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URBAN ENTOMOLOGY IN BRAZIL: SHORT HISTORY, BIG CHALLENGES, GREAT MEN

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Abstract Brazil occupies nearly half of South America and is the fifth largest country in the world by geographical area. Brazil's biodiversity reserves are the greatest in the world and urban pest diversity is not any different. It is estimated that 85 percent of the inhabitants in the country live in urban areas where urbanization processes have been chaotic in many regions. Tropical diseases are still common. Since the beginning of the 20th century Brazilian scientists have studied the transmission of the diseases by vector borne diseases, their distribution and biology. Research groups have been established throughout the country and research has been conducted on insects, mammals, and birds. In this work we report the most prominent researchers and the current research on urban pests and vector borne diseases in Brazil.
Key Words Vector borne diseases, research centers, urban pests

INTRODUCTION

Brazil is a young country. While in Europe some universities have more than 600 years old, our country is only 511 years old. We are still learning, especially because of our high biodiversity. Biodiversity is also high when the subjects are the urban pests. Most times imported technology does not work and control measures must be adjusted to the Neotropical conditions. The training of human resources, the development of national technology and knowledge on the biology of native and exotic species are the key for maintain human health and environment preservation.

First scientific studies in Brazil in the field of entomology, started with vector borne diseases and their prevention and control measures. The subject is still object of scientific investigations, and Brazil is far from being free from tropical diseases. Current scientific research centers have been dealing with innovative technology using the most modern tools, but government improvements on the mechanisms of preventing and controlling vector borne diseases is fundamental. Industry and academy must think together in order to find solutions for the problems that have an old history but are still updated.

TROPICAL DISEASES AND URBAN PESTS

With urbanization, several diseases which were common in towns nearby forests became a problem in big cities. Garbage and sewage thrown into the rivers and other environments, the introduction of exotic species, besides the absence of government measures for many decades, turned the country into a natural/urban laboratory to be investigated. Brazilian scientists have a great contribution to the science, but the future of urban pest and vector research is promising. There is plenty of work to be done.

In the early twentieth century cities in Brazil faced serious social problems. Infectious and parasitic diseases were the main causes of human deaths. Sanitation was poor and the population was concentrated in urban centers which led to the outbreak of several epidemics, such as yellow fever, bubonic plague and Chagas disease. The transmission of diseases was not yet understandable and Brazilians scientists along others all over the world, started to associate vectors borne diseases with sickness. This led to a change of mentality in both the concern of governments with public health as the population's behavior regarding sanitation, vector control and vaccination.

Since then, great names have come: Oswaldo Cruz (1872-1917), Emilio Goeldi (1859–1917), Carlos Chagas (1878-1934), Belisário Penna (1868–1939), Adolpho Lutz (1855-1940), Arthur Neiva (1880-1943), Vital Brasil (1865-1950). Henrique da Rocha Lima (1879-1956), Ângelo Moreira da Costa Lima (1887-1964), and others. These people changed mentality, concepts, behavior and our history.

THE EARLY 20th CENTURY

In the fields of public health, the turn of the 20th century was marked by an emphasis on insects as transmitters of disease, all over the world. Physicians, bacteriologists and zoologists tried to understand the etiology of diseases like malaria, Chagas diseases and yellow fever. They made an inventory of the species of insects associated with the diseases. Studies focused on their scientific and biological classification and procedures to control epidemics were established (Sanjad, 2003).

Several researchers started at that time their studies. Oswaldo Cruz was the pioneer in the study of tropical diseases and experimental medicine in Brazil. According to the American historian Nancy Stepan, he was the pioneer of the Brazilian science.

Oswaldo Cruz founded in 1900 the Sero-therapeutic National Institute in the district of Manguinhos in Rio de Janeiro, later named Oswaldo Cruz Institute. His studies on the malaria and yellow fever transmission and vaccine campaigns against the yellow fever, is until today an example of persistence and organization.

Carlos Chagas, a young physician, who worked along Oswaldo Cruz, discovered in 1909 the *Tripanossoma cruzi* in a nine years old girl. He associated the protozoan presence in humans with the kissing bugs (Triatominae).

Scliar (2008) describes Chagas´ 'triple discovery' (vector, pathogen infection and human) that celebrated the 'great achievement' of the Brazilian science. Chagas´ first distrusts initiated when he was designated to travel to the interior of the country. The Central Railroad of Brazil participated in a huge project: to unite, by railway, north and southeast of Brazil, Belém do Pará to Rio de Janeiro. The work, however, had stalled - because of the usual malaria, especially around Lassance, a very small town. When Carlos Chagas arrived in the town, he found many sick people, but few of them with Malaria symptoms. There were even many cases of heart failure, and there were also cases of sudden deaths, probably by the same cause. At that time most deaths were attributed to cases of syphilis. And this could even be happening in Lassance. But Carlos Chagas, with his investigative spirit, decided to go further. He realized that the region was infested by kissing bugs and with his experience with malaria; he soon investigated the insects and discovered the presence of a parasite, which later he named *Trypanosoma cruzi*. Chagas decided to verify experimentally in monkeys, the ability of this parasite to infect mammals. But the monkeys in the region, often infected, were not suited for it. Then he sent some infected triatomines to Oswaldo Cruz, asking him to try to infect his monkeys in the laboratory - which did Oswaldo. Several days passed, then came the message from Manguinhos, one of the monkeys became ill. Chagas left to Rio de Janeiro to identify the trypanosome in. The infection of mammals by *T. cruzi* was confirmed. But what about human infections?

On February 14, 1909, a nine month old girl, Berenkce, was brought to the arbor where Chagas patients were attended. The girl had high fever and edema on the face and body. The case was not similar to other patients in Lassance. Chagas decided to investigate her blood under a microscope and there was the *T. cruzi*. It was the first event that proved the association of the parasite with the disease - and thus Chagas completed an extraordinary work in medicine, he discovered a new disease, identified the causative agent and its transmission mechanism. Later in 1912 two other researchers in a seven thousand kilometer expedition around Brazil, reported the territorial extension from the disease. Arthur Neiva and Belisario Penna attributed to *Triatoma sordida* to be the prevalent vector of the Chagas Disease (Neiva and Penna, 1916).

Adolpho Lutz was another researcher of great achievements who also worked with Oswaldo Cruz. Along an intense activity of research in laboratory conditions, Adolpho Lutz worked on sanitary campaigns, epidemiological studies involving the urban and wild (he foresaw) yellow fever, malaria in swampy areas and also in the mountain forests (he discovered), cholera, typhoid and the bubonic pest (Benchimol et al, 2003).

Henrique da Rocha Lima besides contributing to the understanding of the impact of the yellow fever virus on several human organs, especially on the liver, he made a tremendous contribution to the science of the world. Rocha Lima , in 1916 discovered a pathogenic agent in human ticks, called by him as "rickettsias". The pathogens penetrated in the epithelial liver cells and multiplicated clarifying the ethiology, epidemiology and prophylaxis of typhus (Rebouças, 2009).

Several other researchers came along and after those names. Their discoveries are still used until today.

MIDDLE 20TH CENTURY

Urbanization and Urban Pests

The urbanization process in Brazil began in 1940 as a result of economic modernization and industrial development due to the entry of foreign capital in the country. Transnational companies have chosen to settle in cities where the population concentration was greater and with better infrastructure, leading to large metropolises.

Industrialization created jobs for skilled professionals, expanded middle class and the level of urban consumption. The city has become a standard of modernity, creating a rural exodus.

With metropolises men started to deal with the pests that remain until today: Cosmopolitan pests such as rodents, ants, cockroaches and domestic flies and also the tropical leaf cutting ants, spiders, and scorpions started to be a problem, along the vector borne diseases. It was time for pest studies, and some important Research Centers started to focus their attention on them.

Leaf cutting ants were one of the first pests to be studied. They were important agricultural pests, but urban gardens were attacked by those tiny ants that carried leaves and flowers into their nests. Mario Autuori (1906-1982) a disciple of Brother Thomas Borgmeir started his studies in 1936 on *Atta* (saúvas). At that time he was a young scientist at Instituto Biológico and dedicated his studies on the biology and structure of the nests of *Atta* species. Autuori started rearing the leaf cutting ants (*Atta*) in laboratory conditions and his methodology is used until today. His first observations were done in urban leaf cutting nests. For five years he measured and observed workers, nuptial flights. His data are undoubtedly the most precise from any other study on *Atta*. He could evaluate when the first workers were developed, the time queens take to dig the hole to nest foundation and the percentage of success of alate females from mating to nest foundation. Autuori tested several control methodologies against the ants. At that time the phrase by Saint-Hilaire in the 19th century was still in vogue: "Or Brazil ends with the *saúvas* or the *saúvas* end with Brazil".

CURRENT RESEARCH CENTERS ON URBAN PESTS AND VECTOR BORNE DISEASES

Below is a list prepared by Campos and Justi Junior (2011) (www.biologico.sp.gov.br) of the current Brazilian research centers and government agencies responsible for research, technology and control of urban pests and vector borne diseases (Table 1).

Table 1. Current research Centers and Government agencies regarding urban pests and vector borne diseases in Brazil.

Research Center	Research	Location
Centro de Pesquisa do Cacau www.ceplac.gov.br	Urban ants, identification, ants in hospitals, community ecology.	Ilhéus, BA
Fundação Oswaldo Cruz www.fiocruz.com.br	Vector borne diseases strategies of control, support to the Brazilian Ministry of Health	Rio de Janeiro, Pernambuco, Amazônia, Bahia, Minas Gerais, Paraná,
Instituto Biológico www.biologico.sp.gov.br	Urban Pest Management and biology, toxicology, chemical analysis.	São Paulo, SP.
Instituto Estadual do Ambiente www.feema.rj.gov.br	Urban Pest management and control	Rio de Janeiro, RJ
Instituto Nacional de Pesquisas da Amazônia www.inpa.gov.br	Cockroach diversity	Manaus, AM
Museu Nacional www.museunacional.ufrj.br	Cockroach taxonomy	Rio de Janeiro, RJ
Museu Paraense Emilio Goeldi	Ant taxonomy and diversity	Belém, PA
Museu de Zoologia www.mz.usp.br	Ant and Termite taxonomy	São Paulo, SP
Universidade de Brasília http://e-groups.unb.br/ib/zoo/	Termite taxonomy	Brasília, DF

Table 1. continuation

Research Center	Research	Location
Universidade Estadual de Campinas (UNICAMP) www2.ib.unicamp.br/profs/eco_aplicada/ent_medica.htm	Culicidae and Simulidae management	Campinas, SP
Universidade Estadual do Norte do Paraná www.uenp.edu.br	Urban ants	Bandeirantes, PR
Universidade Estadual Paulista www.rc.unesp.br/ib/ceis/	Social Insects	Rio Claro, SP
Universidade Estadual de Santa Cruz www.uesc.br	Microbiology	Ilhéus, BA
Universidade Estadual Paulista www.fcav.unesp.br	Application Technology	Jaboticabal, SP
Universidade Federal de Goiás www.agro.ufg.br	Urban ant diversity	Goiânia, GO
Universidade Federal de Minas Gerais http://www.dpar.icb.ufmg.br/	Culicidae management and control; flea and tick taxonomy; ectoparasites biology and interaction with hosts	Belo Horizonte, MG
Universidade Federal do Paraná www.ufpr.br	Biology and control of Culicidae	Curitiba, PR
Universidade Federal Rural do Rio de Janeiro www.ia.ufrrj.br	Dry Wood and subterranean termites	Seropédica, RJ
Universidade Federal de Sergipe www.ufs.br	Termite Biology and grain pest control	Aracaju, SE
Universidade Luterana do Brasil, Instituto Luterano de Enino Superior de Itumbiara www.ulbra.br/itumbiara	Urban ants – diversity and ecology	Itumbiara, GO
Government Agency	**Mission**	**Local**
Centro de Controle de Zoonoses	Research, prevention, management and control of urban pests and vector borne diseases	At the Brazilian national level
Coordenação de Vigilância em Saúde www.anvisa.gov.br	Research on surveillance and control of urban pests and vector borne diseases	At the Brazilian national level
Ministério da Saúde/Secretaria de Vigilância Sanitária www.anvisa.gov.br	Vector borne diseases strategies of control	Brasilia, DF
Superintendência de Controle de Endemias	Research, prevention, management and control of urban pests and vector borne diseases	At the Brazilian national level

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