



COMPARATIVE BIOLOGY OF FRUIT FLIES BACTROCERA CUCURBITAE, AND BACTROCERA ZONATA ON INDIAN ROUND GOURD (PRAECITRULLUS FISTULOSUS)

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ABSTRACT

Fruit flies are the noxious pests of fruits and vegetables throughout out the Tropical and subtropical regions of the world. The melon fruit fly *Bactrocera cucurbitae* Peach fruit fly *Bactrocera zonata* are polyphagous pests of vegetables and fruits. We evaluated the effect of Indian round gourd (*Praecitrullus jistulosus*) on the biology of *B. cucurbitae* and *B. zonata* under lab conditions. Results revealed that lowest incubation. $O \pm 0.44$ was observed on eggs of *B. cucurbitae* whereas; lowest hatching (33.3 ± 7.63) was observed on eggs of *B. zonata*. Furthermore, reduced larval duration (5.6 ± 0.24) was observed when maggots of *B. cucurbitae* were provided with Indian round ground as compared with maggots of *B. zonata* (6.6 ± 0.24). Moreover, higher pupal recovery, and adult emergence were recorded on maggots of *B. cucurbitae* (79.33 ± 7.02 , 75.33 ± 3.51). In addition to number of deformed adults was higher when *B. cucurbitae* was provided with Indian round gourd as compared to *B. zonata* eggs. These findings could be helpful in defining more optimum conditions for the mass rearing of *B. cucurbitae* and *B. zonata* for use in Sterile Insect Technique (SIT), programmes for various orchards.

1. INTRODUCTION

The fruit flies *Bactrocera cucurbitae* (Coquillett) and *Bactrocera zonata* (Saunders) commonly, known as melon fruit fly and peach or guava fruit flies. *B. cucurbitae* and *B. zonata* are economical pests of vegetables and fruits. It has been reported to damage over 125 fruit species and 81 host plants of *cucurbita* (Sapkota *et al.*)^[9]. Fruit flies cause most of the damage to fruits and vegetables in the Indo-Pak subcontinent. The members of the sub-family Dacinae infest almost all kinds of fleshy fruits, including solanaceous and cucurbitaceous plants. Many species are specialized, and host specific in their feeding habits, while others are generalists and attack a wide range of fruits and vegetables.

Both fruit flies native to Asia as well as in Southeast Asia and widely distributed in Pakistan, India, Sri Lanka, and Thailand. At present it is a significant horticultural pest in India and Pakistan. The scope of damage reported by the fruit flies species, *B. zonata* and *B. cucurbitae* were 5% to 100% loss in Pakistan. Damage caused by fruit flies to fruit and vegetable growers in Pakistan is about 200 million US dollars annually at farm level with added losses to traders, retailers, and exporters (Rauf *et al.*)^[7].

DESCRIPTION:

Adult Melon fruit flies are about 6-8 mm long. Their body is light brown to a honey color in appearance. There are several prominent bright yellow markings on the thorax (upper body) and a distinctive black 'T' pattern at the base of the abdomen (lower body). The

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wings are clear with a dark coastal vein and "melon seed" shaped spot at the tip. Adults generally live for 10 months in a year. Melon fly damage occurs when adult female flies lay their eggs into fruits. An indentation often occurs at oviposition and the fruit may or may not become curved. Laid eggs later hatch into maggots where they feed and live within the fruit. Infested fruit frequently become rotted, either in the field or after harvest. Attacks are severe on young developing fruits, especially under high humidity conditions. (USAID-Inma Agribusiness Program).

LIFE CYCLE:

The life cycle from egg to adult emergence requires 14-27 days. Females have a slender pointed ovipositor which they use to lay eggs under the skin of the host fruit. Oviposition occurs about 10 days after emergence and continues at intervals. One female may deposit up to 1,000 eggs, although 300 eggs total are estimated in natural conditions. Eggs are slender, white, and inserted into fruit in bunches. Eggs hatch in 2 to 4 days.

(Actual size 0.8mm long x 0.2mm wide). There are 3 larval stages for this insect. The larvae, or maggots, are cylindrical, elongated, narrowed, and somewhat curved downward at the end and mouth hooks at the head. These maggots reach approximately 1.27 cm in length upon maturity. The larval period lasts from 6 to 11 days, with each stage lasting 2 or more days. Duration of larval development is strongly affected by host. Larvae (maggots) are white and legless, growing to a length of 10 mm inside the host fruit. Pupae occur in the soil beneath the host plant. They are 5 - 6 mm long, elliptical, and dull white to yellowish brown in color. They are distinctly ringed by narrow yellow bands around each segment. During warm weather, the pupal stage lasts 9 to 11 days. (USAID-Inma Agribusiness Program)

DESCRIPTION:

The adult peach fruit fly is about size of a housefly 5-6 mm in length the peach fruit fly reddish brown, with yellow patches on the top of sides of thorax. Two black spots on the face, a faint T shaped mark on the abdomen and transparent wings with a small brown spot at the tip. Eggs are laid below the skin of the host fruit. These hatch within 1-3 days and the larvae feed for another 4-5 days. Pupations in the soil under the host plant and adults emerge after 1-2 weeks. Adults occur throughout the year (Foote et al.,) [4].

LIFE CYCLE:

The female has a pointed slender ovipositor to deposit eggs under the skin of host fruits vegetables. The white eggs are 1.1 mm long and 0.2 mm wide the

maggots are (larva) creamy-white legless and may attain a Length of 7-10mm. The pupa is encased in a dark brown cylindrical puparium about 5mm in length. These hatch within 1-3 days and the larvae feed for another 4-5 days. Pupation is in the soil under the host plant. Adults emerge after 1-2 weeks (longer in cool conditions). (USAID-Inma Agribusiness Program)

2. MATERIALS AND METHODS

An experiment on "comparative biology of fruit flies *Bactrocera cucurbitae*, and *Bactrocera zonata* on Indian round gourd (*Praecitrullus fistulosus*) " was carried out in the Department of Zoology University of Sindh, Jamshoro under laboratory conditions. The studies were conducted at the temperature $30\pm 2^{\circ}\text{C}$, and relative humidity 65-70%. Eggs of *B. cucurbitae* and *B. zonata* were collected from the Adult fruit flies and their Parasitoid Laboratory Plant Protection Division, Nuclear Institute of Agriculture (NIA), Tandojam. Eggs were collected through egg laying receptacles and were removed from the receptacles very gently with the help of camel hairbrush and seeded inside the young fruits to assess the effect of young fruit on biological parameters of *B.cucurbitae* and *B. zonata*.

Fresh Indian round gourds (*Praecitrullus jistulosus*) were brought from the local market of Jamshoro city. Each piece of Indian round gourds was weighed ~ 125 grams. 100 eggs of *B. cucurbitae* and *B. zonata* were transferred on each piece. Seeded pumpkins were kept in beaker (1000 ml) and slight layer of saw dust was kept as pupation substrate inside the beaker. Afterwards, beakers were covered with muslin cloth. This part of experiment was repeated three times. After 3rd day of larval emergence, an additional amount of fresh Indian round gourds was provided to maggots. Full grown larvae popped out from the Indian vegetables and pupated in pupal substrate. Observation on incubation period and hatching percentage was recorded. Pupae were sieved with iron mesh (18 mesh) and collected. Emerged adults of *B. cucurbitae* and *B. zonata* were shifted into plastic cages (30 x 25 x 11cm). Adults Fruit Flies were supplied with protein hydrolysate, casein, sugar and 1: 3 soaked cotton to observe the sex ratio (Male & Female) Half Emerged adults and Deformity.

STATISTICAL ANALYSIS:

All statistical analyses were done with the help of Statistix" Version 8.1, Analytical Software, Inc., and Tallahassee, FL, USA.

3. RESULTS

Results of present study confirmed that the eggs of *Bactrocera zonata* which were kept on natural host took longer time to hatch (5.0 ± 0.51). However, lowest incubation period was observed when eggs of *Bactrocera cucurbitae* were kept on the same natural host (4.0 ± 0.44). Whereas 30% - 90% hatchling was observed between eggs of both species on the same natural host. (Table 1).

Likewise, reduced larval period (5.6 ± 0.24 days) was recorded when eggs of *B. cucurbitae* kept on Indian round gourd whereas; increased larval period (6.6 ± 0.24) days was recorded when eggs of *B. zonata* were kept on the same host. Nevertheless, maximum larval survival (79.33 ± 7.02) was observed of *B. cucurbitae* eggs and minimum larval survival (19.33 ± 5.13) was recorded of *B. zonata* eggs on the similar natural host. (Table 2).

Furthermore, results revealed that reduced pupal duration (8.8 ± 0.37) was observed when eggs of *B. cucurbitae* were kept on natural diet and increased pupal period (10.6 ± 0.24) was recorded when the eggs of *B. zonata* were provided with same natural host. Moreover, results depicts that maggots of *B. zonata* provided with Indian round gourd their pupal survival, (15.66 ± 4.04) were significantly affected as it was compared with the maggots of *B. cucurbitae* provided with same natural diet (75.33 ± 3.51) respectively. (Table 3).

Likewise, Indian round gourd also negatively affected on sex ratio (7.33 ± 3.05 , 5.33 ± 2.30) male and female of *B. zonata* respectively, as compared with the male and female of *B. cucurbitae* (32.33 ± 2.51 , 36.00 ± 5.29) respectively. Moreover same natural host also affected half emergence and deformed emergence of *B. zonata* eggs (1.66 ± 0.57 , 1.33 ± 0.57) as compared to the eggs of *B. cucurbitae* (2.66 ± 0.57 , 4.33 ± 1.52) respectively. (Table 4)

4. DISCUSSION

It has been widely documented that food is positively correlated with the biological parameters of the insects. Similarly, in our study Indian round gourd significantly affected the pupal duration, pupal survival and adult emergence of *Bactrocera zonata*. Our results are similar with the studies carried out by (Hollingsworth *et al.*)^[6]. In our study *Bactrocera cucurbitae* showed maximum growth ratio on Indian round gourd as compared to *Bactrocera zonata* (Chiou *et al.*)^[2] who reported substantial difference in the pupal period and their survival and also adult emergence, when they provided them different diets.

Similarly, on same cucurbit host pupal duration and pupal survival fluctuated, (Gupta and Verma)^[5]. Interestingly, cucurbit host affected negatively we found the less deformity of *B. cucurbitae* as compared to *B. zonata*. Similar with results were reported by (Rauf *et al.*)^[7]. Furthermore, in this experiment, reduced larval duration was recorded when the maggots of *B. cucurbitae* were provided with natural diet compared to *B. zonata*. Reduced larval growth was reported by (Abro *et al.*)^[1], who provided maggots with natural host. Similarly lowest incubation period was demonstrated by (Manzar and Srivastava)^[8], who provided *B. cucurbitae* eggs with *Momordica charantia* in comparison with *B. zonata* eggs.

Our results are in line with the studies carried out by (Dohrey)^[3], who reported lowest incubation period and reduced larval growth when they provided *B. cucurbitae* with Indian round gourd. Similarly, Egg viability of *B. cucurbitae* was not affected when provided with Indian round gourd. Correspondingly, higher survival and egg viability was recorded by (Samalo *et al.*)^[10] when they fed *B. cucurbitae* with Indian Squash. However, egg hatchability of *B. zonata* was significantly affected when they were kept on Indian round gourd, might be suggesting the physiological effects emitted by fruit odor as *B. zonata* is not the regular host of Indian round gourd.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interests regarding the publication of this article.

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Table 1. Showing incubation duration and Eggs hatching ratio, of *B. cucurbitae* and *B. zonata* eggs reared on Indian round gourd.

Fruit flies	Incubation duration (days)	Hatched Eggs (number of Hatchlings)
Eggs of <i>B. cucurbitae</i>	4.0± OA4	91.6 ± 1.52
Eggs of <i>B. zonata</i>	5.0±0.51	33.3 ± 7.63

Table 2. Showing larval duration and larval survival (Pupal recovery) of *B. cucurbitae* and *B. zonata* eggs reared on Indian round gourd.

Fruit flies	Incubation duration (days)	Larval survival (Pupal recovery)
Eggs of <i>B. cucurbitae</i>	5.6 ± 0.24	79.33± 7.02
Eggs of <i>B. zonata</i>	6.6± 0.24	19.33± 5.13

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Table 3. Showing pupal duration and pupal survival (No of adult emergence) of *B. cucurbitae* and *B. zonata* eggs reared on Indian round gourd.

Fruit flies	Pupal duration (days)	Pupal survival/No of adult emergence
Eggs of <i>B. cucurbitae</i>	8.8± 0.37	75.33 ± 3.51
Eggs of <i>B. zonata</i>	10.6±0.24	15.66 ± 4.04

Table 4. Showing effect of Indian round gourd on the on total adult emergence of *B. cucurbitae* and *B. zonata* eggs.

Fruit Flies	Male	Female	Half emergence	Deformed emergence
Eggs of <i>B. cucurbitae</i>	32.33±2.51	36.00±S.29	2.66±0.57	4.33±1.52
Eggs of <i>B. zonata</i>	7.33±3.05	S.33±2.30	1.66±0.57	1.33±0.57