STINGLESS BEE REARING AS AN ACTIVITY FOR SUSTAINABLE DEVELOPMENT

M. CORTOPASSI-LAURINO, V.L. IMPERATRIZ-FONSECA, H.W. VELTHUIS, P. NOGUEIRA-NETO

Dep. de Ecología, Instituto de Biociencias, Universidade de S. Paulo
Rua de Matão, travessa 14, 321, CEP 05508-900 S. Paulo, BRAZIL
E-mail: mclaurin@usp.br; vlifonse@usp.br; hhwvelthuis@hotmail.com

Introduction

1. The importance of bees for the mankind; a study case

"In the discussions of sustainable development it is generally agreed that nature still harbours large number of organisms potentially important for the mankind. Their profitable use is only waiting the discovery of their value, or the formulation of the way they should be multiplied. Concerning the more than 20,000 species of bees, there is the recognition that all have a certain role in pollination, leading to the production of seeds and fruits, and that the various morphological differences among these species (such as their body size, the absolute and relative tongue length) are related to a certain degree of specialization for the rather varied flower types.

...The future use of many undiscovered pollinators depends on the establishment of methods to breed them in the necessary quantities. The time needed for such a development is generally underestimated.

...From the point of view of nature conservation, it is most enjoyable that also the commercial breeders nowadays rely largely in their own production of queens and males for the next generations. This circumvents the escalation of the conflict concerning mass collection of mated queens in the field. At the same time, the possibility of such conflicts might be a warning for future introductions of new pollinators: if there would be an economic success without a sufficiently developed breeding technique, the balance of the invention would soon skip to the negative side”

VELTHUIS, in press (the historical background of the domestication of the bumblebee, Bombus terrestris, and its introduction in Agriculture).

The successful use of Bombus terrestris as agricultural pollinators was a result of joining of academic researchers, experienced breeders and tomatoes growers. It began in 1985, when DE JONGHE placed bumblebees in a greenhouse in southern part of Holland. The grower trusted the breeder, to the later greater delight of both of them. The grower got record prices for his produce in the market. In a few years, in the Low Countries, there was hardly a tomato grower left that still used pollination through artificial vibration, more expensive and less effective. Tomatoes pollinated by bumblebees have different taste, leading to a more juiced product with higher sugar contents. A breeding industry rapidly developed. The international market for the agricultural product demands from equal chances, and therefore importation of bumblebee colonies began also in some Latin America countries (VELTHUIS, op. cit.). Nevertheless, there are reports about the value of bumblebees as pollinators: for each dollar invested in bees, the return is US$100 in tomato crops (data from Australian researchers, press release of APIMONDIA Congress 1999).

Today, there are references in literature on the negative impact of such introduction if native pollinators are considered (DAFNI et al., submitted). We have to look for our native pollinators that can be used for the same job.

2. Honeybees using for sustainable development

Projects on bees rearing as a solution for sustainable development have been proposed, and sometimes developed, with honeybees. Nevertheless, in Brazil the Africanised honeybees are a species that complete strongly with the other native bee species for food sources. They are very good honey and propolis producers, but of course an increase in their number interfere in biodiversity centers, if we are in National Parks or in other conservation units.

Africanised honeybees generally use intensively some expressive floral sources. They communicate their choice to their nestmates, and mark flowers with pheromones. Their ability to store food is high, as well as their capacity to adjust the food availability to development of nest population and of new swarms. They produce a high amount of honey and pollen. Propolis gives a higher income, and wax trade is almost not developed yet. Nevertheless, the higher profit of the honeybee use for mankind is an general pollinators, because 1/3 of our diet comes from plants pollinated by bees.

Until recently there were no comparative data on relative abundance of honeybees, stingless bees and solitary bees in flowers. Several bee surveys have been done in Brazil after 1960, but in most of them honeybees were not counted, because at first glance the interest was the knowledge of new species of bees (PINHEIRO-MACHADO et al., in press). When honeybees were also considered, it was verified by WILMS et
al. (1966) in Boracéia Biological Station that the most common bees species collected in flowers during 3 years were Africanised honeybees (23%), inside the Atlantic Rainforest. In our University Campus, located in São Paulo, a city with more than 18 millions of inhabitants, the percentage of honeybees collected on flowers was also similar (KNOLL, 1992). They come from feral nests, spread everywhere. The Africanised bee also has the same size of most of the bigger Melipona bees, whose number visiting flowers is much smaller.

When arrived, the African honeybee competed for nests sites with stingless bees, mainly in tree hollows. One very interesting comment on this problem comes from Father BRUENING, a stingless bees breeder in Mossoró, Northeast Brazil. He told in his book (1990) on the bee Melipona subnitida that in the same day in early sixties several swarms arrived, killing weak colonies of stingless bees, as well as parrots and other birds with their brood in the hollow trees. Excellent foragers, they could spread out their population through rapid swarm formation, as well as depart in another kind of swarm when environment was not good enough for their development. It was taught that Africanised honeybee could not survive inside forests because of their high humidity, but this was only a wrong evaluation.

It was around 1978 that a parasite, the Varroa mite, appeared in the Brazilian colonies. This has been a big problem in many counties, mainly in cold regions. Nevertheless, in Brazil the hygienic behaviour of our bees and the climate (GONÇALVES et al., 1997) diminished this impact. Honeybees are still very competitive.

Considering the balance of activities between generalist and specialist pollinators, for long date honeybees have been used as generalist pollinators for most of the crops. The main reason is that breeding technology and management is well known, and pollination is accompanied by pollen or honey production as well.

Stingless bee rearing

In Northeast Brazil, there is a tradition in stingless bees breeding using several species of bees: Melipona subnitida, Melipona assimilis, Melipona mandassia, Melipona scutellaris, Melipona rufiventris, Melipona cumpressipes, Scaptotrigona sp., etc. The breeding system generally is very primitive, but hives are kept in families for long time, sometimes more than 50 years. Regional breeding systems have been established long time ago. Nowadays, a very successful rearing “industry” is arisen, with a new technique of making small colonies with a new fertilized queen, 50 workers and some food pots. Those nests are sold and sent by post to all country, resulting in several questions in the electronic discussion list concerning species introduction, genetic variability in population, survivorship under unfavourable conditions, competition among introduced and local species, among others.

Recently, the poor dry Brazilian areas have been damaged by the intense use of their resources, including here the firewood crops. The trees used by stingless bees as nest sites are becoming rare, as well as their food sources. Nevertheless, the honey prices are much higher for stingless bees than for honeybees, and used as medicine for these rural populations. The old tradition of rearing the native species still can be found.

Stingless bees rearing became also a very popular activity among beekeepers. The global movement around Ecology, Nature and Conservation created a market for nature observers. In this case, stingless bees are very useful for the facility of keeping, breeding, observing, and understanding ecological rules. A market for nests of stingless bees arose, and as a consequence breeding techniques are developed (NOGUEIRA-NETO, 1997). Besides, the Brazilian environmental laws are very severe, what also improves breeding. Recently, at the Brazilian Beekeeping Congress, held in Bahia in 1998, the interest in stingless bees was very strong, and some leaders that live only by selling stingless bees nests did their very good business. It is interesting that Universities are good customers for them: in the research laboratories there is no tradition on bee breeding, but of bees using.

The importance of stingless bees as pollinators was recently reviewed by HEARD (1999). In Australia they are already used by beekeepers for crop pollination (HEARD, 2000). CASTRO (in press) showed the role of local Brazilian stingless bees in several fruit trees pollination in Atlantic Rainforest from Bahia State. MALAGODI-BRAGA et al. (2000) reviewed the use of stingless bees in crop pollination, and showed their efficiency in strawberries pollination.

In Brazil, stingless bees from genus Melipona have buzz pollination, what make them strong candidates for the substitution of bumblebees as tomatoes and sweet peppers pollinators. Our bumblebees species are very aggressive, and difficult to manage for greenhouses pollination purposes.

Breeding of stingless bees includes the knowledge of bee plants; nest sites preferences, reproductive biology. Laboratory rearing conditions are generally artificial, although bees forage in the environment, but are very useful for experiments.

In natural environments, nests development, genetic structure and genetical improvement for certain characteristics can be better studied, as well as the quality of pollen resources for the establishment of new colonies. The accumulation of knowledge about breeding necessarily involves hobbyists, with cultural
transmission between generations or breeders, besides scientific work, performed at the Universities and other Research Centres.

Stingless bees breeding can be an activity of sustainable development. Breeding of local species generally do not damage environment, nor modify the pollination degree of local botanical species. The community of stingless bees is generally formed by 10 or more local species and they have different strength according to environmental conditions. The advantage of local rearing is of knowing about genetic mating variability and nest relatedness under natural conditions (through DNA analysis). The local food resources also help in the colony maintenance and quality, as well in honey, pollen, wax and resin production. Two subjects will be our priorities: reproductive biology and nuclear-nests development (the small nest that can be turned in a good colony). In the bumblebee project, one problem for the breeding company was to deal with the sex ratio of the colonies, generally male-biased. This is also true for stingless bees, although not quantified, and one of the aspects that are studied at USP laboratory in São Paulo as well in field conditions.

New colonies can also be formed using fertilized queens exchange or queen manipulations; because of this, we will test possibilities for queen rearing, fertilization under controlled conditions and development of new colonies.

Research priorities for the near future

• To develop breeding techniques and interest of local communities for the breeding of stingless bees as an activity of sustainable development;
• To develop techniques for stingless bees honey storage;
• To evaluate the possibilities of stingless bees as pollinators of agricultural importance;
• To provide the community with educational material for stingless bees breeding and use for educational purposes and for hobbyists;
• The big goal for using native stingless bees for sustainable development will be the creation of breeding capacity, where the male biased sex ratio of the colonies in nature will be our main richness.

What must be changed

• The bee nests extraction and predation, regarding the honey and pollen collection suited by killing of the bees, a normal practice in the populations that are not aware of stingless bees economic value, breeding and biology;
• The establishment of a new incomes with stingless bees breeding by the local inhabitants, with the help of a research team (maybe in a cooperative system);
• To improve participants with abilities for environmental restoration through the comprehension of nature rules and interest of planting trees that serve as nest sites and food resources for the bees, as well and other for using as firewood crops, mainly in border areas, in urban and agricultural areas;
• To provide a central point for trading natural products as wax, honey, pollen;
• Leadership training.

The project developed by São Paulo University, Paraíba Federal University and ADEMASP, a Brazilian NGO, related with stingless bees keeping as activity of sustainable development (http://www.ib.usp.br/jandaira) brings together scientists, breeders and hobbyists. We have the feeling that we are in the same way of bumblebees program related to their use as pollinators. The University, applied later to tomatoes (and other crops) breeders, will evaluate the value of Melipona in buzz-pollinated species. Educational material is also being prepared through the electronic net, for species recognition (http://www.ib.usp.br/beetaxon; http://www.ib.usp.br/beelife; http://www.ib.usp.br/beeplant; http://www.ib.usp.br/didactic) and general biology, for attaining hobbyists and educating children. The communication system through Internet is well developed in our country, what also allowed the improving of a discussion list on bees and their use (http://bdt.org.br/listas/beebr). Besides, a technical cooperation with Polytechnic School at São Paulo University resulted in an internet-based monitoring system for behaviour studies of stingless bees (CUNHA et al., 2001), that will help a lot in the biological monitoring and evaluation of colonies in nature.

Additional programs of stingless bees and honeybees rearing by Kaiapos indians are being established by another ONG, Instituto Socioambiental, in Xingu, with the technical support from APACAME, the very well organized and active beekeeping association from São Paulo State. Several technical questions arose from this project, and it is clear that we need to develop an evaluating system for analysing competition level among stingless bees and honeybees in natural areas.

Conservation of native bees will be possible only with the support of local populations. Honey hunters must be trained to be beekeepers, nestsite trees must be planted and bee flowers grew. Products
honey, swarma, wx, resin) need further studies for application; nevertheless, the high prices and sustainability of this activity will be attractive for people living in protected areas as incomes. In this, sense, the improving of links between beekeepers and researchers will be very important. This is a relevant initiative for sustainable development of people living in preservation areas, whose results will give support for other broader projects.

REFERENCES

Castro M., in press-Bees and Fruit Pollination in Brazil. In: Kevan P. & Imperatriz-Fonseca eds., Pollination bees: a link between Agriculture and conservation. EDUSP/IBRA
Dafni A., Kevan P., Gross C. & Imperatriz-Fonseca, VL Bombus terrestris, pollinator, invasive and pest: an assessment of problems associated with its widespread introductions for commercial purposes (submitted)
Heard T., In the Role of Stingless bees in crop pollination. Anu. Rev. Entomol. 44 (1999), 183-206
Knoll, Abundância relativa, sazonalidade e preferências florais de Apidae em uma área urbana. Tese de Doutoramento. Instituto de Biociências da universidade de São Paulo, 1992, p. 127