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Screening of Oats (*Avena sativa*) Against Cereal Leaf Beetle Within the Ranges of Himalayas of Kashmir

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ABSTRACT

Cereal leaf beetle (*Oulema melanopus* L.) Chrysomelidae: Coleoptera is one of the devastating pests of wheat, oat and barley in Kashmir valley. Freezing temperatures of Kashmir valley are not suitable for double cropping in a single year. In these harsh winters, farmers are not able to feed their cattle fresh greens, to overcome the problem oats serve as best green fodder not only for cattle but now a days oats are preferred as dietary meal for people. Oats is encountered by various limiting factors, among which cereal leaf beetle has posed a threat in both quality and quantity as well. Hence, an experiment was laid to study the screening of four available varieties of Oats. Investigations were carried out at the farmers field near the Faculty of Agriculture, Wadura, Kashmir, India during 2021-22 under free choice conditions to evaluate the results. Among the evaluated varieties SKO-90 registered least damage of 17% followed by SABZAR (19%), however highest damage of (35%) was found on the cultivar KENT, it was closely followed by SKO-96 with leaf damage of (33%). It is advisable that, farmers should go through the two least damaged varieties of the oats and the chemical constituents responsible for the less damage need to identified through biochemical analysis.

Keywords Degree of damage, Incidence, Susceptible, *Avena sativa, Oulema melanopus* L.

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INTRODUCTION

The oats, *Avena sativa* Linnaeus is the sixth major crop of the world after wheat, maize, rice, barley and sorghum. It is mainly cultivated as fodder for animals and also for grain because of its high nutritional and medicinal value. The use of grain is now more focused on mining its benefits as a health food. They importance of oats in the biochemical and cosmetic industry is also on the rise. Oats is being used as an important grain crop especially by the people of peripheral populations among the developing countries, and for specifically important uses in developed world. In many parts of the world oats are grown for use as grain as well as for forage and for fodder, straw for bedding, hay, haylage, silage and chaff. Oats contain a good source of protein, fiber and minerals. This crop is considered to be a rich source protein, equal to meat, milk and, egg protein. As food source oats are being most preferably used in breakfast, however it is being considered by consumers as healthiest food from natural source which adds to its global demand. Moreover, oats are preferred over other types of grain because it possess a distinctive nutritional composition and multifunctional benefits of select bioactive compounds, including protein, unsaturated fatty acids, soluble (beta-glucan) and insoluble fiber,

micronutrients such as iron, potassium, copper and magnesium, thiamine, folate, zinc and phosphorus (Yu *et al.* 2012). Oats is also provided with source of many compounds such as tocopherol, inositol hexaphosphate, phenolic compounds, avenanthramides and sterols that bears antioxidant activity. Brindzova *et al.* (2012). Oats being rich in dietary fibers believed to produce various health benefits with preferably recommended to exhibit hypocholesterolemic and anticancerous properties. In addition to above mentioned properties, it is known to be effective against a number of diseases prevailing in mankind Prasad *et al.* (2015).

Global production of oats was 23 million tonnes with major contributions from Russia and Canada, each having about 20% of the world total production. Other remarkable producers were, Australia and Finland, the United Kingdom and Poland each with over 1 million tonnes (Anon 2019). In India, the total fodder cultivation constitutes approximately 4.9 (%), which covers an area of approximately 8.6 million ha on individual crop basis. The total area under cultivated fodders is 8.6 million ha on individual crop basis. The total area covered under oats cultivation in the country is about 1.0 million ha with its production of 35-50 t/h (Anon 2019). In India, it is grown in Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra and West Bengal. Uttar Pradesh holds maximum share of oat production with - 34%, followed by Punjab 20%, Bihar 16%, Haryana 9% and Madhya Pradesh 6% Panday and Roy (2011).

Besides diseases, A number of insect pests has been reported so far on oats which lead to considerable losses in green fodder and oat meal as well. Fifteen (15) insect pests, belonging to 5 different orders were recorded in the oats *(Avena sativa* L.) Kashmir agro-ecosystem. Soil borne insects viz. white grubs (*Holotrichia longipennis*, *Brahmina* spp, *Melolontha furcicauda* and *Oryctes* spp), wireworm (*Agriotes* spp) and cutworm (*Agrotis* spp); sucking pests including wheat aphid (*Schizaphis graminum*), green stink bug (*Carpocoris* spp), aster leafhoppers (*Macrosteles quadrillineatus*), broad-headed bug (*Camptopus lateralis*) and oat thrips (*Stenothrips graminum*) and foliage pests including cereal leaf beetle (*Oulema melanopus* L.), surface grasshopper (Chrotogonus trachypterus Blanchard), armyworm (*Mythimna separata*) and gram pod borer (*Helicoverpa armigera*) appeared as pests in the oats field. Among these *M. separata, O. melanopus* and *H. armigera* were major pests (Kumar *et al.* 2019). The first record of cereal leaf beetle in the United Status was in Southern Michigan in the early 1960s but can now be found throughout much of North America. In recent decades economic damage caused by cereal leaf beetle is increasing. The cereal leaf beetles *Oulema melanopus* L is an oligophagous insects, with limited host plants of family Gramineae, but found to prefer wheat, barley and oats. In these agroecosystems, they are pests with economic importance. The phase of enormous population increases of *O. melanopus* resulted in important economic damage in North America (Philips *et al.* 2011, Onychko 2012). The crop damage from cereal leaf beetles in certain areas of Europe could also lead to yield losses (Huusela-Veistola 2010, Tanasković *et al.* 2012, Onychko 2012) This beetle is characterized to produce one generation in a year. The Adult members of this beetle feed before winter and stay much of over wintering time in protected areas such as wind rows, crop stubble and tree bark crevices. Adults perform matting once the temperature reaches optimum levels of above 9-10 degrees Celsius (or 44.6 degrees F) and females have a comparably long laying period of approximately 45-60 days. They eggs are laid on the undersurface of leaves. The larvae make appearance in 7-15 days, and begin feeding on leaves with marked stripes along the leaf. The larvae took 12-20 days to attain maturity. Larvae poses serious threat to crops, as they consume upper surface of the leaves and make them hindered and unable to photosynthesize. Pupation takes place inside soil and took 20-25 days for adults to emerge, to repeat the cycle once again. Keeping in view the above facts, it becomes imperative to study the Seasonal Incidence of *Oulema melanopus* Infesting *rabi* Oats (*Avena sativa* L.) in North Kashmir.

MATERIALS AND METHODS

Field trials and experimental genotypes

Present study was carried out at farmers field near

FOA SKUAST-K Wadura campus during *rabi* season (2020-21 and 2021-22). Sowing was done on 12th of November 2020 and 5th Nov 21 for two consecutive years. A set of 4 oat genotypes with 3 check varieties were screened for their resistance against cereal leaf beetle. The cultivars were sown in Complete Randomized Block Design with genotype to genotype spacing of 50 cm and plant to plant spacing of 10 cm. The packages of practices were followed as per recommendations of SKUAST-K. However, no insecticidal treatment was given to experimental material. The genotypes were screened under natural infestation in the field.

Estimation methods

The relative resistance of oat genotypes against cereal leaf beetle Oulema melanopus was recorded on 3 plants per entry of each genotype. The degree of damage was determined during the phase of flowering after the development of the larvae and was defined as a percentage of leaf area damaged by cereal leaf beetles over the entire surface of the leaf flag.

The damage on flag leaf were recorded on percentage basis and evaluated on a scale ranging from 1 to 5 Rouag *et al.* (2012) and gave rise to different varieties such as resistant, moderately resistant, moderately susceptible and susceptible. (Table 1).

Statistical analysis

Data obtained from the experiments have been analyzed using standard statistical procedures.

RESULTS AND DISCUSSION

Table 1. Scale for scoring intensity of flag leaf damaged by cereal leaf beetle.

Scale	Percentage of flag leaf damaged	Grade
1-2	<10%	Resistant varieties
2-3	10-20%	Moderately Resistant varieties
3-4	20-40%	Moderately susceptible varieties
4-5	>40%	Susceptible varieties.

Screening of different oat genotypes for relative resistance against cereal leaf beetle (*Oulema melanopus* L.)

A perusal of data in figure revealed that the oat cultivar 'KENT' had the highest damage followed by SKO-96 and was found to be significantly different. The least damage was observed in cultivar SKO-90.

Degree of damage by cereal leaf beetle on 4 oat genotypes

The degree of damage on the leaves of 4 oat genotypes showed variation from 5 to 37%. Among the varieties, very low damage was reported on the variety namely SKO-90 (17%) followed by SABZAR (19%). The highest damage of (35%) was found on the cultivar KENT, it was closely followed by SKO-96 with leaf damage of (33%) (Table 2).

Since, Kashmir valley is altogether different in climate from rest of the country and no work in this regard has been conducted so far.

Data from both the years and their respective depicted same trend of results. The results obtained might be due to the antixenosis or the antibiotic properties in the tested cultivars in the experiment. As plant produces so many exudates as a defense management from biotic stresses. Supplementing the biochemical/exudate production there are several morphological characters possessed by the plant in the form of pubescence, hardiness, waxy layer which ultimately deter the insect population. These characters ultimately define the degree of damage done by the insect pest. Although Umer *et al.* (2018) described an-

Table 2. Screening of various genotypes against cereal leaf beetle.

Sl. No.	Scale	Percentage of flag leaf damaged	Grade	Genotype	Damage percent
1	1-2	10-20	Moderately resistant varieties	SKO-90, SABZAR	17 19
2	2-3	20-40	Moderately susceptible varieties	SKO-96, KENT	33 35

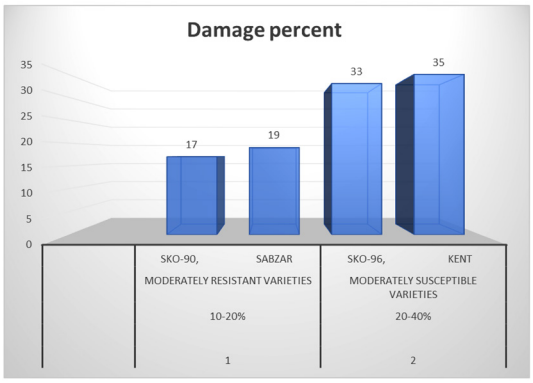

Fig.1. Degree of damage by *Oulema melanopus* on 4 oat genotypes.

tixenosis resistance in winter wheat and found lowest incidence and degree of damage by cereal leaf beetle in cultivar Ajanta with 3.33 and 7%, respectively. However, highest values of incidence and degree of damage was found in cultivar HB-208 by 35.55 and 37%, respectively. Adults feed actively when they are reproductively active and cause substantial damage to host plants Kher *et al.* (2011).

However, Anna *et al.* (2018) worked on the chemical control of cereal leaf beetle on spring wheat, while the monitoring was conducted in May-June of each year in Poznan (Institute of plant protection, National Research Institute) and found that the reduction of cereal leaf beetle larvae by foliar application of (pirimicarb + dimethoate + cypermethrin) with increase in the crop yield by 0.41 t ha (10.7 %) and additionally by 0.78 t ha (20.4 %). In addition to this seed treatment of wheat with imidacloprid and sowing season (autumn) proved to be a very suitable pest controlling strategy. Similarly, Koleva *et al.* (2015) conducted screening for antixenosis resistance of winter wheat genotypes to cereal leaf beetles in modern and old cultivars, local forms and breeding lines of winter wheat (*T. aestivum* L.) created in Bulgaria. The examination of natural infestation of local populations of cereal leaf beetle were monitored under field conditions on wheat plants and all 54 genotypes were classified according to infestation by cereal leaf beetle and host suitability. As a result, the highest density of cereal leaf beetles was found in cultivar Nedan while as, lowest density was found in cultivar Enola, breeding lines No 301 and Sofia No 312. *O. melanopus* favors interior portions of fields to avoid greater densities of natural enemies along the edge of fields. Although information is not available on spatial distributions of natural enemies of *O. melanopus,* a recent survey in Virginia and North Carolina did not find any parasitized eggs or larvae Philips *et al.* (2011). Determining when and where *O. melanopus* actually aggregate within wheat fields in the southeastern United States can give fundamental detail that may lead to better sampling plans and extra systematic use of insecticides. Efforts are underway in the southeastern United States to improve the ability to predict *O. melanopus* infestations using temperature and field characteristics Philips *et al.* (2011).

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