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Occurrence and dispersal of sclerotinia rot of chickpea incited by *Sclerotinia sclerotiorum* in Rajasthan

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Abstract
Chickpea is one of the major legume crops cultivated in India. Sclerotinia rot or white rot of chickpea incited by *Sclerotinia sclerotiorum* (Lib.) de Bary has become a serious problem in recent years in major chickpea growing areas of Rajasthan and other chickpea growing parts of India. A roving survey was conducted during *Rabi* 2016-17 and 2017-18 in foremost chickpea growing districts of Rajasthan exposed that Sclerotinia rot was the main problem in Sri Ganganagar (19.95%), Hanumangarh (19.04%), Kota (18.55%), Sawaimadhopur (17.84%) and Bikaner (16.53%) districts. The maximum disease incidence was observed on the collar region, stem, and foliage leading to mortality of the plants. With the progress of the disease, a white web of fungal mycelium and Sclerotia were seen on disease-infected parts giving its typical diagnostic symptoms. The diseased plants were spotted in the field during February and March.

Keywords: Chickpea, *Sclerotinia sclerotiorum,* survey

Introduction
Stem rot is also known as Sclerotinia wilt or white mold, is caused by *Sclerotinia sclerotiorum* is a serious disease of chickpea, it infects all the economically important food and feeds legumes (Pratt & Knight, 1984) [16]. This fungus has a wide host range and has a worldwide distribution on numerous crops (Boland & Hall, 1994) [5]. It is one of the destructive pathogens associated with the root rot/wilt complex of chickpea and its occurrence is increasing in both incidence and severity on chickpea grown in the Mediterranean region (Anon., 1996) [2], The early contagion occurs in the late winter or early spring, and the fungal mycelia grow within and between plants. Patches like symptoms of dead plant parts enlarge and coalesce through spring and cause major losses in stands (Bolton *et al.* 2006) [6], The fungus produces many black fleshy structures called Sclerotia, which survive from one cropping season to the next, Over-wintered Sclerotia may germinate during the summer or may remain dormant for many years (Adams & Ayers, 1979) [1]. The etiology, biology, and epidemiology of the fungus had been studied extensively by several workers (Philips, 1987; Purdy, 1979; Roberts *et al.* 1982) [15]. Cultivation of resistant varieties is the ideal and feasible control of the disease and no resistant varieties against this disease have been identified so far. Erect-type cultivars can better withstand the disease and management can also minimize the crop losses, Stable resistance could not be achieved due to the prevalence of virulent isolates of *S. sclerotiorum* (Sharma *et al.* 2002) [18]. Overcome of Sclerotinia rot of chickpea through alone chemical is less effective as *S. sclerotiorum* having a broad host range and survives in soil for long periods in the form of Sclerotia. The Sclerotia will survive up to ten years still in the lack of host plants and beneath prevailing dry soil conditions. It is essential to recognize the incidence of the disease and factors associated with disease development, which will help in devising appropriate and successful management tactics feasible to each location, looking into the prevailing conditions. consequently, the present research was carried through to study the factors associated directly or indirectly with Sclerotinia rot disease incidence in Rajasthan.

Materials and Methods
Areas Surveyed
A roving survey was conducted to record the occurrence and distribution of Sclerotinia rot in main chickpea production districts of Rajasthan *viz.*, Sri Ganganagar, Hanumangarh, Kota,

Sawaimadhopur, Bikaner, Jaipur, Nagour, Sikar, Churu, and Jhunjhunu during *Rabi* season 2016-17 and 2017-18. In each district, a minimum of five locations/villages was selected, in each location/village minimum of five fields were selected and, in each field, five plots of 10 m^2 were selected and the incidence of disease was recorded after counting the diseased and healthy plants.

Data Collection

While surveying, data on the variety grown, soil type, cropping pattern prevalence in the area, method of irrigation of chickpea crop, based on infected plants and a total number of plants observed, disease incidence was calculated.

Disease-infected plants showing the typical Sclerotinia rot symptoms were collected from surveyed locations, packed in labeled paper bags, and brought to the laboratory for isolation of the pathogen. Based on observations the disease incidence was calculated by using this formula (Horsfall and Cowling, 1978) [10].

$$\text{Percent disease incidence (PDI \%)} = \frac{\text{Total number of infected plants}}{\text{Total number of plants observed}} \text{ X } 100$$

Results and Discussion

Sclerotinia rot of chickpea is an important soil-borne disease in Rajasthan. A roving survey was conducted during *Rabi* season 2016-17 and 2017-18 in major chickpea production districts of Rajasthan revealed that Sclerotinia rot was a major disease in Sri Ganganagar, Hanumangarh, Kota, Sawaimadhopur, and Bikaner districts. The survey was conducted when the crop stage was between 90 to 120 days.

The results presented in Table: 1 and Fig: 1 indicated that the disease incidence and distribution were noticed in all the chickpea fields wherever the survey was conducted. The maximum disease incidence was observed in plants at the flowering and podding stage in February and March. The overall range of disease incidence in all the districts varied from 13.83 to 19.95 percent with an average of 16.55 percent in Rajasthan. The maximum disease incidence was recorded in Sri Ganganagar (19.95%) followed by Hanumangarh (19.04%), Kota (18.55%), Sawaimadhopur (17.84%) which was above the state level average (16.55%) of Rajasthan. While, in the case of Bikaner (16.53%), Jaipur (15.40%), Nagour (15.32%), Churu (14.66%), Sikar (14.39%), and Jhunjhunu (13.83%) the disease incidence was found below the state level average. In the surveyed districts, no single district and location were completely disease-free.

Observations of Sclerotinia incidence were also recorded on superior and local chickpea varieties. superior varieties *viz.*, GNG-1581 and RSG-888 were sown in seventeen locations while local varieties were found in four locations. Results are given in Table: 1 and Fig. 2 (A) revealed that the disease incidence was more in local varieties (18.04) in comparison to superior varieties (16.25).

Table 1: Percent incidence of Sclerotinia rot of chickpea (*Sclerotinia sclerotiorum*) in different districts of Rajasthan

S. No.	Name of Districts	Tehsil (No. of Village/Locations)	Mean disease Incidence (%)*	Crop variety	Cropping pattern	Soil type	Irrigation method	Stage of disease incidence
1.	Sri Ganganagar	Sri Ganganagar (2)	20.77	GNG-1581	CB:CP	Sandy loam	Flood	F
		Padampur (3)	18.33	GNG-1581	CB:CP	Sandy loam	Rainfed	F
		Sri Karanpur (2)	20.75	GNG-1581	CB:CP	Loamy sand	Flood	F
		Mean	19.95					
2.	Bikaner	Bikaner (5)	16.10	GNG-1581	CB:GN	Sandy loam	Sprinkler	F
		Sri Dungargarh (3)	16.17	GNG-1581	CB/Fallow	Sandy loam	Sprinkler	F
		Khajuwala (3)	17.33	Local	CB/Fallow	Loamy sand	Flood	F & P
		Mean	16.53					
3.	Hanumangarh	Hanumangarh (2)	18.25	GNG-1581	CT:CB	Clay loam	Flood	F
		Rawatsar (3)	19.83	GNG-1581	CB:CT	Clay loam	Flood	F & P
		Mean	19.04					
4.	Sawaimadhopur	Sawaimadhopur (2)	13.75	GNG-1581	PM:MU	Sandy loam	Flood	F
		Choth ka Barwada (4)	17.12	GNG-1581	PM:CO	Sandy loam	Flood	F
		Khandar (3)	22.66	Local	PM:MU	Sandy loam	Flood	F & P
		Mean	17.84					
5.	Jaipur	Bassi (4)	15.37	RSG-888	PM:CB	Loamy sand	Flood	F
		Chaksu (3)	15.50	RSG-888	PM:CB	Loamy sand	Flood	F
		Chomu (3)	15.33	RSG-888	PM:CB	Loamy sand	Flood	F
		Mean	15.40					
6.	Nagour	Degana (3)	14.90	GNG-1581	PM:MU	Sandy loam	Rainfed	F
		Merta City (2)	15.75	GNG-1581	PM:MU	Sandy loam	Rainfed	F
		Mean	15.32					
7.	Churu	Ratangarh (2)	14.00	GNG-1581	CB:MO	Sandy loam	Sprinkler	F
		Sardar Sahar (3)	14.16	GNG-1581	CB:MO	Sandy loam	Sprinkler	F
		Rajgarh (3)	15.83	GNG-1581	MO:CB	Sandy loam	Sprinkler	F
		Mean	14.66					
8	Sikar	Shrimadhopur (3)	14.67	GNG-1581	PM:MU	Sandy loam	Rainfed	P
		Laxmangarh (2)	15.50	Local	PM:CO	Sandy loam	Sprinkler	P
		Fathepur (2)	13.00	GNG-1581	PM:CO	Sandy loam	Rainfed	P
		Mean	14.39					
9.	Jhunjhunu	Jhunjhunu(3)	12.16	GNG-1581	PM:CO	Sandy loam	Sprinkler	P
		Pilani (3)	14.16	GNG-1581	PM:CO	Sandy loam	Sprinkler	P
		Chirawa (2)	15.17	GNG-1581	PM:CO	Sandy loam	Sprinkler	P
		Mean	13.83					

10.	Kota	Ummedganj (3)	18.50	GNG-1581	PM:MU	Clay loam	Flood	P
		Borkhera (3)	16.67	Local	PM:CO	Clay loam	Rainfed	P
		Kaithun (2)	20.50	GNG-1581	PM:CO	Clay loam	Rainfed	P
		Mean	18.55					
	General Mean		16.55					

PM = Pearl millet [*Pennisetum Americana* (L.) Leeke], MU = Mung [*Vigna radiate* (L.) Wilczek], CP= Chickpea [*Cicer arietinum* (L.)], CT= Cotton [*Gossypium hirsutum*], CB = Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.], GN= Groundnut [*Arachis hypogaea* (L.)], CO= Cow pea [*Vigna unguiculate* (L.) Walp.], MO= Mothbean [*Vigna aconitifola* (Jacq.) Marchel]
F= Flowering, P= Podding
*Pooled data of two year

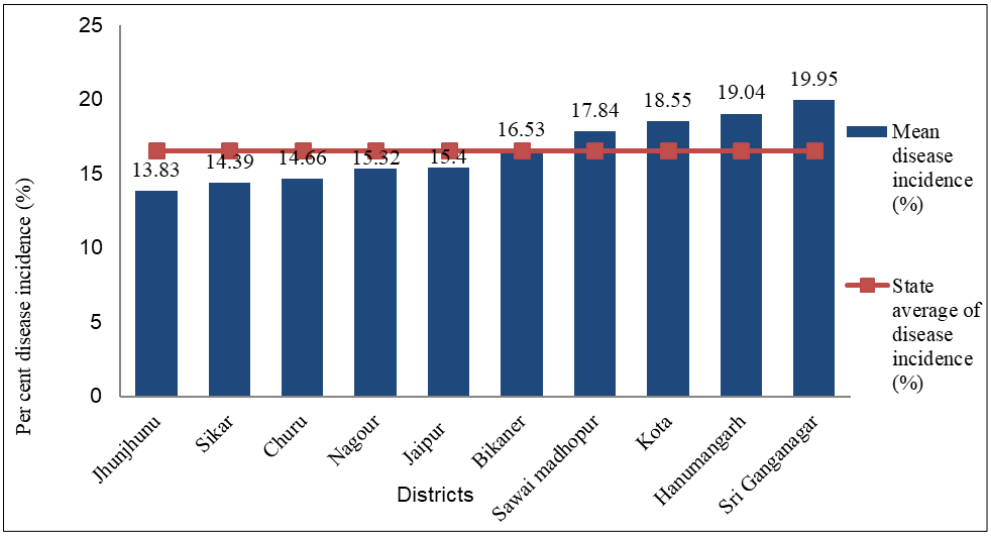

Fig 1: Percent incidence of Sclerotinia rot of chickpea in different districts of Rajasthan

Sandy loam was found in eighteen locations, Loamy sand and clay loam were found at five locations of Rajasthan, respectively. Results are given in Table: 1 and Fig: 2 (B) mention that the maximum average disease incidence was found in clay loam soil (18.75%) followed by loamy sand soil (16.85%), Minimum disease incidence was recorded in sandy loam soil (15.78%).

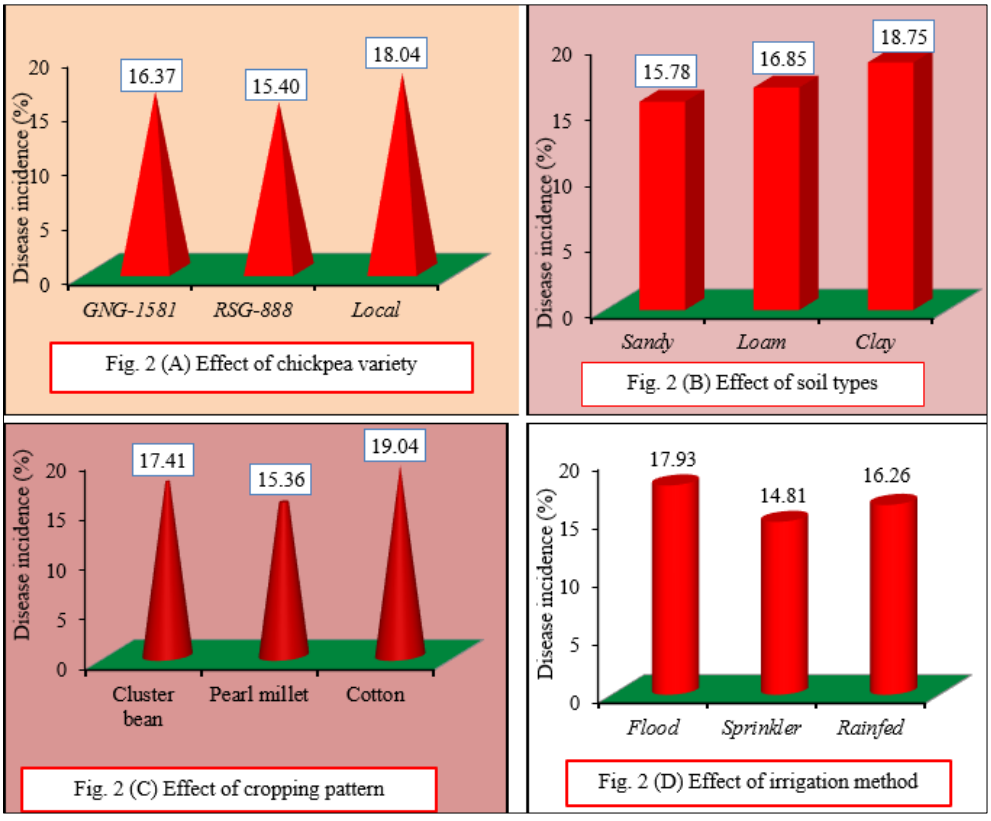

Fig 2: Effect of different parameters on percent incidence of Sclerotinia rot of chickpea in Rajasthan

The effects of cropping patterns on Sclerotinia rot incidence were also recorded during the survey of chickpea fields. mostly, four types of cropping patterns were followed in ten districts of Rajasthan. The cluster bean-based cropping pattern was found in ten locations of Sri Ganganagar, Bikaner, Hanumangarh, and Churu district. The pearl millet-based cropping pattern was found in fourteen locations of Sawaimadhopur, Jaipur, Nagour, Sikar, and Jhunjhunu districts. Results presented in Table: 1 and Fig: 2 (C) referred that the maximum average disease incidence (19.04%) was found in the cotton-based cropping pattern and minimum disease incidence was observed in pearl millet (15.36%) based cropping pattern.

Results also mentioned that the disease incidence was maximum (16.59%) under irrigated conditions. While in rainfed conditions disease incidence was 16.26 percent [Fig:-2 (D)] as compared to irrigated conditions.

In the present findings, it is evident from survey data, Sclerotinia rot incidence varied from locality to locality. It may be due to soil type, varieties grown, environment conditions *viz.*, low temperature, high soil moisture content, relative humidity, and cropping pattern like cluster bean-chickpea, pearl millet-cotton. These conditions favor the inoculums' build-up and, as a result, higher disease development.

The present findings are supported by various earlier workers. Kang and Chahal, (2000) [12] revealed that out of 680 fields surveyed in 11 districts of Punjab, India. In Ludhiana, Patiala, and Jalandhar districts, disease prevalence in gobhi sarson was higher (60-73.81%) than in other districts (20-50%). The highest disease incidence in gobhi sarson was recorded in Ludhiana (12.0%), and the lowest in Bathinda (1.2%). The disease was noticed irrespective of soil types, cropping system, and cultivars used and incidence ranged from 1.0 to 60 percent or more in badly infected soils. The present findings are also supported by Shivpuri *et al.* (2000). Ghasolia *et al.*, (2004) [9] also reported that out of 640 mustard fields surveyed in 24 districts of Rajasthan, 40-60% disease incidence was recorded in 31 fields of 10 districts. In 71 fields incidence of Sclerotinia rot was 20-39% and in the rest of the 538 fields < 20%. Metha *et al.*, (2010) [14] studied the incidence of Sclerotinia rot in Haryana and reported that yield-reducing factors especially in Raya (*Brassica juncea*) ranged from 40-80 percent losses in yield. Yadav *et al.*, (2013) [21] reported incidence of stem rot of mustard in Rajasthan & Haryana ranged from 7.4 to 29.2 percent and disease was more severe at pod formation to grain filling stage. A similar result was recorded by Chauhan *et al.* (1992) [7] and they reported that stem rot of mustard caused yield losses of up to 72 percent in severe cases in Uttar Pradesh. Bharti *et al.* (2016) [3] revealed that out of 360 mustard fields from all blocks surveyed in five districts, the maximum percent disease incidence was found in Gohad 18.33 and in Karahal 0.67 percent was recorded. Out of the 24 blocks, 14 blocks showed disease incidence percent in the range of 10-18, and in the remaining 10 blocks, the disease incidence comes under 1-10 percent.

Conclusion

A roving survey was conducted during *Rabi* 2016-17 and 2017-18 in seventy-eight locations of ten major chickpea growing districts of Rajasthan revealed that Sclerotinia rot incited by *Sclerotinia sclerotiorum* (Lib.) de Bary was a major disease problem in Sri Ganganagar, Hanumangarh, Kota, Sawaimadhopur and Bikaner districts.

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References

1. Adams PB, Ayers WA. Ecology of Sclerotinia species. Phytopathology. 1979;69:896-98.
2. Anonymous. Annual Report, Legume Program, International Centre for Agricultural Research in the Dry Areas (ICARDA). 1996, 316.
3. Bharti O, Pandya RK, Yadav R, Singh R. Sclerotinia stem rot: A potential potential threat to mustard cultivation in northern Madhya Pradesh. Asian Journal of Plant Science and Research. 2016;6(2):52-55.
4. Bliss CL. The method of probits. Sci. 1934;79:38.
5. Boland GJ, Hall R. Index of plant hosts of *Sclerotinia sclerotiorum.* Can. J Plant Pathol. 1994;16:93-108.
6. Bolton ND, Thoma PHJ, Nelson BD. *Sclerotinia sclerotiorum* (Lib.) de Bary: Biology and molecular traits of cosmopolitan pathogen. Molecular Plant Pathology. 2006;7:1-16.
7. Chauhan LS, Singh J, Chandra DR. In: Proceedings of National symposium on Management of microbes in service of mankind. Nov. 19-21, 1992 at Univ. of Allahabad, Allahabad. 1992, 65-66. (Abstr.).
8. Cuong ND, Dohroo NP. Study on biologically based management practices of Sclerotinia rot of cauliflower. Pl. Dis. Res. 2007;22(2):124-128.
9. Ghasolia RP, Shivpuri A, Bhargava AK. Sclerotinia rot of Indian mustard in Rajasthan. Indian Phytopathol. 2004;57(1):76-79.
10. Horsfall JG, Cowling EB. Plant Disease: An Advanced Treatise, Volume II: How disease develops in populations. Chapter 6: Pathometry: The measurement of plant disease. Academic Press, New York. 1978, 120-136.
11. Javeria S, Kumar H, Gangwar RK, Tyagi S, Yadav RS. Isolation of stem rot disease-causing organism of brinjal and their *In-vitro* inhibition with fungicides and bio-control agents. European Researcher. 2014;83(9-2):1662-1670.
12. Kang SD, Chahal SS. Prevalence and incidence of white rot of rapeseed and mustard incited by *Sclerotinia sclerotiorum* in Punjab. Pl. Dis. Res. 2000;15(2):232-233.
13. Kaur J, Kaur R, Kaur P, Singh RS. Evaluation of *Trichoderma* against different soil-borne pathogens of vegetables. In: Proceeding of Annual meet of IPS and National Symposium on Integrated plant disease management through eco-friendly strategies 22-23 Nov. at PAU Ludhiana, Punjab. 2003, 61-64.
14. Metha N, Hieu NT, Sangwan MS. Efficacy of botanicals against *Sclerotinia sclerotiorum* inciting white stem rot of rapeseed-mustard. Pl. Dis. Res. 2010;26(1):82-86.
15. Phillips AJI. Carpogenic germination of Sclerotinia white mold (*Sclerotina sclerotiorum*) in nay bean (*Phaseolus vulgaris*). Mededelingen van de Faculteit Land

Bouwwetenschappen Rijksuniversiteit Gent. 1987;53:787-796.
16. Prat RG, Knight WE. Foundation of apothecia by sclerotia of *Sclerotinia trifoliorum* and infection of crimson clover in the field. Plant Disease. 1984;66:1021-1023.
17. Sharma BK. Efficacy of biocontrol agents for the control of chickpea stem rot. Journal Biological Control. 1994;8:115-117.
18. Sharma BK, Singh UP, Singh KP. Variability in Indian isolates of *Sclerotium rolfsii*. Mycologia. 2002;96:1051-1058.
19. Sharma SK, Verma BR, Sharma BK. Biocontrol of *Sclerotinia sclerotiorum* causing stem rot of chickpea. Indian Phytopatholog. 1999;52(1):44-46.
20. Shivpuri A, Sharma KB, Chippa HP. Some studies on the stem rot disease (*Sclerotinia sclerotiorum*) of rapeseed/mustard in Rajasthan, India. Phytopatho. 2004;24(2):452-455.
21. Yadav MS, Singh N, Singh S, Ahmad N, Godika S. Assessment of prevalence and severity of Sclerotinia rot of Indian mustard in Rajasthan and Haryana. Indian Journal of Plant Protection. 2013;41(3):249-252.