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Age specific life-table of *Bactrocera dorsalis* (Hendel) under room temperature

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Abstract

The present investigation entitled “Age specific life-table of *Bactrocera dorsalis* under room temperature”. The experiments were undertaken at Bio-control Laboratory, Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) during years 2019. It was the insect required 71 days for the complete its generation at room temperature. The table clearly revealed that a drop in the survivorship (lx) for the first 3rd days. It again started decline on 4th to 18th day. A longpause where no survivorship reduction was recorded between 19th to 30th day. Thereafter, a long pause where no survivorship reduction was recorded between 32nd to 36th day. It again started decline on 37th day. In difference of survivorship, mortality curve followed an irregular pattern with few high and negative peaks. The highest mortality (30) was recorded on 7th day, followed by 29 on 5th day, 26 on 4th and 8th day, 25 on 6th day, 18 on 3rd day, 15 on 12th and 67th day, 13 on 7th, 31st and 61st day, 11 on 10th day and 10 on 9th and 55th day, respectively. The lowest mortality of 2 occurred on starting day (at evening) and 71st day, followed by 3 death were observed on 14th, 17th and 18th day, 4 death were observed on 15th day, 5 death were observed on 16th, 37th and 49th day and 7 death were observed on 13th and 43rd day, respectively. No mortality was point out in rest remaining days.

Keywords: Age specific life- table, *Bactrocera dorsalis*, Survivorship, Mortality

Introduction

Mango, *Mangifera indica* is the national fruit of India that's popularly called the 'King of Fruits' belonging to family *Anacardiaceae* is one of the maximum famous tropical fruits in the world (Majumdar, and Sharma, D. K 1990 and Scherrer, 2007) ^[1, 2]. It is a major fruit crop with a high potential for exports. India ranks first in world production accounting for about 50 percent of the world's mango production (FAOSTAT, 2018). The cultivation of mango is 2.5 mha with an annual production of fresh mango 20.26 million tonne. (DGCI&S, 2019-20) ^[3]. In view the importance of *Bactrocera. carambolae* for national fruit growing and the lack of knowledge about its biological cycle, biological studies on its different hosts and even potential hosts are fundamental for risk prediction models of pest dispersal. Therefore, this work aimed to describe the biology of *B. carambolae* on the potential host, grape, and on the natural host, acerola, as well as calculate parameters of the fertility life table. (Luiza *et al.*, 2019) ^[4]. The Purpose of this study was to increase awareness about pest and to provide knowledge about different life stages of insect pest and to give accurate information of morphometrics of various life stages and their developmental time duration, The monitoring of adult life span (Longevity), pre-oviposition, oviposition periods, fecundity and the effect of diet on adult longevity, which is helpful for the professional management strategies that will keep mangoes away from poor effect of drugs and insecticides. This investigation will be also help in the identification of pest and shall draw attention towards the commercial varieties of Sindh, which are undermined by the fruit fly pest at the present time (Amur *et al.*, 2017) ^[5]. Life table gives the most comprehensive description on the survival, stage differentiation and reproduction of a population and is thus the most important basis of population ecology and pest management. In this study, we constructed life tables for *Bactrocera cucurbitae* on cucumber (*Cucumis sativus* L.) in the laboratory and under simulated field conditions. To assess the variability of the life tables, we carried out two experiments under each treatment. It is the only solid theory to describe in details the survival, stage differentiation and reproduction of insects such as fruit flies (Huang and Chi, 2012) ^[6].

Materials and Methods

Location of study area

The area under investigation is situated 29^o 04' N latitude and 77^o 42' E longitudes at an altitude of 237 meter above the mean sea level (MSL). The Meerut district of Western Uttar Pradesh has a total area of 2,522sq km. It is bounded by district Muzaffarnagar, Bijnor, J.P. Nagar, Hapur, Ghaziabad, Baghpat, and Shamli in North, South West, South, West, East and North East, respectively. Meerut has a total population of over 3.4 million. The Ganga and Hindan are adjoining major rivers of the district.

Climate

Meerut has sub-tropical and semi-arid climate with hot and dry summers and cold winters. High rainfall and wide temperature range are the characteristic features of this region. Normally rain continues from July to September and few showers are also expected during the spring season. Cold generally occur towards the end of December and may continue till the end of January. The studies on several aspects related *B. dorsalis* (Hendel) to were conducted under natural condition in the Bio-control Laboratory, Department of Entomology, College of Agriculture, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.).

Experimentation

All the experiments were conducted in Bio-control Laboratory, Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.)

Construction of age specific life table of *B. dorsalis* (Hendel)

Time taken for hatching of eggs was recorded. The egg period was recorded as number of days from date of egg laying to the date of larval emergence. Ten maggots were selected for the study. Maggots were reared separately in respective fruit pieces in plastic containers and covered with muslin cloth. Fruit pieces were replaced with fresh ones at two days interval. The maggots were carefully transferred using a soft and fine bristled brush into the fresh fruit pieces. The larval period was recorded as number of days from date of larval emergence to the date of pupation. When the larvae became full grown they were transferred to glass troughs provided with soil at for pupation. The pupal period was recorded as number of days from the date of pupation till the date of adult emergence.

The emerged adults were fed with mango pulp. The adult longevity was recorded as the days taken for adult emergence to the death of the adult.

Data analysis

The Procedures adopted for computations of various life parameters were as specified by Birch, 1948 [7]. Observation on number of alive and dead insects out of hundred were recorded daily. The following assumption was used in the

construction of age specific life-table.

X = Age of the Insect in days.

I_x= Number surviving insects at the beginning of each interval x out of 100.

dx = Number dying during the age interval x out of 100.

100q_x = Mortality rate at the age interval x.

e_x = Expectation of life or mean life remaining for individuals of age x.

Life expectation was calculated using the equations

$e_x = T_x/L_x$

To obtain e_x two other parameters L_x and T_x will also computed as given below -

L_x= The number of individuals alive between age x and x+1 and calculated by the equation.

$L_x = l_x + l_{x+1} / 2$

T_x= the total number of individuals of x age units beyond the age x, and obtained by the equation.

$T_x = l_x + (l_x + 1) + (l_x + 2) + \dots + l_w$

Where, l_w = The last age interval.

Result and Discussion

In order to gauge the response of mango fruit responsible for fluctuation in the population build-up of *Bactrocera dorsalis* (Hendel) an effort was made to construct life-table and computing various life parameters of this pest under natural conditions. The age specific life table were formulated which have been summarized under the following heads.

It was the insect required 71 days for the complete its generation at room temperature. The table clearly revealed that a drop in the survivorship (l_x) for the first 3rd days. It again started decline on 4th to 18th day. A long pause where no survivorship reduction was recorded between 19th to 30th day. Thereafter, a long pause where no survivorship reduction was recorded between 32nd to 36th day. It again started decline on 37th day. Thereafter, a long pause where no survivorship reduction was recorded between 38th to 42nd day. It again started decline on 43th day. Thereafter, a long pause where no survivorship reduction was recorded between 44th to 48th day. It again started decline on 49th day. Thereafter, a long pause where no survivorship reduction was recorded between 50th to 54th day. It again started decline on 55th day. Thereafter, a long pause where no survivorship reduction was recorded between 56th to 60th day. It again started decline on 61st day. Thereafter, a long pause where no survivorship reduction was recorded between 62th to 66th day and it again started decline on 67th day. Thereafter, a long pause where no survivorship reduction was recorded between 68th to 70th day. Thereafter, survivorship again dropped at 71st day and after wards sharp decline in survivorship (l_x) was recorded till the culmination of the generation.

Table 1: Construction of Age Specific Life Table of *Bactrocera dorsalis* under Room Temperature during Year 2019

X	l _x	D _x	100q _x	L _x	T _x	E _x
0	300.00	2.00	0.67	299.00	597.00	1.99
1	298.00	0.00	0.00	298.00	596.00	2.00
2	298.00	0.00	0.00	298.00	587.00	1.97
3	298.00	18.00	6.04	289.00	556.00	1.87
4	280.00	26.00	9.29	267.00	506.50	1.81
5	254.00	29.00	11.42	239.50	452.00	1.78

6	225.00	25.00	11.11	212.50	397.50	1.77
7	200.00	30.00	15.00	185.00	342.00	1.71
8	170.00	26.00	15.29	157.00	296.00	1.74
9	144.00	10.00	6.94	139.00	267.50	1.86
10	134.00	11.00	8.21	128.50	245.00	1.83
11	123.00	13.00	10.57	116.50	219.00	1.78
12	110.00	15.00	13.64	102.50	194.00	1.76
13	95.00	7.00	7.37	91.50	178.00	1.87
14	88.00	3.00	3.41	86.50	169.50	1.93
15	85.00	4.00	4.71	83.00	161.50	1.90
16	81.00	5.00	6.17	78.50	153.00	1.89
17	76.00	3.00	3.95	74.50	146.00	1.92
18	73.00	3.00	4.11	71.50	141.50	1.94
19	70.00	0.00	0.00	70.00	140.00	2.00
20	70.00	0.00	0.00	70.00	140.00	2.00
21	70.00	0.00	0.00	70.00	140.00	2.00
22	70.00	0.00	0.00	70.00	140.00	2.00
23	70.00	0.00	0.00	70.00	140.00	2.00
24	70.00	0.00	0.00	70.00	140.00	2.00
25	70.00	0.00	0.00	70.00	140.00	2.00
26	70.00	0.00	0.00	70.00	140.00	2.00
27	70.00	0.00	0.00	70.00	140.00	2.00
28	70.00	0.00	0.00	70.00	140.00	2.00
29	70.00	0.00	0.00	70.00	140.00	2.00
30	70.00	0.00	0.00	70.00	133.50	1.91
31	70.00	13.00	18.57	63.50	120.50	1.72
32	57.00	0.00	0.00	57.00	114.00	2.00
33	57.00	0.00	0.00	57.00	114.00	2.00
34	57.00	0.00	0.00	57.00	114.00	2.00
35	57.00	0.00	0.00	57.00	114.00	2.00
36	57.00	0.00	0.00	57.00	111.50	1.96
37	57.00	5.00	8.77	54.50	106.50	1.87
38	52.00	0.00	0.00	52.00	104.00	2.00
39	52.00	0.00	0.00	52.00	104.00	2.00
40	52.00	0.00	0.00	52.00	104.00	2.00
41	52.00	0.00	0.00	52.00	104.00	2.00
42	52.00	0.00	0.00	52.00	100.50	1.93
43	52.00	7.00	13.46	48.50	93.50	1.80
44	45.00	0.00	0.00	45.00	90.00	2.00
45	45.00	0.00	0.00	45.00	90.00	2.00
46	45.00	0.00	0.00	45.00	90.00	2.00
47	45.00	0.00	0.00	45.00	90.00	2.00
48	45.00	0.00	0.00	45.00	87.50	1.94
49	45.00	5.00	11.11	42.50	82.50	1.83
50	40.00	0.00	0.00	40.00	80.00	2.00
51	40.00	0.00	0.00	40.00	80.00	2.00
52	40.00	0.00	0.00	40.00	80.00	2.00
53	40.00	0.00	0.00	40.00	80.00	2.00
54	40.00	0.00	0.00	40.00	75.00	1.88
55	40.00	10.00	25.00	35.00	65.00	1.63
56	30.00	0.00	0.00	30.00	60.00	2.00
57	30.00	0.00	0.00	30.00	60.00	2.00
58	30.00	0.00	0.00	30.00	60.00	2.00
59	30.00	0.00	0.00	30.00	60.00	2.00
60	30.00	0.00	0.00	30.00	53.50	1.78
61	30.00	13.00	43.33	23.50	40.50	1.35
62	17.00	0.00	0.00	17.00	34.00	2.00
63	17.00	0.00	0.00	17.00	34.00	2.00
64	17.00	0.00	0.00	17.00	34.00	2.00
65	17.00	0.00	0.00	17.00	34.00	2.00
66	17.00	0.00	0.00	17.00	26.50	1.56
67	17.00	15.00	88.24	9.50	11.50	0.68
68	2.00	0.00	0.00	2.00	4.00	2.00
69	2.00	0.00	0.00	2.00	4.00	2.00
70	2.00	0.00	0.00	2.00	3.00	1.50
71	2.00	2.00	100.00	1.00	1.00	0.50

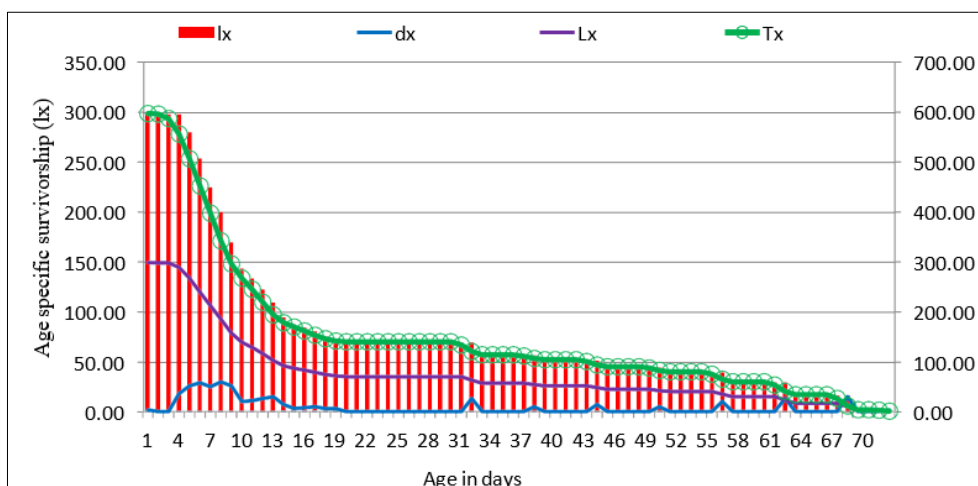


Fig 1: Construction of age specific life table of *Bactrocera dorsalis* under room temperature.

In difference of survivorship, mortality curve followed an irregular pattern with few high and negative peaks. The highest mortality (30) was recorded on 7th day, followed by 29 on 5th day, 26 on 4th and 8th day, 25 on 6th day, 18 on 3rd day, 15 on 12th and 67th day, 13 on 7th, 31st and 61st day, 11 on 10th day and 10 on 9th and 55th day, respectively. The lowest mortality of 2 occurred on starting day (at evening) and 71st day, followed by 3 death were observed on 14th, 17th and 18th day, 4 death were observed on 15th day, 5 death were observed on 16th, 37th and 49th day and 7 death were observed on 13th and 43rd day, respectively. No mortality was point out in rest remaining days.

As far as the life expectancy (e_x) was concerned, it reduced marginally up to 1st day and there after it gradually high in the beginning of age and remained the same with slight fluctuation up to 1st day and increase till 71th day an account of more number of death on preceding days then decreased gradually and reached lowest 0.50 on 71th day. Curve so obtained exhibited low and high peaks nonlinear.

The observation for age specific life-table of *B. dorsalis* professed that the survivorship (l_x), death (dx) and life expectancy, these finding like highest mortality (30) was recorded on 7th day, by agreement with the finding of Mohamed *et al.*, (2019) [8] who has reported that the 50 percent mortality occurred on 23th day and also partially relationship with the finding of Golizadeh *et al.* (2008) [9], The lowest mortality of 2 occurred on starting day (at evening) and 71st day these findings partially similar to the findings of Mahmed *et al.*, (2019) and also reported partially supported findings of Lashkari *et al.*, (2007) [10].

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