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Screening of *Brassica* Genotypes against *Alternaria* Blight under Northern Indian Shivalik Hill conditions

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ABSTRACT: *Brassica napus* L. (Oilseed rape) is a very valuable crop for purposes such as food, feed and industrial use. Simultaneously, several diseases have negatively impacted on the oilseed rape production. In Brassicaceae, a fungal disease caused by *Alternaria* spp. creates a substantial yield loss risk and is considered amongst the censorious global disease complexes. For this, taking into consideration the economic importance of disease, the present study aimed to bring about the information related to various aspects of disease and to find the status as well as the resistant species by screening of *Brassica napus* varieties. For two years, a study was carried out in the experimental field at SKUAST-Jammu region. Screening of fifteen genotypes of *Brassica napus* was done for their disease interaction with *Alternaria* blight disease (leaf and pod) by visual examination by using the 0-9 scale given by Conn *et al.* (1990). In the first season the *Alternaria* blight disease intensity ranged from 15.66 to 44.88 on leaf and 13.7 to 37.76 on pod and in the second season the disease intensity ranged from 18.66 to 49.93 on leaf and 24 to 52.87 on pod. None of the varieties were found completely resistant to *Alternaria* blight disease. RSPN-28 is the only genotype found moderately resistant to both seasons.

Keywords: *Brassica napus*, *Alternaria*, Screening, Resistant, oilseed rape.

INTRODUCTION

Rapeseed-mustard known to be as oilseed Brassicas, holds a paramount place in the group of the world's oilseed crops, belong to family Cruciferae (Brassicaceae) (Chauhan *et al*., 2011). It is the third most desirable crop comes after the soybean and palm (Kumar *et al.*, 2022). The genus Brassica circumscribes of various diverse plant types grown mainly as vegetables, condiments, and sources of oils and fodder purposes. (Cartea *et al*., 2019). The most consistently grown *brassica* species are six in number which are present in India and among these there are three diploids species commonly known as *Brassica nigra* with genome BB (n= 8) , *Brassica oleracea* with genome CC (n=9) and *Brassica rapa* with genome AA (n=10); and rest of the three are amphidiploids known as *Brassica carinata* with genome BBCC (n=17), *Brasssica juncea* with genome AABB (n=18) and *Brassica napus* with genome AACC (n=19) (Yadava *et al*., 2010).The model of 'U triangle' defined the relationship among various *Brassica* species (Zhang *et al*., 2022). Canola quality wise with low erucic acid and low glucosinolates and *Brassica rapa* and *Brassica napus* are main *Brassica* oilseed crops in many countries (Kumar *et al*., 2022) .

During 2018-19, area along with production and productivity of rapeseed-mustard is estimated to be 36.59 mha (million hectares), 72.37 mt (million tonnes) and 1980 kg/ha, respectively) in World. Globally, in India, total area (acreage) and production account for 19.8 % and 9.8% (Anonymous, 2019). There is a rising demand for vegetable oils, with expanding in the global population. Third largest oil source derived plant in the world is the *Brassica napus* L. with 27.3 mmt (million metric tons) global production annually [Anonymous, 2021].

The rapeseed oil has many usages such as in product related to food purposes and other non-nutrition purposes like lubricant mainly, diesel fuel oils, greases, The *Brassica napus* seed oil has an application for culinary purposes. The root part of *Brassica napus* is also desirable for the remedial purposes like diuretic, anti-inflammatory of bladder as well as anti-scurvy and anti-goat (Saeidnia and Gohari 2012).

Due to its nutritional composition, the value of oil is high and is observed as healthiest among various vegetable oils used for human consumption (Wllenhammar *et al*., 2022). Climate change, inadequate farming methods like high-intensity and continuous cropping, pathogen variation and, gives rise to disease outbreaks causes severe threats to *Brassica* production currently (Lv *et al*., 2020). Various types of stresses such as biotic and abiotic affect the all agricultural crops which are grown under natural condition. Hence, they are subjected to these stresses and affect their potential yield (Parewa *et al*., 2020). And there would be a large gap among the yields like potential and realized. The most common abiotic stresses involves water logging, drought, salt stress, mineral deficiency and low temperature (Dwivedi, 2016). Out of the biotic factors, the major contributors towards declining crop productivity is the disease incidence (Srinivasarao *et al*., 2021) and among these fungal diseases contribute to severe damages leads to yield losses up to 70% on world-wide. The fungal diseases cause severe attack by not only declining the seed quality but also by the oil content reduction greatly in various oil-yielding *brassica* species.

Out of the drastic fungal disease related to oilseed brassicas occur in India is *Alternaria* blight which is caused by the pathogen *Alternaria brassicae*, and is the most disastrous and extensive disease belongs to oilseed *brassicas* noted over a broad geographical area throughout the world recorded yield loss up to 70% (Gupta, 2020). An intermediate behavior shown by the *B. napus* lines with an incidence of 63.3% recorded due to *Alternaria* leaf blight (Lekhraj *et al*., 1997). So far, there has not been find any resistant genetic resources against this deadly disease. The occurrence of this noxious disease has been around a long time but become more condemnatory in the few last years because of the complete resistance to some of the most effective fungicides that were used to manage the disease.

MATERIAL AND METHODS

The experiment was carried out in the experimental field of Division Plant Breeding and Genetics, (FAO) Faculty of Agriculture, Chatha, SKUAST-J (Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu). The Chatha is positioned at a latitude (32°40 N) with longitude (78°48 E) and altitude (336 meters) above mean sea level. The experimental material comprised of 15 varieties enumerated in Table 1. Evaluation of these varieties was done in RBD (randomized block design) with three replications. As for as each replication concerned, sowing of individual entry in a plot includes five rows and each of the rows comprises of 5 m length and distance for row to row was kept at 30cm while the plant to plant was kept at 10cm with thinning after 20 days of sowing. The recommended fertilizer dose was given and also there was an adoption of recommended plant protection for good crop rising. The two sowings were done. For reaction to *Alternaria brassicae*, screening of all the genotypes done under the natural epiphytotic field conditions on scale 0-9 given by Conn *et al.* (1990) and with visual examinations, data was recorded for disease severity on leaves as well as pods after 100 days of sowing on ten leaves and pods randomly sampled out of each plot.

Table 1: From the per cent disease index the varieties were categorized as below.

Resistant	0-10%
Moderately Resistant	11- 25%
Moderately susceptible	26-50%
Susceptible	51- 75%
Highly susceptible	> 75%

Table 2: Genotypes with their pedigree used for study.

Sr. No.	Entries	Pedigree	Source
1.	RSPN-29	DGS-1 × GSL 1	SKUAST-J
2.	RSPN-28	DGS-1 × RSPN-25	SKUAST-J
3.	DGS-1	Selection from exotic collection	SKUAST-J
4.	RSPN-25	*B.napus* × *B. hirta*	SKUAST-J
5.	CNH-11-7	OCN8NA × China 1006BCR	PAU Ludhiana
6.	CNH-11-13	RT108NA × China 1006BCR	PAU Ludhiana
7.	GSL-1	Selection from farmer's field	PAU Ludhiana
8.	GSC-101	Rivette × RR001	PAU Ludhiana
9.	CNH-11-2	ECN 3 NA × China 6-1006NAR	PAU Ludhiana
10.	GSC-6	-	PAU Ludhiana
11.	EC552608	An exotic line of Gobhi sarson	CSKHPKV
12.	CNH-13-2	OCN66BC × China 6-1006-2	PAU Ludhiana
13.	HNS-1102	EC552601 × HNS0901	CCSHAU
14.	RL-1359	RLM -514 × Varuna	CSKHPKV
15.	HNS-1101	EC552600 × HNS0901	CCSHAU

According to Conn *et al*. (1990), 0= No infection, 1= Up to 5 percent infection, 3= › 5-10 percent infection, 5= › 11-25 percent infection, 7= › 26-50 percent infection and 9= › 50 percent infection.

Ten leaves were randomly selected from each of the genotype for recording the disease severity and on the basis of this PDI (Per cent Disease Index) was calculated with the McKinney (1923) formula:

$$PDI = \frac{\text{Sum of all disease ratings}}{\text{Total no.of ratings} \times \text{Maximum disease grade}} \times 100$$

RESULTS AND DISCUSSION

Within Brassicaceae, *Alternaria* spp. have a broad host range. As for example being taken, attack on the *Brassica oleracea var. capitata* (head cabbage), *Brassica campestris var. chinensis* (Chinese cabbage), *Brassica oleracea var. botrytis* (cauliflower), *Brassica oleracea* var. *italica* (broccoli), *Brassica napus* (canola), *Brassica juncea* (mustard) and other cultivated and wild grown crucifer plants**.** The reaction of different genotypes of *Brassica napus* in terms of *Alternaria* blight (on leaf and on pod) differed significantly shown in table 3. Most of the genotypes found susceptible to *Alternaria* blight because of the weather condition during the crop season were conducive for the disease development. Among all genotypes, none of the genotype found completely resistant to *Alternaria* blight disease. Many of the genotypes found susceptible to disease. Only the genotype, RSPN 28 found moderately resistant in both seasons (Table 3). The results are in resemblance with Singh *et al*. (2018), Singh *et al*. (2022); Chakrabarty *et al*. (2018); Singh, (2020).

Table 3: Screening of the genotypes based on Percent Disease Index (PDI) in two seasons at SKUAST Jammu.

	Season 1st (during first year)				Season 2nd (Second year)			
Genotypes	**Leaf**		**Pod**		**Leaf**		**Pod**	
	PDI	**RD**	**PDI**	**RD**	**PDI**	**RD**	**PDI**	**RD**
RSPN-29	20.83	MR	17.83	MR	36.86	S	32.07	S
RSPN-28	17.63	MR	15.73	MR	22.8	MR	24.28	MR
DGS-1	18.76	MR	13.76	MR	25.7	S	24	MR
RSPN-25	34.73	S	24.6	MR	49.93	S	34.6	S
CNH-11-7	28.6	MR	20.83	MR	35.76	S	27.9	S
CNH-11-13	44.86	S	37.76	S	60.76	MS	52.87	HS
GSL-1	15.66	MR	36.63	S	18.66	MR	47.66	S
GSC-101	35.7	S	25.73	S	46.76	S	34.92	S
CNH-11-2	21	MR	35.96	S	27.53	S	42.63	S
GSC-6	43	S	32.93	S	59.63	HS	54.63	HS
EC552608	20.76	MR	14.76	MR	27.66	S	25	MR
CNH-13-2	23.8	MR	13.7	MR	26.7	S	25.6	S
HNS-1102	25.66	S	26.73	S	36.63	S	37.93	S
RL-1359	22.8	MR	14.7	MR	28.3	S	24.46	MR
HNS-1101	26.7	S	23.76	MR	31.9	S	28.96	S

PDI: Percent Disease Index and **RD:** Reaction to Disease

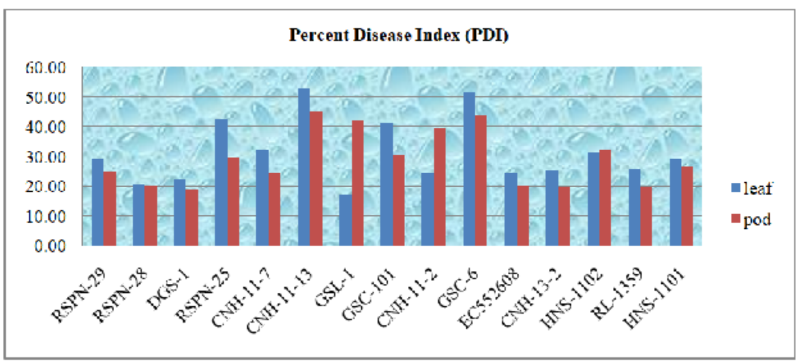

Fig. 1. Percent Disease Index leaf and pod across all genotypes.

CONCLUSION

In the first year, the genotypes (RSPN0-29, RSPN-28, DGS-1, CNH-11-7, GSL-1, CNH-11-2, EC552608, CNH-13-2 and RL-1359 are moderately resistant to *Alternaria* blight (on leaf) and genotypes (RSPN-29, RSPN-28, DGS-1, RSPN-25, CNH-11-7, EC552608, CNH-13-2, RL-1359 and HNS-1101 found moderately resistant to *Alternaria* blight (on pod).

In the second year, the genotypes (RSPN-28 and GSL-1) found moderately resistant *Alternaria* blight (on leaf) and genotypes (RSPN-28, DGS-1, EC552608 and RL-1359) found moderately resistant *Alternaria* blight (on pod). Overall, genotype RSPN-28 found moderately resistant in both the year. Therefore, our study suggests the farmers in selection of resistant cultivars and shows the status of *Alternaria* blight severity so to adopt the suitable disease management strategies for future endeavors.

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Conflict of Interest. None.

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