

DIPTERA OF TROPICAL SAVANNAS

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Summary

Dipterous are a very much diversified group of insects that occurs in almost all tropical habitats and also other terrestrial biomes. Some diptera are important from the economic and public health point of view. Mosquitoes and sandflies are, respectively, vectors of malaria and leishmaniasis in the major part of tropical countries. Housefly and blowflies are mechanical vectors of many pathogens, and the larvae of the latter may parasitize humans and other animals, as well. Nevertheless, the majority of diptera are inoffensive to humans and several of them are benefic, having important roles in nature such as pollinators of plants, recyclers of decaying organic matter and natural enemies of other insects, including pests.

1. Introduction

Diptera are a very diverse and abundant group of insects inhabiting almost all habitats throughout the world. Although diptera are known mainly for the annoyance they cause or for the diseases they transmit, they also play other different roles in nature, such as: plant pollinators of plants, recyclers of decaying organic material, as a source of food for other animals, predators of other insects, parasitizes of humans and other animals, etc. Larvae of many dipterous develop on or inside vertebrate bodies, causing a morbid condition called *myiasis*. Adults of diverse species are obligate bloodsuckers and may transmit several diseases during the bite. Human occupation, especially on tropical savannas has promoted changes in the insect communities' structures and in the dipterous fauna of these regions. This occupation has created favorable conditions for dipterans parasitize or transmit diseases to humans. Some of these diseases are partially, and in some cases, mainly responsible for human misery in many tropical areas, including savannas and tropical rain forests. Because of this, national and multilateral public health institutions make great efforts to control such diseases. Other species are also responsible for economic losses in the agriculture, fruit culture and cattle raising. Although diptera are the most important insects from the public health point of view, they should also be seen as a group that plays many important roles in nature. This chapter treats only of some of those families whose members are considered to have great relevance to human, mainly in tropical areas throughout the world.

2. General Characteristics

Dipterous generally vary between 2 to 25 mm in length. They present a pair of forewings and a peculiar pair of structures called *halteres* or balancins, located laterally on their third thoracic segment. These halteres are the result of evolutionary modifications of the hind pair of wings that are still present in other kinds of insects. Because the muscles are responsible for flying activity they are more pronounced inside the thoracic median segment, the *mesothorax*. So, diptera present this segment more developed than the other two thoracic segments, pro- and metharorax. The number and disposition of wing veins are very useful characters for separation of diptera into taxonomic groups. Their larvae are multsegmented and do not have thoracic limbs. They are *holometabolous*, passing through egg, larva and pupa forms during their development up to the adult stage.

3. Classification

Order	Suborder	Infra-order	Families
Diptera			
	Nematocera		
		Psychodomorpha	
			Psychodidae
		Culicomorpha	
			Culicidae
			Simuliidae
			Ceratopogonidae
	Brachycera		
		Tabanomorpha	
			Tabanidae

		Muscomorpha	
			Syrphidae
			Tephritidae
			Drosophilidae
			Chloropidae
			Muscidae
			Glossinidae
			Calliphoridae
			Oestridae
			Sarcophagidae
			Tachinidae

Table 1. Classification of diptera

Dipterous are divided into the suborders Nematocera and Brachycera. Mosquitoes and the sandflies belong to the first suborder, while housefly and horseflies belong to the latter suborder. Diptera present about 120,000 described species distributed in 188 families, several of which occur in tropical savannas. The classification presented in Table 1 is a simplified one that has been adopted by the majority of dipterologists:

4. Suborder Nematocera

The Nematocera (Figure 1) have slender bodies and legs, and antennae with more than six segments. Their larvae generally have conspicuous heads and pass through more than three instars until they reach pupae stage.

Figure 1. The female of the mosquito *Culex quinquefasciatus*.

4.1. Psychodidae

Psychodids are minute flies, up to 5mm long, having bodies and wings covered with hair and look like small moths. Their thoraxes are bent ventrally, giving the impression that their heads are fixed at their ventral part. Wings present lanceolate shape and do not overlap each other when the insects are resting. Immature psychodids develop in humid, shady places that contain organic material substrates such as those in jungles soils, caves, animal burrows, tree holes, etc. Immature psychodids are saprophagous and the adults, in their majority, are inoffensive to human beings. Females of the subfamily Phlebotominae, *sandflies*, are haematophagous of reptiles and mammals. Many sandflies feed on humans and may transmit viruses, bacteria and protozoans. Bartonellosis, caused by *Bartonella bacilliformis* Strong et al, is transmitted by sandflies in South American Andin Valley. Leishmaniasis are diseases caused by protozoans of the genus *Leishmania* and are transmitted by sandflies in tropical and subtropical areas. There are four major clinical types of leishmaniasis: cutaneous, diffuse cutaneous, mucocutaneous and visceral. Species of *Phlebotomus* are responsible for the transmission of leishmaniasis in the Old World and species of *Lutzomyia* are responsible for this in the New World.

4.2. Culicidae

The members of this family are called mosquitoes and are slender flies 3 to 10 mm long. Their legs and proboscises are long and slender, as well. Their bodies, including wing veins and legs are covered with scales, which may be different colors. Their larvae and pupae live in natural and artificial aquatic habitats such as: lakes, still waters, tree holes, swamps, pools, old tires and many other habitats. Females of several species are bloodsuckers and hematophagy generally occurs during the twilight or at night or sometimes during the day. Mosquitoes are the most relevant insect group for humans from the public health point of view. They cause annoyance and transmit several diseases. *Anopheles* species are encountered in every biogeographic region, especially in tropical areas. They present scales with different colors forming specific spots on their wings. Larvae and pupae develop in natural habitats such as: lakes, still waters and plant axils. They are responsible for the transmission of malaria in tropical and subtropical areas. Malaria is transmitted mainly in forests of the Amazon basin in South America and in the jungle areas of Southeast Asia. However, 80% of the world's malaria and 90% of mortality due to this disease occurs in Sub-Saharan Africa, mainly in the savanna areas. *Malaria* transmission is seasonal and correlates with relatively predictable patterns of rainfall in some African areas. The main vectors of Malaria in Africa, *Anopheles gambiae* Giles, *A. Funestus* Giles and *A. Arabiensis* Patton are found abundantly in savannas. *Anopheles darlingi* Root and *A. pseudopunctipennis* Baisas are the main vectors in the Americas and the last one is often the only malaria vector in areas above 600 m of altitude. Species of *Aedes* have scales of different colors forming peculiar stripes and spots on their bodies. Females of *Aedes aegypti* (Linnaeus) lay their eggs in artificial habitats containing still limpid water. Their larvae and pupae develop until hit adults in such places as pools, old tires, flowerpots, water tanks, etc. Eggs of this species are resistant and lie dormant through dry conditions, hatching out, when the rainy season begins. Many mosquitoes transmit yellow fever virus in Tropical America

and Africa. The domestic mosquito, *Aedes aegypti* is the vector of dengue and urban yellow fever in both continents. Humans and monkeys are the main infected species with yellow fever virus. The virus is transmitted to animals by the bite of the female mosquito and to the mosquito offspring via infected eggs. Therefore, the mosquito is the virus reservoir, ensuring a supply for transmission from one year to the next. Species of *Haemagogus* are also responsible for transmission of this virus in sylvatic areas of South America. In semi-humid African savannas, mosquitoes transmit yellow fever to humans in many villages and there have been many outbreaks of this disease in recent decades in many African areas. Dengue is nowadays the most widespread and common human arboviral disease, causing thousands of deaths every year throughout the world. Like yellow fever, Dengue virus is also transmitted to mosquito offspring, via infected eggs. *Aedes aegypti* is the main vector of dengue and *Aedes albopictus* (Skuse) is secondary in importance in dengue transmission. *Culex* species are another very important group of mosquitoes. *Culex quinquefasciatus* (Say) (Figure 1) is the major domestic pest in many urban areas of tropical and subtropical areas. This species and *Culex pipiens* Linnaeus, which occurs in the temperate regions of the world, are called the *Culex pipiens* complex that is distributed worldwide. They have similarities in morphology and biology but have different geographic distribution. When their distribution overlaps, they interbreed to form viable hybrids. Birds, humans and dogs are the main hosts from which this complex takes their bloodmeals. Larvae and pupae of *C. quinquefasciatus* develop in highly polluted waters in human environments. The adults are active at night and bite humans when they are in bed. This species is the main vector of *Wuchereria bancrofti* (Cobbold), a filarial round worm responsible for filariasis in humans, mainly in tropical Africa and in South America. Other mosquito species are also vectors of this filarial worm.

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Biographical Sketch

Júlio Mendes is graduated in Biology at Federal University of Uberlândia (UFU), Brazil and received his master and doctor degree from Universidade Estadual de Campinas also in Brazil, where he specialized in Parasitology. He has worked as professor at UFU from 1996 up today. He has been researcher professor of Parasitology and of Medical and Veterinary Entomology in graduate and post-graduate curses of UFU's Instituto de Ciências Biomédicas throughout this period. He has studied biology, epidemiology and control of some dipterans of Medical and Veterinary importance such as the horn fly, blowflies and *Aedes aegypti*. He also has developed studies of Forensic Entomology.