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COMPARATIVE EFFICACY OF DIFFERENT TRAPS IN ATTRACTING MALES OF FRUIT FLY, *Bactrocera invadens*

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ABSTRACT : The average catches of *Bactrocera invadens* obtained from home-made open-bottom dry traps of mineral water translucent plastic bottles of 1.5 liters and 5 liters, and "Sentrap" Open-top Dry local Trap (plastic prototype improved by SENCHIM, an agrochemicals industry based in Senegal) were compared to the conventional trap "Multilure" (Better World Manufacturing, Inc.., Miami, FL). Results showed that no significant difference was found when "Multilure" was compared to the 5-liters plastic bottle trap. In the relationship between catches at different periods and type of trap, the coefficient of correlation was significant ($P < 0.05$) for all traps. In the absence of conventional traps, the plastic bottle of 5 liters could, therefore, be used as an alternative. Due to simple design, and less time needed for servicing, "Sentrap", increasing its volume and openings and fixing firmly the upper part with a lid screw might improve its efficiency. This trap can also be manufactured at an affordable price for different categories of fruit producers.

Keywords : *Bactrocera invadens*, catches, traps.

INTRODUCTION

If pests could be attracted to relatively few points where they would be either in contact with or consume the toxin then many of the objections that confront broadcasted pesticides could be overcome (Holler *et al*., 2004). Such bait stations and related devices have a long history in Tephritids (Cowley *et al.* 1990 and Robacker *et al.,* 1990). Actually, these techniques are being used in Mauritius against the oriental fruit fly and in Egypt against *Bactrocera zonata*. In both countries, the main technology used is the Male Annihilation Technique (MAT). Studies have shown that peak populations of *Bactrocera invadens* (Dew) (Drew *et al.,* 2005), the most destructive invading species, occur during the wettest periods with an abundance of food (Vayssières *et al*., 2005) in July-August in Senegal (Ndiaye *et al*., 2007). So, such situation limits the use of killer-blocks. In the absence and the high cost of conventional traps in the domestic market, various initiatives such as plastic bottles of mineral water are used as alternatives by growers. Regarding partly their limited financial resources, SENCHIM (an agrochemical industry based in Senegal) has tried to improve the local plastic bottle trap, so-called "Sentrap". This study aims to compare the effectiveness and attractiveness of these different

local trapping devices to the conventional trap "Multilure" (Better World Manufacturing, Inc.., Miami, FL), a new version of McPhail trap. This trap is well known in a broad scope in monitoring the population dynamics of insects, comparison of bait and prototype traps and large-scale control (Hall *et al.* 2007; Conway and Forrester, 2007). The Multilure, specially when used with the dry synthetic lure, allows for a cleaner servicing and is much less labor intensive (Joint FAO/IAEA, 2003). Finding an efficient local device which is able to be included in an area-wide IPM program should help overcoming the large number of traps needed and the high operational costs. It will solve the adverse effects of the climate (leaching of killer-blocks, easy degrading of the attractants by sun lights etc).

MATERIALS AND METHODS

The study was conducted in the Niayes, a costal area in Senegal, providing 60% of exported mangoes from Senegal in a 10-years-old orchard of the late season variety "Kent". In this area, the seasonal production lasts from July to October.

Table 1. Characteristics of the different traps used in the experiment

Types	height (cm)	diameter (cm)	volume (cm^3)	holes (cm)
1.5 litre[1]	21	7.5	927.28	2.8
5 litres[1]	21	14.5	3465.97	4.8
Sentrap[2]	17	9	1055.04	0.8
Multilure[3]	19	14	1335.28	3.5

[1] Local open-bottom dry trap of mineral water translucent plastic bottle of 1.5 liter.

[2] Local open-bottom dry trap of mineral water transparent plastic bottle of 5 liters. Bottles are cut at the junction between the base of the conic part bearing the bottle neck and the cylindrical part at the bottom. Both parts are embedded and the conic part reversed after separation.

[2] "Sentrap": Open-top dry local Trap (dry synthetic lure) of brown plastic bottle painted in yellow from the base on 7 cm. Eight (8) holes were drilled (diameter 0.8 cm) on the yellow part to allow for easier dissemination of the lure and access of flies inside the trap.

The experimental design was set in three randomized blocs. Each type of trap (treatment) was repeated 4 times. The distance between traps was 50m. Small killer-blocks (5 x 5 x 1,25 cm) of Triplex were soaked in Mal'atrap, a mixture of 75 percent methyl eugenol (1,2-Dimethoxy 4 - (2-propenyl) benzene) and 25 percent malathion. The impregnation lasted three days (Stonehouse *et al.* 2007) and then dried up to 15 minutes to avoid leakage. A wire was used to support the impregnated blocks inside the traps. Every 30 days, the Mal'atrap was applied with a brush on both sides of the blocks. The branch serving as a support is coated with solid fat, about 10 cm in length on both sides of the string that suspends the trap to prevent any predatory activity of ants to adult flies dead at the bottom of the trap. Flies were collected separately every 10 days in plastic bags. The experiment lasted three months, from July 15 to October 15, 2008, the wettest period of the year and mango production season. Each collecting sample was dated and labelled. Collected flies were sorted and counted in the laboratory.

Data variability on individuals were analyzed using a one-way ANOVA, means separation between treatments performed by the Tukey honestly significant difference (HSD) test at 5%.The dependence with variables such as time and catch was done using the test of Pearson correlation with SPSS version 10.0.5 (SPSS Advanced Statistics, 1999, Release 10.0.5 Chicago).

RESULTS AND DISCUSSION

In total, over the three months, 989 081 males of *B. invadens* were collected. Individuals of *B. invadens* recorded from the classic "Multilure" traps were higher (32%); followed

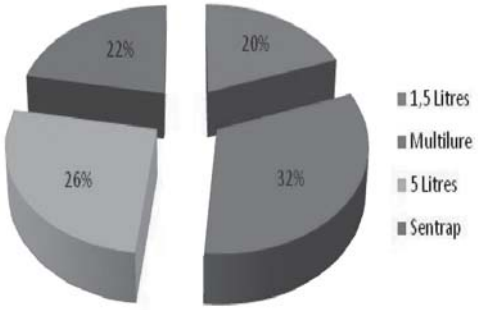

Fig. 2 : Proportion of catches for each trap type

by the 5-liters trap (26%), "Sentrap" (21%) and the 1.5-liter trap (20%) respectively (Figure 2).

The comparison of average catches of "Multilure" to those of 1.5-liter, "Sentrap" and 5-liters showed a significant difference. The differences between means of catch of "Multilure" to 1.5-liter, "Sentrap" and 5-liters traps were 1166.73, 925.66 and 536.68 respectively. However, results from the Tukey HSD test indicated that only 5-liters trap was statistically comparable to "Multilure" (Table 2). Regarding their volume and diameter of holes as in table 1, both devices allowed the flies to get in the trap. In a field experiment in Japan, a new trap could capture sterile melon fly males in equal numbers compared with the Steiner trap, without a significant difference (Yomoto *et al*. 2006). From a point of view of the authors, this new trap can be manufactured at a lower cost.

The study of the relationship between catch at different times and type of trap showed that the covariances are all negative with high value, indicating opposite directions for variables and meaning a strong relationship. However, Sentrap, "Multilure" and 1.5-liter exhibited a very significant dependency relationships to the variables time and catch (P=-0.969**, P=-0.903** and P=-0.801**; á < 0.01); consequently more pronounced with "Sentrap" and Multilure the reference. The common feature between these two traps is probably their yellow basal color. The response of tephritid fruit flies to variously coloured sticky traps was studied in the field in southeastern Queensland over three seasons, according to Hill and Hooper (1984), Saturn Yellow captured significantly more flies than any of the other ten colours. Field tests on attraction of Caribbean fruit flies to 15×20 cm colored sticky traps revealed a clear preference for orange, followed by yellow according to Greany *et al.* (1977). Field cage tests with medfly, *Ceratitis capitata*, were carried out in order to verify how the flies approach the trap body and the frequency of flies captured after landing. In terms of landing, regardless the bait, 59 to 80% of males and 50 to 71% of females arrived in the yellow

Table 2. Average catches of the different types of traps by Tukey's test.

Treatments	N	α = 0.05	
		Group 1 Means and SE	Group 2 Means and SE
1.5-litre	12	1780.08 ± 178.976	
"Sentrap"	12	2021.14 ± 235.324	
5-litres	12	2410.12 ± 224.167	
Multilure	12		2410.12 ± 224.167
			2946.81 ± 227.923

The group averages for homogeneous subsets are displayed.
α uses the sample size of the harmonic mean = 12.

Table 4. Average catch as for the different types of traps by Pearson correlation analysis

Types	N	Means and SE	*Pearson corrélation	Sig (á) (bilateral)	Covariance
1.5-Litre	9	1780.08 ± 178.976	-0.801**	0.009	-1612,134
Multilure	9	2021.14 ± 235.324	-0.903**	0.001	-3088,980
5-Litres	9	2410.12 ± 224.167	-0.750*	0.020	-2314,250
Sentrap	9	2946.81 ± 227.923	-0.969**	0.000	-2765,559

** The correlation 9 is significant at the 0.01 level (bilateral).

* The correlation 9 is significant at the 0.05 level (bilateral).

bottom part of the trap (D´Agostino *et al.* 2006). The trap of the 5-liters bottle was only significant with P = -0.801* and á < 0.05 (Table 4).

During (July-September) the temperatures is high and accompanied by heavy rains and violent winds. Definitely, high winds have led to the collapse of the upper part with lid screw of these traps. Hence, failing on the upper part was observed with three "Sentrap". As stressed by Yomoto *et al*. (2006), "Sentrap" can also be manufactured at an affordable cost, less than USD 2.The study has shown a close relationship between prototype of traps and catch level. However, the 5-liter bottle trap can be recommended for popular use as its catch was not different to "Multilure"'. In regard to its characteristics, "Sentrap is very simple in design, easy to use by the existence of a top lid screw and can be also manufacturer at an affordable price for different categories of fruit producers. But it would be more efficient and competitive by increasing its volume and basal opening diameters. Also, the upper part of "Sentrap" taking off, needs to be well fixed.

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