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Parasitoids of insects of economic and sanitary importance collected in Brazil (Collectanea)

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Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae)

Figure

Contents

Introduction

Diptera is one of the largest orders of insects, comprising abundant number of species as well as of individuals. Besides, these dipterous are of great medical and veterinarian importance since they may produce myiasis and may be vectors of microorganisms pathogenic to men and animals (Grennberg, 1971). Flies have been found to carry diseases causing organisms such as: bacteria, protozoa and helminthes (D'Almeida, 1992, Greenberg, 1971). Sarcophagidae are ovoviviparous insects or, rarely, viviparous (Lopes & Leite, 1989). There have been recognized 600 species of Sarcophagidae from Neotropical region (Shewell, 1981). On the other hand, this dipterous takes relevant importance in public health, for being the vehicle of pathogenic micro-organism to human beings (Greenberg, 1971). Fly control using insecticides usually selects resistant populations, being just a palliative. Mendes & Linhares (1993) believed that research on new methods concerning fly control is needed. Natural regulators, such as parasitoids, are agents responsible for reduction of fly populations (Mcalpine, 1981).

Among the Coreidae known to cause economic damage to crop plants, much attention has been directed to the species Leptoglossus zonatus (Dallas, 1852) (Hemiptera: Coreidae) that is abundant on maize and is considered a serious insect pest (Souza & Amaral Filho, 1999b). Leptoglossus zonatus, known in Brazil as maize bug, also feeds on several other species (14 families of fructiferous, forage and ornamental plants) showing characteristics of polyphagia and adaptation to different feeding resources (Souza & Amaral Filho, 1999a). The insect sucks on grains and fruits inducing wilt and decay, thus reducing yield. It is more serious, however, in relation to the maize crop where losses may reach 15%. This hemipteran has been already found in Mexico as well as in Central and South America and occurs mainly from December to April (Zucchi et al., 1993), probably influenced by the weather and available food. According to Souza & Amaral Filho (1999a), little or nothing is known about its natural enemies. No methods of population control have so far been proposed for this insect.

The caterpillars of the genus Lonomia (Lepidoptera: Saturniidae), which were collected in this experiment, are important causative agents of skin problems in humans, especially for individuals who work in rural areas. These insects can be found associated with economically important crops, which often feed and/or perform your posture (Souza &

Reis, 1992).Among these pests, the tomato leaf miner Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) stands out (Gonçalves-Gervásio et al., 1999). Tuta absoluta presents high destructive potential and may attack plant parts in all developmental stages (Souza & Reis, 1992; Michereff Filho).

The insects of the order Hymenoptera form a diverse group of approximately 200,000 species. Thanks to these insects, great savings in pest control programs have been achieved. They are mostly parasitoid organisms and, in the Neotropical region, they have been little studied and are poorly known. Hymenoptera parasitoids are the most important biological control agents and they are responsible for the majority of the economic and environmental benefits produced by biological control programs. They may provide support for biological and conservation studies. Their action on hosts increases with growth in their population and decreases with reductions in populations. The two interlinked populations fluctuate in relation to each other in such a way as to impede both abrupt increases and the extinction of the host population (Gauld & Bolton, 1988; La Salle & Gauld, 1991; Scatolini & Penteado-Dias, 1997).

Interest in biological controls has grown in various countries, as a response to the adverse effects of chemical pesticides on the environment and on biodiversity. Moreover, it has grown as a function of new international trends in agricultural production involving the utilization of alternative means that are less aggressive to the environment and which favor conservation and the sustainable use of biodiversity (Scatolini & Penteado-Dias, 1997; Marchiori & Dias, 2002).

Since parasitoids occupy a superior trevel, they act as determining factors on the population densities of their hosts due to the diversity of their physiological and behavioral adaptations (Gauld & Bolton, 1988).

REFERENCES

D'Almeida, J. M. Calyptrate Diptera (Muscidae and Anthomyiidae) of the State of Rio de Janeiro – I. Synanthropy. Memórias do Instituto Oswaldo Cruz, v.87, p. 381-386, 1992.

Gauld, I. D. & Bolton, B., 1988, The Hymenoptera. Oxford University Press, Oxford, 33p.

Greenberg, B. Flies and disease – ecology, classification and biotic association. New Jersey: Princeton Univ. Press, 1971. 447p.

Gonçalves-Gervásio R.C.R.G., Ciociola A.I, Santa Cecília L.V.C., Maluf, W.R. 1999. Aspectos biológicos de Tuta absoluta (Meyrick, 1917) (Lepidoptera: Gelechiidae) em dois genótipos de tomateiro contrastantes quanto ao teor de 2-tridecanona nos folíolos. Cienc Agrotec 23: 247-251.

Hanson, P. E. & Gauld, I. D. (1995). The Hymenoptera of Costa Rica. Oxford, Oxford Univ. Press. 893p.

La Salle, J. & Gauld, I. D., 1992, Parasitic Hymenoptera and biodiversity crisis. Redia. 74: 315-334, 1992.

Lopes, H.S.; Leite, A.C.R.. Morphology of the egg of Sarcodexia lambens (Diptera: Sarcophagidae). Memórias do Instituto Oswaldo Cruz, v.84, p.497-500, 1989.

Marchiori, C. H.; Dias, A. M. P. (2002). Famílias de parasitóides coletadas em área de mata e pastagens no município de Itumbiara, Estado de Goiás. Acta Scientiarum, 24, 897-899.

Mcalpine, J.E.; Peterson, B.V.; Sheweell, G.E.; Teskey, H.J.; Vockroth, J. R.; Wood, D.M. Manual of neartic Diptera. Otawa: Research Branche Agriculture Canada, Otawa, Canadá, 1981. 1332 p.

Michereff Filho M., Vilela E.F. 2000. Traça-dotomateiro, Tuta absoluta (Lepidoptera: Gelechiidae). pp. 81-84. In: Vilela E. F. Zucchi R.A., Cantor, F. (eds.), Pragas introduzidas. Holos Editora, São Paulo, Brasil.

Shewell, G.E. Sarcophagidae. In: Mcalpine, J.E.; Peterson, B.V.; Sheweell, G.E.; Teskey, H.J.; Vockroth, J. R.; Wood, D.M. Manual of neartic Diptera. Otawa: Research Branche Agriculture Canada, 1981. p.1159-1186.

Scatolini, D.; Penteado-Dias, A. M., Fauna de Braconidae (Hymenoptera) Como bioindicadora do grau de preservação de duas localidades do Estado do Paraná. Rev. Brás. Ecol., 1:84-87, 1997.

Souza, E. P.; Amaral Filho, B. F. 1999a. Nova Planta hospedeira de Leptoglossus zonatus (Dallas) (Heteroptera: Coreidae). An. Soc. Entomol. Brasil, 28: 753: 755.

Souza, E. P.; Amaral Filho, B. F. 1999b. Ocorrência natural de parasitóides de Leptoglossus zonatus (Dallas) (Heteroptera: Coreidae). An. Soc. Entomol. Brasil, 28: 757:759.

Souza J.B., Reis, P.R. 1992. Traça-do-tomateiro: histórico, reconhecimento, biologia, prejuízos e controle. Epamig, Lavras, 20p

Zucchi, R. A.; Neto, S. S.; Nakano, O. 1993. Guia de identificação de pragas agrícolas. 5ª Ed. Fealq, Piracicaba, 139 pp.

Chapter 1- Parasitoids of Musca domestica L. 1758 (Diptera: Muscidae) collected in two areas in Brazil

This study to aimed acertain the specie of parasitoids Musca domestica L. 1758 (Diptera: Muscidae) collected in two areas in Brazil.

This experiment was conducted in two places: 1) on the farm of the School of Veterinary and 2) Animal Science of the Federal University of Goiás, Brazil (rural area), and

on the campus of the Federal University of Goiás in Goiânia, Goiás, Brazil (urban area). Parasitoids were collected by exposing larvae of Musca domestica L. (Diptera Muscidae) and its breeding substrate (bovine beef liver) outdoors, in containers filled with sand that were placed next to garbage containers. The larvae of M. domestica used were from the stock maintained and reared at the Institute of Tropical Pathology and Public Health. They were kept in the laboratory so as to begin abandonment of the diet. The larvae remained in the field for fifteen days, and became pupae. The insects collected were taken to the laboratory, sacrificed using 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 field 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.

The total of 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.

From March to December 2015, 66 species of parasitoids were collected: 39.3% of the individuals were obtained from rural areas, whereas 60.7% were obtained from urban areas. The greater number of specimens collected in urban areas was possibly due to greater food supply, to variations in the quality and availability of food resources, the composition and relative abundance of parasitoids undergoes variation according to the localities, seasonal period and habitat type. Possibly, these parasites have become adapted to urban conditions, and may be used in biological control programs. Nevertheless, it is believed that rural areas are important source locations for parasitoids that are natural enemies of other insects. These insects are considered bioindicators for the biodiversity of ecosystems, and are considered as key species for maintaining the equilibrium of the communities in which they are included. In addition, since they are natural enemies of insects, they may be used in biological control programs of agricultural pests (Scatolini & Penteado-Dias, 1997).

In both locations, Pachycrepoideus vindemmiae (Hymenoptera: Pteromalidae) was the most frequent species, with 79.2% and 62.0% in the rural and urban areas, respectively. Since several species of parasitoids were collected in the same host, it is very likely that interspecific competition determined which species of parasitoid would emerge in greater quantity, as well as the remainder would have been eliminated by competition. Pachycrepoideus vindemmiae is a solitary parasitoid of many Diptera of the families

Anthomyiidae, Calliphoridae, Muscidae, Sarcophagidae, Tachinidae, Tephritidae and others. It presents wide geographical distribution, including in North America and Africa (Hanson & Gauld, 1995).

The percentage of parasitism in urban was 9.0% and in rural areas 6.9%. These proportions are related to the search capacity and the seasonal variation in parasitoid levels. Pachycrepoideus vindemmiae found in the two collection areas also had the highest percentage of parasitism. Perhaps its greater competitive potential in the larval stage can explain this fact.

Several species of the Encyrtidae family have been successfully used in biological control programs. Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae) behave as parasitoid, developing internally in the host body and emerging from the puparium (Noyes, 1980; Gauld & Bolton, 1988).

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

When determined reliably through rearing, species of Spalangia Latreille, 1805 (Hymenoptera: Pteromalidae) have been shown to be either primary parasitoids of Diptera puparia or, much more rarely, hyperparasitoids of Diptera puparia through Hymenoptera primary parasitoids or hyperparasitoids of non-dipterous hosts through Tachinidae (Diptera) primary parasitoids. Because of their dipterous hosts, many species of Spalangia are economically important and there is a huge literature reporting their parasitism against Muscidae, Calliphoridae, Sarcophagidae, Drosophilidae, Chloropidae, Sepsidae and others (Gibson, 2009).

As Tachinobia (Boucek, 1977) (Hymenoptera: Eulophidae) species behave as gregarious parasitoids of Lepidoptera and Diptera (Boucek, 1977; La Salle, 1994).

1. REFERENCES

Boucek Z. 1977. Descriptions of Tachinobia gen. n. and species of Testrastichine (Hymenoptera: Eulophidae), with a tentative to genera. Bull Entomol Res 67: 17-30.

Gauld I.D. Bolton D.B. 1988. The Hymenoptera, ed. 1, Oxford University Press, Oxford, 893 p.

Gibson G.A.P. 2009. Revision of new world Spalangiinae (Hymenoptera: Pteromalidae). Zootaxa 2259: 1–159.

Hanson P.E., Gauld I.D. 1995. The Hymenoptera of Costa Rica, ed. 1, Oxford University Press, Oxford. 893 p.

La Salle J. 1994. North American genera of Testrastichine (Hymenoptera: Eulophidae). J Nat Hist 8: 109-236.

Marchiori C.H. 2014. Parasitoid flies collected in the south Goiás and west Minas Gerais, Brazil. Sylwan 158: 485 – 493.

Rivers D.B., Denlinger D.L. 1995. Fecundity and development of the ectoparasitic wasp Nasonia vitripennis are dependent on host quality. Entomol Exp Appl l: 76: 15-24.

Scatolini D., Penteado-Dias A.M. 1997. A fauna de Braconidae (Hymenoptera) como bioindicadora do grau de preservação de duas localidades do Estado do Paraná. Rev Bras Ecol 1: 84-87

Schurmanm D., Sommer C., Schinko A.P.B, Smid M.G., Hans S, Johannes L.M. 2014. Demonstration of long-term memory in the parasitic wasp Nasonia vitripennis. Entomol Exp Appl 143: 199–206.

Chapter 2 - Anastatus sp. (Hymenoptera: Eupemidae) collectd in eggs of Leptoglossus zonatus (Dallas) (Diptera: Coreidae) in Brazil

The objective of this scientific note was to report, for the first time in Brazil, the occurrence of the parasitoid Anastatus sp. parasitizing eggs of L. zonatus.

The experiment was carried out at the College of Agronomy Farm, located in Itumbiara County, State of Goias, Central Brazil (18°25'S; 49°13'W). Samples were obtained in a 44 m x 22 m maize (Zea mays) L. field plot, where 50 ears of maize (cultivar Dekalb 601) were randomly harvested, individualized in plastic bags and taken to the laboratory of the Instituto Luterano de Ensino Superior (Lutheran Institute of Superior Teaching) for Hemiptera eggs collection. The presence of eggs (egg masses oviposited on a straight line) was verified on each single ear of maize. In order to obtain parasitoids, each egg mass was placed near a small piece of maize leaf sheath inside a glass flask that was maintained in the laboratory, at room temperature, until emergence of parasitoids and/or nymphs of the insect pest.

Samplings were weekly performed from December 2001 to February 2002. Percentage of parasitism was computed by using the following formula: P=(parasitized eggs/total eggs) x 100.

Seventy-two eggs of L. zonatus were collected in 15 of January of 2002, from which five parasitoids of the genus Anastatus (Hymenoptera: Eupelmidae) emerged. The percentage of parasitism observed was 6.9%. The use of chemicals in controlling crop pests may result in increased production costs as well as in damages to the environment

and to human health. Torres et al., (1996) indicated the occurrence of Anastatus spp. in eggs of Podisus nigrispinus (Dallas) (Heteroptera: Pentatomidae) collected in plantations of Eucalyptus sp. in the State of Minas Gerais, Brazil. Jones (1993) also reported parasitism of the genera Anastatus on eggs of L. zonatus in Arizona (E.U.A)

The identification of natural enemies by the basic research may become an important alternative in the control of this pest. The groups of parasitoids that occur on maize could be selected for future studies aiming their use as agents of biological control of maize insect pests (Hanson & Gauld, 1995).

These results contribute to the knowledge of the parasitoids occurring in the State of Goias. This is the first report of the occurrence of Anastatus sp. parasitizing immature stages of L. zonatus in Brazil.

REFERENCES

Hanson, P.E., Gauld, I.D. The Hymenoptera of Costa Rica. Oxford: University, 1995. 893 p.

Jones, W.A. New host and habitat associations for some Arizona Pentatomoidea and Coreidae. Soutwestest Entomology, 1993. 29 p.

Torres, J.B., Zanuncio, J.C., Cecon, P.R., Gasperazzo, W.L. Mortatlidae de Podisus nigrispinus (Dallas) por parasitóides de ovos em áreas de eucalipto. Anais da Sociedade Entomológica do Brasil, v.25, n.3, p. 463-472, 1996.

Chapter 3 - Brahymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) as parasitoid of Hemilucilia flavifacies Enderlein (Dptera: Calliphoridae) collected in Brazil

This paper was to report a new host for Brachymeria podagrica in Brazil.

This study was conducted at the College of Agronomy (Faculdade de Agronomia) located in Itumbiara County, State of Goias, Central Brazil (18º25´S; 49º13´W), Brazil.

Flies were attracted to traps made of dull black tin cans (19 cm tall and 9 cm in diameter) with two blinders-like openings, located at the 1/3rd bottom part to allow flies to entry. A nylon funnel with opened extremities and base turned down was attached to the upper part of each can. These traps were then wrapped with plastic bags, which after removal would allow the capture of flies and parasitoids. Human feces, deposited on top of a soil layer, were placed as baits inside each can. Five of these traps were randomly hung on Eucalyptus sp. trees at 1 m above the soil level, 2 m apart from each other and 50 m away from a domestic garbage deposit.

The specimens collected were taken to the laboratory, killed with ethyl ether and stored in 70% ethanol for further identification. After the removal of the insects, the content of

each trap was individually placed into plastic containers layered with sand to serve as substrate for larvae and pupae development. After remaining 15 days in the field these substrata were sifted for extraction of the pupae obtained under natural environment. Pupae were then individually transferred to gelatin capsules (number 00) to obtain flies and/or parasitoids.

The parasitism was calculated by the following formula: P=(parasitized pupae/total of pupae) x100.

During March 2001 to March 2002, three specimens of Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) were collected from 30 pupae of Hemilucilia flavifacies Enderlein (Diptera: Calliphoridae) showing 10.0% of parasitism. The percentage of parasitism can also be related to capacity of search of the parasitoid and to the availability of recourses.

According to Roberts (1933) B. podagrica was collected as a solitary parasitoid of Sinthesiomyia larvae (Muscidae), Cochliomyia, Lucilia, Calliphora sp., Calliphora coloradensis Hough, Callitroga macellaria (Fab.) Phaenicia sericata (Meig.) Phaenicia mexicana (Macq.), Phormia regina (Meig.) (Calliphoridae), Sarcophaga carnaria Linné, Sarcophaga haemorrhoidalis Fallén, Sarcophaga impar Aldrich, Sarcophaga peregrina (Robineau-Desvoidy) and Peckia chrysostoma (Wiedemann) (Sarcophagidae) (Marchiori, 2001).

This species occurred as dipterous parasitoid, developed in rats carcasses in areas of tropical wood in the State of Goiás, Brazil. Its preferred host was Patonella intermutans (Walker) (Sarcophagidae) from where parasitoid pupae emerged, predominating females (Silva 1991). Tomberlin & Adler (1998) studying the decomposition and colonies of insects in the carcasses of rats during the summer and winter in the South Caroline (E.U.A), collected B. podagrica in pupae of Sarcophaga sp. (Sarcophagidae). Since the use of some chemical substances to control this fly may cause damages to the environment as well to human health, the search for effective natural enemies might be a viable alternative to hold this vector in a control program.

This is the first report of B. podagrica in pupae of H. flavifacies in Brazil.

REFERENCES

Marchiori, C.H. Ocorrência de Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) como parasitóide de Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae) no Brasil. Entomol. Vect., v.8, n.4, p.513-517, 2001.

Roberts, R.A. Activity of blowflies and associated insects at various heights above the ground. Ecology, v.14, p. 306-314, 1933.

Silva, A.S. Himenópteros parasitóides associados a dípteros saprófagos, com especial referência aos Alysiinae (Braconidae). São Carlos: 1991. 54p. [Dissertação (Mestrado) -

Universidade Federal de São Carlos].
Tomberlin, J.K & Adler, P.H. Seasonal colonization and decomposition of rat carrion in water and on land in na open field in South Carolina. J. Med. Entomol., v.27, p.704-709, 1998.

Chapter 4 - Parasitoids of Ophyra aenescens (Wiedemann) (Diptera: Muscidae) collected in Brazil

The aim of this paper was to report a new host for Brachymeria podagrica (Hymenoptera: Chalcididae) in Brazil.

This study was conducted at "the Agriculture Faculty" (Itumbiara, GO, 18º25´S – 49º13´W), Brazil. The flies were attracted to 19x9cm opaque dark can traps built, with two openings like blinders, located in the third inferior part to permit the entrance of the flies. Nylon funnels were coupled in the upper part the cans, opened in the ends, with bases pointing down and wrapped with plastic bags, enabling the collection of flies and parasitoids.

Human feces were used as baits inside the cans, over a layer of sand. Five traps hanging on eucalyptus trees were disposed one meter above the ground two meters apart from each other and 50 meters from domestic garbage cans were disposed. The collected insects were taken to the laboratory, killed with ethyl ether and kept in 70% alcohol for further identification. The contents of the traps were placed in plastic containers having a layer of sand to be used as a substratum for larvae to pupate. The sand was sifted after 15 days and pupae were extracted and placed individually in gelatine capsules (00 number) to obtain flies and/or the parasitoids.

The percentage of parasitism was calculated by the following formula: P= (parasite pupae/total of pupae) x100.

Through during the period from March to December 2001 four specimens of Brachymeria podagrica (Fabricius) were collected in 20 pupae of Ophyra aenescens (Wiedemann) (Diptera: Calliphoridae) showing 20% of parasitism. The percentage of parasitism can also be related to the type of methodology used. The species B. podagrica occurs almost everywhere around the world and lives associated to synanthropic dipterous and other Diptera, emerging from their pupae.

According to Roberts (1933) B. podagrica was collected as a solitary parasitoid of Sinthesiomyia larvae (Muscidae), Cochliomyia, Lucilia, Calliphora sp., Calliphora coloradensis Hough, Callitroga macellaria (Fab.) Phaenicia sericata (Meig.) Phaenicia. mexicana (Macq.), Phormia regina (Meig.) (Calliphoridae), Sarcophaga carnaria Linné,

Sarcophaga haemorrhoidalis Fallén, Sarcophaga impar Aldrich e Sarcophaga peregtina Robineau-Desvoidy (Sarcophagidae) (Roberts, 1933).

This species occurred as dipterous parasitoid, developed in rats carcasses in areas of tropical woods in the State of Goiás, Brazil. Its preferred host was Patonella intermutans (Walker) (Sarcophagidae) from where emerged parasitoid pupae, predominating females (Silva, 1991) The decomposition and colonies of insects in the carcasses of rats during the summer and winter in the South Caroline (E.U.A) collect B. podagrica in pupae of Sarcophaga sp. (Sarcophagidae) (Tomberin & Adler, 1998)

Fly control using insecticides usually selects resistant populations, being just a palliative. Some investigations ((Mendes & Linhares, 1993) believed that research on new methods concerning fly control are needed.

This is the first report of B. podagrica in pupae of O. aenescens in Brazil.

REFERENCES

Mendes J, Linhares AX. Atratividade por iscas, sazonalidade e desenvolvimento ovariano em várias espécies de Muscidae (Diptera). Revista Brasileira de Entomologia 37: 289-297, 1993.

Roberts RA. Activity of blowflies and associated insects at various heights above the ground. Ecology 14: 306-314, 1933.

Silva AS. Himenópteros parasitóides associados a dípteros saprófagos, com especial referência aos Alysiinae (Braconidae). Dissertação de Mestrado, Universidade Federal de São Carlos São Carlos, 1991.

Tomberlin JK, Adler PH. Seasonal colonization and decomposition of rat carrion in water and on land in na open field in South Carolina. Journal of Medical Entomology 27: 704-709, 1998.

Chapter 5 - Gnathopleura quadridentata Wharton, 1986 (Hymenoptera: Braconidae) collected in Brazil

The objective of this note is to report on the occurrence of the parasitoid of G. quadridentata in different substrates in the Park of the mountain range of Caldas Novas, State of Goiás.

The study was conducted in a wooded area of the Park of the mountain range of Caldas Novas State of Goiás, located in the vicinity of the city of Caldas Novas, State of Goiás (18º25´S – 49º13´W), Brazil. The flies were attracted to traps consisting of dark-colored cylindrical metal cans, measuring 19 cm height and 9 cm diameter, with two openings

measuring 30 mm in width, located in the lower third of the can, to allow flies to enter. A more detailed description of the traps is given by Ferreira (1978). Human feces, fish, bovine liver, and chicken served as bait for attracting the flies. Sixteen traps were used, spaced two meters apart. These were hung on trees at a height of one meter above the ground. Four traps were utilized for each type of bait. The collected insects were taken to the laboratory, sacrificed using ethyl ether and kept in 70% alcohol for further identification. The baits were removed from the traps and placed in plastic containers with a layer of sand to form the substratum for the larvae to pupate in. The sand was then sifted to collect the pupae. These were then placed individually in gelatin capsules (00 number) and kept until the emergence of the flies or their parasitoids.

The specimens were stored in the Biology Laboratory of Instituto Luterano de Ensino Superior de Itumbiara, GO, Brazil. The parasitism percentage was calculated using the following formula: P = (no. of parasitized pupae/total pupae) x 100. The host preference of the parasitoid G. quadridentata was evaluated using the chi-squared statistical test.

Between August 2003 and July 2004, 958 puparia of three species of Diptera were collected. From these, 104 specimens of the parasitoid G. quadridentata emerged. The percentage of parasitism obtained was 10.9%.

Gnathopleura quadridentata shows preference for calyptrate muscoid flies, especially sarcophagids (Shenefelt, 1974). This parasitoid is solitary and emerges from the puparium of the host. Species of Gnathopleura have been released for biological control of sarcophagids and muscids (Wharton, 1979).

The greatest numbers of parasitoids (28 specimens) and the greatest frequency of parasitism (56.0%) were found in bovine liver, in the host Sarcodexia lambens (Diptera: Sarcophagidae). This was probably due to variations in quality and availability of food resources. Sarcodexia lambens is widely distributed in the Americas, and is found from the South of the United States of America to Argentina (Lopes & Leite, 1989). This species colonizes organic material of animal nature that is used as bait, such as human faces, bovine faces and bovine liver (Rocha & Mendes, 1996; Marchiori et al., 2000a).

The species with the second greatest frequency of parasitism was Oxysarcodexia thornax (Walker) (Diptera: Sarcophagidae), with a rate of 16.8%. This species was also collected from all the bait types utilized. This was possibly because of its capacity to colonize many different types of substrate of animal origin. Oxysarcodexia thornax has also been collected from bait in Itumbiara, State of Goiás: 23 specimens from human feces, 31 from fish and 46 from bovine kidneys. Previously, this species had been collected from the same municipality, from bovine liver and feces (Marchiori et al., 2000; 2000a).

Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae) is a widely distributed neotropical synanthropic species (Ferraz, 1995). In Rio de Janeiro, this species has shown preference for environments inhabited by humans, and it is primarily attracted to raw fish (D'Almeida, 1984).

Gnathopleura quadridentata has presented preference for S. lambens in human feces; for P. chrysostoma in bovine liver and chicken; and for O. thornax in fish ($X2=69.26$; GL: 6; $P<0.05$).

REFERENCES

D'Almeida, J. M., 1984, Sinantropia de Sarcophagidae (Diptera) na região metropolitana do Estado do Rio de Janeiro. Arq. Univ. Fed. Rur. Rio de J., 7: 101-110.

Ferraz, M. V., 1995, Larval and pupal periods of Peckia chrysostoma and Adiscochaeta ingens (Diptera: Sarcophagidae) reared under laboratory conditions. Mem. Inst. Oswaldo Cruz, 90: 611-614.

Lopes, H. S. & Leite, A. C. R, 1989, Morphology of the egg of Sarcodexia lambens (Diptera: Sarcophagidae). Mem. Inst. Oswaldo Cruz, 84: 497-500.

Marchiori, C. H., 2000, Parasitóides de estágios imaturos de dípteros sinantrópicos coletados em vários ambientes em Itumbiara-GO. Acta Scientiarum, 22: 655-661.

Marchiori, C. H, Castro, M. E. V, Paiva T. C. G, Silva C. G. & Teixeira, F. F., 2000a, Dípteros muscóides de importância médica e veterinária e seus parasitóides em Goiás. Arq. Bras. Med. Vet. Zootec., 52: 350-353.

Rocha, U. R & Mendes, J., 1996, Pupation of Dermatobia hominis (L. Jr., 1781) (Diptera: Cuterebridae) associated with Sarcodexia lambens (Wiedemann, 1830) (Diptera: Sarcophagidae). Mem. Inst. Oswaldo Cruz, 91: 299-300.

Shenefelt, R. D., 1974, Braconidae 7. Alysiinae hymenopteron catalogus. Ed. J. Van der Vecht and R. R. Shenefelt, 1113p.

Wharton, R. A., 1979, Puparia of cyclorrhaphous Diptera from bovine dung in open pasture and rangeland in the transition zone of Western North America. Ann. Entomol. Soc. Am., 72: 80-89.

Chapter 6 - Study of the community of Diptera at different altitudes in Brazil

The objective of the present study was to analyze the type of substrate utilized by and the influence of altitude variation on synanthropic flies.

The study was conducted during the period from August 2003 to July 2004, in the Serra de Caldas Novas Park, located within the municipality of Caldas Novas, State of Goiás (17° 44´S – 48° 37´W). Adult flies were collected by means of traps constructed

using cans of matt black color, measuring around 19 cm in height by 9 cm in diameter. These had two slat-type openings located in the lower third of the cans, to allow insects to enter. Nylon funnels were attached to the tops of the cans, with their narrow bases pointing downwards into the cans. The upper, wide ends of the funnels were open and had plastic bags wrapped around them. The flies were collected by removing these plastic bags containing the flies.

Human feces, fish, bovine liver, chicken and fruit served as bait for attracting the flies. These were deposited inside the cans, on a layer of earth. Ten traps were utilized for the altitude of 740 meters (17° 46'04"S - 48° 39' 35"W) and ten for the altitude of 1000 meters (17° 46' 52"S - 48° 41' 14"W). There were two traps for each type of bait, and these traps were hung on trees at a height of one meter above the ground and two meters from each other. The insects collected were taken to the laboratory, sacrificed using ethyl ether and conserved in 70% alcohol for subsequent identification.

To obtain the flies, the contents of the traps were placed in plastic containers with a layer of sand to serve as a substrate for pupation of the larvae. The sand was sifted 15 days after the traps were placed in the field, and the pupae were extracted from the sand and then placed individually in gelatin capsules (number 00) to obtain the flies. The flies' preferences for altitude and substrates were tested using ANOVA, with the data transformed to $\sqrt{x+0.5}$, using a 5% significance level.

Between August 2003 and July 2004, a total of 2946 flies were collected, of which 1255 were from the altitude of 740 meters and 1691 from the altitude of 1000 meters. The flies did not present any preference between the traps placed at the altitudes of 740 meters and 1000 meters ($F=0.16$; $P=0.6949$), probably due to the proximity of the traps to each other.

The altitude of 1000 meters presented greater richness of species (13 species collected) and abundance of flies (57.4% of the flies collected), in comparison with the altitude of 740 meters. This was possibly because of the diversity of resources at this altitude. Recent studies on parasitoids have demonstrated different distribution patterns and richness when considering the altitude gradient (Shimbori et al. 2003).

At 740 meters the most frequently found species was Oxysarcodexia thornax (Walker) (Diptera: Sarcophagidae), accounting for 42.4% of the individuals collected. In Itumbiara, State of Goiás, this species has been collected from bovine liver and feces (Marchiori et al., 2000; 2000a).

At 1000 meters, the most frequently found species was Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae), accounting for 27.6%. Peckia chrysostoma is a synanthropic species found in various parts of the world (Ferraz, 1995). In Rio de Janeiro, this species demonstrated a preference for locations inhabited by man, and fish was the

bait that presented the greatest attraction (D'Almeida, 1984).

With regard to altitude preference, none of these species presented any difference between the traps installed at 740 meters (F=0.86; P=0.5985) and 1000 meters (F=1.54; P=0.3313). These flies also did not present any preference between the substrates at 740 meters (F=0.40; P=0.9314) and 1000 meters (F=0.77; P=0.7179).

According to Shimbori et al. (2003), each parasitoid genus (Braconidae) is influenced by altitude in a different manner. This demonstrates the complexity of the factors involved in variations due to altitude, in addition to the other environmental factors that are not directly related, such as human influence. This is probably what occurs in the case of synanthropic flies.

REFERENCES

D'Almeida, J. M., 1984, Sinantropia de Sarcophagidae (Diptera) na região metropolitana do Estado do Rio de Janeiro. Arq. Univ. Fed. Rur. Rio de J., 7: 101-110.

Ferraz, M. V., 1995, Larval and pupal periods of Peckia chrysostoma and Adiscochaeta ingens (Diptera: Sarcophagidae) reared under laboratory conditions. Mem. Inst. Oswaldo Cruz, 90: 611-614.

Marchiori, C. H, Castro, M. E. V, Paiva T. C. G, Silva C. G. & Teixeira, F. F., 2000, Dípteros muscóides de importância médica e veterinária e seus parasitóides em Goiás. Arq. Bras. Med. Vet. Zootec. 52: 350-353.

Marchiori, C. H, Silva, C. G., Caldas, E. R., Vieira, C. I. S, Almeida, K. G. S, Teixeira, F. F & Linhares A X., 2000a, Dípteros muscóides associados com carcaça de suíno e seus parasitóides em área de pastagem e de mata em Goiás. Arq. Bras. Med. Vet. Zootec. 52: 459-460.

Shimbori, E. M., Yamada, M. V., Penteado-Dias, A. M., 2003, Estudo da comunidade de Braconidae (Hymenoptera: Insecta) em diferentes altitudes no Parque Estadual do Jaraguá, Anais do 16ª Reunião Anual do Instituto Biológico, São Paulo, Brasil, p. 630.

Chapter 7 - Families of parasitoids (Hymenoptera) collected in Brazil

The objective of this study was to verify the families of the parasitoids collected in area of forest in the south Goiás, using yellow pan traps and Malaise traps, from February to October 2002.

The experiment was conducted at the Faculty of Agronomy Farm in south of Goiás, in the period February to October 2002. Sampling was weekly, with 10 yellow pan traps

placed at ground level and allocated at random to areas of native vegetation and pastures. A total of five yellow pan traps were placed in the pastures and five in forests. These traps were the spherical yellow plastic bowls approximately 30 cm in diameter and 12 cm height which was deposited a mixture of 2 liters of water, 2 ml of detergent and 2 ml of formaldehyde.

Three Malaise traps were built with fine mesh fabric bands of black cloth that intercept the insects, conducting them trough two white fine mesh fabric bands up to the upper part of the apparatus where two 200 ml plastic flasks, connected to each other by a screw cap, were placed. The inferior flask, where the insects fell, contained a fixing liquid Dietrich solution 600 ml 96° ethanol, 300 ml distilled water, 100 ml 40% formaldehyde and 20 ml acetic acid. These flasks were positioned to the North to allow higher insect attraction. Flasks were retrieved every 7 days and the trapped specimens were separated, using a fine mesh sieve, and stored in 70% ethanol until identification.

A total of 2.242 specimens of parasitoid were collected in the yellow pan traps and 4.135 specimens in the Malaise traps, in period of February to October 2002.

Family Ichneumonidae was the most collected in the yellow pan traps with 19.7%. Also, in the Malaise traps, the family Ichneumonidae was the most frequent with 37.4%. The vast majority of Ichneumonidae are parasitoids of holometabolous insects and spiders (Hanson & Gauld, 1995).

The superfamily Chalcidoidea presented the highest diversity of families (10 families) in both traps types (Tables 1 and 2). It was not possible to compare the of quantity of family collected by the two types of traps due to in number of traps used. Although it was observed that the Malaise traps presented durability problems when exposed to sunlight, rain and wind for being made of a more fragile material (cloth). These problems did not occur when the yellow pan traps were used. Thus, it is possible to conclude that Malaise are more efficient than yellow pan traps in sampling this group of parasitoids.

Malaise traps are indicated for the capture of insects of the orders Hymenoptera, Diptera and Thysanoptera (Segade et al., 1997; Campos et al., 2000). Noyes (1989) working with yellow pan traps found that these traps are important in collecting specimens of some families of Hymenoptera of the parasitic series.

Since these parasitoids are natural enemies of insect pests, the feasibility of their use on biological control is an encouraging possibility (Marchiori et al., 2002; Perioto & Lara, 2003; Palmas-Santos & Perez-Maluf, 2012)).

The faunal survey of arthropods in today preserved areas is of great importance for you to serve as a parameter for comparison between areas modified by human actions (Scatolini & Penteado-Dias, 2003).

REFERENCES

Campos, W. G., Pereira D. B. S. & Schoereder J. H. (2000). Comparision of the efficiency of flight-interception trap models for sampling Hymenoptera and other insects. An. Soc. Entomol. Bras., 29, 381-389.

Hanson, P. E. & Gauld, I. D. (1995). The Hymenoptera of Costa Rica. Oxford, Oxford Univ. Press. 893p.

Marchiori, C. H. & Dias, A. M. P. (2002). Famílias de parasitóides coletadas em área de mata e pastagens no município de Itumbiara, Estado de Goiás. Acta Scientiarum, 24, 897-899.

Noyes, H. S. (1989). The study of five methods of sampling Hymenoptera (Insecta) in a tropical rainforest, with special reference to the Parasitica. J. Nat. Hist., 23, 285-298.

Palma-Santos, M. C. l. & Perez-Maluf, R. (2012). Comunidade de parasitóides associada à cultura do café em Piatã, Chapada Diamantina, BA. Rev. Ceres, 57, 194-197.

Perioto, N. W. & Lara, R. I. R. (2003). Himenópteros parasitóides (Insecta: Hymenoptera) da Mata Atlântica. I. Parque Estadual da Serra do Mar, Ubatuba-SP-Brasil. Arq. Inst. Biol., 70, 441-445.

Scatolini, D. & Penteado-Dias, A. M. (2003) Análise faunística de Braconidae Hymenoptera) em três áreas de mata nativa do Estado do Paraná, Brasil. Rev. Bras. Entomol., 47, 187-195.

Segade, C., Ros-Farré, P., Algarra, A., Ventura, D. & Pulade-Villar, J. (1997). Estudio comparativo de las capturas realizadas com trampas malaise en Andorra com especial atención a los Himenópteros (Hymenoptera). Rev. Aragon. Entomol., 7, 71-82.

Chapter 8 - First occurrence of parasitoid Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae) in pupae of Hemilucilia flavifacies Enderlein (Diptera: Calliphoridae) in Brazil

This study report First occurrence of parasitoid Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae) in pupae of Hemilucilia flavifacies Enderlein (Diptera: Calliphoridae) in Brazil.

The study was conducted in an urban area of the College of Agronomy (Faculdade de Agronomia), located in Itumbiara County, State of Goias, Central Brazil (18°25' S; 49°13' W).

Flies were attracted to traps made of dull black tin foil cans, measuring 19 cm in height and 9 cm in diameter, with two Venetian blind type openings placed in the inferior third to allow insects entering. To the upper part of the cans, nylon funnels with opened

extremities and bases turned down, were attached. These traps were then wrapped with plastic bags, which after removal would allow the capture of flies and parasitoids. Chicken deposited on top of a soil layer were placed as baits inside the cans.

Five of these traps were suspended on Eucalyptus sp. trees at 1 m above the soil level, 2 m apart from each other and 50 m away from a domestic garbage deposit. The specimens collected were taken to the laboratory, killed with ethyl ether and preserved in 70% ethanol for further identification. After retrieval of insects, the traps contents were placed into plastic containers containing a layer of sand to serve as substrate for larvae population. After remaining 15 days in the field the sand of these containers was sifted for extraction of pupae obtained in a natural environment. These pupae were than individually transferred to gelatin capsules (number 00) to obtain flies and/or parasitoids. The percentage of parasitism was computed by the following formula: P=(parasite pupae/total pupae) x 100

From March of 2001 to January of 2002, 16 specimens of Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae) were collected from 81 pupae Hemilucilia flavifacies Enderlein (Diptera: Calliphoridae). The percentage of parasitism was 19,8%. The H. herbertii presented himself as gregarious, emerging several individuals from the same pupary, a poliembrionary is considered very ordinary. The species H. herbertii occurs almost everywhere around the world and lives associated to Diptera, emerging from their pupa shell. Muscoids dipterous control using insecticides usually selects resistant populations, being just a palliative. Natural regulators, such as parasitoids are agents responsible for reduction of fly populations.

The results obtained with this research allow us to stretch the occurrence of H. herbertii on a new host.

REFERENCES

D'Almeida, 1992 Mem. Inst. Oswaldo Cruz, v. 87, n.3, p. 454-457.

D'Almeida & Lopes 1983 Arq. Univ. Fed. Rur. Rio de J., v.6, p. 39-48

Geenberg, 1971 Princeton Univ. Press. Princeton, N.J.;

Chapter 9 - Hosts of the parasitoid Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae) collected in Brazil

The objective of this research was to extend the knowledge of the biology of the parasitoid H. herbertii in Brazil.

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 bait: cattle kidneys, 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.

Each pitfall traps consisted of a plastic receptacle (basin) of 15 cm in diameter by 10 cm in height. Each receptacle was buried in earth, such that its upper extremity was at the ground surface level. One liter of water, 20 ml of detergent and 2 ml of formol were placed in each receptacle. A 200 ml pot was attached to the basin by means of a thin wire that went across it close to its edge, so as to keep the pot hanging and centralized in the basin. The bait, consisting of human feces, was placed in this pot. This trap was protected by another plastic receptacle of the same measurements (15 x 10 cm), which functioned as a cover. This contained four diametrically opposite holes of around 5 cm in diameter and 7 cm in height, and was supported on a metal wire suspended 10 cm from the group. Six traps were used, with separations of two meters between each other, placed randomly. The bait was replaced every 15 days. The pupae that were found in the bait were separated out by means of the floatation method. These were then individually packed in gelatin capsules until the parasitoids emerged.

One liter of water, 20 ml of detergent and 2 ml of formol were placed in each receptacle. A 200 ml pot was attached to the basin by means of a thin wire that went across it close to its edge, so as to keep the pot hanging and centralized in the basin. The bait, consisting of human feces, was placed in this pot. This trap was protected by another plastic receptacle of the same measurements (15 x 10 cm), which functioned as a cover. This contained four diametrically opposite holes of around 5 cm in diameter and 7 cm in height, and was supported on a metal wire suspended 10 cm from the group. Six traps were used, with separations of two meters between each other, placed randomly. The bait was replaced every 15 days. The pupae that were found in the bait were separated out by means of the floatation method. These were then individually packed in gelatin capsules until the parasitoids emerged.

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.

Between March 2001 and June 2006, 1.336 flies pupae were collected 31 specimens Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae). The overall percentage of parasitism was observed in 2.3%. Probably due to the availability of resources, to the density of hosts and to the searching capacity of the parasitoids.

Sarcodexia lambens (Wiedemann) (Diptera: Sarcophagidae) was the fly that had a higher percentage of parasitism, 29.4%. Probably the percentage of parasitism was influenced by variations in the quality and availability of resources, the density of hosts and the gregarious parasitoid behavior. Sarcodexia lambens is widely distributed in the Americas, being found from the southern United States to Argentina (Lopes & Leite, 1989).

This species colonizes animals in organic matter such as human feces, feces of cattle and beef liver used as baits (Rocha & Mendes, 1996; Marchiori et al, 2000).

Among the hosts collected, the species Chrysomya albiceps (Wiedemann) (Diptera: Calliphoridae), Chrysomya megacephala (Fabricius) (Diptera: Calliphoridae) and Musca domestica L. (Diptera: Muscidae) stood out regarding their importance (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. M. domestica is a species of great sanitary interest because of its synanthropic characteristic, abundance in urban areas, capacity to develop in several sorts of substrates and high reproductive capacity (Marchiori, 2013).

Chrysomya megacephala is often found associated with the modified human environment with creating their larvae into an animal decomposing organic matter. This is of great interest Diptera medical sanitary and their occurrence, distribution and percentage in metropolitan areas are very important factors. Have been observed in human bodies and pets. Adults can be attracted by substances in the fermentation process, decomposing, blood and wounds (Carvalho & Ribeiro, 2000; D'Almeida, 1993; 1994).

It is possible to control these insects, by using the natural regulators such as parasitoids, which are the responsible agents for the reduction of the insects pests populations (Marchiori, 2013).

REFERENCES

Carvalho, C.J.B.; Ribeiro, P.B. Chave de identificação das espécies de Calliphoridae (Diptera) do sul do Brasil. Rev. Bras. Parasitol., v. 9, p.255-268, 2000.
D'Almeida, J.M. Capture of caliptrate flies with different breeding substrates on beaches in Rio de Janeiro, RJ, Brazil. Mem. Inst. Oswaldo Cruz, v.88, p.215-220, 1993.
D'Álmeida, J.M. Ovipositional substrates used by Caliptrate Diptera in Tijuca Forest, Rio de Janeiro. Mem. Inst. Oswaldo Cruz, v.89, p.261-264, 1994
Lopes, H.S.; Leite, A.C.R. Morphology of the egg of Sarcodexia lambens (Diptera: Sarcophagidae). Mem. Inst. Oswaldo Cruz, v.84, p.497-500, 1989.
Marchiori ,C.H.; Castro, M.E.V.; Paiva T.C.G. et al. Dípteros muscóides de importância médica e veterinária e seus parasitóides em Goiás. Arq. Bras. Med. Vet. Zootec., v.52, p.350-353, 2000.
Marchiori, C.H.; Borges, L.M.F.; Ferreira, L. L. Hosts of the parasitoid Pachycrepoideus vindemmiae (Rondani) (Hymenoptera: Pteromalidae) of medical-veterinary and economic importance collected in the State of Goiás, Brazil. Amer. J. Li. Scie. , v1, p.228-231, 2013.
Rocha, U.R; Mendes, J. Pupation of Dermatobia hominis (L. Jr., 1781) (Diptera: Cuterebridae) associated with Sarcodexia lambens (Wiedemann, 1830) (Diptera: Sarcophagidae). Mem. Inst. Oswaldo Cruz, v.91, p.299-300, 1996.

Chapter 10 -Parasitoids of Leptoglossus zonatus (Dallas, 1852) (Hemiptera: Coreidae) on maize in Brazil

The present study aimed to identify parasitoids that naturally occur on eggs of L. zonatus and to report the occurrence of the parasitoid Anastatus sp. in this host.

The experiment was performed at the Agronomy School Farm (Site 1) and at the Santa Maria Farm (Site 2) from) from December 2001 to February 2002. Both farms are located in Itumbiara County, State of Goiás, Central Brazil (18°25'S; 49°13'W). Hemiptera egg collections were carried out on a 44x20m maize plot, at Site 1. At Site 2, an area of one hectare was divided into 44x20m plots for each of the seven samplings. Fifty ears of maize were randomly collected weekly on each site, a total of 700 ears. At Site 1, two ears were infested with eggs on January 15, 2002 (20 eggs with 5 parasitoids and 21 eggs with 8 parasitoids). Concerning Site 2, three ears were infested with eggs on February 5, 2002 (20 eggs with 12 parasitoids, 23 eggs with 18 parasitoids and 29 eggs with 21 parasitoids). These ears were collected on different plots.
The ears were individualized in plastic bags and taken to the laboratory of the Instituto

Luterano de Ensino Superior for collection of the naturally infested host eggs. All ears were individually checked for the presence of Hemiptera egg masses. These egg masses were then transferred, together with a small piece of maize foliar sheath, to glass flasks that were maintained in the laboratory, under room temperature, until the emergence of parasitoids and/or nymphs of the host insect. Thepercentage of parasitism was computed using the following formula: R= (parasitized eggs/total number of eggs) x 100.

A total of 113 eggs of L. zonatus were collected from January to February 2002, from which 40 nymphs (35.4%) of the host species and 64 parasitoids (56.6%), from five different species, emerged. Nine of the eggs (8.0%) did not produce either nymphs or parasitoids. The percentage of parasitism recorded was 56.6%. At Sites 1 and 2, 41 and 72 eggs of L. zonatus were, respectively, obtained (Table 2).

Although the planted area at Site 2 was smaller than at the Site 1, a higher number of eggs was found in the samples collected at Site 2. This possibly took place because of higher environmental pressure.

Among the parasitoids collected, G. gallardoi was the most frequent species representing 79.6% of the specimens, probably influenced by the seasonal variation. Gryon gallardoi is also a parasitoid of eggs of other hemipterans belonging to the Coreidae family that, in Brazil, attack rice, potato, tobacco, tomato and papaya (Loiacono, 1980).

The parasitic rate of the parasitoids Anastatus sp., Brasema sp., Gryon gallardoi and Trissolcus sp. was 4.4%, 1.8%, 45.1% and 5.3%, respectively. Souza & Amaral Filho (1999a; b) in the State of São Paulo, Brazil, and Mitchell & Mitchell (1986) in the State of Texas, USA, found, respectively, parasitic rates of 64.0% and 70.4% for Gryon sp. on eggs of L. zonatus. Jones (1993) also reported parasitism of the genera Gryon, Neolreleya (Hymenoptera: Eurytomidae), Ooencrytus (Hymenoptera: Encyrtidae) and Anastatus (Hymenoptera: Eupelmidae) on eggs of L. zonatus.

This data is important because it contributes to the knowledge of the natural enemies of L. zonatus in the Itumbiara region, GO, Brazil.

REFERENCES

Jones, W. A. 1993. New host and habitat associations for some Arizona Pentatomoidea and Coreidae. Southwest. Entomol., Suppl., 16, 29 pp.

Loiacono, M. S. 1980. Nota sobre tres escelionidos parasitoides de hemipteros de la Republica Argentina y Brasil (Hymenoptera-Proctotrupoidea). Rev. Soc. Entomol. Argent., 39: 173-178.

Mitchell, P. L.; Mitchell, F. L. 1986. Parasitism and predation of leaffooted bug (Hemiptera:

Heteroptera: Coreidae) eggs. Ann. Entomol. Soc. Am., 79: 854-860.
Souza, E. P.; Amaral Filho, B. F. 1999a. Nova Planta hospedeira de Leptoglossus zonatus (Dallas) (Heteroptera: Coreidae). An. Soc. Entomol. Brasil, 28: 753: 755.
Souza, E. P.; Amaral Filho, B. F. 1999b. Ocorrência natural de parasitóides de Leptoglossus zonatus (Dallas) (Heteroptera: Coreidae). An. Soc. Entomol. Brasil, 28: 757:759.

Chapter 11 - Species of Diptera collected from buffalo dung and cattle dung in Brazil

The aim of this study was to determine the dipterous species collected from buffalo and cattle dung in southern Goiás, Brazil.

In southern of Goiás, the experiment was conducted from May 2003 to June 2004 in the farm of Faculdade de Agronomia. Every fortnight, 10 plates of fecal cake (of approximately 3 kg each) were produced from fresh bovine feces and that were collected immediately after defecation in pastures of Brachiaria brizantha (Hochst ex. A. Rich) and in corrals. The material was collected in plastic buckets and was homogenized. It was then placed in 10 round plastic supports, with a hole to allow rainwater to drain away.
This methodology was used for precise determination of the time between the emission of the fecal cake and its collection. The feces remained exposed (five in the pastures and five in the corrals) for 15 days. After this period, the feces were taken to the laboratory for extraction of pupae by means of the flotation method. The pupae were removed with the aid of a sieve; they were counted and individually stored in gelatin capsules (number 00) until the dipterous emerged. The dipterous that emerged were identified with the aid of a stereoscopic microscope and were conserved in 70% alcohol. The same methodology was used for feces of buffalos. The hypothesis preferably dipterous by buffalo dung and cattle dung was tested by Chi-square.
A total of 3473 pupae of dipterous were coletads in buffalo dung, belonging to three families and six different species. In cattle feces were collected a total of 628 pupae of dipterous pertecentes to four families and 10 species.

The more abundant species in the faeces of buffalo and cattle dung were Palaeosepsis sp. (Diptera: Sespidae) (56.0%) and Cyrtoneurina pararescita Couri (Diptera: Muscidae) (24.0%), respectively. The biology of Sepsidae family is virtually unknown to the Neotropical region. They are usually found near or on animal feces or other various materials such as garbage, animal housing , and low shrub foliage (Silva, 1991). In a preliminary survey of family Sepsidae in Roraima, Project Maraca, were collected species

Archisespsis scabra Loew and Palaeosespsis pusio Schiner (Silva, 1991).

Chrysomya megacephala (Fabricius) (Diptera: Calliphoridae) and Musca domestica L. (Diptera: Musidae) (Diptera: Musidae) of the species collected were the most important from the point of view of medical and veterinary. C. megacephala is of great medical and sanitary interest, because it is responsible for secondary myiasis and is a vector for pathogenic microorganisms. M. domestica is a species of great sanitary interest because of its synanthropic characteristic, abundance in urban areas, capacity to develop in several sorts of substrates and high reproductive capacity .

The species showed a preference for buffalo feces were : Brontaea debilis (Williston) (Diptera: Muscidae, Brontaea quadristigma (Thomson) (Diptera: Muscidae); C. pararescita, C. megacephala, M. domestica, Oxysarcodexia thornax (Walker) (Diptera: Sarcophagidae) and Ravinia belforti (Prado & Fonseca) (Diptera: Sarcophagidae). The species showed a preference for cattle feces were: A. scabra, Palaeosepsis sp. and Sarcophagula occidua (Fabricius) (Diptera: Sarcophagidae) ($X2= 2105.69$; GL:10; $P <0.05$).

Knowledge of the biology and population activities of the various portions of these dipterous is important from an epidemiological point of view, since, through these studies can verify the places where they occur, the period and the mechanisms that induce these activities, as well the importance of certain members of the population in the transmission of diseases and dispossession of the host process. This information contributes significantly in studies aimed at the prevention of which can be transmitted by these insects diseases as well as for the formulation of more effective methods of control (Marchiori et al., 2013a; b; Marchiori, 2014; Marchiori et al., 2014).

This study conducted the first survey of Diptera collected in feces of buffalo in the state of Goiás. This increases work with this knowledge of the bioecology and geographical distribution of dipterous in Brazil .

REFERENCES

Marchiori, C.H. (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- 8.

Marchiori, C.H., Borges, L.M.F. and Ferreira, L.L. (2013). Dipterous parasitoids collected from cattle dun in Goiânia, central Goiás, Brazil. Journal Pensée, 75, 418-426.

Marchiori, C.H. (2014). First occurrence of Neralsia splendens (Borgmeier) (Hymenoptera: Figitidae) as parasitoids of Cyrtoneurina pararescita (Couri) (Diptera: Muscidae) in a rural area in Brazil. Agricultural Sciences, 5, 84 – 86.

Marchiori, C.H., Borges, L.M.F. and Ferreira, L.L (2014). Parasitoids of dipterous collected in cattle dung in the Regions Southern and Central of Goiás, Brazil. Advances in

Entomology, 2, 20–23.
Silva, V.R. (1991). Levantamento preliminares de Sepsidae (Diptera: Schizophora) em Roraima, projeto Maracá com descrição de uma espécie nova. Acta Amazônica, 2, 369-374.

Chapter 12 - Diptera of economic and sanitary importance collected on different substrates in Brazil

The objective of this study was to determine the species of dipterous medical and veterinary importance in southern Goiás.

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

The dipterous 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 could be collected. The following items were used as baits: human feces, cattle kidneys, cattle liver, fish and fruit, 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 dipterous. The experiment was conducted from May 1998 to June 1999

Experiment with cattle dung and buffalo dung

In southern of Goiás, the experiment was conducted from May 1998 to June 1999 in the farm of Faculdade de Agronomia. Every fortnight, 10 plates of fecal cake (of approximately 3 kg each) were produced from fresh bovine feces and that were collected immediately after defecation in pastures of Brachiaria brizantha (Hochst ex. A. Rich) and in corrals. The material was collected in plastic buckets and was homogenized. It was then placed in 10 round plastic supports, with a hole to allow rainwater to drain away. This methodology was used for precise determination of the time between the emission of

the fecal cake and its collection. The feces remained exposed (five in the pastures and five in the corrals) for 15 days. After this period, the feces were taken to the laboratory for extraction of pupae by means of the flotation method. The pupae were removed with the aid of a sieve; they were counted and individually stored in gelatin capsules (number 00) until the dipterous emerged. The dipterous that emerged were identified with the aid of a stereoscopic microscope and were conserved in 70% alcohol. The same methodology was used for feces of buffalos.

In the present study were obtained 4080 dipterous belonging to six families.

The most frequent was the family Sarcophagidae with 41.6%, followed by Sepsidae family with 40.2%. In contrast, in this study, the family Calliphoridae was the most abundant in the work done in Rio de Janeiro, RJ [1].

The species Palaeosepsis spp. (Diptera: Sepsidae) (Figure 3) was the most abundant with 36.6% of the individuals collected, then the species Sarcophagula occidua (Fabricius) (Diptera: Sarcophagidae) with 22.8%. Both species were collected from cattle feces, probably due to the greater number of substrates listed for performing the work. These results are different to those found by [1, 2] whose research Palaeosepsis pusio (Schiner) (Diptera: Sepsidae) was the most frequent species, with 29.9% and 29.5%, respectively. Was collected from a greater diversity of species of the family Sarcophagidae (06 species), among the four families studied. Probably due to the ability of adults to search to find the food sources. In the work of [3, 4], this family was also presented that a greater number of species.

Noted the absence of species of the genus Phaenicia (native) this work. Probably, this fact can be interpreted as an escape mechanism to competition with Chrysomya. The species of Chrysomya (exotic) have great adaptability to different environments remarkable competitive ability capable of displacing native species.

Species Chrysomya were collected in bovine liver in Uberlândia, Minas Gerais, and Rio de Janeiro-RJ, respectively, represent 100% of Calliphoridae collected. They are of great medical and sanitary importance, because they are producing secondary myiasis and transmission of pathogenic microorganisms [3, 4].

Despite the M. domestica was not the most abundant Diptera, but is the species of greatest health concern because of its synanthropic character, its abundance in the urban districts ability to develop into various types of substrates, their high reproductive power and be identified as veiculadora of pathogens to humans and animals.

In this study Zaprionus indianus (Gupta) (Diptera: Drosophilidae) was the species of greatest economic importance. The first record published on the occurrence of this dipterous in the American continent was in khaki fruit in Santa Isabel, São Paulo, Brazil. Its poliphagy and relatively fast lifetime in high hot weather have contributed for its

settling and dispersion through this country. A loss of 50% was recorded in the fig production in the state of São Paulo, Brazil due to this fly [5].

This information contributes significantly in studies aimed at the prevention of which can be transmitted by these insects diseases as well as for the formulation of more effective methods of control [6, 7].

REFERENCES

[1] D'Almeida, J.M. (1993). Capture of Calyptrate flies with different breeding substrates on beaches in Rio de Janeiro, RJ, Brazil. Memórias do Instituto Oswaldo Cruz, 88, 215-220.

[2] Lomônaco, C. and Almeida, J.R. (1995). Estrutura comunitária de dípteros muscoídeos da restinga de Jacarepaguá, Rio de Janeiro, Brasil. Revista Brasileira de Entomologia, 39, 891-896.

[3] Carvalho, A.M.C., Mendes, J., Marchiori, C.H. and Lomônaco, C. (1991). Variação espacial e sazonal de dípteros muscoídeos em duas áreas de cerrado no município de Uberlândia-MG. I. Calliphoridae e Muscidae. Revista do Centro Ciências Biomédicas da Universidade Federal de Uberlândia, 7, 27-34.

[4] D'Almeida, J.M. and Mello, R.P. (1996). Comportamento de dípteros muscoídes frente substrato de oviposição, em laboratório, no Rio de Janeiro, RJ, Brasil. Memórias do Instituto Oswaldo Cruz, 91, 131-136.

[5] Vilela, C.R., Teixeira, E.P. and Stein, C.P. (1999). Nova praga nos figos: Zaprionus indianus Gupta, 1970. Informativo da Sociedade Entomológica do Brasil, 4, 1-5.

[6] Marchiori, C.H. (2014). First occurrence of Neralsia splendens (Borgmeier) (Hymenoptera: Figitidae) as parasitoids of Cyrtoneurina pararescita (Couri) (Diptera: Muscidae) in a rural area in Brazil. Agricultural Sciences, 5, 84 – 86..

[7] Marchiori, C.H., Borges, Borges, L.M.F. and Ferreira, L.L (2014). Parasitoids of dipterous collected in cattle dung in the Regions Southern and Central of Goiás, Brazil. Advances in Entomology, 02, 20–23.

Chapter 13 - Paraganaspis egeria Díaz, Gallardo & Walsh (Hymenoptera: Figitidae) as potential agent in the biocontrol of dipterous collected in several substracts Brazil

The search was carried out in order to meet the hosts of the parasitoid Paraganaspis egeria associated to several muscoids substracts in Itumbiara, Goiás, Brazil.

In a natural area, two pig carcasses Sus scrofa L. weighing approximately 10 kg each, were used as baits. They were mechanically killed and immediately placed inside metal frame cages to exclude the large vertebrate scavengers. Underneath the cages, metal trays with sawdust were placed to collect the pupae. The pupae were obtained by the

floating method and individually deposited in jelly capsules until flies and the parasites were able to come out. The adults obtained by this process were counted and identified. The cattle feces were kept in the manure deposit for about 10 days, serving as a substract for the development of several fly species. The collecting of these pupae was done each 15 days, on the manure dung that stayed for more than eight days in the manure deposit. The manure was collected in plastic basins (40cm diameter and 12cm high) of manure. The pupae were obtained by the floating method and individually deposited in jelly capsules until the flies and the parasites were able to come out. The adults obtained by this process were counted and identified.

The flies were attracted to the traps, which were made of dark dull cans, measuring 19cm height and 9cm diameter, with two openings like blinders, located in the inferior third part to allow the entrance of the flies. In the upper part, the cans were coupled with nylon funnels, opened at the bottom, base pointing down and wrapped with plastic bags, so when removed, it would make possible the collecting of flies and parasitoids. Human feces, cattle kidneys and chicken deposited on top of a soil layer were placed as bait inside the each can. Three traps were used and they were hanged on trees one meter above the ground, two meters apart from each other. The collected insects were taken to the laboratory, sacrificed with ethyl ether and kept in 70% alcohol for further identification. The content of the traps were placed in plastic containers, having a layer of sand to be used as a substratum of larvae pupae. Therefore, this sand was sifted after being 15 days in fields and from this sand the pupae was extracted and individually placed in jelly capsules (00 number) to obtain flies and /or the parasitoids.

These study were conducted at the Faculdade de Agronomia settled in the city of Itumbiara, GO (18º25´S – 49º13´W), Brazil.

The 6,087 pupae of dipterous muscoids were collected in several substracts, from January, 1999 to October, 2001. From the collected hosts it must be point out the importance of the species Chrysomya albiceps (Wiedennam) (Diptera: Calliphoridae). The C. albiceps has a great medical and sanitary concern, because its responsibility for secondary myiasis and carrying pathogenic microorganisms. 206 individuals of Paraganaspis egeria Díaz, Gallardo & Walsh (Hymenoptera: Figitidae) parasitoids were obtained in five substracts and from four different hosts. The fact of several dipterous, P. egeria being used helps their permanence in the environment, improving their potential as biological agent keepers (Fergusson, 1988).

A great number of individuals were obtained from the Sarcophagula occidua (Fabricius) (Diptera: Sarcophagidae) host about 84.9% in cattle dung. The total percentage of observed parasitism was about 3.4%. The host showing more percentage of parasitism was the Fannia pusio (Wiedemann) (Diptera: Fanniidae) in chicken.

As a possibility to control these flies, the natural regulators can be used, such as parasitoids, that are the agents responsible for the reduction of the synanthropic fly populations. Several eucoilid species have been implicated as important natural enemies of different dipteran species (Quilan 1979; Hanson & Gauld, 1995; Ronquist, 1995; Wharton et al., 1998)

REFERENCES

Fergusson, N.D.M. A comparative study of the structures of phylogenetic importance of female genitalia of the Cynipoidea (Hymenoptera). System. Entomol., v.13, p.13-30, 1988.

Hanson, P.E., Gauld, I.D. The Hymenoptera of Costa Rica. Oxford: Oxford Univ. Press, 1995. 893p.

Quilan, J. A revisionary classification of the Cynipoidea (Hymenoptera) of the Ethiopian zoogeographical region. Bull. Br. Mus. Nat. Hist. (Ent.), v.39, p. 85-133, 1979.

Ronquist, F. Phylogeny and early evolution of the Cynipoidea (Hymenoptera). Sist. Entomol., v.20, p.309-335, 1995.

Wharton, S.M., 0vruski, S.M., Giltrap, F.E. Neotropical Eucoilidae (Cynipoidea) associated with fruit-infesting Tephritidae, with new records from Argentina, Bolivia and Costa Rica. J. Hym. Res., v.7, p.102-115, 1998.

Chapter 14 - Parasitoids de dipterous collected in the urban area in Brazil

This study had the objective of determining the species of parasitoids of dipterous collected in urban area in Goiânia central regions of the state of Goiás, Brazil.

The dipterous 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 dipterous 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 dipterous and parasitoids could be collected. The following items were used as bait cattle kidneys 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 (size number 00) in order to obtain the dipterous and/or parasitoids.

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.

There were 53 specimens of Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae); one of Hemencyrtus herbertii Ashmead (Hymenoptera: Encyrtidae); five of Pachycrepoideus vindemmiae (Rondani) (Hymenoptera: Pteromalidae); and one of Tachinobia sp. (Hymenoptera: Eulophidae).

The lower diversity in the central region was probably related to the low synanthropy of the species of dipterans and parasitoids collected in the urban area studied.

The most frequent species was B. podagrica, accounting for 88.3% of the individuals collected. Species of the genus Brachymeria Westwood are important primary parasitoid of muscoid Diptera, such as species of the Sarcophagidae and Calliphoridae families. Some species are of economical importance, for they attack insect pests (Gauld & Bolton, 1988).

The lower diversity in the central region was probably related to the low synanthropy of the species of dipterans and parasitoids collected in the urban area studied. The locality studied is now surrounded by human populations on all sides.

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The species B. podagrica occurs almost everywhere in the world and lives associated with Diptera synanthropic and other flies emerging from their pupae (Delvare & Boucek, 1992; Marchiori, 2001).

The total percentage of parasitism was 16.8%, probably due to the presence of gregarious parasitoids. Brachymeria podagrica was the species that showed highest percentage of parasitism, possibly due to variations in the quality and availability of food resources or the density of hosts.

In relation to the hosts collected, the species Chrysomya albiceps (Wiedemann) (Diptera: Calliphoridae) 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).

Besides the chemical technique by means of insecticides for insect control, natural regulators called various pests as an alternative control these insects in agriculture and animal husbandry areas (Silveira et al., 1989) can be used. Mendes & Linhares (1993) research of new methodologies for the control of flies believe necessary.

REFERENCES

Delivered, G. & Z. Boucek (1992): On the new world Chalcididae (Hymenoptera). Memoirs of American Entomologist Institute 53: 30-31.

Gauld, I.D. & D.B., Bolton (1988): The Hymenoptera. Oxford University Press, London, 332 pp.

Marchiori, C.H. (2001): Ocorrência de Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) como parasitóide de Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae) no Brasil. Entomologia Y Vectores 8:: 513-517

Marchiori, C.H. (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, C.H., Borges, L.M.F. & L.L Ferreira (2013): Dipterous parasitoids collected from cattle dun in Goiânia, central Goiás, Brazil. Journal Pensée 75: 418-426.

Mendes, J. & A.X. Linhares (1993): Atratividade por iscas, sazonalidade e desenvolvimento ovariano em várias espécies de Muscidae (Diptera). Revista Brasileira de Entomologia 37: 289-297.

Silveira, G.A.R., Madeira, N.G., Azeredo-Espin A.M..L. & C. Pavan (1989): Levantamento de microhimenoptera parasitóides de dípteros de importância médico-veterinária no Brasil. Memórias do Instituto Oswaldo Cruz 84: 505-510.

Chapter 15 -Parasitoids of Diptera collected in traps of different colors in Brazil

The objective of this study was to report the parastoids of Diptera collected in traps of different colors in the south of Goias state.

This study was conducted within the School of Agronomy of the municipality of Itumbiara (18°25´S – 49°13´W), in the southern Goiás State. Adult dipterous were collected with traps built with metal cans measuring approximatelly 19 cm of height and 9 cm of diameter, with two horizontal retangular openings in their lower third, to allow the insects to enter. Nylon funnels that were opened at both ends were attached to the tops of the cans with their bases pointing downwards. The funnels were wrapped in plastic bags to

allow the insects to be removed from the traps. Raw bovine liver placed on a layer of dirt, was used as bait to attract dipterous (Ferreira, 1978).

Twelve traps two as of each color were used, painted yellow, black, red, white, green and blue were used. The traps were hung from eucalyptus trees (Eucalyptus sp.) approximatelly one meter above the ground two meters from each other and 50 meters from the domestic garbage. The adult insects collected were taken to the laboratory, sacrificed using ethyl ether and preserved in 70% alcohol for subsequent identification.

To obtain the parasitoids, the contents of the traps were placed in plastic recipients containing a layer of sand to serve as the substrate for pupation of the larvae. Fifteen days after collection in the field, the sand was sieved and the pupae were extracted from it. The pupae were then placed individually in gelatin capsules (number 00) until the emergence of the dipterous and/or their parasitoids.

The attraction of the specimens and species of parasitoids for the trap colors was analyzed by means of ANOVA, with transformation of the data to $\sqrt{x+0.5}$, and α set at 5%.

Between March and December 2006, 17 parasitoid specimens were collected from the yellow trap, 15 from the blue trap, 12 from the white trap, 37 from the black trap, one from the green trap and three from the red trap. The greater absorption of heat by the black trap caused a faster decomposition of the bovine liver, thus attracting a greater number of parasitoids. The parasitoids did not present any preference for any of the trap colors ($F=0.772$; $P=0.58$).

The most frequently collected parasitoid species was Brachymeria podagrica, with 80.0% (Table 1), which was possibly because of seasonal factors or the search capacity presented by this species. The species B. podagrica occurs almost all over the world, parasitizing synanthropic and other Diptera (Marchiori et al., 2001; Marchiori et al., 2003).

With regard to the attraction of the parasitoid species for trap color, it was found that Brachymeria sp. (Hymenoptera: Chalcididae) presented attraction for red; Brachymeria podagrica (Fabricius, 1789) (Hymenoptera: Chalcididae) presented attraction for yellow, white, black and green; Spalangia cameroni Perkins, 1910 (Hymenotera: Pteromalidae) presented attraction for white; and Spalangia endius Walker, 1839 (Hymenotera: Pteromalidae) presented attraction for red ($F=3.11$; $P=0.05$).

Considering the public health importance of these Diptera as vectors of agents of diseases, surveying of their natural enemies is essential, in order to adequately controlling them through integrated methods (Silveira et al.,1989; Scatolini & Penteado-Dias, 1997)

REFERENCES

Ferreira, M.J.M. Sinantropia de dípteros muscóideos de Curitiba, Paraná: Calliphoridae. Revista Brasileira de Biologia, v.38, n.2, p.445-454, 1978.
Marchiori, C.H.; Oliveira, A.T.; Linhares, A.X. Artrópodes associados a massas fecais bovinas no Sul do Estado de Goiás. Neotropical Entomology, Londrina, v.30, p.19-24, 2001.
Marchiori, C.H.; Pereira, L.A.; Silva Filho, O.M.; L.C.S. Ribeiro; V R. Borges. Ocorrência de Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) como parasitóide de dípteros coletados em diferentes substratos em Itumbiara, Sul de Goiás, Brasil. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, Belo Horizonte, v.55, n.2, p. 246-248, 2003.
Silveira, G.A.R.; Madeira, N.G.; Azeredo-Espin, A.M.L. Levantamento de microhimenóptera parasitóides de dípteros de importância médico-veterinária no Brasil. Memórias do Instituto Oswaldo Cruz, Rio de Janeiro v.84, p.505-510, 1989.
Scatolini, D.; Dias, A.M.P., 1997. A fauna de Braconidae (Hymenoptera) como bioindicadora do grau de preservação de duas localidades do Estado do Paraná. Revista Brasileira de Ecologia, Rio Claro, v.1, n.1, p. 84-87, 1997.

Chapter 16 - Parasitoids of flies collected on human feces in Brazil

The objective of this study was to identify species of parasitoids that parasitize flies occurring on human feces, under field conditions.

This study was conducted from March 2001 to April 2002 at the College of Agronomy (Faculdade de Agronomia) located in Itumbiara County, Goias State, Central Brazil (18º25´S;49º13´W). Flies were attracted to traps made of dull black tin foil cans (19 cm tall and 9 cm in diameter) with two blinders-like openings, located at the 1/3rd bottom part to allow flies entry. To the upper part of each a nylon funnel with opened extremities and base turned down was attached.
These traps were then wrapped with plastic bags, which after removal would allow the capture of flies and parasitoids. Human feces, deposited on top of a soil layer, were placed as baits inside each can. Five of these traps were randomly hung on Eucalyptus sp. trees at 1 m above the soils level, 2 m apart from each other and 50 m away from a domestic garbage deposit. The specimens of parasitoids and flies collected were after remaining 15 days in the field were taken to the laboratory, killed with ethyl ether and stored in 70% ethanol for further identification. After removal of insects, the content of each trap was individually placed into plastic containers layered with sand to serve as substrate for larvae and pupae development. These substrata were sifted for extraction

of pupae obtained under natural environment. The pupae were then individually transferred to gelatin capsules (number 00) and maintained a environment temperature in the laboratory to obtain flies and/or parasitoids.

The percentage of parasitism was computed using the following formula: P=(parasitized pupae/total of pupae) x 100. The preference of species for their host was tested by the Chi-square test, at 5% probability.

From March 2001 to April 2002 a total of 823 pupae of dipterans was collected. From these, a total of 180 specimens of parasitoids, representing 6 species from 5 families was obtained. The total percentage of parasitism observed was 21.9%. From the hosts collected, the importance of the specie Musca domestica Linnaeus (Diptera: Muscidae) has to be emphasized. This species is of large sanitary importance due to its sinanthropic characteristics, its abundance in urban areas, its capacity of development on several sorts of substrata, its high reproductive power and for being appointed as pathogenic mediator to men and animals.

The percentage of parasitism for the species Gnathopleura quadridentata Wharton (Braconidae), Brachymeria podagrica (Fabricius) (Chalcididae), Hemencyrtus herbertii (Encyrtidae), Paraganapis egeria Díaz and Gallardo (Eucoilidae), Nasonia vitripennis (Walker) and Pachycrepoideus vindemiae (Rondani) (Pteromalidae) was 2.7%, 2.5%, 2.8%, 0.1%, 1.5% and 12.1%,, respectively.

Pachycrepoideus vindemiae was the most frequent species and the species that parasitized the largest diversity of hosts. It is probably a polyphagous species and is considered a solitary parasitoid of numerous Diptera from Anthomyiidae, Calliphoridae, Muscidae, Tachinidae and Tephritidae families, among others (Cow, 1940; Silva, 1991) (Table 1). Hemencyrtus herbertii has shown preference for pupae of Oxysarcodexia thornax Walker (Diptera: Sarcophagidae) and M. domestica; N. vitripennis for pupae of Peckia chrysostoma (Wiedemann) and Sarcodexia sp. (Diptera: Sarcophagidae); G. quadridentata for pupae of O. thornax and P. vindemiae for pupae of Poecilosomella sp. (Sphaeroceridae), Sarcophagula sp. (Sarcophagidae), O. thornax, Fannia pusio (Wiedemann) (Fanniidae) and Sarcodexia sp. ($X2=355.0$; $DF=35$; $P=39.3$).

Nasonia vitripennis and Hemencyrtus sp. behaved as gregarious with four and five individuals emerging from a single host pupa, respectively. According to Rivers & Denlinger (1995), N. vitripennis behave as a gregarious parasitoid and is an ectoparasitoid on pupae of several species of the Diptera, especially in the families Calliphoridae, Muscidae, Sarcophagidae and Tachinidae.

Silva (1991) reported Hemencyrtus sp. parasitizing pupae of Chrysomya albiceps (Wiedemann) (Calliphoridae), Phaenicia eximia (Wiedemann) (Calliphoridae), Synthesiomyia nudiseta Wulp (Muscidae), Ophyra sp. (Muscidae), Oxysarcodexia sp. and

Patonella intermutans (Walker) (Sarcophagidae), collected on rat carcasses in São Carlos County, São Paulo State, Brazil.Considering the importance of this flies for public health, as vector of diseases-causing agents, it is essential to conduct surveys on these natural enemies to aid in the adequate control of flies through integrated control methods. This paper reports the first occurrence of B. podagrica parasitizing pupae of Ophyra sp.

REFERENCES

Chow, C.Y. 1940. The common blue bottle fly Chrysomya megacephala as a carrier of pathogenic bacteria in Beijing . China Chinase Medical, 57:145-153.

Rivers, D.B.; Denlinger, D.L. 1995. Fecundity and development of the ectoparasitic wasp Nasonia vitripennis dependent on host quality. Entomologia Experimentalis et Applicata, 76:15-24.

Silva, A.R. 1991. Himenópteros parasitóides associados a dípteros saprófagos, com especial referência aos Alysiinae. Dissertação de mestrado, Universidade Federal de São Carlos, São Carlos, Brasil, 54pp.

Chapter 17- Parasitoids of insect pests collected in the agricultural area in Brazil

The present study aimed to identify the parasitoids collected in insect pests in agricultural area in southern Goiás, Brazil.

Experiment with maize.

The experiment was performed at the Agronomy School Farm and at the Santa Maria Farm from December 2001 to February 2002. Both farms are located in Itumbiara County, State of Goiás, Central Brazil (18°25'S; 49°13'W). Hemiptera egg collections were carried out on a 44x20m maize plot, the Agronomy School Farm. At the Santa Maria Farm, an area of one hectare was divided into 44x20m plots for each of the seven samplings. Fifty ears of maize were randomly collected weekly on each farms, a total of 700 ears. These ears were collected on different plots. The ears were individualized in plastic bags and taken to the laboratory of the Instituto Luterano de Ensino Superior for collection of the naturally infested host eggs. All ears were individually checked for the presence of Hemiptera egg masses. These egg masses were then transferred, together with a small piece of maize foliar sheath, to glass flasks that were maintained in the laboratory, under room temperature, until the emergence of parasitoids and/or nymphs of the host insect.

Experiment with fruits.

This study was conducted from March to November of 2001 at the College of Agronomy (Faculdade de Agronomia) located in Itumbiara County, State of Goiás,

Central Brazil (18º25´S; 49º13´W), Brazil. Flies were attracted to traps made of dull black tin foil cans (19 cm tall and 9 cm in diameter) with two blinders-like openings, located at the 1/3rd bottom part to allow flies entry. To the upper part of each can a nylon funnel with opened extremities and base turned down was attached. These traps were then wrapped with plastic bags, which after removal would allow the capture of flies and parasitoids.

Fruits (divided banana, apple and pear) were replaced weekly and deposited on top of a soil layer, were placed as baits inside each can. Five of these traps were randomly hung on Eucalyptus sp. trees at 1 m above the soil level, 2 m apart from each other and 50 m away from a domestic garbage deposit. The specimens collected were taken to the laboratory, killed with ethyl ether and stored in 70% ethanol for further identification. After removal of insects, the content of each trap was individually placed into plastic containers layered with sand to serve as substrate for larvae and pupae development. After remaining 15 days in the field these substrata were sifted for extraction of pupae obtained under natural environment. Pupae were then individually transferred to gelatin capsules (number 00) to obtain flies and/or parasitoids.

Experiment with Tuta absoluta (Meyrick, 1917) (Lepidoptera: Gelechiidae)

The study was carried out using an area of 20 m2 in a greenhouse belonging to the Departmento de Agricultura da Universidade Federal de Lavras, in Lavras County (21o14'43"S; 44o59'59"W), State of Minas Gerais. From August 2001 to February 2002, parasitoids were obtained from T. absoluta pupae collected on 35 out of a total of 120 tomato plants, cv. Santa Clara. Tomato seedlings were planted in PVC pots with 20-liter capacity and maintained in the greenhouse at 27°C and 60 ± RH. When plants reached 40 days, the leaves containing pupae were cut with scissors and transferred to the Biological Control Laboratory. Pupae were then retrieved with the aid of tweezers, counted, and individualized in glass flasks until emergence of Lepidoptera or parasitoid adults. These were identified under stereomicroscope and then preserved in 70% ethanol.

Experiment with Lomonia sp. (Lepidoptera: Saturniidae)

During the period August to November 2002 100 plants were inspected C. arabica, in a culture of conventional type system located at the Federal University of Lavras, in SE - MG. Larvae were collected with the aid of tweezers, individuliazadas in glass tubes and brought to the laboratory Reception and Screening of Insects Entomology Department of the Federal University of Lavras (UFLA), where they remained until the emergence of adults and / or their parasitoids , which were subsequently identified.

A total of 113 eggs of L. zonatus were collected from January to February 2002, from

which 40 nymphs (35.4%) of the host species and 64 parasitoids (56.6%), from five different species, emerged. Nine of the eggs (8.0%) did not produce either nymphs or parasitoids.

Among the parasitoids collected, Gryon gallardoi (Brethes) (Hymenoptera: Scelionidae) was the most frequent species representing 79.6% of the specimens, probably influenced by the seasonal variation. Gryon gallardoi is also a parasitoid of eggs of other Hemiptera belonging to the Coreidae family that, in Brazil, attack rice, potato, tobacco, tomato and papaya (Loiacono, 1980).

The parasitism also reported in the genera Gryon, Neolreleya (Hymenoptera: Eurytomidae), Ooencrytus (Hymenoptera: Encyrtidae) and Anastatus (Hymenoptera: Eupelmidae) on eggs of L. zonatus (Jones, 1993).

Between March to November of 2001, 285 specimens of Pachycrepoideus vindemmiae Rondani (Hymenoptera: Pteromalidae) were obtained from 963 pupae of Z. indianus (Table 1). P. vindemmiae is considered a solitary parasitoid of numerous Diptera from the families Anthomyiidae, Calliphoridae, Muscidae, Tachinidae and Tephritidae, among others. P. vindemmiae was the most collected species with 98.9%., probably due to their ability to search.

Between March and November 2001, 03 specimens of Leptopilina boulardi Barbotin et al. (Hymenoptera: Figitidae) collected in the months of September (two specimens) and November (one specimen) of 2001 in the spring, were obtained from 139 pupae of Z. indianus (Table 1).

Species of the genus Leptopilina, well-known parasitoids of Drosophilidae, may also be reared from rotting fruit (Wharton et al.,1998).

During the study, from 500 T. absoluta pupae obtained, emerged parasitoides of the species Bracon sp. (Hymenoptera: Braconidae), Earinus sp. (Hymenoptera: Braconidae), and Conura sp. (Hymenoptera: Chalcididae). Bracon sp. was the most collected species with 60.0 (Table 1), due to its greater efficiency in searching for the host or to the influence of seasonal variation. Tomato plant infestation inside the greenhouse occurred because the windows allowed both pests and parasitoids insects to enter.

The natural occurrence of the genera Bracon, Earinus, and Conura inside the greenhouse suggests a close interaction among these species and their tomato leaf miner host. The nature of this relationship, however, has to be further studied in order to better evaluate the impact of these parasitoids on the insect pest population. Since these parasitoids are natural enemies of insect pests, the feasibility of their use as biological control agents in the tomato crop should be investigated.

Larvae belonging to 40 species were collected Lonomia sp., Of which seven Hymenoptera were parasitized by ectoparasites being four per Anastatus

sp. (Eupelmidae) and three Aprostocetus sp. (Eulophidae) was the most frequent specie Anastatus sp. to 57.1% (Table 1). Given the importance of this lepidopteran, there is a great need for knowledge of their biogeographical distribution, as well as their enemies natural, which may be part of biological pest control programs (Oliveira Júnior et al., 2007).

The use of some chemical substances to control this insect pest may result in high production costs, causing damages to the environment and to human health as well. So, search for effective natural enemies may be a viable alternative to control this pest in a long-term control program.

The nature of this relation, however, has to be deeper studied in order to permit a better evaluation of the impact of these parasitoids on the insect pest population. Since these parasitoids are natural enemies of insect pests, the feasibility of their use as biological control agents on the fig is an encouraging possibility.

REFERENCES

Jones W.A. 1993. New host and habitat associations for some Arizona Pentatomoidea and Coreidae. Southw Entomol 16: 1-29.

Loiacono M.S. 1980. Nota sobre tres escelionidos parasitoides de hemipteros de la ista epublica Argentina y Brasil (Hymenoptera-Proctotrupoidea). Rev Soc Entomol Ar, 39: 173-178.

Oliveira Júnior J.B., Silva C.G., Marchiori, C.H. 2007. Himenópteros parasitóides capturados em imaturos de Lonomia sp. (Lepidoptera: Saturniidae) oriundas de plantas de cafeeiro. Rev Trópica 1: 4-5.

Wharton S.M., 0vruski S.M., Giltrap, F.E. 1998. Neotropical Eucoilidae (Cynipoidea) associated with fruit-infesting Tephritidae, with new records from Argentina, Bolivia and Costa Rica. J Hymen Res 7: 102-115.

Chapter 18 - Aphaereta sp. (Hymenoptera: Braconida) as natural enemy to Peckia Chrysostoma (Wiedemann) (Diptera: Sarcophagidae), in Brazil.

The aim of this note is to relate the new host for the Aphaereta sp. species in Brazil.

The study was conducted at the wood of Faculdade de Agronomia setlled in the city of Itumbiara GO(18º25´S – 49º13´W), Brazil . The flies were attracted to the traps made of dark dull cans, measuring 19 cm of height and 9 cm diameter, with two

openings like blinders, located in the third inferior part to allow the entrance of the flies. In the upper part the cans were coupled with nylon funnels, opened at the bottom, base pointing down and wrapped with plastic bags, so when removed would make possible the collection of flies and parasitoids. The following items were used as fish baits placed inside the cans, over a layer of land.

Five traps were used and they were hanged in trees one meter from the ground, two meters apart from each other. The collected insects were taken to the laboratory, sacrificed with ethyl ether and kept in 70% alcohol for further identification. The content of the traps was placed in plastic containers having a layer of sand to be used as a substratum of larvae pupae. Therefore this sand was sifted after being 15 days in the fields and from this sand was extracted the pupae which were individually placed in gelatine capsules (00 number) to obtain flies and /or the parasitoids.

During the period from March to September 2001, 374 specimes of Aphaereta sp. (Hymenoptera: Braconidae) were collected in 26 pupae of Peckia chrysostoma (Diptera: Sarcophagidae). From the first to twelfh pupae were found 8, 10, 22, 27, 28, 29, 3l, 31, 40, 42, 47 e 60 specimens, respectevally. The Aphaereta sp. presented himself as gregarious, emerging several individuals from the same pupary, a poliembrionary is considered very ordinary. (Figg et al., 1993) it was observed that a lot of species of Aphaereta are gragarious. The species Aphaereta sp. occurs almost everywhere around the world and lives associated to sinatropic dipterous and other Diptera, emerging from their pupa shell.

Watts & Combs (1977) points out Aphaereta sp. as an important component in cattle excrements attacking pupas of Haematobia irritans L. (Diptera: Muscidae) in the Mississipi estate (USA). The Aphaereta sp. has attracted the attention of a large number of investigators as a potential biological control, in fact because of its wide distribution and host range (Whistlecrsft, 1984).

This specie occurred as dipterous parasitoid, developed in bovine liver in typical wood areas in the state of Goiás (Marchiori et al., 2000). Therefore, this is the first register of Aphaereta sp. in pupae P. chrysostoma in Brazil.

The results obtained with this research allow us to stretch the occurrence of Aphaereta sp on a new host.

REFERENCES

Marchiori, C. H., Castro, M. E. V., Paiva, T. C. G., Teixeira, F. F. & Silva, C. G., 2000. Dipteros muscóides de importãncia médica e veterinária e seus parasitóides em Goiás. Arq. Bras. Med. Vet. Zootec. 52: 350-353.

Watts, K. J. & Combs, Jr. L., 1977. Parasites of Haematobia irritans and Other Flies

Breeding in Bovine Feces in Northeast Mississippi. Environ. Entomol., 6:823-826.
Whistlecraft, J. W., Harris, C. R. Tomlim, A. D. & Tolman, J. H. Mass rearing technique for a braconid parasite, Aphaereta pallipes (Say) (Hymenoptera: Braconidae). J. Econ. Entomol., 77: 8134-816.

Chapter 19 - Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) as parasitoids Sarcodexia lambens (Wiedemann) (Diptera: Sarcophagidae) in Brazil.

The aim of this paper was to report the first occurrence for Brachymeria podagrica on pupae of Sarcodexia lambens in Brazil.

This study was conducted at " Faculdade de Agronomia" (Itumbiara, GO, 18º25´S – 49º13´W), Brazil. The flies were attracted to traps built with 19x19cm opaque dark cans, with two openings like blinders located in the third inferior part to permit the entrance of the flies. Nylon funnels were coupled in the upper part the cans, opened in the ends, with bases pointing down and wrapped with plastic bags, enabling the collection of flies and parasitoids.
Human feces were used as baits inside the cans, over a layer of sand. Five traps hanging on eucalyptus trees one meter above the ground and two meters apart from each other, near domestic garbage cans were disposed. The collected insects were taken to the laboratory, killed with ethyl ether and kept in 70% ethanol for further identification. The contents of the traps were placed in plastic containers having a layer of sand to be used as a substratum for larvae to pupate. The sand was sifted after 15 days and pupae were extracted and placed individually in gelatine capsules (00 number) to obtain flies and/or the parasitoids. The percentage of parasitism was calculated by the following formula: P=(parasite pupae/total of pupae) x100.
During the period from March of 2001 to March of 2002 three specimens of Brachymeria podagrica (Fabricius) were collected in 33 pupae of Sarcodexia lambens (Wiedemann) (Diptera: Sarcophagidae) showing 9.0% of parasitism. The species B. podagrica occurs almost everywhere around the world and lives associated to synanthropic dipterous and other Diptera, emerging from their pupae (Silva, 1991). According to Roberts (1933) and Silva (1991) B. podagrica was collected as a solitary parasitoid of Sinthesiomyia larvae (Muscidae), Cochliomyia, Lucilia, Calliphora sp., Calliphora coloradensis Hough, Callitroga macellaria (Fab.) Phaenicia sericata (Meig.) Phaenicia. mexicana (Macq.), Phormia regina (Meig.) (Calliphoridae), Sarcophaga carnaria Linné, Sarcophaga haemorrhoidalis Fallén, Sarcophaga impar Aldrich e Sarcophaga peregtina Robineau-Desvoidy (Sarcophagidae).

Fly control using insecticides usually selects resistant populations, being just a palliative. Mendes & Linhares (1993) believed that research on new methods concerning fly control are needed. Natural regulators, such as parasitoids, are agents responsible for reduction of fly populations (Mendes & Linhares, 1993).

The aim of this note is to report the first occurrence for Brachymeria podagrica on pupae of Sarcodexia lanbens in Brazil.

REFERENCES

Mendes J. & Linhares, A.X. Atratividade por iscas, sazonalidade e desenvolvimento ovariano em várias espécies de Muscidae (Diptera). Rev. Bras. Entomol., v.37, p. 289-297, 1993.

Roberts, R.A. Activity of blowflies and associated insects at various heights above the ground. Ecology, v.14, p. 306-314, 1933.

Silva, A.S. Himenópteros parasitóides associados a dípteros saprófagos, com especial referência aos Alysiinae (Braconidae). São Carlos: 1991. 54p. [Dissertação (Mestrado) - Universidade Federal de São Carlos].

Chapter 20 - Gnathopleura quadridentata (Wharton) (Hymenoptera: Braconidae) as natural enemy of Sarcodexia lambens (Wiedemann) ((Diptera: Sarcophagidae) in Brazil

The aim of this paper was to report the first occurrence for Gnathopleura quadridentata on pupae of Sarcodexia lanbens in Brazil.

This study was conducted at Parque da Serra de Caldas Novas setlled in the city of Caldas Novas, GO (18°25´S – 49°13´W), Brazil. The flies were attracted to traps built with 19x19cm opaque dark cans, with two openings like blinders located in the third inferior part to permit the entrance of the flies. Nylon funnels were coupled in the upper part the cans, opened in the ends, with bases pointing down and wrapped with plastic bags, enabling the collection of flies and parasitoids.

Human feces were used as baits inside the cans, over a layer of sand. Five traps hanging on eucalyptus trees one meter above the ground and two meters apart from each other, near domestic garbage cans were disposed. The collected insects were taken to the laboratory, killed with ethyl ether and kept in 70% ethanol for further identification. The contents of the traps were placed in plastic containers having a layer of sand to be used as a substratum for larvae to pupate. The sand was sifted after 15 days and pupae were extracted and placed individually in gelatine capsules (00 number) to obtain flies and/or the parasitoids.

The percentage of parasitism was calculated by the following formula: P=(parasite pupae/total of pupae) x100. A identificação dos parasitóides foi realizada utilizando trabalho de Penteado-Dias, e a dos hospedeiros, chave proposta por McAlpine et al. (1981). O material coletado, sob números 28 (parasitóides) e 29 (dípteros muscóides) foram depositados in the Laboratory of Biology of Lutheran Institute of Superior Teaching.

During the period from April to May of 2004, 28 specimens of Gnathopleura quadridentata (Wharton) (Hymenoptera: Braconidae) were collected in 28 out of 50 pupae of Sarcodexia lanbens (Wiedemann) (Diptera: Sarcophagidae) showing 56.0% of parasitism. The percentage of parasitism can also be related to capacity of search of the parasitoid and to the availability of recourses. Gnathopleura quadridentata shown preference por Calyptrate muscoids flies, specially sarcophagids. This parasitoid is solitary, and emerge from the puparium of host. Gnatopleura have been and released for the biological control of sarcophagids and muscid (Shewell, 1981).

Penteado-Dias collected three specimens of Gnathopleura sp. from vegetation and reared seven of them from puparia of P. chrysostoma obtained from a wet area near Miranda River, MS, Brazil.

The aim of this note is to report the first occurrence for G. quadridentata on pupae of S. lambens in Brazil.

REFERENCES

Mcalpine, J.E.; Peterson, B.V.; Sheweell, G.E.; Teskey, H.J.; Vockroth, J. R.; Wood, D.M. Manual of neartic Diptera. Otawa: Research Branche Agriculture Canada, Otawa, Canadá, 1981. 1332 p.

Penteado-Dias, A.M. Notes on the biology of Gnathopleura sp. (Hymenoptera: Braconidae) in Brazil. Entomological News, v:3, p.127-129, 1995.

Shewell, G.E. Sarcophagidae.. In: Mcalpine, J.E.; Peterson, B.V.; Sheweell, G.E.; Teskey, H.J.; Vockroth, J. R.; Wood, D.M. Manual of neartic Diptera. Otawa: Research Branche Agriculture Canada, 1981. p.1159-1186.

Chapter 21 - Parasitoids collected from artificial bovine dung pats exposed for different periods of time in Brazil.

. The objective of this study was to evaluate the succession of parasitoid species in artificial bovine pats exposed in the pasture in Itumbiara, State of Goiás, Central Brazil.

The experiment was carried out at “Chácara Vilela”, a small farm located in the

bairro Village, 5 km away from Itumbiara city, State of Goiás, Central Brazil (18º25'S and 49º13'W), on the Paranaiba river margin. The property has an area of approximately 29 hectares, with 50 heads of "girolanda" breed dairy cattle. Fresh feces were collected immediately after deposition on the barn and mixed in four 20 L plastic buckets. Artificial pads of feces (approximately 2 L each) were produced and placed into 10 plastic containers (40 cm in diameter x 12 cm in height) containing a 5 cm layer of soil from the same site.

The containers had the bottom perforated to allow water drainage and were then randomly placed at the soil level in the pasture to allow the colonization by arthropods. Pads (one dung pat) were individually retrieved from the field at 24 h intervals (24, 48, 72, 96, 120, 144, 168, 192, 216, and 240 h of exposure), and taken to the laboratory where they were kept for 10 days. Tem repetitions were done for each exposition time. Each bowl was covered with cheese cloth and maintained in the laboratory for collection of pupae by water flotation. Pupae were individualized into gelatin capsules (number 00) and maintained in the laboratory (temperature of 27°C and humidity of 60%) until parasitoid hatching. The experiment was carried out from January to October 2001.

Percentage of parasitism was calculated using the formula: P= (parasitized pupae/ total pupae)x100. The preference of species for time of feces exposure was tested by the Chi-square test, at 5,0% probability.

Paraganaspis egeria (Hymenoptera: Figitidae) was the most frequent species (44,4%) followed by Spalangia drosophilae (Hymenoptera: Pteromalidae) (22,7%) of the parasitoids collected. Paraganaspis egeria was collected from feces of all exposition times, with the exception of 216 h. These results are similar to those of Marchiori et al. (2001). We consider these two species to be the most well adapted to pasture areas in Itumbiara.

In addition, Trichopria sp. (Hymenoptera: Diapriidae), Neralsia splendens (Hymenoptera: Figitidae), P. egeria, and Aleochara notula (Coleoptera: Staphylinidae) were collected in feces with 24, 48, and 72 h of exposure indicating that they probably are parasitoids of larvae of muscoids dipterans.

According to Diaz & Gallardo (1995; 1996), N. splendens and P. egeria are parasitoids of first instar larvae of Sarcophagula occidua (Diptera: Sarcophagidae) in bovine feces. The Figitidae are parasitoids of Diptera and behave as primary parasitoids of dipteran larvae. Guimarães & Mendes (1998), working with succession of Staphylinidae on bovine feces, found that Aleochara spp. were more abundant after 24 h of exposure, indicating that they are predators of eggs or larvae of Diptera.

The presence of the parasitoids Trichopria sp, Triplasta atrocoxalis (Hymenoptera: Figitidae) and P. egeria in the exposure time of 120, 144, 168, 192, 216,

and 240 h can be explained by they being parasitoids of pupae or due to the possible presence of eggs and/or larvae of Diptera in the feces with those times of exposure. Sanders & Dobson (1966) stated that the Sepsidae are the first flies to visit feces, and possibly that they are not limited solely to fresh feces. According to Laurence (1955), some Diptera groups such as Sphaeroceridae and Sepsidae, seem to be non-demanding in terms of time of exposure of the substrate, since they may produce more than one generation in the same fecal mass. In the case of Trichopria sp., oviposition may occur on the host larva as well as on the pupae (Hanson & Gauld, 1995).

Species of Spalangia are predominantly associated to bovine dung and are parasitoids of Diptera pupae (Rueda & Axtell, 1985). In this experiment species of Spalangia occured in the feces after 96 h of exposure because species of these genus are parasitoids of fly pupae. Our results indicate that, in Itumbiara, pupae of muscoid flies may be found in bovine feces only after 96 h of exposure. This is a very important finding since the adults of the horn fly preferentially oviposit on recently dropped fecal masses (Mendes & Linhares, 1999).

The most important period -- the parasitoids are active occurred in fresh fecal pats (Table 2) with exposure times from 24 to 96 h. In the only those parasitoid species found in fresh feces (24 and 48 h) would be more suitable to be used in future horn fly control programs. Amaral (1996) found that the Hymenoptera reached their highest abundance in feces exposed for 144 h.

The collected parasitoids showed the following for fecal pats: Trichopria sp. preferred feces exposed for 72 and 192 h; P. egeria preferred feces exposed for 24, 48, 72, 192, and 240 h; Triplasta atrocoxalis for 72, 96, 144, and 198 h exposed feces; Spalangia cameroni (Hymenoptera: Pteromalidae) for 72, 96 144 and 168 h exposed feces; Spalangia nigra (Hymenoptera: Pteromalidae) for 72 and 240 h of exposure; Spalangia nigroaenea (Hymenoptera: Pteromalidae) for 96 h exposure; Spalangia sp. for 96 and 120 h exposure; and A. notula for 24 and 48 h of feces exposure in the field ($X2= 277,4$; $DF = 108$; $P< 0.0001$).

The percentage total of parasitism was 13,8% (Table 3). The percentage of parasitism observed was 17,5%, 15,1%, 9,0%, 52,5%, 18,4%, 9,1%, 5,3%, 12,0%, 2,0%, and 9,3% in feces with 24, 48, 72, 96, 120, 144, 168, 192, 216, and 240 h of exposure, respectively.

REFERENCES

Diaz, N.; Gallardo, F. Aportes al conocimento de Neralsia splendens en la Argentina (Hymenoptera, Figitidae). Rev. Soc. Entomol. Argent., v. 54, n.1-4, p.74, 1995.

Diaz, N.; Gallardo, F. Sobre cinipoideos del Brasil, parasitoides de dipteros estercoleros

(Hymenoptera: Cynipoidea). Rev. Soc. Entomol. Argent., v. 55, n.1-4, p.127-129, 1996.
Guimarães, J. A.; Mendes, J. Succession and abundance of Staphylinidae in cattle dung in Uberlândia, Brazil. Mem. Inst. Oswaldo Cruz, v. 93, n.1, p.127-131, 1998.
Hanson, P. E.; Gauld, I. D. The Hymenoptera of Costa Rica. Oxford: Oxford University Press, 1995.
Laurence, B. R. The Larval Inhabitants of Cow Pats. J. Anim. Ecol. , v. 23, p.234-260, 1955.
Marchiori, C.H.; A.T. Oliveira; Linhares, A.X. Artrópodes associados a massas fecais bovinas no Sul do Estado de Goiás. Neotrop. Entomol., v. 30, n.1, p.19-24, 2001.
Mendes, J.; Linhares, A. X. Diapause, pupation sites and parasitism of the horn fly, Haematobia irritans, in south-eastern Brazil. Med. Vet. Entomol v.13, n.2, p.185-190, 1999
Rueda, L. M.; Axtell, R. C. Guide to common species of pupal parasites (Hymenoptera: Pteromalidae) of the house fly and other muscoid flies associated with poultry and livestock manure. Technical Bulletin, n. 278, p.1-87, 1995.
Sanders, D. P. R.; Dobson, C. The Insect Complex Associated with Bovine Manure in Indiana. Ann. Entomol. Soc. Am., v. 59, n.5, p.955-959, 1966.

Chapter 22 - Parasitoid collected during the diurnal and nocturnal periods in Brazil

The objective of this study was to investigate the frequency of occurrence of parasitoid Hymenoptera collected during the diurnal and nocturnal periods in Itumbiara, State of Goiás.

The experiment was carried out in an area of remnant forest located close to the urban perimeter of Itumbiara, Goiás, at the coordinates 18°25'S and 49°13'W, in an area of the southern part of the State that has great economic importance because of its agricultural and industrial activities. The climate of the region is of AW type, according to Köppen's classification (Rosa & Assunção, 1991), with dry winters and rainy summers. It is a type of savanna climate, in which the annual rainfall is more than ten times the rainfall in the driest month (which is less than 60 mm).

The insects were collected in a Malaise trap. The collecting flasks were put out at 6:00 p.m. and replaced by new ones at 7:00 a.m. every day for ten consecutive days, thus totaling 40 collections between May and August 2005.

The parasitoids' preference for the diurnal or nocturnal period was analyzed by means of ANOVA, with transformation of the data to $\sqrt{x+0.5}$, at the 5% probability level.

A total of 135 specimens of parasitoids were collected. These were distributed

among seven superfamilies and sixteen families of Hymenoptera. Chalcidoidea presented the greatest diversity of families, and this group together with Ichneumonoidea predominated in the native forest ecosystem.

Among the individuals collected, 39.3% were in the diurnal period and 60.7% in the nocturnal period. The specimens and the parasitoid families did not present any preference for either of these two periods ($F = 0.73$; $P > 0.39$) and ($F=1.26$; $P>0.24$), respectively. Factors such as resource quality and availability, host density, climatic factors, floristic composition of the sampled fragment and the number of collections carried out may have influenced these results. According to Wallner (1987), not only climatic factors but also variations in resource quality and availability may provoke changes in the population abundance levels of these insects.

During the diurnal period the family that was collected most was Ichneumonoidea, accounting for 56.5% of the individuals collected , with statistically significant predominance of this family in relation to the others ($F=9.23$; $P >0.0001$). This was probably due to its parasitizing efficiency: its species are parasitoids on eggs, larvae, pupae or imagos of other insects (Scatolini & Penteado-Dias, 1997; Ros-Ferré et al., 1997).

During the nocturnal period, the family that was collected most was Encyrtidae, accounting for 31.7% of the individuals collected (Table 1). Many genera of Encyrtidae present polyembryonic reproduction, with many parasitoids emerging from a single host. Several species of this family have been successfully utilized in biological control programs (Noyes, 1980; Gauld & Bolton, 1988).

These results contribute towards the knowledge of the entomofauna of parasitic Hymenoptera in the Itumbiara region, southern part of the State of Goiás.

REFERENCES

Gauld, I. D. & Bolton, B., 1988, The Hymenoptera. Oxford University Press, Oxford, 33p.

Noyes, J. S., 1980, A review of genera of Neotropical Encyrtidae (Hymenoptera: Chalcidoidea). Entomol. Ser., 41: 1-253.

Ros-Ferré, C. S. P.; Algarra, A.; Ventura, D., 1997, Estudio comparativo de las capturas realizadas com trampa malaise en Andorra com especila atención a los himenópteros (Hymenoptera). Rev. Aragon. Entomol., 7: 71-82.

Scatolini, D.; Penteado-Dias, A. M., 1997, Fauna de Braconidae (Hymenoptera) como bioindicadora do grau de preservação de duas localidades do Estado do Paraná. Rev. Brás. Ecol., 1:84-87.

Wallner, W. E, 1987, Factors affecting insect population dynamics: differences between outbreak and non-outbreak species. Ann. Rev.Entomol., 32: 317-340.

Chapter 23- Occurrence of Trissolcus sp. (Hymenoptera: Scelionidae) in eggs of Leptoglossus zonatus (Dallas, 1852) (Hemiptera: Coreidae) in maize crops in Brazil.

This note reports, for the first time in Goiás, the occurrence of Trissolcus sp. parasitizing eggs of Leptoglossus zonatus.

The experiment was carried out at the "Fazenda da Faculdade de Agronomia" (College of Agronomy Farm), located in Itumbiara County, State of Goiás, Central Brazil (18°25'S; 49°13'W). Samples were obtained in a 44m x 22m maize (Zea mays) field plot, were 50 ears of maize crop were randomly harvested, individualized in plastic bags and transferred to the laboratory of the "Instituto Luterano de Ensino Superior" (Lutheran Institute of Superior Teaching) for collection of the naturally infested host eggs. The presence of eggs (egg masses on a straight line) was verified on each single ear of maize. In order to obtain parasitoids, each egg mass was placed near a small piece of maize leaf sheath inside a glass maintained in the laboratory, at room temperature (27°C), until emergence of parasitoids and/or nymphs of the insect pest.

Samplings were weekly taken from December 2001 to February 2002. Jorge Anderson Guimarães, from the "Universidade de São Paulo", (Esalq), Piracicaba, State of São Paulo, identified the parasitoid species. The percentage of parasitism was computed by using the following formula: P=(parasitized eggs/total eggs) x 100.
Seventy-two eggs of L. zonatus were collected, from which six parasitoids of the genus Trissulcus (Hymenoptera: Scelionidae) emerged. The percentage of parasitism observed was 8.3%. Hymenoptera egg parasitoids are the most important factor of natural mortality of Hemiptera, their higher reproductive rates, their synchrony with host development rate, the possibility of mass production and absence of hyperparasitoids make these insects suitable agents for biological control (Orr, 1988; Zucchi, 1993; Hanson & Gauld, 1995; Beevi & Lyla, 2000; Lynch & Thomas, 2000).

REFERENCES

Beevi, S.P., Lyla, K.R. Hymenopteran diversity in single and double cropped rice ecosystems in Kerala, India. P. Manage., v.25, p. 20-21, 2000.

Hanson, P.E., Gauld, I.D. The Hymenoptera of Costa Rica. Oxford: University Press, 1995. 893p.

Lynch, L.D., Thomas, M.B. Nontarget effects in the biocontrol of insects, nematodes and microbial agents: the evidence. Bioco., v.21, p.117-130, 2000.

Orr, D.B. Scelionid wasps as biological control agents: a review. Fla. Entomol., v.71, p.

506-528, 1988.
Zucchi, R.A., Silveira Neto, S., Nakano, O. Guia de identificação de pragas agrícolas. Piracicaba, FEALQ, SP, 1993. 139p.

Chapter 24 - Diptera collected from cattle dung pats in pastures in Brazil.

The purpose of this work was to identify the species of Diptera present in bovine feces that had been exposed to different periods of time in a pasture in Itumbiara, Southeastern of Goiás.

The experiment was carried out at “Chacara Vilela” , located in “Bairro Village” 5km from Itumbiara-GO (18º25’S and 49º13’W), on the margin of the Paranaiba River. This property has an area of approximately 29 hectars, and 50 head of cron baed cattle are maintained for milk production. Fresh feces were collected immediately after emission and mixed in 20-liter pails. Artifitial 2-liter fecal pats were produced and placed inside 10 plastic buckets (40cm of diameter by 12cm of height), containing a layer of 5cm of soil collected from the pasture. A few holes were made in the bottom of the buckets to allow water drainage.
The buckets were then placed on the pasture, to serve as substratum for the colonization and development of arthropods. Every 24h pads were individually retrieved from the field up to 240h of exposure and taken to the laboratory where they were kept for 10 days. Tem repetitions were done for each time of exposure. The buckets were covered with a fine mesh fabric, and kept in the laboratory where the pupae were extracted by water flotation. The pupae were individually placed gelatin capsules (number 00) and kept until the emergence of the adult flies. The experiment was carried out from January to August, 2001. The species preference by the time of exposition was tested by l2, 5% level of probability (Triola, 1999).
Among the Diptera, Palaeosepsis spp. (Diptera: Sepsidae) were the most abundant, comprising 50.3% of sampled insects, followed by Sarcophagula occidua (Diptera: Sarcophagidae) with 39.1%. These results were similar to those obtained by Marchiori & Linhares (2001). It is believed that these fly species are the most well adapted to areas of pasture in Itumbiara-GO. Although adult horn flies were found in the study area, no pupae were collected.
The number of families and species of insects were lower than that reported by Cervenka & Moon (1991). Probably this is due either to a more extensive sampling done by those authors or due to different weather conditions.

Brontaea debilis (Diptera: Sarcophagidae), S. occidua and Palaeosepsis spp. were

collected from pats of all exposure times. Sanders & Dobson (1996) reported that Sepside are the first flies detected in feces and that probably they are not limited to fresh feces. This statement is based on the fact that apparently some samples produced a second generation. According to Laurence (1955), some Diptera groups, such as Sphaeroceridae and Sepsidae, are not dependent on the time of exposure in the breeding substratum, since one can see more than one generation on the same fecal pat. The collected flies were more abundant in feces of 72h and 144h of exposure (16.6% and 13.6%, respectively).

The results show that the flies were more abundant (52.4%) in freshes fecal pats (with highest levels of humidity (24, 48, 72, 96 and 120 hours of exposure).

The collected flies showed the following preferences for fecal pats: Brontaea quadristigma (Diptera: Muscidae) preferred feces exposed 48, 168, 216 and 240 hours; B. debilis for 24 and 168 hours; Cyrtoneurina pararescita (Diptera: Muscidae) preferred 168, 192 and 240 hour-feces; Ravinia belforti (Diptera: Sarcophagidae) preferred 120 and 168 hour-feces; S. occidua 48, 72, 120 and 216 hour-feces; Archisepsis scabra (Diptera: Sepsidae) preferred 192 and 216 hour-feces; Palaeosepsis spp. showed its preference for 96, 144, 168, 216 and 240-hour-feces and Sphaeroceridae for 24 and 192 hours of exposure in the field (X2= 1085,8; GL=56, P<0,0001).

REFERENCES

Cervenka, V.J.; Moon, R.D. Arthropods associated with fresh cattle dung pats in Minnesota. J. Kansas Entomol. Soc., v. 64, p.131-145, 1991.

Laurence, B.R. The larval inhabitants of cow pats. J. Anim. Ecol., v.23, p.234-260, 1955.

Sanders, D.P.; Dobson, R.C. The insect complex associated with bovine manure in Indiana. Ann. Entomol. Soc. Amer., v. 59, p. 955-959, 1966.

Triola, M.F. Introdução à estatística. Rio de Janeiro: Livros técnicos e Científicos Editora S.A., 1999. 410p.

Chapter 25 - First report in Brazil of Brachymeria podagrica (Fabricius) (Hymenoptera: Chalcididae) as parasitoid of Chrysomya albiceps (Wiedemann) (Diptera: Calliphoridae) in Brazil

The aim of this note is to report a new host for B. podagrica species in Brazil.

This study was conducted at " the Agriculture Faculty" (Itumbiara, GO, 18°25´S – 49°13´W), Brazil. The flies were attracted to 19x9cm opaque dark can traps built, with two openings like blinders, located in the third inferior part to permit the entrance of the

flies. Nylon funnels were coupled in the upper part the cans, opened in the ends, with bases pointing down and wrapped with plastic bags, enabling the collection of flies and parasitoids.

Chicken viscera were used as baits inside the cans, over a layer of sand. Five traps hanging on eucalyptus trees one meter above the ground two meters apart from each other and meters from domestic garbage cans were disposed. The collected insects were taken to the laboratory, killed with ethyl ether and kept in 70% alcohol for further identification. The contents of the traps were placed in plastic containers having a layer of sand to be used as a substratum for larvae to pupate. The sand was sifted after 15 days and pupae were extracted and placed individually in gelatine capsules (00 number) to obtain flies and/or the parasitoids.

The percentage of parasitism was calculated by the following formula: P=(parasite pupae/total of pupae) x100.

During the period from March to August 2001 four specimens of Brachymeria podagrica (Fabricius, 1787) were collected in 29 pupae of Chrysomya albiceps (Diptera: Calliphoridae) showing 13.8% of parasitism. The percentage of parasitism can also be related to the type of methodology used. The species B. podagrica occurs almost everywhere around the world and lives associated to synanthropic dipterous and other Diptera, emerging from their pupae shell, formerly known as Brachymeria fonscolombei (Delvare & Boucek, 1992).

According to Roberts (1933), Burks (1960) and Habu (1960), B. podagrica was collected as a solitary parasitoid of Sinthesiomyia larvae (Muscidae), Cochliomyia, Lucilia, Calliphora sp., Calliphora coloradensis Hough, Callitroga macellaria (Fab.) Phaenicia sericata (Meig.) Phaenicia. mexicana (Macq.), Phormia regina (Meig.) (Calliphoridae), Sarcophaga carnaria Linné, Sarcophaga haemorrhoidalis Fallén, Sarcophaga impar Aldrich e Sarcophaga peregtina Robineau-Desvoidy (Sarcophagidae).

This species occurred as dipterous parasitoid, developed in rats carcasses in areas of tropical woods in the State of Goiás, Brazil. Its preferred host was Patonella intermutans (Walker) (Sarcophagidae) from where emerged parasitoid pupae, predominating females (Silva, 1991). Tomberlin & Adler (1998) studying the decomposition and colonies of insects in the carcasses of rats during the summer and winter in the South Caroline (E.U.A) collect B. podagrica in pupae of Sarcophaga sp. (Sarcophagidae).

According to de Santis (1980), the genus Brachymeria has 11 species found in Brazil, spread over the states of Paraná, São Paulo, Mato Grosso, Amazonas, Rio Grande do Sul, Rio de Janeiro and Minas Gerais.

This is the first report of B. podagrica in pupae of C. albiceps in Brazil.

REFERENCES

Burks, B.D. A revision of the genus Brachymeria Westwood in America North and Mexico (Hymenoptera: Chalcididae). Trans. Amer. Ent. Soc., v.86, p.238-239, 1960.

de Santis, L. Catalago de los himenopteros brasilenõs de la Série Parasitica incluyendo Bethyloidea. Curitiba: Ed. Univ. Fed. do Paraná, 1980. 395p.

Delvare, G., Boucek, Z. On the new world Chalcididae (Hymenoptera). Mem. Amer. Ent. Inst., v.53, p.30-31, 1992.

Habu, A. A revision of the Chalcididae Hymenoptera of Japan with descriptions of sixteen new species. Bull. Nat. Inst. Agr. Sci. Ser. C., v.11, p.131-357, 1960.

Roberts, R.A. Activity of blowflies and associated insects at various heights above the ground. Ecology, v.14, p.306-314, 1933.

Tomberlin, J.K., Adler, P.H. Seasonal colonization and decomposition of rat carrion in water and on land in na open field in South Carolina. J. Med. Entomol., v.27, p. 704-709, 1998.

Chapter 26 - Gnathopleura semirufa (Brullé, 1846) parasitoid of dipterous synanthropic in Brazil

The aim of this study was to record the parasitoid Gnathopleura semirufa (Brullé, 1846) parasitizing flies of the family Sarcophagidae in Brazil

The study on pitfall traps was also conducted on the campus of the Agronomy School in Itumbiara, Goiás, between January and November 2005. Each trap consisted of a plastic receptacle (basin) of 15 cm in diameter by 10 cm in height. Each receptacle was buried in earth, such that its upper extremity was at the ground surface level. One liter of water, 20 ml of detergent and 2 ml of formol were placed in each receptacle. A 200 ml pot was attached to the basin by means of a thin wire that went across it close to its edge, so as to keep the pot hanging and centralized in the basin. The bait, consisting of human feces, was placed in this pot. This trap was protected by another plastic receptacle of the same measurements (15 x 10 cm), which functioned as a cover. This contained four diametrically opposite holes of around 5 cm in diameter and 7 cm in height, and was supported on a metal wire suspended 10 cm from the group.

Six traps were used, with separations of two meters between each other, placed randomly. The bait was replaced every 15 days. The pupae that were found in the bait were separated out by means of the floatation method. These were then individually packed in gelatin capsules until the parasitoids emerged.

The percentage parasitism of each parasitoid species was calculated by means of the number of pupae parasitized per species of parasitoid, divided by total number of pupae from that host, and multiplied byx100.
Collected from 305 pupae Oxysarcodexia thornax (Walker) (Diptera: Sarcophagidae), 143 Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae) and 182 of Sarcodexia lambens (Wiedemann) (Diptera: Sarcophagidae) that emerged 75, 51 and 31 parasitoid species Gnathopleura semirufa (Brullé, 1846) (ym enoptera: Braconidae), respectively.

The total percentage parasitism observed was around 25.0%. The host showing the highest percentage parasitism was P. chrysosotoma in cattle liver (Table 1), and this was probably due to the seasonality factor presented by this species.
The percentage of parasitism observed in O. thornax, P. chrysosotoma and S. lambens was 24.6%, 35.7% and 17.0%, respectively (Table 1). Probably, these parasitism obtained may have been due to variations in the quality and availability of food resources or the densities of hosts.
Barros et al (2006) reported Peckia (Squamatodes) trivittata (Curran) (Diptera, Sarcophagidae) being parasitized by G. semirufa in the savanna of Brasilia, DF.
. The resistance to insecticides shows the growing need to introduce alternative insect control programs, for instance the biological control. It is possible to control these insects, by using the natural regulators such as parasitoids, which are the responsible agents for the reduction of the insects pests populations (Marchiori et al., 2002; Panizzi & Parra 2009).

REFERENCES

Barros R.M., Penteado-Dias, A.M., Luz J.R.P. 2006. Registro de Peckia (Squamatodes) trivittata (Curran) (Diptera, Sarcophagidae) parasitada por Gnathopleura semirufa (Brullé) (Hymenoptera, Braconidae, Alysiinae) no cerrado de Brasília, DF. Rev Bras Entomol, 50, 436-438
Marchiori C.H., Caldas E.R., Dias K.G.S. 2002. Parasitoids of Diptera in cattle feces at various exposure times in Itumbiara, Goiás, Brazil. Arq Inst Biol 69: 37-42.
Panizzi A.R. and Parra J.P. 2009. Bioecologia e nutrição de insetos. Embrapa informação Tecnológica, Brasília,1163p.
Chapter 27 - First occurrence of parasitoid Spalangia endius (Walker) (Hymenoptera: Pteromalidae) in pupae of Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae) in Brazil

The aim of this paper was to report a new host for Spalangia endius in Brazil.

The study was conducted in an urban area of the College of Agronomy (Faculdade de Agronomia), located in Itumbiara County, State of Goias, Central Brazil (18°25' S; 49°13' W). Flies were attracted to traps made of dull black tin-foil cans, measuring 19 cm in height and 9 cm in diameter, with two venetian blind type openings placed in the inferior third to allow the insects to enter. To the upper part of the cans, nylon funnels with open extremities and bases turned down were attached. These traps were then wrapped in plastic bags which, after later removal, would allow the capture of flies and parasitoids. Bovine kidney deposited on top of a soil layer was placed as bait inside the each can. Five of these traps were suspended on Eucalyptus sp. trees at 1 m above the soil level, 2 m apart from each other and 50 m away from a domestic garbage deposit. The specimens collected were taken to the laboratory, killed with ethyl ether, and preserved in 70% ethanol for further identification. After retrieval of insects, the traps contents were placed into plastic containers containing a layer of sand to serve as substrate for the larva population. After remaining 15 days in the field, the sand of these containers was sifted in order to extract the pupae produced in the natural environment. These pupae were than individually transferred to gelatin capsules (number 00) to obtain flies and/or parasitoids.

The percentge of parasitism was computed by the following formula:

P = (parasite pupae/total pupae) x 100.

During the period from March to December 2001, six specimens of Spalangia endius (Walker) (Hymenoptera: Pteromalidae) were collected in 76 pupae of Peckia chrysostoma (Wiedemann) (Diptera: Sarcophagidae), showing 7.9% of parasitism. The percentage of parasitism can be related to the period or the number of the collections which were performed.

Spalangia are solitary, idiobiont ectoparasitoids of fly pupae, the most important of which are Muscidae, Calliphoridae and Sarcophagidae. Because of their economic importance, the biologies of several species have been fairly intensively studied. Spalangia endius is widespread in the world as a parasitoid of Diptera, mostly in the form of muscoids and sarcophagids (Gauld & Bolton, 1988 Lopes & Leite).

Fly control using insecticides usually selects resistant populations, acting merely as a palliative. Natural regulators, such as parasitoids, are agents which are responsible for the reduction of fly populations (Mendes & Linhares, 1993).

REFERENCES

Gauld, I. D.; Bolton, B. 1988. The Hymenoptera. Univ. Press, Oxford, 331 pp.

Greenberg, B. 1971. Flies and disease – ecology, classification and biotic association.

Princeton Univ. Press, New Jersey, 856 pp.

Lopes, H. S.; Leite, A. C. R. 1989. Morphology of the egg of Sarcodexia lambens (Diptera: Sarcophagidae). Memórias do Instituto Oswaldo Cruz, 84: 497- 500.

Mendes, J.; Linhares A. X. 1993. Atratividade por iscas, sazonalidade e desenvolvimento ovariano em várias espécies de Muscidae (Diptera). Revista Brasileira de Entomologia, 37: 289-297.