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Population dynamics of red pumpkin beetle, *Aulacophora foveicollis* Lucas on cucumber, *Cucumis sativus* Linneaus

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Abstract
The investigations on "Population dynamics of red and black pumpkin beetle, *Aulacophora foveicollis* Lucas on cucumber, *Cucumis sativus* Linneaus" was carried out at College Farm, College of Agriculture, Navsari Agricultural University, Bharuch (Gujarat) during summer, 2020. The population of red pumpkin beetle, *A. foveicollis* on cucumber initiated from 3rd week of March (11th SMW, 4th WAS) and persisted till 4th week of May (21th SMW, 14th WAS) in the range of 0.13 to 3.30 beetles/plant with an average of 1.49 beetle/plant. The population reached to the first (2.53 beetles/plant) and second as well as the highest (3.30 beetles/plant) peak during 2nd week of April (15th SMW, 8th WAS) and 1st week of May (18th SMW, 11th WAS), respectively. The correlation studies revealed that bright sunshine hours (r= 0.64906*) and evapotranspiration rate (r= 0.66310*) significantly positively correlated while, maximum temperature (r= 0.72768**) and wind speed (r= 0.79715**) showed highly significant and positively associated with the activity of red pumpkin beetle. The other weather parameters had non-significant association with red pumpkin beetle population.

Keywords: Zeel Pansara, population dynamics, red pumpkin beetle, *aulacophora foveicollis*, cucumber, Bharuch

1. Introduction
Cucumber (*Cucumis sativus* L.) is a member of cucurbitaceae family which is comprised of 118 genera and 825 species (Laila *et al.*, 2015) [7]. Cucumber provides protein (1%), carbohydrates (1%), potassium (4%), vitamin C (4%) and small amount of iron, calcium, magnesium and vitamin A (Szalay, 2017) [11]. Cucumber has been reported as a commercial cash crop in tropical and sub-tropical parts of India with an annual production of 1.67 million tonnes from an area of 105 thousand hectares and productivity is 15 tonnes per hectare (Anon., 2019) [1]. Like other cucurbits, cucumber is attacked by various insect pests right from the initial stage of the crop upto harvest of the fruits which adversely affect the quality and quantity of the produce. The red pumpkin beetle is the most serious and destructive polyphagous pest of cucurbitaceous vegetables specially cucumber, white gourd, water melon, muskmelon and sweet gourd in India (Varavdekar and Dumbre, 1992) [12]. The beetle is brilliant orange red coloured, about 7 mm long and 2.6 mm broad. The body has a very shining dorsal, smooth surface and its underside is entirely black and covered with short white soft hair like setae hence, the name is also given as red and black pumpkin beetle. The grub is small yellowish white with a brownish head and when full grown measured about 12 mm in length (Atwal and Dhaliwal, 2002) [2]. In India, two species of pumpkin beetle *viz*., red [*Aulacophora foveicollis* Lucas] and black [*A. atripennis*] were recorded. In Gujarat, only A. foveicollis was recorded. The adults feed on both surface of leaves. When the adult feed on the middle of the leaf, they produce a characteristic circular ring like injury. Young seedlings are particularly susceptible to damage as small numbers of beetles can cause total defoliation. The adult also feeds on flowers, anthers, pollens, stigma and ovary rendering the flowers incapable of fruiting and in some cases on young fruits, while the grubs attack the root, underground stem and leaves closely in touch with soil thereby lowering the yield substantially. The beetles also injure fruits, producing characteristic circular bands on the fruits, which help in rotting and subsequent attack of disease of the fruits (Atwal and Dhaliwal, 2002) [2]. The basic information on relative occurrence and population dynamics is necessary before deciding the strategy for management of any insect pests. With this background information, the present experiment was planned at the College Farm, College of Agriculture, Navsari Agricultural University, Bharuch, Gujarat.

2. Materials and Methods

Field experiment was conducted to study the population dynamics of *A. foveicollis* on cucumber during summer, 2020 at College Farm, College of Agriculture, Navsari Agricultural University, Bharuch in a plot size of 20 x 10m with a variety Cucumber, Gujarat Cucumber 1. The cucumber crop was sown during the third week of February. All recommended agronomical practices were followed to raise the cucumber crop. For recording observations, the whole plot was divided into five equal sectors and five plants were selected randomly from each sector. The observations of red pumpkin beetle were made from the whole plant. The observations were recorded at weekly interval starting from one week after germination till to the harvest of the crop. The whole experimental plot was kept free from any insecticidal application. The observations on different weather parameters, such as temperature, relative humidity, vapour pressure, bright sunshine hours, wind speed, evaporation *etc.* recorded at Regional Cotton Research Station, Navsari Agricultural University, Bharuch were used to correlate with the data on population of red pumpkin beetle.

3. Results and Discussion

3.1 Population Dynamics of *A. foveicollis*

The data on incidence of red pumpkin beetle, *A. foveicollis* on cucumber presented in Table 1 and also depicted in Fig. 1. The incidence of red pumpkin beetle was started from 3rd week of March (11th SMW, 4th WAS) and persisted in the field till 4th week of May (21th SMW, 14th WAS) in the range of 0.13 to 3.30 beetles/plant with an average of 1.49 beetle/plant. The population of red pumpkin beetle increased gradually up to the 2nd week of April (15th SMW, 8th WAS) and reached to the first peak (2.53 beetles/plant). The population slightly declined in next week and further increased during two weeks and reached to the second and the highest peak (3.30 beetles/plant) during 1st week of May (18th SMW, 11th WAS). Then after beetle population declined till to the crop maturity i. e. 4th week of May (21st SMW, 14th WAS). Thus, the incidence of red pumpkin beetle was observed higher (> 2.00 per plant) during 2nd week of April to 1st week of May (15th – 19th SMW, 8th – 12th WAS) in the field.

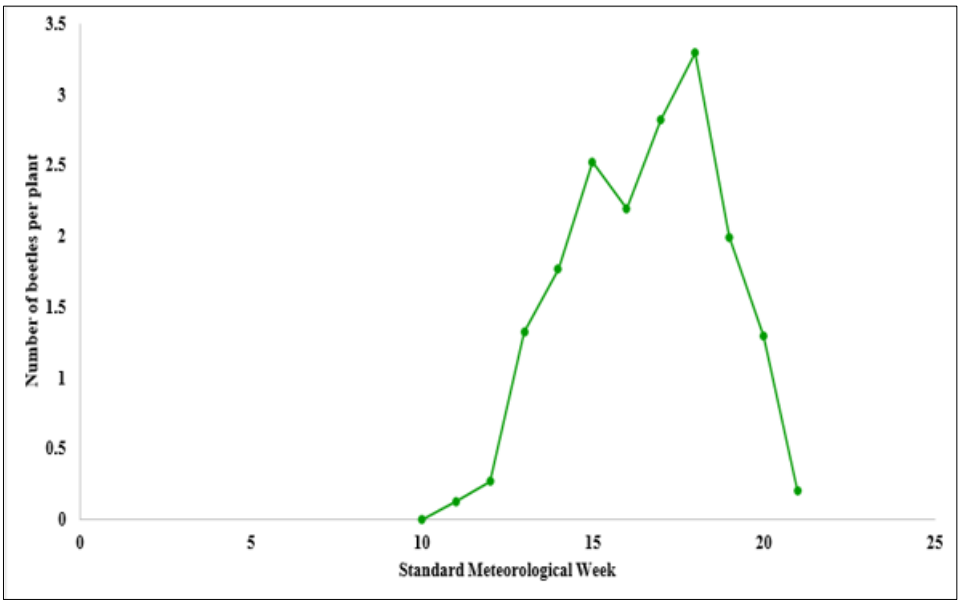

Fig 1: Population dynamics of *A. foveicollis* in cucumber

Table 1: Population dynamics of *A. foveicollis* in cucumber

Months and Weeks		Week after Sowing	Standard Meteorological Week	No. of red pumpkin beetle /plant
March	II	3	10	0.00
	III	4	11	0.13
	IV	5	12	0.27
	V	6	13	1.33
April	I	7	14	1.77
	II	8	15	2.53
	III	9	16	2.20
	IV	10	17	2.83
May	I	11	18	3.30
	II	12	19	2.00
	III	13	20	1.30
	IV	14	21	0.20
Mean				1.49

The fluctuation in red pumpkin beetle population in cucurbits was studied and reported by many research workers. Rathod and Borad (2010) [9] reported the higher incidence of red pumpkin beetle on cucurbitaceous vegetables during March to April in summer season. Khan *et al.* (2012) [4] concluded that the population of red pumpkin beetle on muskmelon, cucumber and sweet gourd was minimum in the month of March. Its population was increased gradually with the progress of time up to May and decreased thereafter. The highest population of red pumpkin beetle was recorded in the

month of May. At farmer's field, Bara (Hamirpur) the appearance of red pumpkin beetle on cucumber was noticed during 1st fortnight of March and reached to its peak during 3rd and 2nd weeks of April, 2009 and 2010, respectively (Khursheed *et al.*, 2013) [5]. At Sabour, Bihar, red pumpkin beetle infestation on cucumber was observed throughout the cropping period with highest population (2.80 to 3.40 adults/plant) during 1st week of May to 1st week of June (Saha *et al.*, 2018) [10]. Patel (2020) [8] at AAU, Anand (Gujarat) during summer, 2019 noticed that the activity of red pumpkin beetle commenced from 2nd week of March (10th SMW, 1st WAG) and persisted till 1st week of May (18th SMW, 9th WAG) on bottle gourd. The population of red pumpkin beetle reached to first and second peak during 5th week of March (13th SMW, 4th WAG) and 2nd week of April (15th SMW), respectively. Beetle population declined then after till to the crop maturity and escaped during 2nd week of May.

3.2 Correlation study

The data on population dynamics of red pumpkin beetle, *A. foveicollis* on cucumber were correlated with weather parameters to know the relationship between incidence of red pumpkin beetle and weather parameters. The results obtained are presented in Table 2. The results of correlation studies (Table 2) revealed that bright sunshine hours (r= 0.64906*) and evapotranspiration rate (r= 0.66310*) significantly positively correlated with population of red pumpkin beetle while, maximum temperature (r= 0.72768**) and wind speed (r= 0.79715**) showed highly significant and positively associated with the activity of red pumpkin beetle. It indicated that unit increase in above weather parameters were responsible for increase in population of red pumpkin beetle or vice a versa. The other weather parameters *viz*., minimum temperature (0.41939), morning relative humidity (0.34762), morning vapour pressure (0.50456), evening vapour pressure (0.18831), morning vapour pressure deficit (0.46702) and evening vapour pressure (0.41230) were positively correlated with population of red pumpkin beetle but the results were non-significant. Similarly, evening relative humidity (-0.31424) was negatively correlated with population of red pumpkin beetle but the results were non-significant. It showed the negligible influence of above weather parameters on the fluctuation of red pumpkin beetle population.

Table 2: Relationship between weather parameters and population of *A. foveicollis* in cucumber

Weather Parameters	correlation co-efficient (r)
Bright Sunshine Hours, hrday-1 (BSS)	0.64906*
Maximum Temperature, 0C (MaxT)	0.72768**
Minimum Temperature, 0C (MinT)	0.41939
Mean Temperature, 0C (MeT)	0.61340*
Morning Relative Humidity, % (MoRH)	0.34762
Evening Relative Humidity, % (EvRH)	-0.31424
Mean Relative Humidity, % (MeRH)	0.11260
Morning Vapour Pressure, mm of Hg (MoVP)	0.50456
Evening Vapour Pressure, mm of Hg (EvVP)	0.18831
Mean Vapour Pressure, mm of Hg (MeVP)	0.40530
Morning Vapour Pressure deficit, mm of Hg (MoVPD)	0.46702
Evening Vapour Pressure deficit, mm of Hg (EvVPD)	0.41230
Mean Vapour Pressure deficit, mm of Hg (MeVPD)	0.49185
Wind Speed, kmhr-1 (WS)	0.79715**
Evapotranspiration Rate (mm/day)	0.66310*

* Significant at 0.05% level of significance
** Significant at 0.01% level of significance

Many research workers studied and reported the correlation between weather parameters and red pumpkin beetle population. According to Rathod and Borad (2010) [9], significant positive correlation with maximum and minimum temperature, while maximum RH and rainy days had non-significant negative correlation; positively correlated with RH (Khan *et al.*, 2012) [4]; average minimum temperature showed significant negative correlation (Khursheed *et al.*, 2013) [5]; significant positive correlation with mean atmospheric temperature while negative with mean RH (Yadav *et al.*, 2017) [13]; positive correlation with mean temperature while negative significant correlation with mean RH and rainfall (Kumar and Saini, 2018) [6]; significant positive correlation with maximum and minimum temperature, whereas negative correlation with RH and rainfall (Saha *et al.*, 2018) [10]; significantly positively correlated with minimum temperature, while non- significantly negatively correlated with maximum temperature, evening RH, bright sun shine hours and rainfall on ridge gourd (Dubale *et al.*, 2018) [3]; wind speed showed highly significant negative association while, morning relative humidity showed non- significant positive correlation and other weather parameters *viz*., bright sunshine hours, maximum temperature, minimum temperature, evening relative humidity, morning vapour pressure and evening vapour pressure exhibited non-significant negative correlation (Patel, 2020) [8]. Thus, the above reports of Yadav *et al*. (2017) [13] and Saha *et al.* (2018) [10] gave strong conformity to the results of present findings. The reports of Rathod and Borad (2010) [9], Khan *et al*. (2012) [4] and Kumar and Saini (2018) [6] are more or less similar to the results of present findings. On the other hand the reports of Khursheed *et al.* (2013) [5], Dubale *et al*. (2018) [3] and Patel (2020) [8] are in opposition to present findings, it might be due to difference in seasons and location of the experiment.

4. Conclusions

The present investigations on "Population dynamics of red and black pumpkin beetle, *Aulacophora foveicollis* Lucas on cucumber, Cucumis sativus Linneaus" was carried out at College Farm, College of Agriculture, Navsari Agricultural University, Bharuch (Gujarat) during summer, 2020. The results obtained from the investigations concluded that the data on incidence of red pumpkin beetle, *A. foveicollis* on cucumber reached to the first (2.53 beetles/plant) and second

as well as the highest (3.30 beetles/plant) peak during 2nd week of April (15th SMW, 8th WAS) and 1st week of May (18th SMW, 11th WAS), respectively. The incidence of red pumpkin beetle was observed higher (> 2.00 per plant) during 2nd week of April to 1st week of May in the field.

5. Correlation study

Among the different weather parameters, bright sunshine hours (r= 0.64906*) and evapotranspiration rate (r= 0.66310*) significantly positively correlated while, maximum temperature (r= 0.72768**) and wind speed (r= 0.79715**) showed highly significant and positively associated with the activity of red pumpkin beetle. The other weather parameters had non-significant association with red pumpkin beetle population.

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