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Effect of Mixed Orchards on Population Dynamics and Dominant on Tephritid Flies in the New Valley Governorate, Egypt

Abdellah Said Hussein Abdel-Moniem[1,2] and Magdy Youssef El-Kholy[2,3]

1. Department of Plant Protection, Faculty of Agricultural, Beni Suef University, Egypt

2. Department of Pests and Plant Protection, National Research Center, Dokki, Cairo, Egypt

3. Department of Biology, College of Science, Aljouf University, Sakaka, Aljouf, Kingdom of Saudi Arabia

Abstract: Peach Fruit Fly (PFF) *Bactrocera zonata* (Saunders) and of the Mediterranean fruit fly (MFF) *Ceratitis capitata* (Wiedemann) are the most of dominant and destructive key pests in fruit orchards in different agro-ecosystem in Egypt. Population fluctuations of the Mediterranean fruit fly *Ceratitis capitata* (Wiedemann) and the peach fly *Bactrocera zonata* (Saunders) was monitored with lure traps collections in three provinces in the New Valley oases, Western Desert, Egypt. Results showed marked temporal differences in peak trap catches of the two flies in the selected sites all over the entire studied areas. One annual peak of *C. capitata* was recorded during both October and February and coincided with the ripening period of citrus trees in Kharga oases. However, two annual peaks were recorded during June and September in Bodkholow province and coincided with the ripening period of apple and mango. On the other hand, two annual peaks of *B. zonata* were recorded in Kharga oases throughout May and September and coincided with the ripening periods of apricot, mango and guava. One annual peak only was recorded round up of September and/or October in both of Moot and Bodkholow in Dakhla oases and coincided with the ripening period of mango, guava and citrus. Occurrence of *C. capitata* was very limited in comparison with *B. zonata*. Population fluctuations of the two pests in the studied sites were significantly different. The ability of the used traps in capturing both of *C. capitata* and *B. zonata* indicated that the yellow sticky trap was more effective in capturing *C. capitata*. However, Abdel-Kawi trap was significantly efficient in trapping *B. zonata*. Occurrence of *B. zontata* in high numbers all over the study period than *C. capitata* is considered as a good proof that this invading fly may be consider a vigor competitive tephritid fly to the native fly *C. capitata*.

Key words: Mixed orchards, Population fluctuations, *Ceratitis capitata* (Wiedemann), *Bactrocera zonata* (Saunders), lure traps, yellow sticky trap.

1. Introduction

Fruit flies (Diptera: Tephritidae) are a diverse, rapidly evolving group of more than 700 described species with a persistent effect on tropical agriculture [1]. The Mediterranean fruit fly *Ceratitis capitata* (Wiedemann) and the peach fruit fly *Bactrocera zonata* (Saunders) were recorded in the New Valley oases, Western Desert, Egypt, as severe orchard pests [2, 3]. The med fly *C. capitata* was first reported in Spain in 1842 by DeBreme according to Back & Pemberton [4] as mentioned by Eskafi & Kolbe [5]. It is considered as one of the most serious pests world wide, infesting fruits of more than 300 plant species [6]. It is ranked first among economically important fruit fly species, whereas its larvae develop and feed on most deciduous, subtropical and tropical fruits and some vegetables.

The peach fruit fly *B. zonata* (Saunders) is native to South and South-east Asia, where it attacks a wide variety of soft fruits, e.g. peach, guava and mango [7]. It is not known exactly when it spread to the Middle East, but there is a record from Saudi Arabia dated 1982, and more recently it has been found in Oman

Corresponding author: Praprut Promsomboon, research field: plant production technology.

[8]. By the late 1990s it was well established in Egypt. There is also, an old record from Egypt [9] but that appears to have been based on a quarantine interception.

The aim of this investigation which submitted by the Academy of Scientific Research and Technology, Cairo, Egypt, as a part of ongoing project entitled "Study on biological means for controlling the Mediterranean fruit fly *Ceratitis capitata* (Wiedemann) in New Valley Governorate" is to study the population trends, occurrence and distribution of the two competitive fruit flies *C. capitata* and *B. zonata* in the New Valley oases as an isolated and new reclaimed area in the Egyptian Western Desert.

2. Material and Methods

2.1 Study Area

The New Valley oases are located in the Egyptian Western desert. It occupies some 67% of the Western Desert and 45.8% of the total area of Egypt. It lies 602 km, from Cairo and 232 km, from Assiut. It's bordered by the Governorate of Matruh in the north, Sudan in the south, Libya in the west, and the Governorates of Middle Egypt in the east. It includes the Kharga, Dakhla, Farafrah and Paris oases. The oases are famed for their dry climate most of the year, and humidity never exceeds 9.5%. Their temperatures ranged from 25-35 °C in winter and sometimes reach to 40-45 °C in summer.

2.2 Study Sites

Nine mixed orchards have been chosen to study the population trends, occurrence and distribution of *C. capitata* and *B. zonata* in Kharga and Dakhla oases.

2.3 Traps Data

Two types of traps have been used to collect the med fly and the peach fly. The first one is known as the yellow sticky trap (Figure 1-A), and the second one is known as Abdel-Kawi trap (Figure 1-B) as described by Abdel-Galil [2]. Traps were provided by the male specific para pheromone trimedlure® (Tetr-butyl-4-[and5] Chloro-2-Methyl Benzene) [10] to collect the med fly and by methyl eugenol® (1, 2-Dimethoxy-4-[2-Propenyl] Benzene) [11] to collect the peach fly.

2.4 Sampling Scheme

Traps were randomly distributed in 3 orchards in Kharga and in 6 orchards in Dakhal Oases. Traps positions were located in the field and traps were spread on trees at a high of 1.5 m from the ground. Traps were left on the selected trees and changed every week during the entire study period from April 2012 till March 2014.

2.5 Data Analysis

To indicate the population trends of the two pests the average numbers of flies per trap per week were counted during all the study period in all chosen sites. On the other hand, the active trapping season was divided into months to indicate the occurrence of the pest and its relation to ripening period of each host plant. Distributions of the two pests enable to determine the competition between them.

Data obtained were statistically analyzed by using F. test. The means were compared according to Duncan's multiple range tests [12].

3. Results and Discussion

3.1 The Mediterranean Fruit Fly Ceratitis Capitata (Wiedemann)

Data presented in Tables 1-3 showed the population fluctuations of *C. capitata* in Kharga, Moot and Bodkholow provinces, respectively. Population fluctuations of the pest were determined by using the yellow sticky trap and Abdel-Kawi trap provided with trimedlure. At Kharga oases, the first occurrence of the fly was on April 2012 Table 1. One annual peak of the pest was recorded during October 2012 and February 2013 by 3.14 and 3.65 flies/week, respectively. No adults of *C. capitata* were caught in Kharga region

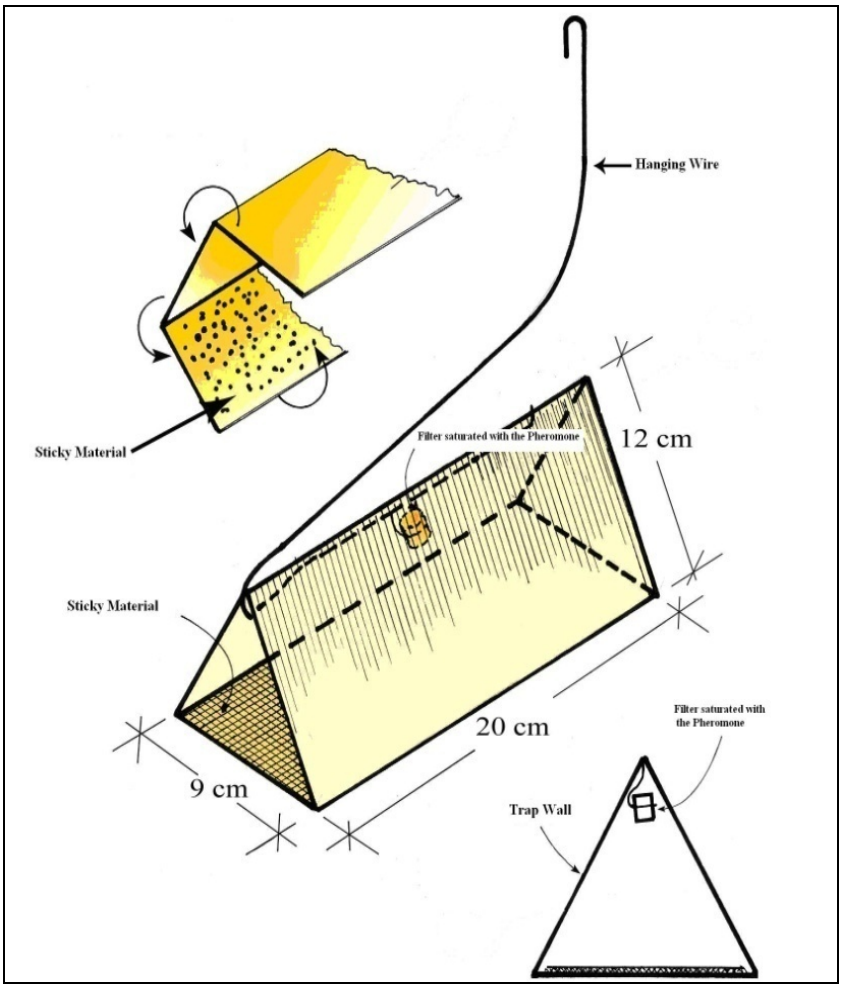


Fig. 1 A. The Yellow Sticky Trap.

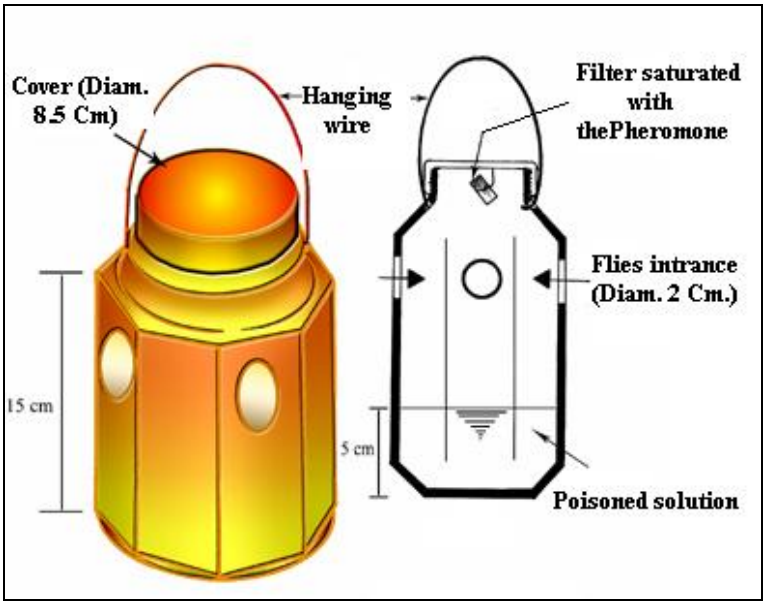


Fig. 1 B. Abdel-Kawi Trap. (Style # 2)* [2].

* Abdel-Kawi Trap (Style # 1) without filter which saturated with the pheromone.

Table 1 Weekly average numbers of *Ceratitis capitata* collected from Kharga oases during April 2012-March 2014[(a)].

Trap & site Date	Yellow sticky trap				Abdel-Kawi trap				Grand total
	1	2	3	Total	1	2	3	Total	
April 2012 (4)	0.00	0.08	0.58	0.66	0.00	0.08	0.58	0.66	1.32
May (4)	0.00	0.17	0.42	0.59	0.00	0.08	0.17	0.25	0.84
June (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
July (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sept. (4)	0.17	0.17	0.17	0.51	0.00	0.08	0.08	0.16	0.67
Oct. (5)	0.00	0.07	0.4	0.47	0.20	0.53	1.99	2.72	3.19
Nov. (4)	0.00	0.08	0.58	0.66	0.00	0.17	0.58	0.75	1.41
Dec. (5)	0.00	0.00	0.27	0.27	0.53	0.00	0.40	0.93	1.20
Jan. 2013 (4)	0.33	0.08	0.33	0.74	0.67	0.17	0.17	1.01	1.75
Feb. (4)	0.33	0.33	0.33	0.99	0.58	0.75	1.33	2.66	3.65
March (4)	0.50	0.25	0.92	1.67	0.67	0.08	0.49	1.24	2.91
Apr. (5)	0.47	0.00	0.27	0.74	0.39	0.13	0.27	0.79	1.53
May (4)	0.08	0.08	0.17	0.33	0.74	0.08	1.5	2.32	2.65
June (4)	0.00	0.08	0.25	0.33	0.00	0.08	0.25	0.33	0.66
July (5)	0.00	0.00	0.07	0.07	0.00	0.00	0.07	0.07	0.14
Aug. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.58	0.58
Sept. (4)	0.00	0.25	0.08	0.33	0.00	0.08	0.00	0.08	0.41
Oct. (5)	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.14	0.14
Nov. (4)	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.16	0.16
Dec. (5)	0.00	0.00	0.13	0.13	0.70	0.08	0.00	0.78	0.91
Jan. 2014 (4)	0.00	0.00	0.00	0.00	0.17	0.00	0.25	0.42	0.42
Feb. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
March (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.88	1.64	4.97	8.49	4.65	2.54	8.86	16.05	24.54
Mean	0.08b	0.07b	0.21b	0.35B	0.19b	0.11b	0.37a	0.67A	1.02
% of grand total	7.66	6.68	20.25	34.59	18.95	10.35	36.11	65.41	100.00

[(a)] Traps were provided by Trimedlure.

( ) Numbers between parentheses refer to number of field trips.

F value between sites = 9.32**.

F value between traps = 7.02**.

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

during June, July and August 2012 and during February and March 2014. Peaks of the pest were coincided with the ripening periods of citrus trees Figure 3. Concerning the distribution of the pest in Kharga region, the highest percentage of the pest was recorded in the third location (Northern Kharga) by 30.25% and 36.11% by using the yellow sticky traps and Abdel-Kawi traps, respectively. Statistical analysis of the data revealed highly significant differences in the pest population between sites and between the kind of traps (F = 9.52** and 7.02**), respectively. In contrast adults were caught once only in Moot village at Dakhla oases allover the year round Table 2. In a similar study [13] stated that no adult male *C. capitata* were caught in central Israel between January and April. However, flies were caught in the trimedlure traps starting in May. It trapped in the entire region continuously until mid-December.

Although, the pest trapped allover the first year in Bodkholow province at Dakhla oases (April 2012-March 2013), it disappeared completely throughout the second year (April 2013-March 2014) Table 3. Weather factors,

Table 2 Weekly average numbers of *Ceratitis capitata* collected from (Moot) Dakhla oases during April 2012-March 2014[(a)].

Trap & site Date	Yellow sticky trap				Abdel-Kawi trap				Grand total
	1	2	3	Total	1	2	3	Total	
April 2012 (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
June (4)	0.00	0.00	0.58	0.58	0.00	0.00	0.00	0.00	0.58
July (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sept. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan. 2013 (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
March (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apr. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
June (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
July (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sept. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan. 2014 (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
March (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.58	0.58	0.00	0.00	0.00	0.00	0.58
Mean	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00
% of grand total	0.00	0.00	100	100	0.00	0.00	0.00	0.00	100

[(a)] Traps were provided by Trimedlure.

( ) Numbers between parentheses refer to number of field trips.

host plant foundation and Interspecific competition with *B. zonata*, could be responsible for this phenomenon. Results recorded in the first year indicated that *C. capitata* showed two annual peaks during June and September 2012 by 24.59 and 26.59 flies/week, respectively. The percentage of the population captured showed no significant differences between sites ($F = 1.62^{ns}$) and significant difference between the kind of the trap (F = 5.37*). Papadopoulos *et al*. [14] explain the reason responsible for high population of *C. capitata* during specific period. He reported that the possible reason of the large numbers of adults is due to the movement of females to the study orchards in search of oviposition sites after the harvest of its fruits host plants.

3.2 The Peach Fly Bactrocera zonata (Saunders)

Data presented in Tables 4-6 exhibited the population trends of *B. zonata* in Kharga, Moot and Bodkholow provinces, respectively. Population monitoring and detection of *B. zonata* is mostly based on trapping by both of the above mentioned traps provided by methyl eugenol.

At Kharga oases, flies were trapped allover the study period continuously. Temporal trapping patterns in the region showed two annual peaks during May and September 2012 and two similar annual peaks during the same months at 2013 by 250.42, 434.08

Table 3 Weekly average numbers of *Ceratitis capitata* collected from (Bodkholow) Dakhla oases during April 2012-March 2014[(a)].

Trap & site	Yellow sticky trap				Abdel-Kawi trap				Grand total
Date	1	2	3	Total	1	2	3	Total	
April 2012 (4)	0.25	0.25	0.33	0.83	0.08	0.25	0.24	0.57	1.40
May (4)	0.84	0.33	1.25	2.42	0.50	0.25	0.67	1.42	3.84
June (4)	8.42	7.09	2.50	18.01	2.25	3.83	0.50	6.58	24.59
July (5)	6.67	0.80	1.40	8.87	1.53	0.73	0.80	3.06	11.93
Aug. (4)	2.08	0.58	1.92	4.58	1.25	0.75	1.17	3.17	7.75
Sept. (4)	5.00	3.92	5.92	14.84	3.67	4.25	3.83	11.75	26.59
Oct. (5)	2.87	2.60	2.46	7.93	2.20	4.07	2.73	9.00	16.93
Nov. (4)	1.00	0.17	0.08	1.25	0.33	0.28	0.67	1.28	2.53
Dec. (5)	0.53	0.27	0.13	0.93	0.27	0.33	0.47	1.07	2.00
Jan. 2013 (4)	0.59	0.00	0.17	0.76	0.25	0.17	0.17	0.59	1.35
Feb. (4)	0.50	0.00	0.00	0.50	0.00	0.00	0.08	0.08	0.58
March (4)	0.08	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.08
Apr. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
June (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
July (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sept. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan. 2014 (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
March (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	28.83	16.01	16.16	61.00	12.33	14.91	11.33	38.57	99.57
Mean	1.20a	0.67b	0.67b	2.54A	0.51b	0.62b	0.47b	1.61B	4.15
% of grand total	28.95	16.08	16.23	61.26	12.38	14.98	11.38	38.74	100.00

[(a)] Traps were provided by Trimedlure.

( ) Numbers between parentheses refer to number of field trips.

F value between sites = 1.62^{ns}.

F value between traps = 5.37**.

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

and 114.59, 121.67 flies/week, respectively Table 4. Peaks of *B. zonata* are coincided with the ripening period of apricot, mango and guava Figure 3.

Concerning the pest distribution among the study sites, the third site at Kharga oases ranked first by 17.67% and 29.39% of the captured flies by using the aforementioned traps. Highly significant differences between sites and between traps was recorded (F = 13.44** and 12.00**), respectively. Data indicated that Abdel-Kawi traps captured 64.13%, while the yellow sticky traps captured 35.87% of the total captured flies. In a similar study Harris and Lee [15] stated that seasonal and annual fluctuations in patterns of occurrence were influenced by seasonal annual differences in abundance of coffee berries and distribution of other fruits.

Data presented in Tables 5 & 6 refer to the population trends of *B. zonata* at Moot and Bodkholow regions in Dakhla oases, respectively. Flies were caught continuously by the two kinds of traps throughout the entire period of the study (April 2012 till March 2014). One annual peak of *B. zonata*

Table 4 Weekly average numbers of *Bactrocera zonata* collected from Kharga oases during April 2012-March 2014[(a)].

Trap & site / Date	Yellow sticky trap				Abdel-Kawi trap				Grand total
	1	2	3	Total	1	2	3	Total	
April 2012 (4)	7.59	24.92	12.84	45.35	14.17	42.08	17.5	73.75	119.1
May (4)	21.67	43.08	45.67	110.42	26.17	54.75	59.08	140	250.42
June (4)	3.17	25.92	55.84	84.93	4.92	29.84	43.83	78.59	163.52
July (5)	5.20	4.27	15.73	25.20	9.27	12.17	28.53	49.97	75.17
Aug. (4)	1.92	0.42	1.17	3.51	7.08	3.17	4.00	14.25	17.76
Sept. (4)	28.49	40.42	67.59	136.5	65.08	100.00	132.50	297.58	434.08
Oct. (5)	44.99	39.07	61.93	145.99	92.4	105.60	67.33	265.33	411.32
Nov. (4)	15.34	7.00	14.33	36.67	29.42	16.67	9.00	55.09	91.76
Dec. (5)	8.20	8.80	10.93	27.93	26.40	21.20	21.67	69.27	97.20
Jan. 2013 (4)	3.50	12.42	7.34	23.26	6.33	16.25	9.50	32.08	55.34
Feb. (4)	1.33	2.25	2.50	6.08	0.92	2.92	4.09	7.93	14.01
March (4)	1.00	2.08	0.67	3.75	0.92	3.25	1.67	5.84	9.59
Apr. (5)	3.53	12.47	2.73	18.73	6.60	12.13	12.47	31.20	49.93
May (4)	2.92	14.33	13.84	31.09	14.42	16.08	53.00	83.50	114.59
June (4)	0.75	7.58	15.00	23.33	5.00	7.00	39.34	51.34	74.67
July (5)	0.27	3.33	14.33	17.93	3.47	4.93	29.47	37.87	55.80
Aug. (4)	4.33	6.67	38.67	49.67	11.84	8.50	23.67	44.01	93.68
Sept. (4)	0.67	5.83	21.34	27.84	0.83	8.17	84.83	93.83	121.67
Oct. (5)	0.13	2.33	3.20	5.66	3.39	7.47	27.33	38.19	43.85
Nov. (4)	0.17	2.50	3.75	6.42	4.17	8.00	19.58	31.75	38.17
Dec. (5)	5.47	16.53	20.4	42.4	16.33	15.80	22.60	54.73	97.13
Jan. 2014 (4)	1.83	1.50	3.42	6.75	3.92	3.50	7.50	14.92	21.67
Feb. (4)	0.33	0.33	1.00	1.66	0.75	0.50	1.17	2.42	4.08
March (4)	1.42	1.00	1.92	4.34	2.00	1.92	5.92	9.84	14.18
Total	164.22	285.05	436.14	885.41	355.8	501.9	725.58	1583.28	2468.69
Mean	6.84d	11.88cd	18.17bc	36.89B	14.82bc	20.91b	30.23a	65.97A	102.86
% of grand total	6.65	11.55	17.67	35.87	14.41	20.33	29.39	64.13	100.00

[(a)] Traps were provided by Methyl eugenol.

( ) Numbers between parentheses refer to number of field trips.

F value between sites = 13.44**.

F value between traps = 21.00**.

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

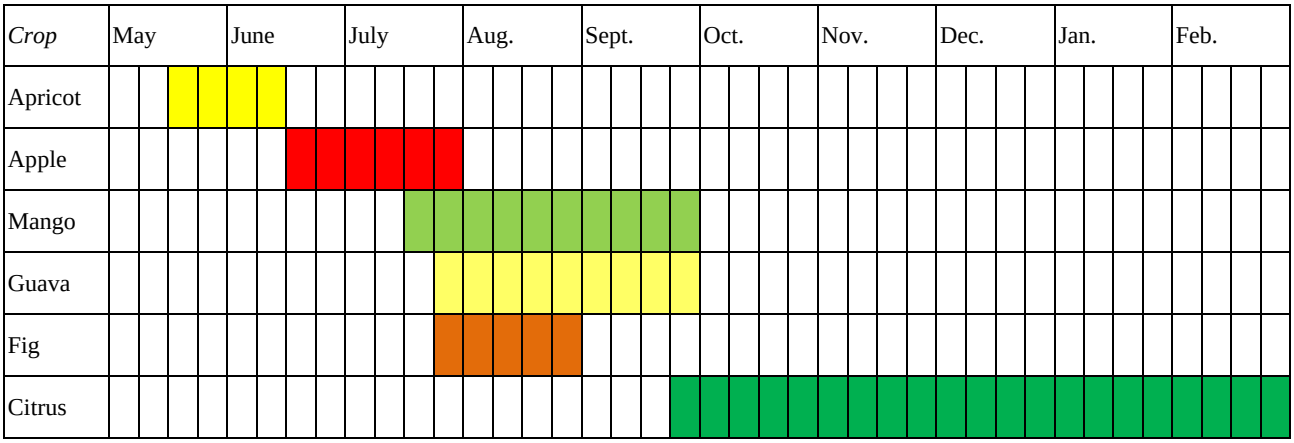


Fig. 3 Ripening periods (Shaded areas) of the principal host trees of Tephritid flies in the New Valley Oases.

Table 5 Weekly average numbers of *Bactrocera conata* collected from (Moot) Dakhla oases during April 2012-March 2014[(a)].

Trap & site	Yellow sticky trap				Abdel-Kawi trap				Grand total
Date	1	2	3	Total	1	2	3	Total	
April 2012 (4)	9.33	19.84	5.42	34.59	14.92	23.00	12.34	50.26	84.85
May (4)	4.17	7.09	6.34	17.60	7.25	15.42	14.58	37.25	54.85
June (4)	1.33	8.75	2.08	12.16	8.00	14.75	12.17	34.92	47.08
July (5)	2.67	3.6.00	3.53	9.80	4.20	6.47	8.40	19.07	28.87
Aug. (4)	9.58	6.67	6.84	23.09	11.17	10.17	8.83	30.17	53.26
Sept. (4)	24.75	36.49	12.75	73.99	42.75	62.83	21.59	127.17	201.16
Oct. (5)	102.66	151.67	181.6	435.93	236.67	307.33	252.99	796.99	1,232.92
Nov. (4)	33.75	42.50	66.67	142.92	80.83	99.58	122.92	303.33	446.25
Dec. (5)	12.73	18.73	19.59	51.05	20.87	22.19	25.27	68.33	119.38
Jan. 2013 (4)	4.58	5.58	4.92	15.08	6.58	7.84	5.58	20.00	35.08
Feb. (4)	1.34	2.67	2.08	6.09	3.33	7.92	5.92	17.17	23.26
March (4)	6.58	9.67	4.00	20.25	9.67	14.58	5.17	29.42	49.67
Apr. (5)	3.53	4.80	2.40	10.73	6.27	8.20	3.33	17.80	28.53
May (4)	2.83	6.5.00	4.59	13.92	9.08	14.48	9.00	32.56	46.48
June (4)	1.75	4.25	4.83	10.83	8.09	8.75	12.25	29.09	39.92
July (5)	3.73	10.20	4.47	18.40	8.13	14.60	9.27	32.00	50.40
Aug. (4)	10.92	12.00	12.08	35.00	17.25	23.17	21.09	61.51	96.51
Sept. (4)	24.84	18.83	35.83	79.50	41.00	36.92	40.08	118.00	197.50
Oct. (5)	2.54	1.60	1.80	5.94	6.60	4.13	6.26	16.99	22.93
Nov. (4)	1.50	1.59	1.59	4.68	3.58	4.08	5.49	13.15	17.83
Dec. (5)	13.73	7.07	9.13	29.93	18.73	15.27	12.27	46.27	76.20
Jan. 2014 (4)	2.17	1.92	1.42	5.51	1.67	1.50	1.92	5.09	10.60
Feb. (4)	3.92	3.00	2.50	9.42	5.50	4.99	4.00	14.49	23.91
March (4)	11.17	4.25	3.09	18.51	11.67	7.34	7.17	26.18	44.69
Total	296.10	389.27	399.55	1,084.92	583.81	735.51	627.89	1,947.21	3,032.13
Mean	12.34c	16.22bc	16.65bc	45.20B	24.33ab	30.65a	26.16ab	81.13A	126.34
% of grand total	9.77	12.83	13.18	35.78	19.25	24.26	20.71	64.22	100.00

[(a)] Traps were provided by Methyl eugenol.

( ) Numbers between parentheses refer to number of field trips.

F value between sites = 1.18^{ns}.

F value between traps = 19.30**.

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

was recorded in Moot village by 1,232.92 and 197.50 flies/week during October 2012 and September 2013, respectively Table 5. Also, one annual peak was recorded in Bodkholow province during September 2012 and October 2013 by 108.91 and 83.81 flies/week, respectively Table 6. Although, the pest has one annual peak in each village, it captured by high numbers in Moot than that those captured in Bodkholow. Diversity of the preferred host plants in Moot mixed orchards could be responsible for this phenomenon. The pest peaks is coincided with the ripening period of mango and guava. In this approach Mohammed [16] indicated that *B. zonata* has four generations per year. These generations was coincided with the ripening period of Valencia orange, apricot, mango and guava fruits, respectively.

Statistical analysis of the data revealed non significant differences between sites in both provinces (F = 1.18^{ns} and 2.64^{ns}) and highly significant and non significant differences between kind of traps (F = 19.30** and 3.03^{ns}), respectively. In the two provinces, Abdel-Kawi trap caught high percentage of

Table 6 Weekly average numbers of *Bactrocera zonata* collected from (Bodkholow) Dakhla oases during April 2012-March 2014[(a)].

Trap & site Date	Yellow sticky trap				Abdel-Kawi trap				Grand total
	1	2	3	Total	1	2	3	Total	
April 2012 (4)	3.08	3.75	8.35	15.18	7.08	4.08	7.00	18.16	33.34
May (4)	5.25	2.35	6.17	13.77	2.42	3.50	9.58	15.50	29.27
June (4)	8.48	9.25	5.75	23.48	5.42	6.34	4.83	16.59	40.07
July (5)	4.13	4.20	2.73	11.06	2.13	2.07	1.53	5.73	16.79
Aug. (4)	7.67	5.24	8.83	21.74	6.50	5.92	8.59	21.01	42.75
Sept. (4)	16.17	14.25	11.50	41.92	28.33	17.58	21.08	66.99	108.91
Oct. (5)	17.39	14.87	18.13	50.39	18.93	16.60	18.87	54.40	104.79
Nov. (4)	25.00	10.42	10.58	46.00	11.67	11.17	12.33	35.17	81.17
Dec. (5)	11.27	12.06	13.19	36.52	13.27	13.00	12.60	38.87	75.39
Jan. 2013 (4)	8.75	7.08	9.08	24.91	6.67	7.92	8.58	23.17	48.08
Feb. (4)	7.25	3.25	6.58	17.08	7.00	7.75	7.42	22.17	39.25
March (4)	3.75	4.09	3.33	11.17	3.83	2.92	3.75	10.50	21.67
Apr. (5)	3.87	3.13	2.66	9.66	3.40	3.60	3.73	10.73	20.39
May (4)	5.67	5.08	5.67	16.42	6.00	5.83	6.09	17.92	34.34
June (4)	9.17	8.75	8.75	26.67	10.09	9.92	9.50	29.51	56.18
July (5)	8.07	9.20	10.67	27.94	9.07	9.67	6.87	25.61	53.55
Aug. (4)	9.33	9.75	9.33	28.41	10.17	10.75	10.58	31.50	59.91
Sept. (4)	5.17	9.25	7.17	21.59	11.67	12.25	10.75	34.67	56.26
Oct. (5)	20.53	10.60	10.93	42.06	14.75	13.87	13.13	41.75	83.81
Nov. (4)	10.92	11	11.42	33.34	14.58	13.42	13.17	41.17	74.51
Dec. (5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan. 2014 (4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. (4)	0.67	0.67	0	1.34	1.25	1.09	0	2.34	3.68
March (4)	1.33	1.08	1.25	3.66	2.67	1.92	2.08	6.67	10.33
Total	192.92	159.32	172.07	524.31	196.9	181.17	192.06	570.13	1094.44
Mean	8.40a	6.64b	7.17ab	21.55A	8.20a	7.55ab	8.00ab	23.76A	45.60
% of grand total	17.63	14.56	15.72	47.91	17.99	16.55	17.55	52.09	100.00

[(a)] Traps were provided by Methyl eugenol.

( ) Numbers between parentheses refer to number of field trips.

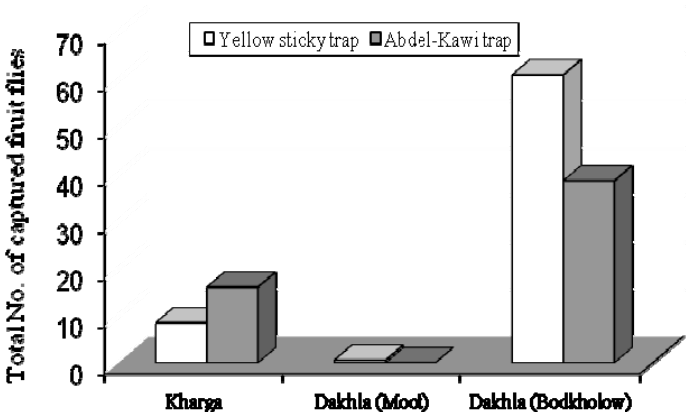
F value between sites = 2.64^{ns}.

F value between traps = 3.03^{ns}.

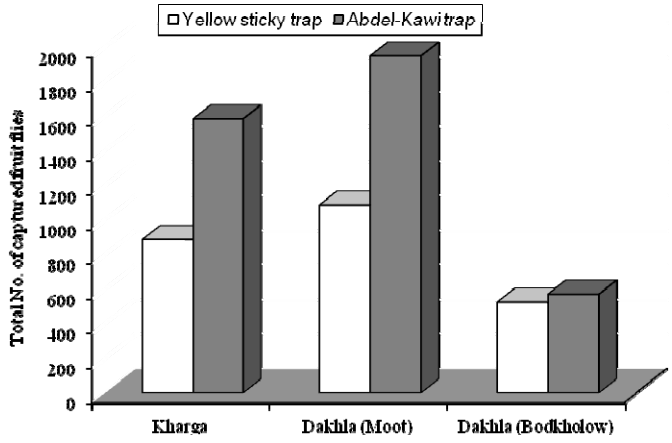
Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

the captured flies by 64.22 and 52.09% than the yellow sticky trap by 35.78 and 47.91%, respectively.

The ability of each trap in capturing both of *C. capitata* and *B. zonata* illustrated in Figure 4. (A & B). It is clear that the yellow sticky trap was more effective in capturing *C. capitata* flies. However, Abdel-Kawi trap was significantly more efficient in capturing *B. zonata*. Amongst the possible reasons for the trap performance, may be that adult's response to the attractants varies over the study period. This varying response may due to changes in adult physiology or the emission rates of the attractants resulting from changes in temperature and/or relative humidity [17]. Evaluation of traps efficiency was previously studied by Cunningham and Couey [18] and By El-Sayed & Darwish [19]. So, it is of importance to point herein that the relative favorability of the habitat for fruit flies is dependent upon a number of unknown factors related to the environment and the insect [20].



(a) *Ceratitis capitata*



(b) *Bactcera zonata*

Fig. 2 Total No. of captured fruit flies by using the yellow sticky and Abdel-Kawi Traps during April 2012-March 2014 at the New Valley Oases.

In general, occurrence of *B. zonata* in high numbers than *C. capitata* is considered as a good proof of the vigority of this pest. So, survival in a new territory such as the New Valley oases by *C. capitata*, sometimes has involved competition and coexistence with other native or invading fruit flies, e.g. *B. zonata*.

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