in the press).