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Research Article

STUDY FOR POPULATION OF APHIDS AND WHITEFLY ON POTATO

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Abstract: Two experiment was carried out at the Adisaptagram Block Seed Farm, Department of Agriculture, Govt. of West Bengal during *rabi* season from the month of November, 2007 to March, 2008. Eight potato germplasms were taken for resistance or tolerance to insects population and their management under field condition with randomized block design. Kufrichandramukhi, Kufrijyoti, Atlantika and Kufripukhraj were highly infested by both aphids and white fly .

Keywords: Aphids, Whitefly, Insect, Population, Control, Leaves, Screening, Potato

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Introduction

In India, West Bengal is an important state for vegetable production including potato. Vegetables being rich sources of vitamins and minerals along with medicinal values have become integral part of the human diet by all classes of the society throughout the world. So, considering food and nutritional security, vegetables play an important role in Indian agriculture. Due to improved methods of vegetables cultivation, the production has been increased tremendously, and as the crop can be stored for longer periods its usefulness has been increased prodigiously. Vegetables are increasing in number all over the world and approximately 500 million tonnes produced with annual growth rate of 2% [2]. Now a day, India occupies the fourth position in area (1.40 mill. ha) under potato cultivation and third position in potato production (23.91 mill. tonnes) in the world [1]. In vegetables, more than 40% yield loss is caused due to pest attack [5]. [11] reported that more than more than 100 anthropods attack potato crop from various part of the world. But [3] and [7] gave a comprehensive list of insect and non-insect pests damaging this crop in the context of India. To minimize the crop loss due to attack of various insect pests the farmers use insecticides not only as control tactics, but also as an assurance against uncertain pest's attacks. The health hazards among the living organisms are increased due to indiscriminate use of insecticides. Therefore a thorough study regarding the incidence varieties are very much essential to control these pests effectively.
Therefore in the present investigation germplasm screening against important pests of potato have been studied for their varietal performance. Apart from these, efforts were also being given to workout the most effective way of managing these pests with a view to safer human toxicity and other ecosystem.

Materials and methods

The two experiment was setup at Adisaptagram Block Seed Farm, Department of Agriculture, Govt. of West Bengal, Hooghly District from November to March 2007-2008. The plots are situated at 81.5°N latitude and 35.5° longitude and 9.75 m above mean sea level in altitude. The experiment was laid in Randomized Block Design (RBD) with eight potato germplasms *viz*., Kufri chipson-1, Kufri chipsons-2, Kufrichadramukhi, Kufrijyoti, Kufrianand, Atlantic, Kufrisurya and Kufripankaj, each replicating for thrice.

Plot size was kept at 6m x 2m with 60 cm inter row and 20 cm intra row spacing. The incidence pattern of aphid and white fly on different potato germplasms was recorded at weekly intervals. For aphid population, 100- leaf index method [10] was followed and for the white fly population was recorded from one upper, one middle and one lower compound leaves of 15 plants selected, randomly in each plot.

Results and Discussion

Eight- potato germplasms were screened for resistance or tolerance to different insect pests under field condition. During this study, more or less similar type of insect's pests were found to infest different potato germplasms throughout the present investigation, which mentioned in [Table-1].

Table-1 List of insects infesting at farm

Common name	Scientific Name	Family	Order
1.Aphids	a) *Myzus persicae* (Sulzar)	Aphidae	Hemiptera
	b) *Aphis gossypii* Glover		
2.White fly	*Bemisia tabaci* Genn.	Aleyrodidae	Hemiptera

Incidence pattern of aphid on different potato germplasms

Both the species of aphids *viz. Myzus persicae* (Sulzer) and aphids *gossypii* Glover were recorded to infest all the potato germplasms under field condition. But their incidence pattern was not similar in all cases and the detailed observation on the population development of aphids in different potato germplasms for the season from November, 2007 to March, 2008 has been presented in [Table-2]. The data, shown in the [Table-2] indicated that the pest was first appeared on the crop in second week of December in the germplasms Kufri Chandramukhi (0.33) and Kufri Jyoti (2.66) while in case of others, the infestation of the crop was mainly started inbetween third and fourth week of December, expectKufriChipsona-1 (1.00) Kufri Anand (3.00), it was first observed during first week of January in both germplasms where as in case of Kufri Chipsona -2 (0.66) it was appeard from second week of January. Similarly, in most of the potato germplasms, the pest population reached its critical level (20aphids/100 compound leaves) during third to fourth week of January, when temperature ranged from 11.96-27.80°C, Relative Humidity (RH) 42.14-95.30%, bright

Table-2 Population dynamics of aphid on different potato germplams during 2007-2008

Different germplasms	Population of the pest on different dates of observation													
	December,2007				January,2008				February,2008				March,2008	Mean
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	
Kufri Chipsona-1	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.00 (0.88)	3.33 (1.95)	7.66 (2.77)	14.00 (3.74)	46.33 (6.81)	81.66 (9.04)	118.00 (10.86)	123.33 (11.11)	108.00 (10.39)	38.72
Kufri Chipsona-2	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.66 (1.05)	2.00 (1.38)	6.68 (2.58)	12.33 (3.51)	39.66 (6.30)	87.00 (9.33)	141.33 (11.89)	113.33 (10.66)	31.02
KufriChandramukhi	0	0.33 (0.88)	2.66 (0.71)	8.00 (2.91)	21.66 (4.71)	43.66 (6.65)	77.33 (8.79)	121.66 (11.03)	163.00 (12.77)	219.33 (14.81)	297.33 (17.24)	251.66 (15.86)	158.00 (12.57)	104.02
Kufri Jyoti	0	2.66 (1.77)	4.33 (2.20)	6.00 (2.54)	17.33 (4.22)	34.66 (5.93)	56.33 (7.51)	113.66 (10.66)	167.33 (12.94)	201.00 (14.18)	276.33 (16.62)	218.66 (14.79)	173.33 (13.17)	97.81
Kufri Anand	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	3.00 (1.86)	7.33 (2.80)	13.66 (3.70)	31.00 (5.57)	57.66 (7.59)	81.33 (9.02)	102.66 (10.13)	118.00 (10.86)	107.33 (10.36)	40.15
Atlantic	0	0.00 (0.71)	4.66 (2.27)	8.33 (2.97)	20.66 (4.60)	45.00 (6.75)	88.33 (9.40)	132.33 (11.50)	191.66 (13.84)	224.33 (14.98)	229.33 (15.14)	226.66 (15.06)	193.33 (13.90)	104.97
Kufri Surya	0	0.00 (0.71)	0.00 (0.71)	0.33 (0.88)	2.33 (1.68)	4.00 (2.11)	11.66 (3.41)	23.33 (4.83)	48.66 (6.98)	102.00 (10.10)	144.33 (12.01)	172.66 (13.14)	106.33 (10.31)	47.35
KufriPukhraj	0	0.00 (0.71)	0.00 (0.71)	4.00 (2.11)	16.33 (4.10)	29.33 (5.46)	65.66 (8.10)	89.33 (9.45)	141.00 (11.87)	202.66 (14.24)	225.00 (15.97)	194.66 (13.95)	118.33 (10.88)	85.86
	Source of variation													
	Date of observation				Variety				Date of observation and variety					
SEm(±)	0.74				1.04				2.08					
CD 0.05	2.07				2.93				5.86					

Figures in parenthesis are square root transformed values

Table-3 Population dynamics of white fly on different potato germplasms during 2007-2008

Different germplasms	Population of the pest on different dates of observation													
	December,2007				January,2008				February,2008				March,2008	Mean
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	
Kufri Chipsona-1	0	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.00 (1.41)	5.33 (2.31)	7.66 (2.77)	12.33 (3.51)	10.33 (3.21)	8.66 (2.94)	4.33 (2.08)	2.66 (1.63)	4.10
Kufri Chipsona-2	0	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.33 (1.52)	4.33 (2.08)	5.00 (2.23)	7.66 (2.77)	10.33 (3.21)	7.00 (2.64)	4.33 (2.08)	2.66 (1.63)	3.35
KufriChandramukhi	0	0	2.33 (1.68)	5.66 (2.48)	8.66 (3.02)	10.33 (3.21)	13.66 (3.70)	16.33 (4.04)	21.00 (4.58)	17.33 (4.16)	15.66 (3.96)	10.00 (3.16)	7.66 (2.77)	9.89
Kufri Jyoti	0	0	2.33 (1.68)	6.33 (2.61)	7.66 (2.86)	12.33 (3.51)	16.66 (4.08)	18.33 (4.28)	23.00 (4.80)	19.66 (4.43)	15.66 (3.96)	8.33 (2.89)	7.66 (2.77)	10.61
Kufri Anand	0	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.00 (1.41)	5.33 (2.31)	8.66 (2.94)	13.33 (3.65)	14.66 (3.83)	11.33 (3.37)	5.66 (2.38)	3.33 (1.82)	4.94
Atlantic	0	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.00 (1.00)	3.00 (1.72)	5.66 (2.37)	10.00 (3.16)	12.66 (3.56)	15.66 (3.96)	19.00 (4.36)	23.00 (4.80)	6.92
Kufri Surya	0	0	0.00 (0.71)	0.00 (0.71)	1.66 (1.46)	3.66 (1.91)	5.33 (2.29)	8.66 (2.94)	13.00 (3.60)	10.66 (3.27)	8.33 (2.89)	4.66 (2.16)	3.66 (1.91)	4.58
KufriPukhraj	0	0	0.00 (0.71)	0.66 (1.05)	3.33 (1.95)	5.66 (2.38)	10.33 (3.21)	13.66 (3.70)	17.33 (4.16)	19.66 (4.43)	11.33 (3.36)	5.66 (2.18)	4.33 (2.08)	7.07
	Source of variation													
	Date of observation				Variety				Date of observation and variety					
SEm(±)	0.03				0.04				0.08					
CD 0.05	0.08				0.12				0.24					

Figures in parenthesis are square root transformed values

Table-4 Population dynamics of aphid on potato under different treatment schedules during 2007-2008

Treatment Schedules	Population of the pest on different dates of observation												Mean	Percent decrease over control
	December,2007				January,2008				February,2008					
	I	II	III	IV	I	II	III	IV	I	II	III	IV		
T_1	0	2.00 (1.56)	6.00 (2.54)	11.50 (3.46)	19.00 (4.36)	35.00 (5.91)	79.25 (8.90)	98.75 (9.93)	161.25 (12.69)	196.00 (13.99)	261.50 (16.17)	203.25 (14.26)	89.45	-
T_2	0	0.00 (0.71)	0.00 (0.71)	2.00 (1.56)	4.25 (2.05)	8.00 (2.82)	4.25 (2.05)	16.25 (4.03)	6.25 (2.49)	10.50 (3.24)	12.25 (3.49)	20.00 (4.47)	6.97	92.20
T_3	0	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	4.00 (2.00)	6.50 (2.55)	4.50 (2.12)	15.75 (3.97)	4.50 (2.12)	6.50 (2.55)	7.25 (2.69)	14.25 (3.77)	5.27	94.10
T_4	0	0.00 (0.71)	5.25 (2.39)	12.25 (3.57)	14.25 (3.77)	23.25 (4.81)	12.50 (3.53)	17.50 (4.18)	6.75 (2.59)	13.75 (3.71)	16.00 (3.99)	22.75 (4.77)	12.04	86.53
T_5	0	0.00 (0.71)	4.00 (2.11)	9.75 (3.19)	16.75 (4.09)	31.25 (5.59)	15.50 (3.93)	18.75 (4.33)	21.75 (4.66)	28.50 (5.33)	25.50 (5.05)	37.00 (6.08)	17.39	80.55
SEm(±)	-	0.06	0.06	0.09	0.08	0.06	0.08	0.05	0.07	0.05	0.06	0.04	-	-
CD 0.05	-	0.18	0.19	0.29	0.24	0.78	0.24	0.16	0.23	0.16	0.18	0.14	-	-

Figure in parenthesis are square root transformed values

Table-5 Population dynamics of white fly on potato under different treatment schedules during 2007-2008

Treatment Schedules	Population of the pest on different dates of observation												Mean	Percent decrease over control
	December,2007				January,2008				February,2008					
	I	II	III	IV	I	II	III	IV	I	II	III	IV		
T_1	0	0	3.00 (1.86)	5.50 (2.34)	10.25 (3.20)	13.25 (3.64)	14.75 (3.83)	18.25 (4.27)	20.25 (4.49)	17.25 (4.15)	12.50 (3.60)	10.50 (3.24)	10.45	-
T_2	0	0	0.00 (0.71)	0.75 (0.87)	2.00 (1.39)	3.00 (1.69)	2.75 (1.65)	4.00 (2.00)	2.50 (1.57)	3.25 (1.79)	1.50 (1.40)	3.00 (1.72)	1.89	81.91
T_3	0	0	0.00 (0.71)	0.50 (0.71)	1.50 (1.21)	2.50 (1.54)	1.00 (0.10)	2.00 (1.39)	1.25 (1.10)	1.75 (1.31)	0.25 (0.83)	2.00 (1.39)	1.06	89.85
T_4	0	0	2.75 (1.79)	3.00 (1.73)	5.25 (2.28)	10.75 (3.27)	5.25 (2.28)	4.75 (2.17)	3.00 (1.71)	3.75 (1.92)	3.50 (1.99)	4.00 (2.00)	3.83	63.34
T_5	0	0	1.50 (1.40)	3.50 (1.87)	5.75 (2.39)	11.25 (3.35)	5.75 (2.39)	5.00 (2.23)	3.50 (1.84)	3.50 (1.84)	4.25 (2.17)	4.75 (2.17)	4.06	61.14
SEm(±)	-	-	0.07	0.11	0.11	0.14	0.08	0.11	0.11	0.12	0.11	0.11	-	-
CD 0.05	-	-	0.22	0.34	0.38	0.43	0.25	0.34	0.35	0.38	0.33	0.34	-	-

Figures in parenthesis are square root transformed values

sunshine duration (BSS) 4.25-7.8 hr with very little precipitation, during crop season November, 2007 to March 2008. But in Kufri Chipsona -1 the critical level was attained in first week of February, while in Kufri Chipsona -2, the threshold limit was crossed far later than the others *i.e*., in second week of February. However, the maximum population of the pest was recorded in between third and fourth week of February in all the potato germplasms, under the climate condition of 13.08-29.72°C temperature, 39.0- 96.0% RH, 6.4-8.20 hr BSS with very little precipitation. By this time, the aphid population was found highest in Kufri Chandramukhi (297.33 per 100 compound leaves), which was followed by kufrijyoti (276.33), kufripukhraj (255.0), Atlantic (229.33), Kufri Surya (172.66), Kufri Chipsona-2 (141.33), Kufri Chipsona-1 (123.33) and Kufri Anand (118.0) respectively. After attaining the peak, the population of the pest was started to decline till the dehaulming of the crop in first week of March. In this case, the potato germplasms according to their descending order of aphid infestation were as follows Atlantic (104.97), KufriChandramukhi (104.92), Kufri Jyoti (97.81), KufriPukhraj (85.86), Kufri Surya (47.35), Kufri Anand (40.15), Kufri Chipsona-1(38.72) and Kufri Chipsona-2 (31.02), respectively. Considering the incidence pattern as well as mean population of the pest on different potato germplasms, it may concluded that the maximum incidence of aphid was recorded in Atlantic, KufriChandramukhi and Kufrijyoti germplsms of potato, whereas lower population was found on Kufri Chipsona-2, Kufri Chipsona-1 Kufri Anand andKufri Surya on the KufriPukhraj maintained moderate aphid population throughout the tenure of present investigation. The low aphid population in KufriChipsona-2 was maybe due to its morphological characters, since the leaves of the plant were rough, course and narrower as well as smaller than other germplasms. In addition, this, the taller habit of the plant, perhaps made an unfavourable microclimate conditions within the crop canopy as the pest population was positively correlated with relative humidity and negatively with minimum temperature during *rabi* season [12]. Konar and Paul, (2004) [6] also reported that KufriChandramuukhi, Kufri Jyoti and Kufri Badsha were susceptible to the pest as compared to Kufri Anand. In addition to this, it has also been observed that the bottom leaves of most of the germplasms maintained the highest aphid population, while the upper leaves maintained the lowest, suggesting that the aphids have marked preference for screening leaves under shady condition [8].

Incidence pattern of white fly on different potato germplasms

During the present investigation the infestation of white fly (*Bamisia tabaci*, Genn.) was recorded throughout the crop season in all the potato germplasms, but its incidence pattern was not uniform in all the cases. From the month of November, 2007 to March 2008, the initiation of infestation of the aleurodid was observed during third and fourth week of December in case of germplasms like KufriChandramukhi (2.33), Kufri Jyoti (2.33, and KufriPukhraj (0.66), But in case of other germplasms *viz*. Kufri Surya (1.66) Kufri Chipsona-1 (2.00),Kufri Chipsona-2 (2.33), Kufri Anand (2.00) and Atlantic (1.0) infestation started during first and second week of January [Table-3]. The peak population of the pest was recorded at first and second week of February in seven germplasms *viz*., Kufri Chipsona-1,KufriChandramukhi,Kufri Jyoti, Kufri Surya, Kufri Chipsona-2,Kufri Anand and KufriPukhraj and it may be due to favourable weather conditions 26.11-28.16°C maximum temperature, 10.50-11.54°C minimum temperature, 94.28-94.71% maximum relative humidity, 39.0-43.28% minimum relative humidity, 8.33-8.96 hr bright sunshine with very little rainfall prevailed during this period of the crop season and maximum vegetative phase of the crop as their population was favoured by bulking stage of the crop characterized by more foliage[4]. Thereafter, the whitefly population was gradually decreased in the sepotato germplasms till full maturity of the crop. But in remaining one germplasms *i.e*., Atlantic in which pest population increased till up to maturity. Regarding the maximum population the pest during peak period activity, Kufri Jyoti and Atlantic stood first (23.00 per 45 compound leaves) and than in the order were KufriChandramukhi (21.00), KufriPukhraj (19.66), Kufri Anand (14.66), Kufri Surya (13.00), Kufri Chipsona-1 (12.33) and Kufri Chipsona-2 (9.89) respectively. The mean white fly population was also found highest in Kufri Jyoti (7.07), Atlantic (6.92), Kufri Anand (4.94), Kufri Surya, Kufri Chipsona-1 (4.10) and Kufri Chipsona-2 (3.35) respectively. Added to this, from the incidence pattern as well as mean population of the pest on different potato germplasms, it can also be stated that Kufri Jyoti and Kufri Chandramukhi were more susceptible to the aleurodid while Kufri Pukhraj and Atlantic were moderately susceptible and the remaining *i.e*.., Chipsona-1,Kufri Chipsona-2,Kufri Surya and Kufri Anand were less susceptible to the pest. But the data regarding whitefly population on different potato germplasms were not available in the literature.

Efficacy of insecticidal treatment scheduled against important insects of potato

To control the potato pests effectively and economically, an experiment was conducted in this trial. Five treatment schedules (T1, T2, T3, T4 and T5) consisting of both chemical and non chemical insecticides were evaluated against the pests and the results of the present field study were discussed here categorically.

Incidence pattern of aphid on potato under different treatment schedules

Perusal of data [Table-4] to indicated that during *rabi* season from the month of November, 20007 to March, 2008, all the treatment schedules were significantly superior over control. Among the treatments, only in T3, which received phorate10G at planting, followed by foliar spraying of chloropyriphos 20EC at 40 days after planting (DAP), foliar spray of imidacloprid at 17.8 SL at 55 DAP then again spray with chloropyriphos 20EC+cypermethrin 5 EC at 70 DAP, the aphid population never crossed the economic threshold level (ETL), *i.e*. 20 aphid 100 compound leaves. In addition to this, T2 and T4treatment were maintained lower population of the pest throughout the crop life by supporting 6.97 and 12.04 mean aphid population per 100 compound leaves as compared to 89.45 in control (T1). The percent decrease of population over control was found maximum in T3(94.10), which was trailed by T2(92.20), T4(86.53) and T5(80.55), respectively. The treatment schedule containing only chemical insecticidal (*i.e*. T3), maintained the aphid population below its critical level allround the crop season. Added to this, T3 (in which the seeds were treated with imidacloprid at the time of planting, followed by foliar) spraying of imidacloprid at emergence, then second spraying with thiamethoxam (25 WG) at 15 days after emergence of pests and T4 (in which seed treatment with imidacholprid 70 WS followed by foliar spray with azadirectin1

EC at 30 DAP, *Baillus thurengiensis* var. Kurstaki 5WP at 45 DAP and foliar spray with chloropyriphos20 EC at 60 DAP) also gave better control of the pests. But among these two treatment schedules, T2 was quite better (92.20%) in reducing the aphid population than T4 as well as control (86.53%) this is due to the application of imidacloprid as seed treatment as well as spraying and it is a systematic insecticide remained active for longer period.

Incidence pattern of white fly on potato under different treatment schedules

The efficacy of different treatment schedules was also evaluated against white fly on potato from November, 2007 to March, 2008.The treatment schedules were significantly superior over control [Table-5]. The pest was first appeared the crop during third and fourth week of December, irrespective of remained lower than the other treatments throughout the growing period of the crop, while T4 and T5harboured comparatively higher population of the aleurodid, but it was quite lower than the control (T1). In T1, the mean whitefly population was 10.45 per 45 compound leaves, which was followed by T5 (4.06), T4 (3.83), T2 (1.89) and T3 (1.06), respectively. The maximum percent decrease of the pest was found in T3 (89.85%), which was simultaneously followed by T2 (81.91%), T4(63.34%) and T5(61.14%), respectively. It is therefore, evident from the table that the treatment schedules were significantly superior over control in decreasing the white fly population on potato. Among the schedules, T3 in which phorate10G (@ 1.5 kg a.i./ha) was applied to the soil at the time of planting and the spraying of chloropyriphos 20EC (@ 2.5 ml/lit. Of water), spraying with imidacloprid (@ 1 ml/4 lit. Of water) and spray with chloropyriphos + cypermethrin (@ 1.5ml/lit. Of water) at 40,55 and 70 days after planting (DAP), respectively, was most effective in reducing the population of white fly (89.85%) over untreated check plot and it was occurred due to application of phorate and imidacloprid as both of them are systematic in nature and remained active for a long period [9]. Chandramohan and Nanjan, (1992) [4] also recorded low glass house white fly (*Trialeurodes varporariorum* W) population on potato when treated with the systematic insecticide, monocrotophos. It may be concluded that T3 treatment was found most effective followed by T2, T4 and T5 as well as control (T1).

Conclusion

The two experiments regarding potato were conducted during *rabi* season from the month of November, 2007 to March, 2008. Eight potato germplasms were screened against different insects *viz*, aphid and white fly. Added to this different insecticidal treatment schedules for the management of potato pests was also studied. The potato gerrmplasms, Kufri Chandramukhi, Kufri Jyoti, Atlantic and Kufri Pukhrajwere highly infested by both aphid and white fly. The yield of healthy potato tubers was found highest in Kufri Anand and others higher yielded were Atlantic, Kufri Jyoti and Kufri Surya.

Application of research: Research is applicable to controlling the insects of potato.

Research Category: Agricultural Entomology

Abbreviations: T= Treatment, CD= Critical Difference

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