Comparison of Sclerotinia rot incidence and sclerotial formation in different rapeseed-mustard species

A. S. Rathi[1], Dhiraj Singh[2]
[1]Oilseeds Section, Department of Plant Breeding, CCS, Haryana Agricultural University, Hisar-125 004, Haryana, India, rathias1961@gmail.com
[2]Oilseeds Section, Department of Plant Breeding, CCS, Haryana Agricultural University, Hisar-125 004, Haryana, India, dhiraj542004@yahoo.co.in

ABSTRACT

A comparative study was conducted in Research Area at Hisar, Haryana, India during 2007-08 and 2008-09 *rabi* crop seasons to observe the differences in sclerotinia rot incidence/ severity and formation of sclerotia in different rapeseed-mustard species due to infection by *Sclerotinia sclerotiorum* under sick plot and artificial stem inoculation conditions. Sclerotinia rot disease appeared first (45-52 DAS) in *Eruca sativa* followed by (50-57 DAS) in *Brassica rapa* (*var. toria*, *yellow sarson* and *brown sarson*) while, the disease appeared late (60-70 DAS) in *B. juncea, B. napus*, *B. carinata* and *B. tournefortii* followed by more late (70-80 DAS) in *B. nigra*, *B. chinensis* and *Sinapsis alba* under sick plot conditions. The mean disease incidence also varied in different rapeseed-mustard species, being highest of more than 45 per cent in *Eruca sativa* followed by between 30-45 per cent in *B. nigra*, *B. rapa* varities and *B. juncea.* The mean incidence of 10-25 per cent was also recorded in *B. napus*, *B. chinensis*, *B. carinata*, *Sinapsis alba and B. juncea* (purple mutant). A least mean incidence of less than 10 per cent was observed in *B. tournefortii*. Under artificial stem inoculation conditions (with pure culture), Sclerotinia rot severity of more than 50 per cent was observed in *Eruca sativa*, *B. juncea*, *B. rapa* varieties, *B. nigra*, while mean severity range of 30-40 per cent was recorded in *Sinapsis alba* and *B. chinensis*. Mean severity of less than 30 per cent was recorded in *B. napus, B. carinata* and *B. tournefortii* under artificial stem inoculation conditions. A direct positive correlation was observed between delay in stem breaking and more number of sclerotia formed inside the pith of main stem, having maximum in *B. napus* followed by *B. juncea*. Minimum numbers of sclerotia per main stem were recovered from the pith of *Sinapsis alba* and almost nil from *B. tournefortii*.

Key words: Rapeseed – mustard - Sclerotinia rot – Incidence-severity - sclerotia

INTRODUCTION

Rapeseed-mustard is the second most important oilseed crops in India after groundnut both in area and production. The cultivated species comprises *Brassica juncea* (Indian mustard), *B. rapa (var. toria*, *var. yellow sarson* and *var. brown sarson)*, *B. napus* (Gobhi sarson), *B. carinata* (Karan rai) and *Eruca sativa* (Taramira). *Sclerotinia sclerotiorum* (Lib) De Bary, the causal fungus of Sclerotinia rot or white blight or stem disease is a necrotrophic pathogen with world wide distribution known to infect over 400 species of plants (Boland and Halls, 1994). The pathogen affects many crops in India, particularly rapeseed-mustard and has become a wide spread and destructive in mustard growing parts (Ghasolia et al., 2004) and take a heavy toll of yield (Chauhan et al., 1992). In mustard growing areas, this disease led to complete crop failure, as the disease incidence has been recorded up to 80 per cent in some parts of Punjab and Haryana states (Kang and Chahal, 2000; Sharma *et. al*., 2001). Once the pathogen is established, it is extremely difficult to control. This ascomycete can cause systemic and aerial infection by myceliogenic and carpogenic germination of sclerotia surviving in soil. Being ubiquitous necrotroph, it severely affects cultivated oilseed Brassica grown in different geographical regions of the world. Increase in Sclerotinia rot incidence in Haryana state is associated with yield losses and is of concern for two reasons, the scarcity of resistant cultivars in *Brassica species* in maturity groups appropriate for the region, and the cost of fungicides for the control of disease. The disease attacks all Rapeseed-mustard species at their different phenological stages of plant growth and ultimately led to add large sclerotial inoculum to the soil

depending upon the cultivars grown. Authors have not seen apothecial formation under natural sick plot conditions in field during the course of this investigation in rapeseed-mustard crops, probably because of adverse climatic conditions during the season for the formation of apothecia. Large numbers of sclerotia are formed in soil on dead organic matter, on roots, on and inside the pith of stem in rapeseed-mustard crops, they get mix in soil and serve as source of primary inoculum for the next season and infect the plants by myceliogenic germination. However, non-formation of apothecia in this region cannot be completely ruled out, as symptoms of disease were also noticed on upper parts of plants without having stem rot symptoms. Keeping this background in view, present study was undertaken to observe differences in Sclerotinia rot incidence/ severity and formation of sclerotia in different rapeseed-mustard species due to infection by *Sclerotinia sclerotiorum.*

MATERIALS AND METHODS

Eleven species of rapeseed-mustard *viz*., *Brassica juncea, B rapa var. toria*, *B. rapa var. yellow sarson B. rapa var. brown sarson*, *B. napus*, *B. tournefortii, B. nigra*, *B. carinata*, *B. chinensis*, *Sinapsis alba* and *Eruca sativa* were grown in field in paired rows of 3m length in randomized block design with three replications at Research Farm of CCS Haryana Agricultural University Hisar. The soil of the experimental plots was sandy loam in texture, low in organic carbon (0.28%) and available nitrogen (170 kg N ha^{-1}), medium in available phosphorus (20 kg P_2O_5 ha^{-1}) having Ece 0.30 dS m^{-1} and slightly alkaline in reaction (pH 7.7). All the experimental plots received recommended dose of fertilizers (80 kg N and 40 kg P_2O_5 ha^{-1}). Sowing was done in the last week of October 2007 and 2008 in permanent natural sick plot in field having high sclerotial inoculum density and also in field plot adjacent to it having low sclerotial density. In later plot, 10 plants per rapeseed-mustard specie were inoculated with pure culture of *Sclerotinia sclerotiorum* at the third internode of main stem at flowering stage by the method of Zhao et al., (2004) with some modifications. Frequent irrigations were given to create high humidity. Observations on days to initial symptoms and disease incidence (per cent number of plants infected) were recorded from the plants grown in natural sick plot conditions while, observation on disease severity was recoded on the artificially stem inoculated plants using 0-4 scale of Lesovoi et al., 1987 with slight modification. Observations on days to stem breaking and number of sclerotia formed per main stem (inside pith) were counted at end of the season from plants of rapeseed-mustard species inoculated with pure culture.

RESULTS

Data in table 1 reveal, that Sclerotinia rot appeared early (45-52 DAS) in *Eruca sativa* followed by (50-57 DAS) in *Brassica rapa* (*var. toria*, *yellow sarson* and *brown sarson*) while, the disease appeared late (60-70 DAS) in *B. juncea, B. napus*, *B. carinata* and *B. tournefortii* followed by more late (70-80 DAS) in *B. nigra*, *B. chinensis* and *Sinapsis alba* under sick plot contions. The mean Sclerotinia rot disease incidence was also found varied in different rapeseed-mustard species, being highest of more than 45 per cent in *Eruca sativa* followed by between 30-45 per cent in *B. nigra*, *B. rapa* varities and *B. juncea.* The mean incidence of 10-25 per cent was also recorded in *B. napus*, *B. chinensis*, *B. carinata*, *Sinapsis alba and B. juncea* (purple mutant). A least mean incidence of less than 10 per cent was observed in *B. tournefortii*. Sclerotinia rot severity of more than 50 per cent was observed in *Eruca sativa*, *B. juncea*, *B. rapa* varieties, *B. nigra*, while mean severity range of 35-40 per cent was recorded in *Sinapsis alba* and *B. chinensis* under stem inoculation conditions (with pure culture). Mean severity of less than 30 per cent was recorded in *B. napus* and *B. carinata* and *B. tournefortii* (Table 2). A direct positive correlation was observed between delay in stem breaking and more number of sclerotia formed inside the pith of main stem, having maximum number (27.2) of sclerotia per main stem in *B. napus* followed by (21.4) in *B. juncea*. Minimum numbers () of sclerotia per main stem were recovered from the pith of *Sinapsis alba* and almost nil from *B. tournefortii* (Table 2)

Table 1. Stem rot incidence in different rapeseed-mustard species under sick plot conditions

Rapeseed-mustard species	Variety	Stem rot incidence (%)*			Initial symptoms (DAS)		
		2007-08	2008-09	Mean	2007-08	2008-09	Range
Brassica juncea	Varuna	39.2	32.1	35.7	65	70	65-70
Brassica juncea	Purple mutant	7.1	13.4	10.3	70	80	70-80
Brassica rapa var. toria	TH 68	45.1	34.4	39.8	52	57	52-57
Brassica rapa var. yellow sarson	YSPB 24	38.7	28.7	33.7	50	55	50-55
Brassica rapa var. brown sarson	BSH 1	35.7	30.0	32.8	50	56	50-56
Brassica nigra	Local	43.1	45.8	44.5	70	80	70-80
Brassica carinata	HC 212	10.7	13.3	12.0	62	70	62-70
Brassica napus	HNS 9605	21.4	27.5	24.5	65	70	65-70
Brassica tournefortii	Local	6.6	9.0	7.8	60	65	60-65
Brassica chinensis	Local	14.2	22.5	18.4	70	80	70-80
Sinapsis alba	Local	7.4	12.9	10.2	70	80	70-80
Eruca sativa	T 27	48.6	45.0	46.8	45	52	45-52

* Per cent number of plant infected

DISCUSSION AND CONCLUSION

Sclerotinia sclerotiorum infects more than 400 plant species including cultivated crops and oilseed Brassica and cause Sclerotinia rot (Boland and Halls, 1994). In Haryana (India), the sclerotinia rot infects many crops particularly rapeseed-mustard every year and causes severe infection in rapeseed-mustard depending upon the environmental conditions and cultivars grown. In the present investigation, initial symptoms of Sclerotinia rot appeared first (45-52 DAS) in *E. sativa* followed by (50-57 DAS) in *B. rapa* while, the initial symptoms appeared late 60-70 DAS) in *B. juncea, B. napus*, *B. carinata* and *B. tournefortii* followed by more late (70-80 DAS) in *B. nigra*, *B. chinensis* and *Sinapsis alba* under sick plot conditions. Dense, thin and more lateral branching intermingled with each other in field may provide congenial micro-climate within the crop canopy for the initiation and spread of disease in *E.sativa and B. rapa* varieties. Early phenological susceptible phase in early maturing rapeseed-mustard species couples with favorable environmental condition for myceliogenic/ carpogenic germination may also be a region for early appearance of disease. The mean disease incidence also varied in different rapeseed-mustard species, being highest of more than 45 per cent in *Eruca sativa* followed by between 30-45 per cent in *B. nigra*, *B. rapa* varities and *B. juncea*. The mean incidence of 10-25 per cent was also recorded in *B. napus*, *B. chinensis*, *B. carinata*, *Sinapsis alba and B. juncea* (purple mutant). A least mean incidence of less than 10 per cent was observed in *B. tournefortii*. The results are in partial accordance with the observation made by Sharma, et al. in 2001.they also reported that among Brassica species, *B. napus* was least susceptible followed by *B. carinata*, while in *B rapa*, *B. tournefortii*, *B. chinensis and Eruca sativa*, plant mortality exceeded 70 per cent. Ghasolia and Asha Shivpuri (2007) also suggested that the incidence of Sclerotinia rot was associated with differences in the micro-climate of the plant canopy and this may be the reason for high disease incidence in *E. Sativa*, as the crop is short stature in nature which covers soil surface and enhances the humidity within the crop canopy.

Table 2. Stem rot severity in different rapeseed-mustard species under stem inoculation conditions

Rapeseed-mustard species	Variety	Stem rot severity (%)[1]		Days to stem breaking	No. of Sclerotia/main stem (in pith)	
		2007-08	2008-09	Mean	Mean	Mean
Brassica juncea	Varuna	52.5	60.0	56.3	12.9	21.4
Brassica juncea	Purple mutant	52.5	57.5	55.0	9.1	7.8
Brassica rapa var. toria	TH 68	50.0	52.5	51.3	2.2	11.7
Brassica rapa var. yellow sarson	YSPB 24	47.5	52.5	50.0	9.8	15.2
Brassica rapa var. brown sarson	BSH 1	55.0	50.	52.5	8.6	8.1
Brassica nigra	Local	50.0	57.5	53.8	9.4	8.3
Brassica carinata	HC 212	30.0	25.0	27.5	13.9	15.3
Brassica napus	HNS 9605	32.5	25.0	28.8	14.7	27.2
Brassica tournefortii	Local	22.5	27.5	25.0	8.7	0.5
Brassica chinensis	Local	35.0	30.0	32.5	13.1	7.8
Sinapsis alba	Local	32.5	42.5	37.5	8.1	3.8
Eruca sativa	T 27	55.0	60.0	57.5	8.4	13.4

[1]Per cent Sclerotinia rot severity is based on 0-4 scale

In the present investigation, *B. napus* and *B. carinata* and *B. tournefortii* were least susceptible (<30% severity), while disease severity was more than 50 per cent in *Eruca sativa*, *B. juncea*, *B. rapa* varieties, *B. nigra* under stem inoculation conditions. Based on the available level of tolerance, it is advocated that the identified genotypes in tolerant group of rapeseed- mustard species could be utilized to further enhance the level of resistance/tolerance rather than donor parents for incorporating resistance against *Sclerotinia sclerotiorum*. A direct positive correlation was found between delay in stem breaking and more number of sclerotia formed inside the pith of main stem, having maximum in *B. napus* followed by *B. juncea*. Minimum numbers of sclerotia per main stem were recovered from the pith of *Sinapsis alba* and almost nil from *B. tournefortii*. This suggests, that due to early break down of stem, the further progression of fungal mycelium may stop results in formation of less number of sclerotia, while in the plants like *B. napus* or *B. juncea*, thick wide main stem may help in delay of stem breaking, hence fungal mycelia may infect through the whole pith resulting in formation of more number of sclerotia.

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