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INFLUENCE OF BIO-PHYSICAL CHARACTERS OF DIFFERENT POTATO VARIETIES ON THE INCIDENCE OF INSECT PESTS

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ABSTRACT

Studies were conducted for the first time among eight varieties of potato to know the influence of bio-physical characters of potato plant against insect pests namely whitefly (*Bemisia tabaci*), leaf hopper (*Amarasca biguttula bigutulla*), epilachna beetle (*Henosepilachna vigintioctopunctata*) and tobacco caterpillar (*Spodoptera litura*) in two different locations (L_1. Venkataramannagudem, West Godavari District. L_2. Pandirimamidi, East Godavari District.) of Andhra Pradesh. Bio- physical characters, *viz.*, Plant height (cm), Internodal length (cm), Trichome density on leaves (no/mm^2) and Number of leaves per plant were recorded from the eight different varieties of potato namely kufri badshah, kufri chandramukhi, kufri jyoti, kufri khyati, kufri himalini, kufri surya, kufri chipsona-3 and kufri phukraj in two locations (L_1 and L_2). Results revealed highest trichome number in the variety kufri badshah (96/mm^2) in L_1 and kufri himalini variety (93/mm^2) in L_2 moreover both these were significantly negatively correlated with insect pests population. Subsequently, other biophysical parameters *viz.*, Plant height (cm), Internodal length (cm) and Number of leaves per plant were non significantly negatively correlated with insect pests population among all the eight varieties in both the locations. Consequently kufri badshah in L_1 and kufri himalini in L_2 expressed less pest population, which might be due to its biophysical basis of resistance.

Key words : Potato pests, bio-physical characters, Trichome density, Kufri Badshah, Kufri Himalini.

Introduction

Potato, *Solanum tuberosum* L. is one of the most productive and widely grown food crops in the world. Among the various insects, aphids (*Myzus persicae* Sulzer), thrips (*Thrips palmi* Karny); leaf hopper (*Amarasca biguttula bigutulla* Ishida); white fly (*Bemisia tabaci* Gennadius) and soil insects like cut worm (*Agroti sipsilon* Hufnagel); potato tuber moth (*Pthoromea opercullela* Povolny), epilachna beetle (*Henosepilachna vigintioctopunctata* Fab.), tobacco caterpillar (*Spodoptera litura* Fab.) have significant influence on potato yield (Bhatnagar, 2013).

The damage caused by *Amrasca biguttula biguttula* starts from young seedling to the mature crop resulting in 50% yield loss (Meena *et al.*, 2010). Excessive feeding results in the damage of phloem tubes and causes disease, hopper burn (phytotoxemia) the main symptom of jassid attack (Javed, 2016). Both adults and nymphs of *B. tabaci* suck plant sap from the underside of leaves causing chlorotic spots. Continuous feeding affects the physiology of plant leading to detrimental effect on all stages of the crop (Jamuna *et al.*, 2017).

The epilachna beetle, *Henosepilachna vigintioctopunctata* is a polyphagous pest and is considered as foliage feeder of many cultivated and wild plants belongs to the families of Solanaceae and Cucurbitaceous. It causes damage at both, adult and larval stages which feed on the epidermal tissues of leaves by scrapping the chlorophyll content and cause a heavy yield loss by skeletonization of leaves which gradually dry and

drop down (Barik *et al*., 2020). *Spodoptera litura* (Fab.) is an economically important polyphagous insect causing considerable economic loss to many field, vegetables and fruit crops. Crop loss due to insect varies between 10 to 30 percent for major crops. In case of severe infestation, the entire crop is damaged badly, thus causing 40 percent defoliation of leaf area (Sundar *et al*., 2018).

Very recently investigations have been carried out to assess the suitability of conditions in Andhra Pradesh for growing potato crop especially in Godavari districts out of these two districts one is coastal zone (Venkataramannagudem) and the other one is high altitude zone (Pandirimamidi). Results of these studies indicated positive scope for potato cultivation in Godavari districts of Andhra Pradesh. As the crop is newly being introduced in costal Andhra Pradesh *i.e.* in Godavari districts, it is essential to inquest about the biotic stress on the crop. In this region so far no information is available on pest scenario of potato in Godavari districts of Andhra Pradesh. Hence, it is highly essential to have preamble information about pests occurring, its bioecology, biodiversity, natural enemies and suitability of variety (Haldar *et al*., 2015) *etc.*, to work out effective pest management measures. Along with this information there is a need to know about the bio-physical basis of resistance in potato which plays a pivotal role in the incidence and severity of the insect pests on potato crop (Haldar *et al*., 2006).

Materials and Methods

Agronomy of crop

The experimental locations were consists of moderate level of available nitrogen, Low level of phosphorous and high level of potassium. Eight Potato varieties for experiment were brought from CPRS, Jalandar, Badshahpur, Punjab - 144 026, India. The crop was raised during second week (9th October) of October 2017. Regular cultural practices were made except pesticides spraying. Weeding was done at 10 days interval. Regular N: P: K fertilizer application was made at basal dose and top application @10:15:10 kg/plot.

The Location – 1 experimental site was situated at College of Horticulture, Dr. Y. S. R. Horticultural University, Venkataramannagudem, West Godavari District of Andhra Pradesh during 2017-18. The location falls under Agro-climatic zone-10, humid-east coast plains and hills (Krishna-Godavari zone) with an average rainfall of 900 mm at an altitude of 34 m (112 feet) above mean sea level. The experimental site was geographically situated at 16^0 88’ N latitude and 81^0 44’ E longitudes. It experiences hot humid summer, rainy and mild winter.

The Location – 2 experimental site was situated at HRS, Pandirimamidi, East Godavari District of Andhra Pradesh and experiment was carried out during 2017-18. The experimental site was geographically situated at 17^0 25’ N latitude and 81^0 45’ E longitude.

Counting of different insect pests

Number of hoppers and whiteflies were recorded by visual observation on both surfaces of all the leaves on five randomly selected plants per plot and the average number of hoppers per plant was worked out and the value was taken as a mean number of hoppers per plant (Nag, 2016). Number of tobacco caterpillar and epilachna beetle population were recorded by visual observation on both surfaces of all the leaves on five randomly selected plants per plot and the average number of tobacco caterpillar per plant was worked out and the value was taken as a mean number of tobacco caterpillar per plant (Nag, 2016).

Plant height

Plant height was recorded by using 200 cm tape from five randomly tagged plants per replication and the mean plant height per replication, means plant height per treatment was worked out and presented in centimeters. (Nag, 2016).

Internodal length

The internodal length was recorded from the distance between two nodes by using 30 cm scale from five randomly tagged plants per replication and the mean per internodal length per replication, mean internodal length per treatment was worked out and presented in centimeters.

Number of leaves

Total number of leaves per plant was recorded by visual counting of the leaves on the plant from the ground level to the top most bud leaf from five tagged pants per replication and the mean number of leaves per plant was worked.

Trichomes bases of resistance

Trichome density was enumerated from the leaves of 8 potato varieties that showed low to high levels of incidence of insect pest in the screening trial. Leaf samples were collected from 8 potato varieties and were cut into one mm square size. The leaf samples were heated in 20 ml of water in small glass vials for 15 minutes at 85^{o}C. Water was decanted and 20 ml of 96% ethyl alcohol was added. The samples were boiled at 80^{o}C for 20 minutes. The alcohol was drained and fresh alcohol was added till chlorophyll was removed completely. The leaf samples were then boiled at 85^{o}C by adding 90 per

cent concentrated lactic acid until the leaf segments were cleared. The vials were cooled and stored for observation. The number of trichomes was counted per mm^2 under the compound microscope at 45x magnification. (Manivannan *et al*., 2017).

Results and Discussion

Location-1: Venkataramannagudem, West Godavari District

Location - 1

The bio-physical plant characters studied *viz.*, plant height (r = -0.07), internodal length (r = -0.04), number of leaves (r= -0.26) were non significantly negatively correlated and trichome number (r= -0.88**) was significantly negatively correlated with whitefly population in all the eight varieties, similarly the bio-physical plant characters studied *viz*., plant height (r = -0.03) and number of leaves (r = -0.22) were non significantly negatively correlated, whereas trichome number (r = -0.89**) was significantly negatively correlated with leaf hopper population. The internodal length (r = 00) has no impact on leaf hopper population. In case of tobacco caterpillar also similar trend was observed, in which the trichome number was significantly negatively correlated (r = -0.82**) with tobacco caterpillar population number per plant subsequently, plant height (r = -0.02) and number of leaves (r = -0.26) were non significantly negatively correlated with tobacco caterpillar population. Internodal length (r = 00) has no impact on tobacco caterpillar population. The bio-physical plant characters studied *viz.*, plant height (r = -0.02) and number of leaves (r = -0.26) were non significantly negatively correlated and trichome number (r = -0.90**) was significantly negatively correlated with epilachna beetle population. The internodal length (r = 00) has no impact with epilachna beetle population. Among the eight varieties tested Kufri badsah showed resistance against pests attacked due to its bio-physical basis of resistance in Venkataramannagudem.

Fig. 1 : Epilachna Beetle (*Henosepilachna vigintioctopunctata*) present on leaves of potato crop.

Fig. 2 : Epilachna beetle (*Henosepilachna vigintioctopunctata*) damage on leaves of potato crop.

Fig. 3 : Leaf hopper (*Amarasca biguttula bigutulla*) present on leaves of potato crop.

Fig. 4 : Leaf hopper (*Amarasca biguttula bigutulla*) damage on leaves of potato crop.

Location-2: Pandirimamidi, East Godavari District

Location - 2

The bio-physical plant characters studied *viz.*, plant height (r = -0.35), number of leaves (r = -0.21) were non significantly negatively correlated and trichome number (r = -0.90**) was significantly negatively correlated (r = -0.90**) with whitefly population in all the eight varieties, similarly The bio-physical plant characters studied *viz.*, plant height (r = -0.35), number of leaves (r = -0.18) were non significantly negatively correlated and trichome number (r = -0.90**) was significantly negatively correlated (r = -0.90**) with leaf hopper population. In case of tobacco caterpillar also similar trend was observed, in which the trichome number was significantly negatively correlated (r = -0.88**) with tobacco caterpillar population number per plant. Whereas, plant height (r = -0.33) and number of leaves (r = -0.20) were non significantly negatively correlated with tobacco caterpillar population. The bio-physical plant characters studied *viz.*, plant height (r = -0.36), number of leaves (r = -0.23) were non significantly negatively correlated but trichome

Table 1 : Correlation coefficient studies of biophysical components among different varieties of potato in relation to population of different insect pests.

S. no.	Variable	Correlation coefficient at Venkataramannagudem	Correlation coefficient at Pandirimamidi
1	Trichome number vs whitefly infestation	-0.90**	-0.90**
2	Trichome number vs leaf hopper infestation	-0.90**	-0.89**
3	Trichome number vs tobacco caterpillar infestation	-0.88**	-0.82**
4	Trichome number vs epilachna beetle infestation	-0.90**	-0.90**
5	Internodal length vs whitefly infestation	-0.40	-0.04
6	Internodal length vs leaf hopper infestation	0.40^{NS}	0.00^{NS}
7	Internodal length vs tobacco caterpillar infestation	0.40^{NS}	0.00^{NS}
8	Internodal length vs epilachna beetle infestation	0.39^{NS}	0.00^{NS}
9	Plant height vs whitefly infestation	-0.35	-0.07
10	Plant height vs leaf hopper infestation	-0.35	-0.03
11	Plant height vs tobacco caterpillar infestation	-0.33	-0.02
12	Plant height vs epilachna beetle infestation	-0.36	-0.02
13	Number of leaves vs whitefly infestation	-0.21	-0.26
14	Number of leaves vs leaf hopper infestation	-0.18	-0.22
15	Number of leaves vs tobacco caterpillar infestation	-0.20	-0.26
16	Number of leaves vs epilachna beetle infestation	-0.23	-0.26

Fig. 5 : Tobacco caterpillar (*Spodoptera litura*) damage on leaves of potato crop.

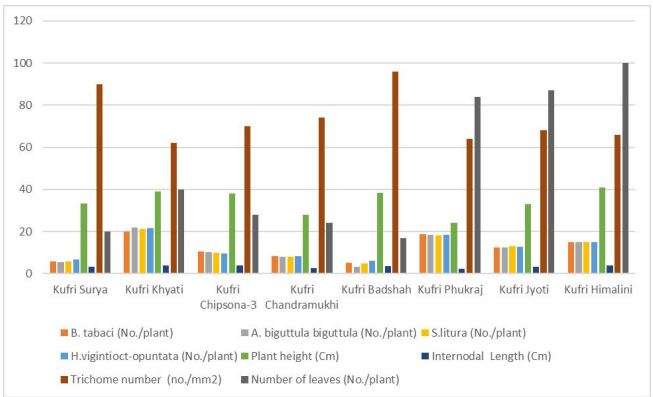

Fig. 6 : Population of different insect pests and biophysical parameters of potato varieties at Venkataramannagudem.

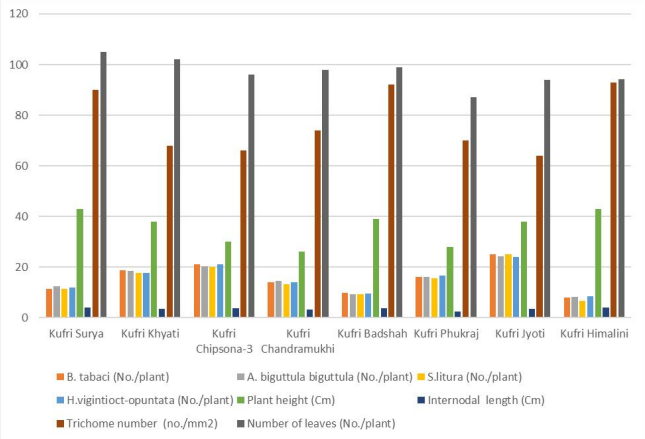

Fig. 7 : Population of different insect pests and biophysical parameters of potato varieties at Pandirimamidi.

number (r = -0.90**) was significantly negatively correlated with epilachna beetle population. Internodal length has no impact on pest population.

Sasane *et al*. (2018) were observed that leaf thickness (r = -0.793, -0.789) and trichome density on the leaf surface (r = -0.821, -0.835) in soybean were significantly and negatively associated with leaf damage percentage, which was similar to my studies. Results were in accordance with the finding of Chandrasekhar *et al*. (2009), who recorded the correlation between jassid nymph population and mid vein hair density was negative and significant (r = –0.67, –0.83, –0.75, respectively). Naqvi *et al*. (2009) reported that trichome density was negatively correlated with the brinjal shoot and fruit borer incidence, which was on-par with my present study. Muthukumaran (2016) also reported that trichome density was negatively correlated with the tomato shoot and fruit borer incidence which is similar to my studies.

Conclusion

Among the eight varieties tested Kufri badsah showed resistance against pests attacked due to its bio-physical basis of resistance in Venkataramannagudem. Whereas in Pandirimamidi among the eight varieties tested Kufri himalini showed resistance against pests attacked. Among the morphological parameters studied trichome number was significantly negatively correlated against pest incidence in the both the two locations.

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