BIOENVIRONMENTAL CORRELATES OF CHAGAS´ DISEASE

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Summary

Chagas´ disease is intimately related to sub development conditions of vast zones of Latin America. For that reason we must approach this problem through a transdisciplinary and totalized perspective. In that way we analyze the dynamics of different transmission cycles: wild, yard, domiciled, rural and also urban. The passage from a cycle to another constitutes a domiciliation dynamics even present that takes from hundred to thousands of years and that even continues in the measure that man destroys the natural ecosystems and eliminates the wild habitats where the parasite, the vectors and the guests take refuge.

Also are analyzed the main physical factors that influence the persistence of the illness and their vectors as well as the peculiarities of the rural house of Latin America that facilitate the coexistence in time and man's space, the parasites and the vectors .

Current Chagas' disease transmission is related to human behavior, traditional, cultural and social conditions

1. Introduction

Many human diseases are associated with environmental factors, so they had to be analyzed by a holistic view that considers the relationships between the environment and living organisms. Since this disease is intimately related to sub development conditions of Latin America most factors are economic and political. For that reason in this chapter we will provide a totalized perspective of the disease. In consequence we must approach this problem from a transdisciplinary point of view.

The existence of this disease depends on the convergence in time and place of the etiologic agent, insect vector, hosted animal or human and the susceptible one, within a geographical context that allows the reproduction of the vectors and hostess and the coexistence of them with humans.

So, Chagas´ disease is a complex reality conformed by multiple biological and heterogeneous variables that include from physical factors to the existence of all the biologic members, until the economic and social conditions and cultural concepts that allow the coexistence of humans with vectors. Within the last ones must be included the population attitudes towards the vectors and reservoirs, organization of control services, their operational capacity, research programs, availability of drugs against trypanosomas, the productive capacity of the ecosystems and the cadastre of precarious houses.

2. Biological Members and Transmission Dynamics of Disease

Chagas´ disease is produced by *Trypanosoma cruzi* so, the disease is known as well as American Trypanosomiasis. *T. cruzi* is a protozoon that lives in the blood and organs of humans and other mammals and in the intestine on certain blood – feeders' insects. The insect's vectors (Triatominae) become infected when they feed on a person or mammal who has parasites in peripheral blood. The mechanism of infection is by vector insect's dejections deposited near their punctures loaded with trypanosomas. Parasites cross the skin by excoriations or the mucous.

The parasites circulate in the blood of humans and mammals and penetrate in tissues cellules where they multiply destroying them and producing irreversible injuries. Any organ can be invaded but more exposed are heart, central nervous system and the digestive apparatus.

Infection by sanguine transfusion can be important in some areas of South America because serological studies made on selected blood donation "banks" show 63% of prevalence. Trans placenta or congenital transmission could be important too because rates shows a variation between 2% and 8%.

Less frequent forms of infection are by organs transplants, by skinning infected animals or manipulations on laboratories. Some authors contend that oral route (food contaminated by reservoir feces) could be frequent form of human infection; animals could become infected ingesting infected insects.

Vectors are some species of predatory insects of the family Triatominae. They are a subfamily of Reduviidae (who are plant feeders as leafhoppers, aphids, stinkbugs), suborder Heteroptera (typically called "true bugs" which name comes from their membranous and hard portions forewings), order Hemiptera (from the Greek word for half-wing). They are also known as *conenose bugs, assassin bugs, kissing bugs or triatomines, Mexican bed bug, vinchuca, barbeiro*. All species of this subfamily are hematophageous, i.e. feed on vertebrate blood.

Figure 1. VINCHUCA
T. infestans: *T. infestans* adult (Females 25 to 29 mm and Males 21 to 26 mm).

The mouthpart of these insects is armed with a long, piercing proboscis capable of sucking. The insects feed on many domestic pets and wild animals. However, they are also capable of taking blood meals from humans. Triatominae insects do 5 molts before reaching maturity. All Triatominae nymph instars and adults are hematophagous and require the stability of a sheltered environment where they aggregate.

3. Interconnection of Wild, Peridomestic and Domestic Cycles

Most species of Triatominae have strictly wild habits and lives associated to different animals; some have preference to certain species (birds, edentates, lizards), whereas others do not have defined preference. These "*sylvatic*" or "*wild*" species generally have less numerous populations due to the natural enemies and the seasonal changes of animal populations that constitute their nourishing source. Armadillos (*Dasypus* sp.), opossum (*Didelphis* sp.) bats, raccoons, squirrels, Edentates and Primates (Birds and reptiles do not become infected with *T. Cruzi*) are the main wild infected reservoirs in different parts of the continent. Triatominae aggregate in refuges during day and search for blood during night when the host is asleep and the air is cooler. Odors as well as heat guide these insects to the host. Vision also serves Triatominae for orientation. After having had a blood meal the insects sometimes show a limited mobility, as they are found resting on walls, probably incapable of flight. Birds serve like host for the Triatominae but they do not stop the parasite because Triatominae cannot be developed in their blood. Because of their association with wild animal hosts, interactions with humans are less probable than in areas with urban environment. In consequence in these wild focus humans are not included in the cycle of the infection.

Several sylvatic or wild species are in process of domiciliation ("*semi domestics*"). They frequently invade the yards (hen houses, corrals, rabbit breeders). Goats, rabbits and rats constitute the host of the parasite in the peridomestic focus. These species of Triatominae constitute a potential risk as some have shown tendency to invade the houses. Triatominae bugs usually leave their refuge during the night to search for their host.

Few species of Triatominae live in human dwellings or in the surroundings of human houses (peridomicile), near the shelters of domestic animals; these are denominated "*domestic*" species. This species of Triatominae are hidden during day to avoid the predators and they fed preferably at night during the sleep hours of the settlers. In these cases the cycle of transmission only includes the humans and domestic animals.

Figure 2. Goats' shelter
(Puesto El Cavadito, Province of Mendoza, Argentina). Photo courtesy Carolina Beceyro.

All Triatominae species are potentially able to transmit T*rypanosoma cruzi* to humans but *T. infestans, Rhodnius prolixus, Triatoma dimidiata, Panstrongylus megistus* and *Triatoma brasiliensis* are the most important vectors of Chagas´ disease because they are domestic species.

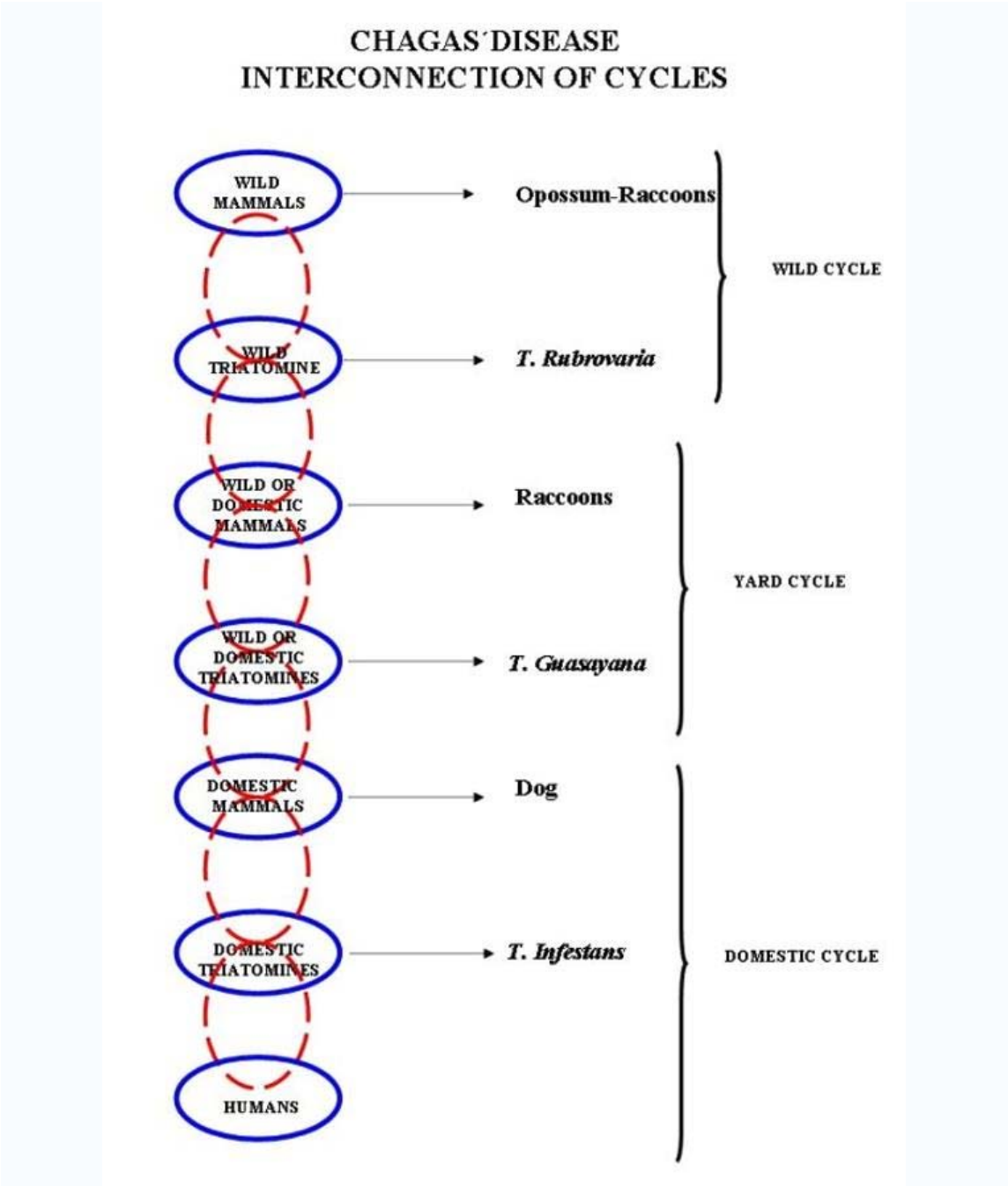

Figure 3. Epidemiologic cycles of Chagas´ Disease

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Biographical Sketch

S.I Curto, Leading Specialist on Chagas Disease, ecologycal and environmental factors. PhD, Geoography. Universidad de Buenos Aires, Argentina. Thesis in Medical Geography, the first one in Argentina on this issue, which obtained the maxima recomendation from the University, and obtained the **"Carlos María Biedma"** Prize, awarded by GÆA Sociedad Argentina de Estudios Geográficos. Bachelor and masters´from Universidad del Salvador, Argentina. Investigador Principal (Leading Researcher) at the National Council for Scientific and Technological Research (CONICET), now working at the National Academy of Medicine, Argentine.

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