

RESEARCH ARTICLE

Incidence, yield losses and symptomatology of sclerotinia stem rot (SSR) of Indian mustard (*Brassica juncea* L.) incited by *Sclerotinia sclerotiorum*

■ Irfan Khan, Pokhar Rawal and Roop Singh

SUMMARY

SSR hamper successful cultivation and causes significant yield losses globally including India. The SSR disease incidence ranged from 3.59 to 18.50 per cent in mustard growing areas of Rajasthan and Bhartpur district having the highest (18.50%) disease incidence. However, the Udaipur district had the lowest (3.59%) disease outbreak. SSR was responsible to cause 18.80 per cent overall yield losses in two consecutive years (rabi 2016-17 and 2017-18). Highest yield loss (43.82%) was observed from Bhartpur district while minimum yield loss (3.51%) had recorded from Udaipur district. Characteristics symptoms, formation of white mycelium on host stem and development of sclerotia on/inside the stem, of SSR on mustard crop were noted during survey.

Key Words : Incidence, Sclerotinia, Yield loss, Mustard

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MEMBERS OF THE RESEARCH FORUM

Author to be contacted :

Irfan Khan, Department of Plant Pathology, Rajasthan College of Agriculture, Udaipur (Rajasthan) India
Email : kkirfan786@gmail.com

Address of the Co-authors:

Pokhar Rawal, ICAR-AICRP on Sorghum, Directorate of Research, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan) India

Roop Singh, Department of Plant Pathology, Rajasthan College of Agriculture, Udaipur (Rajasthan) India

Indian mustard [*Brassica juncea* (L.) Czernj. and Cosson] is, belongs to family *Brassicaceae*, naturally amphidiploids ($2n=36$) and self-pollinated. It is also known as *raya* and in India mainly cultivated in Rajasthan, UP, Haryana, Madhya Pradesh and Gujarat. It is also grown in some non-traditional areas in southern India, such as Karnataka, Tamil Nadu and Andhra Pradesh. In addition to India, it is also grown in different countries, including Canada, China, Germany, France, Australia, Pakistan and Poland. In India, rapeseed mustard occupies

about 6.05 million hectares, with an annual output of 7.46 million tons and a productivity of 1234 kg ha⁻¹. The area of rapeseed and mustard planted in Rajasthan is approximately 2.37 million hectares, with a yield of 4.08 million tons and a productivity of 1720 kg ha⁻¹ (Anonymous, 2019). Indian mustard contributed 24.3% and 24.7% of the area and total edible oilseed production the country, respectively (Rathore *et al.*, 2018). In India, more than thirty diseases have been identified as attacking brassica crops (Saharan *et al.*, 2005). Stem rot (SR) or Sclerotinia rot, caused by *Sclerotinia sclerotiorum* (Lib.) de Bary, is the most calamitous fungal disease that causes serious damage to Indian mustard. Shaw and Ajrekar (1915) first reported sclerotinia stem rot on various host plants including canola. *S. sclerotiorum* (Lib) de Bary is the most ubiquitous, omnivorous, soil-borne and destructive plant pathogen distributed worldwide. Previously, the SSR disease in rapeseed-mustard was thought to be of minor concern in India. It was due to mycelial infection, which occurred only on isolated plants infrequently. Sclerotial populations proliferated in the soil as a result of persistent monocropping and irrigated rapeseed-mustard farming. SSR has become a highly dangerous disease of oilseed Brassica crops in areas such as Rajasthan, Haryana, Punjab, Assam, West Bengal, Madhya Pradesh, Uttar Pradesh, and Bihar as a result of these conditions (Saharan and Mehta, 2002). In keeping above factors in mind, present investigation was carried out to study incidence, yield losses and symptomatology of SSR in mustard growing areas of Rajasthan.

MATERIAL AND METHODS

Survey for distribution and severity of disease:

Mustard growing areas of Rajasthan (Table A) were surveyed to record incidence and severity caused by stem rot disease at flowering and pod maturity stage during 2016-17 and 2017-18. A total of seventy five mustard fields were surveyed which comprises five districts and from each district three blocks (one village from each) had selected. Five fields from each village were randomly selected. An area of 1 m×1 m was marked at five randomly selected spots on each farmer's field. The per cent disease incidence was recorded randomly from different locations of each field *i.e.* four corners (S1, S2, S3, S4) and one central patch SC of 1m² each by counting total number of plants and number of plants showing characteristic symptomatic of SSR infection

Table A: List of surveyed locations of mustard growing areas during Rabi 2016-17 and 2017-18

District	Blocks	District	Blocks
Udaipur	Mavli	Chittorgarh	Begun
	Udaipur		Nimbahera
	Fatehnagar		Gangrar
Bhartpur	Bhartpur	Hanumangarh	Sangaria
	Deeg		Ravatsar
	Kumher		Tibbi
Ganganagar	Ganganagar		
	Raisingh Nagar		
	Anupgarh		

using the formula given below:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Estimation of yield losses :

The estimation of yield loss was accomplished by comparing yield of health and infected plots. Yield loss (%) was determined using the formula given below (Mousanejad *et al.*, 2010).

$$\text{Per cent yield loss} = \frac{\text{Yield in healthy plot} - \text{Yield in infected plot}}{\text{Yield in healthy plot}} \times 100$$

Estimated yield losses = Per cent yield losses × Per cent disease incidence

Observation of characteristic symptoms:

Diagnostic symptoms of SSR were observed and recorded from infected plants during Rabi 2016-17 and 1017-18 survey.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Incidence of SSR:

A survey was carried out in major mustard growing districts of Rajasthan during Rabi 2016-17 and 2017-18 for estimation of disease incidence of SSR incited by *S. sclerotiorum*. The disease incidence was ranged from 3.59 to 18.50 per cent and maximum disease incidence (18.50%) had reported from Bhartpur district. However, minimum disease incidence (3.59%) documented from Udaipur district. After Bhartpur, it was observed that 14.13 and 13.17 per cent disease incidence had documented from Ganganagar and Hanumangarh,

respectively. In case of Chittorgarh district, disease incidence of SSR was 4.28 per cent (Table 1 and Fig. 1). During *Rabi* 2016-17, utmost disease incidence (21.05%) was observed from Bhartpur followed by Ganganagar, Hanumangarh and Chittorgarh by 13.02, 12.72 and 4.94 per cent, respectively. Although, 3.14 per cent disease incidence was reported from Udaipur district that was least among all district during 2016-17. Likewise, it had reported highest incidence (15.95%) of

SSR from Bhartpur than Ganganagar, Hanumangarh and Udaipur by 15.23, 13.62 and 3.78 per cent during *Rabi* 2017-18. Howbeit, during this year minimum (3.62%) SSR incidence was documented from Chittorgarh. Among blocks of Udaipur district, highest incidence (4.62%) of SSR disease had documented from Mawli block followed by Fatehnagar (3.34%) and Udaipur (2.83%), respectively. In case of Chittorgarh district, Nimbahera block had have maximum disease incidence than Begun (3.72%) and Gangrar (3.18%). Similarly, Bhartpur block had utmost SSR disease incidence (25.45%) followed by Dig (21.47%) and Kumher (8.6%), respectively. The disease incidence 14.88, 12.67 and 11.97 per cent was noticed from Ravatsar, Tibbi and Sangaria blocks of Hanumangarh district, respectively. Although, 16.53, 15.55 and 10.3 per cent disease incidence had noted from Ganganagar, Anupgarh and Raisingh Nagar blocks of Ganganagar, respectively. These results are in accordance with Kang and Chahal (2000), as they documented incidence of this disease in Raya and Ghobhi sarson from different districts of Punjab that was ranged between 1.2 to 12 per cent. Parallel to our findings, Yadav *et al.* (2013) recorded 29.2 per cent disease incidence from Dausa district of Rajasthan followed by 24.8 per

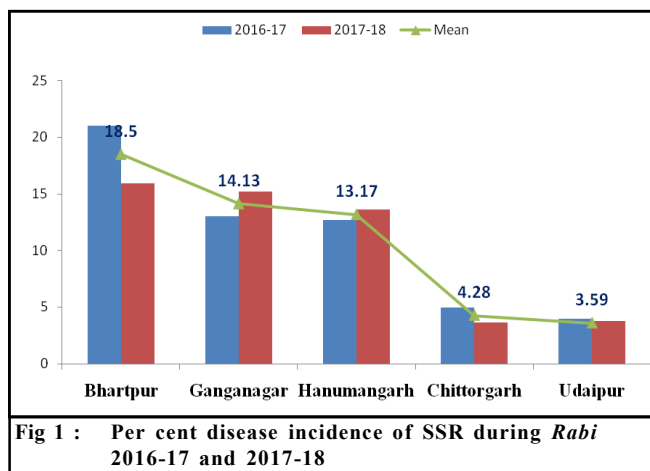


Fig 1 : Per cent disease incidence of SSR during *Rabi* 2016-17 and 2017-18

Table 1 : Incidences of sclerotinia stem rot disease of mustard during *Rabi* 2016-17 and 2017-18 from different location of Rajasthan

Districts	Block	Per cent disease incidence		
		2016-17	2017-18	Pooled
Udaipur	Mawli	4.07	5.17	4.62
	Udaipur	3.37	2.3	2.83
	Fatehnagar	2.8	3.87	3.34
	Mean	3.41	3.78	3.59
Chittorgarh	Begun	4.27	3.17	3.72
	Nimbahera	7.4	4.5	5.95
	Gangrar	3.17	3.2	3.18
	Mean	4.94	3.62	4.28
Bhartpur	Bhartpur	28.07	22.83	25.45
	Dig	27.87	15.07	21.47
	Kumher	7.23	9.97	8.6
	Mean	21.05	15.95	18.50
Hanumangarh	Sangaria	13.47	10.47	11.97
	Ravatsar	14.37	15.4	14.88
	Tibbi	10.33	15	12.67
	Mean	12.72	13.62	13.17
Ganganagar	Ganganagar	15.7	17.36	16.53
	Raisingh Nagar	9.6	11	10.3
	Anupgarh	13.77	17.33	15.55
	Mean	13.02	15.23	14.13

cent from Rohtak district of Haryana and minimum 7.0 and 7.4 per cent at Jaipur and Bharatpur district, respectively. The outbreak of SSR was reported have incidence about 20 per cent from Madhya Pradesh in mustard (Dhakad, 2006). Disease was reported from all major mustard growing states (10-74% incidence) of India including Rajasthan, Haryana and Punjab and also from some non-traditional growing region (Krishnia *et al.*, 2000; Chattopadhyay *et al.*, 2003 and Saharan *et al.*, 1985).

Estimation of yield losses caused by *S. sclerotiorum*:

Yield losses caused by SSR were assessed by comparing yields of healthy and infected fields. Yield data had recorded during *Rabi* 2016-17 and 2017-18 survey and presented in Table 2 and Fig 2. Results of yield losses depicted that 18.80 per cent overall yield was recorded in two consecutive years. Highest yield loss (43.82%) had documented from Bhartpur followed by 21.41 and 21.26 per cent from Ganganagar and Hanumangarh, districts, respectively. However lowest yield loss (3.51%) due to SSR had reported from Udaipur. Similarly, 4.03 per cent yield loss was observed from

Chittorgarh district. The yield losses ranged from 3.21 to 44.41 per cent during *Rabi* 2016-17 and maximum yield loss (44.41%) was noted from Bhartpur followed by 20.86, 18.45 and 3.62 per cent from Hanumangarh, Ganganagar and Udaipur districts, respectively. Although, minimum yield loss was 3.21 per cent had recorded from Chittorgarh district. During 2017-18 *Rabi* season, utmost yield loss (43.22%) was documented from Bhartpur followed by 24.37, 21.65 and 4.85 per cent from Ganganagar, Hanumangarh and Chittorgarh districts, respectively.

From Udaipur, 3.4 per cent yield loss was noticed that least among all district during *Rabi* 2017-18. These results are in agreement with the findings of Shivpuri *et al.* (2000) and Krishnia *et al.* (2000), as they observed economic losses ranges from 39.9 per cent to more than 60 per cent have been recorded from Rajasthan. Similarly, 40-80 per cent losses have been noticed from Haryana and Punjab (Sharma *et al.*, 2001 and Chattopadhyay *et al.*, 2003 and Mehta *et al.*, 2010).

Symptomatology:

Characteristic symptoms of SSR of mustard were noted during *Rabi* 2016-17 and 2017-18. Water soaked lesion first appeared either on stem or leaves, later they were proliferated and appeared as a necrotic spots. Thereafter, necrotic lesions are transformed in fluffy white mycelium. Misshaped lesion has also appeared on leaves. Development of white mycelium on host surface is apparent sign of *S. sclerotiorum* infection. Occasionally pathogen infection confines to limit portion of pith that causes stunting and premature ripening of plants. During the advance stages of disease development, tan to black spherical sclerotia are produced in stem pith or on the surface of the infected plant parts. Similar symptoms had recorded by Bolton *et al.* (2006) from canola crop. Presence of white fluffy mycelia on stem and siliquae has also been observed from infected

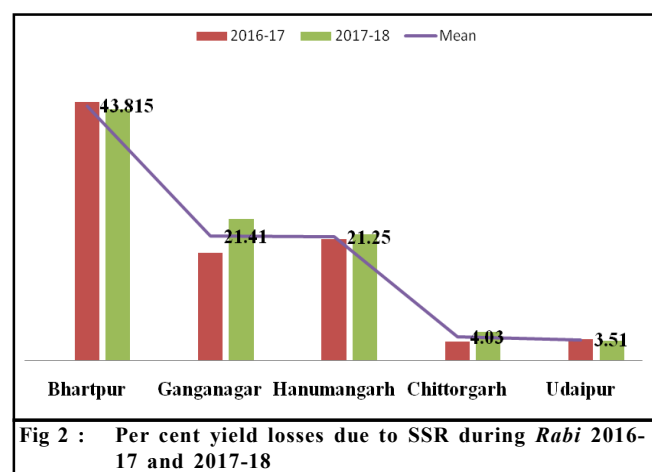


Fig 2 : Per cent yield losses due to SSR during *Rabi* 2016-17 and 2017-18

Table 2 : Yield losses due to incidences of sclerotinia stem rot disease of mustard during *Rabi* 2016-17 and 2017-18 from different location of Rajasthan

District	Per cent disease incidence		Mean	Estimated yield loss (%)		Mean
	2016-17	2017-18		2016-17	2017-18	
Bhartpur	21.05	15.95	18.5	44.41	43.22	43.82
Ganganagar	13.02	15.23	14.13	18.45	24.37	21.41
Hanumangarh	12.72	13.62	13.17	20.86	21.65	21.26
Chittorgarh	4.94	3.62	4.28	3.21	4.85	4.03
Udaipur	3.98	3.78	3.59	3.62	3.4	3.51
	Overall disease incidence (%)		10.73	Overall estimated yield loss (%)		18.80

mustard plants (Rakesh *et al.*, 2016). Defoliation, stem shredding, wilting, and plant drying are all symptoms of a severe infection. Plants that have been infected will ripen as compare healthy plant (Meena *et al.*, 2014). The emergence of water-soaked lesions at the base of the stem is more common symptom of SSR (Sharma *et al.*, 2015).

Conclusion:

During survey maximum disease incidence (18.50%) had reported from Bhartpur district and minimum (3.59%) from Udaipur district. After Bhartpur, it was observed that 14.13 and 13.17 per cent disease incidence had documented from Ganganagar and Hanumangarh, respectively. In case of Chittorgarh, disease incidence of SSR was 4.28 per cent. Highest yield loss (43.82%) had documented from Bhartpur followed by 21.41 and 21.26 per cent from Ganganagar and Hanumangarh, districts, respectively. However lowest yield loss (3.51%) due to SSR had reported from Udaipur. Similarly, 4.03 per cent yield loss was observed from Chittorgarh district. Characteristics symptoms, formation of white mycelium on host stem and development of sclerotia on/inside the stem, of SSR on mustard crop were noted during survey.

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REFERENCES

- Anonymous (2019). Directorate of economics and statistics, agricultural statistics at a Glance, Department of Agricultural and cooperation. Ministry of Agriculture, Government of India.
- Bolton, D.M., Thomma, P.H.J.B. and Nelson, D.B. (2006). *Sclerotinia sclerotiorum* (Lib.) de Bary: biology and molecular traits of a cosmopolitan pathogen. *Molecular Plant Pathology*, **7**: 1-16.
- Chattopadhyay, C., Meena, P.D., Sastry, R.K. and Meena, R.L. (2003). Relationship among pathological and agronomic attributes for soil borne diseases of three oilseed crops. *Indian J. Plant Protection*, **31**: 127-128.
- Dhakad, K.S. (2006). Studies on some aspects of Sclerotinia blight of mustard. M.Sc. Thesis, College of Agricultural, Gwalior, JNKVV, Jabalpur, (M.P.), pp 25-26.
- Kang, I.S. and Chahal, S.S. (2000). Prevalence and incidence of white rot of rapeseed and mustard incited by *Sclerotinia sclerotiorum* in Punjab. *Plant Disease Research*, **15** : 232-233.
- Krishnia, S.K., Meena, P.D. and Chattopadhyay, C. (2000). Seed yield and yield attributes of Indian mustard affected by sclerotinia rot. *J. Mycology & Plant Pathology*, **30** : 265.
- Meena, P.D., Rathi, A.S., Kumar, V. and Singh, D. (2014). Compendium of rapeseed-mustard diseases: Identification and Management. Directorate of Rapeseed-Mustard Research (ICAR), Bharatpur (Rajasthan), pp. 30.
- Mehta, N., Hieu, N.T. and Sangwan, M.S. (2010). Efficacy of botanicals against *Sclerotinia sclerotiorum* inciting white stem rot of rapeseed-mustard. *Plant Disease Research*, **26**(1): 82-86.
- Mousanejad, S., Alizadeh, A. and Safaie, N. (2010). Assessment of yield loss due to rice blast disease in Iran. *J. Agric. Sci. & Technol.*, **12**: 357-364.
- Rakesh, Rathi, A.S., Kumar, P, Kumar, A. and Kumari, P. (2016). Sclerotinia rot of rapeseed mustard: A comprehensive review. *J. Appl. & Nat. Sci.*, **8** (4): 2325-2336.
- Rathore, S.S., Shekhawat, K., Meena, P.D. and Singh, V.K. (2018). Climate smart strategies for sustainable production of rapeseed-mustard in India. *J. Oilseed Brassica*, **9** (1): 1-9.
- Saharan, G.S., Kaushik, J.C. and Kaushik, C.D. (1985). White stem rot disease of *Brassica juncea*. *Crucifers Newsletter*, **10**: 109.
- Saharan, G.S. and Mehta, N. (2002). Fungal diseases of rapeseed-mustard. In: *Diseases of field crops* (Gupta, VK and Paul YS eds.). Indus Publishing Company, New Delhi, pp. 193-228.
- Saharan, G.S., Mehta, N. and Sangwan, M.S. (2005). Diseases of oilseed crops. Indus Publication Co., New Delhi, pp.643.
- Sharma, P., Meena, P. D., Verma, P. R., Saharan, G. S., Mehta, N., Singh, D. and Kumar, A. (2015). *Sclerotinia sclerotiorum* (Lib.) de Bary causing Sclerotinia rot in oilseed Brassicas: a review. *J. Oilseed Brassica*, **6**: 1 - 44.
- Sharma, S., Yadav, J.L. and Sharma, G.R. (2001). Effect of various agronomic practices on the incidence of white rot of Indian mustard caused by *Sclerotinia sclerotiorum*. *J. Mycology & Plant Pathology*, **3**: 83-84.

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Shaw, F.J. and Ajerakar, S.L. (1915). The genus *Rhizoctonia* in India. Department of Agriculture in India, *Botanical Series*, **7**: 177-194.

Shivpuri, A., Sharma, K.B. and Chipa, H.P. (2000). Some studies on the stem rot disease of rapeseed-mustard in

Rajasthan. *J. Mycology & Plant Pathology*, **30**: 268.

Yadav, M.S., Singh, N., Singh, S., Ahmad, N. and Godika, S. (2013). Assessment of prevalence and severity of sclerotinia rot of Indian mustard in Rajasthan and Haryana. *Indian J. Plant Protection*, **41**: 249-252.

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