Chapter 38

Queen-rearing and Royal-jelly Production in Asian Honeybee *Apis cerana*

R. Kumar and Neelima R. Kumar
Department of Entomology and Apiculture, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230 (H.P.), India

The Asian hive-bee, *Apis cerana*, exhibits remarkable genetic diversity in the region of its distribution. Several sub-species/geographical ecotypes have been identified (Ruttner, 1986; Verma, 1990) each of which is adapted to its particular area and shows significant variation in biological and economic performance. The scientific and commercial potential of this diversity is related to the fact that populations of *A. cerana* in some parts of the Hindu Kush-Himalayas match the European counterpart, *A. mellifera*, in size and productivity. Selection and queen-rearing in such populations might produce a line of *A. cerana* that is suitable for commercial beekeeping. Therefore, the present study was undertaken. Royal-jelly production was studied to explore its economic potential in the selected population.

Materials and Methods

Three ecotypes of *A. cerana* – high hill (2500 m), mid-hill (1500 m) and foothill (500 m) – were established at the University research-cum-demonstration apiary (1250 m) and subjected to selection over five years through 10 generations. Experiments on queen-rearing and royal-jelly production were then conducted on the selected stock only. The experimental colonies were classified as follows.

- Cell-builder colony: This was a strong selected colony with a 10-frame bee strength in its brood chamber. It had 3–4 combs of honey, 120–150 cm^2 of pollen, a young and emerging worker brood and an abundance of nurse bees. This colony was rendered queenless.
- Donor colony: This was also a strong selected colony. It had over 500 cm^2 of brood of less than 48 hr of age at the time of experiment. It was queen-right.
- Acceptor colony: This was a queenless nucleus or a small colony or a divide from a strong colony. It had at least one comb with a young, emerging worker brood and nurse bees. The new queen was introduced in it.

Queen-rearing frames each with two parallel bars were used. Ten wax discs each measuring 15 mm^2 and 5 mm thick were mounted on each bar with wax. Queen cups were made from beeswax with a special cell-forming rod. The cups were attached to the discs with warm wax facing downwards. The frame was placed in the

centre of the cell-builder colony and left overnight for the bees to clean and glean the cups. Larvae of different ages—12–24 hr and 24–48 hr—were used in two parallel sets of experiments. Larvae were picked up with a grafting needle from the donor colony and grafted into the prepared cups. The cups and brood frames were kept covered with moist muslin cloth to prevent drying out of larvae. When all the cups in the queen-rearing frames had been provided with suitable larvae, the frame was reintroduced in its position in the cell-builder colony. Sugar syrup was provided to encourage the workers to accept the cups and raise them into queen cells. These manipulations were accomplished in as short a time as possible to prevent chilling of the brood.

For queen-rearing, five well-attended cells were selected. When the cells became ripe, these were enclosed in queen-cell protectors. One newly emerged queen was then introduced into queenless acceptor colonies to make them queen-right. For royal-jelly extraction, 3–5 accepted queen cups were removed 48 and 72 hr after grafting. The cups were cut open a few millimetres above the larva embedded in the royal jelly. The larva was gently removed and discarded. Royal jelly was then extracted with a spatula and weighed with an electronic balance.

Results and Discussion

Results of experiments on queen-rearing and royal-jelly production are presented in Tables 1 and 2.

It was observed that percentage acceptance of artificial queen cups was higher in late spring-early summer than in autumn (Table 1). Maximum average amount (202.9 mg) of royal jelly was collected from 12–24 hr grafts after 72 hr during late spring-early summer (Table 2). It has previously been reported that queen-rearing

Table 1. Queen-rearing in *Apis cerana*

No. of larvae grafted	Total number of cells accepted				Queen production success (%) from five selected cells			
	12–24 hr		24–48 hr		12–24 hr		24–48 hr	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
20	17(85)	13(65)	15(75)	11(55)	80	70	70	60
20	15(75)	12(60)	14(70)	13(65)	60	60	60	40
20	18(90)	15(75)	16(80)	12(60)	100	70	80	80

Figures in parentheses are percentages.

Table 2. Royal-jelly production in *Apis cerana*

No. of larvae grafted	Weight of royal jelly/cup extracted 48 hr after grafting(mg)				Weight of royal jelly/cup extracted 72 hr after grafting(mg)			
	12–24 hr		24–48 hr		12–24 hr		24–48 hr	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
20	179.6	154.5	172.0	168.6	210.9	180.7	162.1	134.7
20	182.9	148.7	222.7	179.6	197.5	172.6	158.5	142.5
20	165.2	151.5	190.7	167.7	200.3	179.5	176.9	153.5
Average	175.9	151.6	198.3	172.0	202.9	177.6	165.8	143.6

and/or royal-jelly production is dependent upon nectar and pollen sources available during the period (Chang and Hsieh, 1993; Wongsiri *et al.*, 1988). The location where the study was conducted abounds in late spring-early summer flora, mainly stone and pome fruits. These provide good bee-forage and probably explain the results obtained during the study. Wongsiri *et al.* (1988) conducted queen-rearing with *A. cerana* in Thailand and reported more than 90 % acceptance both in single and double grafts although only 12.5% cells could be raised during the rainy season. Although royal-jelly production in *A. mellifera* is extensively exploited (Chang and Hsieh, 1993; Crane, 1990; Smith, 1959; Rana, 1996), this is the first report of obtaining economically viable amounts of royal jelly from a selected high-hill population of *A. cerana* from India.

Acknowledgements

Research facilities provided by the Department of Entomology and Apiculture, and the sincere efforts of Mr Dev Raj (Bee Attandant) are greatly acknowledged. Thanks are also due to Mr Ajay Kumar for reviewing this paper.

References

Chang, C. and Hsieh, R. 1993. Factors affecting royal jelly production. In: *Asian Apiculture* (L. J. Connor, T. Rindrer, H. A. Sylvester and S. Wongsiri (eds)), Wickwas Press, US. pp. 316–326.

Crane, E.1990. The newer hive products: pollen, propolis, royal jelly, bee venom, bee brood. In: *Bee and Beekeeping.* Heinemann Neunes Publ. pp. 452–472.

Rana, V K. 1996. *Studies on royal jelly production techniques in A. mellifera* L. Ph.D. Thesis, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni-Solan (H.P.), India. 88 pp.

Ruttner, F. 1986. Geographic variability and classification. In: *Bee Genetics and Breeding* (T. E. Rinderer (ed.), New York Academic Press.

Smith, M. V. 1959. The production of royal jelly. *Bee World,* 40(10): 250–254.

Verma, L.R. 1990. *Beekeeping in Integrated Mountain Development: Economic and Scientific Perspectives.* Oxford and IBH Publishing, New Delhi. pp. 169–252.

Wongsiri, S., S. Polkichot and C. Feng Zhi. 1988. Environmental factors necessary for *A. cerana* rearing in Thailand. In: *Proc. Unit. Conf. Apic. Trop. Climates, Cairo.* pp. 466–470.