BIOTA-FAPESP PROGRAM

BIODIVERSITY AND SUSTAINABLE USE OF POLLINATORS, WITH EMPHASIS ON BEES

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FAPESP Grant 2004/15801-0 I Term: May 2006 to May 2010

The Convention of Biological Diversity and the United Nations Millennium Assessment Program considers environmental services provided by pollinators as a priority for the 21st century. Conservation and sustainable use of pollinators helps to ensure food security, sustainable agriculture and biodiversity conservation.

The main focus of this four-year project is to study the biodiversity and conservation of bees, as well as their sustainable use as pollinators. To address these questions, we have been using molecular tools, bee surveys, trap nests, baits, pollinic analysis, biodiversity informatics for species distributions, ecological modeling, automatic identification of species through wing venation, artificial diets for colonies improvement, *in vitro* queen rearing and experiments in pollination.

Queen and workers of Melipona scutellaris. *Oldroyd BP, Beekman M. Intergenerational reproductive parasitism in a stingless bee.* Molecular Ecology. ***18****: 3958-3960*

Stingless bee, Melipona fasciculata *(Apidae), collecting pollen by vibration in eggplant (*Solanum melongena *L., Solanaceae). Nunes-Silva P, Hnrcir M, Imperatriz-Fonseca VL. 2010. A polinização por vibração.* Oecologia Australis. ***14****: 140-151*

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

Solitary bees were sampled in remnants of Atlantic Rainforest by trap nest and baits methods and the pollinic analysis has allowing the knowledge improvement on floral resources used by females to feed their offspring. The molecular analysis has brought new insights on the conservation *status*, as showed by the genetic variability, gene flow and the patterns of dispersion, mainly for the orchid bee populations.

Concerning the social bees, our current knowledge about the biology of stingless bees has a pronounced improvement. We highlight the study of small managed populations of stingless bees, where, despite a great reduction in the genetic variability, the genetically impoverished population can be successfully bred, providing useful guidelines for stingless bee breeding and conservation efforts. Indeed, we have provided genetic evidence showing that: 1) upon loss of the mother queen, many colonies are invaded by unrelated queens that fly in from unrelated hives nearby and 2) some reproductive workers greatly outlive all other workers and lay male eggs for a long time. These very innovative studies opened a new area of investigation, and showed how powerful and fundamental are the molecular studies to address basic biological questions.

The next important results with stingless bees were the development of a methodology to rear *in vitro* queens. It allows the production of large amount of colonies in laboratory conditions, in order to provide the market with bees to be used in greenhouse pollination. To address this question, we showed that eight Melipona species are very good candidates for pollination of agricultural crops, since they are very effective in buzz pollination and are efficient pollinators for several crops. All these results summarizes that the breeding of stingless bee species, in large scale, is therefore of great importance for the use in agriculture, as well as, for the conservation of natural biodiversity in the tropics.

Biodiversity informatics tools were developed and used throughout the project. A monitoring system was developed to allow data acquisition inside the colonies to study thermoregulation and flight activity. Wireless sensor networks technology was also studied aiming at the development of a new generation of monitoring systems. We demonstrated the importance of geometric morph metrics based on wing features to identify bee genera, species, subspecies and populations, opening the possibility to track the geographical origin of the bees. We used the species distribution modeling and geographical system information tools in order to analyze the influence of different factors that act in the geographical distribution of Neotropical bees and plants presenting obligatory interactions. Also, our data has shown a general increasing in the models' accuracy and has appointed future scenarios projection, considering climate changes.

MAIN PUBLICATIONS

Alves DA, Francoy TM, Imperatriz-Fonseca VL, Santos-Filho P, Nogueira-Neto P, Billen J, Wenseleers T. 2009. The queen is dead – long live the workers: intraspecific parasitism by workers in the stingless bee *Melipona scutellaris*. *Molecular Ecology.* **18**: 4102-4111.

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Francoy TM, Grassi ML, Imperatriz-Fonseca VL, May-Itzá WJ, Quezada-Euán J. 2011. Geometrics morphometrics of the wing as a tool for assigning genetic lineages and geographic origin in *Melipona beecheii* (Hymenoptera, Meliponini). *Apidologie*. DOI 10.1007/s13592-011-0013-0

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