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Evaluation of traps and lures for mass trapping for Mediterranean fruit fly in citrus groves.

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ABSTRACT. Mass trapping has proven to be a powerful weapon in the control of *Ceratitis capitata* (Wiedemann) and its application in Mediterranean countries has currently increased notably as a control method. In this study, the efficacy of newly developed traps and dispensers of attractants were assessed with the aim of finding the best trap and set the lifetime of the dispensers, thus improving the total efficacy of mass trapping. Efficacy trials with six different types of traps and six different types of female dispensers were carried out. Moreover, the lifetime of three female dispensers, including a new attractant composition dispenser with n-methyl pyrrolidine, were studied. Results show significant differences among the trap types using female attractants, with an advantage of nearly three times more catches in best trap. Tested female dispensers showed no significant differences in efficacy between trimethylamine and putrescine attractants regard n-methyl pyrrolidine, however we observed differences in lifetime between dispensers. As a conclusion there are significant differences among different types of traps and dispensers in efficacy. Therefore the appropriate selection of the trap and dispenser will improve the mass trapping results.

KEY WORDS: *Ceratitis capitata*, lure, attractant, trap, monitoring medfly, fruit fly

MASS TRAPPING method is currently being employed over large areas in Mediterranean regions in order to control *Ceratitis capitata* (Wiedemann) and *Bactrocera oleae* (Gmelin) (Broumas et al. 2002, Delrio 1989). This technique, and the lure and kill method, are now being employed all over the world with good results (McQuate et al. 2005, Agunloye 1987, Cunningham et al. 1978). Moreover, the perimeter trapping strategy has obtained satisfactory results in order to avoid fruit fly intrusions in medium-large orchards, and this strategy depends on the efficacy of traps and lures (Cohen and Yuval 2000).

Traps designs, including different colors and shapes, are essential to obtain a high efficacy in fruit fly catches (Epsky et al. 1995, Vargas et al. 1997). In the last decade, the development of new powerful attractants , (Heath et al. 1997, Epsky et al. 1999), has increased the possibility of using mass trapping as a more economical medfly control method. Recent studies demonstrate that the International Pheromone McPhail Trap (IPMT) combined with Biolure (three-component lure) is highly efficacious in medfly catches (Gazit et al. 1998, Katsoyannos et al. 1999, Katsoyannos and Papadopoulos 2004) with respect to other traps and attractants. Currently in Spain, the most frequently used lure is Biolure associated with Tephri-trap, a modified McPhail trap with four lateral holes, which shows a similar efficacy when compared to the IPMT (Miranda et al. 2001). Similar results were obtained in Australia using IPMT and Tephri-trap with Biolure, that improve the traditional protein baits.(Broughton and De Lima 2002).

Currently, more than 30,000 ha of citrus groves in Spain are being treated with mass trapping, and surface treatment increases year by year. Initial field trials showed a good efficacy with this technique using a density of 50 traps/ha during the 3 months before harvest, but more studies for trap density optimization and pre-harvest placing time are being carried out. In order to improve the efficacy of this technique, longer-lasting dispensers covering the entire growing season and more efficient traps are necessary. The efficacy of the dispensers also varies depending on weather conditions, mainly temperature and humidity, and that is because field trials should be performed in all kinds of climatic conditions.

The efficacy of new longer-lasting dispensers is also being studied. A mesoporous material like zeolites (Munoz-Pallares et al. 2001) has been employed to manufacture dispensers. These materials adsorb substances through a physico-chemical interaction and release these substances at a controlled emission rate. They have been used to increase the lifetime of the dispensers and to optimize the release rate In this work we compare the longevity of a new mesoporous dispenser (EPAlure) with the most used in Spain, Biolure.

The main objectives of this study are to compare the efficacy of commercially available traps and lures, to study and quantify the attractant composition of the dispensers, and to fix their lifetime.

Materials and Methods

Traps and lures: Traps used were: EPAtrap by Ecologia y Protección Agrícola SA (EPA) (Carlet, Valencia, Spain), Probodelt trap by Probodelt (Amposta, Tarragona, Spain), Multilure by Better World Manufacturing Inc. (Fresno, CA, USA), IPMT by Econex (Santomera, Murcia, Spain), Tephri-trap by Utiplas SL (Madrid, Spain), Easytrap by J.P. Ros (INIA, Madrid), Mosquitrap by Sansan (Valencia, Spain).

Attractants used were: female attractants with ammonium acetate, trimethylamine and a diaminalkane: Biolure by Suterra (OR, USA), Biolure Medfly 100 (Biolure M100) by Suterra, TMA female attractant by Susbin (Mendoza, Argentina), SEDQ (Barcelona, Spain) female attractant and Trypack by Econex (Santomera, Murcia, Spain). Another female attractant with ammonium acetate and n-methyl pyrrolidine: EPAlure by EPA (Valencia, Spain) and a male attractant of trimedlure (TML) (Beroza et al. 1961) Magnet by Aragonesas Agro (Madrid, Spain).

Trap type trial: Traps were tested in 4 different fields near the western coast of the Mediterranean Sea, in Valencia, Spain. Each field trial included 4 plots, with each plot using all types of tested traps. Traps were separated 20-25 m. to avoid direct interaction between traps, with no distance greater than 25 m. so as to reduce medfly population variation to a minimum inside the same field. The plots within each field were separated by almost 100 m. to give independent replications. The field trials were located in citrus groves in Sagunto, Alzira, Denia and Tavernes, all in Valencia province, at least 30 km. apart from one another. Field trials are described on Table 1.

Field trials were performed in 2004 and 2005, during summer and autumn seasons, when *C. capitata* population is high enough to obtain representative numbers of catches, and citrus fruit begin to ripen. Traps tested in 2004 were IPMT, Probodelt, Easytrap, Multilure and Tephri-trap with two types of attractants, female attractants (Biolure) and male attractants (Magnet). During 2004, the traps were hung in all fields in mid-June and were left for 6 weeks for the trap trial with Biolure and 6 more weeks for the second trial from 2 August with TML dispensers. Within each plot *C. capitata* catches were counted every week, distinguishing males and females in traps with Biolure, and traps were rotated clockwise. In 2005, based on 2004 results, the best trap for 2004 was tested, the same standard trap (Tephri-trap), plus two new traps, Mosquitrap trap and EPAtrap, to confirm 2004 results. In 2005, the trap trial was carried out from June to August lasting 6 weeks.

In order to compare 2004 and 2005 results with different *C. capitata* population levels, an index of captures was established, taking the Tephri-trap as a reference trap. The average catches for each trap type, in each field per week, were divided by the average number of weekly catches, in the corresponding field, in the Tephri-trap to obtain a captures index. This index was obtained for all 4 fields every week and gives us a standardized efficacy of each type of trap respect the Tephri-trap. In this way we can compare relative efficacy of each trap in two different years.

Attractants trials: Six different dispensers with different female attractants were tested: Biolure by Suterra, EPAlure, Biolure M100, TMA Susbin, SEDQ and Trypack. All dispensers were extracted and analyzed by GC at 0 days and after 90 days of use in the field to obtain a lifetime for each dispenser. All attractants were tested in field trials in 2005 for 13 weeks from August to November. Dispensers were placed in Tephri-trap traps with a DDVP strip and hung at 1.5 m. high from southern tree faces. Each field plot contained 6 traps, each one with one type of dispensers. Each trial field contained 4 plots and the trial was replicated 4 times in 4 different fields separated between them almost 30 km. As in the trap trials, traps with different dispensers were rotated clockwise each week after counting *C. capitata* catches.

Attractants durability: To obtain an estimation of attractant duration, three female lures were tested: Biolure, Trypack and EPAlure. All attractants were placed in Tephri-traps and hung from orange trees facing south at 1.5 m. in height. The three lures, each in one Tephri-trap, were hung 30m. apart in the same field to avoid interference. This trial was replicated in four fields. Traps were hung at the end of June and remained in the field till the end of October. At the beginning of the second aging month (last week of July) and fourth aging month (last week of

September), two new traps were added to the trial. These traps contained a new Biolure and Trypack lures in each trap in order to compare medfly catches of aged lures vs. a new lure. These new traps were added to every one of the four trial fields.

Traps were counted and rotated clockwise every week. *C .capitata* catches were accumulated monthly in order to obtain monthly efficacies and monthly estimations of lost efficacy through aging.

Statistical analysis: Statistical analysis was performed using an ANOVA of the weekly catches in each trap for each plot. Data were transformed X=(log(x+1)) to normalize distribution in trap trial and X=SQRT(x) in attractants trial. Index of trap efficacy versus Tephri-trap was transformed to log X before ANOVA analysis. Statgraphics plus 5.1 was employed for statistical analysis.

In order to combine 2004 and 2005 field trials results we define an efficacy index to refer all catches to a standard trap. In this way we avoid affectation of fly catches due to variation of fly population in different years. This index of captures was calculated, dividing weekly medfly catches (females, males and total) for each type of trap tested by Tephri-trap catches for the same week and same plot.

Results

Type of trap. Results of catches depending on type of trap are shown on Table 2 and Table 3 for 2004 and 2005 respectively. When Biolure was used as a *C. capitata* attractant, the best trap was shown to be the Probodelt trap for male and female catches. IPMT, Easy-trap and

Tephri-trap obtained significantly worse results, but even better than Multilure trap that catch less than two times fewer Mediterranean fruit flies than the best trap Probodelt.

Very similar results were obtained when TML was used as a *C. capitata* attractant: the best traps were Probodelt and IPMT, whereas Multilure was the worst trap tested.

In 2005 only traps with female attractants (Biolure) were tested, with the Tephri-trap and Probodelt re-tested in a new trial, to which the EPAtrap and Mosquitrap trap were added. *C. capitata* catches obtained with Tephri-trap and Probodelt confirmed 2004 results, showing the worst results with the Tephri-trap, an intermediate result with Mosquisan and the best results with Probodelt trap and EPAtrap.

Table 4 shows the defined efficacy index for each trap type. Probodelt and EPAtrap are the best traps, as they obtain over 3 times more female catches than the Tephri-trap or Multilure. Probodelt and EPAtrap improve mass trapping efficacy greatly, as they catch more Mediterranean fruit flies using the same dispenser under the same conditions.

When male attractants were used, nearly 3 times more males were captured in Probodelt or IPMT traps than in Multilure traps. This result is very important for monitoring programs or fruit import protocols in which maximum population levels are described for aerial treatments (USDA-APHIS, 2003). In this index it is clear that normalizing the type of trap and lure is necessary in order to obtain consistent results.

The proportion of females captured per trap type in 2004 and 2005 shows that Tephri-trap captured significantly fewer females than Probodelt, Mosquitrap, EPAtrap, Easytrap and Multilure. Consequently, Tephri-trap cannot be recommended for female mass trapping, because females are the main objective of this technique.

Attractant trials. Two types of attractants were tested in these trials. Several formulations of the mixture ammonium acetate, trimethylamine and a diaminoalkane (putrescine or cadaverine), and a formulation of the mixture ammonium acetate, n-methyl pyrrolidine (NMP). Putrescine and cadaverine are considered to be equal efficiency in *C. capitata* attraction (Clemente-Angulo, 2002) so this trial compares trimethylamine and n-methyl pyrrolidine as a component of female attractants. Table 5 shows the results of medfly catches with each type of attractant tested. Biolure, Biolure Medfly 100, TMA-Susbin and EPAlure are the best attractants for total number of medfly catches, whereas Biolure, Biolure M100, and TMA Susbin caught significantly more *C. capitata* females than the other attractants. In addition, BiolureM100, Biolure, SEDQ and Trypack showed a higher percentage of female catches, and EPAlure caught significantly fewer females than the other attractants. Significant differences in female proportions caught were found between trimethylamine and NMP attractants: whereas NMP attracts the same number of *C. capitata* as trimethylamine, the proportion of females caught with NMP is always closer to 40-50%. However, female proportions in trimethylamine attractants vary over the year from 40 to 80%, averaging between 61 and 66%.

Table 6 shows the quantification of female attractants when they were placed in the traps (aging 0) and 3 months later (aging 90 days). All cited attractants contain trimethylamine and ammonium acetate combined with a diamino alkane, except EPAlure, which consists of ammonium acetate and n-methyl pyrrolidine. It was shown that attractant concentration varied among the commercial products used. The initial ammonium acetate content was different for each dispenser and the values varied between 8.12 and 3.7g for SEDQ and Trypack, respectively. The initial trimethylamine values varied from 3.23 to 0.46 for Biolure M100 and SEDQ, respectively. In this study, it was important to know which dispensers released more ammonium acetate and trimethyalmine because such differences in emission might help explain the different levels of insect catches for each dispenser.

On Table 6, Biolure M100, Biolure, SEDQ and EPAlure can be seen to release from 2.46 to 3.07g of ammonium acetate over the same interval (90 days). On the other hand, Trypack only released 0.65g. The largest trimethylamine emission was for Biolure M100 (0.52g), with the smallest for SEDQ (0.18g). The best dispenser for insect catches therefore proves to be Biolure M100, as the dispenser emitting the most ammonium acetate and trimethylamine. Trypack and SEDQ, however, show minor emissions of ammonium acetate and trimethylamine, respectively, and only provided minor catches. In summary, different ammonium acetate and trimethyamine emissions can explain the levels of insect catches for each dispenser.

Attractants durability. Trial results are shown on Table 7. Initial results show that Trypack attracts significantly fewer flies than Biolure or EPAlure during the first 2 months. If Trypack and Biolure are compared directly, Biolure can be seen to be significantly better over the first 2 months ($F=3.11$, df:4,3, $P<0.05$), but by the third month Trypack is just as efficient as Biolure, and no differences can be found between a Trypack dispenser aged for 3 months and a new one. In other words, although Biolure is better than Trypack for the first two months, it has a shorter duration in the field. Nevertheless, Trypack is as active at the start of the trial as it is in the third month, so it is as attractive as a Biolure in the third month of the test.

In the fourth month, differences between aged and new Trypacks can be detected. It was therefore concluded that Trypack has a lifespan between 3 and 4 months whereas Biolure is shorter with a 2-3 month. EPAlure was the only lure to remain just as efficient in the fourth aging month as a new Biolure or Trypack dispenser, so EPAlure can be seen to have a lifespan of more than 4 months. For mass trapping techniques it is essential to have a dispenser lifespan of more than 3 months because this allows for placing only one trap and dispenser per year. Medfly population can therefore be reduced 1-2 months before the beginning of fruit damage until the end of harvest.

Conclusions

Field trials show that different trap designs give highly varying efficacies in Mediterranean fruit fly catches. It is important to remark that the best traps caught three times more flies than traps giving worse results. Such high efficacy differences are very important in systems using traps to control *C. capitata*. Fruit fly control methods include the mass trapping technique in extensive areas, but this technique has not been widely applied due to the high cost of attractants and the manpower to install the traps. This study suggests that the number of traps per hectare can be reduced, but even more, this reductions can also be made in the number of attractants, insecticide and the labor required installing the traps. Currently in Spain the cost of mass trapping including manpower, traps and attractants amounts around 300 euro per ha. Using 3 times more efficient traps we can reduce almost 60% of traps and therefore this technique will cost near 120 euro per ha. Insecticide applications (almost 5 applications in mandarin orchards) cost around 20 euro/ha/application with malathion or 30 euros/ha/application with Spinosad. This means that the cost of mass trapping and spraying treatments are very similar, but mass trapping avoids insecticide residues in fruit and reduces affectation of non target organisms.

Monitoring programs should include a detailed description of the trap type being used, because the significant differences observed in this study may lead to overestimation or, even worse, underestimation of high populations. In Spain, treatments against *C. capitata* depend on catches level in monitoring traps and ripening status of fruit hosts. In this case, using a low efficacy trap would lead us to underestimate the fruit fly population and therefore decide not to treat with a population level which would require a treatment.

In order to optimize mass trapping techniques in citrus orchards, attractants should remain active in the field for almost 3 months. In this way, the *C. capitata* population can be reduced since one generation before starting fruit ripening until harvesting. Currently, commercial products do not reach this lifetime, and attractant replacement should be done to maintain fruit protection until harvest. The use of long life dispensers would make unnecessary the attractant replacement, halving the cost of mass trapping. This will provide economic viability of the mass trapping method.

In addition, the mass trapping technique should obtain the highest proportion of female captures. This proportion is obviously influenced by attractant type, and it has been shown that trimethylamine was the best attractant when used with ammonium acetate with or without putrescine (Heath et al. 2004). But trap type also modifies this proportion (Gazit et al. 1998), so it is better to use a trap that achieves higher captures and better female proportions. Moreover, currently in Spain several field trials try to validate the use of mass trapping as a method of reducing female populations during sterilized male release in SIT programs. In this case, it is essential to use the trap that catches the higher female proportion. However, in the chemosterilization method (Navarro-Llopis et al. 2004), Navarro-Llopis et al, 2007), the main objective is to attract the largest number of flies, both males and females, over the whole season. When this technique is used, the selected attractant should maximize both, the number of total flies attracted and the lifetime of dispensers.

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Table 1. Plot description in lufenuron and malathion treated areas

Trial Year	Localization	Trap type	Attractant	N	Weeks	Variety
2004	Sagunto	TT,ML,IPMT,P,ET	F, M	4	12	Marisol
	Alzira		F, M	4	12	Marisol
	Tavernes		F, M	4	12	Clementina
	Denia		F, M	4	12	Clemenules and Okitsu
2005	Sagunto	TT,EPA,SS,P	F	4	6	Marisol
	Alzira		F	4	6	Marisol
	Tavernes	TT,EPA,SS,P, ET	F	4	6	Clementina
	Denia		F	4	6	Clemenules and Okitsu

TT=Tephri-trap, ML=Multilure, IPMT = International Pheromone McPhail Trap, P=Probodelt, ET=Easytrap, MS=Mosquisan, EPA=EPAtrap.

a,b Values for annual periods with the same letter within the same crop and year are not significantly different in paired data t-test ($P \leq 0.05$).

N: Plots per field

Table 2 . Overall weekly captures of male and female Mediterranean fruit fly (Mean± SE) by trap type during 2004 assay.

Trap	Males[§] (Mean± SE)[#]	Females[§] (Mean± SE)[#]	Total[§] (Mean± SE)[#]	% females[§] (Mean± SE)[¥]	Total[*] (Mean± SE)[#]
Tephri-trap	24.32 ± 2.60b	30.61 ± 3.45a	54.93 ± 5.88bc	53.71 ± 1.56a	10.37 ± 1.53b
Easy-trap	19.27 ± 1.78b	33.98 ± 2.73b	53.25 ± 4.36bc	63.04 ± 1.20b	10.57 ± 1.56b
Multilure	16.57 ± 1.95a	25.26 ± 2.59a	41.83 ± 4.41a	64.67 ± 1.57b	5.46 ± 0.81a
IPMT	22.88 ± 2.30b	38.70 ± 3.31b	61.60 ± 5.41c	64.85 ± 1.16b	16.20 ± 2.33c
Probodelt	34.12 ± 4.03c	60.5 ± 6.17c	94.62 ± 10.02d	64.16 ± 1.11b	15.57 ± 1.64c

[§] Captures with Biolure attractant.

[*] Captures with Agrisense Trimedlure.

[#] Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD conducted in the logarithm scale.

[¥] Total females captured divided by total flies. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD.

Table 3. Overall weekly captures of male and female Mediterranean fruit fly by trap type baited with Biolure attractant during 2005 assay.

Trap	Males (Mean ± SE)[#]	Females (Mean ± SE)[#]	Total (Mean ± SE)[#]	% females (Mean ± S.E.)[*]
Tephri-trap	19.07 ± 3.06a	24.61 ± 4.76a	43.83 ± 7.08a	58.55 ± 2.47[a]
EPAtrap	25.17 ± 2.92ab	49.90 ± 5.27bc	74.98 ± 7.83bc	71.70 ± 1.57b
Probodelt	34.64 ± 4.42b	56.43 ± 6.06c	91.05 ± 9.96c	68.81 ± 1.76b
Mosquitrap	22.47 ± 3.40a	39.47 ± 5.02b	61.92 ± 7.98ab	70.70 ± 1.86b

[#] Mean flies per trap. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD conducted in the logarithm scale.

[*] Total females captured divided by total flies. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD.

Table 4. Captures index of male and female Mediterranean fruit fly by trap type baited with Biolure attractant over two assay years.

Trap	Males (Mean ± SE)#	Females (Mean ± SE)#	Total (Mean ± SE)#
Easy-trap	1.09 ± 0.14ab	1.78 ± 0.27ab	1.39 ± 0.18b
Multilure	0.77 ± 0.11a	1.03 ± 0.15a	0.87 ± 0.11a
IPMT	1.29 ± 0.23b	2.05 ± 0.41bc	1.60 ± 0.26bc
Probodelt	1.95 ± 0.20c	3.34 ± 0.36d	2.48 ± 0.23d
EPAtrap	1.60 ± 0.24bc	3.22 ± 0.74cd	2.22 ± 0.35cd
Mosquitrap	1.28 ± 0.25ab	2.78 ± 0.67bc	1.85 ± 0.34bc

Total fly captures divided by total flies captured by Tephri-trap. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD conducted in the logarithm scale.

Table 5. Overall weekly captures of male and female Mediterranean fruit fly by type of attractant

Attractant	Males (Mean ± SE)[#]	Females (Mean ± SE)[#]	Total (Mean ± SE)[#]	% Females (Mean ± SE)[*]
Biolure	9.24 ± 0.69bc	18.06 ± 1.42ab	27.30 ± 1.91abc	62.84 ± 1.79bc
TMA-Susbin	10.43 ± 1.06bc	21.03 ± 2.66ab	31.46 ± 3.61bc	60.01 ± 1.93b
EPAlure	12.53 ± 1.57c	16.17 ± 3.46a	28.71 ± 4.87abc	48.46 ± 2.03a
SEDQ	8.38 ± 0.69ab	15.83 ± 1.53a	24.21 ± 2.08ab	61.74 ± 1.72bc
Biolure M100	11.53 ± 1.47bc	26.64 ± 3.57b	38.18 ± 4.90c	66.70 ± 1.63c
Econex TP	6.65 ± 0.95a	13.72 ± 1.99a	20.37 ± 2.88a	62.97 ± 1.92bc

[#] Mean flies per trap. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD conducted in the square root scale.

[*] Total females captured divided by total flies. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD.

Table 6. Composition of female dispensers

	Component quantity ± SE							
	0 days				90 days			
Attractant type	AA(g)	TMA (g)	PUT (mg)	MP(g)	AA(g)	TMA (g)	PUT (mg)	MP (g)
EPAlure	4.26 ± 0.21	-	-	0.42 ± 0.01	1.19 ± 0.02	-	-	0.21 ± 0.02
Biolure	5.03 ± 0.02	2.24 ± 0.02	39.60 ± 0.16	-	2.57 ± 0.19	1.80 ± 0.03	34.31 ± 0.44	-
BiolureM100	7.23 ± 0.06	3.23 ± 0.03	39.60 ± 0.16	-	4.41 ± 0.26	2.71 ± 0.10	31.59 ± 4.36	-
Econex TP	3.70 ± 0.10	0.80 ± 0.10	33.89 ± 3.85	-	3.05 ± 0.22	0.50 ± 0.03	17.24 ± 1.34	-
SEDQ	8.12 ± 0.12	0.46 ± 0.09		-	5.32 ± 0.25	0.28 ± 0.01		-

AA: Ammonium acetate
TMA: HCl-Trimethyl amine
PUT: Putrescine
MP: Methyl pyrrolidine

Table 7. Weekly captures of Mediterranean fruit fly during life attractant assay.

	Date			
	16/6-22/7	28/7-25/8	1/9-28/9	06/10-16/11
Attractant	(Mean ± SE)[#]	(Mean ± SE)[#]	(Mean ± SE)[#]	(Mean ± SE)[#]
Biolure	19 ± 7.15ab	35.9 ± 6.70b	19.45 ± 8.12ab	3.81 ± 0.93a
Econex TP	9.85 ± 3.34a	18.05 ± 5.06a	7.3 ± 2.42a	6.37 ± 2.15ab
EPAlure	19.2 ± 5.25b	45.95 ± 7.79b	16.25 ± 5.89ab	12.12 ± 3.68cd
Biolure[1]		46.1 ± 11.43b	27.15 ± 7.41b	8 ± 1.68abc
Econex TP[1]		35.25 ± 7.80ab	12.3 ± 3.61ab	15.87 ± 3.95cd
Biolure[2]				19.37 ± 4.73d
Econex TP[2]				13.68 ± 3.46d

[#] Mean flies per trap. Means followed by the same letter are not significantly different at the 5% level by Fisher's protected LSD conducted in the logarithm scale.

[1] Attractants placed the 22 July.

[2] Attractants placed the 6 October.