Biological Forum – An International Journal **16(7): 274-276(2024)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Status of Root Rot of Pea Caused by *Rhizoctonia solani* in Zone-III A of Rajasthan, India

Astha Sharma[1*], R.P. Ghasolia[1], Pinki Sharma[1], Ratan Lal Sharma[2], S. Godika[1], S.K. Goyal[1], G.K. Mittal[3], Kiran Gaur[4], S.K. Jain[5], Pooja Yadav[6], Sushila Yadav[7] and Suman Chopra[1]

[1]Department of Plant Pathology, S.K.N. College of Agriculture (SKNAU), Jobner, Jaipur (Rajasthan), India.
[2]Department of Plant Pathology, ARS Keshwana, Jalore, (AU, Jodhpur) (Rajasthan), India.
[3]Department of Bio-Chemistry, S.K.N. COA (SKNAU), Jobner, Jaipur (Rajasthan), India.
[4]Department of Statistics, S.K.N. COA (SKNAU), Jobner, Jaipur (Rajasthan), India.
[5]Department of PBG, RARI, Durgapura, SKNAU, Jobner (Rajasthan), India.
[6]Department of Plant Pathology, RARI, Durgapura, SKNAU, Jobner (Rajasthan), India.
[7]Department of Plant Pathology, COA, MPUAT, Udaipur (Rajasthan), India.

(Corresponding author: Astha Sharma)*
(Received: 14 April 2024; Revised: 22 May 2024; Accepted: 17 June 2024; Published: 15 July 2024)
(Published by Research Trend)

ABSTRACT: Garden pea (*P. sativum* sp. *hortense*) is a crucial vegetable crop cultivated globally in cooler regions, serving both as a fresh vegetable (green pea) and a dried pulse. Despite its extensive production, pea yields are often hindered by various biotic (diseases) and abiotic (environmental) factors. Among the biotic constraints root rot disease caused by *Rhizoctonia solani* is the major limiting factor in pea production. To know the status of root rot disease, survey was conducted in the major pea-growing regions of Rajasthan during the Rabi season of 2022-23 which revealed significant prevalence and economic concern. The study focused in Zone-III A of Rajasthan *viz.*, which includes districts like Ajmer, Jaipur, Tonk and Dausa. The findings showed an average disease incidence of 23.12% across the surveyed districts of Rajasthan. Jaipur had the highest incidence(29.01%) while Dausa recorded the lowest (18.13%). This survey provides crucial data on the spread of root rot in continuously pea growing districts of Rajasthan, which need effective disease management strategies.

Keywords: Pea, root rot, *Rhizoctonia solani*, Disease incidence, Survey.

INTRODUCTION

Peas is one of the most preferred vegetable crops grown in cooler regions worldwide, used both as a vegetable (green pea) and a pulse (dried pea). According to Duke (1981) there are four types of peas: garden pea (*P. sativum* sp. *hortense),* dry pea (*P. sativum* sp. *arvense*), edible podded pea (*P. sativum* sp. *macrocarpon*) and early dwarf pea (*P. sativum* var. *humile*). Pea belongs to the family *Fabaceae* and is a diploid species. Pea is cultivated in tropical and subtropical regions and are valued for their nutritional content. Fresh green peas (100g) contain 44 calories, 75.6% water, 6.2g protein, 0.4g fat, 16.9g carbohydrate, 2.4g crude fiber, 0.9g ash, 32mg Ca, 102mg P, 1.2mg Fe, 6mg Na, 350mg K, 405 µg β-carotene equivalent, 0.28mg thiamine, 0.11mg riboflavin, 2.8mg niacin, and 27mg ascorbic acid. Dried pea contains 10.9% water, 22.9% protein, 1.4% fat, 60.7% carbohydrate, 1.4% crude fiber, and 2.7% ash (Duke, 1981; Hulse, 1994; Kadam *et al.,* 2018). Pea is significant economically crop in India, which ranking fourth in area (10.53%) and fifth in production (6.96%) (FAO, 2022). In India, the total cultivation of pea is 582 thousand ha area and 6700 million tons production (Anon., 2022). It is grown in Uttar Pradesh, Madhya Pradesh, Himachal Pradesh, Punjab, Haryana, Rajasthan, Maharashtra, Bihar and Karnataka with 67 per cent of the total production. In Rajasthan, it is grown on an area of 12687 hectares with an annual production of 25385 tonnes. It is mainly cultivated in Jaipur, Sikar, Kota, Bharatpur and Udaipur regions. The district Jaipur alone covers an area of about 7801 hectares with a total production of 7335 tonnes (Anon., 2022). This crop is also intercropped with cereals to enhance soil fertility through nitrogen fixation in their root nodules.

Among diseases, Root rot disease, particularly in the third A zone of Rajasthan, poses a significant threat to pea cultivation, causing substantial losses during initial plant establishment. It is considered the most destructive ailment in peas, significantly impacting initial plant stand and involving over 20 different pathogens reported globally. Among these pathogens, *Rhizoctonia solani*, *Fusarium solani* f.sp. *pisi*, *Fusarium oxysporum* f.sp. *pisi*, *Aphanomyces euteiches*, and *Pythium* spp. are particularly destructive. This disease inhibits early root growth, affecting nutrient and water uptake, leading to stunted growth. Infected plants bear few, partially filled pods that mature early (Oyarzun, 1993). Under favorable environmental

conditions, the disease can cause complete crop failure (Tu, 1987). The disease has also been reported in the Kashmir Valley, where peas are the primary pulse crop grown during the rabi season, with incidence rates ranging from 14.8% to 64.7% (Masoodi *et al*., 2000). *Rhizoctonia solani* can survive for many years in soil by way of sclerotia or as a saprophyte, colonizing soil organic matter. Sclerotia and mycelia present in soil and plant tissues can eventually activate to produce vegetative hyphae that can attack a wide range of crops (Keijer, 1996).

The pathogen mainly attacks the root and underground parts, but it is also capable of infecting other plant parts like the green foliage, the seeds and the hypocotyls (Acharya *et al*., 2014). Among the initial symptoms of the disease, the yellowing of leaves is a first symptom which in the next 2- or 3-days leaves droop and wither off. The roots of infected plants are poorly developed; finer roots are either not formed or rotted. Plants show stunted growth and can easily be pulled out. If the plants are pulled from the soil, the basal stem along with the main root, may show symptoms of rotting. The tissues are weakened and break off easily in advanced cases and sclerotial bodies can be seen scattered on the affected roots. In lieu of economic concern & wide prevalence, roving survey was conducted to assess the occurrence of this important disease in the Rajasthan region.

MATERIALS AND METHODS

Survey and Incidence of Disease. A roving method of survey was followed to assess the incidence of root rot in peas during 2022-23. The survey was conducted in the major pea-growing districts of Zone-III A of Rajasthan, specifically in Ajmer, Jaipur, Dausa, and Tonk. It was carried out from the last week of December to the first week of January to determine the incidence of root rot disease. The survey covered sixteen villages from eight tehsils across the four districts, with two villages randomly selected from each tehsil.

To assess the disease incidence, five pea fields were selected in each village within each tehsil of each district. The average incidence of the disease in each village was then calculated. In each field, five spots of one square meter area were marked diagonally at random to cover the entire field. Diseased and healthy plants were counted in each spot, and the percentage of disease incidence was calculated using the following formula:

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

Infected plants showing typical symptoms of root rot were collected along with rhizosphere soil in paper bags for examination and isolation of the pathogen. Diseased samples were preserved under dried conditions for further studies. Additional information related to soil type, irrigation status, and the variety of pea cultivated was also recorded in the respective survey fields.

RESULTSAND DISCUSSION

Distribution and Incidence of Root Rot of Pea. The data depicted in Table 1 show that the incidence of root rot in peas was noticed in all the surveyed fields in four districts of Rajasthan. The average incidence of root rot disease ranged from 18.13% to 29.01% across the four districts. The mean disease incidence was highest in Jaipur (29.01%) followed by Tonk (23.19%), Ajmer (22.13%) and lowest in Dausa (18.13%). The overall mean average of disease incidence across the eighty fields in the four major pea-growing districts of Rajasthan was 23.12%.

Disease incidence also varied among the tehsils, following the sequence of decreasing order: Jobner (31.30%) > Amber (26.73%) >Newai (24.54%) > Ajmer (23.22%) >Deoli (21.85%) >Peesangan (21.05%) >Lalsot (20.58%) > Ramgarh Pachwara (15.69%). Root rot-affected plants appeared in patches in all surveyed fields, with no single location in the surveyed districts completely free from the disease. As per verbal discussions with farmers, it was concluded that disease incidence was higher in fields where mono-cropping with local cultivars was practiced year after year, particularly in sandy loam to sandy soils. Local varieties were found to be more susceptible to *R. solani* compared to improved varieties.Earlier, root rot of pea caused by *R. solani* was considered as a minor disease, but now it is gaining importance & becoming destructive in monotonic pea growing areas of Rajasthan. Similarly finding align with Swaroop *et al.* (2014) highlighted pea root rot caused by *Fusarium sp*. and reported disease incidence from 18.22% to 32.43% in Jobner and nearby areas. Singh and Rao (2015) observed 34.67% incidence of root rot in fenugreek caused by *Rhizoctonia solani* with a yield loss of 55.26% in Chhattisgarh. Thakur *et al*. (2016) noted severe root rot incidence in pea-growing areas of Himachal Pradesh, with 54.7% incidence at HAREC, Kukumseri, and moderate incidence of 17.7% to 35.3% in Zones II and III at Bajaura and Palampur, respectively. Karibasappa *et al*. (2018) found maximum stem and root rot incidence of sesame caused by *M. phaseolina* in sandy soils, followed by loamy sand and loam soil textures. Williamson-Benavides *et al*. (2020) observed that root rot is a devastating disease of peas, causing significant yield losses (15-60%) worldwide. Yan and Nelson (2022) reported that soil type significantly affected disease development, with higher severity in lighter soils (sandy loam and silt loam) compared to clay, and maximum severity observed in sandy loam for *Fusarium solani.*

Table 1: Distribution and incidence of Root Rot of Pea Caused by *Rhizoctoniasolani* in surveyed districts of Rajasthan (Zone- lllA).

Sr. No.	District	Tehsil	Village	% disease incidence (PDI) in surveyed field & their No.					Average PDI of Village (Avg. of five fields)	Average PDI of Tehsil (Avg. of two village)	Average PDI of District
	Ajmer	Peesangan	Bhagwanpura	32.14 (1)	22.23(2)	15.89(3)	20.91(4)	28.95(5)	24.02	21.5	22.13
			Bhatsoori	14.52(6)	12.96(7)	25.2(8)	17.38(9)	20.31(10)	18.07		
		Ajmer	Nand	23.6(11)	18.35(12)	28.67(13)	31.53(14)	33.4(15)	27.11	23.22	
			Kayampura	18.84(16)	22.47(17)	21.89(18)	12.48(19)	20.95(20)	19.33		
	Jaipur	Jobner	Bassi Jhajhra	38.14(21)	32.84(22)	34.62(23)	37.68(24)	29.75(25)	34.61	31.30	29.01
			Khejrawas	21.84(26)	32.98(27)	28.3(28)	26.58(29)	30.29(30)	27.99		
		Amber	Bhurthal	30.38(31)	28.78(32)	18.94(33)	26.85(34)	36.78(35)	28.35	26.73	
			Nangalladi	16.38(36)	26.91(37)	28.88(38)	31.58(39)	21.78(40)	25.11		
	Tonk	Newai	Dangarthal	34.72(41)	31.48(42)	24.68(43)	18.91(44)	27.88(45)	27.53	24.54	23.19
			Manoharpura	17.98(46)	15.67(47)	28.56(48)	26.18(49)	19.35(50)	21.55		
		Deoli	Kokod	25.78(51)	29.64(52)	19.91(53)	16.51(54)	28.63(55)	24.10	21.85	
			Bhikapura	24.87(56)	22.87(57)	14.78(58)	18.58(59)	16.97(60)	19.61		
	Dausa	Lalsot	Didwana	25.66(61)	21.78(62)	26.69(63)	12.35(64)	19.91(65)	21.28	20.58	18.13
			Ramthala	16.33(66)	15.28(67)	20.01(68)	28.89(69)	18.93(70)	19.89		
		Ramgarh Pachwara	Bidoli	18.66(71)	14.36(72)	9.78(73)	23.66(74)	21.59(75)	17.61	15.69	
			Ranoli	6.89(76)	20.87(77)	17.38(78)	10.78(79)	12.88(80)	13.76		
Over all mean											**23.12**

PDI = Per cent disease incidence

CONCLUSIONS

The survey of four districts (Zone-III A of Rajasthan) revealed that no location was free from the disease. Among all surveyed districts, disease incidence ranged from 6.89% to 38.14%, with an overall mean of 23.12%. The highest mean disease incidence was observed in Jaipur district, while the lowest was in Dausa district (18.13%).

FUTURE SCOPE

Conducting detailed studies on the environmental conditions contributing to the disease prevalence and identifying more resistant pea varieties could enhance future management efforts for root rot of pea.

Acknowledgements. The authors are thankful to The Head, Department of Plant Pathology and The Dean, SKN College of Agriculture, SKN Agriculture University, Jobner, Jaipur, Rajasthan, for valuable guidance, support, and facilities to conduct this research experiment successfully.

REFERENCES

Acharya, K., Chakraborty, N., Chatterjee, S. and Basu, S. K. (2014). Fungal diseases of fenugreek. Fenugreek SpecialIssue, Mar/Apr2014. *American Journal Social Issues and Humanities*, Pp.176.

Anonymous (2022). Directorate of Agriculture, Crop-wise area, production, productivity in Rajasthan, Statistical Department of Rajasthan.

Anonymous (2022). National Horticulture Board, New Delhi.

Chattopadhyay, C., Meena, P. D. and Sudher, K. (2002). Management of sclerotinia rot of Indian mustard using ecofriendly strategies. *J. Mycol. Plant Pathol., 32*,194-200.

Duke, J. A. (1981). Handbook of legumes of world economic importance. Plenum Press, New York. 1981;199-265.

FAO (2022). FAOSTAT, Food and Agriculture Organization of the United Nations, Rome, Italy.

Hulse, J. H. (1994). Nature, composition and utilization of food legumes. In: Muehlbauer F.J. and Kaiser W.J. (eds.), Expanding the production and use of cool Season Food Legumes. *Kluwer Academic Publishers. Dordrecht, the Netherland*. 1994; 77-97.

Kadam, A. M., Chavan, S. S., Dhutraj, D. N. and Rewale, K. A. (2018). Survey of dry root rot of chickpea incidence in Marathwada region. *Journal of Pharmacognosy and Phytochemistry, 7*(1S), 3004-3008.

Karibasappa, S., Bharati, N., Bhat, S. and Rao, C. (2018). Survey for the disease incidence of root rot of sesame caused by *Macrophomina phaseolina* (Tassi.) Goid, in major sesame growing areas of Telangana. *Journal of Pharmacognosy and Phytochemistry, 7* (6), 655-657.

Keijer, J. (1996). The initial steps of the infection process in *Rhizoctonia solani*. In *Rhizoctonia Species*: Taxonomy, Molecular Biology, Ecology, *Pathology and Disease Control*, Pp 149–162.

Masoodi, S. D., Bhat, N. A. and Shah, T. A. (2000). Occurrence and severity of root rot of peas (*Pisum sativum*) in Kashmir valley. *SKUAST Journal of Research, 2*, 8-81.

Oyarzun, P. J. (1993). Bioassay to assess root rot in pea and effect of root rot on yield. *Netherlands Journal of Plant Pathology, 99,* 61-75.

Singh, A. K. and Rao, S. S. (2015). Management of root rot disease of fenugreek. *Journal Spices Aromatic Crops*, *24* (1), 58-60.

Swaroop, K. R., Ahir, R. R. and Kumar, J. N. (2014). Survey of root rot disease in Jobner vicinity induced by *Fusarium solani* f. sp. *pisi*. *Trends in Biosciences. 7*(20), 3311-3314.

Thakur, B. R., Kumari, N. and Singh, A. (2016). Occurrence of pea root rot/wilt complex disease in Himachal Pradesh. *Himachal Journal of Agricultural Research, 42*(2), 187-191.

Tu, J. C. (1987). Integrated control of the pea root rot disease complex in Ontario. *Plant Dis., 71*, 9-13.

Williamson-Benavides, B. A., Sharpe, R.M., Nelson, G., Bodah, E. T., Porter, L. D. and Dhingra, A. (2020). Identification of *Fusarium solani* f. sp. *pisi* (Fsp) responsive genes in *Pisum sativum. Frontiers in genetics*, *11,* 950.

Yan, H. and Nelson, J. B. (2022). Effects of soil type, temperature and moisture on development of *Fusarium* root rot of soybean by *Fusarium solani* (FSSC 11) and *Fusarium tricinctum*. *Plant Disease, 106*(11), 2974-2983.

How to cite this article: Astha Sharma, R.P. Ghasolia, Pinki Sharma, Ratan Lal Sharma, S. Godika, S.K. Goyal, G.K. Mittal, Kiran Gaur, S.K. Jain, Pooja Yadav, Sushila Yadav and Suman Chopra (2024). Status of Root Rot of Pea Caused by *Rhizoctonia solani* in Zone-III A of Rajasthan, India. *Biological Forum – An International Journal, 16*(7): 274-276.