Chapter 5

Effect of Synthetic Queen Pheromone on Honey Production of *Apis mellifera* and *Apis cerana*

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The Chemical Department of Yunnan University first composed synthetic queen pheromone in China in 1993. Its effect was tested on honey production of *Apis mellifera* and *A. cerana* during the blooming period of Chinese tallow tree.

Materials and Methods

Test site is by the Jingsa river at 950 m. It was mostly cloudy with some showers during the blooming season of Chinese tallow tree in June 1997. Temperatures were 26–32°C. Each selected colony of *A. mellifera* and *A. cerana* had eight combs with similar potency. Sixteen *A. mellifera* colonies (M) and 16 *A. cerana* colonies (C) were divided into four groups of four colonies: CA and MA, test colonies without queen; CB and MB, test colonies with virgin queen; CC and MC, test colonies with queen; CD and MD, control colonies with laying queen. 20 mg of synthetic queen pheromone on a carrier of cigarette filter was placed once a day for three days in the test colonies of CA group. Every three days honey was collected and weighed to find average honey production for each group.

Natural recovery of Chinese bee populations of Changbai mountains

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Chinese bee of the Changbai mountains, *Apis cerana*, had several thousands of years of no competition until *A mellifera* was imported in the 1920s. Over the next sixty years, the Chinese bee suffered a period of decline. However, after ninety years, the Chinese bee appears to be recovering alongside a rapid reduction of *A. Mellifera*. This is probably because the Changbai mountains have nectar sources and ecology, and remnants of the Chinese bee that are fit for natural recovery. Reduction of *A. mellifera* will promote development of the Chinese bee.

Results

Table 1 shows honey production of the *A. cerana* was increased by the presence of synthetic queen pheromone. The honey production of CA was increased 17.8% over CD, 16.3% over CC, and 13.5% over CB.

Double-cross honeybee breeding of Songdan

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On the basis of inbreeding selection, four high-purity stocks named C, D, R and H that had strong breeding, high honey yield, high royal jelly yield, low feed need, high hibernating ability, and good adaptation were selected as parents. Two kinds of double-cross bee were bred by hybridisation named SongDan I (C*D x R*H) and Song Dan 2 (R*H x C*D). Compared with the local *Apis mellifera*, honey yield increased 70.8% and 54.4%, royal jelly increased 14.4% and 23.7%, overwintering weakening rate reduced 11.9% and 5%, feed expenditure reduced 23.7% and 14.9%, and they showed greater superiority in produce.

Relationship between character diversity and environment factors of *Apis cerana* in Yunnan

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Relationship between five main morphological indexes of the forage bee and of main environmental factors were studied by means of principal component analysis (PCA) at 26 sample locations in Yunnan Province. It showed that effects of sunshine hours and active accumulated temperature on the forage bee's morphology are obvious, especially on the right forewing length. Effect of environment on elbow vein index and body length is least. Generally right forewing length shows a tendency to become short in more sunshine hours and higher accumulated temperature regions.

Special distribution future of *Apis cerana* forage in mountain regions

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Special distribution feature of *Apis cerana* forage in the high mountain region was studied by means of geostatistics. Its structure was described quantitatively by variograms. It showed that *A. cerana* forage is characterised clearly in special structure and its variograms took on directional features, especially at E or N in the long distance.

Biological diversity of *Apis cerana* hive

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Besides *Apis cerana* there are many other species of animal living in the hive. They belong to 3 phyla, 3 classes, 22 orders. The relationship for 17 species (34%) is predation; for 16 species (32%) is parasitism; for 9 species (18%) is mutualism; for 6 species (12%) is amensalism; and for 2 species (4%) is neutralism.

Table 1. Total honey production by *A. cerana* groups (kg)

Groups	First 14 June	Second 18 June	Third 23 June	Total
CA	10.4	12.0	14.0	37.1
CB	9.8	10.7	12.2	32.7
CC	9.4	10.1	12.4	31.9
CD	10.2	11.1	10.2	31.5

Table 2 shows that average honey production of each CA colony increased 17.7% over CD, 19.2% over CC, and 7% over CC colony.

Table 2. Average honey production per *A. cerana* colony (kg)

Groups	First 14 June	Second 18 June	Third 23 June	Total
CA	2.6	3.0	3.7	9.3
CB	2.5	2.7	3.5	8.7
CC	2.4	2.5	3.1	7.8
CD	2.6	2.8	2.6	7.9

Table 3 shows honey production of *A. mellifera* was increased by the presence of synthetic queen pheromone. Honey production of MA group increased 21.7% over MD, 16.3% over MC, and 11.1 % over MB.

Table 3. Total honey production by *A. mellifera* groups (kg)

Groups	First 14 June	Second 18 June	Third 23 June	Total
MA	14.4	15.7	19.5	50.00
MB	14.9	14.0	14.1	43.00
MC	14.3	14.8	14.9	44.10
MD	13.5	14.0	13.8	41.00

Table 4 shows that average honey production of each MA colony increased 21.5% over MD, 12.7% over MC, and 9.8% over MB.

Table 4. Average honey production per *A. mellifera* colony (kg)

Groups	First 14 June	Second 18 June	Third 23 June	Total
MA	3.6	3.9	4.9	12.4
MB	3.7	3.5	3.6	11.3
MC	3.6	3.7	3.8	11.0
MD	3.4	3.5	3.5	10.2

Discussion

When synthetic queen pheromone is put into a colony without a queen, the colony maintains its normal foraging action. Since there is no queen in the colony and so no eggs or brood, more workers can go foraging and so increase honey storage.

When synthetic queen pheromone is put into a colony with a virgin queen, the density of queen pheromone is increased, which postpones the virgin queen's mating and egg-laying. Consequently, more workers go foraging, and honey yield is increased.

When synthetic queen pheromone is put into a colony with a queen, worker bees believe that another queen has intruded and they begin to fight. After about one hour, they adapt themselves and behave normally. The high density of pheromone can restrain swarming, and so increase honey yield.

The study shows the effect of synthetic pheromone is more evident on *A. mellifera* than on *A. cerana*. This probably means that although the components of queen pheromone are similar in both bees there are some differences that require further investigation.

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