Open Access Research Journal of
Biology and Pharmacy
Journals home page: https://oarjbp.com/
ISSN: 2782-9979 (Online)

(Research Article)

Bibliographical research on the muscoid dipterans of the family Fanniidae

Carlos Henrique Marchiori *

Goiano Federal Institute, Biological Sciences, Parasitology. Goiânia, Goiás, Brazil.

Open Access Research Journal of Biology and Pharmacy, 2021, 02(02), 054–062

Publication history: Received on 20 September 2021; revised on 23 October 2021; accepted on 25 October 2021

Article DOI: https://doi.org/10.53022/oarjbp.2021.2.2.0051

Abstract

Fanniidae are a small family of Diptera Calyptratae found in all zoogeographic regions, although more diverse in the Holarctic Region. The objective of the mini review consists of bibliographical research on the muscoid dipterans of the Family Fanniidae. The research was carried out in studies related to quantitative aspects of the Family and Species (taxonomic groups) and in conceptual. A literature search was carried out containing articles published from 1971 to 2021. The mini review was prepared in Goiânia, Goiás, from August to September 2021, through the Online Scientific Library (Scielo), internet, ResearchGate, Academia.edu, Frontiers, Publons, Qeios Portal of Scientific Journals in Health Sciences, https://goo.gl/gLTTTs and https://www.growkudos.com/register.

Keywords: Feces; Synanthropy; Vectors; Pathogens; Worldwide

1. Introduction

Fanniidae are a small family of Diptera Calyptratae found in all zoogeographic regions, although more diverse in the Holarctic Region. 280 species are recognized, distributed in four genera: *Australofannia* Pont (Australia, 1 species), *Euryomma* Stein (mainly neotropical, 10 species), *Piezura* Rondani (Holártica, 4 species) and *Fannia* Robineau-Desvoidy (all regions, 265 species) (Figure 1) [1].

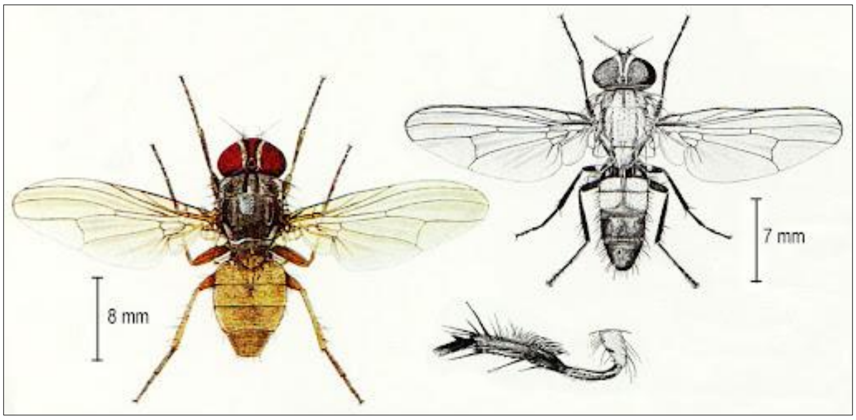

Figure 1 Specimens of Fanniidae; (Source: https://dbpedia.org/page/Fanniidae)

Adults can be recognized by the very short A1+CuA2 vein, course of the subcostal vein, with a smooth apical curve forward towards the costal; presence of a dorsal submedian seta on the posterior tibia; middle leg usually modified on the ventral surface, with many groups of hairs, spines, or tubercles; wide front-orbital plate; convex inner margins,

* Corresponding author: Carlos Henrique Marchiori
Goiano Federal Institute, Biological Sciences, Parasitology. Goiânia, Goiás, Brazil.

proclined orbital bristle and absent crossed interfrontal bristles. Eggs are elongated, with a pair of lateral-dorsal fringes. Larvae are very characteristic; they have a dorsoventrally flattened body, ornamented by numerous lateral processes, departing from the dorsal and lateral regions of the body thickened cuticle; prothoracic spiracles with 3-12 short processes dorsal posterior spiracle, usually in short peduncles (Figures 2, 3 and 4) [2, 3, 4].

Figure 2 Wing of a Fanniidae (A1+CuA2 vein); (Source: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html)

Figure 3 Fanniidae larva – *Fannia*; (Source: https://bugguide.net/node/view/379869)

Figure 4 Fanniidae pupae – *Fannia; (*Source: https://elp.tamu.edu/ipm/bugs/order-diptera-flies/diptera-fanniidae-fannia-canicularis-little-house-fly-larva-a/)

Some species are closely associated with man. *Fannia canicularis* (Linnaeus, 1758) and *Fannia scalaris* (Fabricius, 1794) are best known for their fondness for human habitation. The Fanniidae occur in the peri-domestic environment and feed on feces and decaying organic matter, although they are of little importance as mechanical vectors of pathogens that occur in feces. Larvae of few species have been recorded in cases of urinary-genital and intestinal myiasis, in man and in domestic animals (Figure 5) [3, 4].

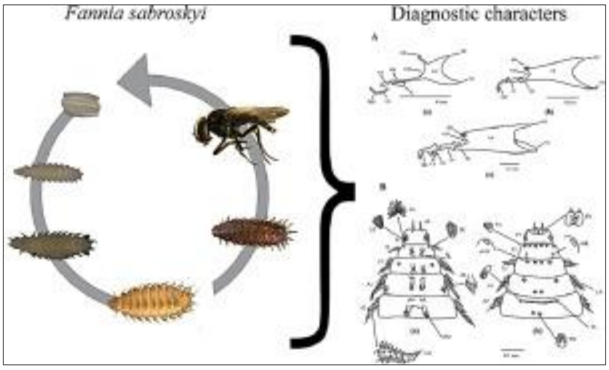

Figure 5 Fanniidae life cycle; (Source: https://www.sciencedirect.com/science/article/abs/pii/S0001706X20313176)

The Fanniidae have only two genera in the Neotropical Region, distributed as follows: Euryomma Stein (9 species) Argentina, Bolivia, Brazil, Chile, Ecuador, Guadeloupe Islands, Panama, Peru, and Venezuela and Fannia Robineau-Desvoidy (64 species) **-** Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, El Salvador, Ecuador, Guatemala, Guyana, Guadeloupe Island, Mexico, Panama, Paraguay, Peru, Peru, Uruguay and Venezuela [4].

In Brazil, 2 species of *Euryomma* and 32 *Fannia* are known. Of these, 2 and 24 species, respectively, are reported from Rio de Janeiro. The present list lists 26 species valid in two genera (Figure 6) [4].

Figure 6 *Euryomma*, male: (7) *E. cornuatum*, dorsal view; (8) *E. peregrinum*, thorax, dorsal view; (9) *E. tahami*, dorsal view; (10) *E. guane*, wing, dorsal view; (11) E. cornuatum, head, frontal view; (12) *E. aburrae*, lateral view. Scale bars: 1.0 mm; (Source: https://www.researchgate.net/figure/Figures-7-12-Euryomma-male-7-E-cornuatum-dorsal-view-8-E-peregrinum-thorax_fig1_306253276**)**

Objective

The objective of the mini review consists of bibliographical research on the muscoid dipterans of the Family Fanniidae.

2. Methods

The research was carried out in studies related to quantitative aspects of the Family and Species (taxonomic groups) and in conceptual. A literature search was carried out containing articles published from 1971 to 2021. The mini review was prepared in Goiânia, Goiás, from August to September 2021, through the Online Scientific Library (Scielo), internet, ResearchGate, Academia.edu, Frontiers, Publons, Qeios and Portal of Scientific Journals in Health Sciences, https://goo.gl/gLTTTs and https://www.growkudos.com/register.

3. Studies performed

3.1. Study 1

This study records the transmission of eggs of *Dermatobia hominis* (L. Jr., 1781) (Insecta, Diptera, Oestridae) by *Fannia punctipennis* (Albuquerque) (for Southeastern Brazil) and by *Fannia canicularis* (L.) (for South America) (Insecta, Diptera, Fanniidae).

Adult females of *D. hominis* are quite peculiar because they use other insects to carry their eggs, laying them on the abdomen or base of the wings of the organism called foretic, defined as that which is responsible for the active transport of another organism that is fixed, for a limited period, on the surface of the first. Thus, parasitism is successful when the carrier insect lands on the vertebrate: stimulated by the host's temperature, *D. hominis* larvae hatch and settle there.

Egg masses adhered to the abdomen of *F. canicularis* and *F. punctipennis* were identified as being from *D. hominis*, from pastures close to forests may represent greater risks of parasitism about dermatobiosis (Figure 7) [5].

Figure 7 *Dermatobia hominis* (L. Jr., 1781) (Insecta, Diptera, Oestridae) eggs carried by the genus *Fannia* spp; (Source: http://www.coccidia.icb.usp.br/parasite_db/galerias_a.php?id_galeria=A_16&nome_gal=Moscas)

3.2. Study 2

Fanniidae is a family of true flies composed of a group of approximately 360 species distributed in five genera, found in all biogeographic regions, except at the poles, being more predominant in temperate regions. Fanniidae adults are often found in rural areas, in forested areas on bushes or in flowers.

The larvae have a saprophagous habit and develop on the most different substrates such as decomposing organic matter, fungi, and feces, or associated with bee or bird nest rejects (Figure 8).

Figure 8 Fanniidae - larva feeding on decaying organic matter;

(Source: https://www.bioimages.org.uk/image.php?id=50733)

Many species have synanthropic habits and can cause economic impacts, while others are of forensic and public health importance. The smaller housefly is a synanthropic species worldwide, as it is well adapted to urbanization and lives close to man [6].

3.3. Study 3

Fannia pusio (Wiedemann 1830), known as the chicken dung fly is a fly species of the family Fanniidae including over 260 species of flies worldwide. Originally native to Central and North America, its distribution is now largely global, having been introduced with livestock (Figure 9).

Figure 9 *Fannia pusio* (Wiedemann, 1830) adult

As its common name implies it can be very abundant at facilities, resulting in considerable nuisance by their huge numbers. But the larvae will also feed on a wide variety of food, including rotting vegetable matter, excrement, fungi, and carrion [7].

3.4. Study 4

This study aimed to verify the species of insects parasitizing *Fannia pusio* (Wiedemann, 1830) (Diptera: Fanniidae) in Caldas Novas, Goiás, from August 2003 to May 2004.

325 *F. pusio* pupae were obtained from 24 of which 24 parasitoids emerged, being 03 specimens of *Paraganaspis egeria* Díaz, Gallardo & Walsh, 1996 (Hymenoptera: Figitidae), 14 specimens of *Pachycrepoideus vindemmiae* (Rondani, 1875) Pteromalidae), 02 specimens of *Spalangia drosophilae* Ashmead, 1887 (Hymenoptera: Pteromalidae) and 05 specimens of *Spalangia nigra* Latrielle, 1805 (Hymenoptera: Pteromalidae). The percentage of parasitism obtained was 7,4% (Figure 10).

Figure 10 *Pachycrepoideus vindemmiae* (Rondani, 1875) Pteromalidae); (Source: http://bestfreshglobal.blogspot.com/2016/08/pachycrepoideus-vindemmiae-podria-ser.htmlStudy)

The percentage of parasitism presented by *P. vindemmiae, S. nigra, P. egeria*, and *S. drosophilae* was 4.3, 1.5, 0.9 and 0.6%, respectively. The species with the highest occurrence was *P. vindemmiae* representing 58.3% of the individuals collected and the one present in all attracting baits.

The species *S. nigra* was the second most abundant, representing 20.8% of the individuals collected and had the highest frequency of parasitism with 7.7%. Regarding the preference of parasitoids for substrates, it was found that: *P. vindemmiae* showed preference for *F. pusio* collected from bovine liver; *P. egeria* occurred only in *F. pusio* collected from human feces; *S. drosophilae* and *S. nigra* also showed preferences for *F. pusio* collected from bovine liver, however, they were collected only in this substrate (X2=14.78; GL=6; P<0.05) [8].

3.5. Study 5

The purpose of this article is to study the effects of temperature on the development of immature stages of *Fannia pusio* (Wiedemann, 1830) (Diptera: Fanniidae) in the laboratory.

A total of 25 age-matched females were observed daily. The number of surviving females and the number of eggs produced were noted for life table calculations. Three temperatures were used: 20, 27 and 33°C. The highest reproductive rate (Ro) was 48.18 and occurred at 27ºC, in which the highest fecundity was also obtained. The temperature of 20ºC had an intermediate rate, 29.21, and the lowest rate was 3.39, obtained at 33ºC, reflecting lower longevity and fecundity, parameters used to calculate the reproductive rate (Ro) (Figure 11).

Figure 11 Ventral view of the egg mass of *Dermatobia hominis* (Linnaeus, 1781) (Diptera: Cuterebridae), removed from the abdomen of *Haematobia irritans* (L.) (Diptera: Muscidae) captured on cattle in the municipality of São Pedro d'Aldeia, RJ, and preserved immersed in 70% ethanol in February 2010

The fecundity and longevity of *F. pusio* adults were determined at constant temperatures of 20, 27 and 33ºC. The mean number of eggs laid by females was 324, 342 and 55, and the mean number of eggs laid by female daily was 7, 10.1 and 2.6, respectively. At the three temperatures, the average longevity was 26, 18.5 and 12 days, respectively.

The purpose of this article is to study the effects of temperature on the development of immature stages of *Fannia pusio* (Wiedemann, 1830) (Diptera: Fanniidae) in the laboratory. The longevity and fecundity of *F. pusio* females are influenced by the diet. The temperature of 33ºC was harmful to both the longevity and the reproductive rate of *F. pusio*.

Fannia pusio was more tolerant to high temperatures, being, therefore, more abundant during the hot seasons of the year. The highest intrinsic rate of natural increment (Rm) was 0.1849 at 27ºC, followed by 0.1009 at a temperature of 20ºC. The lowest growth rate was 0.0670 at 33ºC. The natural increment rate (Rm) is dependent on the fecundity, longevity, and development time of the insect, which in turn is affected by temperature, humidity, diet and age. Regarding the generation time (T), the temperature that caused the longest time was 20ºC (33.41 days) and the smallest was 33ºC with 19.88 days. At 27ºC, the generation time was 20.95 days [9].

3.6. Study 6

3.6.1. Creation technique

The purpose of this study is to demonstrate the importance of techniques for collecting and breeding diptera Muscomorpha (flies) in the laboratory (Figure 11).

After separation, the adults were transferred to a cage (30 cm long x 15 cm wide x 15 cm high) (Figure 1) containing water-soaked gauze, a mixture of milk powder, brewer's yeast, and sugar to feed them. For oviposition of adult females, minced meat (baits) was provided. This content with eggs and larvae was transferred to plastic cups containing fermented food for pupae development of larvae. The cups were later transferred to the adult cages for emergence (Figure 12).

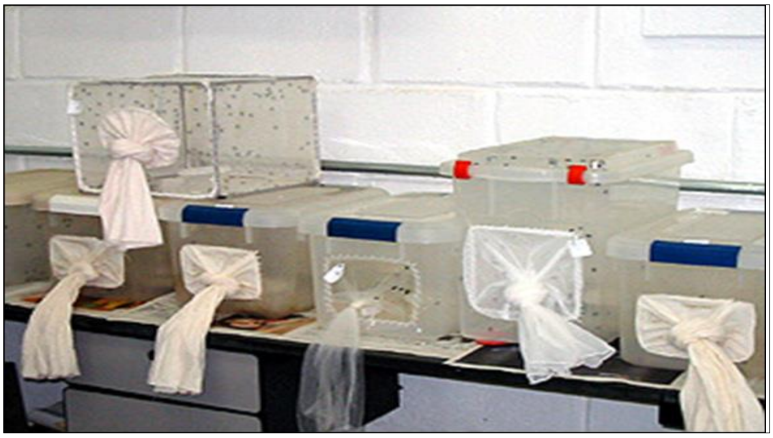

Figure 12 Flies breeding cages in laboratory; (Source: https://www.scielo.br/j/rbent/a/ttmBHMV7YX3hxvxDnZFBRYr/?lang=pt)

The adults and their immature stages were kept in the rearing room at a temperature of 27 degrees Celsius, humidity of 60 + 5% and photoperiod of 12:12 (L.E). In winter the room temperature was maintained at this level using electric heaters [10].

3.7. Study 7

Aspects of population dynamics of *Fannia pusio* (Wiedemann, 1830) (Diptera: Fanniidae) were studied in the laboratory. Adults were collected at the Capuavinha farm in the municipality of Monte-Mor (30 km from Campinas-SP) and at the back of the Parasitology department of the State University of Campinas. Adults were kept in the laboratory and fed on a medium rich in powdered milk, sugar, brewer's yeast, and water-soaked gauze, as oviposition medium provided fermented rat ration.

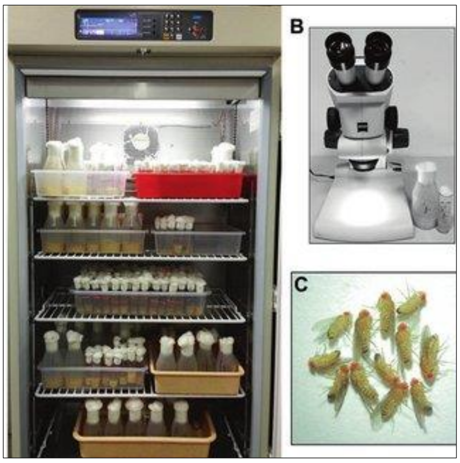

Figure 13 (a) BOD incubator showing rearing of dipterans in culture bottles and vials; (Source: https://www.researchgate.net/figure/Maintenance-and-handling-a-BOD-incubator-showing rearing_fig1_342494026)

The percentage of eggs hatching at the different temperatures studied were high at 20ºC with 69.25% and at 33ºC with 72.5%. The development time decreased with the increase in temperature from 10 to 33ºC; the development time was less at 33ºC with 19 hours and longer at 10ºC with 132 hours. *F. Pusio* showed a synchronization in the hatching of her eggs.

The larvae showed a sigmoid-like growth curve, with rapid growth at first. At 20ºC the larvae reached their maximum weight between 138 and 162 hours and at 27 to 33ºC between 90 and 114 hours. Mean larval development time at 20ºC was 96.5 hours and 63 hours at 27 and 33ºC. There were no significant differences in weight and larval development time at the three temperatures (Figure 13).

The beginning of the pupation period at 20ºC was between 210 and 234 hours, while at 27 and 33ºC it was between 138 and 162 hours. The period of pupal development showed statistically significant differences for the three temperature levels to which they were submitted.

The longevity of adults was greater at 20ºC, followed by the temperature of 27ºC, with the rise in temperature there was a decrease in longevity at all temperatures, females were longer than males. Most of the observed oviposition peaks appeared in the first days of life of the females. The highest reproductive cup (Ro) and natural increment rate (Rm) occur at 27ºC with rates of 48.18 and 0.1849 respectively, the longest generation time was at 20ºC, but at all temperatures there was positive addition of individuals. *F. pusio* showed a pattern of emergence of adults, characteristically revealed that males emerge earlier than females. Preferably most adults emerged during the light period, where 37% of individuals emerged between 10 and 12 am [11].

3.8. Study 8

The aim here is to contribute to knowledge of the Diptera species of the Calliphoridae, Fanniidae and Muscidae families occurring in animal organic material.

In three areas, five traps were baited with 50 grams of sardines and chicken gizzards with 24 hours of exposure. The most abundant family of the three collected was Fanniidae, totaling 2,458 individuals collected, with just over half of the total (51.02%) (Figure 14).

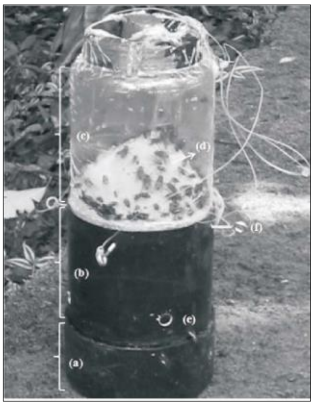

Figure 14 Traps modified from Ferreira (1978) to capture calliphorid flies (Diptera) in the Biological Reserve of Tinguá, RJ, Brazil. (a, PVC pipe as base of the trap where the bait is sets inside its; b, PVC pipe; c, transparent plastic container; d, inverted funnel made with nylon screen; e, orifices of dipterous entrance; f, hooks to hang the traps); (Source: https://www.researchgate.net/figure/Traps-modified-from-FERREIRA-1978-to-capture-calliphorid-flies-Diptera-in-the_fig1_262447953)

Despite the high number of specimens, Fanniidae had the lowest richness, with only three identified species, *Fannia bahiensis* Albuquerque, 1954, *Fannia heydenii* (Wiedemann, 1830) and *Fannia pusio* (Wiedemann, 1830), constant in all months of collection. Of these, *F. pusio* was the most representative (total of 1,388 individuals), with the greatest abundance [12,13].

4. Conclusion

The species of Fanniidae occurs in the peri-domestic environment and feed on faeces and decaying organic matter, although they are of little importance as mechanical vectors of pathogens that occur in faeces. Larvae of few species have been recorded in cases of urinary-genital and intestinal myiasis, in man and in domestic animals.

References

[1] Pont AC. Family Fanniidae. Budapest: Science Herald. 2000.

[2] Holloway BA. Larvae of New Zealand Fanniidae (Diptera: Calyptrata). New Zealand Journal of Zoology. 1985; 11: 239-257.

[3] Guimarães JH, Papavero N. Myiasis in man and animals in the Neotropical Region bibliographic database. São Paulo: Pleiade/FAPESP. 1999.

[4] Couri MS, Carvalho CJB. Catalog of Fanniidae species from the state of Rio de Janeiro (Brazil). Neotropical Biota. 2005; 5(2): 1-9.

[5] Maia BMC, Prado AM, Purgato NCS, Mira CT, Thyssen PJ. Record of egg phoresia of Dermatobia hominis (L.) (Diptera, Oestridae) by Fannia canicularis (L.) and Fannia punctipennis (Albuquerque) (Diptera, Fanniidae) in São Paulo, Brazil. EntomoBrasilis. 2018; 11(3): 226-229.

[6] Fanniidae [Internet] Berlin: DBpedia © 2007 [cited Oct 2021]. Available from https://pt.wikipedia.org/wiki/Fanniidae.

[7] Wiedemann RW. Fannia pusio [Internet] Berlin: DBpedia University of Mannheim © 2007 [cited Oct 2021]. Available from https://pt.wikipedia.org/wiki/Fanniidae.

[8] BDTD. Brazilian Institute of Information in Science and Technology. SAUS Brazil © 2010 [cited Oct 2021] Available from https://bdtd.ibict.br/vufind/Record/CAMP_d6cf00b6bdbab370089d86994dde4c18.

[9] Parasitoids of Fannia pusio (Wiedemann, 1830) (Diptera: Fanniidae) collected in Caldas Novas, Goiás, Brasil. Ciência e Agrotecnologia. 2005; 29(6): 1288-1291.

[10] Marchiori CH, Prado AP. Effects of temperature on the development of immature stages of Fannia pusio (Wiedemann, 1830) (Diptera: Fanniidae) in the laboratory. Brazilian Journal of Biology. 1996; 56(3): 93 - 98.

[11] Marchiori CH. Techniques for collecting and breeding Diptera Muscomorpha in the laboratory. MOJ Biology and Medicine. 2021; 6(2): 88–89.

[12] Marchiori CH. Biology of Fannia pusio (Wiedemann, 1830) (Diptera: Fanniidae), in laboratory. [Thesis Master's degree]. Universidade Estadual de Campinas, Instituto de Biologia. 1993.

[13] Monteiro TT, Silva EN, Bravo FR. Taxonomic and Seasonal Survey of Calliphoridae, Muscidae and Fanniidae (Insecta: Diptera) in Feira de Santana, Bahia, Brazil. EntomoBrasilis. 2014; 7(3): 171-177.