

Parasitoid flies collected in the south Goiás and west Minas Gerais, Brazil

Carlos Henrique Marchiori¹

¹ Instituto Federal Goiano

Abstract

The objective of the present study was to extend the knowledge of the biology of the parasitoid *Nasonia vitripennis* (Walker) (Hymenoptera: Pteromalidae). The pupae were obtained using the flotation method. They were individually placed in gelatin capsules until the emergence of adult dipterous or their parasitoids. Between May 1998 and February 2013, 6.030 fly pupae were collected. In 228 of these pupae, 1105 specimens of *N. vitripennis* were found. The overall percentage of parasitism was 3.8%. *Chrysomya megacephala* (Fabricius) (Diptera: Calliphoridae) was the fly that had the highest percentage parasitism (9.6%). In relation to the hosts collected, the species *Chrysomya albiceps* (Wiedemann) (Diptera: Calliphoridae), *C. megacephala* and *Musca domestica* L. (Diptera: Muscidae) medical-veterinary.

Keywords: Hymenoptera, Diptera, substrates, traps, baits.

1. Introduction

All the representatives of Chalcididae behave as parasitoid and most attack Lepidoptera, Diptera, Hymenoptera and Coleoptera (Grissel and Schauff, 1990). The Chalcididae are cosmopolitan insects with a high diversity in the tropics (Gauld and Bolton, 1988) including approximately 1500 species. They are predominantly solitary endoparasitoids (Gauld and Bolton, 1988).

The Pteromalidae are one of the biggest families of the superfamily Chalcidoidea, with approximately 3100 species. They may be solitary or gregarious, ectoparasitoids or endoparasitoids, primary or secondary parasitoids, or even predators. Most of them develop as solitary or gregarious ectoparasitoids in the larvae or pupae of Diptera, Coleoptera, Hymenoptera, Lepidoptera or Siphonaptera (Gauld and Bolton 1988; Hanson and Gauld, 1995).

Nasonia vitripennis (Walker) (Hymenoptera: Pteromalidae) behaves as gregarious parasitoid is ectoparasitoid in pupae of several species of Diptera families, particularly Calliphoridae, Muscidae, Sarcophagidae and Tachinidae (Rivers and Denlinger, 1995; Schurmanm et al., 2014). It is a polyphagous insect parasite over 68 species of Diptera.

The objective of the present study was to extend the knowledge of the biology of the parasitoid *N. vitripennis* in Brazil.

2-Material and Methods

2.1. Experiment with Human Feces, Cattle Kidneys, Cattle Liver, Fish and Fruit.

The flies were collected by using traps, made of dark cans measuring 19 cm in height and 9 cm in diameter, with two openings resembling blinders, located in the lowest third of the can, to allow flies to enter. The top of the can was connected to a nylon funnel that was open at both ends, with the base pointing down. This was wrapped in plastic bags, so that when they were removed, the flies and parasitoids could be collected. The following items were used as baits: human feces, cattle kidneys, fish, chicken and cattle liver which were placed inside the cans, over a layer of earth. Five traps were used and they were hung on trees at a height of one meter above the ground, two meters apart from each other.

The insects collected were taken to the laboratory, sacrificed with ethyl ether and kept in 70% alcohol for further identification. To obtain the parasitoids, the contents of the traps were placed in plastic containers with a layer of sand for use as a substrate for transformation of the larvae into pupae. This sand was sifted after being in the fields for 15 days and the pupae were extracted from it and were individually placed in gelatin capsules (number 00) in order to obtain the flies and/or parasitoids.

2.2- Experiment with Manure Chicken.

The feces collected originated from 40 “Hyline” chickens that were reared in a cage system. The feces that accumulated under the cages varied in terms of moisture content, ranging from pasty to firm. Fresh feces (pasty), which were collected immediately after emission, were placed in five basins of 30 cm in diameter and 12 cm in height, and were left in an appropriate environment, in a dry location, for 15 days. For extraction of the pupae using the floatation method, the routine procedures for this type of experiment were modified. The parasitoids and dipterous that emerged were identified with the aid of a stereoscopic microscope.

2.3- Percentage of Parasitism.

The total percentage parasitism was calculated by means of the number of pupae parasitized, divided by the total number of pupae collected, and multiplied by 100. The percentage parasitism of each parasitoid species was calculated by means of the number of pupae parasitized per species of parasitoid, divided by the total number of pupae from that host, and multiplied by 100.

3- Results and Discussion

Between May 1998 and February 2013, 6.030 fly pupae were collected. In 228 of these pupae, 1105 specimens of *N. vitripennis* were found (Table 1). The overall percentage of parasitism was 3.8%. This percentage can probably be explained in terms of the availability of resources, the host density and the searching capacity of the parasitoids.

Some species of dipterous included in the infraorder Muscomorpha are of fundamental medical and veterinary importance, since they can produce myiasis (Oliveira et al., 2004) and act towards transmission of pathogens to humans and animals (Chow, 1940; Greenberg, 1971; Ekanem et al., 2013; Marchiori, 2013). These dipterous are potential mechanical vectors for etiological agents such as viruses, bacteria, protozoan cysts and helminths eggs (Greenberg, 1971).

The occurrence, distribution and prevalence of these dipterous in metropolitan areas are factors of great public health importance. In rural areas, these insects can cause decreased egg production and animal diseases and constitute a nuisance for human populations close to the breeding sites (Berti Filho et al., 1996; Couri and Barros, 2010; Ekanem et al., 2013; Marchiori et al., 2014; Velásquez et al., 2013).

Chrysomya megacephala (Fabricius) (Diptera: Calliphoridae) was the fly that had the highest percentage parasitism (9.6%). *Chrysomya megacephala* is often found associated with the modified human environment, in which its larvae live on decomposing organic matter from animals. This is of great interest from the medical and sanitary point of view, and occurrence, distribution and prevalence of this species in metropolitan areas are very important factors. This species has been observed in human bodies and in pets. Adults of *C. megacephala* can be attracted by substances in the fermentation process, decomposition, blood and wounds (D'Almeida, 1993; 1994; Carvalho and Ribeiro, 2000; Renaud et al., 2012).

In relation to the hosts collected, the species *Chrysomya albiceps* (Wiedemann) (Diptera: Calliphoridae), *C. megacephala* and *Musca domestica* L. (Diptera: Muscidae) medical-veterinary. *Chrysomya albiceps* is of major medical and sanitary interest, because it is responsible for secondary myiasis and is a vector for pathogenic microorganisms (Marchiori et al., 2013).

Musca domestica is a species of great sanitary interest because of its synanthropic characteristics, abundance in urban areas, capacity to develop in several sorts of substrates and high reproductive capacity (Marchiori, 2014a; b).

Considering the importance of these dipterous insects for public health, as vectors of disease-causing agents, it is essential to conduct surveys on these natural enemies to aid in adequate control of dipterous insects through integrated control methods (Marchiori, 2014c; Marchiori and Borges, 2014; Marchiori et al., 2014).

References

- Berti Filho E, Thomazini MJ, Costa VA. (1996): Artrópodes benéficos associados ao esterco de galinhas poedeiras no Brasil. *Revista de Agricultura*, 71: 73-286.
- Carvalho CJB, Ribeiro PB. (2000): Chave de identificação das espécies de Calliphoridae (Diptera) do sul do Brasil. *Revista Brasileira de Parasitologia Veterinária*, 9: 255-268.
- Chow CY. (1940): The common blue bottle fly *Chrysomya megacephala* as a carrier of pathogenic bacteria in Beijing. *China Chinese Medical*, 57: 145-153.
- Couri MS, Barros GPS. (2010): Diptera hosts of *Stylogaster* Macquart (Diptera: Conopidae) from Madagascar and South Africa. *Revista Brasileira de Entomologia*, 54: 361-366.
- D'Almeida JM. (1993): Capture of calyprate flies with different breeding substrates on beaches in Rio de Janeiro, RJ, Brazil. *Memórias do Instituto Oswaldo Cruz*, 88: 215-220.
- D'Almeida JM. (1994): Ovipositional substrates used by calyprate Diptera in Tijuca Forest, Rio de Janeiro. *Memórias do Instituto Oswaldo Cruz*, 89: 261-264.
- Ekanem MS, Idiong MO, Usua EJ. (2013): Synanthropic indices and baits preferences of common nonbiting dipterous (Diptera: Cyclorrhapha) of Akwa Ibom State, Nigeria. *International Journal of Biodiversity and Conservation*, 5: 192-197.
- Gauld ID, Bolton, B. (1998): *The Hymenoptera*. Oxford University Press.
- Greenberg B. (1971): *Dipterous and disease – ecology, classification and biotic association*. Princeton University Press.
- Grissell E, Schauff ME. (1992): *A handbook of the families of Nearctic Chalcidoidea (Hymenoptera)*. The Entomological Society of Washington, 2: 2-23.

- Hanson, PE, Gauld ID. (1995): The Hymenoptera of Costa Rica. Oxford University Press.
- Marchiori CH. (2013): Parasitoids of Diptera of importance to public health, medical, veterinary and economic collected in two different types of traps in southern Goiás, Brazil. *Mitteilungen Klosterneuburg*, 62: 23- 28.
- Marchiori CH, Borges LMF, Ferreira LL. (2013): Dipterous parasitoids collected from cattle dun in Goiânia, central Goiás, Brazil. *Journal Pensée*, 75: 418-426.
- Marchiori CH. (2014a): Species of Diptera of medical, sanitary and veterinary importance collected from buffalo and cattle dung in south Goiás, Brazil. *International Journal of Applied Science and Technology*, 4: 54-57.
- Marchiori CH. (2014b): First occurrence of *Neralsia splendens* (Borgmeier) (Hymenoptera: Figitidae) as parasitoids of *Cyrtoneurina paraescita* (Couri) (Diptera: Muscidae) in a rural area in Brazil. *Agricultural Science*, 5: 84-86.
- Marchiori CH. (2014c): Diptera of economic and sanitary importance collected on different substrates in southern Goiás, Brazil. *International Journal of Advanced Technology and science*, 1: 4-9.
- Marchiori CH, Borges LMF. (2014): *Spalangia drosophilae* Ashmead (Hymenoptera: Pteromalidae) collected in the south and central regions of Goiás, Brazil. *European Journal of Natural and Applied Sciences*, 2: 1-6.
- Marchiori CH, Borges LMF, Ferreira LL. (2014): Parasitoids of dipterous collected in cattle dung in the Regions Southern and Central of Goiás, Brazil. *Advance in Entomology*, 2: 20-23.
- Oliveira JTM, Oliveira BMA, Gonçalves AS, Serra-Freire NM. (2004): Ocorrência de míases humanas na região da Baixada Fluminense, Estado do Rio de Janeiro, Brasil. *Entomología y Vectores*, 11: 85-102.
- Renaud A.K, Savage J, Adamowicz SJ. (2012): DNA barcoding of northern Nearctic Muscidae (Diptera) reveals high correspondence between morphological and molecular species. *BMC Ecology*, 12: 24-24
- Rivers DB, Denlinger DL. (1995): Fecundity and development of the ectoparasitic wasp *Nasonia vitripennis* are dependent on host quality. *Entomologia Experimentalis et Applicata*, 76: 15-24.
- Schurmanm D, Sommer C, Schinko APB, Smid MG, Hans S, Johannes LM. (2014): Demonstration of long-term memory in the parasitic wasp *Nasonia vitripennis*. *Entomologia Experimentalis et Applicata*, 143: 199-206.
- Velásquez Y, Ivorra T, Grzywacz A, Martínez-Sánchez A, Magaña C, García-Rojo A, Rojo S. (2013): Lachryal morphology, development and forensic importance of *Synthesiomyia nudiseta* (Diptera: Muscidae) in Europe: a rare species or just overlooked?. *Bulletin of Entomological Research*, 103: 98-110.

Tabela 1. *Nasonia vitripennis* and their hosts collected of May 1998 to February 2013 in the south Goiás and west Minas Gerais, Brazil.

Taxonomic Group	Number of flies	Number of parasitized pupae	Percentage
Calliphoridae:			
<i>Chrysomya albiceps</i>	1131	55	4.9
<i>Chrysomya megacephala</i>	83	08	9.6
Muscidae			
<i>Musca domestica</i>	2140	36	1.7
<i>Ophyra</i> sp.	529	38	7.2
<i>Synthesiomyia nudiseta</i>	109	05	4.6
Sarcophagidae:			
<i>Oxysarcodexia thornax</i>	855	36	4.2
<i>Peckia chrysostoma</i>	575	24	4.2
<i>Sarcodexia lambens</i>	608	28	4.6
Total	6030	228	-