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Response of pea varieties to insect pests in Peshawar

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Abstract

An experiment to determine response of pea varieties to insect pests in Peshawar was conducted at the New Developmental Farm, The University of Agriculture, Peshawar during 2013-14. Seven pea varieties including Climax (New Zealand NTL), Classic, Leader, Azad P-1, PF-400, Meteor and Peshawar Local (Check) were tested treatments. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The results revealed that density of pea leaf miner, *Chromatomyia horticola* Goureau was significantly higher on Azad P-1 (7.21 leaflet⁻¹) and lower on Climax (5.85 leaflet⁻¹). Peshawar Local was significantly highly infested by pea aphid, *Acyrtosiphon pisum* Harris (5.34 leaf⁻¹) while Climax was less infested (3.66 leaf⁻¹). Thrips, *Caliothrips* sp. infestation was higher on the leaves of Meteor (1.80 leaf⁻¹) and lower on Climax (1.64 leaf⁻¹) as well as Peshawar Local (1.64 leaf⁻¹). The data showed that Climax gave significantly higher (4235.81 t/ha) pea yield. It was concluded that Climax yielded more and also found comparatively more resistant to the attack of insect pests as compared to all other varieties. Climax variety should be brought under cultivation for its comparatively high resistance and more production and further research on its other physico-morphic plant characters should be carried out.

Keywords: Pea leaf miner, aphids, thrips, pea varieties

1. Introduction

Pea (*Pisum sativum* L.) is cultivated as winter crop all over the world and is utilized as nutritious vegetable. It contributes to about 40% of total trading in pulses^[14]. Cooked green peas are a rich source of proteins. One pound of green peas containing 13.7 g protein, 8 g fat, 36.2 g carbohydrates, 45.1 mg calcium, 29 mg phosphorus and 54 mg ascorbic acid^[12]. World widely peas are grown on an area of 528.71 thousands hectares and ranks fourth in the production (441.53 thousand tons) among grains legume after soybean, ground and beans^[5]. It is grown in many tropical and subtropical countries including Burma, India, Ethiopia, Morocco, Columbia, Ecuador, Peru and Pakistan^[14]. Over the last decade, Canada has been the leading producing country of peas in the world^[27]. In Pakistan, more than 100,000 hectares is under cultivation, yielding less than 1000 kilograms ha⁻¹^[16].

Regardless of large number of cultivars in the field, pea yield per unit in Pakistan is still lower than international standard. There are several factors responsible for it, among which poor cultural practices, low weed control and high pest and disease attack are important ones^[14]. Among insect pests of peas, pea leaf miner (*Phytomyza horticola* Goureau (Diptera: Agromyzidae) is a serious hold back in cultivation of pea causing 90% damage to the pea crop by mining young leaves which leads to stunting and low flower production^[18]. Pea aphid infestation causes severe economic losses in pea crop- by reducing crop yield and contamination of crop for processing or fresh market. Plants representing Fabaceae serve as main host for aphid pea that includes field pea, alfalfa and clovers^[31]. Pea thrips, *Caliothrips indicus* (Thysanoptera: Thripidae) also come under the category of serious pests of peas. Due to their infestation, tissue surface becomes silvery and may result to the failure of flowers production and also change structure of plant and pods. At the range of 250 eggs per 10 flowers causes reduction in the harvest by up to 60%^[9].

It is understood that almost all plants emit volatile organic compounds (VOCs) into the atmosphere. These VOCs play a fundamental ecological role, which initiate interactions of plants to other living things^[7]. Leaves having high phenolic contents are not preferred for feeding^[11]. Leaves consisting of high nitrogen content are mostly preferred by pea leaf miners therefore high dose application of nitrogen are dangerous^[17]. Keeping in view the importance of pea, assessing its higher production and its resistance or susceptibility to different insect pests, different varieties were tested to evaluate the more appropriate variety for the farmers of the region.

2. Materials and Methods

The present experiment was carried out at the New Developmental Farm (NDF) of The University of Agriculture, Peshawar during 2013-14. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Each replication consisted of seven treatments (i.e. Climax (New Zealand NTL), Classic, Leader, Azad P-1, PF-400, Meteor and Peshawar Local (Check)), 4 m x 4m each. Plant to plant and row to row distance was kept at 10 cm and 65 cm, respectively. Standard agronomic practices were applied in the field throughout the pea growing season. The field was left open for natural infestation of insect pests and their natural enemies. During the course of study, data was recorded on pea leaf miners, pea aphids and thrips on pea leaves and pods from germination till maturity of crops at weekly intervals. The data recorded for each parameter was analyzed statically by using Statistix 8.1 software and means were separated by using Fisher Protected Least Significance Difference Test at 5% level of significance [28].

Aphid's data collection

Data of aphids was recorded on randomly selected 20 plants in four rows per treatment for recording its population density. Progress of the aphids was determined by the aphids/leaf count method [20]. Aphids were inspected on three fully expanded leaves on top, middle and bottom, and its number counted. Mean number of aphids was derived for all the treatments from each replication

Leaf miners data collection

For leaf miners data was commenced by counting the number of leaf miners larvae per plant on five plants per row [4]. Four rows were randomly selected from each treatment. Data was taken at weekly intervals.

Thrips data collection

Twenty leaves were collected from each variety in 75% alcohol in plastic bottle at weekly intervals and brought to the Entomology Research Laboratory the University of Agriculture, Peshawar. Thrips were washed out with camel hair brush from the leaves. They were counted and permanent slides were prepared.

3. Results

Pea leaf miner infestation

The results in table 1 reveal the infestation of pea leaf miner leaf⁻¹. Pea leaf miner's infestation was significantly affected by different varieties as well time intervals. Interaction of time and varieties also showed significant difference. The results showed that significantly higher infestation of leaf miner was recorded during week 7 (16.30 leaf⁻¹) and lower during week 1 (0.74 leaf⁻¹). It was also found that mean leaf miner infestation was significantly higher (7.21 leaf⁻¹) on Leader, followed by PF-400 (7.18 leaf⁻¹) and Azad P-1 (7.14 leaf⁻¹) while lower on Climax (5.85 leaf⁻¹). Interaction of time and varieties implied that statistically significant higher infestation of pea leaf miners (17.50 leaf⁻¹) was recorded during week 7 on Leader and lower (0.62 leaf⁻¹) during week 1 on Meteor.

Table 1: Mean weekly no. of pea leaf miners leaf⁻¹ on pea crop during 2013-14.

Variety	Mean no. of pea leaf miner/leaf in week									Over all Mean
	1	2	3	4	5	6	7	8	9	
Climax	0.65t	1.07st	1.88qrs	3.60op	4.96mn	10.78hi	13.90d	10.23i	5.55lm	5.85b
Classic	0.85t	1.13st	2.35qr	4.57mno	6.38jkl	12.92def	15.68c	12.90ef	6.90jk	7.08a
Leader	0.75t	1.17st	2.50q	4.57mno	6.20kl	12.57ef	17.50a	13.07de	6.54jkl	7.21a
Azad P-1	0.67t	1.28st	2.57q	4.75mn	6.30jkl	12.00fg	17.20ab	12.80ef	6.69jk	7.14a
PF-400	0.74t	1.20st	2.80pq	4.53no	6.82	11.37gh	17.45ab	13.12de	6.59jk	7.18a
Meteor	0.62t	1.40rst	2.70pq	4.70mn	7.07jk	10.97hi	15.85c	12.60ef	6.57jk	6.94a
Pesh Local	0.93st	1.30st	2.85pq	4.67mn	7.22j	11.12ghi	16.48bc	12.93def	6.63jk	7.12a
Mean	0.74h	1.22g	2.52f	4.48e	6.42d	11.67c	16.30a	12.52b	6.50d	

Means in columns and rows followed by different letter(s) are significantly different at 5% level of significance (LSD test).

LSD value for Varieties = 0.3323,

LSD value for time intervals = 0.3768

LSD value for interaction = 0.9970

Pea Aphids infestation

The aphid's infestation leaf⁻¹ on pea crop was significantly affected by time intervals and different pea varieties (Table 2). Interaction of weeks and varieties for Aphids infestation leaf⁻¹ was also found significant. Mean values for weeks showed that significantly higher Aphids infestation (11.01 leaf⁻¹) was recorded during week 3 while lower aphid's infestation (1.83 leaf⁻¹) during week 7. Mean values for varieties showed that

significantly higher aphids density (5.34 leaf⁻¹) in pea crop was recorded on Peshawar Local, which was followed by Azad P-1 (5.11 leaf⁻¹) and Meteor (4.91 leaf⁻¹) while lower aphids density (3.66 leaf⁻¹) was recorded in Climax. Interaction of weeks and varieties for aphids infestation leaf⁻¹ revealed that lower aphids density (0.89 leaf⁻¹) was recorded during week 7 on Climax whereas higher (13.93 leaf⁻¹) at week 3 on Azad P-1.

Table 2: Mean weekly no. of pea Aphids leaf⁻¹ on pea crop during year 2013-14.

Variety	Mean no. of pea leaf miner/leaf in week									Over all Mean
	1	2	3	4	5	6	7	8	9	
Climax	2.22t-m	3.10q-u	8.20de	2.82s-w	4.24n-r	2.59s-w	0.89x	4.52m-p	4.31n-q	3.66d
Classic	2.58s-w	4.32n-q	9.99c	3.19q-u	5.44i-n	3.05q-w	1.94u-x	6.94e-h	5.16j-n	4.74bc
Leader	2.63s-w	4.54m-p	10.33c	3.04q-w	6.06g-l	2.63s-w	1.81wx	6.50f-i	5.10k-o	4.74bc
AzadP-1	2.99r-w	3.86o-s	13.93a	2.91s-w	5.68h-m	2.84s-w	2.11t-x	6.43f-j	5.27i-n	5.11ab
PF-400	2.88s-w	3.32p-t	9.36cd	2.93s-w	5.31i-n	2.40t-w	1.85vwx	6.31f-k	5.04k-o	4.38c
Meteor	2.97r-w	3.84o-s	12.36b	3.06q-w	5.03k-o	3.04q-w	1.96u-x	6.99efg	4.97i-o	4.91ab
Pesh. Local	3.15q-u	4.58m-p	12.91ab	3.34p-t	5.76g-m	3.20q-u	2.24t-m	7.59ef	5.28i-n	5.34a
Mean	2.78e	3.94d	11.01a	3.04e	5.36c	2.82e	1.83f	6.47b	5.02c	

Means in columns and rows followed by different letters are significantly different at 5% level of significance (LSD test).

LSD value for Varieties = 0.4308

LSD value for time intervals = 0.4885

LSD value for interaction = 1.2923

Thrips infestation

The results for the infestation of pea crop leaves by thrips are given in Table 3. Higher mean density of thrips (1.79 leaf⁻¹) was recorded on Meteor followed by Azad P-1 and lower on Climax (1.63 leaf⁻¹) and Peshawar Local (1.63 leaf⁻¹). Significantly higher mean infestation was noted during week 3 (2.14 leaf⁻¹) followed by week 1 (2.09 leaf⁻¹) and lower during

week 6 which was 1.36 thrips leaf⁻¹. Interaction of time and varieties for thrips infestation indicated that significantly higher density of thrips was recorded during week 1 on Meteor which was 2.58 thrips leaf⁻¹ and lower during week 6 on Climax which was 1.18 thrips leaf⁻¹. The results revealed that thrips densities did not vary significantly among the pea varieties.

Table 3: Mean weekly density of thrips leaf⁻¹ on seven pea varieties during 2014.

Variety	Mean density of thrips leaf ⁻¹ in week							Overall Mean
	1	2	3	4	5	6	7	
Climax	1.80d-l	1.85d-k	1.95b-i	1.63e-o	1.47h-o	1.18o	1.55g-o	1.63
Classic	2.15abcd	1.68d-n	2.35abc	1.53g-o	1.43j-o	1.20no	1.60g-o	1.74
Leader	2.38ab	1.85d-k	2.12a-e	1.60g-o	1.53g-o	1.22mno	1.45j-o	1.72
Azad P-1	1.85d-k	1.97b-h	2.52a	1.35l-o	1.91b-j	1.43j-o	1.38k-o	1.75
PF-400	1.80d-l	1.85d-k	2.15abcd	1.38k-o	1.60g-o	1.45j-o	1.43j-o	1.67
Meteor	2.58a	1.58g-o	2.00b-g	1.58g-o	1.60g-o	1.57g-o	1.70d-m	1.79
Pesh Local	2.10a-f	1.55g-o	1.88c-j	1.65e-o	1.30l-o	1.48h-o	1.47i-o	1.63
Mean	2.09a	1.76b	2.14a	1.53cd	1.54c	1.36d	1.51cd	Ns

Means in columns and rows followed by different letters are significantly different at 5% level of significance (LSD test).

LSD value for varieties = 0.1942

LSD value for time intervals = 0.1856

LSD value for interaction = 0.4911

Yield (kg ha⁻¹)

In the present investigation highest yield was recorded for Climax (4235.80 kg ha⁻¹), which was followed by PF-400 (3882.72 kg ha⁻¹) and Classic (3764.23 kg ha⁻¹). Minimum yield was recorded for Peshawar Local (2962.71 kg ha⁻¹) (Fig. 1).

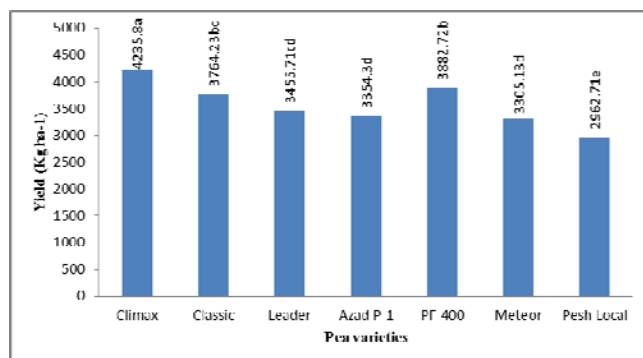


Fig 1. Total yield (kg ha⁻¹) of different Pea varieties.

LSD value = 323.56

4. Discussion

The pea leaf miner infestation started from last week of January and continued till the start of April. Pest density was lower during the first weeks and gradually increased in a sequence on all the varieties and reached to peak during week 7. In the last week of March infestation decreased because of maturity of the crop [26]. Stated that pea leaf miner density with an average population of 7.3 leaf miners per plant was started to increase from 2nd week of February and was highest during the 4th week of February with a 9.25 leaf miner per plant. Our results are in accordance with the work done by [15]. According to them no larval infestation was observed till January and highest infestation was recorded during the month of March with an average of 15.25 ± 1.292 leaf miner per leaf. Our results are also in conformity with the results of [30]. They had found that in Egypt, leaf miner larval population of *Phytomyza orobanchiae* peaked in the third week of March and infested the leaves up to 100% during the 2nd and 4th weeks of April on ovules of *Orbanchiae crenata*. The results (Table-1) regarding infestation on different varieties showed that lowest pest

density of Pea leaf miner was observed on Climax and highest on Peshawar Local. Our results are comparable with those of [3]. They had found minimum leaf miner infestation (4.3 infested leaflets/branch) on Climax variety while highest infestation on Great Feast variety with 9.6 infested leaflets/branch [22]. Found significant effect of varieties on leaf miner infestation. Their study showed that leaf miner infestation begun in February and Climax variety was declared resistant to leaf miner infestation due to thick leaf and spongy tissues. Different infestation level on different varieties of Pea crop and in different localities was also recognized by [21].

Pea aphid *Acyrtosiphon pisum* infestation on pea varieties was observed in the last week of January. It fluctuated and reached to its peak in the middle of February (week 3). The fluctuation in pest density might be due to rain fall. Pest density also decreased with maturity of the crop as aphids infest young shoots and unfolded leaves of the crop [19]. Reported that both biological and physical factors could be responsible for the variation in aphid population densities. He also stated that environmental factors (particularly temperature and humidity) and food availability greatly influenced the buildup of aphid population. The results also revealed that mean density of aphids was higher on Peshawar Local¹) and lower on Climax. These results are in agreement with those of (6). They had tested five varieties of pea for resistance against aphids and found none of these promising varieties were completely immune to aphids. The reason for these pea varieties could be their genetic makeup as less infested variety was Climax [1]. Stated that there is need for exploring resistant cultivars because completely resistant varieties are lacking in Pakistan

[23]. stated that thrips were present throughout the year except July and August due to high rainfall. Highest density of thrips was observed from April to May in which maximum density recorded was 26.82 per three leave in the second fortnight of April. Our results are not in conformity with the findings of [29] in case of thrips densities, who found occurrence of maximum sucking pest densities in the months of July, August and September whereas [10] recorded maximum population of thrips during the last week of July to mid-August. The month of August was favorable for thrips population in 2009. The low density level of thrips recorded may be due the rain fall.

Negative and significant correlation between rainfall and thrips density was recorded by [2], [25]. Also reported negative correlation while [13] recorded non-significant positive correlation between thrips density and rainfall.

Climax performed well among the seven pea varieties in terms of yield production. The variations in yield of pea may be due to pest infestation and its susceptibility to pest attack. It may be due to genetic variations and environmental conditions. Biomass, pea N production and grain yield are variable and depend on genotype and growing conditions [8]. The variation can be caused by other yield components as [32] stated that plants m⁻², number of pods plant⁻¹, seeds pod⁻¹ and also the mean seed weight are the main yield components. [14] recorded higher yield of 4673.0 kg/h while lower of 2399.0 kg/h for peas in Peshawar.

5. Conclusion

The results of the present research strengthen that Climax variety was more resistant to the attack of all the three major insect pests. Due to higher resistance to pest infestation it resulted in higher yield.

6. Recommendations

Based on the above mentioned results of lower incidence of pests and higher yield, cultivation of Climax variety is recommended to the growers in Peshawar. Further research on its other physico-morphic plant characters and testing in other areas of the province should be carried out.

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