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Seasonal incidence of major insect pests of bottle gourd in relation with weather parameters under mid altitude hills of Meghalaya

Sandip Patra*, A. Ratankumar Singh, V.K. Verma, Debasish Chakraborty and Bijoya Bhattacharjee

ICAR Research Complex for North Eastern Hill Region, Umiam - 793 103, Meghalaya, India

ABSTRACT

Observations of red pumpkin beetle were recorded from five randomly selected plants from each replication at weekly basis after emergence of seedlings whereas fruit flies infestation was recorded during harvesting at weekly interval. Results revealed that population of red pumpkin beetle ranged from 0.50 to 4.83 beetles/plant with peak population of 4.83 beetles/plant on 20th SMW in 2019 and 4.50 beetles/plant on 31st SMW in 2020. Fruit infestation reached its peak on 33rd SMW with 77.78 and 71.43% fruit damage during 2019 and 2020, respectively. Temperature had positive influence whereas relative humidity and rainfall had negative influence on pest population. It was also observed that fruit infestation of bottle gourd was maximum during the month of August.

Key words : Bottle gourd, fruit flies, red pumpkin beetle, seasonal incidence, weather parameters.

INTRODUCTION

Bottle gourd, *Lagenaria siceraria* (Malina) Standl. is a common vegetable grown all over India and some other Asian countries. The bottle gourd fruit is used as cooked vegetable as well as it can be used for making different types of pickles and sweets. Total production of bottle gourd in India stand at 2,683 thousand MT from 157 thousand hectare with a productivity of 17.09 MT/ha while in Meghalaya bottle gourd occupied 0.75 thousand hectare and produced 9.36 thousand MT with a productivity of 12.48 MT/ha during 2017-18 (Anonymous, 2018). Cucurbitaceous vegetables encountered huge yield loss due to pest attack depending upon cucurbit species and the season in different parts of the world (Dhillon *et al*., 2005). Among them, red pumpkin beetle, *Aulacophora foveicollis* (Lucas) (Chrysomelidae, Coleoptera) and fruit flies (*Bactrocera* spp.) (Tephritidae, Diptera) are the major limiting factors for commercial cultivation of bottle gourd. Red pumpkin beetle is a widely distributed and serious polyphagous pest on cucurbit crops in India (Butani and Jotwani, 1984). It attacks on bottle gourd especially at early seedling stage and potential yield loss due to this beetle ranged 35 - 75% (Bhowmik and Saha, 2017). Cucurbit fruit fly, *Bactrocera cucurbitae* (Coquillett) is a notorious pest to the many cucurbit vegetables. The extent of yield loss caused by the pest to cucurbitaceous vegetables ranges from 30 - 100%, depending upon cucurbit species and the season (Dhillon *et al*., 2005).

Incidence and severity of pest attack varies from region to region depending upon the prevailing weather parameters. Abiotic factors *viz*., temperature, humidity and rainfall can affect reproduction, growth and survival of insect pests (Ajij *et al*., 2009). Pattern of pest incidence is changing under climate change scenario. The northeastern region of the country has also witnessed lots of changes in the key weather parameters which is having direct impact on the insect pests, disease vectors as well as diseases over the region (Chakraborty *et al*., 2014, 2017; Saha *et al*., 2016). Moreover, literatures on population dynamics of major pests of bottle gourd are scanty. Therefore, the present study focused to investigate the effect of weather parameters on seasonal incidence of major insect pests in bottle gourd under mid hills of Meghalaya.

*Corresponding author's E-mail : sandippatra47@gmail.com

MATERIALS AND METHODS

To study the seasonal incidence of major insect pests of bottle gourd, the field experiments were conducted at ICAR Research Complex for NEH Region, Umiam, Meghalaya during *kharif* seasons of 2019 and 2020. Bottle gourd (variety: Mahy Warad) seed was sown in 15 m^2 area with three replications during fourth week of April in 2019 and second week of May in 2020 with a spacing of 2.5 m × 2.0 m. Observations of red pumpkin beetle were recorded from five randomly selected plants from each replication at weekly basis after emergence of seedlings whereas fruit flies infestation was recorded during harvesting at weekly interval. Weather data were collected from Agro-meteorological observatory of ICAR Research Complex for NEH Region, Umiam, Meghalaya. Population of red pumpkin beetle and fruit flies infestation were correlated with weather parameters of preceding week of pest observation. Then, Pearson Two-Tailed correlation analysis was done using SPSS Software (Version 26.0) for calculation of correlation coefficient.

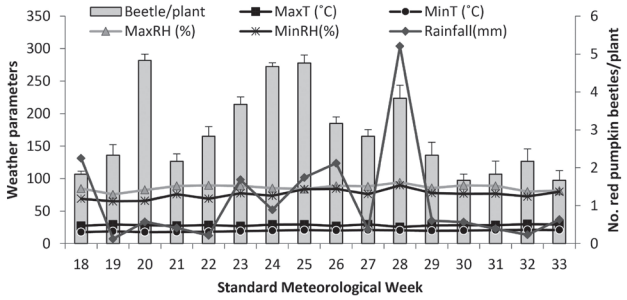

Fig. 1. Weather parameter and seasonal incidence of red pumpkin beetle during 2019.

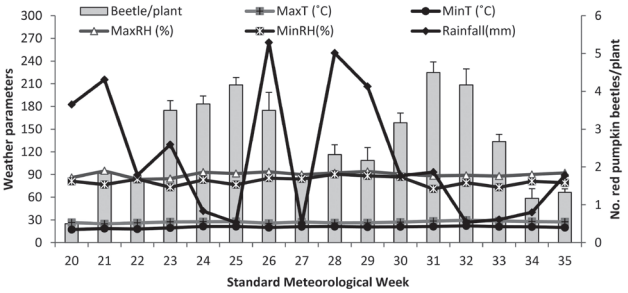

Fig. 2. Weather parameter and seasonal incidence of red pumpkin beetle during 2020.

RESULTS AND DISCUSSION

Seasonal incidence of red pumpkin beetle along with weather parameters during 2019 are predicted in Fig. 1. Results revealed that incidence of red pumpkin beetle started within a week after germination of seeds with 1.83 beetles/plant. Initially a peak of red pumpkin beetle was observed on 20th Standard Meteorological Week (SMW) (3rd week of May) with a highest population of 4.83 beetles/plant, then population of red pumpkin beetle decline gradually and again showed second peak during 24 - 25th SMW (2nd to 3rd week of June) with a population ranged of 4.67 - 4.76 beetles/plant. Results of population dynamics of red pumpkin beetle during 2020 are illustrated in Fig. 2. Incidences of red pumpkin beetle were noticed immediately after emergence of seeds with less population (0.5 beetle/plant). Population of red pumpkin beetle increased slowly and reached its first peak on 25th SMW (3rd week of June) with 4.17 beetles/plant and then decline its population and maintain moderate numbers for almost one month. After that population again increased from 30th SMW and reached its second peak with a highest population of 4.50 beetles/plant on 31st SMW (end of July to 1st week of August). During both the year population of red pumpkin were noticed till the maturity of the crop. The findings are in agreement with Rahman and Prodhan (2007) who revealed that the red pumpkin beetle occurred throughout the year and caused severe damage to the crops especially at seedling stage. The present findings are in analogous with the study of Butani and Jotwani (1984) who reported that the red pumpkin beetle resumes its activity in March and persist in the field till October. The peak period of activity of the beetle observe from April to June with declining of population from September onwards. Rahman and Prodhan (2007) revealed that the red pumpkin beetle found throughout the year and caused severe damage at seedling stage of the crops. Our results are in line with Bisen *et al*. (2018) who reported that the total population of red pumpkin beetles varied from 0.2 to 4.5 beetles/plant in ash gourd.

Seasonality and severity of fruit infestation due to fruit flies in bottle gourd during 2019 and 2020 are presented in Fig. 3. During 2019, fruit infestation due to fruit flies was recorded from first harvesting of the fruit of bottle gourd on 28th SMW with 14.28% fruit damage. Fruit infestation was increased gradually with due course of time and reached its highest level on 33rd SMW with

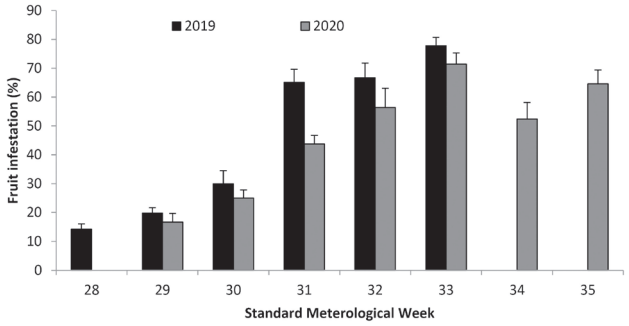

Fig. 3. Severity of fruit infestation of bottle gourd during 2019 and 2020.

77.78% fruit infestation. An average seasonal fruit infestation of 45.61% was recorded in 2019. During 2020, fruit infestation was recorded since harvesting started with 16.67% fruit damage. Then infestation of fruit increased steadily till 33rd SMW with a peak infestation of 71.43% fruit damage. Later, level of infestation decreased to some extent but persist till last harvesting of the fruits. Seasonal average fruit damage due to fruit flies was recorded as 47.18%. The present findings may be supported by Dhillon *et al*. (2005) who reported the extent of yield-loss to cucurbitaceous vegetables due to this pest ranged from 30 - 100% depending upon cucurbit species and the season. Meena *et al*. (2019) also reported the fruit fly infestation up to 50.53% in bottle gourd which may be augmented the present findings.

Correlation between insect population/insect damage and weather parameters is presented in Table 1. It was observed that maximum (r = 0.155 and 0.159) and minimum (r = 0.048 and 0.426) temperatures had non-significant positive influence and rainfall (r = -0.077 and -0.148) had non-significant negative influence on population buildup of red pumpkin beetles during both the years whereas the effects of relative humidity on population buildup could not properly understand. The present findings may be corroborated with the observation of Rajak (2000) who reported the positive association between red pumpkin beetle population and temperature while negative association with relative humidity. Kumar and Saini (2018) reported that the population of red pumpkin beetle exhibited positive association with mean temperature while significant negative association with mean relative humidity and rainfall. In case of fruit infestation, maximum (r = 0.393 and 0.913**) and minimum (r = 0.241 and 0.474) temperature showed positive effect and maximum (r = -0.507 and -0.778*) and minimum (r = -0573 and -0.709) relative humidity as well as rainfall (r = -0.480 and -0.941**) showed negative effect on fruit flies infestation in bottle gourd. Our findings are in concurrence with Ganie *et al*. (2013) who stated that the population of fruit flies was significantly correlated with the minimum and maximum temperature. Khan and Naveed (2017) reported a weak positive association between temperature and population of fruit fly whereas no correlation was observed with relative humidity. The present findings are also in agreement with Kannan and Venugopala (2006) and Win *et al*. (2014) who showed a positive association between fruit fly and temperature. Relative humidity and rainfall had non-significant negative association with fruit fly (Meena *et al*., 2019).

Therefore, date of sowing of bottle gourd may be manipulated to avoid the coincidence of fruiting stage during this period.

AUTHORS' CONTRIBUTION

Conceptualized the research (SP, ARS); Conducted field experiments (SP, ARS, VKV);

Table 1. Correlation coefficient (r) between weather parameters and pests incidence.

Weather parameter	Correlation coefficient (r)			
	Red pumpkin beetle		Fruit infestation	
	2019	2020	2019	2020
Maximum temperature (°C)	0.155	0.159	0.393	0.913**
Minimum temperature (°C)	0.048	0.426	0.241	0.474
Maximum RH (%)	-0.160	0.193	-0.507	-0.778*
Minimum RH (%)	-0.096	0.256	-0.573	-0.709
Rainfall (mm)	-0.077	-0.148	-0.480	-0.941**

**Significant at 0.01 level; *Significant at 0.05 level

Analyzed the data, tabulated and prepared the manuscript (SP, DC); Reviewed and edited the manuscript (BB); All authors read and approved the manuscript.

DECLARATION

The authors declare that they have no conflict of interests.

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