Survey of ear flies (Diptera, Ulidiidae) in maize (*Zea mays* L.) and a new record of *Euxesta mazorca* Steyskal in Brazil

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ABSTRACT. Survey of ear flies (Diptera, Ulidiidae) in maize (*Zea mays* L.) and a new record of *Euxesta mazorca* Steyskal in Brazil. Species of *Euxesta* (Diptera, Ulidiidae), known as silk flies or ear flies, are becoming increasingly important as maize insect pests in South America, although very little is known about them in Brazil. The larvae of some species of this genus initially damage female reproductive tissues, and then the developing kernels on the ear. As a result of feeding, fermentation and associated odors cause complete loss of the grain because it is no longer fit for human or livestock consumption. The main objective of this work was to evaluate the incidence of *Euxesta* spp. in Brazilian maize fields and to determine the most prevalent species using two different hydrolyzed protein foods attractants, BioAnastrepha® (hydrolyzed maize protein) and Torula, placed inside McPhail traps. The two species identified were *E. eluta* Loew and *E. mazorca* Steyskal, the latter being a new record from Brazil. Between the two species, *E. eluta* was the more abundant in maize fields. Both attractants were efficient in capturing the two species. However, BioAnastrepha® captured significantly more insects than Torula.

KEYWORDS. Corn silk fly; food attractant; maize pest; traps; Tephritoidea.

RESUMO. Levantamento de mosca-da-espiga (Diptera: Ulidiidae) em milho (*Zea mays* L.) e primeiro relato de ocorrência de *Euxesta mazorca* Steyskal no Brasil. Espécies de *Euxesta* (Diptera, Ulidiidae), conhecidas como moscas do cabelo ou moscas da espiga estão aumentando em importância nas culturas de milho em diferentes países, embora muito pouco se conheça sobre elas no Brasil. As larvas das espécies representativas de Ulidiidae inicialmente danificam a parte reprodutiva feminina da planta e depois os grãos em desenvolvimento. Como resultado da alimentação das larvas ocorre fermentação e odor forte tornando a espiga inapropriada para o consumo humano ou animal. O principal objetivo deste trabalho foi avaliar a incidência de espécies de *Euxesta* em áreas de produção de milho e identificar as espécies predominantes usando dois atraentes alimentares diferentes à base de proteínas hidrolisáveis, BioAnastrepha® (proteína hidrolisável de milho) e Torula, colocados no interior de armadilha McPhail. As duas espécies identificadas foram *E. eluta* Loew and *E. mazorca* Steyskal, registrada pela primeira vez no Brasil. Entre as espécies, *E. eluta* foi predominante no milho. Ambos os atraentes foram eficientes na captura das duas espécies. No entanto, as armadilhas com BioAnastrepha® capturaram significativamente mais insetos do que aquelas com Torula.

PALAVRAS-CHAVE. Armadilhas; atraente alimentar; mosca da espiga; pragas de milho; Tephritoidea.

Members of Ulidiidae inhabiting Brazil are represented by several endemic genera including the genus *Euxesta* (Steyskal 1961, 1968), with around 64 species, the majority of which occur in the Neotropical zone (Scully *et al.* 2000). Frías *et al.* (1982) mentioned that very little is known about the biology of this family. Nevertheless, some species live in association with plants (Steyskal 1968, 1974). For example, *Euxesta eluta* Loew, 1868, *Euxesta annonae* Fabricius, 1794, *Euxesta stigmatias* Loew, 1868, *Euxesta mazorca* Steyskal, 1974 (Diptera, Ulidiidae) live in association with maize (Frías 1978; Steyskal 1974; Díaz 1982; Huepe *et al.* 1986; Seal & Jansson 1989, 1993, 1995; Seal *et al.* 1996; Hentz & Nuessly 2004; Nuessly & Hentz 2004). *Euxesta eluta* is known from Florida (Goyal *et al.* 2010), Puerto Rico (Wolcott 1948), Ecuador (Evans & Zambrano 1991), Chile (Frías 1978; Olalquiaga 1980), Peru (Díaz 1982), Argentina (Arce de Hamity 1986), and Brazil (Franca & Vecchia 1986). *Euxesta annonae* is known from Florida (USA), the West Indies, Guyana, Brazil, Bolivia, Philippines, Fiji, Hawaiian Islands (Bisby *et al.* 2009) and Chile (Frías 1978). *Euxesta stigmatias* is known from several U.S. states (Van Zwaluvenberg 1917; Barber 1939; Walter & Wene 1951; Fisher 1996; Evenhuis 1997), as well as Antigua (Painter 1955), Mexico to Panama, the West Indies, Trinidad, Guyana, Venezuela, Brazil, Peru, Bolivia (Bisby *et al.* 2009) and Brazil (Franca & Vecchia 1986). Finally, *E. mazorca* is known from Colombia, Ecuador, and Peru (Bisby *et al.* 2009). Several members of the genus *Chaetopsis*, represented by 10 known species in the Americas south of the United States (Steyskal 1968), have also been found associated with maize, including *C. massyla* Walker, 1849 (Goyal *et al.* 2010, 2011) and *C. aenea* Wiedemann, 1830 (Gossard 1919).

Injury to maize plants, especially in sweet cultivars, includes consumption of silks, reduced pollination, clipped silks within the silk channel, blank ear tips due to larval feeding, destruction of developing kernels, feeding on ears, increasing vulnerability to ear rots, and reduced grain quality (Reis *et al.* 1980; Branco *et al.* 1994; Nuessly & Capinera 2006). The principal injury occurs on the developing ear, where they often hollow out the kernels. Larvae can be found feeding along the entire length of the ear. Yield reductions can reach 100%, with peak levels of injury occurring early in the season (Seal & Jansson 1989; Seal *et al.* 1996). Significant injury can occur even when insecticides have been applied. Sweet corn ear infestations greater than 30% usually result in the field being rejected from fresh market sale.

The incidence and economic importance of *Euxesta* in maize fields in Brazil has not been well studied and probably is underestimated. The main objective of this work was the determination of the species associated with maize field crops. Food attractants comprised of hydrolyzed protein are commercially registered for use in Brazil for monitoring other Diptera species such as the fruit flies *Ceratitis capitata* (Wiedemann, 1824) and *Anastrepha* Schiner, 1868 (Diptera, Tephritidae). Therefore, another objective was to evaluate the potential of these food attractant products as tools for monitoring Ulidiidae in maize.

MATERIAL AND METHODS

Two experiments were conducted in the experimental area of the Agriculture and Livestock Brazilian Research Institution (EMBRAPA) at the Maize and Sorghum Unit in Sete Lagoas town, Minas Gerais state, Brazil in 2009. The first trial was conducted in an organic maize production system using the open-pollinated cultivar BR 106 during the fall season comparing the food attractants BioAnastrepha® (maize hydrolyzed protein) and Torula, two protein sources specifically used together with traps to monitor true fruit flies compared to check plots (soapy water solution). The attractants were used at 5% concentration (300 ml solution/trap), placed inside a McPhail trap (Steyskal 1977). The traps were randomly distributed in the field and spaced 40 meters apart. Two traps for each treatment composed the replications in space. The traps were initially deployed in the field when the plants were in the flowering stage, hung by a wood pole at the maize ear level. Evaluations were made two, four, 11 and 17 days after deploying the traps in the filed. After each evaluation period, the traps were re-arranged in the field, always following a randomized complete block design pattern. Insects were removed from each trap using a fine-mesh screen and then placed inside vials containing a 70% alcohol solution. Reposition to the initial volume of solution and water was made after each evaluation period.

The second experiment was conducted in a conventional production system during the spring season. The experiment was arranged in a randomized complete block design containing six replications of three treatments (i.e., the two food attractants and a soapy water control). McPhail traps were distributed in the maize (BRS 1030 hybrid) field when the plants were at the V10 stage (Ritchie & Hanway 1993) and initially held at one meter above the soil surface. As the plants grew, the traps were elevated to the level of the ear insertion in the plant. The traps were checked twice a week. Captured insects were counted and separated according to species in the laboratory. Reposition of solution and water in the traps were made at 15-day intervals.

For both experiments the insects were identified and stored according to the species, attractant, and date. Identification was based on well-described morphological differences between species, such as the color pattern and distribution of spots on wings, head structure and ovipositor (Steyskal 1968, 1974; Huepe *et al.* 1986). Voucher specimens were deposited in the entomology laboratory at Embrapa in Sete Lagoas, MG, Brazil.

Data from these experiments were analyzed by one-way Analysis of Variance (ANOVA) through the computer program SISVAR (Ferreira 2000) and treatment means were compared with the Scott-Knott test ($P = 0.05$) (Scott & Knott 1974). Before running the ANOVA, tests were conducted to determine if the data set met the necessary assumptions. Burr-Foster Q and Shapiro-Wilk W tests were used to test equality of variance and normality of the data, respectively, following description found in Anderson & McLean (1974). Transformation, when applied, was used according to the criteria suggested by Ostle & Mensing (1975). In the first experiment, evaluation period was considered as a source of variation in the ANOVA.

RESULTS AND DISCUSSION

Only two species of *Euxesta* (i.e., *E. eluta* and *E. mazorca*) were identified. This is the first report of *E. mazorca* in Brazil. Adults feed on pollen, nectar, plant sap and glandular exudates. Mating generally occurs at dusk and dawn. *Euxesta mazorca* is slightly larger than *E. eluta*. Wing bands are much darker and completely cross the wing in *E. mazorca*, as opposed to *E. eluta*.

The data on average daily number of *Euxesta* spp. caught in the traps in our first experiment indicated a significant difference among treatments. The number of insects in traps baited with BioAnastrepha® was significantly higher than the number of insects obtained in traps with Torula ($F = 23.0$, $df = 14$, $P \leq 0.001$). The lowest number of insects was obtained from the water control traps (Table I).

A greater number of insects was also captured with BioAnastrepha® in experiment 2 (Table I). Using this attractant, an average of 1105.6 adults were captured. This was significantly higher than the average number caught in traps containing Torula (788.2 adults). The lowest average number of insects captured was found in traps containing only water (43.7 insects).

Averaging captures of these insects across the three types of attractants, *E. eluta* was captured in much greater numbers than *E. mazorca* (*i.e*., capture ratio of 3.4:1). Analyzing each attractant separately, the average number of insects captured was significantly different between the two species in traps containing BioAnastrepha® and Torula (Table I). For *E. eluta*, there were significant differences among the average number of insects caught in relation to the attractant used. A higher number of insects was captured in the traps baited with BioAnastrepha® (1721.3 insects) than the other food attractants. For *E. mazorca*, there was no significant difference in the number of insects caught between traps baited with BioAnastrepha® (489.8 insects) or those containing Torula (373.5 insects). The proportion of females found in the traps was higher than the proportion of males (sex ratio ranging from 0.73 to 0.82) for all treatments.

The number of males captured (F = 27.2, df = 25, P ≤ 0.001) was significantly lower in traps containing only water, with an average of 9.5 insects (18.8 insects of *E. eluta* and 6.2 insects of *E. mazorca*). In the traps containing BioAnastrepha® or Torula, the number of males captured was much higher (i.e., 201.1 and 162 adults, respectively). However, there was no significant difference between these averages (Table II). Overall, a higher number of male *E. eluta* (195.2) was captured in traps when compared to the number of male *E. mazorca* (53.2).

When averaged across all food attractants, the number of females (F = 43.6, df = 25, P ≤ 0.001) captured on traps was greater for *E. eluta* (800.9 insects) than for *E. mazorca* (242.4 insects). The greatest number of female *E. eluta* and total number of all females were captured by BioAnastrepha® followed by Torula and then by water. More female *E. mazorca* were captured by the baits than by water, but there was no significant difference between traps baited with BioAnastrepha® and in traps baited with Torula (Table II).

Table III shows comparisons between the sexes for each species by food attractant. For both species, traps baited with BioAnastrepha® or Torula captured significantly higher num-

Table I. Effect of attractive food in total catch and the sex ratio of two *Euxesta* species in McPhail trap.

Food attractant	Exp. 1[1,2,3]	Experiment 2				
		Total[2,3]			Sex ratio[2,3]	
		E. eluta	*E. mazorca*	Mean	*E. eluta*	*E. mazorca*
Bio Anastrepha®	112 ± 21A	1721.3 ± 268Aa	489.8 ± 59Ab	1105.6A	0.82 ± 0.01A	0.82 ± 0.01A
Torula	33 ± 5B	1203.0 ± 166Ba	373.5 ± 67Ab	788.2B	0.79 ± 0.01A	0.82 ± 0.01A
Water	3 ± 1C	64.0 ± 33Ca	23.3 ± 9Ba	43.7C	0.73 ± 0.3B	0.73 ± 0.03B
Mean		996.1a	295.6b			

[1] Average daily number of adults *Euxesta* spp.; [2] Number ± Standard Error of the Mean; [3] Means followed by the same uppercase letters in columns and lowercase letters in rows did not differ significantly, according to Scott-Knott test.

Table II. Effect of attractive food in the capture of males and females of two *Euxesta* species in McPhail trap.

Food attractant	Experiment 2					
	Male[1,2]			Female[1,2]		
	E. eluta	*E. mazorca*	Mean	*E. eluta*	*E. mazorca*	Mean
Bio Anastrepha®	315.7 ± 50Aa	86.5 ± 12Ab	201.1A	1405.7 ± 219Aa	403.3 ± 48Ab	904.5A
Torula	257.2 ± 51Aa	66.8 ± 11Ab	162.0A	945.8 ± 119Ba	306.7 ± 57Ab	626.2B
Water	12.8 ± 5Ba	6.2 ± 3Ba	9.5B	51.2 ± 29Ca	17.2 ± 7Ba	34.2C
Mean	195.2 a	53.2 b		800.9a	242.4b	

[1] Number ± Standard Error of the Mean; [2] Means followed by the same uppercase letters in columns and lowercase letters in rows did not differ significantly, according to Scott-Knott test.

Table III. Effect of attractive food in the capture of *E. eluta* and *E. mazorca* in McPhail trap according to the sex of each species.

Food attractant	Experiment 2					
	E. eluta[1,2]			*E. mazorca*[1,2]		
	Male	Female	Mean	Male	Female	Mean
Bio Anastrepha®	315.7 ± 50b	1405.7 ± 219a	860.7A	86.5 ± 12b	403.3 ± 48a	244.9A
Torula	257.2 ± 51b	945.8 ± 119a	601.5B	66.8 ± 11b	306.7 ± 57a	186.7A
Water	12.8 ± 5 a	51.2 ± 29a	32.0C	6.2 ± 3a	17.2 ± 7a	12.3B
Mean	195.2 b	800.9 a		53.2b	256.0a	

[1] Number ± Standard Error of the Mean; [2] Means followed by the same uppercase letters in columns and lowercase letters in rows did not differ significantly, according to Scott-Knott test.

bers of females than males. The mean number of *E. eluta* captured in the BioAnastrepha® baited traps was greater than those in Torula baited traps, which in turn were greater than those in the water traps. Mean trap counts for *E. mazorca* were significantly greater in the traps baited with BioAnastrepha® and Torula than those baited with water.

Although *E. eluta* and *E. mazorca* are considered pests that attack corn on the ear, both species were caught well before the plant had reached the susceptible stage to pest attack (Fig. 1). Activity of these pests increased with plant phenological development, reaching peak infestations during R1 (silking) and R2 (blister) phenological stages (Ritchie & Hanway 1993), which occurred between mid-September and mid-October. Thereafter, there was a significant decrease in the capture of insects (Table IV). During the installation of traps when the maize was in the V10 development stage, there were other maize fields in later stages of development within the region. These adjacent areas could have been the initial source of these insect species. By the time maize in the experimental area was in the ear stage, maize in the surrounding areas was already in the process of senescence. The ears are most attractive and the pericarp of the kernals is most suitable for entry by Ulidiidae larvae during the first two weeks of the ear stage in maize. Dry silks and the harder pericarps of the soft dough stage maize is not suitable for development by these flies. Therefore, *Euxesta* spp. counts

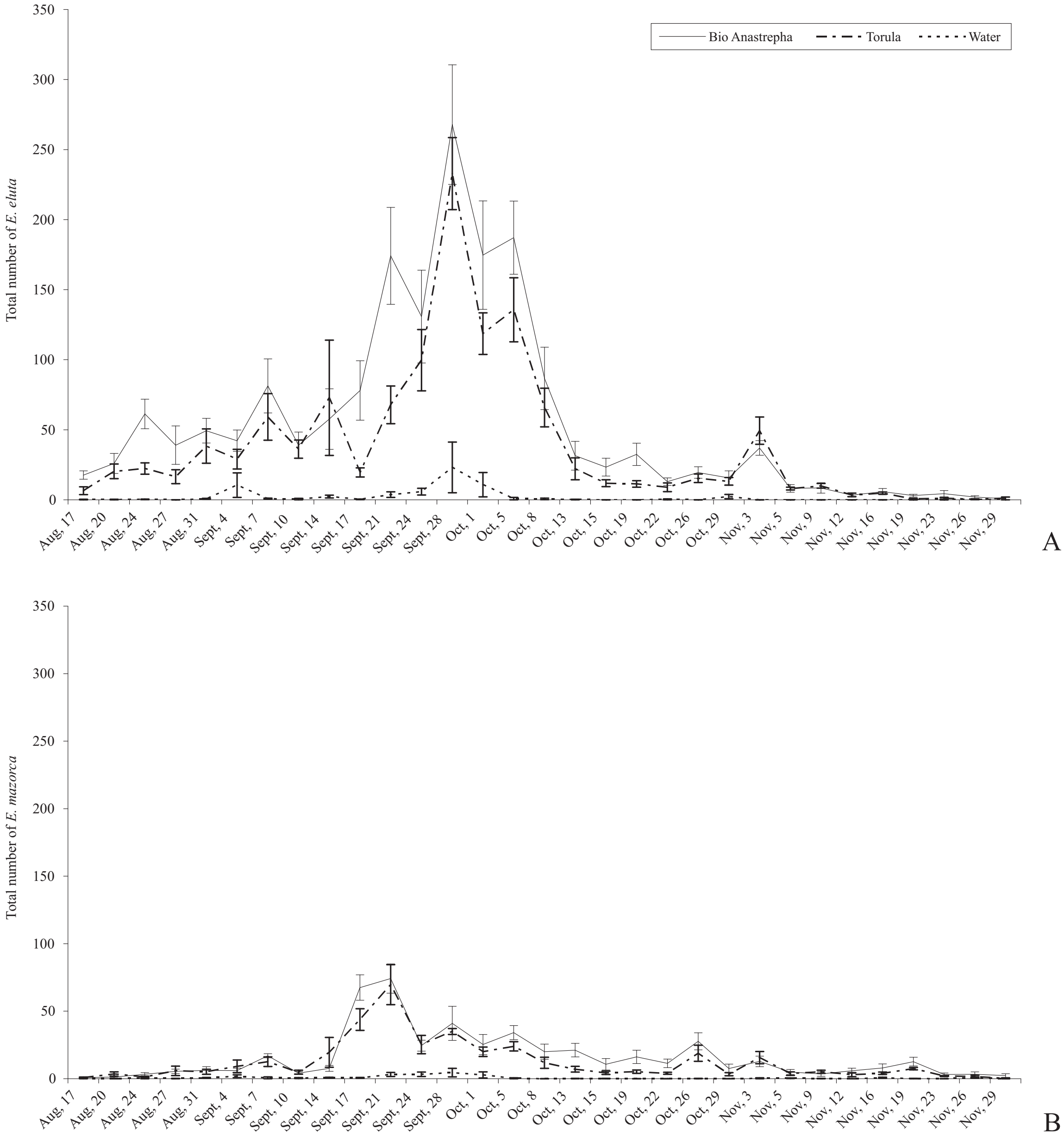

Fig. 1. Adults *E. eluta* (A) and *E. mazorca* (B) captured in McPhail traps using three food attractants during different sample periods in Sete Lagoas, Minas Gerais state, Brazil – experiment 2.

Table IV. Effect of attractive food in the capture of *E. eluta* and *E. mazorca* in McPhail trap in different time[1,2].

Sampling time	*Euxesta eluta*			*Euxesta mazorca*		
	Food source			Food source		
	Bio Anastrepha®	Torula	Water	Bio Anastrepha®	Torula	Water
Aug, 17	17.7 ± 3Aa	6.5 ± 3Aa	0.2 ± 0Aa	0.8 ± 0Aa	0.8 ± 0Aa	0.3 ± 0Aa
Aug, 20	26.0 ± 7Aa	20.3 ± 5Aa	0.2 ± 0Aa	1.2 ± 0Aa	3.5 ± 2Aa	0.0 ± 0Aa
Aug, 24	61.3 ± 11Bb	22.3 ± 4Aa	0.3 ± 0Aa	3.3 ± 1Aa	1.3 ± 0Aa	0.5 ± 0Aa
Aug, 27	39.0 ± 14Ba	16.5 ± 5Aa	0.0 ± 0Aa	5.5 ± 2Aa	5.8 ± 3Aa	0.2 ± 0Aa
Aug, 31	49.3 ± 9Bb	38.3 ± 12Bb	0.7 ± 0Aa	6.2 ± 3Aa	5.2 ± 2Aa	0.7 ± 0Aa
Sept, 4	42.2 ± 8Ba	29.0 ± 7Aa	10.5 ± 9Aa	6.0 ± 2Aa	9.2 ± 5Aa	1.8 ± 1Aa
Sept, 7	81.3 ± 19Cb	59.2 ± 17Bb	0.8 ± 0Aa	17.0 ± 2B	12.7 ± 4Bb	0.7 ± 0Aa
Sept, 10	39.0 ± 9Bb	36.2 ± 6Bb	0.5 ± 0Aa	4.2 ± 1Aa	4.8 ± 1Aa	0.5 ± 0Aa
Sept, 14	57.7 ± 22Bb	72.8 ± 41Bb	2.3 ± 1Aa	7.7 ± 2Ab	19.5 ± 11Ba	0.8 ± 0Aa
Sept, 17	78.0 ± 21Cb	19.5 ± 3Aa	0.3 ± 0Aa	67.5 ± 9Dc	43.8 ± 8Cb	0.7 ± 0Aa
Sept, 21	174.2 ± 35Ec	67.8 ± 13Bb	3.7 ± 2Aa	74.2 ± 11Db	69.7 ± 15Db	3.2 ± 2Aa
Sept, 24	130.8 ± 33Db	99.7 ± 22Cb	5.8 ± 2Aa	24.5 ± 4Bb	25.3 ± 7Bb	3.3 ± 2Aa
Sept, 28	267.8 ± 43Fb	232.8 ± 26Db	23.2 ± 18Aa	41.0 ± 13Cb	35.0 ± 2Cb	4.5 ± 3Aa
Oct, 1	174.7 ± 39Ec	118.7 ± 15Cb	10.8 ± 9Aa	25.3 ± 7Bb	20.0 ± 4Bb	2.8 ± 2Aa
Oct, 5	187.2 ± 26Ec	135.7 ± 23Cb	0.8 ± 0Aa	34.2 ± 5Cb	24.0 ± 3Bb	0.3 ± 0Aa
Oct, 8	86.7 ± 22Cb	65.8 ± 14Bb	0.7 ± 0Aa	20.0 ± 6Bb	11.8 ± 4Bb	0.0 ± 0Aa
Oct, 13	31.5 ± 10Aa	22.2 ± 8Aa	0.2 ± 0Aa	21.2 ± 5Bb	7.0 ± 2Aa	0.2 ± 0Aa
Oct, 15	23.3 ± 6Aa	11.8 ± 2Aa	0.0 ± 0Aa	10.7 ± 4Aa	4.3 ± 1Aa	0.2 ± 0Aa
Oct, 19	32.5 ± 8Aa	11.3 ± 2Aa	0.0 ± 0Aa	16.2 ± 5Bb	5.2 ± 1Aa	0.0 ± 0Aa
Oct, 22	13.0 ± 3Aa	9.0 ± 3Aa	0.3 ± 0Aa	11.3 ± 3Aa	4.0 ± 1Aa	0.0 ± 0Aa
Oct, 26	19.5 ± 4Aa	15.3 ± 3Aa	0.0 ± 0Aa	27.7 ± 6Bb	18.8 ± 6Bb	0.2 ± 0Aa
Oct, 29	15.7 ± 5Aa	13.2 ± 3Aa	2.3 ± 1Aa	7.5 ± 3Aa	3.3 ± 1Aa	0.0 ± 0Aa
Nov, 3	37.0 ± 5 Bb	49.3 ± 10Bb	0.0 ± 0Aa	12.8 ± 4Aa	15.7 ± 4Bb	0.3 ± 0Aa
Nov, 5	8.2 ± 3Aa	8.0 ± 1Aa	0.0 ± 0Aa	5.0 ± 2Aa	3.8 ± 1Aa	0.3 ± 0Aa
Nov, 9	8.5 ± 4Aa	10.0 ± 2Aa	0.0 ± 0Aa	3.5 ± 2Aa	5.2 ± 1Aa	0.2 ± 0Aa
Nov, 12	3.3 ± 1Aa	3.5 ± 1Aa	0.0 ± 0Aa	5.8 ± 2Aa	3.0 ± 1Aa	0.0 ± 0Aa
Nov, 16	5.8 ± 2Aa	4.8 ± 1Aa	0.0 ± 0Aa	8.0 ± 3Aa	4.0 ± 1Aa	0.7 ± 0Aa
Nov, 19	3.0 ± 1Aa	0.7 ± 0Aa	0.0 ± 0Aa	12.7 ± 3Aa	7.5 ± 1Aa	0.2 ± 0Aa
Nov, 23	4.3 ± 2Aa	1.2 ± 1Aa	0.0 ± 0Aa	3.2 ± 1Aa	2.0 ± 0Aa	0.0 ± 0Aa
Nov, 26	2.0 ± 1Aa	0.3 ± 0Aa	0.3 ± 0Aa	3.3 ± 2Aa	1.7 ± 1Aa	0.8 ± 0Aa
Nov, 29	0.8 ± 0Aa	1.2 ± 1Aa	0.0 ± 0Aa	2.3 ± 1Aa	0.3 ± 0Aa	0.0 ± 0Aa
Mean	55.5c	38.8b	2.3a	15.8c	12.2b	0.8a

[1]Number ± Standard Error of the Mean; [2]Means followed by the same uppercase letter in columns and lowercase letter in rows within species did not differ significantly, according to Scott-Knott test.

should decrease in older fields. The susceptible stage of maize in the experimental area and the attractiveness of the proteins can be considered as the main components to explain the population peaks of both species. In Florida (U.S.A), *Euxesta* spp. and *Chaetopsis massyla* begin to move into maize fields during the week before tassel push and congregate in susceptible fields as surrounding fields are harvested or become unsuitable for colonization (Nuessly, unpublished data). However, the capture of insects in other periods suggests a major effect of the food attractants.

Good survivorship capacity in various humidity conditions indicated the ecological adaptations of both species as maize pests (Reis *et al.* 1980; Frías 1981). These flies also take advantage of damage by other insects to increase their access to maize ears. In Brazil and in the U.S.A, adult females can easily enter ears to feed and oviposit after previous damage from insects such as the fall armyworm, *Spodoptera frugiperda* (J. E. Smith, 1797), and the corn earworm, *Helicoverpa zea* (Boddie, 1850) (Lepidoptera, Noctuidae) (Link *et al.* 1984; Matrangolo *et al.* 1997). In field trials using *S. frugiperda* and *E. stigmatias* to evaluate resistance and potential damage interactions between these two primary corn pests, Nuessly *et al.* (2007) found that *E. stigmatias* larval damage was less in Zapalote Chico varieties than the other maize varieties in single-species tests. Additionally, *E. stigmatias* damage was greater on *S. frugiperda*-infested versus *S. frugiperda*-excluded ears. Ears with *S. frugiperda* damage to husk, silk and kernels had greater *E. stigmatias* damage than ears with less *S. frugiperda* damage.

Previous researchers have observed that protein-based attractants, combined with McPhail traps are among the most efficient in trapping *Anastrepha* spp. in fruit trees (Raga *et al.* 2006; Scoz *et al.* 2006; Monteiro *et al.* 2007). BioAnastrepha® is registered in Brazil for monitoring the true fruit flies belonging to the genera *Anastrepha* and *Ceratitis*. As demonstrated in the present study, this material is also effective for monitoring *Euxesta* spp. in maize fields. The higher presence of *E. eluta* adults in maize fields may indicate a better ecological adaptation to this crop than *E. mazorca*, as was pointed out by Huepe *et al.* (1986).

These findings also demonstrated Brazilian maize fields can be attacked simultaneously by *E. eluta* and *E. mazorca* with a predominance of the former. The commercial hydrolyzed protein BioAnastrepha® can effectively be used for monitoring the silk flies *E. eluta* and *E. mazorca* in maize fields.

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