J. Agric. Sci. Mansoura Univ., 30 (7): 4247 - 4262, 2005

EVALUATION OF PARTIAL BAIT SPRAYING EFFICIENCY ON THE POPULATION OF *Ceratitis capitata* WIED. IN GUAVA AND CITRUS GROVES IN SOUTH GAZA STRIP

Saleh, A. S. A.
Faculty of Agriculture-El Azhar University, Gaza

ABSTRACT

Field study was conducted to evaluate the efficiency of three cases in applied Bait Application Technique (BAT) as area-wide control programs against Medfly Ceratitis capitata Wied. in KhanYunis And Rafah Governorates. The first case was real partial bait spraying BAT as traditional treatments , the second was high BAT frequency treatments programs (10-20 days around) in Valencia orange and guava groves and the third was low BAT frequency treatments programs (more than 30 days round) also in above fruit trees during two successive seasons; 2002 & 2003.

Investigation was conducted on all agricultural areas treated traditional BAT treatments; two guava groves for every high and low BAT frequency and two Valencia orange groves also for every high and low BAT frequency treatments program in both seasons. Jackson traps with the male attractant trimedlure were used in all groves study for monitoring the population fluctuation under three cases used of BAT. The capture males per trap /day (CTD) for 36 dates of inspection in season was considered as indicator for efficiency three cases used of BAT against *C. capitata* and to estimate Medfly population in fields study. Results show exist statistically differences mean number CTD of *C.capitata* in three cases BAT used (traditional, high, low frequency) in all groves, guava and Valencia. While this differences not exist between two seasons 2002 and 2003 for all groves (traditional treatments) in both Governorates. However the data indicated that high frequency BAT (10-20 days round) in guava and Valencia orange groves reduce significantly the population of Medfly comparison with the low BAT frequency (more then 30 days round) in guava and Valencia groves. In seasons 2002 & 2003, CTD of *C. capitata* ranged between 2.54 , 2.47 respectively in all groves treated first case BAT treatment (traditional). The grand mean of 36 inspection every season in guava groves treated high and low BAT frequency the CTD of Medfly was ranged 3.37-4.32 , 7.12-7.5 respectively. In Valencia orange groves the grand mean of 36 inspection every season treated high and low BAT frequency the CTD of *C. capitata* was ranged 3.66-3.56 , 3.82-7.12 respectively. Relationship between fruit availability of host fruit, climatic condition and Medfly numbers have been observed in this study. Percentages fruit infestation in guava ranged between 25 % to 48% while the percentage infestation in Valencia orange ranged between 0.0% to 56.9% in KhanYunis and Rafah during harvesting periods in 2002 & 2003 seasons.

Keywords: Population dynamic, Mediterranean fruit fly, *Ceratitis capitata* Wied., Gaza strip, Partial Bait Spraying, BAT , guava and citrus groves.

INTRODUCTION

The Mediterranean fruit fly(Medfly), *Ceratitis capitata* (Wied.) is one of the most serious fruit flies in the world because of the great variety of its host plants; attacking over 100 crops of economic importance (Hill, 1983 ; Karpati, 1983 ; Liquido, *et al.* 1991) and of its geographical distribution (Anonymous, 1988 and White and Elson-Harris, 1992). Damage of up to

100% has been observed in some stone fruits and citrus (Cramer, 1967) and Karpati, 1983). The Medfly detected in Gaza strip causes considerable damage which inflicted significantly economic losses to guava, citrus, fig, peach, apricot the all over KhanYunis and Rafah Governorates (Avidov and Harpaz 1969 ; Saleh and Abdel-Aziz, 2002). The Medfly adapted too many climates (White and Elson-Harris 1992 ; Vadora, *et al.* 1993 and Teresa, *et al.* 2002).

The Medfly *C. capitata* have been the subject of control experiments for many years

. Cover sprays, hygiene, partial bait ground spray (BAT), killing bags, sterile insect technique were used for controlling and suppressing the population of *C. capitata* in citrus, guava and other fruit trees (Hashem, *et al.* 1987 ; Lindquist and Peterson, 1987; Roessler, 1989; Mitchell and Saul, 1990 ; Permalloo, *et al.* 1997 ; Peck, 2000 and Saafan, 2001) . Also the Medfly can be controlled effectively by regular applications of cover sprays using insecticides (Anonymous, 1986 ; Roessler,1989 and Peck, 2000). However, this method of control may be detrimental to beneficial insects such as bees, other pollinators, and could also cause environmental pollution (Roessler, 1989 Permalloo, *et al.* 1997 and Peck, 2000) . Moreover, the Sterile Insect Release Method would not be appropriate (Lindquist,1987). Therefore a team in plant protection recommended the BAT area wide control program on *C. capitata* applied in citrus and guava groves in Gaza strip (Anonymous, 2003). In citrus and guava groves BAT implemented was as one common methods against *C. capitata* at KhanYunis and Rafah Governorates. The program conducted by Ministry of Agriculture, started operations in 1969, until now (Anonymous 2003) . Therefore, the aim of the present study is to evaluate the effect of update three cases used the BAT on *C. capitata* in guava, Valencia orange groves and total areas of KhanYunis and Rafah Governorates. These cases are the following: 1)Traditional protein BAT on *C. capitata* in totat areas of two governorates, 2) High and low frequency used of the protein BAT on *C. capitata* abundance in guava groves and 3) High and low frequency used of the protein BAT on *C. capitata* abundance in Valencia groves of two Governorates.

MATERIALS AND METHODS

A study and climate:

The current study carried out in KhanYunis and Rafah Governorates are located in the southern of Gaza strip. Their collective area is approximately 160 Km2.In this area there are dens plantation of guava and citrus orchards (form 46.12 % of host plants *C. capitata* and 37.6% of fruit plants (anonymous, 2004b). Orchards of these areas characterized by mixed crop system in cultivated trees. The study was carried out during 2002-2003 seasons in three experiments; all areas of Governorates, guava and Valencia groves. These areas located 30-40Km faraway from Gaza town at approximately sea level. Orchards of KhanYunis and Rafah with area of 3-15 ha consisted primarily of Valencia orange *C.sinensis* and guava *Pisidium guajava*, also, neighboring other citrus species (grapfruit *C. paradisi*,

Shammoty orange, clementin), and small groups of figs, stone fruit, plume and pome fruit tree These trees occupied very small area and not cultivated regularly. Also in this area cultivated non host trees such as olives (*Olea europea* L.) and almonds (*Prunus amygdalus*).

The fruiting period are long a year for host fruits of *C. capitata*. Citrus mature first, followed by, peach, apples, figs, vineyard and guava. The climate of area is characterized by a warm, dry summer(23.6 -25.7C) and wet winter (relative humidity 64.1-75.7%) with low temperatures over zero (12.6-14.1C) at KhanYunis and Gaza station (Anonymous, 2004a).

To achieve the aim of this study three experiments were carried to compare three statuses of farmers in implementation of BAT (area-wide control of Medfly) in all area , guava and Valencia orange groves to represent real update statuses of farmers in implementation BAT control of Medfly in fruit trees ; the first case was real practice BAT in all orchards was as real traditional status, the second case was on four guava orchards treated high and low BAT frequency (GuHCo and GuLCo) , the third case was also on four Valencia orange orchards treated high and low BAT frequency (VaHCo and VaLCo) during 2002 and 2003 in KhanYunis and Rafah Governorates.

Control treatments sites:

All areas of the study are under partial bait spraying technique (BAT). A wide range control program conducted by Ministry of Agriculture using ground bait spray. The BAT consists of the use of protein hydrolysate / malation 1040 EC. A mixture of water (carrier), protein hydrolysate (a food attractant), and Malation 1040 EC (insecticide). in the ratio of 8.875:1: 0.125

1-**In the first experiments** (BAT) was applied not regular as traditional program (once each 10-30 days round) for all areas of the Governorates (KRT) by a wide range control program conducted by team of Ministry of Agriculture. This technique was used seven times in guava during12th July to15th November nine times in Valencia during 30th February to end of May to and clementin six times during 1st August to 30th December at 2002 and 2003. The bait spraying applied at rate of 10 L mixture per 0.7ha (Figure 1).

2- **In the second experiments:** Two BAT treatments were carried ; the first was applied in guava in high frequency treatments program (GuHCo) at 10-20 days round ten treatments approximately on Tafesh Showrab farm (about 2.5 ha.) and El-Abaaddella farm (about 3ha.) orchards at KhanYunis Governorates. The second treatment was applied in low frequency (GuLCo) on regular more than 30 days round. Three treatments only were implemented in Timraz farm (about 1.0 ha. guava) and Zougrub farm (about 7.0 ha.guava) in every season at Rafah Governorate through BAT period during 2002 and 2003.

3-**In the third experiments** the same above treatments (high and low frequency BAT spraying) were applied on Valencia orange orchards, the first was used high frequency once each 10-20 days round the BAT (VaHCo) with fifteen treatments in El Smiiry (about 2.0 ha Valencia) and El-Kgadi farm (about 12.0 ha.Valencia) and the second BAT was used in low frequency on regular more than 30 days round the BAT period (VaLCo), (three treatments in Omar El Abaadelh (farm about 2.0 ha. Valencia) and

El-Fara (about 20 ha. Valencia)) at KhanYunis Governorate through BAT period during 2002 and 2003.

Control operation

BAT are being used for suppression of populations of *C. capitata* in the districts of KhanYunis and Rafah. This method was selected because it is safe, cheap, and require very simple equipment for its application. Selection of geographical area of application was motivated by several factors; the main one being logistics; this area covers 160 km2 approximately and represents about 15.01% of fruit production. Each district was divided into 3 zones and each zone was visited by a team ; the three teams were composed of a supervisor and 63 men for spraying, involved full time; each team was allotted a vehicles for its movement (Anonymous, 2003). The solution is applied at a rate of 10 L/0.7 ha (Permalloo, *et al.*1997 ; Peck, 2000 and Anonymous 2003).

Bait Application Technique

Foliage baiting using protein hydrolysate (attractant), Malation 1040 Emulsifiable Concentrate (EC) (insecticide) and water (carrier) is standard practice throughout the world and also in Gaza strip for control of Medfly (Anonymous 2003). This mixture is applied as a coarse spray to foliage in the infested area. Application is done on a weekly basis. The bait consist of use protein hydrolysate / malation spraying recommended on regular 7-10 days round (Allwood, 1989). This recommendation does not exactly apply in guava and Valencia groves in KhanYunis and Rafah Governorates.

A mixture of water (carrier), protein hydrolysate (a food attractant), and Malathion 1040 EC (insecticide) in the ratio of 88.75: 10 : 1.25 is used, at a rate of less than 1.6 L mixture per 0.1ha. This method is relatively more safe to non-target insects and is also less polluting to environment than cover sprays, as it produces very little spray drift and very little chemical residue. The solution is applied at the rate of 10ml/tree as a coarse spot spray to the undersides of foliage.(Table 1)

Monitoring

In the three experiments the Medfly population was monitored to estimate the effectiveness of the three above cases of BAT treatments control on the population fluctuation *C. capitata* in all area, guava and Valencia orange groves. In addition to evaluate the correlation between climatic condition and Medfly population (CTD).

Adult fruit fly field population study:

To estimate adult fly population, Jackson sticky traps (Harris *et al.* 1971) were baited ten days round with trimedlure. The traps were distributed in chosen guava and Valencia orange orchards from early January 2002 to late December 2003 in KhanYunis and Rafah Governorates (about 150 traps in the first experiments, eight traps in each of other two experiments).

Effectiveness the trap and suitability of pheromone traps for monitoring the populations of *C. capitata* described and discussed by many researchers (Harris, *et al.*1971 ; El-Abbassi and Makkar, 1994 and Mogahed, 1999).

Table 1 : The area (Hectare) of Valencia orange and guava orchards treated partial bait spraying (BAT) control *Ceratitis capitata* in KhanYunis and Rafah Governorates by Ministry of Agriculture during 2002 & 2003.

	2002				2003				
Date of treatment	Khan Yunis Valencia	Khan Yunis Guava	Rafah Valencia	Rafah Guava	Khan Yunis Valencia	Khan Yunis Guava	Rafah Valencia	Rafah Guava	Total
January	-	-	-	-	218.0	-	124.5	-	3425
February	164.5	-	153.0	-	101.5	-	52.4	-	4714
March	109.0	-	175.0	-	177.5	-	67.8	-	5293
April	44.0	-	19.0	-	57.6	-	122.3	-	2429
May	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-
July	-	74.8		25.0	-	64.3	-	-	1641
August	-	93.1	-	18.0	-	366.7	-	4.9	4827
September	294.5	207.1	-	106.0	28.0	306.0	23.5	8.6	9737
October	127.0	-	80.5	21.7	137.5	168.5	36.2	8.2	5796
November	277.5	-	103.4	8.4	208.0	19.5	86.8	8.4	7120
December	159.0	-	88.9	-	159.0	-	88.9	-	4958
Total	1175.5	375.0	619.8	179.1	1087.1	925.0	602.4	30.1	4990

To study the level of adult *C. capitata* under various statuses of BAT used. The adult population was monitored in all area, guava and Valencia orchards of two Governorates as measure for efficacy of the cases BAT used. Eight sticky traps were distributed for every Valencia orange and guava groves at a rate one trap per 10 ha. In addition one hundred and fifty traps were distributed at a rate one trap per 10ha. in all orchards of KhanYunis and Rafah Governorates including groves of guava and Valencia orange, starting from January 2002 to 31 December 2003 of the two successive years. Traps were suspended on tree branches in shaded area at a height 1.5-2.5m. Traps were baited 15-20 days with the sex attractant (trimedlure).Traps were inspected three times per month. The number of flies captured by the sticky cardboard located inside the trap was counted and the cardboard strips were then renewed ; CTD was calculated and then used as a measure of fly abundance.

Host survey, fruit sampling and examination:

A total number of 981 Valencia (Citrus sp.) and guava fruit samples were collected. Each sample distributed homogeneously. The samples were subjected to study the fruit infestation by insect during the period maturity (from early March to the end of November; the end of fruit harvesting) of the

two successive seasons 2002 and 2003. The collected samples were weighed, measured and then processes were followed according to methods of Niklause–Ruiz and Basedow, 1997 ; Saafan, etal. 2001 to estimate fruit infestation by *C.capitata*.

Statistical analysis

Data obtained in the different experiments were statistically analysed using ANOVA or analysis of variance and least significant differences (LSD) tests, performed by Genstat 5 computer program.

RESULTS AND DISCUSSION

Seasonal fluctuations and influence of host fruit availability & climatic condition on Medfly population

The effectiveness of three cases BAT used (traditional, high and low frequency) in the target experimental sites has been demonstrated by a simultaneous decrease in Medfly population. Table 2 show the grand mean of the thirty sixes dates of inspection for mean number males catch per trap per day CTD of *C. capitata* at KhanYunis and Rafah Governorates along two successive seasons 2002 and 2003. Data represented in Table 2 show that the grand mean of CTD of *C. capitata* was significantly different in guava and Valencia orange groves treated by high, low BAT frequency (GuHCo, GuLCo, VaHCO, VaLCo) and in total area treated by traditional BAT frequency (KRT). These results may be due to the differences in frequency of BAT implementation. In addition, mean CTD of the insect was significantly different in 36 dates of inspections for all sites of experiments during 2002 & 2003 due to differences in climatic conditions (Anonymous, 2004a). (Table 2).

Table 2 :The general grand mean number of captured males in Jackson traps per trap per day (CTD) of *Ceratitis capitata* in total area of KhanYuins and Rafah Governorates(KRTo) , guava and Valencia orange groves under high (GuHCo, VaHCo) and low (GuLCo, VaLCo) used BAT against *C.capitata* for thirty sixes dates of inspection during 2002 & 2003.

Growing season*	KR** Total	KR** GaLCo	KR** GuHCo	KR** Total	KR** VaLCo	KR** VaHCo
2002*	2.54 X	7.5 Y	4.32 Z	2.54 XK	7.12 Y	3.66 XM
LSD at 0.05%	0.84	8.33	12.58	0.84	17.18	4.93
2003*	2.47 XK	7.12 L	3.37 M	2.47 K	3.82 L	3.56 M
LSD at 0.05%	1.95	4.98	10.91	1.95	6.99	6.82

*Grand means of CTD within a thirty sixes dates of inspection are significantly different (LSD test, at 0.05% Genstat 5 programme).

**Grand means within a row followed by the same letter are not significantly different (LSD test, at 0.05% Genstat 5 program).

In general, the data indicated that the CTD of *C. capitata* was relatively high during June- July (mean CTD = 2.07-2.55) and October-December (mean CTD = 3.21-5.45) during 2002 & 2003. The increased values of CTD could be due to the (abundance) exist of the repining host fruits of *C. capitata* (Valencia orange, peach, apricot and fig during March - August and guava, clementin and Shamoty during ,October-December) (Figure 2 & 3). Similar results was obtained by Benfatto *et al.* (1989); Isreaiy, and Nestel, (1996); Isrealy, *et al.*(1997a,c); Katsoyannos *et al.* 1998 ; Papadopoulos *et al.* (2001) and Katsoyannos & Papadopoulos, (2004).

The availability of host fruit in this study was found to be an important factor influencing fruit fly numbers. Relationships between fruit availability and Medfly numbers have been observed in citrus and guava (Figure 1 & 2). Penaloza, *et al.*, 2001 reported that the peak population numbers are recorded after of maximum host fruit availability. However the Medfly dispersion was found to be closely related to host ripening sequence. A significant relationship was found between number of CTD and average monthly temperature, relative humidity and rainfall within the season 2002 & 2003 (Table 2 and Anonymous 2004a). Similar population dynamic have been reported from other Mediterranean countries (Harris and Lee1, 1987 ; Benfatto, *et al.*1989 ; Campos,*et al.* 1989 ; Israeal *et al.*1997a,c ; Papadopoulos, *et al.* 2001 and Ahmed & Mofleh, 2002) . The weather condition was optimal to population growth of Medfly *C.capitata* during the period of increasing the mean number CTD of *C. capitata* (Anonymous 2004b). These results are in agreement with those mentioned by Teresa *et al.*2002 and Mazih, 2004. In addition the mean number CTD of *C.Capitata* was not high significant during 2002 comparison with that during 2003. This could be attributed to climatic condition and decrease of Medfly host fruits and change in frequency of BAT (insecticide) application against *C. capitata* in 2003 & 2002, (Table 1 , 2 and Figure 1, 2, 3, 4) .

Effect of BAT treatment on *Ceratitis capitata* Wied. abundance

The Medfly *C.capitata* population fluctuation in guava, Valencia orange (Va.) groves(Gu.) and total areas treated high (GuHCo, VaHCO) and low (GuLCo, VaLCO) and traditional (KRTo) BAT frequency (area-wide control program) respectively, was studied in KhanYunis & Rafah Governorates. The population of *C. capitata* was represented by CTD during the 2002 and 2003 seasons (Figure 1, 2 , 3 and 4).

In guava

The area of guava groves treated in KhanYunis & Rafah by BAT in 2003 was more then in 2002 (Table 1). Figure 1& 2 showed the mean number CTD of *C. capitata* in guava groves treated by high and low BAT frequency, and also traditional BAT applied in total area during 2002 & 2003. In the treated guava groves by low BAT frequency, Medfly population increased gradually from 2nd half of September (0.4-13.53) until 2nd half of December (CTD: 20,23-33), then the population decreased during the end of December (CTD: 8.68-12.7). This mean that Medfly adults migrate from guava orchard to the neighbouring citrus groves.

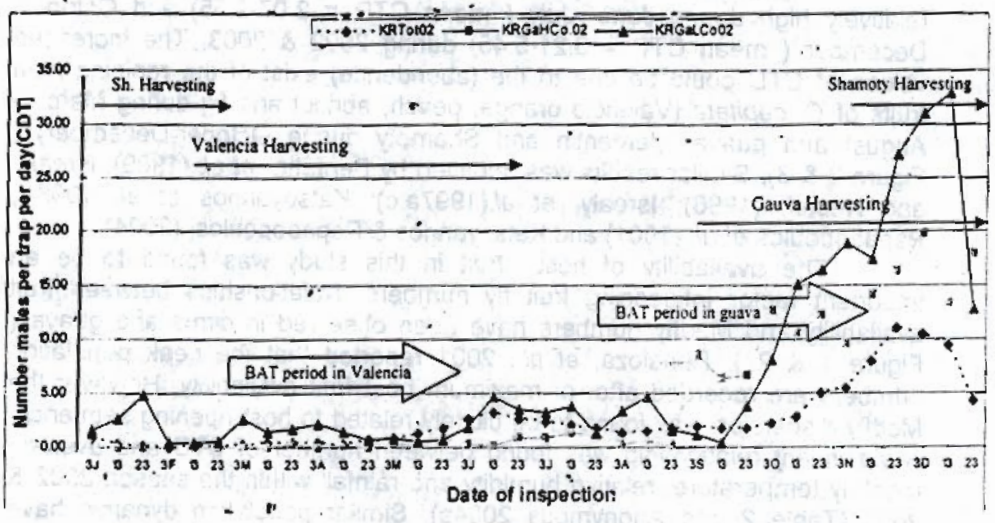

Figure 1: The mean number of captured males in Jackson traps per trap per day (CTD) of *Ceratitis capitata* in total area of KhanYunis and Rafah (KRT), under high frequency BAT treatments in guava (GuHCo)and low frequency treatments in guava(GuLCo) during 2002.

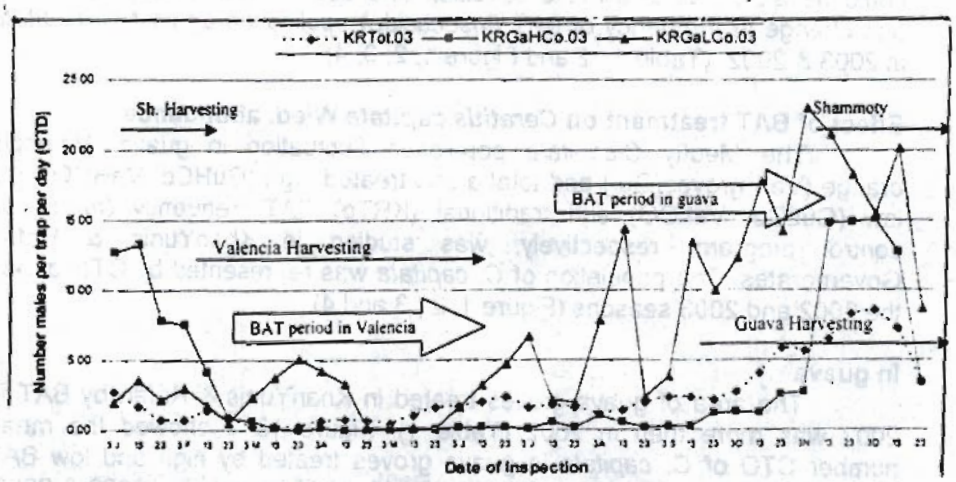

Figure 2: The mean number of captured males in Jackson traps per trap per day (CTD) of *Ceratitis capitata* under traditional treatments in total area of KhanYunis and Rafah (KRT), under high BAT frequency treatments in guava (GuHCo) and low BAT frequency treatments in guava (GuLCo) during 2003.

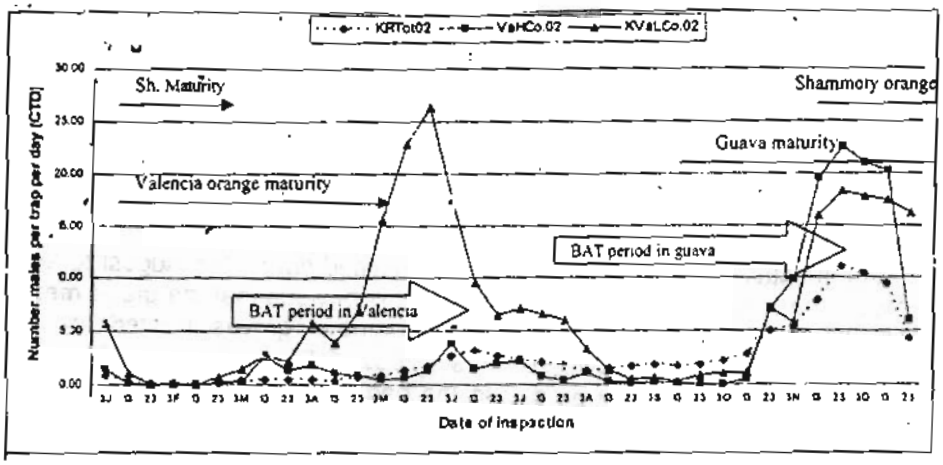

Figure 3: The mean number of captured males in Jackson traps per trap per day (CTD) of *Ceratitis capitata* under traditional BAT treatments in total area of KhanYunis and Rafah (KRT), under high BAT frequency treatments in Valencia orange (VaHCo) and low BAT frequency treatments in Valencia orange (VaLCo) during 2002.

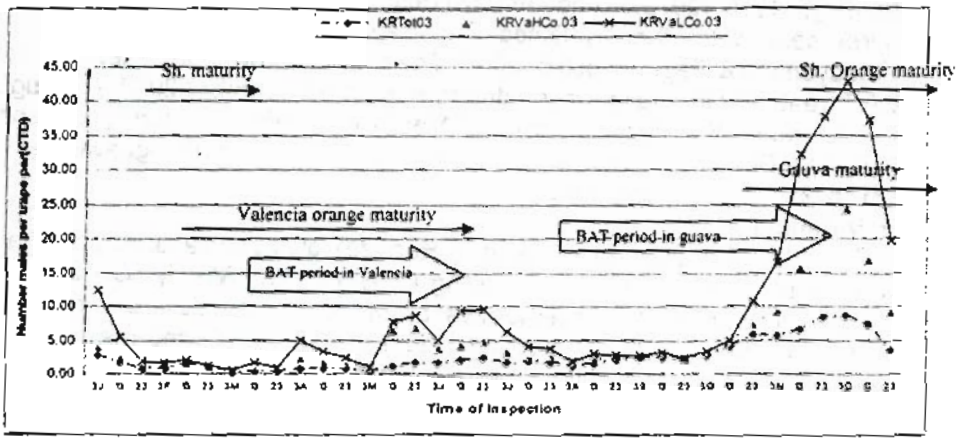

Figure 4: The mean number of captured males in Jackson traps per trap per day (CTD) of *Ceratitis capitata* under traditional treatments in total area of KhanYunis and Rafah (KRT), under high frequency treatments in Valencia orange (VaHCo) and low frequency treatment in Valencia orange (VaLCo) during 2003.

The data indicated that, male *C. capitata* numbers in treated three cases BAT frequency showed similar fluctuations during the study period. In the same time significant high level CTD in guava treated by low BAT frequency treatment and also low level CTD treated by high BAT frequency treatment. These results may be due to different effect in frequency of BAT and amount of insecticides (table 1).

Data indicated that the persistent of *C. capitata* adult in guava groves treated by low BAT frequency was early August to end of November and fruits infestation with Medfly larvae were noticed during the August to end of November (Table 2). In the Same time it is obvious that the grand mean of Medfly *C. capitata* (CTD) was high in guava groves treated low BAT frequency treatments in two seasons (2002, CTD = 7.5 and 2003, CTD = 7.12). These results may be due to the bad applied in the recommendation and low frequency of BAT treatments in these orchards (Roessler 1989 ; Allwood, 1989 ; Mitchel and Saul 1990 and Permalloo, *et al.*1997). However CTD in groves treated high (GuHCo) and traditional treatment (KRT) was as follow :

2002, the Medfly *C.capitata* (CTD) was 4.32 , 2.54, respectively .In 2003, the Medfly *C. capitata* (CTD) was 3.37 , 2.47 in treated high BAT frequency treatment (GuHCo) and in total area treated by traditional BAT treatment (KRTo) respectively. The low population (CTD) in groves treated by GuHCo treatment due to the best applied of recommendation related to BAT treatment in comparison with CTD in groves treated by GuLCo treatment (Table 2). These results due to the differences in frequency of BAT treatments. In spite of this fact the *C. capitata* in all areas is low comparison with others treatment, could be due to fast distribution and decrease the density and area of host fruits and Medfly refuge to host fruits in backyards (Isrealy, 1996,1997a,c and Anonymous, 2003). These results are in agreement with that obtained by Saafan, 2001, Mazih, 2004 ano Katsoyannos & Papadopoulos, 2004. The results showed also that in spite of BAT treatment in guava groves during August – November 2003 and August – September 2002 the population of Medfly was persistent during November – middle December. This fact could be due to the effect of guava repining which was in harvesting periods.

In Valencia

Table 1 showed the area (Hectare) of Valencia orange orchards treated traditional partial bait spraying (BAT) control Medfly *C. capitata* in KhanYunis and Rafah Governorates by Ministry of agriculture during 2002 was more then 2003. Table 2 and Figure 3 & 4 showed the mean number CTD of *C. capitata* in total area treated by traditional BAT (KRTo), high (VaHCo) and low (VaLCo) BAT frequency treatments applied in Valencia orange orchards during 2002 & 2003.The *C. capitata* numbers under three statuses treated BAT (KRTo , VaHCo , VaLCo) in two seasons showed similar fluctuation profiles. These results may be due to the similar host fruits distribution. In the same time there was statistically differences between CTD in total areas and Valencia orange groves treated by traditional BAT (KRT) , high BAT frequency (VaHCo) and low treated BAT frequency (VaLCo) respectively, during the 2002 & 2003. These results may be due to

differences in frequency and number treatments of BAT. However the significant high level population was found in treated low BAT frequency treatment. Also low population level of *C. capitata* was found in treated high BAT frequency treatment (Table 1 and Figure 3 & 4). These results may be due to the differences in frequency of BAT (Isrealy, 1996 ; Anonymous, 2003 and and Mazih, 2004). However the persistent of *C. capitata* adult also in Valencia orange groves treated by low BAT frequency was middle March to end July and fruits infestation started at the may to early August during repining fruit. In the same time it is obvious that CTD in Valencia orange was high in treated by low BAT frequency treatments in two seasons (2002, CTD =7.12 and 2003, CTD = 3.82). These results could be attributed to the low BAT frequency and bad applied the recommendation in these orchards (Peck, 2000). However CTD in Valencia groves treated by high BAT frequency (VaHCo) and traditional BAT treatment (KRTo) was as follow: 2002, the Medfly *C.capitata* (CTD) was 3.66 (VaHCo), 2.54 (KRTo) respectively. In 2003, the Medfly *C. capitata* (CTD) was 3.56 (VaHCo), 2.47(KRTo) respectively. The low population in Valencia groves treated by high frequency of BAT (VaHCo) treatment in both seasons was not statistical different (Table 2) . These results could be due to the best implementation of recommendation of BAT frequency comparison with Valencia groves treated by low BAT frequency (VaLCo) . These result agreed the other researchers Hashem *et al.*, 1987a ; Katsyannos, 2004 and Mazih, 2004).

HOSTS FRUITS INFESATION

Survey of host plants:

The cultivated host fruits of *C. capitata* existing in KhanYunis and Rafah Governorates during 2002 & 2003 were as follow: Valencia orange *(Citrus aurantum* ; Shamoty orange *(Citrus sp.)* ; Navel orange (*Citrus sienensis)*; Grapefruit *(Citrus paradisis)* ; Clementin *(Citrus mitis)* ; Sweet orange *(Citrus sinensis)* ; Lemon *(Citrus lemon)* ; Guava *(Pisidium guajava);* Fig (Ficus carica); Pear (*Pyrus connunis)* ; Apple *(Malus pumla);* Peach *(Prunus persica;P.amygdalus)* ; Apricot *(Prunus armeniaca L)* ; Mango *(Mangifera indica,L)* ; Loquat *(Eriobotrya jabanic)* ; Pear *(Pyrus communis L.);* Grapvine *(Vitis vinifera)* ; Date (*Phoenix dactylifera L.).*

Percentage of Medfly infestation on guava and Valencia orange hosts:

The maximum percentage of Medfly infestation occurred on guava (25-48%) and Valencia orange (23.1-56.9%) Table 3. The highest rate of Valencia orange fruits infestation with Medfly larvae (56.9%) during the end of fruit harvesting (June) may be due to that Valencia fruits are preferred host for Medfly, suitable weather conditions prevailing during the period of repining Valencia fruits period (Table 3). The highest rate of guava fruits infestation, with Medfly larvae comparison with Valencia orange fruits may be due to that guava fruits are preferred host for Medfly, suitable weather conditions prevailing during the period of ripening guava fruits and the build up of Medfly population in ripening guava varieties. These results are in agreement with that obtained by Lobos, *et al.* 2001 ; Saafan, *et al.* 2001 and Saafan & Tadros, 1996.

Table 3: Mean number larvae and pupae of Medfly *Ceratitis capitata* reared and per fruit; its percentage infestation on Valencia orange and guava host fruits collected from KhanYunis and Rafah Governorate during 2002-2003.

Months of inspection	Number fruits collected	Mean of % infestation fruits	Number larvae and pupae reared	Number larvae and pupae per fruit
Guava				
August	40	25	60	1.5
September	178	25.23	179	1.01
October	190	55.15	220	1.15
November	25	48	36	1.44
December	21	28.6	18	0.86
Valencia orange				
March	105	0.0	0.0	0.0
April	50	0.0	0.0	0.0
May	128	23.1	134	1.05
June	98	56.9	303	3.09
July	113	19.78	78	0.69
August	33	31	39	1.18

Our results provide a useful *C.capitata* management tool. We further seek to understand how knowledge on seasonality, hosts area and level of *C.capitata* population under different statuses of BAT treatment program may help to plan a sound area-wide control program strategy for managing the Medfly *C.capitata* (IPM). In addition the information may be used in the future design of alternative strategies of control, in the application of the Sterile Insect Technique and BAT.

The results emphasize the urgent need of BAT area wide control Medfly improvement , specially in following the regular applied of partial bait spraying weekly round.

ACKNOWLEDGEMENT

The author express their deep gratitude to Dr.Maged Yassen ,Msc. Mohammed El-Hamalawii and Zakaria Omran for useful and helpful notes during the writing of this paper and Agronomists Ba:em, Shakowra ; Omar, Abu-Rkhaia ; Hasan, Reehan; Mouhamad, El-Jowranii ; Mohammad Kareem and Osama ,El-Hamalawii for their considerable help in data collection.

REFERENCES

Ahmed, M. and Mofleh, M. (2002): Population Dynamic of the Mediterranean, *Ceratitis capitata* wied (Diptera: Tephritidae) in the Coastal region of Syria Researches Abstract, Arab society for plant protection (ASPP) in the Egypt Arab congress of plant protection, held in Faculty of Agriculture Omar AL-Mukhtar University, EL- Beida city, Libya, Octobar 12-16, 2003.

Allwood A. 1989. Use of protein bait for fruit fly control. Agnote,2 p.

Anonymous.2004a. Meteorological data of Gaza and KhanYunis station 2000-2004.pp30

Anonymous.2004b.Statistical reports on agricultural production cost and cultivated area of fruit tree, vegetables and field crops in Gaza strip. Ministry of Agriculture for cultivated area ,2002/2003. Authority of Palestine .(in Arabic),35.

Anonymous.2003.Anual report on SIT project.P.25 (Unpublished).

Anonymous.1988. Distrbution maps of pests, *Ceratitis capitata* (Wiedemann). Series A (agricultural), map no.1.CAB International Institute of Entomology, London.

Anonymous 1986. Chemical control of fruit flies. Annual Report, Entomology Division, Ministry of Agriculture, Fisheries and Natural Resources, Reduit, Mauritius.(Unpublished).

Avidov, Z.andI.Harpaz.1969.Plant pest of Israel. Israel University Press, Jerusalem, 435-444.

Benfatto, D.,S. Longo, and G. Siscaro. 1989. Four years comparative analysis on population dynamics trend of Ceratitis capitata (Wied.) (Diptera, Tephritidae) on *citrus*,pp.35-40.InR. Cavelloro(ed.), Proceedings, Symposium: Fruit Flies of Economic Importance 87.Commission of the European Communities International Organization for Biological Control, International Symposium,7-10April1987,Rome,Italy. Balkema, Rotterdam, The Netherlands.

Bodenheimer, F.S.1951. Citrus Entomology in the Middle East. The Hague, Netherlands. Pp.663 .

Campos, M., P. Ramos and O.T. Jones. 1989. Monitoring population of Ceratitis capitata in the Granada province of Spain using three different trapping systems, pp.401-404. In R. Cavalloro (ed.), Proceedings, Symposium: Fruit Flies of Economic Importance 87. Commission of the European Communities International Organization for Biological Control, International Symposium, 7-10 April 1987, Rome, Italy. Balkema, Rotterdam, The Netherlands.

Cramer,H.B.1967.Plant protection and word production, Bayer AG,Leverkusen.

EL-Abbassi,T.S. and A.W. Makkar. 1994 Evaluation of three different formulations of trimedlure as attractactant lures for the Mediterranean fruit fly, *Ceratitis capitata* (wied.) Egypt J. Agric Res., 72(2), 451-460.

Eskafi, F. M.Kolbe.1990. Infestation patterns of commonly cultivated, edible fruit species by *Cratitis capitata* and *Ananstrepha* spp. (Diptera; Tephritidae) in Guatemala and their relationship to environmental factors. Environ. Entomol.19; 1371-1380.

Harris, E. J. and C. Y.L. Lee. 1987 .Seasonal and annual distribution of Mediterranean fruit fly (Dptera; Tephritidae) in Honolulu and Suburban areas of Oahu, Hawaii .Environ. Entomol. 15:507-512.

Harris,E.J.;S. Nakagaw,A. and T.Urago.1971. Sticky traps for detection and survey of three tephritids .J. Econ. Entomol. 64:62-65.

Hashem, A.G.; Harris, E. J.; Saafan, M.H. and .M.Foda.1987a.Control of the Mediterranean fruit fly in Egypt with complet coverage and partial bait sprays. Annals Agric. Sci.,Fac.Agric.,Ain Shams Univ., Cairo, Egypt. 32(3),1813-1825,1987.

Hill. D.S. 1983. *Ceratitis capitata* (wied) Pp. 386 in Agricultural insect pests of the tropics and their control, 2nd edition Cambridge university press. 746 pages.

Israely, N. ,B. Yuval, U. Kitron and D. Nestel. 1997a. Dispersion Patterns of the Medfly Population in Heterogeneous Habitats . The 10TH conference of the Entomological society of Israel , Abstracts of Papers Presented 166.

Israely, N., Nestel, D. and Yuval, B. 1997b .Influence of Season and host phenology on the Mediterranean fruit fly population fluctuations in the Central hills of Israel .Alon Hanotea ,51:264-271.

Israely, N.,B. Yoval, U. Kitron, and D. Nestel 1997c. Population fluctuations of adult Mediterranean Fruit flies (Dipera: Tephritidae) in a Mediterranean Heterogeneous agricultural region. Environ. Entomol. 26:1263-1269.

Israely ,N, Yaral , B. and Nestel, D., 1996 : Relationship between Temporal and Spatial Distribution of Mediterranean Fruit fly Population and Host Phenology . Paper presented at 8th conference of entomological society of Israel . Abstract ,129 1996.

Katsoyannos, B.I. and Papadopoulos,N.T.2004. Research on Medfly population in Greece and other Mediterranean Region.Xth International Citrus Congress, Agadir,Morocco,15-20 February 2004. Abstract. 180 .P.59

Katsoyannos, B.I, N.A. Kouloussis, and J.R. Carrey.1998. Seasonal and annual occurrence of Mediterranean Fruit flies (Diptera: Tephritidae) on Chios island: differences between two neighboring citrus ann. Entomol. Soc. Am. 91:43-51.

Karpati, J., 1983. The Mediterranean Fruit Fly. (Its importance, detection and control).FAO Rome.

Lindquist, D.A. & Busch- Peterson, E.1987. Applied insect genetics and IPM. In integrated pest management: parasitoids (ed. Delucchi) Geneva PP. 237-256.

Liquido , N. J., L. A. Shinoda , and R. T. Cunningham.1991.Host plants of Mediterranean fruit fly :an annotated world review. Ann.Entomol.Soc. Am. 77:1-52 .

Lobos, C. ,Ingeborg Rosenbaum , Raul Gonzalez and Jaime Gonzalez. 2001. Fruit types used as hostages by the Mediterranean fly (Ceratitis capitata- WIED.) in the province of Arica, I region of Chile. Abstracts 4th Meeting of working group fruit flies of the western hemisphere, November 2001,p.55.

Mazih,A.2004.Spatial and Temporal Distribution, and Population Dynamics of the Mediterranean Fruit fly (Ceratitis capitata Wiedemann), in the Souss Area (Marocco).Xth International Citrus, Agadir, Marocco,15020 February 2004.Abstract 181,59.

Mitchell, A.C., and S.H. Saul. 1990. Current control methods for Mediterranean Fruit fly.*Ceratitis capitata* and their application in the USA. Rev Agric. Entomol. 78(9):924-940.

Mogahed, M.I. (1999): Suitability of Pheromone Traps for Monitoring and Suppressing the Population of Ceratitis capitata (wied) on Mondarin Trees. J. Egypt Ger. Soc. Zool Vol. 30(E), 49-60. 1999.

Niklause-Ruiz Berge,M.,and T.Basedow.1997.A survey of the accurence and flight periods of fruit fly species (Deptera:Tephritidae) in fruit growing area in southwest Nicaragua,1994/95.Bull.Entomol.Res.87: 405-412.

Papadopoulos,N.T.,Katsoyannos,B.I.,Carey,J.R.,Kouloussis,N.A.2001. Seasonal and Annual Occurrence of the Mediterranean fruit fly (Diptera:Tephritidae) in Northern Greece. Ann. Entomol. Soc. Am. 94(1): 41-50.

Peck, S. L., and G. T. McQuate. 2000. Field test of environmentally friendly malation replacements to suppress wild Mediterranean fruit fly (Diptera: Tephritidae) populations. J. Econ. Entomol. 93:280-289.

Penaloza, C. and Sergio M. Ovruski, 2001.Preliminary sudies on adult population flucuation Ceratitis capitata (DIPTERA ; TEPHRITEDAE) in peach Cordopa province, Argentina. Abstracts 4th Meeting of working group fruit flies of the western hemisphere, November 2001,p.44.

Permalloo,S. S. I. Seewooruthun, A. Joomye, A. R. Soonnoo, B. Gungah, L. Unmole and R. Boodram. 1997. An area wide control of fruit flies in Mauritius. AMAS 1997, 203-210.

Roessler,Y.1989. Insecticidal bait and cover sprays , pp.329-335. In A.s.Robinson , and G. Hooper (eds.) , Elsevier, Amsterdam.

Saafan,M.H. 2001. Integrated control of the Mediterranean frui fly ,*Ceratitis capitata*(Wied.)in guava orchards in Egypt, Egypt.J.Agric. 79(1),2001.

Saafan, M.H. and Tadros, A.W. 1996. Ecological studies on The Medfly, *Ceratitis Capitata* in apricot orchards in relation to neigbouring citrus orchards Egypt. J. Agric. Res. 72 (1), 61-70.

Saleh,A. and Abd-Elaziz,I. 2002.The status of horticulture protection and using pesticides in Gaza Strip. An-Najah University Journal for Research-A(Natural Science),volume 16 (2):152-182.

Teresa, M., Rodriguez, R., Segura, D.F., Clad era, J.L. and Sutierst, R.W. 2002: Potential Geographical Distribution of the Mediterranean fruit fly, *Ceratitis capitata* (Diptera: Tephritidae), with Emphasis on Argentina and Australia. Environ. Entomol. 31(6): 1009-1022.

Vadora, M.L., Salaverrey, L. & Rodriguez, L. (1993) Prediction of Ceratitis capitata Captures based on climatic factors. Pp. 211-216.

White, I.M. & Elson- Harris, M.M. (1992) Fruit flies of economic significance: their identification and bionomics. Significance: their identification and bionomics. 601 Pp. CAB international, Walling ford. UK. And ACIAR. Conberra, Australia.

تقييم فعالية الرش الجزئي للطعم السام على الكثافة العددية لمجتمع ذبابه فاكهه البحر الأبيض المتوسط (*Ceratitis capitata* Wied.) في بساتين الجوافة والفلنسيا في جنوب قطاع غزه .

أحمد صالح احمد صالح
قسم الإنتاج النباتي ووقاية النبات - كليه الزراعة - جامعه الأزهر - غزه

أجريت دراسة حقلية لتقييم تأثير ثلاثة حالات لتطبيق المزارع للرش الجزئي للطعم السام BAT لمكافحة ذبابه فاكهه البحر الأبيض المتوسط *Ceratitis capitata* Wied. في محافظات خانيونس ورفح جنوب قطاع غزة خلال الموسمين الزراعيين ٢٠٠٢ & ٢٠٠٣. الحالة الاولى الرش التقليدي الفعلي للطعم السام لجميع بساتين الفاكهة KRT والثانية التكرار العالي لرش الطعم السام كل ١٠-٢٠ يوم والثالثة التكرار القليل لرش الطعم السام (أكثر من ٣٠ يوم) في كل من حدائق الفلنسيا والجوافة خلال الموسمين السابقين. أجريت الدراسة في جميع المناطق الزراعية وبستانين للحالة الأولى وفي كل من الجوافة والفلنسيا لكل من الحالتين (التكرار العالي HCo والقليلLCo) لرش الطعم السام (BAT). أستعملت مصائد جاكسون الجاذبه لذكور ذبابة الفاكهة في حقول الدراسة لمراقبة تذبذب الكثافة العددية لمجتمع ذبابة الفاكهة تحت تأثير الحالات الثلاثة لاستعمال الطعم السام. أستعمل متوسط جذب الذكور في المصيدة الواحدة وفي اليوم الواحد (CTD) ل ٣٦ قراءة خلال الموسم كمؤشر لفعالية الثلاثة حالات لتطبيق المزارع لرش الطعم السام (BAT) في مكافحة ذبابة الفاكهة. أظهرت النتائج وجود فروقات معنوية لمتوسطات ذكور ذبابة الفاكهة لقيم الCTD تحت تأثير الحالات الثلاثة لرش الطعم السام (التقليدي والتكرار العالي والمنخفض). بينما لا توجد هذه الفروقات بين الموسمين ٢٠٠٢ و ٢٠٠٣ في جميع البساتين الزراعية للمحافظتين. كما أظهرت النتائج أيضا أن رش الطعم السام بالحالة الثانية (التكرار العالي) يؤدي لخفض أكثر لمتوسط ذكور ذبابة الفاكهة (CTD) بالمقارنة برش الطعم السام بالتكرار المنخفض (الحالة الثالثة) في كل من بساتين الفلنسيا والجوافة. حيث تراوحت قيم المتوسط الإجمالي ل٣٦ قراءة مراقبة ل CTD خلال الموسمين ٢٠٠٢ و٢٠٠٣ تحت تأثير الرش التقليدي للطعم السام (الحالة الأولى) للمراقبات ٢,٥٤ و٢,٤٧ على التوالي. أما في الجوافة تراوحت قيم متوسطات ال CTD للمراقبات خلال الموسمين تحت تأثير رش الطعم السام بالتكرار العالي والمنخفض ٤,٣٢-٣,٣٧ و ٧,١٢-٧,٥على التوالي. وفي الفلنسيا تراوحت المتوسطات الإجمالية لقيم ال CTD ل٣٦ قراءة مراقبة خلال الموسمين تحت تأثير رش الطعم السام بالتكرار العالي (الحالة الثانية) والمنخفض (الحالة الثالثة) ما بين ٣,٦٦-٣,٥٦ و٣,٨٢-٧,١٢ على التوالي، لوحظ أيضا وجود علاقة بين أعداد ذبابة الفاكهة وكل من توافر الثمار الناضجة لعوائلها وظروف المناخ. كما تراوحت النسبة المئوية لاصابة ذبابة الفاكهة لثمار الفلنسيا تحت تأثير رش الطعم السام بالأسلوب التقليدي في إجمالي البساتين المزروعة ما بين٠,٠%- ٥٦,٩% بينما هذه النسبة تراوحت ما بين ٢٥%-٤٨% في الجوافة في محافظات خانيونس ورفح خلال الموسمين ٢٠٠٢ و٢٠٠٣.