Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(5): 488-491

Received: 28-07-2019
Accepted: 30-08-2019

Razique Ali Nahiyoon
Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Pakistan

Rashid Ali Lashari
Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Pakistan

M Kashif Arain
Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Pakistan

Mir Nadir Ali Marri
Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Pakistan

Qurban Ali Nahiyoon
Department of Plant Breeding and Genetics, Faculty of Crop Production, Sindh Agriculture University, Tandojam, Pakistan

Correspondence
Razique Ali Nahiyoon
Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Pakistan

Investigation of comparative biology of *Bactrocera dorsalis* on various hosts

Razique Ali Nahiyoon, Rashid Ali Lashari, M Kashif Arain, Mir Nadir Ali Marri and Qurban Ali Nahiyoon

Abstract
Studies on comparative biology revealed that the female laid eggs in small clusters just underneath the rind of fruit, 2-4 mm. During the studies, lower incubation period of *Bactrocera dorsal* was recorded in mango (2.68±0.60) followed by that sapota (2.76±0.83), guava (3.00±0.71) and banana (3.12±0.67 days). The pre-pupal period did not differ (0.5 to 1 day) when *Bactrocera dorsalis* was reared on different hosts. The pupation of *Bactrocera dorsalis* took place at the depth of 0.5 to 5.0 cm in the soil. The average oviposition period was recorded as 6.12±1.44 days on mango, 5.96±1.65 on guava, 5.52±1.50 on banana and 5.48±1.45 on sapota. Correspondingly, the post-oviposition period was recorded as 3.40±0.82 on sapota, 3.04±0.84 on banana, 3.00±0.76 on guava and 2.88±0.78 days on mango. The total life cycle of male was shorter (24.50 to 36.50 days) than the female (30.00 to 46.00 days) ignoring of host fruit. The total life cycle was finalized in 24.50 to 46.50 days on different hosts however; it was little on mango than rest of the fruits. Therefore, the further study recommended that mango was the most acceptable fruit for faster development of *Bactrocera dorsalis*.

Keywords: Oviposition, pupal period, hosts, *Bactrocera dorsalis*

Introduction
Pakistan is the second largest producer of mango, banana, sapota and acid lime about 39.5 per cent of the world's mango and 23 percent of world's banana are produced in Pakistan (Anonymous, 2008) [1]. The major states producing fruits are Sindh, Panjab and Balochistan. In Panjab, fruits such as sapota, banana and many other fruits are cultivated on large scale. Among the various fruits, mango, sapota and banana cover 8, 65, 04 hectares i.e. 30 per cent of total area covered under these crops (Anonymous, 2006) [2]. The demand for fruits has increased in many developed and developing countries especially in the form of canned or fresh fruits. The per capita consumption of fruits has increased from 40 to 85 gm., leading to the demand for increasing the yield as well as quality of fruits. However, the insect pest problems affect both quality and quantity of fruits (Steiner *et al.*, 1970) [3]. There are over 1000 species of insects found damaging fruit trees all over the world; of these, as many as 800 have been reported from India (Butani, 1979) [4].
Insect pests of the family, 'Tephritidae' (Diptera) are one of the most fascinating and diversified. They are commonly called as "fruit flies" or "orchard flies" due to their close association with fruits. These flies are also referred to as 'Peacock flies' due to their habit of strutting and vibrating their wings. There are over 4000 species of fruit flies in the world (Norrbom *et al.*, 1998) [5], of which about 5 percent occur in India (Ramani, 1998) [6]. This family is represented in the entire world region except Antarctica. The oriental region comprises nearly 1000 species so far recorded (Kapoor, 1993) [7]. Of the three subfamilies under Tephritidae Dacinae, Tephritinae and Trypetinae, the subfamily Dacinae is of economic importance. In this subfamily, the genera *Dacus* and *Bactrocera* are important as they include economically important species such as *Bactrocera dorsalis* (Hendel) and *Bactrocera zonata* (Saunders). The subgenus Zeugodacus includes economically important species like *Bactrocera cucurbitae*. Nearly 35 percent of the known fruit fly species attack soft fruits like mango, guava, sapota, citrus, ber, peach, etc, and several cucurbitaceous vegetables (White and Harris, 1992) [8]. It has been reported that in India fruit flies cause loss up to Rs.29,460 million per annum in mango, guava, sapota and citrus (Mumford, 2001) [9]. Whereas, from south Gujarat its damage has been reported as 16 to 40 and 4 to 52 per cent in mango and sapota, respectively (Patel and Patel, 1995) [10].

Moreover, every specie react differently with the environment, it is very important to have its correct identity. Identification of fruit fly species is the first step in developing and understanding the fruit fly problem. The present investigation was carried out on the following aspects: Comparative biology of *Bactrocera dorsalis* and population dynamics of fruit fly.

Materials and Methods

Study Area

Studies on comparative biology of *Bactrocera dorsalis* on mango, guava, sapota and banana were carried out in the laboratory, Department of Entomology, Sindh Agriculture University, Tandojam during 2017-2018. Data on temperature and relative humidity in the laboratory were recorded daily during present investigation.

Rearing technique

The beginning cultures of *Bactrocera dorsalis* were raised by collecting blight fruits of mango, guava, banana and sapota from the Fruit Research Station, Horticultural Farm, Meer Colony, Tandojam. Overrun fruits were retained in rearing jar (diameter: 15 cm; height: 20 cm) on a 5 cm chunky layer of sieved slightly wet sand to obtain the pupae. The top of each jar was protected with white muslin cloth to block the larvae from escaping. When all the full grown maggots inserted in the sand for pupation, overripe fruits were Took out from the jars. Sand in the jar was filtered after every 4-5 days to collect the pupae. Thereafter, pupae were shifted in clean plastic bottle (diameter: 1.5cm; height: 7.5cm), individually. These bottles were protected with lid so as to avoid the escaping of flies. The flies emerged were used for further studies on life history. Freshly developed adults were paired and compact in glass jars (diameter: 15 cm; height: 20 cm) covered with white muslin cloth bag. A cotton swab having five percent sugar solution was suspended inside the jar as food to the adult flies. Eggs were carefully transferred with a fine hair brush on a glass slide and observed under microscope to study their morphometric characters. When eggs hatched out, the neonate maggots were gently transferred on a fresh fruit slice (2 x 2 x 1 cm); later on, they were kept in a Petridis for further rearing. The jars were protected with muslin cloth duly secure with rubber bands to prevent the escape of maggots.

Experimental Design

The biology of *Bactrocera Dorsalis* was recorded on four different hosts T^1 Mango, T^2 Sapota, T^3 Guava and T^4 Banana. To start the experiment Complete Randomized Design (CRD) experiment was followed and repeated four times.

Results and Discussion

Comparative biology of *Bactrocera dorsalis* (Hendel)

Control of fruit fly is rather more difficult as maggot feed inside the fruits, where any insecticide either in the form of spray or dust do not reach. The recommendations of poison bait given by various workers are proved effective to some extent. Over and above, the flying capacity of this pest is 2 to 90 Km. Considering all this peculiar habits, of fruit fly a thorough understanding of biology of pest on different host is very much necessary to undertake effective and timely control operation. During study period varied between 12 to 37.5ºC (Av.24.87 ± 2.59), while that of humidity from 66 to 87 percent (Av.71.16 ± 2.34). The results obtained during these studies have been presented and discussed here under:

Site and pattern of egg laying in Mango, Guava, Sapota and Banana

The act of egg lying by fruit fly, *Bactrocera dorsalis* includes a series of program which was displayed in sequences. In the laboratory as well as under field conditions it was observed that female fly laid eggs in clusters of 3 to 12 eggs underneath the rind of the mango fruit at a depth of about 2 to 4 mm. Similar observations were also made by (Narayanan and Batra 1960) [11] as well as by (Shah *et al.*, 1948) [12]. Moreover, *Bactrocera dorsalis* preferred to lay eggs in proximal (stalk side) and middle part of fruit rather than distal portion. It was further recorded in Table (1) during this investigation that the fly preferred to lay eggs on lower half of the fruit. The fallen fruits were also preferred for oviposition. (Vaysslerers and Kalabane 2000) [13] have also been recorded in banana, the fruit fly preferred fruits which were ready to ripe under field conditions. The pseudo-puncture often found confused with many such dots as varietal characters. In case of banana, oozing of cell sap was not found during present investigation.

Incubation period

The eggs period of *Batrocera dorsalis* on different hosts varied from 1 to 4 days during the investigation. The average egg period was recorded as 3.12±0.67 days on banana followed by 3.00±0.71, on guava, 2.76±0.83, on sapota and 2.68±0.63, on mango. The result indicated that the lower incubation period of *Bactrocera dorsalis* was recorded in mango fruits followed by that in sapota, guava and banana. Almost similar observation on incubation period was also reported by (Kalia, 1992) [14]. Similarly, lower incubation period (3.00 days) of *D. dorsalis* on mango and sapota as compared to guava (3.20 days) was also recorded by (Doharey, 1983) [15] respectively.

Hatching percent, Pre pupal period

The hatching percentage of eggs of *Bactrocera dorsalis* varied between 68.97 to 93.94 percent on different fruits. The average of egg hatching recorded was 86.97±4.77 in mango, followed by 86.77±4.54 guava, 86.07±5.31 sapota and 85.31±6.08 banana. (Kalia 1992) [14] has also observed 72.80 to 99.20 percent hatchability in mango and 73.60 to 86.40 in guava, which is in close concurrence with present findings. According to (Ramani, 1998) [6], the percent hatching of *D. dorsalis* eggs remained more or less similar on mango, sapota and guava (98.40 to cent per cent). The pre-pupal period did not differ (0.5 to 1 day) when *Bactrocera dorsalis* was reared on different hosts. The pupation of *Bactrocera dorsalis* took place at depth of 0.5 to 5.0 cm in soil. The longer pupal period was recorded on sapota (7.80 ± 0.82 days) compared to guava (7.20 ± 0.76 days), banana (7.20 ± 0.82 days) and mango (7.00 ± 0.71 days) same investigation was observed by (Talati *et al.*, 19981) [16].

Sex ratio

The sex ratio of male: female recorded was 1:1.25 on mango, 1:1.22 on sapota, 1:1.13 on banana and 1:1.12 on guava. Thus a preponderance of females over males was observed during the present investigation. These findings are in close concurrences with those of (Doharey 1983) [15] and (Jayanthi and Verghese 2002) [17].

Table 1: Comparative biology of *Bactrocera dorsalis* (Hendel)

	Period in Days			
Particulars	**Mango**	**Guava**	**Sapota**	**Banana**
Egg period	2.68±0.63	3.00±0.71	2.76 ±0.83	3.12±0.67
Hatching %	86.97±4.77	86.77±4.54	86.07 ±5.31	85.31±6.80
Total maggot	7.44±1.16	7.84±1.03	9.40 ±1.47	8.52±0.71
Pre pupal	0.62±0.22	0.78±025	0.86 ±0.23	0.80±0.25
Pupal period	7.00±0.71	7.20±0.76	7.80 ±0.82	7.20±0.82
Sex ratio	1:1.25	1:1.12	1:1.22	1:1.13

Pre-oviposition period

The data presented in Table (2) indicate that the pre oviposition period ranged between 6 to 12 days on different hosts. It was recorded as 9.20 ± 1.41 days on sapota followed by 8.80 ± 1.08 days on banana, 8.32 ± 1.11 days on guava and 8.16 ± 1.18 days on mango. It is inferred from the study that the pre-oviposition period was longer when *Bactrocera dorsalis* reared on sapota compared to that on the other host fruits. (Doharey 1983) [15] has also recorded longer preoviposition period when *D. dorsalis* reared on sapota than guava and mango. (Kumar and Agarwal 2005) [18] recorded 7 to 13 days of preoviposition period of *Bactrocera dorsalis* on mango.

Oviposition period

The oviposition period varied from 3 to 9 days, when the *Bactrocera dorsalis* was reared out on different hosts. It was recorded as 6.12 ± 1.44 days on mango followed by 5.96 ± 1.65 days guava, 5.52 ± 1.50 days on banana and 5.48 ± 1.45 days on sapota. However it was recorded as 17.0 days on guava, 55.67 days on sapota and 45 days on mango in Delhi by (Mahamood 2000) [19]. Similarly, 13 to 18 days on mango (Dale, 2002) [20] and 12 to 17 days on guava (Rana *et al*., 1992) [21] have been recorded in north Gujarat and Haryana, respectively.

Post oviposition period

The post oviposition period ranged between 1 to 4 days during present investigation. It was recorded as 3.40±0.82 days on sapota, 3.04±0.84 days on banana, 3.00±0.76 days on guava and 2.88±0.78 days on mango. (Mann 1996) [22] has also made similar observations on post oviposition period (1 to 9 days) of *Bactrocera dorsali*, when reared on mango, guava and sapota.

Fecundity

The egg laying capacity of gravid female varied from 54 to 199 eggs on the different hosts. It was recorded as high as 180.00 ± 35.76 eggs in mango followed by 155.00 ± 34.32 eggs in guava 145.00 ± 40.85 in banana and 142.00 ± 38.62 eggs in sapota. Thus the higher fecundity in mango fruit indicated the preference of particular fruits. (Madhura 2001) [23] investigated 150 to 200 eggs which confirms to the present findings. Higher fecundity (621.79 and 707.37 eggs/female) was also recorded on mango and sapota in Delhi by (Madhura 2004) [24].

Longevity

It can be seen from the data that the male longevity varied from 7 to 14 days on different hosts. The average longevity recorded as 11.24 ± 1.92 days on sapota followed by 11.12 ± 1.62 days on banana, 10.32 ± 1.52 days on guava and 9.72 ± 1.17 days on mango. The female longevity varied from 13 to 24 days on different hosts. The average longevity of female recorded as 18.08 ± 2.16 days on sapota followed by 17.36 ± 1.75 days on banana, 17.28 ± 2.03 days on guava and 17.16 ± 2.22 days on mango. Male and female could live longer when reared on sapota compared to rest of the hosts. Earlier, (Liu 1990) [25] recorded longevity as high as 43.70 days on sapota, 39.48 days on mango and 20.76 days on guava for *D. dorsalis*.

Total life cycle

It is evident from total life cycle starting from egg to death of adult of male varied from 24.50 to 36.50 days. This period recorded as 32.06 ± 2.69 days on sapota, followed by 30.76 ± 1.86 on banana, 29.14 ± 2.21 days on guava and 27.46 ± 1.81 days on mango. The shorter period taken to complete the whole life cycle of *Bactrocera dorsalis* on mango revealed the preference by the pest. The present findings on total life period of fruit fly, *Bactrocera dorsalis* are in conformity with those of (Doharey 2005) [26] who also reported shorter duration on mango compared to guava and sapota.

Table 2: Comparative biology of *Bactrocera dorsalis* (Hendel)

	Adult period			
Particulars	**Mango**	**Guava**	**Sapota**	**Banana**
Pre oviposition	8.16±1.18	8.32±1.11	9.20 ±1.41	8.80±1.08
Oviposition	6.12±1.45	5.96±1.65	5.48 ±1.45	5.52±1.50
Post oviposition	2.88±0.78	3.00±0.76	3.40 ±0.82	3.04±0.84
	Longevity			
Male	9.72±1.17	10.32±1.52	11.24 ±1.92	11.12±1.62
Female	17.16±2.15	17.28±2.03	18.08 ±2.16	17.36±1.75
	Total Life cycle			
Male	27.46±1.81	29.14±2.23	32.06 ±2.69	30.76±1.80
Female	34.90±2.13	36.10±2.58	39.90 ±3.32	37.01±1.84
Fecundity	180 ±35.76	155.00 ±34.32	142.0 0±38.62	145.00±40.85

Conclusions

From this study following sex ratio of male : female were recorded, on mango as 1:1.25, 1:1.22 on sapota, 1:1.13 on banana and on guava as 1:1.12, respectivly. On the behalf of these findings it is concluded that the hightest male and female sex ratio were recorded on mango host whereas the lowest sex ratio were recored in guava. Thus a preponderance of females over males was observed during the present investigation.

Acknowledgements
I am greatly thankful to Kamil Kabir Khanzada (Department of Entomology) who helped me throughout in data collection & analyzing.

References

1. Anonymous K. Status of Horticulture in India. Agriculture Today, 2008, 21.
2. Anonymous K. Area and production of fruits and vegetable crop. Repor t of Gujarat state for the year 2005-06. Directorate of Agriculture, Gujarat state, Ahmedabad, 2006.
3. Steiner LF, Hart WG, Harris EJ, Cunnigham RT, Ohinata K, Kamakahi DC. Eradication of oriental f ruit fly from the Mariana Island by the method of male annihilation and sterile insect release. Journal of Entomology. 1970; 63(1):131-135.
4. Butani DK. Insects and Fruits. Periodical Expert Agency, Delhi. 1979, 210-211.
5. Norrbom AC, Caroll LE, Freidberg A. Status of knowledge. Fruit Fly Expert Identification System and Systematic Information Database, Miya. 1998; 9:9-47.
6. Ramani S. Biosystimatic studies on fruit flies (Diptera: Tephritidae) with special reference to the fauna of Karnataka and Andaman and Nicobar. Journal of Banglore. 1998; 2(3):134-136.
7. Kapoor VC. Indian fruit flies. (Insecta: Diptera; Tephritidae). Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. 1993, 142-157.
8. White IM, Harris E. Fruit Flies of Economic Significance: their Identification and Bionomics. CAB International Walling Ford, U.K. 1992, 22-25.
9. Mumford JD. Project memorandum on integrated management of fruit flies in India. Department for International Development (DFID). 2001, 6.
10. Patel RK, Patel CB. Efficacy of modified trap over conventional trap in trapping fruit flies in sapota orchard in south Gujarat. Research Journal of Gugrat. 1995; 21(1):134-141.
11. Narayanan ES, Batra HN. Fruit flies and their control. Indian Council of Agricultural Research, New Delhi. 1960, 20-24.
12. Shah KK. Bionomics of fruit flies (*Dacus* spp.) on some fruits. Indian Journal of Entomology. 1948; 45(4):406-423.
13. Vaysslerers JF, Kalabane S. Inventory and fluctuation of catches of Diptera: Tephritidae associated with mangoes in coastal Guinea. Fruit Paris. 2000; 55(4):259- 270.
14. Kalia V. Bionomics of fruit fly, *D. dorsalis* on some cultivars of mango and guava. Bull Entomology. 1992; 33(1, 2):79-87.
15. Doharey KL. Bionomics of fruit flies (*Dacus* spp.) on some fruits. Indian Journal of Entomology. 1983; 45(4):406-423.
16. Talati G, Vaishnav M, Bhatt J. Plant protection in mango and lemon. Krishi vikas. 1981; 15(1):17-20.
17. Jayanthi PD, Verghese AA. Simple and cost effective mass rearing technique for the Tephritid fruit fly, *B. dorsalis*. Current Science. 2002; 82(3):266-268.
18. Kumar B, Agarwal ML. Comparative biology of three *Bactrocera* species (Diptera: Tephritidae: Dacinae). Journal of Shashpa. 2005; 12(2):93-98.
19. Mahmood R, Karim NB, Makhdum AH, Chaudhary MZ, Mustafa G, Stonehouse J. Fruit flies in Pakistan Damage and control in farmers field. Indian Ocean Region, Mauritius. 2000,
20. Dale NS. Studies on biology of *Bactrocera zonata* (Saunders) and management of fruit fl ies in mango orchards. Journal of Zoology. 2002; 2(4):123-125.
21. Rana JS, Prakash O, Verma SK. Biology of guava fruit fly infesting guava fruits in Haryana and influence of temperature and relative humidity on its incidence. Journal of Crop Research. 1992; 5(3):525-529.
22. Mann GS. Seasonal incidence and population build up of *B. dorsalis* on mango in Punjab. Journal of Insect Sciences. 1996; 9(2):129-132.
23. Madhura HS, Viraktamath CA. Selective response of fruit flies to traps at different heights. New Molecules, Biopesticides and Environent. at Bangalore. 2001, 27-28.
24. Madhura HS, Verghese A. A guide to identification of some common fruit flies. Pest Management Horticulture Ecosystem. 2004; 10 (1):1-10.
25. Liu YC, Huang LH. Ovipositional preference of oriental fruit fly, *D. dorsalis*. Chinese Journal of Entomology. 1990; 10(2):159-168.
26. Doharey KL. Fruit flies (*Bactro* spp.) on some selective fruits. Indian Journal of Entomology. 2005; 45(4):406-423.