

Effect of Synthetic Queen Pheromone on the Behaviour of *Apis cerana*

Kuang Bangyu, Kuang Hsiao and Tan Ken

Eastern Bee Research Institute of Yunnan Agricultural University, Heilongtan, Kunming, China

Although there are many studies reporting the effects of synthetic queen pheromone, as yet no one has looked at its effect on *Apis cerana*. In 1993 the Chemical Department of Yunnan University succeeded in synthesising queen pheromone. In a primary test, its effect on *A. cerana* was evident. To improve honey production of *A. cerana*, this study systematically looked at the effect of synthetic queen pheromone on colony's initial reaction, gathering, colony discipline, worker-bee laying and queen-cell building.

Materials and Methods

The experiment was carried out at the Institute's apiary at Yunnan Agricultural University. Colonies of *A. cerana* of similar potency were selected and divided into test groups. Bees' response to the synthetic queen pheromone was observed and compared.

Synthetic queen pheromone is composed of 9-ODA, 9-HDA, methyl-hydroxy benzoic acid-salt, 4-hydroxy-3-methyl phenyl ethanol and R-9HDA. A carrier for the pheromone was made of a cigarette filter or a filter paper and put into an ether solution containing the pheromone. After the ether volatilised, the carrier (now an

Chemical analysis of worker pheromone component of Asian honeybees

S. Matsuyama*, T. Suzuki* and H. Sasagawa**
 *Institute of Applied Biochemistry, University of Tsukuba, Tsukuba, Ibaraki, Japan, ** PRESTO "Intelligence Synthesis", Tsukuba, Ibaraki, Japan

Report of pheromone gland chemistry of several honeybee species in Asia, *Apis cerana japonica* (Acj), *A. c. cerana* (Acc), *A. c. indica* (Aci), *A. dorsata* (Ad) and *A. andreniformis*. In Nasonov gland extracts of Acj, Acc and Aci none of the compounds known as Nasonov pheromone in *A. mellifera* (Am) was detected. Instead, linalool oxide was identified as the common component in *A. cerana*. 3-hydroxyoctanoic acid was identified as a major mandibular gland component in Acj, Aci and Acc. In Ad, 10-HDA was detected as the main component. Isopentyl acetate was identified in the sting gland of species tested. These results suggest that Asian honeybees developed different sets of chemicals as Nasonov and mandibular gland pheromones to those of Am.

artificial queen with 20 mg synthetic queen pheromone) was transferred to the hive.

Results and Discussion

Initial effect of pheromone on colony

Three minutes after the artificial queen was placed in a colony that had a queen or had just lost a queen, the worker bees begin to gather and fight each other. However, in a colony that had lost a queen for more than 24 hours, such a response did not happen.

Gathering action

Synthetic queen pheromone with three components and five components was placed in test colonies. Queens had been removed from all colonies. Fifteen minutes after introduction, worker bees gathered around the artificial queen and tried to attract other workers by passing on the scent. In a control colony, there was no such response. This shows that the synthetic queen pheromone has a similar effect in attracting *A. cerana* worker bees as real pheromone. It suggests that the pheromone could be used to attract free bees during the season of colony migration.

Effect on colony without a queen

Twenty-four hours after a queen has been lost from a colony, worker bees begin to show some disorder: foraging frequency decreases and worker bees release a scent at the hive entrance. Two queenless colonies with similar potencies were selected and an artificial queen placed in one of them. Workers began to surround it five minutes later, and within ten minutes the colony restored its discipline. The disorder in the control colony lasted until bees had built a new queen cell.

Inhibition of worker-bee laying

In a colony that has no eggs or brood, worker bees will begin to lay unfertilised eggs after the loss of a queen. These eggs develop into small, weak drones. When an artificial queen is placed into these hives, workers stop laying. In the test colonies, an artificial queen was introduced before workers started laying and prevented its occurrence.

Inhibition of queen-cell building

Forty-eight hours after the loss of a queen, worker bees begin to enlarge existing egg or brood cells and modify them into a queen cell. They start to feed royal jelly. In a test colony with an artificial queen, workers did not build a queen cell, whereas in a control colony a queen cell had been built only 24 hours later. If the queen cell was demolished and an artificial queen introduced, no more queen cells were built. If the artificial queen was taken away, worker bees begin to build a queen cell after 96 hours. This test showed that an artificial queen inhibited queen-cell building.

Conclusion

When synthetic queen pheromone is put into a queenless colony, the colony maintains its normal foraging action. Since there is no queen the colony becomes eggless and broodless; more worker bees will go foraging, and process and store honey which increases honey yield.