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Research Article

EFFECT OF WEATHER PARAMETERS ON THE INCIDENCE OF MAJOR INSECT PESTS OF CABBAGE

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Abstract- The cabbage crop was found to be infested by five major pests *i.e.,* tobacco caterpillar, *Spodoptera litura* (Fab.), diamond back moth, *Plutella xylostella* (Linn.), cabbage semilooper, *Thysanoplusia orichalcea* (Fab.), flea beetle, *Phyllotreta chotanica* (Duviv) and the aphids, *Lipaphis erysimi* (Kalt.) and *Myzus persicae* (Sulze). The tobacco caterpillar and diamond back moth population was maximum in the first and second week of February (5th and 6th SMW); the cabbage semilooper population was at its peak in the last week of January (4th SMW); the flea beetle population was maximum in the fourth week of February (8th SMW) and the aphid population was maximum in the second and third week of February (6th and 7th SMW) during *rabi* 2012-13 and 2013-14, respectively. Abiotic factors like temperature, relative humidity, extent and distribution of rainfall, influenced the infestation and stabilization of various insect pests in cabbage.

Keywords- Major insect pests, Cabbage, Weather parameters

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Introduction

Among the crucifers, cabbage is grown more or less in all the states of India and is used as salad, boiled vegetable, in curries, pickling as well as dehydrated vegetable. The total area under cabbage cultivation in India is 372.40 million hectares with an annual production of 8534.20 million tonnes, while in Rajasthan the total area and production is 1188 ha and 5690 metric tonnes [1], respectively. Cabbage crop is attacked by a number of insects *viz*., The important insect pests that infest cabbage crop are the tobacco caterpillar (*Spodoptera litura* Fab.), diamond back moth (*Plutella xylostella* L.), cabbage semilooper (*Trichoplusia ni* Hubner), painted bug (*Bagrada hilaris* Burmeister and *Bagrada cruciferarum* Kirk.), cabbage butterfly (*Pieris brassicae* L.), flea beetle (*Phyllotreta cruciferae* Goeze), aphids (*Lipaphis erysimi* Kalt. and *Brevicoryne brassicae* L.), Cabbage leaf webber (*Crocidolomia bionotalis* Zell) and the mustard saw fly (*Athalia lugens proxima* Klug.) [2,3]. The knowledge of seasonal incidence of insect pests at different growth stages of cabbage crop will be helpful in evolving proper management schedule. The information on seasonal incidence was however, generated by many workers [4-6] from different regions of India. The changing cropping pattern, monoculture, intensive cultivation of high yielding varieties, negligence of crop rotation, non-adoption of summer ploughing besides negation of other cultural practices have aggravated the pest problem. The present research undertaken to study their effects of weather parameters like temperature, relative humidity, extent and distribution of rainfall, etc. influenced the infestation and stabilization of various insect pests in cabbage. Therefore, attempts were made to find out the relationships between pests population and the climatological factors.

Materials and Methods

The experiment was carried out during *rabi,* 2012-13 & 2013-14 in cabbage variety Golden Acre. The experimental site is situated at Horticulture Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. Weekly meteorological data were obtained from the Meteorology Unit at the Instructional farm of the College. All the normal agronomic practices were followed for raising the crop. The experiment was replicated thrice in a randomized block design. The observation on tobacco caterpillar, *Spodoptera litura* (Fab.), diamond back moth, *Plutella xylostella* (Linn.), cabbage semilooper, *Thysanoplusia orichalcea* (Fab.) and flea beetle, *Phyllotreta chotanica* (Duviv), direct visual counting method was used and population was recorded on ten plants selected randomly from each replicate at weekly intervals during morning hours between 6:30 a.m. to 8.00 a.m. when most of the insect species are less active.. The estimation of aphid population was based on the numerical count method as described by Heathcoate (1972) [7]. The population was counted only on three leaves. For recording the aphid population marked leaves were grasped at the petiole by thumb and fore finger and twisted until entire underside of the leaves were clearly visible. The aphid population was counted weekly with the help of magnifying lens. The data collected on various aspects were subjected to the statistical analysis and population build up was correlated with abiotic factors.

Results and discussion

The quantitative abundance of insect pests infesting blackgram revealed that tobacco caterpillar, *Spodoptera litura* (Fab.), diamond back moth, *Plutella xylostella* (Linn.), cabbage semilooper, *Thysanoplusia orichalcea* (Fab.), flea beetle, *Phyllotreta chotanica* (Duviv) and the aphids, *Lipaphis erysimi* (Kalt.) and *Myzus persicae* (Sulze) were recorded under the prevailing agro-climatic conditions of the region [Table-1 & 2].

The infestation of tobacco caterpillar, *Spodoptera litura* (Fab.) was commenced in the second week of December during both the years and reached to its peak with mean population of 5.40 and 5.80 larvae/plant in the 5th SMW during *rabi* 2012-13 and 2013-14, respectively, the mean temperature and relative humidity during peak period of infestation was 17.95^{0}C and 51.60 per cent, 17.40^{0}C and 58.70 per cent during *rabi* 2012-13 and 2013-14, respectively. Tobacco caterpillar population

exhibited a negative correlation with mean temperature and relative humidity during *rabi* 2012-13 and 2013-14. Kumar *et al.* (2007) [8] reported the infestation of tobacco caterpillar during the last week of January in late season cabbage crop. The infestation of diamond back moth, *Plutella xylostella* (Linn.) was commenced in the second week of December during both the years and reached to its peak with mean population of 5.40 and 5.20 larvae/plant in the 5th and 6th SMW during *rabi* 2012-13 and 2013-14, respectively, the mean temperature and relative humidity during peak period of infestation was 17.95^{0}C and 51.60 per cent, 18.30^{0}C and 50.10 per cent during *rabi* 2012-13 and 2013-14, respectively. Dimond back moth population exhibited a positive correlation with mean temperature and negative correlation with mean relative humidity during *rabi* 2012-13 and 2013-14. Similar findings were reported earlier by Shukla and Kumar (2004), Goud *et al*. (2006) and Bana *et al*. (2012) [5, 9, 10].

Table-1 *Seasonal incidence and population dynamics of major insect pests of cabbage ecosystem during rabi 2012-13*

SMW	Dates of Observation	Abiotic factors						Mean population/plant				
		Temperature (°C)			Relative Humidity (%)			Tobacco caterpillar	Diamond back moth	Cabbage semilooper	Flea beetle	Aphid
		Max	Min	Mean	Max	Min	Mean					
50	14/12/2012	27.90	10.30	19.10	81.10	27.10	54.10	1.10	1.20	1.30	0.70	0.00
51	21/12/ 2012	25.90	7.70	16.80	82.00	25.40	53.70	1.80	1.70	1.90	1.00	5.20
52	28/12/2012	25.30	7.00	16.15	76.10	27.10	51.60	2.20	2.00	2.30	1.10	8.40
1	04/12/2013	23.00	4.40	13.70	85.60	30.70	58.15	2.80	2.20	2.60	1.70	15.30
2	11/01/2013	25.10	6.40	15.70	75.30	21.10	48.20	3.10	3.50	3.00	1.90	16.60
3	18/01/2013	23.90	7.50	15.70	80.30	28.10	54.20	4.50	3.60	3.30	2.20	20.80
4	25/01/2013	22.70	4.00	13.35	74.90	19.60	47.25	4.60	3.70	4.00	2.10	29.70
5	01/02 2013	25.90	10.00	17.95	76.30	26.90	51.60	5.40	5.40	3.40	2.50	34.10
6	08/02/2013	24.30	7.60	15.95	78.00	28.10	53.05	4.80	4.50	3.00	2.80	40.80
7	15/02/2013	26.30	11.70	19.00	83.30	34.30	58.80	4.50	4.40	2.80	3.70	28.20
8	22/02/2013	26.80	10.60	18.70	82.00	31.00	56.50	3.60	4.30	2.40	3.90	22.60
9	29/02/2013	29.00	8.70	18.85	65.90	18.40	42.15	2.40	4.10	1.40	2.50	12.40
Seasonal Mean		**25.51**	**7.99**	**16.74**	**78.40**	**26.48**	**52.44**	**3.40**	**3.38**	**2.62**	**2.17**	**21.28**
Coefficient of correlation (r_1) between Mean Atmosphere Temperature and pest population								-0.192	0.170	-0.596*	0.293	-0.181
Coefficient of correlation (r_2) between Mean Relative Humidity and pest population								0.084	-0.165	0.044	0.179	0.060

SMW- Standard meteorological week *r-value significant at p= 0.05

Table-2 *Seasonal incidence and population dynamics of major insect pests of cabbage ecosystem during rabi 2013-14*

SMW	Dates of Observation	Abiotic factors						Mean population/plant				
		Temperature (°C)			Relative Humidity (%)			Tobacco caterpillar	Diamond back moth	Cabbage semilooper	Flea beetle	Aphid
		Max	Min	Mean	Max	Min	Mean					
50	14/12/2012	27.40	8.20	17.80	81.70	25.80	53.75	1.20	1.30	1.00	0.50	0.00
51	21/12/ 2012	24.70	7.00	15.85	85.60	32.80	59.20	2.10	1.50	1.60	0.90	7.40
52	28/12/2012	22.20	7.70	14.95	84.17	42.20	63.18	2.60	2.10	2.00	1.20	10.40
1	04/12/2013	22.20	7.50	14.85	77.40	44.10	60.75	3.40	2.50	2.40	1.50	11.40
2	11/01/2013	21.50	6.40	13.95	84.30	43.40	63.85	3.70	2.70	2.90	1.90	18.30
3	18/01/2013	22.20	6.60	14.40	88.00	47.10	67.55	4.20	3.30	3.20	2.20	25.50
4	25/01/2013	21.40	9.70	15.55	89.70	49.10	69.40	4.80	3.50	3.80	2.40	28.60
5	01/02 2013	26.30	8.50	17.40	87.70	29.70	58.70	5.10	4.50	3.20	2.60	24.90
6	08/02/2013	26.80	9.80	18.30	76.80	23.40	50.10	5.80	5.20	2.90	2.80	22.50
7	15/02/2013	23.00	7.90	15.45	85.10	36.00	60.55	5.20	4.00	2.10	3.10	42.40
8	22/02/2013	25.50	11.00	18.25	85.60	40.00	62.80	3.50	3.70	1.70	4.10	23.90
9	29/02/2013	26.80	8.80	17.80	86.60	31.30	58.95	2.50	2.90	1.20	3.20	15.10
Seasonal Mean		**24.17**	**8.26**	**16.21**	**84.39**	**37.08**	**60.73**	**3.67**	**3.10**	**2.33**	**2.20**	**20.94**
Coefficient of correlation (r_1) between Mean Atmosphere Temperature and pest population								-0.026	0.309	-0.393	-0.382	-0.107
Coefficient of correlation (r_2) between Mean Relative Humidity and pest population								0.078	-0.110	0.446	0.113	0.330

SMW- Standard meteorological week

The incidence of cabbage semilooper, *Thysanopulsia orichalcea* (Fab.) was initiated from the second week of December and reached to its peak with a mean population of 4.00 and 3.80 larvae/plant in the 4th SMW during *rabi* 2012-13 and 2013-14, respectively, the mean temperature and relative humidity during peak period of infestation was 13.35^{0}C and 47.25 per cent, 15.55^{0}C and 69.40 per cent during *rabi* 2012-13 and 2013-14, respectively. Cabbage semilooper population exhibited a negatively correlated with mean temperature and positive correlation with mean relative humidity during *rabi* 2012-13 and 2013-14. The present findings are in agreement with Kumar *et al.* (1998) [11], who reported that the cabbage semilooper occurs early in the season during vegetative growth stage.

The infestation of flea beetle, *Phyllotreta chotanica* (Duviv) was commenced in the second week of December during both the years and reached to its peak with mean population of 3.90 and 4.10 beetle/plant in 8th SMW during *rabi* 2012-13 and 2013-14, respectively, the mean temperature and relative humidity during peak period of infestation was 18.70^{0}C and 56.50 per cent, 18.25^{0}C and 62.80 per cent during *rabi* 2012-13 and 2013-14, respectively. Flea beetle population exhibited a positive correlation with mean temperature and relative humidity during *rabi* 2012-13 and 2013-14. Boopathi and Pathak (2012) [12], reported maximum infestation of flea beetle in the month of February.

The infestation of aphid, *Lipaphis erysimi* (Kalt.) was commenced in the third week of December during both the years and reached to its peak with mean population of 40.80 and 42.40 aphid/plant in the 6th and 7th SMW during *rabi* 2012-13 and 2013-14, respectively, the mean temperature and relative humidity during peak period of infestation was 15.95^{0}C and 53.05 per cent, 15.45^{0}C and 60.55 per cent during *rabi* 2012-13 and 2013-14, respectively. Aphid population exhibited a negative correlation with mean temperature and positive correlation with mean relative humidity during *rabi* 2012-13 and 2013-14. Swami (1995), Rao and Lal (2005) and Rustamani *et al.* (2005) [13, 3, 14], reported that incidence of aphid on cabbage crop started from third week of December and gradually increased. The population peak was recorded in last week of January and first week of February.

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Abbreviations:
SMW = Standard Meteorological Week, ha = hectare, ^{0}C = degree centigrade

Ethical approval: This article does not contain any studies with humanparticipants or animals performed by any of the authors.

Conflict of Interest: None declared

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