SCIENTIFIC NOTE

First Record of *Coptera haywardi* Loiácono (Hymenoptera: Diapriidae) as a Parasitoid of Fruit-Infesting Tephritidae (Diptera) in Brazil

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Primeiro Registro de *Coptera haywardi* Loiácono (Hymenoptera: Diapriidae) Como Parasitóide de Tephritidae Frugívoros (Diptera) no Brasil

RESUMO - Este estudo relata a primeira ocorrência de *Coptera haywardi* Loiácono como parasitóide de pupa de Tephritidae que infestam frutos no Brasil. Este diapriídeo foi obtido de frutos de *Eugenia uniflora* (pitanga) infestados por *Anastrepha fraterculus* (Wiedemann) e/ou *Anastrepha sororcula* Zucchi. Foram também identificadas outras duas espécies de parasitóides de pupa: *Pachrycrepoideus vindemmiae* Rondani e *Spalangia endius* Walker (Pteromalidae). Quatro espécies de parasitóides de larva-pupa foram também obtidas: *Doryctobracon areolatus* (Szépligeti), *Utetes* (*Bracanastrepha*) *anastrephae* (Viereck), *Opius bellus* Gahan (Braconidae) e *Aganaspis pelleranoi* (Brèthes) (Figitidae).

PALAVRAS-CHAVE: Insecta, moscas-das-frutas, Proctotrupoidea, Braconidae, Figitidae, Pteromalidae

ABSTRACT - This study reports the first occurrence of *Coptera haywardi* Loiácono as a pupal parasitoid of fruit-infesting Tephritidae in Brazil. We reared this diapriid from fruits of *Eugenia uniflora* (Surinam cherry) infested by *Anastrepha fraterculus* (Wiedemann) and/or *Anastrepha sororcula* Zucchi. We also identified two other species of pupal parasitoids: *Pachrycrepoideus vindemmiae* Rondani and *Spalangia endius* Walker (Pteromalidae). Four species of larval-pupal parasitoids were also recorded: *Doryctobracon areolatus* (Szépligeti), *Utetes* (*Bracanastrepha*) *anastrephae* (Viereck), *Opius bellus* Gahan (Braconidae) and *Aganaspis pelleranoi* (Brèthes) (Figitidae).

KEY WORDS: Insecta, fruit fly, Proctotrupoidea, Braconidae, Figitidae, Pteromalidae

Among the natural enemies of tephritid fruit flies, the hymenopteran parasitoids are almost exclusively responsible for the equilibrium of their populations. The majority of these parasitoids belong to Braconidae whereas the few others belong to Figitidae, Diapriidae, Pteromalidae and Eulophidae (Ovruski *et al.* 2000).

The family Diapriidae, particularly the subfamily Diapriinae, includes species of parasitoids of Diptera Cyclorrhapha, such as Tephritidae (Muesebeck 1980). Studies on the biology and life history of diapriids suggest that most of them are pupal parasitoids of Diptera (Costa Lima 1962, Riek 1979), and all pupal parasitoids are by definition idiobionts (Godfray 1994).

According to Ovruski *et al.* (2000), the number of pupal parasitoids thus far recorded from the Neotropical region is considerably less than the number known from the Palaearctic. Costa Lima (1940) originally described a Brazilian diapriine species, *Trichopria* (= *Planopria*) *anastrephae,* collected in association with *Anastrepha serpentina* Wiedemann from hog plum (*Spondias* sp.).

Historically the use of pupal parasitoids to control tephritid pests has not been particularly successful because many of those that parasitize Diptera, like *Pachrycrepoideus vindemmiae* Rondani, are poor dispensers, polyphagous, and there is a risk of hyperparasitism.

The objective of this study was to report the occurrence of the genus *Coptera* in Brazil as pupal parasitoids of fruit-infesting Tephritidae, and hence to increase the knowlege of the geographical distribution of diapriines.

In a backyard garden in the residential area of the Universidade Federal Rural do Rio de Janeiro (UFRuralRJ) in Seropédica, RJ, there was a row of trees of Surinam cherry (*Eugenia uniflora* L.). The city of Seropédica is in the southeast of Brazil at 22º 46'S latitude, 43º 41'W longitude and 33m above sea level. The climate is defined as humid-warm, with mean annual temperature of 22.7ºC, 1200 mm rainfall, and with a summer rainy season (FIDERJ 1976). In February 1998, a sample of 1,000 fly-infested fruits of

Surinam cherry was randomly collected from the ground under the trees. These fruits were divided in four samples of 250 fruits each. Each sample was placed in a plastic tray of 40 by 30 by 6 cm with perforated bottom on a 2-cm layer of slightly moistened sand. The trays were placed at ground level under the tree canopy. To avoid predation by ants, the trays were placed on the top of aluminum cans, with their bases dipped into a solution of water plus detergent held in plastic bowls. The fruit samples stayed in the field for 15 days when most of the tephritid larvae had pupated. Afterwards they were transported to the laboratory of the "Centro Integrado de Manejo de Pragas Urbanas e Rurais Cincinnato Rory Gonçalves" (CIMPUR CRG), at the UFRuralRJ. In the laboratory, the fruits were placed in plastic sieves, which in turn were placed on top of 5-liter plastic buckets with a 15-cm layer of sand at the bottom as pupation substrate. Sand from the trays and the buckets was sifted to remove larvae and/or pupae, which were counted and transferred into 250-ml plastic cups partially filled with a 2-cm layer of slightly moistened sand. The cups were placed in 2-liter plastic containers with screened lids to hold flies and parasitoids after emergence, but every second day they were inspected to ascertain if the sand needed to be remoistened.

Fly and parasitoid emergence was checked every day for a period of 30 days after pupation. The adults of both were maintained alive for two to three days to get their color fixed, then killed, counted and preserved in vials filled with 70% alcohol for posterior identification. The species of *Anastrepha* and parasitoids (Braconidae and Figitidae) were identified using taxonomic keys and available descriptions (Canal Daza *et al.* 1994, Guimarães 1998, Zucchi 2000). Some Eucoilinae specimens were sent to Jorge A. Guimarães (ESALQ/USP, Departamento de Entomologia, Piracicaba, SP, Brazil) and Pteromalidae specimens to Systematic Entomology Laboratory (SEL/USDA, Beltsville, Maryland, USA), for conclusive identification. Diapriidae specimens were identified by Dr. Marta S. Loiácono (Departamento Científico de Entomologia, Museo de La Plata, La Plata, Buenos Aires, Argentina). Voucher specimens of fruit flies and parasitoids were placed in the entomological collection of CIMPUR CRG (Tephritidae, Braconidae and Eucoilinae), U.S. National Museum (Pteromalidae) and Museo de La Plata (Diapriidae).

A total of seven hymenopteran parasitoid species were identified: *Doryctobracon areolatus* (Szépligeti), *Utetes* (*Bracanastrepha*) *anastrephae* (Viereck), *Opius bellus* Gahan (Braconidae: Opiinae), *Aganaspis pelleranoi* (Brèthes) (Figitidae: Eucoilinae), *Coptera haywardi* Loiácono (Diapriidae: Diapriinae), *Spalangia endius* Walker and *P. vindemmiae* (Pteromalidae). One unidentified species of Eurytomidae was also recovered. Two species of *Anastrepha* were identified: *A. fraterculus* (Wiedemann) and *A. sororcula* Zucchi. The first fly species was more abundant, representing 87% of all tephritids. Most of the parasitoids (95.7%) were Braconidae. Specimens of the Figitidae, Diapriidae and Pteromalidae represented less than 5% of all parasitoids recovered (Fig. 1).

According to Johnson (1992), in the Neotropical region the genus *Coptera* Say includes two species: *C. breviceps* (Kieffer) recorded by Kieffer from the state of Pará (Brazil), and *C. haywardi* that was recorded from Tucumán (Argentina) (Hayward 1944, Loiácono 1981) and was recently recorded from central Mexico (López *et al.* 1999). Therefore, this is the first record of *C. haywardi* in Brazil (Fig. 2). This species was named *in litteris* as *Galesus haywardi* by Dr. A. Ogloblin, but he has not described it. This species was originally described by Loiácono in 1981 as *C. haywardi* (Loiácono 1981, Johnson 1992).

Various species of *Coptera* are known as parasitoids of species belonging to a number of families of Diptera, including fruit flies (Tephritidae) of economic importance (Muesebeck 1980). Hayward (1944) reported *C. haywardi* (as *G. haywardi, MS.*) from puparia of *A. fraterculus*. Loiácono (1981) mentioned this diapriine in the monophagous *A. schultzi* Blanchard in Tucumán. In Veracruz, México, *C. haywardi* was reared from Mexican fruit fly, *A. ludens* (Loew), infesting citrus (López 1996).

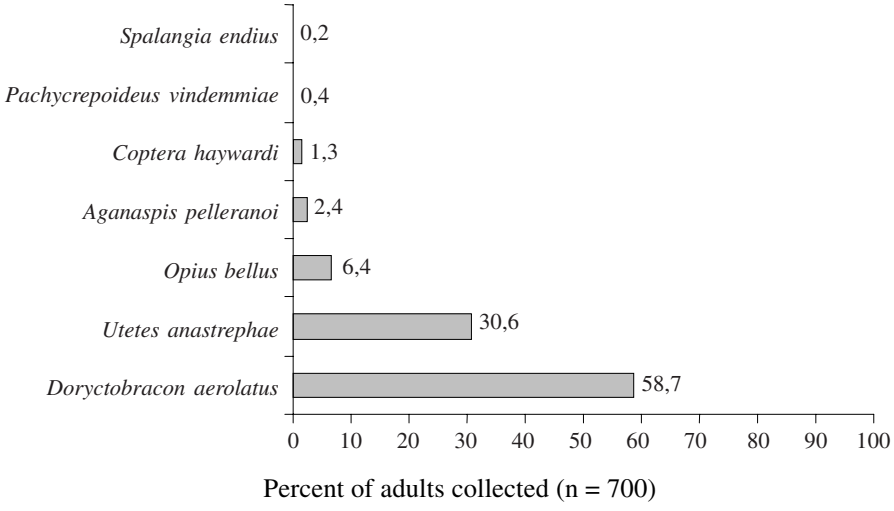

Figure 1. Parasitoids of fruit flies *Anastrepha* spp. (Tephritidae) and the percentage of adults collected in February 1998 in Seropédica, RJ, Brazil.

Figure 2. Adults of *Coptera haywardi* Loiácono, about 16 x; male (at the top) and female.

In 1997 *C. haywardi* was discovered in Venezuela attacking pupae of *A. serpentina* and *A. striata* Schiner whose larvae were reared in fruits of *Chrysophyllum cainito* (L.) and *Spondias mombin* (L.) (García & Montilla 2001). In the laboratory this parasitoid was able to develop in pupae of *A. obliqua* (Macquart) (García & Montilla 2001). A study on the bionomics of pupal parasitoids of tephritid fruit flies showed that *C. haywardi* developed in four species of Tephritidae [*A. suspensa, A. ludens, Ceratitis capitata* (Wiedemann) and *Toxotrypana curvicauda* (Gerstaeker)], but not in species of other families (Muscidae, Calliphoridae, Tachinidae and Drosophilidae) (Sivinski *et al*. 1998). Unlike many common, polyphagous, ectoparasitic, pteromalid and chalcidoid pupal parasitoids of cyclorrhaphous Diptera, *C. haywardi* develops as an endoparasitoid (Sivinski *et al.* 1998), and this could explain its narrower host range (Godfray 1994). According to Muesebeck (1980), species of Tephritidae are the most common hosts of *Coptera* species.

Several studies have suggested that augmentative releases of parasitoids have great potential for reducing Tephritidae pest population (Wong & Ramadan 1987, Knipling 1992, Wong *et al.* 1992). Typically, braconid parasitoids of larvae, such as *Diachasmimorpha longicaudata* (Ashmead), are employed. However, pupal parasitoids might be useful additions to such programs since they are able to attack flies that might otherwise escape parasitism at larval stage. If so, specialized pupal parasitoids are particularly valuable in augmentative releases since they are less likely to harm beneficial insects and more likely to focus their foraging on a small number of target pests (Menezes *et al.* 1998). In this context, *C. haywardi* has potential to be a good candidate for biological control of tephritid pests.

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Literature Cited

Canal Daza, N.A., R.A. Zucchi, N.M. Silva & F.L. Leonel Jr. 1994. Reconocimiento de las espécies de parasitoides (Hym.: Braconidae) de moscas de las frutas (Dip.: Tephritidae) en dos municipios del estado de Amazonas, Brasil. Bol. Mus. Ent. Univ. Valle 2: 1-7.

Costa Lima, A. 1940. Alguns parasitos de moscas de fruta. An. Acad. Bras. Scienc. 12: 17-20.

Costa Lima, A. 1962. Insetos do Brasil; Himenópteros. Rio de Janeiro, Escola Nacional de Agronomia, 12º Tomo, Capítulo 30, 2ª Parte, 393p. (Série Didática, 14).

FIDERJ. 1976. Indicadores climatológicos: sistema de informação para o planejamento estadual. Rio de Janeiro, FIDERJ/SECPLAN, 54p.

García, J.L. & Montilla, R. 2001. *Coptera haywardi* Loiácono (Hymenoptera: Diapriidae) parasitoide de pupas de *Anastrepha* spp. (Diptera: Tephritidae) en Venezuela. Entomotropica 16: 191-195.

Godfray, H.C.J. 1994. Parasitoids: behavioral and evolutionary ecology. Princeton, Princeton University Press, 473p.

Guimarães, J.A. 1998. Espécies de Eucoilinae (Hymenoptera: Figitidae) parasitóides de larvas frugívoras (Diptera: Tephritidae e Lonchaeidae) no Brasil. Tese de mestrado, ESALQ/USP, Piracicaba, 86p.

Hayward, K.J. 1944. Modelo de jaula que permite la distribución de parásitos dentro de las pupas de sus huéspedes. Rev. Ind. Agr. Tucumán 34: 23-26.

Johnson, N.F. 1992. Catalog of world species of Proctotrupoidea, exclusive of Platygastridae (Hymenoptera). Mem. Amer. Entomol. Instit., n. 51, 825p.

Knipling, E.F. 1992. Principles of insect parasitism analyzed from new perspectives, practical implications for regulating insect populations by biological means. Washington, USDA-ARS, Agriculture Handbook no. 693, 522p.

Loiácono, M.S. 1981. Notas sobre Diapriinae neotropicales (Hymenoptera, Diapriidae). Rev. Soc. Entomol. Argentina 40: 237-241.

López, M. 1996. Padrones de parasitismo en moscas de la fruta del género *Anastrepha* (Diptera: Tephritidae), en frutos nativos (*Spondias mombin* L. y *Psidium guajava* L.) y exocotos (*Mangifera indica* L. y *Citrus sinensis* L). Tese de mestrado, Universidad de Veracruz, Xalapa, Veracruz, México, 109p.

López, M., M. Aluja & J. Sivinski. 1999. Hymenopterous larval-pupal and pupal parasitoids of *Anastrepha* flies (Diptera: Tephritidae) in Mexico. Biol. Control 15: 119-129.

Menezes, E., J. Sivinski, T. Holler, M. Aluja, F. Jerônimo & E. Ramirez. 1998. Development of *Coptera haywardi* (Hymenoptera: Diapriidae) in irradiated and unirradiated pupae of the Caribbean fruit fly and the Mediterranean fruit fly (Diptera: Tephritidae). Fla. Entomol. 81: 567-569.

Muesebeck, C.F.W. 1980. The Nearctic parasitic wasps of the genera *Psilus* Panzer and *Coptera* Say (Hymenoptera, Proctotrupoidea, Diapriidae). Washington, U.S. Department of Agriculture, 71p. (Techn. Bull., 1617).

Ovruski, S., M. Aluja, J. Sivinski & R. Wharton. 2000. Hymenopteran parasitoids on fruit-infesting Tephritidae (Diptera) in Latin America and southern United States: diversity, distribution, taxonomic status and their use in fruit fly biological control. Int. Pest Man. Rev. 5: 81-107.

Riek, E.F. 1979. Hymenoptera (wasps, bees, ants), p. 867-959. In CSIRO (ed.), The insects of Australia. Carlton, Melbourne University Press, 1029p.

Sivinski, J., K. Vulinec, E. Menezes & M. Aluja. 1998. The bionomics of *Coptera haywardi* (Ogloblin) (Hymenoptera: Diapriidae) and other pupal parasitoids of Tephritidae fruit flies (Diptera). Biol. Control 11: 193-202.

Wong, T.T.Y. & M.M. Ramadan. 1987. Parasitization of the Mediterranean and Oriental fruit flies (Diptera: Tephritidae) in the Kula area of Maui, Hawaii. J. Econ. Entomol. 80: 77-80.

Wong, T.T.Y., M.M. Ramadan, J.C. Herr & D.O. McInnis. 1992. Suppression of a Mediterranean fruit fly population with concurrent parasitoid and sterile fly releases in Kula, Maui, Hawaii. J. Econ. Entomol. 85: 1671-1681.

Zucchi, R.A. 2000. Taxonomia, p. 13-24. In A. Malavasi & R. A. Zucchi (eds.), Moscas-das-frutas de importância econômica no Brasil: conhecimento básico e aplicado. FAPESP-Holos, Ribeirão Preto, 327p.

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