Chapter 6

Major Constraints in the Performance of *Apis mellifera* and *Apis cerana* under Khumaltar Conditions

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Modern beekeeping was initiated in Nepal 15 years ago with the introduction of moveable-frame hives to rear *Apis cerana* (Kafle, 1992). However, most farmers still use traditional methods. Those who have adopted modern methods face problems such as frequent swarming, absconding, diseases and mites, robbing and pesticide poisoning. The exotic bee, *A. mellifera*, was introduced recently and demand is increasing. Although this species is popular, beekeepers have not been able to benefit fully from its advantages over *A. cerana* because of inefficient management practices. There is a lack of information on modern management practices for farm conditions under which either of the two species perform well.

Materials and Methods

This experiment was initiated at the Nepal Agricultural Research Council, Khumaltar in September 1995. Four healthy colonies each of *A. cerana* and *A. mellifera* with the same age of queen and equal numbers of frames were observed at seven days interval for three years. During each observation, problems were documented and efforts were made to mitigate them. The problems were occurrence of mites and diseases, swarming and queen-cell preparation, robbing during food shortage, and pesticide poisoning.

In the case of mite attack on *A. mellifera* colonies, a piece of cotton soaked with 5 ml of 85 % formic acid per colony was placed on the bottom board of the brood chamber and three applications of sulphur dust on alternate days at the rate of 1 gm per frame were made. For the control of Thai Sac Brood Virus Disease on *A. cerana*, firstly 250 mg of tetracycline dust mixed with 500 ml of sugar solution per colony was given and later a feed of 5 gm Bhaicare powder mixed with 500 ml sugar solution per colony was given. For the control of European Foul Brood in *A. mellifera*, three feedings of 250 mg tetracycline dust mixed with sugar solution per colony were given on alternate days. During dearth periods, artificial feeding of sugar solution was provided to both species depending upon the food store in the colony. During swarming, frequent checking was done and unnecessary queen cells were destroyed. Activities such as spraying of water, spreading of dust and grass pieces, and narrowing the entrance gate were done to reduce robbing. During severe pesticide poisoning the colonies were moved to a safe area.

Results and Discussion

Mite appearance and control

Two mite species, *Varroa jacobsoni* and *Tropilaelaps clareae*, attacked the bees. *Varroa jacobsoni* appeared in both species but *T. clareae* was associated mainly with *A. mellifera*. During the first two years, *V. jacobsoni* was a problem. Although mites were seen on *A. cerana*, their effect was not as critical as in *A. mellifera*, where infested colonies were significantly damaged. The main symptoms of mite attack in *A. mellifera* were punctured capping of brood cells inside the colony, restless crawling and staggering of bees around the hives, mite-infested dead larvae outside the hive entrance and disabled bees with rudimentary wings and legs around the hive. In the third year, *T. clareae* infestation was more problematic than *V. jacobsonii*. Up to five mites infested an individual brood cell. No multiple-mite parasitism was observed.

Application of 5 ml formic acid per colony at seven-day interval was found to be effective for controlling mites during winter whereas application of sulphur dust at the rate of 1 gm per frame was effective at other periods. Dates of mite infestation and treatment application are shown on Table 1.

Thai Sac Brood Virus Disease appearance and control

Thai Sac Brood Virus Disease (TSBVD) was extremely destructive to *A. cerana*. It was first observed in a colony nearby and then spread to experimental hives. All colonies of *A. cerana* were infected by TSBVD during April to August and November/December. The punctured cappings of sealed brood were seen at first and when the cappings were opened dead larvae in an upright position were found. The dead larvae were watery and formed a sac-like structure when pulled out of the cell. The disease was observed more in older larvae than in younger ones.

250 mg tetracycline mixed with 500 ml of sugar solution per colony was given to control it, but was not effective. So, 5 gm Bhaicare powder mixed with 500 ml of sugar solution per colony was given and was comparatively more effective. Dates of TSBVD appearance and treatment application are shown in Table 2.

European Foul Brood appearance and control

European Foul Brood (EFB) was destructive to *A. mellifera*. In 1995/96 it was not observed in *A. mellifera* but it appeared from February to June and August in the other two years. All colonies were infected. During infection many dead

Table 1. Mite appearance date and treatment application for control in *Apis mellifera*.

Control Treatments	1995/96	1996/97	1997/98	REMARKS
Formic Acid Application	5th December 29th October	3rd March Nov. 5 & 18th	Not applied	Effective during winter.
Sulphur Dust Application	13, 17 & 21st March, 4th April 17, 19 & 21st July	24 & 27th Nov., 1 & 4th Dec. 4, 6 & 8th Feb.	15, 17, 19, 25, 27 & 29th Nov.	Effective during other period

Table 2. TSBVD appearance date and treatment application for control in *Apis cerana*.

Control Treatments	1995/96	1996/97	1997/98	REMARKS
Bhaicare powder	10, 12 & 15th April, 1,2 & 7th Nov.	14 & 16th July, 4 & 6th Dec.	Not infected	Bhaicare powder controlled
Tetracycline	13th August.	Not applied	Not applied	better than tetracycline.

Table 3. European Foul Brood appearance date and treatment application for control in *Apis mellifera*.

Control treatments	1995/96	1996/97	1997/98
Tetracycline	Not appeared 6, 8 & 11th May	29 & 31st March, 21, 23 & 25 th August	2nd April, 9,,11 & 13 th Feb. 23, 25 & 27 th June

Table 4. Average number of queen cells and their formation period in *Apis mellifera* and *Apis cerana*.

Year	*Apis mellifera*		*Apis cerana*	
	AV. NUMBER	PERIOD	AV. NUMBER	PERIOD
1995/96	3.66	27th Feb. - 10th March	4.00	5 - 12th March
1996/97	6.00	23rd Feb. - 10th March	9.33	23rd Feb–11th March.
1997/98	2.50	17 - 25th Sept	3.00	26th Sept - 21st Oct.
AVERAGE OF THREE YEARS	4.00		5.40	

Table 5. Artificial feeding date for *Apis mellifera* and *Apis cerana*.

Year	*Apis cerana*		*Apis mellifera*	
	WINTER	RAINY	WINTER	RAINY
1995/96	25th Dec.,6 & 25th Jan., 12th Feb.	19th July	25th Dec., 6 & 25th Jan., 12th Feb.	16 & 19th July., . 23 rd Aug
1996/97	23rd Dec., 13 & 18th Jan., 2nd Feb.	12 & 27th July, 13th Aug.	23rd Dec., 4, 13 & 25th Jan., 2nd Feb.	23rd June, 6, 12 & 30th July, 11 & 23rd Aug.
1997/98	22 & 30rd Dec., 6 & 18th Jan.	17 & 23rd Aug	22 & 30th Dec.	4, 20 & 30th Jan., 3rd Feb.

larvae were observed outside the hive entrance. Unsealed dead larvae of almost the same age were also observed in the comb cells. Later they decomposed and as a result turned black and produced a bad smell.

Three feeding of 250 mg tetracycline mixed with 500 ml of sugar solution in a 1:1 ratio at one-day intervals was an effective control. Date of EFB infection and treatment application are shown in Table 3.

Number and period of queen-cell formation

Maintenance of an appropriate balance in a colony's bee population is important and was done by destroying unnecessary queen cells at regular intervals. The number of queen cells was higher in *A. cerana* than in *A. mellifera*. Up to 12 queen cells were found in a single frame. However the average number of queen cells was four in *A. mellifera* and 5.4 in *A. cerana*. The swarming tendency was lower in *A. mellifera* than in *A. cerana*. The swarming period was from February to March and September to October in both species (Table 4).

Dearth period and artificial feeding

December, January and February during winter and June, July and August during the rainy season were identified as dearth periods. Sugar solution in a 1:1 ratio was fed artificially to both species; a pollen substitute was not needed. The three-year observation data suggest that *A. mellifera* needs 4–5 feedings whereas *A. cerana* needs only 2–4 feedings (Table 5).

Robbing

Robbing tendency was observed during dearth period in both species. However it was severe during December/January and July in 1995/96 and in November during 1997/98. This is probably owing to varying weather conditions over the years. In 1995/96 robbing was done by *A. mellifera* to *A. cerana* but during 1997/98 both species robbed *A. cerana* colonies. However it was difficult to distinguish whether it was from experimental colonies or from apiaries nearby. When robbing took place, the weaker colonies of *A. cerana* were completely destroyed within a short period of time. During 1997/98, robbing occurred in all colonies of *A. cerana*, and only three strong colonies defended it. This problem was reduced by spraying water or dusting. It was also reduced to some extent by narrowing the entrance gate.

Pesticide poisoning

Pesticide poisoning is another serious problem and it occured at Khumaltar during the month of March every year. In 1997 all experimental colonies were badly affected. In general, strong colonies were affected more than weaker ones. The symptoms were dead or dying bees extending their tongue/proboscis, abnormal movement, spinning and crawling around, and inability to fly. Inside the brood chamber, younger larvae of the same age were found dead inside their cells. Aggressive behaviour and attacks by guard bees of foragers were also observed.

Conclusion

Although this experiment is of a preliminary nature, some major constraints to the performance of *A. mellifera* and *A. cerana* have been identified under Khumaltar conditions. Some management practices have also been identified to overcome the problems encountered.

Acknowledgements

Authors are highly grateful to Mr D.N. Manandhar, Chief, and Mr B.K. Gyawali, Senior Scientist, Entomology Division, NARC for providing facilities and continuous encouragement. We would like to thank sincerely other senior scientists and technical officers of the Entomology Division for providing suggestions and interest in our study. Our appreciation and thanks go to Mr J.D. Neupane and Mr S.P. Nepal for help in collecting data during the study.

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Chapter 7

Status of Beekeeping in Himachal Pradesh

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India has enormous potential for beekeeping due to abundance of bee flora and bee-friendly climatic conditions. For the development of beekeeping, floral calendars have already been prepared for different states and regions (Kohli, 1958; Rahman and Singh, 1941; Roy and Hamid, 1987; Sharma and Gupta, 1993; Sharma and Raj, 1985). Himachal Pradesh is unique in having different agro-climatic zones with varying bee flora that help to sustain beekeeping in the state. Broadly, the state can be divided into four agro-climatic zones sub-tropical and low hills (up to 914 m); sub-temperate, subhumid mid-hills (915-1523 m); wet-temperate high hills (1524-2472 m); and, dry-temperate high hills and cold deserts (above 2472 m). Surveys made on different aspects of beekeeping in these agro-climatic zones are presented in this paper.

Sub-tropical and Low-hill Zone Beekeeping

Potential sites

Some parts of this zone, especially adjoining the plain areas of the neighbouring states of Punjab, Haryana and Uttar Pradesh, are suitable for keeping bees based on the density and type of bee flora available throughout the year. Potential areas for beekeeping (Figure 1) are Nurpur block of Kangra, Santoshgarh, Una-Jhalera to Luharbi areas of Una and Paonta valley of Sirmour where smaller units of colonies can be kept around the year. Other beekeeping pockets in this zone that could be exploited to a limited extent are Barotiwala-Nalagarh area of Solan, Dosarka-Kala Umb area of Sirmour, Ichhi, Shahapur, Indora areas of Kangra and Umb-Mubarkpur area of Una. Surplus honey is collected during spring-summer from mixed flora that include *Brassica, Eucalyptus, Citrus, Litchi, Toona, Syzygium, Dalbergia, Trifolium, Ehretia, Sapindus, Acacia,* etc. In addition, large numbers of supporting flora are also available throughout the year. August to October is the dearth period. Rest of the zone has sparsely distributed bee forage and thus is not suitable for practical beekeeping.

Number of bee colonies and beekeepers.

The University maintains 125 *Apis mellifera* colonies and University HPKV, Palampur also keeps 150 bee colonies at different research stations in this zone. The State Horticulture Department has 1300 colonies of *A. mellifera* and 25 *A. cerana* at various locations. In addition, there are about 300 professional beekeepers, having abut 9800 *A. mellifera* and 100 *A. cerana* colonies. There are about 600 *A. cerana* colonies also existing in log and wall hives (traditional). Despite the existence of major beekeeping pockets and huge numbers of bee colonies, only