

**A. Title of Proposed Project: Pollinator/Visitors plant associations: an implement for LEACOL bee collection**

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**Title: Pollinator/Visitors plant associations: an implement for LEACOL bee collection (S. Luís, Brazil)**

**Título: Associações entre plantas e visitantes florais/polinizadores: um implemento para a coleção de abelhas LEACOL (S. Luís, Brasil).**

**Resumo**

A coleção entomológica do Laboratório de Estudos sobre Abelhas (LEACOL) iniciou-se na década de 80 quando o Prof. Dr. João M. F. de Camargo (FFCLRP-USP) permaneceu no Maranhão por ocasião da criação do Curso de Ciências Biológicas da UFMA. Trata-se de uma coleção de âmbito local, mas também abriga exemplares doados de outras regiões do país. Consta de aproximadamente 25.000 espécimens e 260 espécies identificadas por especialistas. As abelhas foram coletadas, na sua maioria em levantamentos anuais em regiões de cerrado, cerradão, dunas, restinga, floresta secundária e floresta pré-amazônica. Além de exemplares obtidos em coletas ocasionais e ninhos provenientes de várias localidades e em estudos de ecologia da polinização principalmente de espécies produtoras de óleo, como o murici, *Byrsonima crassifolia* (Malpighiaceae). Em cadernos de campo referentes a estas coletas sistemáticas temos dados adicionais das plantas em que estas abelhas foram coletadas, sexo, localização geográfica (ver tabela 1). Estes dados são relacionados a 15061 exemplares. A coleção é utilizada por professores e estagiários do Laboratório, servindo como material de referência para identificação das espécies provenientes de novos inventários, bem como para estudos biológicos. Esta solicitação visa à digitalização dos dados dos espécimens provenientes desses inventários e demais espécimens depositados na LEACOL.

**Project Summary:**

The entomological collection of the Bees Studies Laboratory (LEACOL) started up in the 80's when Prof. Dr. João M. F. de Camargo (USP-FFCLRP) remained in Maranhão during the Biological Course creation at the UFMA. This is a local collection, but also have specimens donated by other regions of the country. With approximately 25,000 specimens, among them 260 species, identified by specialists. Those bees were collected, mostly in annual bee surveys in cerrado fragments, cerradão, sand dunes, restinga, secondary forest and pre-Amazon forest, as well as, in occasional bee collections in several areas, bees gotten from their nests and in studies of pollination ecology mainly of oil-producing species, such as Murici, *Byrsonima crassifolia* (Malpighiaceae). In field books for these surveys, we have also additional data on the flowers where some bees were collected, available for 15,061 specimens (see table 1). The collection is used by teachers and trainees of the Laboratory, as a reference material for species identification from new surveys as well as for biological studies. This proposal aims to digitalize the specimens data from these surveys and other specimens deposited in LEACOL.

**Title: Pollinator/Visitors plant associations: an implement for LEACOL bee collection (S. Luís, Brazil)**

**Project description**  
**INTRODUCTION**

The composition and distribution studies of Apoidea in Maranhão, are still incomplete. The first records of Apoidea in the north and northeast of Brazil, were made at the beginning of the century, by Ducke (1902, 1906, 1907) during his botanical and entomological holdings. Despite the limitations of these times, data from Ducke provide important informations about the pattern of distribution of some species.

In 1967, Sakagami and cols proposed a standard methodology for sampling bees visiting flowers, that consists in defining transects or areas to be sampled, where bees are collected with entomological nets on flowers or near the flowers, during a standard period (some minutes), all day long, during seasons or a year round. At the beginning of the 80's the systematic investigation of Maranhão' bees fauna started, resulting in a solid estimating on the composition of the bees communities, even with the north region of the state much better represented. The majority of informations resulting from these bee surveys are unpublished graduation monographs (for a review, see Rebêlo *et al.* 2003). Data used in these studies are species lists, relative abundance, daily and seasonal activities, bee plants and sometimes phenology of bee plants and bee species. The Bee Study Laboratory Collection (LEACOL) is a local collection, but also have specimens donated by other regions of the country. With approximately 25,000 specimens, among them 260 species identified by specialists. The material is stored in sliding steel cabinets with entomological wood drawers under controlled temperature and humidity. The collection is partially scanned in Excel.

Unlike other Brazilian states, the Maranhão State is located in a transition area between the Amazon forest, the Cerrado of the Central Plateau and the Caatinga of the Northeastern. This individual position gives great importance to the state for the ecological point of view.

**Table 1** shows the kind of data that we propose to add to the databank in this Project. Bees were collected in Maranhão State and are unpublished papers, although some data are related to graduate monographs.

Below, a brief summary of the bee surveys that comprises this proposal:

1. **Bee survey at Secondary forest.** This are two graduation monographs made by Andrea Araújo and Silmary Gonçalves in Alcântara ( $2^{\circ}23'00''$  S;  $44^{\circ}25'00''$  W) from 1992 to 1993. This survey contains climate data besides interactions in flowers. Bees collected: 1340 bees collected belonging to 54 species. Apidae was more abundant, with 80,3% of the collected individuals, followed by Halictidae (12,5%), Anthophoridae (5,3%), Megachilidae (1,5%) and Colletidae (0,45%). Apidae represents 36,4% of the collected species, Halictidae (31%), Anthophoridae (21,8%), Megachilidae (7,3%) and Colletidae (3,6%). Bees were more abundant in the dry season, from July 1992 to January 1993. Bees were captured visiting 35 bee plants, belonging to 21 plant families, which the most abundant were: Rubiaceae (26,2%), Guttiferae (16%), Labiatae (12,3%) and Boraginaceae (10,5%). The Euglossina fauna (Hymenoptera, Apidae) was sampling at the same time in the same area using aromatic compounds. 467 male Euglossina were captured belonging to 19 species (Gonçalves *et al.* 1996; Brito & Rêgo 2001).

There were two more surveys at secondary forest sampled for the first time in 1983-1984, and in 1991-1992 both of them made at São Luis ( $2^{\circ}32'S$ ;  $44^{\circ}18'W$ ). The results was 70 species and 1069 specimens. Flowers where these bees were collected, as well as seasons, are available in field books.

2. **Bee survey at Sand dune and Restinga areas.** The bee-plant community in the secondary dunes (30m high) of S Marcos Beach, São Luis, Maranhão ( $2^{\circ}29'S$ ;  $44^{\circ}18'W$ ) was studied concerning phenology and floral preference. A total of 1581 specimens of bees were collected belonging to 36 bee species. The bees visited thirty-three species of 20 families of plants. The most visited species were *Vernonia arenaria* (Asteraceae), *Chamaecrista hispidula* (Caesalpiniaceae), *Passiflora foetida* (Passifloraceae) and *Turnera melochioides* (Turneraceae). Fifty-five percent of plants presented an annual or long flowering period (from 5 to 7 months). The largest number of species blooming was observed from March to August (dry season), corresponding to the period of greatest abundance and diversity of bees. Based on the range of

floral sources used by the dominant bees, three guilds of bees were noted: bees with a restricted range of floral sources: *Melitoma segmentaria*, *Centris tarsata*, *Centris flavifrons*, *Ceratinula* sp.; moderate generalists: *Megachile (Leptorachis)* sp., *Euglossa cordata*, *Augochlorella* sp., *Eulaema nigrita* and *Xylocopa frontalis*; and generalists: *Xylocopa cearensis*, *Apis mellifera*, *Exomalopsis analis* and *Pseudaugochloropsis pandora* (Albuquerque et al. 2007). An additional annual sample was performed in 1999-2000 by Adriana Martins & Emanuella Sousa, in a restinga area at the Curupu Island ( $2^{\circ}24' S$ ;  $44^{\circ}05' W$ ) a very close island from S. Luis (1000 m); data must be analyzed. In this survey, 30 bee species (701 specimens) were found. In 2005/06 Oliveira, Vidigal and Mendonça did another bee collection in a sand dune at Panaquatira beach ( $02^{\circ}28'16.3'' S$   $044^{\circ}03'12.2'' W$ ) that is just in front of Curupu island. 3305 specimens from 31 species of bees were collected. Data must be compared for publishing.

**3. Bee survey in a cerrado area at the West Mesoregion of Maranhão, between the municipalities of Urbano Santos and Barreirinhas.** José Angelo Machado and Ciclene Brito did this survey (1991-1992), published mainly as a graduation monography and one paper (Albuquerque & Mendonça 1996). This is an important area, the closest seaside brazilian cerrado (Eiten personal information). In this survey, 958 specimens belonging to 40 bee species were found.

**4. Bee survey at Cerrado s.l. (“Cerradão”), Chapadinha, Maranhão.** The bee fauna and flora of cerrado vegetation ( $4^{\circ}5' S$ ;  $43^{\circ}30' W$ ) were sampled monthly for one year (Dec/1993-Nov/1994). A total of 1444 specimens and 41 bee species were sampled. Meliponini (1202 spp; 21 sp) was more abundant followed by Centridini (129 spp; 6 sp), Apini (75; 1), Tapinotaspini (22; 3), Exomalopsini (4; 1), Euglossini (2; 1), Xylocopini (02; 1), Ceratinini (01; 01), Augochlorini (01; 01), Megachilini (03 spp; 2sp) and Anthidiini (1 spp; 1 sp). The high density of meliponini was due to the many nests found in the surveyed area, specially *Scaptotrigona* sp. (Rego & Brito 1996).

**5. Bee survey at the Rio Doce Forest Reserve, Pre-Amazon in Buriticupu-Maranhão.** The Amazon forest at Maranhão state – Pre-Amazon - which is the eastern limit of the great forest has been going through an accelerated process of transformation. According to the National Research Institute (INPE), about 60% of its coverage would be degraded. From October 1995 to September 1996, twice a week collecting was performed at the Rio Doce Forest Reserve, Buriticupu. A total of 3398 bee specimens were collected, belonging to 90 bee species. Apidae was more abundant, with 86,6% of the collected individuals, followed by Anthophoridae (7,4 %), Halictidae (6 %), and Andrenidae, Megachilidae and Colletidae (< 1%). Flowers where these bees were collected, as well as seasons, are available in field books. The Euglossina fauna were studied by Francinaldo Silva in the same time and area. 1740 Euglossina males from 37 species were collected (Silva & Rebelo 1999).

**6. Bee survey in Vitória do Mearim, at Maranhão Lowland area.** This is another Graduation Monograph, from Rosilene Ferreira and Cláudia Santos. The bee fauna and flora of a restrict area of the Maranhão Lowland region was studied. Monthly samples were done with entomological nets and baits trap, totaling 288 hours of sampling. A total of 1265 individuals and 61 species were collected. Apidae was more abundant, with 53,3% of the collected individuals, followed by Anthophoridae (35,5%), Megachilidae (8,1%), Halictidae (2,4%), Andrenidae (0,4%) and Colletidae (0,3%). Anthophoridae represents 48% of the collected species, Megachilidae 22%, Apidae 17%Halictidae 10% and Andrenidae and Colletidae (2%). 37 species of plants were visited during this study. The plant families predominantly visited were: Rubiaceae, leguminosae, Malvaceae, Malpighiaceae and Lecythidaceae.

The field books of these surveys are available and must be organized and digitalized. Information therein consists in day of the bee collection, author, hour, temperature, relative humidity, etc., as showed in table 1.

**Tabela I.** Dados associados às 15061 relações entre abelhas e flores em cada um dos levantamentos efetuados no Estado do Maranhão, Nordeste do Brasil. **Table 1.** Data associated to the 15061 registers of relations between bees and flowers in some bee surveys in Maranhão State, north-eastern of Brazil.

DATA		Araújo, 1994; Gonçalves <i>et al.</i> 1996	Brenha, 1986; Rebêlo, 1995; Apocalypse, 1995; Rodrigues, 1996	Albuquerque, 1998	Martins, 2003; Sousa, 2003	Oliveira, 2008;Vidigal, 2008	Brito, 1994; Albuquerque & Mendonça, 1996	Rego, 1998	Pereira, 1998; Pinto,1998	Rego <i>et al.</i> 2000; Albuquerque <i>et al.</i> 2001
<b>Specimens Numbers</b>		1340	1069	1581	701	3305	958	1444	3398	1265
<b>Sample Data</b>	Sample date	X	X	X	X	X	X	X	X	X
	Time	X	X	X	X	X	X	X	X	X
	Collector name	X	X	X	X	X	X	X	X	X
<b>Climate data</b>	Temperature	X	X	X	X	X	X	X	X	X
	Humidity	X	X	X	X	X	X	X	X	X
	Luminosity		X	X	X	X	X	X	X	X
<b>Plant data</b>	Plant Number	X		X	X	X	X			X
	Family	X		X	X	X	X			X
	Genus	X		X	X	X	X			X
	Specie	X		X	X	X	X			X
	Cientif. author name	X		X	X	X	X			X
	Size	X		X	X	X	X			X
	Height	X		X	X	X	X			X
	Flower symmetry			X	X	X	X			X
	Flower colors	X		X	X	X	X			X
	Flower number/ plant	X		X	X	X	X			X
	Plant hab (tree, shrub, herbs, creeper, subshrub)	X		X	X	X	X			X
<b>Taxonomic Specimen data</b>	Family	X	X	X	X	X	X	X	X	X
	Subfamily	X	X	X	X	X	X	X	X	X
	Tribes	X	X	X	X	X	X	X	X	X
	Genus	X	X	X	X	X	X	X	X	X
	Subgenus	X	X	X	X	X	X	X	X	X
	Scientific name author	X	X	X	X	X	X	X	X	X
<b>Taxonomic identification Information</b>	Id people responsib	X	X	X	X	X	X	X	X	X
	Identification date	X	X	X	X	X	X	X	X	X
<b>Another Information</b>	Sex (male or female)	X	X	X	X	X	X	X	X	X
	Common name	X	X	X	X	X	X	X	X	X
<b>Geographic information</b>	Locality	X	X	X	X	X	X	X	X	X
	Ecosystem	X	X	X	X	X	X	X	X	X
	Municipality	X	X	X	X	X	X	X	X	X
	State	X	X	X	X	X	X	X	X	X
	Country	X	X	X	X	X	X	X	X	X
	Longitude	X	X	X	X	X	X	X	X	X
	Latitude	X	X	X	X	X	X	X	X	X

### **Proposed outcome of this project**

In this proposal a databank will be formed for data on bees that belong to the LEACOL bee collection. This information will be available on line in [www.lea.ufma.br](http://www.lea.ufma.br) or/and webbee or/and other database.

**Innovation:** Probably will be one of the first collections to have these data available on line.

**How the success will be measured:** number of registers digitalized, number of access to the data (on line).

**Value to Brazil and to Federal University of Maranhão:** The LEACOL is a very important regional collection and made this collection on line will be very important for other Scientifics communities not only in Maranhão state but also in the country.

**User communities in Brazil interested in the product of this project:** academics, beekeepers, meliponiculturists, and farmers.

**Complementarities:** This database will be updated with the support from other projects to be submitted to the Brazilian agency FAPEMA. If changes are made, this will be automatically updated and available on line.

### **Quantifiable Performance Indicators**

Activities	Month 2	Month 4	Month 6	Month 8	Month 10	Month 12
Digitize 15,061 specimens bees plus their associated plants	2,500 specimens digitized	5,000 specimens digitized	7,500 specimens digitized	10,000 specimens digitized	12,500 specimens digitized	15,061 specimens digitized

### **References**

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## **Work Plan- project budget**

1. Preparation of database to support the specific data to be input : US\$2.000,00
2. Digitalization : US\$3.000,00
3. Preparation of interface to serve data to IABIN, using the Darwin Core extension (under definition): US\$2.940,26
4. Training- US\$2.000, 00.

Item	IABIN	“Matching funds”	Total
Operating costs: Preparation of database	US\$2,000.00	US\$2,000.00 (FAPEMA)	US\$4,000.00
Digitalization	US\$3,000.00	US\$3,000.00	US\$6,000.00
Training	US\$2,000.00	US\$2,000.00	US\$4,000.00
Preparation of Interface	US\$2,940.26		US\$2,940.26
Salaries of Profs Marcia Rêgo and Patricia Albuquerque (15 hs / week)		US\$2,967.65	US\$2,967.65
<b>Total</b>	<b>US\$9,940.26</b>	<b>US\$9,967.65</b>	<b>US\$ 19,907.91</b>



# REPÚBLICA FEDERATIVA DO BRASIL

## CADASTRO NACIONAL DA PESSOA JURÍDICA

NÚMERO DE INSCRIÇÃO 06.279.103/0001-19 MATRIZ	<b>COMPROVANTE DE INSCRIÇÃO E DE SITUAÇÃO CADASTRAL</b>	DATA DE ABERTURA 18/01/1971
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NOME EMPRESARIAL <b>FUNDACAO UNIVERSIDADE FEDERAL DO MARANHAO</b>
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TÍTULO DO ESTABELECIMENTO (NOME DE FANTASIA) <b>UFMA</b>
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CÓDIGO E DESCRIÇÃO DA ATIVIDADE ECONÔMICA PRINCIPAL <b>85.31-7-00 - Educação superior - graduação</b>
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CÓDIGO E DESCRIÇÃO DAS ATIVIDADES ECONÔMICAS SECUNDÁRIAS <b>Não informada</b>
--

CÓDIGO E DESCRIÇÃO DA NATUREZA JURÍDICA <b>101-5 - ORGÃO PÚBLICO DO PODER EXECUTIVO FEDERAL</b>
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LOGRADOURO <b>PC GONCALVES DIAS</b>	NÚMERO <b>351</b>	COMPLEMENTO
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CEP <b>65.020-240</b>	BAIRRO/DISTrito <b>CENTRO</b>	MUNICÍPIO <b>SAO LUIS</b>	UF <b>MA</b>
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SITUAÇÃO CADASTRAL <b>ATIVA</b>	DATA DA SITUAÇÃO CADASTRAL <b>04/04/2001</b>
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MOTIVO DE SITUAÇÃO CADASTRAL
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SITUAÇÃO ESPECIAL *****	DATA DA SITUAÇÃO ESPECIAL *****
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Aprovado pela Instrução Normativa RFB nº 748, de 28 de junho de 2007.

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