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SEASONAL INCIDENCE OF STRIPED FLEA BEETLE *PHYLLOTRETA STRIOLATA* F. ON CRUCIFEROUS CROPS IN NORTH KASHMIR

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ABSTRACT

This study is on the seasonal incidence of *Phyllotreta striolata* F. during 2015 and 2016, on turnip (*Brassica rapa var. rapa*), radish (*Raphanus sativus*) and cabbage (*B. oleracea* var. *capitata*). The incidence observed at weekly intervals was correlated with weather factors. The pest was first observed during 35th standard meteorological week (SMW), and in 2015, peak was observed on turnip (22.8 beetles/ plant) and radish (22.2 beetles/ plant) during the 40th SMW; during 2016, peak was (19.4 beetles/ plant on turnip; 22.2 beetles/ plant on radish) in the 39th SMW; and on cabbage, the peak incidence (4.8 beetles/ plant- 2015; 9.2 beetles/ plant- 2016) was during 38th SMW. The incidence showed a positive correlation with temperature and sunshine hours, and a negative correlation with relative humidity and rainfall.

Key words: *Phyllotreta striolata,* cruciferous crops, turnip, radish, cabbage, seasonal incidence, correlation, regression, temperature, relative humidity, rainfall, sunshine hours

Cruciferous crops are important group of rabi season crops in India (Kumaranag et al*.,* 2014). The productivity of these crops in India is low, as these are attacked by a complex of specialist and generalist insect pests. These include cabbage butterfly (*Pieris brassicae* L.); aphid *viz*., cabbage aphid (*Brevicoryne brassicae* L.) and mustard aphid (*Lipaphis erysimi* K.); diamondback moth (*Plutella xyllostella* L.); cabbage semilooper (*Thysanaplucia orichalcea*); flea beetles (*Phyllotreta* sp.); mustard sawfly (*Athalia colibri* F.); cut worm (*Agrotis ipsilon* H.) and leaf miner (*Chromotomyia horticola* G.) (Hooks and Johnson, 2003; Bana et al*.,* 2012). Flea beetles (Coleoptera: Chrysomelidae), belonging to the genus *Phyllotreta* are important economic pests of cruciferous crops. *Phyllotreta striolata* F., is prevalent as pest of cruciferous crops in Kashmir (Rasool et al., 2019). *Phyllotreta* spp., are found in all geographical regions (≥ 60%) including Palearctic, Afrotropical, and Nearctic regions (≥ 80%) (Gikonyo et al*.,* 2019). Factors like temperature, rainfall, relative humidity and other weather factors affect the seasonal incidence of insects. Hence, studying the effect of these factors on the seasonal incidence is important (Day, 2006; Shang et al*.,* 2010; Shang et al*.,* 2012). In IPM programme, need based application of insecticides is recommended for which monitoring and surveillance is necessary. During last few years, the vegetable growers of Kashmir valley are affected due to the damage caused by flea beetles, earlier considered as minor pests on these crops. These pests have increased their host range, as these are now attacking other fruit crops like apple, grapes, apricot etc. (Ahad et al*.,* 2011). Due to changing climatic conditions, the pests of minor importance are showing severity (Lone et al*.,* 2009). The present study evaluates the seasonal incidence of *P. striolata* on turnip, radish and cabbage crops, so that we can precisely predict its outbreaks.

MATERIALS AND METHODS

The field study was carried out at the Regional Research Station, Faculty of Agriculture, Wadura, Sher-e-Kashmir University of Agricultural Sciences and Technology, Kashmir (34°20′51″, 74°23′54″ E, 1586.8 masl). The crops were sown during rabi season, on 7th of August, 2015 and 2016, and raised as per the recommend agronomical practices of the Sher-e-Kashmir University of Agricultural Sciences and Technology, Kashmir. Recommended varieties of turnip (Purple Top White Bottom), radish (White Round) and cabbage (Golden Acre) were sown in plots of 4x 3 m with row to row spacing of 45 cm and plant to plant spacing of 30 cm. Only adult flea beetles were observed, and counts of *P. striolata* were recorded at weekly

intervals on five tagged plants from each replication (3 replications). From these mean numbers were worked out. *P. striolata* samples were sent to National Bureau of Agriculturally Important Resources, Bangalore for identification. Data on temperature (°C), relative humidity (%), sunshine (hrs.) and rainfall (mm) were obtained from the Meteorological Centre, Srinagar, India. The data was subjected to correlation and regression analysis, using the SPSS Software. Data were arc-sine transformed before performing ANOVA. Means were separated at $p<0.05$ and adjusted with least significant difference (LSD).

RESULTS AND DISCUSSION

Flea beetle species studied was identified as *Phyllotreta striolata* (Accession No. KU752539.1), with the characters of shiny black with yellowish elytral stripes incurved at the base not extending to the posterior end of the elytra. Seasonal incidence of *P. striolata* on turnip, radish and cabbage depicted by Fig. 1 indicate that its incidence commenced during 35th SMW- in 2015 it was @ 1.8, 2.6 and 1.8 beetles/ plant on turnip, radish and cabbage, respectively; and during 2016, it was 0.8, 0.6 and 0.8 beetles/plant, respectively. Initial occurrence on turnip, radish and cabbage was observed just after cotyledonary leaf emergence (35th SMW). Similar findings were reported by Patel and Purohit (2016) with flea beetles (*Chaetochnema indica*) on sorghum. Ulmer and Dosdall (2006) reported that progeny of the overwintering generation of *P. striolata*, already present in the surrounding fields attack newly emerged crops as soon as cotyledons emerge. During 2015, *P. striolata* on turnip and radish reached a peak incidence of 22.8 and 22.2 beetles/ plant, respectively during 40th SMW (1st week of October) at temperature, relative humidity, sunshine and rainfall of 19.06°C, 62.14 %, 8.15 hrs. and 0.00 mm, respectively. These results are in conformity with those of Samoon (2004) who observed maximum catches of *Psylliodes tenebrosus* in October during emergence of the crop.

However, on cabbage, *P. striolata* reached a peak level of 4.8/ plant during 38th SMW (3rd week of September) when temperature, relative humidity, sunshine and rainfall were 17.74 °C, 69.71%, 6.12 hr. and 8.28 mm, respectively; and then there was decline in all the three crops to counts of 0.8, 0.8 and 0.2 beetles/ plant on turnip, radish and cabbage, respectively, during 45th SMW; at this time temperature, relative humidity, sunshine and rainfall were 7.51°C, 80.28%, 0.68 hrs. and 2.8 mm, respectively. During 2016, the incidence on turnip and radish was maximum viz., 19.4 and 22.2 beetles/ plant, respectively during 39th SMW, when temperature, relative humidity, sunshine and rainfall were 19.61 °C, 63.35%, 8.44 hrs. and 0.00 mm, respectively. In case of cabbage, it was maximum (9.2 beetles/ plant) during 38th SMW at a temperature, relative humidity, sunshine and rainfall of 19.53°C, 63.99%, 7.54 hrs. and 0.00 mm, respectively. During 45th SMW, incidence declined to 3.4, 1.4 and 0.1 beetles/ plant on turnip, radish and cabbage, respectively at temperature, relative humidity, sunshine and rainfall of 10.31°C, 64.42%, 3.7 hrs and 0.00 mm, respectively.

The correlation coefficients (r) and regression equation for weekly *P. striolata* counts with weather parameters presented in Table 1. Reveal the following- during 2015, incidence on turnip, radish and cabbage showed a significant positive correlation with temperature (r = +0.607, +0.607, +0.819) and sunshine hrs. (r = +0.625, +0.660, +0.738) and a significant negative correlation with relative humidity-RH (r = -0.605, -0.659, -0.677); but with rainfall it was non-significant. During 2016, incidence on radish and cabbage with temperature was significantly positive (r

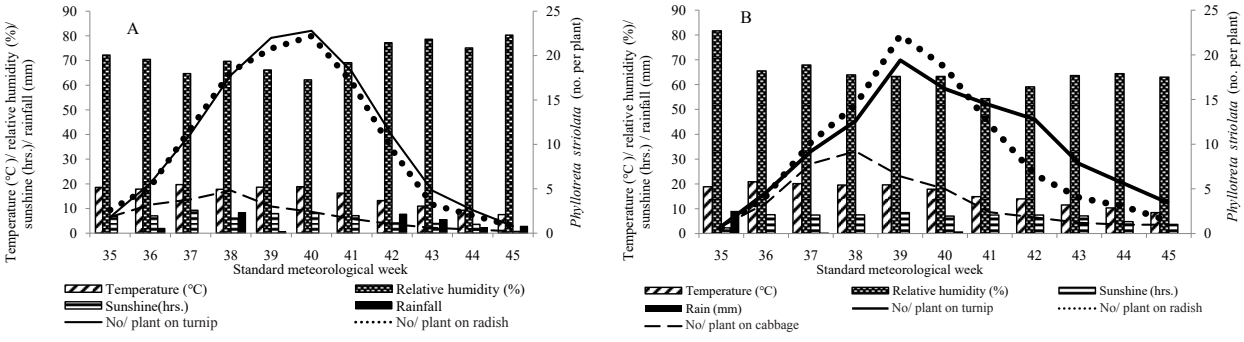

Fig. 1. Population dynamics of *P. striolata* on turnip, radish and cabbage- 2015 (A) and 2016 (B)

Table 1. Seasonal incidence of *P. striolata* on cruciferous crops (2015, 2016)

Year	Factors	Turnip		Radish		Cabbage	
		Correlation coefficient (r)	Regression equation	Correlation coefficient (r)	Regression equation	Correlation coefficient (r)	Regression equation
2015	Temperature (°C)	0.607**	y = 0.3158x + 11.903 R^2 = 0.3642	0.654**	y = 0.3473x + 11.734 R^2 = 0.4227	0.819*	y = 2.3663x + 10.403 R^2 = 0.6743
	Relative humidity (%)	-0.605**	y = -0.5332x + 77.180 R^2 = 0.5616	-0.659**	y = -0.5739x + 77.336 R^2 = 0.6243	-0.677*	y = -2.8362x + 77.309 R^2 = 0.524
	Sunshine (hrs.)	0.625**	y = 0.191x + 3.817 R^2 = 0.3906	0.660**	y = 0.2058x + 3.758 R^2 = 0.4352	0.738*	y = 1.2423x + 3.301 R^2 = 0.5449
	Rainfall (mm)	-0.088^{NS}	y = -0.0332x + 2.988 R^2 = 0.0077	-0.114^{NS}	y = -0.0442x + 3.085 R^2 = 0.013	0.001^{NS}	y = 0.0017x + 2.626 R^2 = 6E-07
2016	Temperature (°C)	0.490^{NS}	y = 0.2126x + 13.941 R^2 = 0.0802	0.655**	y = 0.2994x + 13.354 R^2 = 0.2441	0.787**	y = 1.0021x + 12.361 R^2 = 0.472
	Relative humidity (%)	-0.599^{NS}	y = -0.6841x + 71.237 R^2 = 0.3585	-0.369^{NS}	y = -0.3404x + 67.609 R^2 = 0.1363	-0.070^{NS}	y = -0.1554x + 65.161 R^2 = 0.0049
	Sunshine (hrs.)	0.772*	y = 0.2558x + 3.965 R^2 = 0.5961	0.687**	y = 0.1837x + 4.822 R^2 = 0.472	0.597^{NS}	y = 0.384x + 5.053 R^2 = 0.3559
	Rainfall (mm)	-0.474^{NS}	y = -0.2215x + 3.104 R^2 = 0.225	-0.333^{NS}	y = -0.1257x + 2.066 R^2 = 0.1112	-0.278^{NS}	y = -0.2522x + 1.871 R^2 = 0.0773

*Significant at p=0.01; **Significant at p= 0.05; NS (Non-significant).

= +0.655, +0.787); and a significant positive correlation was also observed between sunshine (hrs.) on turnip and radish (r = +0.772, +0.687); and non-significant values were observed on turnip, radish and cabbage with weather factors. Ghosh et al. (2006) also observed a significantly positive correlation between flea beetle incidence and temperature; however, Shukla and Kumar (2003) reported a negative correlation between *Phyllotreta cruciferae* incidence with temperature. Temperature plays an important role in determining growth rate of insects (Narayanasamy et al*.,* 2014). Patel and Purohit (2016) reported that flea beetle incidence was negatively influenced by morning and evening, and mean RH. The present results are in conformity with results of Yadav et al. (2010) who observed a significant positive correlation in radish with temperature (r = +0.890) and significant negative correlation (r = -0.830) with RH. In mustard it was a positive correlation (r = +0.293) with sunshine.

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