Article

BEEKEEPING WITH *APIS CERANA* IN SRI LANKA

by WILLARD S ROBINSON
PO Box 4329, Casper, Wyoming 82604, USA

Geography and climate

Sri Lanka, formerly Ceylon, is an island 65 610 km^2 in area, situated across the Palk Strait only 30 km South-East of India. It lies between 6 and 10 degrees North latitude. The climate varies with the monsoons and elevation; there are no well-defined seasons. Sri Lanka receives plentiful rainfall. Even the so-called Dry Zone, comprising well over 50% of the land area and occupying the northern and eastern parts of the island, receives between 1000 and 1900 mm of rain annually. There is an Intermediate Zone in the central highlands, which reach over 2000 m above sea level, and the south-western Wet Zone rainfall averages about 2500 mm. The Dry Zone and the coastal areas are hot, with annual average temperatures of 26–35°C; areas in the highlands have averages between 14 and 20°C.

Bees and hives

While on a consultancy in 1986 for the Food and Agriculture Organization of the United Nations (FAO), I had the opportunity to observe the three species of *Apis* in Sri Lanka:

FIG. 1. Tree harbouring more than 40 *A. dorsata* nests.

A. cerana, *A. dorsata* and *A. florea*. *A. florea* builds a small, single vertical comb, usually low and well sheltered by shrubby vegetation, and is unimportant economically. *A. dorsata* builds an open, single-comb nest, often with many colonies clustered in a small area (Fig. 1), and is widely exploited by honey hunters. The natural nests of *A. cerana* are concealed in cavities and usually contain about five or six vertical combs. These nests are also raided for their honey; honey hunting still accounts for about 65% of the 80 tonnes produced annually in the country. All three species are migratory to some extent, especially *A. dorsata*, colonies of which move hundreds of kilometres twice annually between the lowland plains and the central hills in response to dearth conditions.

There have been several introductions of *A. mellifera* to Sri Lanka in the past. All colonies have dwindled and there are probably none alive now. Current beekeeping schemes all use *A. cerana*.

According to 1985 Department of Agriculture figures, there are about 40 000 bee hives in the country, about 40% of which are in movable-frame hives. Traditional hives are usually clay pots or hollow logs. One of the more interesting hive systems I observed was

FIG. 2. *A. cerana* hive made of clay pots. A plastic bag is draped over the top.

the use of three pots to make a hive: a plate-like clay piece as the bottom board; an inverted spheroid pot as the brood chamber, with a hole bored to allow the bees access to a third pot, the honey super, above (Fig. 2). At harvest the beekeeper simply breaks this open, removes the honey combs and squeezes the honey from them.

Hive products

High quality honey is in demand in Sri Lanka. It is used widely in traditional medicine, both as a sweetener to be taken with bitter herbs and as a health-giving food in itself. It is a popular food for table consumption as well. Clean Sri Lankan honey brings a price of about 80 rupees per kg (US$1.40 per lb), a high price considering the low income of most families. The price is about 50% higher in the capital city, Colombo. Nearly all local honey is packed in arrack bottles (a coconut-based liquor) that hold about one kilogram of honey. Imported honey sells for about twice the price of local honey and is consumed mostly by tourists and expatriates.

Unfortunately, most of the honey produced on the island is not of a high standard. Nearly all the honey, whether it is hunted or cultivated, is extracted by squeezing or cutting the combs and straining them, with varying degrees of success, through cotton cloth or simple metal flour sifters. There was debris in nearly all the samples I saw. Crystallization takes place quickly in many of the honeys; I saw completely crystallized *Eucalyptus* honey that had been harvested only 10 days before. High moisture is perhaps the most important quality problem, one that is augmented by the high rainfall and relative humidity. Honey produced from extrafloral nectaries of rubber trees (*Hevea brasiliensis*) is commonly as high as 27% water. Even from *Eucalyptus* it is very rare to find honey with moisture content below 19%. Fermentation under such conditions occurs rapidly. An inexpensive method of lowering the water content of honey is sorely needed in many parts of the tropics. Ventilation holes in honey supers may provide a partial answer, but a reliable post-harvest technique must be found.

Yields of honey are low, perhaps 1–3 kg per hive nationwide. In the best *Eucalyptus* area in the highlands this average is common, though yields of about 6 kg per hive are not unusual. Ten to 15 kg would be an exceptional harvest. (It might be noted here that *Eucalyptus* honey is becoming more common as the highlands undergo a reafforestation programme. The honey is slowly gaining acceptance, but most Sri Lankans prefer honey from a variety of floral sources.)

Beekeeping is not a successful commercial enterprise in Sri Lanka. Very few people supplement their incomes by more than 10% by keeping bees. It is, however, an important source of additional income to a large number of subsistence farmers whose income is low enough that any addition whatsoever is significant. In some areas every family in a neighbourhood has a few hives. Much of the honey produced, even though it may be difficult to market because of quality problems, is consumed by the beekeepers, their families, friends and neighbours, and is at least a medicinal and nutritional gain.

Beeswax is in great demand, mostly by the batik industry, where it is used in a paraffin mixture during dyeing. *A. cerana* is not a prolific wax producer. Methodical harvesting of abandoned or raided *A. dorsata* combs, which are often high off the ground and nearly inaccessible, could do much to alleviate the shortage.

Propolis is not used by Sri Lankan *A. cerana*.

Nectar and pollen sources

There is a great diversity of nectar and pollen sources. G Lanerolle, Director of the Apiculture Centre in Bidunuwewa, has compiled a list of 248 significant plant species. When I asked him to select a few of the most important ones, he with great effort reduced the number to 32! Important as they may be, many are disappearing due to deforestation, land cultivation and settlement schemes for Sri Lanka's swelling population.

In the highlands *Eucalyptus* is the main bee plant. *E. saligna*, *E. toruliana* and *E. diglupta* are the most important species. These are supplemented by such species as *Neolitsea involucrata* and *Litsea glabberinna* (Lauraceae). A few of the important Dry Zone plants are *Madhuca longifolia* and *Manilkara hexandra* (Sapotaceae), *Drypetus seaiaria* (Euphorbiaceae) and three species of *Terminalia* (Combretaceae). In the Wet Zone, rubber provides a copious but brief nectar flow. Where rubber plantations exist alongside plantings of coconut (*Cocos nucifera*), which yields nectar and pollen year-round, beekeeping can be quite successful. *N. involucrata* and clove, *Syzygium aromaticum*, are also important in this region.

Honey harvest generally occurs from July to September, except in rubber growing areas, where the flow occurs from February to April. There is a long dearth period over most of the island from October to March, when only a few plants such as coconut and banana (*Musa* spp.) provide nutrition for bee colonies[1,5,6].

There are probably areas in the northern Dry Zone where honey potential has not been realized. Scale-hives or small apiaries should be scattered throughout this zone as monitors of the nectar flow.

Development assistance

Since 1976 the Canadian International Development Agency (CIDA) has played such a large role in apicultural advances on the island that space will not permit a detailed account here. It has provided funds to equip an Apiculture Centre with laboratory and shop equipment. The Centre is now producing a new, inexpensive 'Metric hive' that was developed there after trials with many hives made from various materials. Current output is about 60 hives (brood chamber and two honey supers) per week. Funds have been provided for education of two researchers to MSc level, one of whom has completed his studies and is conducting research at the Centre. A pilot project for honey collection, processing, bottling and marketing is in its initial stages. Training in one-year apicultural programmes abroad is planned for seven extension workers at the Centre. Centre staff conduct many short courses during the year and also act as visiting lecturers at training centres throughout the country. A Canadian consultant, G D Wilson, is assisting with hive design and production and the development of the pilot honey plant, both of which industries it is anticipated will be replicated by Sri Lankan entrepreneurs.

Since the inception of the CIDA project the number of beekeepers in the country has risen from about 2000 to about 9000.

Management techniques

Establishment of colonies in movable-frame hives is almost always done by transferring bees that have been collected from natural nests. Any brood combs are tied into frames using the long, strong fibres from banana leaf sheaths, which are easily chewed and

removed by the bees. Comb foundation is not used. Poorly orientated combs do not appear to be a problem as long as the beekeeper fastidiously respects the bee space in placing empty frames in the hive. There is a general shortage of empty combs to use in supering for the honey flow. Farmers rarely have access to an extractor; combs are destroyed to remove the honey. Failure to re-use combs undoubtedly contributes to low honey yields.

It is commonly reported that beekeepers who harvest at regular intervals throughout the nectar flow obtain higher yields than those who harvest only at the end of the flow, from one or two supers. The former usually have the added advantage of access to an extractor. Replacement of empty combs not only directs energy into honey making that might otherwise be devoted to comb building, but probably also stimulates more foraging[8].

As the size of the brood nest changes, the Centre recommends rather precise control of hive size through the use of a follower or dummy board. The Metric hive includes one as standard equipment. The hive should be gradually expanded to accommodate nest growth, and should be reduced during the dearth season. This facilitates temperature control and protection against hive invaders, and may also reduce absconding and migratory tendencies.

Under normal conditions, feeding during the dearth is not essential as there are some minor food sources even then. Some people do feed small quantities of sugar syrup or molasses.

A. cerana's swarming instinct is strong. The tendency can be reduced, just as it is with *A. mellifera*, by increasing space for the colony to expand during the swarming season. Most beekeepers also remove queen cells in their early stages. Migration in response to dearth[2] is often as high as 20%, but can be reduced greatly by separating hives and apiaries to decrease intraspecific competition for floral resources. The foraging range of *A. cerana* is only about 0.75 km[4,7].

Migratory beekeeping could probably be practised successfully in Sri Lanka, though currently it is not. Perhaps the biggest hindrances are the rugged terrain, difficult road system and lack of money.

Research needs include: swarming, absconding and migration biology; investigation of possible parasites and diseases; pollination of several crops, most importantly coconut, whose pollination requirements are poorly known considering the crop's global importance; feasibility of migratory beekeeping; selection of better *A. cerana* strains.

Natural enemies

Very little investigation has been done into the possibility that unknown parasites or diseases are detracting from the productive capacity of Sri Lankan *A. cerana*. There are no known serious problems. *Varroa jacobsoni* is common, but is not normally overly detrimental to colony welfare[9]. *Tropilaelaps clareae* and *T. koenigerum* are found on *A. dorsata*; *Euvarroa sinhai* occurs on *A. florea*. Neither of these genera have been seen infesting *A. cerana*. A phoretic (using a bee as a means of transport) pollen-feeding mite, *Neocypholaelaps indica*, occurs on all three species[3].

The most commonly recognized enemies are the hornet *Vespa cincta* and eight species of birds (*Merops* and *Dicrurus*). The Apiculture Centre one year lost 42 of 145 strong

colonies due to depradation by hornets. Both birds and hornets are best combatted by locating hives where they are protected by fairly dense foliage.

Both greater and lesser wax moths (*Galleria mellonella* and *Achroia grisella* respectively) are abundant and problematical in colonies with too much comb to protect. Part of the serious effect of these moths may be because *A. cerana* does not use propolis to seal egg-laying sites. Wax moths are best managed by keeping strong colonies and by controlling hive size with judicious use of the follower board.

Ants, especially weaver ants (*Oecophylla* sp.), are major predators of honeybees. The Apiculture Centre staff recommends the use of ant wells filled with used motor oil, but few people use them. Relatively innocuous hive occupants such as cockroaches, lizards and skinks are commonly encountered.

Conclusion

It is clear that the full potential for beekeeping with *A. cerana* in Sri Lanka has not yet been realized. Indeed many aspects of its management require development. There is undoubtedly a need for a long term research programme and improved extension service to encourage beekeeping with *A. cerana* to take full advantage of the abundant forage which is available to this potentially very productive bee.

Acknowledgements

I am grateful to Messrs. G Lanerolle, R W K Punchihewa and S Wirasinghe of the Sri Lanka Department of Agriculture, and to Mr G D Wilson, CIDA, for their kindness and patience in guiding me through the world of Sri Lankan beekeeping. Dr P G Kevan reviewed the manuscript.

References

1. Fernando, E F W (1979) The ecology of honey production in Sri Lanka. Pp. 115-125. *In* Beekeeping in rural development. *London: Commonwealth Secretariat*
2. Food and Agriculture Organization of the United Nations (1986) Tropical and sub-tropical apiculture. *Rome: FAO*
3. Koeniger, N; Koeniger, G; Delfinado-Baker, M (1980) Observations on mites of the Asian honeybee species (*Apis cerana, Apis dorsata, Apis florea*) *Apidologie* 14: 197–204.
4. Koeniger, N; Vorwohl, G (1979) Competition for food among four sympatric species of Apini in Sri Lanka. *Journal of Apicultural Research* 21: 41–52
5. Lanerolle, G A (1984) Beekeeping in Sri Lanka. Pp. 217–221. *In* Proceedings of the expert consultation on beekeeping with *Apis mellifera* in tropical and sub-tropical Asia. *Rome: FAO*
6. ——(1986) *Personal communication*
7. Punchihewa, R W K; Koeniger, N; Kevan, P G; Gadawski, R M (1985) Observations on the dance communication and natural foraging ranges of *Apis cerana, Apis dorsata* and *Apis florea* in Sri Lanka. *Journal of Apicultural Research* 24: 168-175
8. Rinderer, T E; Baxter, J R (1978) Effect of empty comb on hoarding behaviour and honey production of the honey bee. *Journal of Economic Entomology* 71: 757-759
9. Ritter, W; Sakai, T; Takeuchi, K (1980) Entwicklung und Bekämpfung der Varroatose in Japan. Pp. 69-71. *In* Diagnose und Therapie der Varroatose. *Bucharest, Romania: Apimondia Publishing House*