APIS CERANA IN GLOBAL BEEKEEPING

L. R. VERMA
NEPAL

Introduction

The Asian hive bee, *Apis cerana* F. is equivalent to the European hive bee, *Apis mellifera*, because both can be domesticated and are similar as regards the nest building and dancing behaviour. This native bee species is not only the basic source of most of the commercial or domestic honey and other hive products, but it also enhances the productivity levels of many cultivated crops through cross-pollination. The current importations of allopatric *Apis mellifera* in Asia for commercial exploitation are leading to the decline of *Apis cerana* populations in their native habitats to a level that threatens its extinction as a genetic resource. The development of beekeeping industry in the Hindu Kush Himalayan countries, therefore, requires a different strategy, i.e. conservation through development and promotion of beekeeping with *Apis cerana* in order to maintain its genetic diversity. Such an approach will aid beekeeping and agriculture not only in its native Asian habitat, but worldwide as well.

Exotic Apis mellifera: Problems and Prospects

As a result of the continuous research efforts in the area of genetic diversity, selective breeding and improved management practices, *Apis mellifera* produces three times more honey than *Apis cerana*. Furthermore, *Apis mellifera* is superior to *Apis cerana* due to its maintenance of prolific queens and to its fewer swarming and absconding tendencies. However, many importations of exotic *Apis mellifera* into Asia have proved disastrous. When kept sympatrically, *Apis cerana* and *Apis mellifera* colonies frequently rob each other (KOENIGER, 1982). Another cause of failure in the coexistence of the two species is the attempted intermating which produces lethal offspring (RUTTNER and MAUL, 1983). A new problem is the transfer of parasites from one species to another. A parasitic mite of brood and adults *Varroa jacobsoni* may coexist with *Apis cerana* and cause no serious damage to this native bee species. In several parts of Asia, where both these bee species are now kept together, the parasite has infested *Apis mellifera* colonies and has become a serious pest to this unadapted host. There is now apprehension that the importation of *Apis mellifera* will lead to the decline of *Apis cerana* populations in its native habitat. In Japan and China, *Apis cerana* is now largely replaced by imported *Apis mellifera* colonies. Other Asian countries, such as Pakistan and India are now following this trend.

Apis cerana: Problems and Prospects

Apis cerana has many valuable characteristics of biological and economic importance. These include their docile and industrious

nature, their being less prone to the attack of wasps, and their high level of resistance to nosema disease and to the parasitic Asian mites *Varroa jacobsoni* and *Tropilaelaps clarae* that plague *Apis mellifera*. *Apis cerana* can coexist with other native bee species and requires little chemical treatment of the colonies to control epidemics. However, as yet this native bee species has not become popular among beekeepers because of several behavioural characteristics. These include their frequent swarming and absconding, their tendency to rob, their production of a large number of laying workers and their lower honey yields. These negative traits show ecogeographical variations depending upon the subspecies, the geographic ecotype and the management efficiency of the beekeepers.

Some of these undesirable behavioural traits, from a beekeeping poin of view, emerged in *Apis cerana* during the process of evolution as a result of harmful exploitation of this bee species by man. For example, through traditional methods of beekeeping, which are in vogue even today, during honey harvesting, most of the bees were killed and no honey stocks were left behind in the nest for consumption by bees during the dearth periods. As a result of this, the colonies of *Apis cerana* that survived and propagated in nature have developed the traits of frequent migration and absconding to safer and better pastures. In order to reverse such trends, a strategy through development and promotion of beekeeping, with *Apis cerana* in modern, movable hives, is needed, moderate honey harvests being collected in a timely manner without harming the bees. In order to make such strategies successful, the foremost requirement is the exploration and evaluation of different subspecies/geographic ecotypes of *Apis cerana*, which have not yet been done in detail in its native habitat.

Subspecies/Geographic Ecotypes of *Apis cerana*

In the recent past, attempts have been made to identify different subspecies and geographic ecotypes of *Apis cerana* by using computer assisted statistical methods. RUTTNER (1987) distinguished four different subspecies of *Apis cerana*, namely: *A. c. cerana, A. c. himalaya, A. c. indica* and *A. c. japonica*. His studies were based on 34 morphological characters of 68 samples of *Apis cerana* collected from different parts of Asia. Similarly, MATU and VERMA (1983, 1984 a,b) studied the genetic diversity of *Apis cerana* from the Himalayan region. The results revealed that bees from mountainous regions were significantly larger in size and darker in colour than those from submountainous regions. Morphometric comparison of worker bee populations of Himayas revealed significant differences in size (North-western Himalayan bees > North-eastern Himalayan

bees > South Indian bees). These subspecies correspond to the *A.c. cerana, A.c. himylaya,* and *A.c. indica* in Ruttner's analysis. In the North-eastern Himalayas, Singh et al. (1990) identified 3 geographic ecotypes of *A.c. himalaya* that correspond to a geographic distribution in (1) the foot hills of Himalaya, (2) Bramhaputra valley and Khasi hills and (3) the Naga and Mizo hills. These groups are biologically meaningful because the position of each group fall within separate geographic areas.

The above quoted morphometric analyses, based on a small number of samples, give only an overview of the total genetic diversity, but do not enable one to detect distinct subspecies/ecotypes with varied economic usefulness. Thus, there is a further need to explore the genetic diversity at the subspecies/ecotypes level, especially in the Hindu Kush-Himalayan region which has the largest and perhaps the most economically useful subspecies and ecotypes of *Apis cerana*.

Behaviour and Management of *Apis cerana*

The lack of basic knowledge on *Apis cerana* behaviour is a major constraint in developing appropriate apiary management technologies with this native bee species. Very few papers cover this subject in depth, in comparison to the volumes of material about *Apis mellifera*. In the absence of an appropriate apiary management technology, based on the specific behavioural characteristics of *Apis cerana*, several national and international development projects for the promotion of beekeeping with this bee species, in the developing countries of Asia, attempted the application of the European honeybee, *Apis mellifera*, apiary management technologies on *Apis cerana*. Consequently, many of these projects ended in failure, because *Apis cerana* shows striking differences from *Apis mellifera* in certain behavioral traits, such as colony cycle, foraging, temperature regulation, colony defense, aggressiveness, absconding, swarming, etc. Some of these act as negative behavioral traits, from a practical beekeeping point of view, in *Apis cerana*. For example, frequent swarming and absconding by *Apis cerana*, especially during the honey flow seasons, lead to a decline in colony strength and adversely affect the honey production and pollination efficiency. There are no such problems in beekeeping with *Apis mellifera* and it is and it is easier to get a surplus of honey from this bee species, in comparison to *Apis cerana*. However, these negative traits in *Apis cerana* are amenable through research efforts. This scientifically neglected bee species has the potential to match *Apis mellifera* in economic usefulness. Many studies, especially in India, have demonstrated the ability of *Apis cerana* to pollinate a wide range of agricul-

tural crops. Further studies on the foraging behavior of this bee species will lead to a better exploitation of its pollination efficiency and thus help in productivity of agricultural crops (VERMA, 1990, 1991).

Introduction of *Apis cerana* to Europe and America

There is now an increasing interest, among the western bee scientists and beekeepers, of the Asian hive bee, *Apis cerana*, because of the recent problem of the Varroa mite in European *Apis mellifera* and also because of the danger of the diffusion of Africanized bees to the northern hemisphere. New technologies in molecular biology will present opportunities to introduce genes that code for desirable characteristics of *Apis cerana* into the population of *Apis mellifera* and vice versa. *Apis cerana* could be of a great importance to beekeeping in developed countries. However, the introduction of *Apis cerana* into Europe or America would require rigorous testing and monitoring:

— Identification of commercially valuable subspecies/geographic ecotypes of *Apis cerana*, in its native habitat.

— Further selection and testing of the stock on offshore islands.

— Zonation of areas in each country, for *Apis cerana* and *Apis mellifera* beekeeping. Such zonation has been very successful in China and India. It would solve the problem of inter-species competition and both species could be complementary to each other.

Introducing *Apis cerana* would be quite expensive, but, if successful, it would be only a fraction of its values as a crop pollinator and producer of high quality, organic hive products. In addition, *Apis cerana* would fit in a better way than *Apis mellifera* to alternative sustainable farming systems strategies now being introduced in developed countries.

***Apis cerana* Research in ICIMOD**

The mountain system programmes at the international Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal are aimed at the search for such non-land based activities or options in the context of the continuous development of the mountain agriculture in terms of resource base availability, resource use/management practices, and production flow. Within this context, ICIMOD has identified beekeeping as one such income and food generating activity which offers several comparative advantages, with positive ecological consequences. For the last years, this centre has reviewed the status, scope and strategies for beekeeping development in South and South East Asia, in general, and in the Hindu Kush-Himalayan countries in particular (VERMA 1990, 1991). Recently, ICIMOD had its the regional project on the genetic diversity of *Apis cerana* sanctioned by the United States Agency

for International Development (USAID). The major objective of this project is the conservation of *Apis cerana* through the development and promotion of beekeeping with this native bee species with major thrust on morphometric analyses, mitochondrial and nuclear DNA polymorphism, behavioural and apiary management research. This research project is the first of its kind in which coordinated efforts, at a regional level, will be made by connecting all major beekeeping institutes of Hindu Kush-Himalayan countries. It is hoped that the results of this research project will provide a base for the further improvement of useful subspecies/ecotypes of *Apis cerana* through classical and molecular techniques and appropriate apiary management practices.

REFERENCES

KOENIGER, N. (1982) — In Breed, Michner and Evans (ed). The Biology of Social Insects

MATTU, V.K., L.R. VERMA (1983) — *J. Apic. Res.* 22:79—85

MATTU, V.K., L.R. VERMA (1984) — *J. Apic. Res.* 23:117—122

MATTU, V.K., L.R. VERMA (1984) — B *J. Apic. Res.* 23:3—10

RUTTNER, F. (1987) — Biogeography and Taxonomy of Honeybees. Berlin: Springer Verlag

RUTTNER, F., V. MAUL (1983) — *Apidologie* 14:309—3240

SINGH, M.P., L.R. VERMA, H.V. DALY (1990) — *J. Apic. Res.* (in Durch)

VERMA, L.R. (1990) — Beekeeping in Integrated Mountain Development: Economic and Scientific Prespectives. Oxford and IBH Publishers, New Delhi, India

VERMA, L.R. (1991) — Honeybees in Mountain Agriculture. Oxford IBH Publishers, New Delhi, India

Adrese of autores:

L.R. VERMA

International Center for Integrated Mountain Development

P.O.B. 3226

Kathmandu

NEPAL