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RESEARCH PAPER

Population dynamics of insect pests associated with broccoli, *Brassica oleracea* var *italica* L. during *rabi*

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Abstract: Studies on the population dynamics of major insect pests on broccoli was conducted at Saidapur farm, Main Agricultural Research Station, University of Agricultural Sciences Dharwad during *rabi* 2022-23. The results revealed that the peak population of *Spodoptera litura* Fabricius was noticed during 52nd Standard Meteorological Week with population of 4.54 larvae per plant, *Plutella xylostella* Linnaeus reached its peak level during 2nd SMW (2nd week of January) with population of 4.31larvae per plant. The population of *Trichoplusia ni* Hubner and *Helicoverpa armigera* Hubner population were less predominant and reached their peak population of 1.82 and 1.68 larvae per plant, respectively. *Myzus persicae* Sulzer was persisted throughout the cropping period with maximum population (4.91/cm^2) during 52nd SMW. Correlation of insect pests of broccoli with weather parameters resulted that aphid's population was positively correlated (r=0.688) and defoliators like *S. litura* (r=-0.355) and *P. xylostella* (r=-0.123) were negatively correlated with maximum temperature.

Key words: Broccoli, Correlation, *Myzus persicae, Plutella xylostella*, Population dynamics, *Spodoptera litura*

Introduction

Broccoli, *Brassica oleracea* var. *italica* is a popular and nutritious vegetable crop that belongs to the family Cruciferae. It is known for its green, flowering heads and is widely cultivated in many parts of the world. Broccoli crop production involves several key aspects, including cultivation practices, growth requirements and pest management. Broccoli is highly nutrient rich exotic vegetable in cole crops and rich source of antioxidants, vitamins and minerals. It contains protein (3.3%), carbohydrates (5.5%), calcium (0.80 mg/100 g), phosphorus (0.79 mg/100 g), vitamin A (3500 IU), vitamin C (137 mg/100 g), vitamin B1 (0.05 mg/100 g) and vitamin B2 (0.12 mg/100 g). Compared to cauliflower, broccoli contains 4, 2 and 2 times more riboflavin, calcium and ascorbic acid, respectively (Hazra and Som,1999). Carotenoids are potent antioxidants that may reduce the incidence of coronary heart disease and cancer. It is consumed as a salad, cooked as a solo or mixed vegetable with potatoes and added to curries, soups and pickles. In India, broccoli is cultivated in hilly areas of Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir, Nilgiri Hills and Northern plains of India. Whereas, in Karnataka, its cultivation is negligible and is becoming popular in metropolitan cities and tourist places, especially around Bangalore, Belgaum as there is good market access in Goa and Gokarna in Karnataka in winter months besides, Bangalore and their metropolitan cities. Like other cruciferous crops, insect pests cause damage to broccoli and play a major role in reducing the yield. Aphid *Brevicoryne brassicae* Linnaeus, diamond back moth, *Plutella xylostella* Linnaeus, leaf webber *Crocidolomia binotalis* Zeller, tobacco leaf eating caterpillar *Spodoptera litura* F., semilooper, *Trichoplusiani* Hubner, head borer, *Hellulaundalis* F., tussock moth. *Orgyia* spp and *Bagrada hilaris* Burmeister and generally noticed on all cruciferous crops. Investigations on the seasonal incidence of insect pests and their natural enemies in relation to weather parameters can be effectively utilized in timely management of insect pests and to formulate effective pest management strategies.

Material and methods

The present investigation on population dynamics of insect pests on broccoli (*Brassica oleracea* var. *italica* L.) was carried out at Saidapur farm, Main Agricultural Research Station, University of Agricultural Sciences Dharwad during *rabi* season from last week of November to first week of March 2022-23. Five plants were selected randomly from each quadrate and were tagged to record observations. Incidence of insect pests and their natural enemies at weekly interval were recorded from 7 days after transplanting till the harvest of the curd. The data collected on pest population at weekly interval is statistically analyzed to determine its correlation with the prevailing field climate factors, including maximum temperature, minimum temperature and relative humidity, using the correlation coefficient (r). This analysis aimed to investigate the collective influence of various weather parameters on the populations of both pests and predators in broccoli crops during the *rabi* season of 2022-23.

Sucking pests

Aphids: From each 5 randomly selected plants aphid count was made by selecting 1 cm^2 leaf area.

Lepidopteran pests

The number of larvae of *S. litura*, *T. ni*, *P. xylostella* and *H. armigera* per plant were recorded from 5 randomly selected plants from each quadrate at weekly interval from commencement of pests till the harvest of curd.

Results and discussion

Tobacco leaf eating caterpillar, *Spodopetra litura*

The population of *S. litura* gradually increased from first week of December (49th SMW), with an initial count of 1.35 per plant and reached its peak of 4.54 per plant by the last week of December (52nd SMW). Subsequently, the population gradually declined, ultimately reached nil (Table 1). The incidence of *S. litura* population showed a non-significant positive correlation with all the parameters except for the maximum temperature. There was non-significant and negative correlation between *S. litura* population and maximum temperature (r =-0.355) (Table 2). Present findings are in line with Isaq *et al*. (2023) who reported that tobacco caterpillar population commenced from 46th SMW and reached its peak level of 2.4 larvae/plant. Dasharath (2018) who reported that the incidence of tobacco leaf eating caterpillar on broccoli was noticed from 49th SMW with population of 0.30 larvae/plant and reached the peak of 3.5 larvae/plant. Similarly, Aiswarya (2017) recorded the incidence of tobacco leaf eating caterpillar during 46th SMW with a mean population of 2.60 larvae/plant. Thereafter, population gradually increased to reach peak level of 3.26 larvae/plant and also reported that maximum temperature (r= -0.176) had non-significant negative influence on *S. litura*.

Diamond back moth (DBM), *Plutella xylostella*

Incidence of DBM commenced from 1st week of December (49th SMW) with mean larval number of 1.13 per plant, which gradually increased and reached its peak during 2nd SMW (2nd week of January) with population of 4.31 per plant. Further decline in population was noticed and it was prevailed throughout the cropping period (Table 1). Except for maximum relative humidity, all weather parameters had a negative correlation with the population of DBM. Its incidence demonstrated non-significant negative relationship with maximum temperature (r=-0.123), minimum relative humidity (r = -0.210) and rainfall (r = -0.770). On the other hand, it exhibited a significant negative correlation with minimum temperature (r= -0.508) and non-significant positive correlation with maximum relative humidity (r= 0.030), as depicted in Table 2. The findings are in agreement with Isaq *et al*. (2023) observed that population of DBM started from 2nd week of November and gradually increased and reached the peak of 4.40 larvae/plant and also reported that correlation of DBM revealed that maximum temperature (r=-0.04) and relative humidity (r=-0.264) indicated non-significant negative correlation. Dasharath (2018) who reported that the incidence of DBM on broccoli was noticed from 51st SMW with population of 0.20 larvae/plant respectively and later population increased and reached the peak of 0.50 larvae/plant, respectively. Similarly, Aiswarya (2017) recorded the incidence of DBM during 47th SMW with mean population of 4.60 larvae/plant. Thereafter, population gradually increased to reach peak level of 4.90 larvae/plant.

Cabbage semilooper, *Trichoplusia ni*

Trichoplusia ni larvae appeared during second week of November (48th SMW) with 0.32 larvae per plant. Thereafter the peak population of 1.82 larvae per plant were noticed during 51st SMW (third week of December). Then the population gradually declined from 1st SMW onwards reaching nil at 4th SMW (Table 1). A non-significant negative correlation was observed between *T. ni* and maximum temperature (r = -0.379) and anon-significant positive correlation was observed between the incidence *T. ni* and minimum temperature (r = 0.099), minimum relative humidity (r=0.481) and rainfall (r=0.121). Whereas, significant and positively correlated with maximum relative humidity (r = 0.557) (Table 2). Present findings are in line with Dasharath (2018) who reported that the incidence of semilooper on broccoli was noticed from 50th SMW with population of 1.20 larvae/plant and later population increased and reached the peak of 1.50 larvae/plant. Similarly, Aiswarya (2017) recorded the incidence of cabbage semilooper during 47th SMW with mean population of 1.06 larvae/plant. Thereafter, population gradually increased to reach peak level of 1.20 larvae/

Table 1. Population dynamics of insect pests on broccoli during *rabi* 2022-23

SMW		47	48	49	50	51	52	1	2	3	4	5	6	7	8	9
Defoliators (No.of larvae per plant)	*S.litura*	0	0	1.35	2.47	3.16	4.54	2.76	3.28	2.31	1.83	1.52	1.05	0	0	0
	P.xylostella	0	0	1.13	2.89	2.43	3.92	4.02	4.31	3.37	3.01	2.73	2.52	1.95	1.4	10.94
	T.ni	0	0.32	0.67	1.06	1.82	1.24	0.71	0.28	0.18	0	0	0	0	0	0
	H.armigera	0	0	0	0	0	0	0.52	0.83	1.06	1.68	0.62	0.35	0.33	0	0
Sucking pests (No.per m^2 leaf area)	*Myzus persicae*	0	0	0	0.98	1.58	4.91	3.47	4.56	4.01	3.89	4.43	3.67	3.1	2.87	2.35

*SMW=Standard Meteorological Week

Table 2. Correlation between insect pests population and weather parameters during *rabi* 2022-23

Insect pests	Temperature(°C)		Relative humidity (%)		Rain fall (mm)
	Maximum	Minimum	Maximum	Minimum	
S. litura	-0.355	0.127	0.127	0.007	0.013
P.xylostella	-0.123	-0.508*	0.030	-0.210	-0.077
T. ni	-0.379	0.099	0.557*	0.481	0.121
H. armigera	-0.070	-0.584*	-0.183	-0.183	-0.264
Myzus persicae	0.684**	-0.446	-0.613*	-0.833**	-0.451

* Correlation significance at the 0.05 level **Correlation significance at the 0.01 level

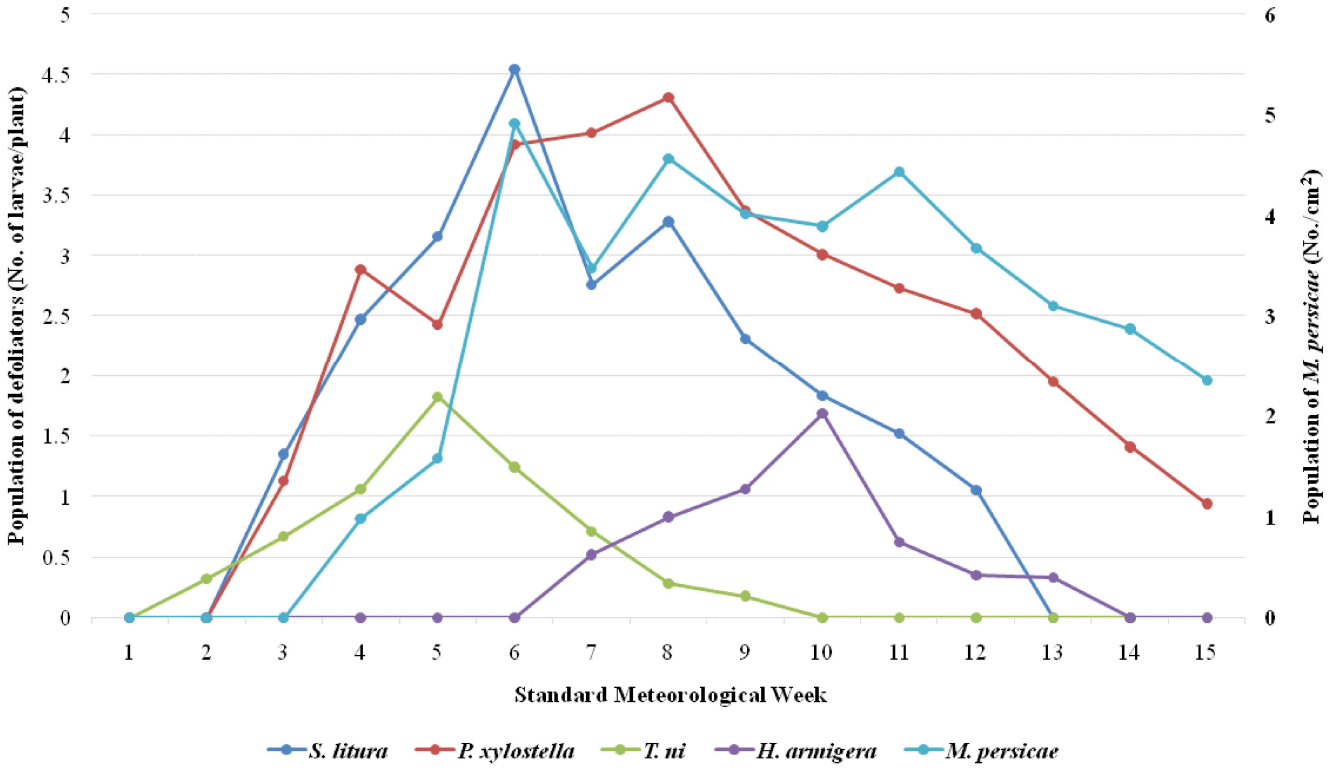

Fig.1 Population dynamics of major insect pests of broccoli during *rabi* 2022-23

plant and the semi looper population had significant negative correlation with maximum temperature (r = -0.030).

Gram pod borer, *Helicoverpa armigera*

Helicoverpa armigera population ranged from 0.33 to 1.68 larvae per plant and it became noticeable during the first week of January (1st SMW) with larval count of 0.52 per plant. Further the population slowly increased till the fourth week of January (4th SMW) and reached its peak of 1.68 larvae per plant. Subsequently, the population gradually declined and reached nil by the end of the cropping period (Table 1). Incidence of *H. armigera* showed a significant negative correlation with minimum temperature (r = -0.584) and a non-significant negative correlation with all other parameters *viz*., maximum temperature (r=0.070), maximum relative humidity (r=-0.183), minimum relative humidity (r =0.183) and rainfall (r=-0.264) (Table 2). These are in agreement with the findings of Debbarma *et al*. (2017) in his survey conducted in Theni as well as in Dindigul districts reported incidence of the *P. xylostella* Linnaeus was most prevalent pest on cauliflower. The others pests recorded during the survey were *viz*., *H. armigera* Hubner, *S. litura* Fabricius, *C. binotalis* Zeller, *T. ni* Hubner, *H. undalis* Fabricius *etc*.

Aphids, *Myzus persicae*

Thepopulation of *M. persicae* under open field was commenced from 50th SMW (2nd week of December) with a population of 0.98 per cm² and there was a gradual increase in population to reach its peak of 4.91 per cm² during 52nd SMW (4th week of December). Thereafter gradual decline in population was observed to nil (Table 1). The population of *M. persicae* indicated a highly significant positive correlation with maximum temperature (r- 0.684). Conversely, it exhibited a non-significant negative correlation with minimum temperature (r=-0.446) and rainfall (r=-0.451). Additionally, a highly significant negative correlation was observed with both maximum relative humidity (r=-0.613) and minimum relative humidity (r=-0.833), as detailed in Table 2. Dasharath (2018) who reported that the incidence of aphid on broccoli was noticed from 46th SMW with population of 8.25/leaf, later population increased and reached the peak of 128.40/leaf. Isaq *et al*. (2023) and Venkateswarlu *et al*. (2011) reported that aphids (*Lipaphis erysimi*) first appeared in 52nd and 51th SMW during 2009-2010 and 2010-2011, respectively. The population of aphid reached at peak of 169.9 aphids per plant in 10th SMW during 2009-2010, while it was 157.8 per plant in 8th SMW during 2010-2011 and also reported that aphid population was positively correlated with maximum temperature (r=0.275) and significant and negatively (r=-0.640) correlated with relative humidity. Yadav *et al*. (2019) reported that aphid population was positively correlated with the maximum temperature.

Conclusions

Field study on population dynamics of major insect pests of broccoli revealed that among the defoliators recorded *viz*., *S. litura* and *P. xylostella* were more predominant and *T.ni* and *H.armigera* population were less predominant and among the sucking pests, *M.persicae* was predominant and was persisted

throughout the cropping period. Correlation study revealed that aphid population was significant and positively correlated with maximum temperature and non-significant and negative correlation was observed between maximum temperature and defoliators *viz*., *S. litura*, *P. xylostella*, *T. ni* and *H armigera*.

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