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Biology, seasonal activity of fruit fly (*Bactrocera cucurbitae* Coq.) on pointed gourd (*Trichosanthes dioica* Roxb.) and weather relations

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A B S T R A C T

Bactrocera cucurbitae (Coq.) is considered as a serious pest of pointed gourd. Peak incidence of it was obtained in third week of May to first week of June during all the three years of study (*i.e.* 2007-08, 2008-09, 2009-10). Studies on biology showed that the incubation, larval, pupal and adult longevity periods were 2 to 5 days, 5 to 7 days, 6 to 9 days, 37 to 41 days in June-July and 4 to 6 days, 16 to 19 days, 17 to 21 days, 23 to 32 days in August-October, respectively. Correlation with individual weather factors revealed that each of maximum and minimum temperature had significant positive correlation (r = +0.386 and +0.501, respectively) on the population build up of the pest. The relative humidity % of morning hours had significantly negative correlation (r = -0.451) and that of evening slightly positive (r = +0.284). Rainfall had insignificantly positive (r = +0.195), soil temperature significantly positive (r = +0.555) and the bright sun shine hours insignificantly positive (r = +0.103) effects on the population development.

Keywords: Pointed gourd, fruit fly, biology, incidence, correlation

Introduction

Pointed gourd (*Trichosanthes dioica* Roxb.) has been subjected to damage by cucurbit fruit fly, *Bactrocera cucurbitae* (Coq.) (Chintha *et al.* 2002; Jha *et al.*2007) limiting the production and productivity of the crop. In India, several reports had been found on this pest. Extent of yield loss caused by the pest to cucurbitaceous vegetables ranged from 30 to 100% depending upon cucurbit species and the season in different parts of the world (Gupta & Verma 1992; Dhillon *et al.* 2005a b c; Shooker *et al.* 2006). The report on infestation of the pest attacking pointed gourd in West Bengal is scanty. Jha *et al.* (2007) observed infestation of fruit fly to the tune of 17% on the crop in the district of Malda, Murshidabad and Nadia. The female lays eggs in groups under the pericarp of young fruits and after hatching maggots bore into the tissues making cavities and feeding on it. Subsequently fruit rots and maggots jump out making exit holes. It is necessary to have basic information on the incidence of the pest in relation to weather parameters which in turn help us in determining appropriate time of action and suitable management methods to be adopted. Hence, through the present study, attempt was made to record the biology, periodicity of occurrence and their relations to various abiotic factors.

Materials and Methods

The field experiment on seasonal incidence of fruit fly was done for three consecutive crop growing seasons from 2007-08 to 2009-10, in the plot area of 3m×2m with a plant spacing 100cm × 135cm. All the recommended agronomic practices were followed to raise the crops. The incidence of fruit fly was recorded on the basis of number of fruits damaged by the pest. The maggots per infested fruits were counted. Data were later converted to maggot population per fruit with the following formula (Gupta & Verma 1992)

$$\text{Maggot population per fruit} = \frac{\text{No. of infested fruits} \times \text{No. of maggots per infested fruit}}{\text{Total no. of fruits sampled}}$$

The meteorological parameters were obtained from the Department of Agricultural Meteorology and Physics, Bidhan Chandra Krishi Viswavidyalaya (BCKV). Correlation was done with the incidence of fruit fly following statistical computer programme.

The experiment on biology of the fruit fly was conducted in the laboratory of Department of Agricultural Entomology, BCKV. The fruit flies were reared under wire net cylinder cages of 25cm diameter. The tops of the cages were covered with muslin cloth and all sides of the cages were covered with moist detachable cloth for maintaining humidity and partial darkness. The adult flies were fed on sugar solution (water, sugar, glucose and yeast in the ratio of 3: 1: 1: 1, respectively). For egg laying, the fruits of pointed gourd were hollowed keeping 2mm thick pericarp. The cavity was filled with wet cotton covered with black cloth to make the eggs easily detectable. Food medium containing slurry of pointed gourd, brewer's yeast and glucose powder were used for rearing maggots.

Results and Discussion

Biology of the fruit fly, B. cucurbitae (Coq.)

The eggs of fruit fly, *B. cucurbitae* (Coq.) were slightly curved, elongated and tapering towards the ends, creamy white in colour, egg surface was sculptured with numerous longitudinal ridges and grooves. Freshly laid eggs measured from 0.76 mm. to 0.84 mm. in length and 0.20 mm. to 0.26 mm. in width (Table 1). The incubation period varied from 2 to 5 days in June-July and 4 to 6 days in August-October (Table 2). The eggs were laid both in singly and in cluster. The first instar larvae were apodus, white translucent, a bit flattened dorsoventrally at both ends. The length and width varied 1.20 to 1.62 mm. and 0.22 to 0.38 mm. respectively (Table 1). The second instar larvae were broad tapering at both ends. The length and width varied from 4 to 4.70 mm. and 1.08 to 1.44 mm. respectively (Table 1). The third instar larvae were yellowish in colour due to reserve food materials within their stomach. The length and width of the larvae at the stage varied from 7.50 to 9.20 mm. and 1.88 to 2.48 mm. respectively (Table 1). The total larval period was found to be 5 to 7 days in June-July and 16 to 19 days in August-October (Table 2). The pupae were somewhat barrel shaped, anterior being narrower, freshly formed ones were yellowish and turned reddish brown later on. The length and width varied from 5.25 to 5.88 mm. and 2.09 to 2.59 mm. respectively (Table 1). The pupal period varied from 6 to 9 days and 17 to 21 days in June-July and in August-October respectively. Total duration from egg to adult stage was found to vary from 16 to 22 days in June-July and 51 to 59 days in August-October (Table 2). The result was in conformity with Koul and Bhagat (1994) and Renjhen (1949), who reported the duration of larval and pupal period lengthened in winter and shortened in summer period.

Seasonal incidence of fruit fly

Fruit fly (B.cucurbitae), one of the most important pests of pointed gourd along with all members of family Cucurbitaceae occurred from second week of April to second week of September of 2008. During 2009, its infestation, initiated during third week of April and continued till the crop was finally harvested (second week of September). During 2010, it was further late being during first week of May and persisted till the end of crop season (second week of September). High larval population (7.09 maggot/fruit) could be recorded from third week of May with corresponding fruit damage of 22.86% in 2008 (Fig.1). Population of maggot was relatively low during 2009 (3-3.4 maggot/fruit) at last part of May and caused 10%

Table1.
Measurement of different life stages of fruit fly

Life stage	Length (mm.)	Width (mm.)
Eggs	0.79±0.03 (0.76 - 0.84)	0.22±0.03 (0.20 - 0.26)
Larval Instar I	1.40±0.19 (1.20 - 1.62)	0.28±0.05 (0.22 - 0.38)
Larval Instar II	4.38±0.23 (4.00 - 4.70)	1.29±0.09 (1.08 - 1.44)
Larval Instar III	8.32±0.66 (7.50 - 9.20)	2.17±0.23 (1.88 - 2.48)
Pupae	5.56±0.22 (5.25 - 5.88)	2.37±0.17 (2.09 - 2.59)
Adult Male	7.19±0.32 (6.48 - 7.54)	2.30±0.07 (2.21 - 2.38)
Adult Female	8.50±0.38 (8.04 - 9.18)	2.43±0.09 (2.30 - 2.54)

Figures in the table are mean values and those within parenthesis are the ranges

Table2.
Duration of different life stages of fruit fly on pointed gourd

Stage	Duration in days	
	June-July	August-October
Egg period	3.4±0.84 (2-5)	5.2±1.03 (4-6)
Larval longevity	5.9±0.73 (5-7)	17.5±0.97 (16-19)
1st instar	1.4±0.51 (1-2)	3.6±0.51 (3-4)
2nd instar	1.8±0.42 (1-2)	5.4±0.52 (5-6)
3rd instar	2.7±0.48 (2-3)	8.5±0.53 (8-9)
Pupal period	7.4±1.17 (6-9)	18.6±1.77 (17-21)
Total developmental period	19.2±1.81 (16-22)	53.6±2.27 (51-59)
Adult longevity	38.5±1.35 (37-41)	28.2±2.65 (23-32)

Figures in the table are mean values and those within parenthesis are the ranges

fruit damage (Fig.2). But highest fruit damage was found at the fag end of the cropping season, i.e., last week of August (25%). During 2010, however, population prevalence was of almost of the same order as on 2008 and the highest population (7.15 to 7.76 maggots/fruit) and fruit damage (25-40%) occurred during first and second week of June (Fig.3). Development of population to reach high level took five weeks during 2008 and 2009 but in 2010 it took lesser time of four weeks. The decline of population to reach minimum during the last days of occurrence took thirteen weeks during 2008 and 2009 but it was eleven weeks in 2010. If three years' incidence pattern be considered together, it could have been found that the average maggot population/fruit was maximum in 2010 followed by 2008. The population was minimum in 2009. The corresponding damage percentage also followed more or less the same trend. However, on critical analysis of the maggot load per affected fruit (Fig.4) it had been found that the population distribution per fruit was much skewed in 2009.

No such study was taken up from this region earlier. However, peak population of the pest had been reported to occur on bitter gourd from this region during summer followed by winter season (Banerji et al., 2005). Patnaik *et al.*, (2004) showed that the peak population of the fly could be noted during April-May, i.e., around 18th to 20th standard weeks on bitter gourd. Such infestation on little gourd could be recorded throughout the year starting from the month of February reaching peak during third week of March and with negligible infestation during December-January (Patel & Patel, 1996).

Relationship between fruit fly population and different weather parameters

Relating the weather factors with incidence of maggot revealed significant positive correlation with both maximum (r = +0.386) and minimum (r = +0.501) temperature, the latter being highly so. Similarly soil temperature also showed highly significant positive correlation (r = +0.555). Morning RH% was negatively and significantly correlated with maggot incidence (r = -0.451). The other weather factors did not have any significant effects on incidence of the pest (Table 3). The result was more or less in conformity with Laskar and Chatterjee (2010) barring the effect of bright sun shine hour which in the present study was positively (insignificantly) correlated and that of the authors referred above were negatively correlated on pumpkin.

Table 3.
Pooled correlation between fruit fly and weather parameters

Sl. No.	Parameters	r
1	Maximum temperature	+0.386*
2	Minimum temperature	+0.501**
3	Morning RH	-0.451*
4	Evening RH	+0.284
5	Rainfall	+0.195
6	Soil temperature	+0.555**
7	Bright sun shine hour	+0.103

[1]Correlation is significant at the 0.05 and 0.01 levels.

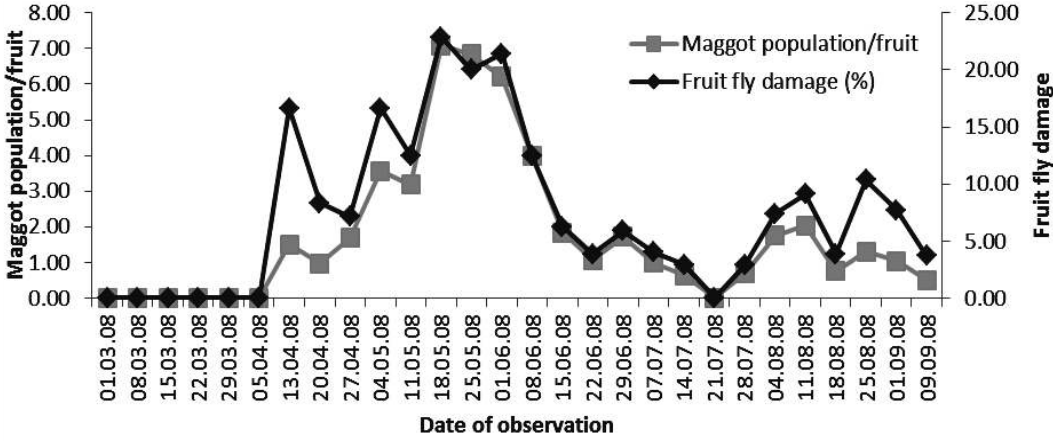

Fig. 1 Incidence pattern of fruit fly as maggot population in pointed gourd during 2008

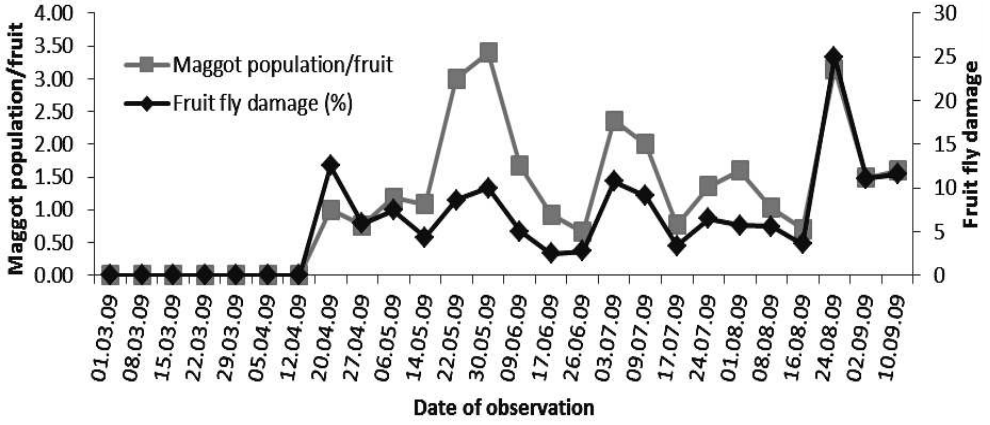

Fig. 2 Incidence pattern of fruit fly as maggot population in pointed gourd during 2009

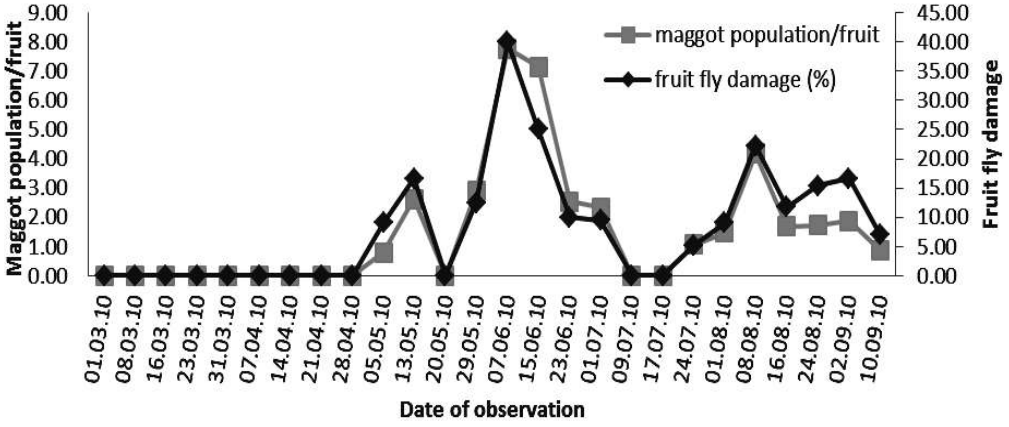

Fig. 3 Incidence pattern of fruit fly as maggot population in pointed gourd during 2010

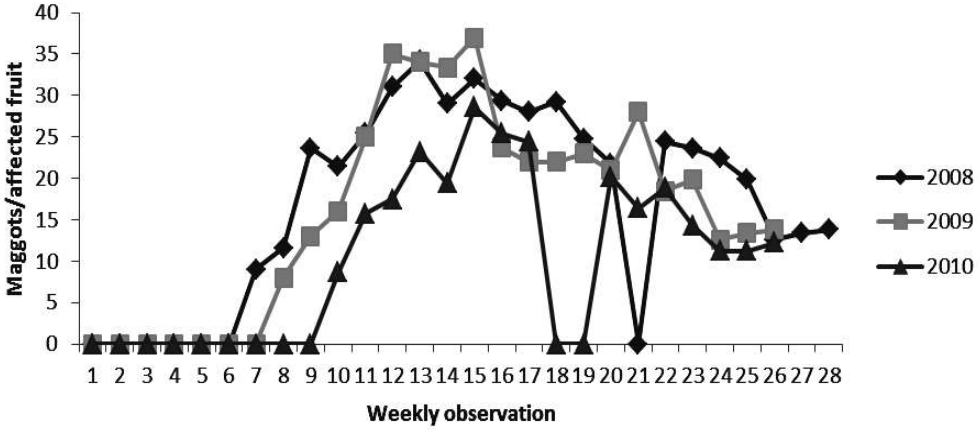

Fig. 4 Maggot population per affected fruit on pointed gourd in 2008-2010

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