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Seasonal incidence of aphids infesting cabbage, *Brassica oleracea* var. *capitata* L.

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Abstract

The field experiment was conducted to study the seasonal incidence of aphids infesting cabbage during *rabi* season of 2020-21 and 2021-22 at Central Experiment Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The population of aphids ranged from 0.32 to 73.00 and 2.48 to 22.44 aphids per plant during *rabi* 2020-21 and *rabi* 2021-22, respectively. During both seasons, peak population of aphids was observed in 7th SMW. However, pooled data on both years revealed that the aphid population was in the range of 0.16 to 47.72 aphids per plant, whereas peak population was observed during 7th SMW. The population of aphids was found to be increased continuously till the harvesting of cabbage. During *rabi* 2020-21, the mean population of aphids exhibited positive significant correlation with wind speed. While, other weather parameters were non-significantly correlated with aphid population. During *rabi* 2021-22, mean population of aphids had positive significant correlation with wind speed and bright sunshine hours, whereas negative significant correlation with morning and evening relative humidity. Remaining parameters were non-significantly correlated with aphid population. The pooled data of aphid population indicated positive significant correlation with wind speed and bright sunshine hours while negative significant correlation with morning and evening relative humidity. Other weather parameters were non-significantly correlated with aphid population.

Keywords: Seasonal incidence, correlation, aphids

Introduction

Cabbage (*Brassica oleracea* var. *capitata* L.) is an important vegetable crop mainly grown in winter season. It is from a group of plants known as the cole crops. The word 'cole' is abbreviated from latin word 'Caulis' which means 'stem'. It is the member of brassicaceae family. The origin of cabbage is Europe. It consists of thick leaves overlapping tightly on growing main bud called 'head'. It is commonly used as cooked vegetable and also used in salad, pickle etc. It is rich in minerals like potassium (170 mg), calcium (40 mg), phosphorus (26 mg), sodium (18 mg), magnesium (12 mg) and vitamin C (36.6 mg). It also contains carbohydrates (5.8 g), fibre (2.5 g), protein (1.8 g) and water (92.18 g) per 100 gram. It prevents oxidative stress, induce detoxification enzymes, stimulate the immune system and reduce cancer risk (Sanlier and Guler, 2018) [12]. Cabbage is an introduced vegetable crop in India, but it has adapted itself well and is grown all over the country. In India, it is cultivated on an area of 412.40 thousand hectare with total production of 9560.01 thousand MT and average productivity is 23.18 MT/ha. While in Maharashtra, it is cultivated on an area of 10.85 thousand hectare with total production 180.11 thousand MT and productivity is 16.6 MT/ha in 2020-21 (Anonymous, 2021) [17].

India ranks second in cabbage production after China. In India, West Bengal (2321.15 thousand MT) is major cabbage producing state followed by Odisha (1130.54 thousand MT), Madhya Pradesh (911.53 thousand MT) and Assam (739.89 thousand MT). In case of productivity of cabbage, Tamil Nadu (67.74 MT/ha) ranks first followed by Uttar Pradesh (33.56 MT/ha) and Telangana (32.99 MT/ha) (Anonymous, 2021) [17].

Although cabbage being one of the important crop, it suffers economic losses due to infestation of various insect pests. The insect pests namely, aphids (*Lipaphis erysimi* Kalt. and *Brevicoryne brassicae* Linn.), diamond back moth (*Plutella xylostella* Linn.), cabbage borer (*Hellula undalis* Fabr.), cabbage looper (*Trichoplusia ni* Hb.), leaf webber (*Crodidolomia binotalis* Zell.), painted bug (*Bagrada cruciferarum* Kirk.), cabbage butterfly (*Pieris brassicae* Linn.) and tobacco caterpillar (*Spodoptera litura* (Fabricius)) etc. are of more significance on cabbage which affect yield and quality throughout the country (Yadav and Malik, 2014) [16].

Among these insect pests, aphids (Aphididae: Homoptera) are one of the important pest damage to cabbage every year. Aphids are serious during February–March months. As a result of sucking of vital sap from the tissues, plants remain stunted resulting in poor head formation. Aphids also produce honey dew which makes the plant sticky and favour the growth of sooty mold with black coating thus hindering the photosynthesis and plant growth (Sardana *et al.*, 2017) [13]. It is very important to reduce the losses caused by pests to improve quality and increased yield. The meteorological factors play important role in the seasonal incidence of pests. For the proper management of pests, it is necessary to study seasonal incidence of pests and their relation with weather parameters. The knowledge of seasonal incidence of insect pests at different growth stages of cabbage crop will be helpful in evolving proper management schedule. Keeping all the above points in view, the experiment was conducted.

Materials and Methods

To study the seasonal incidence of aphids infesting cabbage, the field experiment was conducted at Vegetable Improvement Scheme, CES, Wakawali, DBSKKV, Dapoli during *rabi* season of 2020-21 and 2021-22. The details of experiment are given below

Experimental Details

Location	:	Vegetable Improvement Scheme, CES, Wakawali, DBSKKV, Dapoli.
Season	:	<i>Rabi</i> 2020-21, 2021-22
Crop	:	Cabbage
Variety	:	Golden Acre
Spacing	:	60 cm x 45 cm
Plot Size	:	11.25 m x 1.2 m
Date of transplanting	:	10 th December (<i>rabi</i> 2020-21) 14 th December (<i>rabi</i> 2021-22)

Method of recording observations

Seedlings of the cabbage (Golden Acre, 35 days old) were transplanted in the well prepared field. All recommended cultivation practices were followed. The experimental plot was kept unsprayed throughout the cropping season. Twenty-five plants were selected randomly for observation. The observations of aphids infesting cabbage were recorded at weekly interval (Standard Meteorological Week) in the cropping season.

The population of sucking pests infesting cabbage other than aphids was not observed throughout the cropping season. The observations regarding aphids were recorded at weekly interval during morning hours. The estimation of aphid population was based on the numerical count. The twenty-five plants of cabbage were randomly selected from plot. Total number of aphids on twenty five plants was counted visually with the help of magnifying lens at weekly interval and converted into aphids per plant. For recording the aphid population at early plant stage, leaves were grasped at the petiole by thumb and four fingers and twisted until entire underside of the leaves clearly visible. In the advance plant growth stage, these observations were recorded on outer leaves only.

In order to study the influence of abiotic factors (meteorological parameters) on incidence of aphids, the correlations were worked out with weekly weather data *viz.*, average maximum and minimum temperatures, morning and

evening relative humidity, wind speed and bright sunshine hours available at the meteorological observatory, at Irrigation Water Management Scheme, Central Experiment Station, Wakawali, Tal. Dapoli, Dist- Ratnagiri. The data were used to work out correlation between aphid population and weather parameters.

Statistical analysis

The data on aphids infesting cabbage were averaged. The correlation was worked out between population of aphids and weather parameters by using Microsoft Excel.

Results and Discussion

The data on seasonal incidence of aphids infesting cabbage during *rabi* season of 2020-21, 2021-22 and pooled are presented in Table 1 and graphically depicted in Fig. 1.

During *rabi* 2020-21, the incidence of aphids ranged from 0.32 to 73.00 aphids per plant. The incidence of aphids started in 52nd SMW (24th December to 31st December) *i.e.* 0.32 aphids per plant. The incidence was found to be increased continuously from 3rd SMW till the harvesting of crop. The maximum aphid population (73.00 aphids per plant) was noticed in 7th SMW (12th February to 18th February).

The data of *rabi* 2021-22 showed the population of aphids was in between the 2.48 to 22.44 aphids per plant. The incidence was noticed from 2nd SMW (8th January to 14th January) *i.e.* 2.48 aphids per plant. Then, incidence was found to be increased continuously till the harvesting of cabbage. The maximum aphid population (22.44 aphids per plant) was observed in 7th SMW (12th February to 18th February).

The pooled data of both years indicated that the incidence of aphid population was in the range of 0.16 to 47.72 aphids per plant. The incidence was noticed from 52nd SMW (24th December to 31st December) *i.e.* 0.16 aphids per plant. Then incidence was found to be increased continuously till the harvesting. The maximum population of aphids (47.72 aphids per plant) was observed in 7th SMW (12th February to 18th February).

The results of present findings are corroborative with results of earlier workers. Oduor *et al.* (1996) [9] stated that pest infestation on cabbage occurred within 14 days after the seedlings were transplanted and persisted thereafter. Diamondback moth (*P. xylostella*) and cabbage aphid (*B. brassicae*) were the major pests. Kumawat (2004) [5] observed that aphid population was appeared in third week of November and remained till harvesting. The peak aphid population was recorded in the second week of February on the crop transplanted in October. Mandal and Patnaik (2008) [7] reported that peak incidence of *B. brassicae* was noticed during January and February (119.69-263.18 nymphs and adults/3 leaves). Venkateswarlu *et al.* (2011a) [15] noticed mustard aphid from last week of December. The peak incidence of mustard aphid (169.9 aphids /plant) was recorded during 2nd week of March. Jat *et al.* (2017a) [4] observed that 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. Sain *et al.* (2017) [11] recorded incidence of cabbage aphid, *L. erysimi* in two different *Brassica spp.* *viz.*, *B. oleracea* and *B. juncea*. The initial population of aphid appeared in first week of November (44th SMW) and reached its maximum level of 95.40 aphids/plant during third week of December (50th SMW). Bhagat *et al.* (2018a) [2] studied the seasonal incidence of aphid (*B.*

brassicae) infesting cabbage. The peak population of aphid was observed 172.5 aphids/20 plants and 140.45 aphids/20 plants in month of February during both years (2015-16 and 2016-17), respectively. Gautam *et al.* (2019) [3] observed that the *L. erysimi* (Aphididae: Homoptera) was the most devastating pest of mustard. They observed the aphid attacked generally during December and continues till March. Lal *et al.* (2020) [6] observed that cabbage aphids were initiated in December. The major insect pests of cabbage were reached their peak mean populations during February to March. Sahu *et al.* (2020b) studied the seasonal prevalence of cabbage aphid, *L. erysimi* in relation to weather parameters. The incidence of aphids were initiated during fourth week of November (48th SMW) with 2.10 aphids/head and its feeding continued on the lower surface of leaves till harvesting of the crop. There was increase in population in subsequent weeks and the peak aphid population was recorded in first week of February (5th SMW) with a population of 34 aphids/plant.

Table 1: Seasonal incidence of aphids infesting cabbage during *rabi* 2020-21, *rabi* 2021-22 and pooled data

SMW	Mean population per plant		
	2020-21	2021-22	Pooled
52	0.32	0.00	0.16
1	7.76	0.00	3.88
2	6.08	2.48	4.28
3	8.28	5.28	6.78
4	16.16	9.84	13.00
5	18.44	12.28	15.36
6	51.08	16.92	34.00
7	73.00	22.44	47.72
SD(±)	25.65	8.21	16.73
SMW- Standard Meteorological Week			

Correlation between aphid population and weather parameters

The data on correlation coefficient of mean population of aphids in relation to different weather parameters during *rabi* 2020-21, *rabi* 2021-22 and pooled are shown in table 2.

During *rabi* 2020-21, the mean population of aphids exhibited positive correlation with maximum temperature, wind speed and bright sunshine hours, while negative correlation with minimum temperature, morning and evening relative humidity. The wind speed (r=0.918) recorded positive significant correlation with mean population of aphids. Other parameters were non-significantly correlated with aphid population.

The mean population of aphids during *rabi* 2021-22 showed positive correlation with maximum temperature, wind speed and bright sunshine hours, while negative correlation with minimum temperature, morning and evening relative humidity. The aphid population had positive significant correlation with wind speed (r=0.793) and bright sunshine hours (r=0.852), whereas negative significant correlation with morning (r=-0.825) and evening (r=-0.891) relative humidity. Remaining parameters were non-significantly correlated with aphid population.

The pooled data of aphid population indicated positive correlation with maximum temperature, wind speed and bright sunshine hours, while negative correlation with minimum temperature, morning and evening relative humidity. The aphid population had positive significant correlation with wind speed (r=0.884) and bright sunshine hours (r=0.708) while negative significant correlation with

morning relative humidity (r=-0.856) and evening relative humidity (r=-0.828).

The results of present findings are in conformity with findings of earlier workers. Venkateswarlu *et al.* (2011a) [15] observed mustard aphid had significant positive correlation with wind and sunshine hours whereas, significant negative correlation with morning and evening relative humidity. Other weather parameters did not have significant influence with aphids. Mandavi Pal and Singh (2012) [8] recorded the population of *B. brassicae* was positively correlated to maximum temperature and negatively correlated to relative humidity. Bhagat *et al.* (2018a) [2] revealed that minimum temperature had non-significantly negative association with aphids infesting cabbage. Sreedhar *et al.* (2021) [14] examined the incidence of aphid to different abiotic factors on Indian mustard (*Brassica juncea* v.Rohini). The correlation studies showed the aphid population was positively correlated with maximum temperature and negatively correlated with maximum relative humidity and positively correlated with minimum relative humidity. The aphid population showed significant correlation with minimum temperature and maximum relative humidity during 2016-17.

Table 2: Correlation coefficient of mean population of aphids infesting cabbage in relation to different weather parameters during *rabi* 2020-21, *rabi* 2021-22 and pooled

Weather parameters	Correlation coefficient (r)		
	2020-21	2021-22	Pooled
Temp. Max.	0.418	0.404	0.567
Temp. Min.	-0.501	-0.566	-0.529
RH-I	-0.217	-0.825*	-0.856*
RH-II	-0.560	-0.891*	-0.828*
WS	0.918*	0.793*	0.884*
BSS	0.508	0.852*	0.708*
*Significant at 0.05 level		r=0.707	

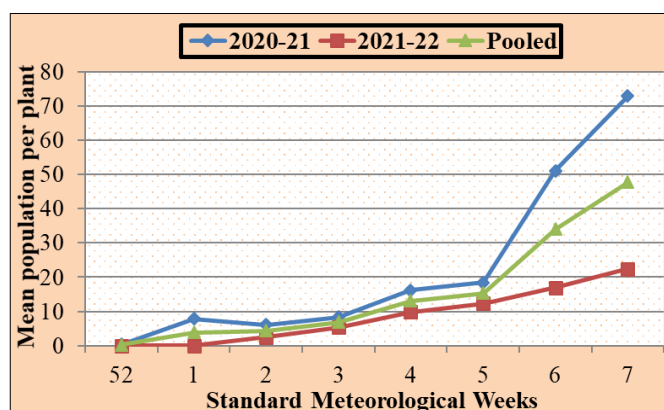


Fig 1: Seasonal incidence of aphids infesting cabbage during *rabi* 2020-21, *rabi* 2021-22 and pooled data

Conclusion

The meteorological factors play an important role in the seasonal incidence of the pests. The study on seasonal incidence revealed that the population of aphids was found to be increased continuously till the harvesting of cabbage. The pooled results revealed that the aphid population had significant positive correlation with wind speed and bright sunshine hours and significant negative correlation with morning and evening relative humidity.

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