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Biological Studies on the Peach Fruit Fly, *Bactrocera Zonata* (Saunders) in *Egypt*

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Abstract: Some essential biological items of the peach fruit fly, *B. zonata* (Saund.) Egyptian strain such as time of adult emergence, highest depth of pupation substrate at which the adult could emerge, host preference and number of generations per year; were studied. Results indicated that most of *B. zonata* adults emerged between 6 a.m and 12 at noon but the maximum emergence took place between 9 a.m and 11 a.m. Ninety percent of adults emerged successfully from pupae situated at 10 cm depth of sand, this percentage decreased gradually with increasing the sand depth till reached to nill at 40 cm depth. The most favouarite host to this fly was pear fruits followed by guava, peach, apple and finally apricot. Present study indicated that *B. zonata* completed 8 generations per year where the longest generation (56 days) was recorded during winter months and the shortest one (34 days) was recorded during summer months.

Key words: Biology, *Bactrocera zonata*, generation, hosts

INTRODUCTION

The peach fruit fly, *Bactrocera zonata* (Saund.) considered one of the most destructive fruit pests which spread in several regions of the world[1]. It is also recorded in several governorates in Egypt where it caused great problems to many fruits. In Pakistan, this pest caused from 25 to 50% losses in guava fruits[10]. This study threw a light on some essential biological aspects which play an important role in controlling this harmful pest.

MATERIALS AND METHODS

Flies used in this study were obtained from the permanent colony installed in pests & plant protection laboratory, National Research Centre, under conditions of 25 ± 2cº and 60- 65% R.H. Larvae were reared on an artificial medium consisted of wheat bran, brewer's yeast, sodium benzoate, HCL and water. Adult flies fed on a mixture of sugar and protein hydrolysate enzymatic by a ratio of 3:1, respectively.

Time of Adult Emergence: A set of 300 pupae (three replicates) were placed in cylindrical jar at 25 ± 2c° and 60- 65% R.H. The emerged adults were counted and sexed at intervals of two hours starting from 5.0 O'clock a.m till 1.0 O'clock p.m.

Effect of Depth of Pupation Substrate on Adult Emergence: Three replicates; each involved 100 pupae (2-days old) were placed in glass tubes, each tube measured 3 cm in diameter and covered by muslin tied with rubber band. Tubes were filled with sand to 5,10,15,20,30 and 40 cm height. The number of normal emerged males and females besides the number of malformed ones were recorded.

Host Preference: Five kinds of fruits were tested; guava, pear, peach, apple and apricot. Half kilogram of each kind was placed in an adult rearing cage for two days, then the fruits were transferred to trays containing a smooth layer of fine sand for pupation. The recovered pupae from each host were seived and kept in glass jar till emergence. The total number of produced pupae, weight of pupae and the number of emerged adults from 100 pupae of each kind of fruit were considered as an index for the preferred host to the peach fly.

Number of Generations Per Year: Newly emerged adults (24 hrs old) were caged in the adult rearing cage[2] provided with usual adult food, source of water and perforated plastic mandarins (for egg laying). The recorded results included the date of the 1st deposited eggs till the adult emergence and the first day in which the produced females laid their eggs (generation from egg to egg)besides the period from adult emergence till the emergence of new adults (generation from adult to adult). Samples of eggs were taken after 3 days of egg-laying.

RESULTS AND DISCUSSION

Time of Adult Emergence: Table (1) indicated that about 26.7% of adults emerged on the 1st day of emergence, about 23.3% on the 2nd day, about 11.0% on the 3rd day and none adults emerged on the 4th day. Also, most of adults emerged in the morning between 6 a.m. and 12 at noon, the maximum number of

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Table 1: Time of emergence of *B. zonata* adults (Under Laboratory conditions).

Emergence time	No. of emerged adults (M±S.E)										Total No.	Adult
	5a.m.		7a.m.		9a.m.		11a.m.		1p.m.		of emerged	emergence
(days)	Males	Females	Males	Females	Males	Females	Males	Females	Male	Females	adults (M±S.E)	(%)
1st	0	0	24 ± 1.15	16 ± 1.07	67 ± 0.57	53 ± 0.8	45 ± 1.29	35 ± 1.82	0	0	240 ± 1.82	26.66
2nd	6 ± 1.29	12 ± 1.41	26 ± 1.52	32 ± 0.81	32 ± 1.31	55 ± 1.52	29 ± 1.15	28 ± 1.15	0	0	220 ± 2.58	23.33
3rd	0	0	31 ± 1.73	33 ± 2.33	12 ± 1.41	7 ± 1.29	7 ± 1.52	5 ± 1.15	0	0	95 ± 2.88	10.95
4th	0	0	0	0	0	0	0	0	0	0	0	0

Three replicates were performed and 300 pupae per each.
Temperature ranged from 25 to 30 C° and from 60 to 65% R.H.

Table 2: Effect of sand depths on the percentages of emergence and malformation of *B. zonata* adults.

Depth (cm).	Ave. No. of emerged adults ± S.E.		Emergence (%)	Malformation (%)
	Males	Females		
Control	46.666± 2.848	46.333± 1.201	92.999	1.000
5	47.000±0.577	44.333±1.855	91.333	2.666
10	46.000± 1.000	44.333± 0.881	90.333	4.333
15	42.666± 3.844	41.666±1.201	84.332	4.333
20	40.000± 3.844	35.333± 3.691	75.333	6.000
30	17.000±0.000	17.666±0.333	34.666	20.666
40	0.000	0.000	0.000	0.000

Three replicates were performed in each depth.
Each replicate hold 100 pupae.

Table 3: Effect of different hosts on the pupal production, pupal weight and percentage of adult emergence of *B. zonata*.

Host	Ave. No. of produced pupae ± S.E.	Ave. weight of 100 pupae (mg.)	Ave. weight of pupa (mg.) ± S.E.	Adult emergence (%)
Guava *(psidium guava)*	1640.666 ± 2.581	786.666	7.866 ± 0.233	91.000
Pear *(Pyrus communis)*	1651.666 ± 4.082	913.333	9.133 ± 0.120	93.000
Peach *(Prunus persica)*	1626.666 ± 1.825	856.666	8.566 ± 0.176	90.666
Apple *(Pyrus malus)*	1223.333 ± 3.162	830.000	8.300 ± 0.251	82.666
Apricot *(Prunus armeniaca)*	1259.000 ± 3.651	823.333	8.233 ± 0.218	76.000

Three replicates (0.5 Kg. for each) were performed for each host.

emerged adults (about 83%) took place between 9 a.m. and 11 a.m (during the 1st and 2nd day of observation) while on the 3rd day most of adult emergence took place between 6 and 9 a.m.). Previous observations agreed with those recorded by Qureshi *et. al,*[6] who observed that *D. zonatus (B. zonata)* flies started emerging at 5:15 a.m and 90% of adult flies were emerged between 7 a.m. and 12 at noon, under conditions of 25 ± 2 c° and 60- 65% R.H. The above observations give an important criterian for choosing the proper time for releasing the irradiated pupae or adults in sterile release programmes.

Effect of Depth of Pupation Substrate on Adult Emergence: Table (2) indicated that about 90% of adult flies could emerge successfully till a depth of 10 cm of sand, by reduction of about 3% than the control. This reduction increased by increasing the sand depth, it was about 8.6%, 17.6%, 58.3% and100% at 15,20,30 and 40 cm depths, respectively. Also, the percentage of malformed adults increased by increasing the depth, it ranged between 2.6% and 20.6% at depths from 5 to 30 cm, compared to 1.0% in the control. These results are practically important especially in controlling this pest by mechanical means.

Table 4: Number of generations and duration of different developmental stages of *B. zonata* / year (2007- 2008).

No. of generation (beginning of generation)	Date of adult emergence	Date of beginning egg laying	Pre-oviposition period (days)	Date of taking sample of eggs	Date jumping prepupae	Egg-larval period (days)	Date of adult emergence	Pupal period (days)	Average temperature (°C))	Average relative humidity (%)
1st	1/1/2007	2/2/2007	32	6/2/2007	15/2/2007	9	25/2/2007	10	16.759	63.740
2nd	25/2/2007	23/3/2007	27	27/3/2007	3/4/2007	7	13/4/2007	10	21.103	58.850
3rd	13/4/2007	8/5/2007	25	12/5/2007	19/5/2007	7	28/5/2007	9	22.103	58.332
4th	28/5/2007	15/6/2007	18	19/6/2007	25/6/2007	6	3/7/2007	8	28.225	66.050
5th	3/7/2007	21/7/2007	18	25/7/2007	31/7/2007	6	6/8/2007	6	29.706	68.143
6th	6/8/2007	24/8/2007	18	28/8/2007	3/9/2007	6	9/9/2007	6	29.838	67.500
7th	9/9/2007	30/9/2007	21	4/10/2007	11/10/2007	7	18/10/2007	7	26.566	64.851
8th	18/10/2007	8/11/2007	21	12/11/2007	19/11/2007	7	26/11/2007	7	22.731	62.855
9th	26/11/2007	17/12/2007	21	21/12/2007	1/1/2008	11	–	–	17.608	63.522

N.B. Average temperature from 1/1/2008 to 26/1/2008 equals 12.780 °C
Average temperature from 26/11/2007 to 26/1/2008 euals 14.975 °C

Studies of Shoukry[9] on the medfly, *C. capitata* (Wied.) largely coincided with the present results. He recorded that medfly adults could emerge successfully without significant differences from the controls till a depth of 30 cm of sand, while at 40 cm none of adults emerged.

Host Preference: Table (3) indicated that the highest number of produced pupae (1651 pupae) and the highest percentage of adult emergence (93%) was recorded from pear fruits. From table (3) it could be arranged the tested fruits according to flies favourability (descending order) as follows: pear fruits followed by guava, peach, apple and apricot, respectively, according to the percentage of adult emergence.

Studies of White[11] largely agreed with the present results. He reported that *B. zonata* attacked wide variety of fruits especially peach, guava and mango. On the other hand, Kapoor[3] stated that mango, guava and peach were the most preferred hosts for *B. zonata* adults.

Number of Generations per Year: Under laboratory conditions, *B. zonata* completed eight successive generations per year (2007) and began the 9th generation till pupation in 1/1/2008. Table (4) indicated the dates of beginning and ending of each generation besides the different biological stages in addition to the averages of temperatures and relative humidities during each generation.

The longest period of generation was 56 days; from 1st of January to 25th of February (from adult to adult); and 49 days from 2nd of February to 23rd of March (from egg to egg) at temperatures ranged between about 16.76 C°. and 21.1 C° and average relative humidities between 58.9% and 63.7%. The shortest periods of generation was 34 days, it occupied months of July, August till the 9th of September where the recorded average temperatures was about 29.75 C° and the average relative humidity was about 67.3%. Generally, the shortest periods of generations (5th, 6th and 7th) were recorded during summer months and the longest periods of generations (1st and 2nd) were occupied the winter, spring and the beginning of summer months.

Data in table (4) clearly indicated that *B. zonata* completed eight generations per year (2007) in addition to the 9th generation which extended to the pupal stage (1/1/2008) only. It is worthy to mention that no adult emerged from these pupae due to the extreme drop in temperature; it was about 12.78 C° from 1/1/2008 to 26/1/2008 (during 25 days of pupation); compared to the longest pupal period (10 days) which previously recorded during the 1st and 2nd generations in the year 2007, where the average recorded temperatures were between 16.76 C°. and 21.10 C°.

We previously mentioned that samples of eggs were taken after three days of beginning egg-laying; about twenty seven days were excluded during the experimented year; thus it could be expected that *B. zonata* could complete the 9th generation. This expectation largely agreed with the previous recorded studies on some fruit flies. Saeki *et al.*[8] and Meats[5] mentioned that *B. dorsalis* (Hendel) and *B. tryoni* (Frogatt), respectively, have three to eight generations per year. Also Qureshi *et al.*[7] stated that *B. zonata* can complete three to nine generations per year in various parts of its range. Again, Mahmoud[4] recoded that *B. zonata* could complete eight to nine

generations per year, in Egypt. Generally, it could be say that *B. zonata* could complete eight to nine generations per year, in Egypt, depending upon the environmental conditions all over the year.

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