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Research Article

Screening of new promising varieties of berseem (*Trifolium alexandrinum*) against aphid and leafminer

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ABSTRACT

High Quality fodder crops are a key component of the white uprising of milk yield. Berseem is a top forage crop also known as the Queen of all Cultivated Fodders or the Green Gold of the Asia. The experiment was designed to screen out the six varieties of berseem viz. F-01-16, F-02-16, F01-17, F-02-17, F-01-18 and F-02-18 against aphid and leaf minor. The data regarding aphid and leaf miner was recorded on weekly bases from five selected plants. The results showed significant difference in aphid and leaf miner population among six berseem varieties. The results depicted that maximum seasonal mean population of aphid was observed in F-02-16 (1.06) followed by F-01-17 (1.03) while minimum mean population was observed in the case of F-02-17 (0.84) followed by F-01-16 (0.96). In case of leaf miner, it was observed that maximum seasonal population was recorded in F-01-18 (13.21) followed by F-02-16 (12.47) while minimum mean population was calculated in the case of F-02-17 (8.45) followed by F-01-16 (11.65).

Keywords: Berseem; varietal screening; Aphid; leaf miner; seasonal abundance.

INTRODUCTION

High Quality fodder crops are a key component of the white uprising of milk yield. Milk output can only be improved if milking animals are properly fed with high-quality fodder. Forage production has become increasingly important since the introduction of high-yielding cross-bred dairy animals. The area under fodder crops in the Punjab state is around 0.67 million hectares, of which two-thirds are solely under berseem (*Trifolium alexandrium* L.) (Tufail et al., 2020; Karar et al., 2017). In Pakistan, berseem becomes major rabi fodder crop and also known as the 'king of fodder'. It is the largest cattle fodder grown in the country, 88% of which grows in Punjab, 9% in Sindh, 2% in the KPK and 0.5% in Balochistan (Gondal et al., 2021). It is a great multicut fodder crop for all types of livestock in this location since it is succulent, tasty, nutritious, and can provide green fodder for a longer length of time (November to June) (Hindoriya et al., 2024). In green form, it contains around 10% Total Digestible Nutrients (TDN) and 2.2% Digestible Crude Protein (DCP), and is substantially richer in protein, accounting for 23% of the dry matter base (Randhawa et al., 2009). As a member of the leguminaceae family, it promotes soil fertility while also helping to reclaim alkaline soils (Khalil and Jan, 2000).

Economic seed and vegetative production in Berseem for fodder and seed purposes requires special care because its production fluctuates year after year. Its final yield relies on the weather, the duration between the last cutting and maturity, and the presence of insect pests (Kushawa and Bharadwaj 1977). The crop is heavily damaged by aphids, leaf minor black ants, jassids, leaf-eating caterpillars, surface grasshoppers, hairy caterpillars, gram pod borers and cabbage semiloopers.

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As a result, insect pests constitute the most significant constraint on berseem seed output. (Malarvannan and Subashini 2007). Due to intense cultivation that began in Southeast Asia around 3000 BCE, Pakistan boasts a diverse array of fauna. Thus, this area also harbors predators and parasitoids of these infamous pests. Honeybees, syrphid flies, and the Coccinellidae family of insects are the main pollinators and predators (Yadav *et al.,* 2015). Insecticides are used by farmers in Pakistan to prevent armyworm and leafminor attacks, but their use comes at a higher cost than benefit. Moreover, the adsorption of chlorinated hydrocarbons in animal adipose tissues serves as a conduit for the transfer of these compounds through the food chain, which may have unfavourable effects on both humans and other animals. (Peakall, 1996; Blus et al., 1996). Among these, an aphid and leafminor had a vast range of hosts ranging from vegetables, fruits to fodder crops (Patel et. al. 2003 and Anonymous. 2007b). These feeds on leaves, buds, flower-buds and sometime even on flower heads of berseem. The aphid sucks the cell sap of the plants and develop fungus on the plants ultimately stop the photosynthesis process of the crop. Similarly, leafminor mines into the surfaces of leaves than star start feed on green portion of the leaves and ultimately decreased the yield production (Singla 1985; Patel et al 2003; Singh and Mullick 1997).

The identification of resistant genotypes, their cultivation, and the use of integrated pest control approaches enable a reduction in the infestation by these insect pests.

METHODOLOGY

The experiment was designed to screen out the six varieties of berseem viz. F-01-16, F-02-16, F01-17, F-02-17, F-01-18 and F-02-18 against aphid and leaf minor. These six verities were sown with hand pulled manual drill at the research area of Entomological Research Institute in Ayub Agriculture Research Institute Faisalabad. The plot size was 7ft*5m. In each plot uniform agronomic practices were applied and no insect pest control measures like insecticide application, mechanical or cultural control were adopted. Data regarding aphid and leaf minor was recorded immediately initiated after germination at a weekly interval till the maturity of the crop. During the seedling stage, the whole plant was counted as a sampling unit while in the later stages aphids and leaf minor population were counted on each tiller. Five randomly selected as sampling units from each plot to record the aphid population and leaf miner. After collected complete data, The Data were subjected to ANOVA after transformation with web based software. Means were compared through post-hoc tuckey's HSD test.

RESULTS AND DISCUSSION

In Pakistan, berseem is a significant winter fodder crop that is plagued by a number of minor and major pests, including aphids, armyworms, and leaf minors. In the current study screening of berseem cultivars was performed in order to evaluate their response toward aphid and leafminer

The results showed that significant differences in aphid population among six berseem varieties and during 4th week of march maximum attack of aphid population was observed Maximum mean population during 4th week of march was observed in F-01-18 (4.73) whereas minimum population was observed in F-01-16 (2.67) (table 1) while in the case of leaf miner, 3rd week of april, maximum population or infestation of leafminor was observed (table 2). The results depicted that maximum mean population of aphid was observed in F-02-16 (1.06) followed by F-01-17 (1.03) while minimum mean population was observed in the case of F-02-17 (0.84) followed by F-01-16 (0.96) (table 1). Zeb et al. (2011) and Saeed et al. (2013) reported similar results, stating that the aphid attack began in the middle of February, increased during March and peaked on 4th week of March. After that, the population decreased and was eradicated entirely on all nine varieties/lines until April 6.

The results are also significantly different from each other in the case of leaf miner. Maximum population of leaf minor was observed in 3rd week of April where maximum poplation was observed in F-01-18 (22.77) followed by F-01-17 (17.33) while minimum population was observed in the case of F-01-16 (8.13). In the case of overall seasonal population, it was observed that maximum population was observed in F-01-18 (13.21) followed by F-02-16 (12.47) while minimum mean population was observed in the case of F-02-17 (8.45) followed by F-01-16 (11.65) (table 2). Shah et al (2010) conducted studies on leaf miner of the berseem and concluded that the study examined the economics of different botanical treatments and found that the pre-sowing treatment with Trineem and the post-sowing treatment with 3% neem seed kernel extract had the highest net returns. This was followed by the pre-sowing treatment with Trineem and the post-sowing treatment with 0.07% endosulfan + 0.09% mancozeb while the current studies on varietal screening to evaluate the best variety against leaf miner.

Table 1. Mean population fluctuation of aphid population on Berseem (*Trifolium alexandrinum*) throughout the growing season.

Sr. No.	genotypes	Mean aphid population per tiller					Seasonal Population
		March		April			
		3rd week	4th week	1st week	2nd week	3rdweek	
1	F-01-16	1.33±0.27	2.67±0.98	0.60±0.023	0.27±0.17	0.27±0.17	0.96±0.87
2	F-02-16	1.07±0.19	4.17±1.25	0.73±0.024	0.27±0.17	0.27±0.17	1.06±0.90
3	F-01-17	1.13±0.16	4.33±1.02	0.40±0.020	0.47±0.027	0.40±0.020	1.03±0.87
4	F-02-17	1.07±0.15	2.67±0.95	0.47±0.027	0.40±0.020	0.40±0.020	0.84±0.11
5	F-01-18	0.73±0.08	4.73±1.12	0.27±0.17	0.20±0.14	0.27±0.17	0.97±0.17
6	F-02-18	1.00±0.10	3.90±1.09	0.60±0.023	0.40±0.020	0.40±0.020	0.99±0.19

Table: 2 Mean population fluctuation of leaf miner population on Berseem (*Trifolium alexandrinum*) throughout the growing season.

Sr. No.	genotypes	leaf miner percentage infestation					Seasonal Population
		March		April			
		3rd week	4th week	1st week	2nd week	3rdweek	
1	F-01-16	10.00±2.27	10.00±2.27	12.63±2.81	9.67±2.27	8.13±2.12	11.65±2.81
2	F-02-16	8.70±2.12	8.70±2.12	14.80±2.88	10.30±2.27	12.47±2.77	12.94±2.77
3	F-01-17	9.03±2.18	9.03±2.18	12.53±2.67	7.83±2.14	17.33±3.37	12.55±2.67
4	F-02-17	6.63±2.05	6.63±2.05	9.40±2.27	14.37±2.97	9.40±2.27	8.45±2.57
5	F-01-18	5.13±1.98	5.13±1.98	12.37±2.77	8.90±2.12	22.77±5.27	13.21±2.87
6	F-02-18	13.27±2.87	13.27±2.87	11.20±2.47	10.80±2.37	14.83±2.87	12.71±2.67

The results are also significantly different from each other in the case of leaf miner. Maximum population of leaf minor was observed in 3rd week of April where maximum poplation was observed in F-01-18 (22.77) followed by F-01-17 (17.33) while minimum population was observed in the case of F-01-16 (8.13). In the case of overall seasonal population, it was observed that maximum population was observed in F-01-18 (13.21) followed by F-02-16 (12.47) while minimum mean population was observed in the case of F-02-17 (8.45) followed by F-01-16 (11.65) (table 2). Shah et al (2010) conducted studies on leaf miner of the berseem and concluded that the study examined the economics of different botanical treatments and found that the pre-sowing treatment with Trineem and the post-sowing treatment with 3% neem seed kernel extract had the highest net returns. This was followed by the pre-sowing treatment with Trineem and the post-sowing treatment with 0.07% endosulfan + 0.09% mancozeb while the current studies on varietal screening to evaluate the best variety against leaf miner.

Three resistance mechanisms-antixenosis, antibiosis, and tolerance-have so far been identified in the interaction between insect and plant. Since 2014, all farmers in the EU are required to use Integrated Pest Management, which aims to use less pesticides (Directive 2009/128/EC). Thus, cultivars resistant to insect pests are bred in a way that satisfies both current environmental trends and applicable standards (Jensen et al., 2002). In the present study cultivar F-01-18 observed least infestation of aphid and leaf minor. However, which mechanism of host plant resistance it confers is still uncovered.

CONCLUSION

It was concluded that F-02-16 variety have more attraction level for aphid while F-02-17 variety have minimum attraction level for aphid and F-01-18 variety have maximum attraction level for leaf miner . While F-02-17 variety have minimum attraction level for leaf miner.

REFERENCES

Blus, L.J., Weigeyer, S.N. & Henney, C.J., (1996) Organochlorine pesticides. In: Non-Infectious diseases of wildlife (eds.) David J. Hoffman, Barnett A. Rattner, G. Allen Burton Jr., and John Cairns Jr.) (2nd edition). Ames, Lowa, Lowa State University Press.

Hindoriya, P. S., Kumar, R., Meena, R. K., Ram, H., Kumar, A., Kashyap, S., ... & Bhattacharjee, S. (2024). The Impact of Integrated Nutrient Management on Trifolium alexandrinum Varietal Performance in the Indo-Gangetic Plains: A Comparative Yield and Economic Analysis. *Agronomy*, *14*(2), 339.

Jensen, E. B., Felkl, G., Kristiansen, K., & Andersen, S. B. (2002). Resistance to the cabbage root fly, Delia radicum, within Brassica fruticulosa. *Euphytica*, *124*, 379-386.

Karar, H., Akhtar, M. S., Khaliq, A., Hussain, A., Niazi, I. A. K., Anees-ul-Hasnain, A. A., ... & Abdullah, A. (2017). Effect of novel insecticdes on Helicoverpa armigera (Lepidoptera: Noctuidae) on seed crop of berseem (Trifolium alexandrinum L.) and their impact on seed yield. *Pak. Entomol*, *39*(1), 9-15.

Kushawa, K.S. & Bharadwaj, B., (1977). Forage Pasture Insect-Pests of Rajasthan ICAR, New Delhi. pp 186, Mularvannan S and Subashini, H, .D. 2007 *Indian Journal of Entomology* 69(1): 01-06

Pathak P.K., Dwivedi, P.N., & Gupta P.D. (2008). Comparative transport cost of loose and baled paddy straw. In: X.,LII ISAE Annual Convention and Symposium, Central Institute of Agricultural Engineering, Bhopal, February 01-03, 2008. Paper No. APE- 2008-ACP-03. pp. APE-1

Peakall, D.B., (1996). Dieldrin & other cyclodiene pesticides in wildlife. In: Environmental Contaminants in wildlife: interpreting tissue concentrations (eds. W.N. Beyer, G.H. Heniz and A.W. Redmon-Norwood): Lewis Publishers, Roca Raton Fla., pp. 93-97.

Randhawa, H.S., Aulakh, S.S., Bhagat, I., & Chhina J.S., (2009). Efficacy of different insecticides against *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) on seed crop of berseem in Punjab. Legume Res., 32: 145-148.

Saeed, Q., Zaka, M., Saeed, S. & Bakhtawar, M., (2013). Lucerne as trap crop in wheat for development of predator's population against wheat aphids (Aphididae: Homoptera). *Pakistan Journal of Zoology* 45: 193-196

Shah, N.K. & Saxena, Prakhar & Azmi, M.I. & Roy, S. and Tyagi, P.K. 2010. Eco-friendly pest management in berseem (Trifolium alexandrinum) and mustard (Brassica comprastis) mixed forage crop. *Indian Journal of Agricultural Sciences*. 80. 1062-1066.

Tufail, M. S., Krebs, G. L., Southwell, A., Piltz, J. W., Norton, M. R., & Wynn, P. C. (2020). Enhancing performance of berseem clover genotypes with better harvesting management through farmers' participatory research at smallholder farms in Punjab. *Scientific Reports*, *10*(1), 3545.

Yadav, P. S., Vijay, D. and Malaviya, D. R. (2015). Effect of cutting management on seed yield and quality attributes of tetraploid berseem. Range Management and Agroforestry, 36:47-51.

Zeb, Q., Badshah, H., Ali, H., Shah, R.A. and Rehman, M., (2011). Population of aphids on different varieties/lines of wheat and their effect on yield and thousands grain weight. *Sarhad Journal of Agriculture*., 27: 443-450.