**Survey and prevalence of stem rot of cluster bean (*Cyamopsis tetragonoloba* L.) incited by *Sclerotium rolfsii* in major growing districts of Northern M.P.,** **India**

**ABSTRACT**

Stem rot of cluster bean caused by *Sclerotium rolfsii* Sacc., is a soil-borne disease that leads to significant crop damage and yield loss. In 2023, a survey was conducted across 100 fields in 20 villages within three districts of northern Madhya Pradesh. The findings revealed that stem rot caused by *Sclerotium rolfsii*, is a prominent pathological issue with its presence confirmed in all surveyed districts. A roving survey was carried out in Gwalior, Morena and Shivpuri districts to evaluate the severity of the disease. Average disease incidence of stem rot varied from 1.33 % to 25.33 % on all the cultivars grown by the farmers. In Gwalior district, the highest incidence of stem rot (25.33%) was recorded in Panihar village while the lowest incidence (2.67%) occurred in Patai village. In Morena district, Mitawali village reported the highest disease incidence of 18.67% whereas Joura village showed the lowest of 1.33%. In Shivpuri district, disease incidence varied from 2.67% in Karsena village to 20.00% in Karyawati village. Disease sample was also be collected and brought to the laboratory for isolation.

***Keywords:*** *Cluster bean, Stem rot, Sclerotium rolfsii, Survey, Prevalence, Percent Disease Incidence.*

**INTRODUCTION**

“Clusterbean [*Cyamopsis tetragonoloba* (L.)], eminently known as guar, is a deep-rooted annual legume crop of family Leguminosae (Fabaceae) known for its drought and high temperature tolerance” (Kumar and Rodge, 2012). “The crop is grown for different purposes such as vegetable, green manure and seed production. Among dryland crops, cluster bean occupies an important place in the national economy because of its industrial importance mainly due to the presence of gum in its endosperm (28 to 32%). Guar gum has its use in several industries viz., textiles, paper, petroleum, pharmaceuticals, food processing, cosmetics, mining explosives, oil drilling etc. Cluster bean is a leguminous crop and can fix 37-196 kg N/ha/year” (Mahata *et al*. 2009). “The world market area of the crop is estimated at more than 1.5 lakh tonnes annually. The total area under its cultivation is 0.2 million hectares around the world. The world’s total Cluster bean production has been recorded at around 7.5 lakh tonnes” (Anon, 2020). “The production of cluster beans is dominated by India as the leading producer of the crop in the world, contributing to around 75–83% of the total production. In India, Cluster bean is mostly grown in Rajasthan, Haryana, Punjab, Uttar Pradesh and Madhya Pradesh. In India total area under the Cluster bean crop in M.P. is 31.4 lakh hectares, production 15.19 lakh tonnes and productivity 750 kg/ha” (Anon, 2021). “Cluster bean stem rot, caused by *Sclerotium rolfsii* Sacc., has become a severe concern in recent years, resulting in yield losses of 50-70 percent, depending on the severity of the disease” (Ronakkumar and Sumanbhai, 2014). “It has become a limiting factor for cluster bean crop cultivation due to its severity and destructive nature. These pathogens exhibit wide variation in their utilization of nutrients. There is a dearth of information on this disease, thus a study of the survey is necessary to identify disease hot spots in M.P. Cluster bean crops faces significant yield and quality losses due to various pests and diseases, despite stable-yielding varieties. Key fungal and bacterial threats include blight (*Xanthomonas axonopodis*), leaf spots (*Alternaria cucumerina*, *Curvularia lunata*, *Myrothecium roridum*), stem rot (*Sclerotium rolfsii*), anthracnose (*Colletotrichum capsici*), wilt (*Fusarium caeruleum*), damping-off (*Macrophomina phaseolina*) and powdery mildew (*Oidiopsis taurica*)” [Vedasree A *et al.,* 2021].

Among these, stem rot caused by *Sclerotium rolfsii* is especially severe, with yield losses of 50–70% [Ronakkumar & Sumanbhai, 2014; Gahlot VS *et al.,* 2022]. *Sclerotium rolfsii* is a soil-borne pathogen with a broad host range, surviving as a saprophyte through sclerotia in plant debris. It causes dark stem rot at any growth stage, leading to leaf drooping, wilting and plant collapse. Infected plants show a white, cottony fungal growth around the stem base extending to roots (Kator *et al.,* 2015; Sun *et al.,* 2020; Punja *et al.,* 1985). The fungus spreads through irrigation water and contaminated tools with infection favored by warm and humid conditions. Entry occurs via wounds or direct penetration with sclerotia germinating to infect nearby hosts (Sachslehner *et al.,* 1997; Ludwig & Haltrich, 2002; Akram, M. *et al.,* 2015).

**MATERIAL AND METHOD**

The cultivator field survey was carried out in major cluster bean growing districts of Madhya Pradesh namely Gwalior, Morena and Shivpuri. To know that incidence of stem rot disease of cluster bean.

**Area surveyed**

Survey was conducted between September and October 2023 in the three major cluster bean growing districts under grid region of Northern Madhya Pradesh (Gwalior, Morena and Shivpuri). The seven villages in each district were selected randomly. A total of five fields covering twenty villages were surveyed.

**Data analysis**

Three (1x1m) quadret were randomly selected in each field in the entire three district surveyed and infected plants were counted in each quadret. Based on infected and total number of plants disease incidence was calculated. Disease incidence of individual fields was used for calculating the mean incidence of each district and the district average was used to calculate the mean incidence of northern region of M. P., these averages indicate relative prevalence of cluster bean stem rot disease in the surveyed areas. The weather data of Gwalior district is also collected from the metrological department. Disease sample was also be collected and brought to the laboratory for isolation. Observation will be recorded by using the following formula by using 0-5 scale (Kokalis Burelle *et al.,* 1997).

Number of infected plants

Per cent Disease Incidence = x 100

Total number of plants observed

**RESULT AND DISCUSSION**

In the area surveyed, 100 farmers field were inspected from all field visited the plants showing symptoms characteristics of cluster bean disease were observed and recorded. During *kharif* 2023 it was observed that stem rot disease on cluster bean was important disease in these three districts of Northern M.P. three major cluster bean growing districts of M.P. viz., Gwalior, Morena and Shivpuri were surveyed to find out the status of cluster bean in grid region of Madhya Pradesh. The data summarized (Table 1) reveals that the disease has become a major biotic constraint in the cultivation of cluster bean particularly in Gwalior, Morena and Shivpuri districts.

**Incidence of soil borne disease (stem rot)**

Stem rot incidence in 2023 at Gwalior district was in the range of 2.67% at Patai to 25.33% at Panihar. In Morena District, it was ranged from 1.33% at Joura to 18.67% at Mitawaligoan. In Shivpuri District, it was in the range of 2.67% at Karsena to 20.00% at Karyawati. The mean data summarized in table 1 and fig. 1 reveals that in Gwalior district the maximum disease incidence of stem rot was recorded in Panihar (25.33%) followed by Karhiya (16.00%), Ghatigaon (13.33%), Aron (10.67%), Nayagaon (9.33%) and Shakhani (5.33%), while the minimum disease incidence was recorded in Patai (2.67%). In Morena district the maximum disease incidence was recorded in Mitawaligoan (18.67%) followed by Barauli (14.67%), Jaraina (12.00%), Padawali (10.67%) and Dhanela (8.00%), Noorabaad (5.33%) and Joura (1.33%) respectively. In Shivpuri district the maximum disease incidence was recorded in Karyawati (20.00%) followed by Khandi (17.33%), Mohana (13.33%), Dhumapura (6.67%) and Kiroli (5.33%) while the minimum disease incidence was recorded in Karsena (2.67%) of Shivpuri district. As per survey data recorded in 2023 the incidence of stem rot in Gwalior, Morena and Shivpuri was 11.81 %, 10.10% and 10.89% respectively. The study through survey was the first to check out the important fungal disease of cluster bean in grid region of Northern M.P. Notably, none of the surveyed locations were completely free from stem rot, indicating widespread occurrence across all districts assessed. The variability in stem rot incidence across different sites may be attributed to factors such as soil type, the cultivar cultivated, prevailing environmental conditions and the differential virulence of pathogen isolates.

**Table 1- Survey of stem rot disease of cluster bean in Gwalior, Morena and Shivpuri district of northern M.P. during *kharif* 2023.**

|  |  |
| --- | --- |
| **Village** | **Disease incidence (%)** |
| **Gwalior District** |  |
| Aron | 10.67 |
| Nayagaon | 9.33 |
| Ghatigaon | 13.33 |
| Shakhani | 5.33 |
| Panihar | 25.33 |
| Patai | 2.67 |
| Karhiya | 16.00 |
| Mean | **11.81** |
| **Morena District** |  |
| Jaraina | 12.00 |
| Barauli | 14.67 |
| Noorabaad | 5.33 |
| Mitawaligoan | 18.67 |
| Padawali | 10.67 |
| Dhanela | 8.00 |
| Joura | 1.33 |
| Mean | **10.10** |
| **Shivpuri District** |  |
| Khandi | 17.33 |
| Dhumapura | 6.67 |
| Karyawati | 20.00 |
| Kiroli | 5.33 |
| Mohana | 13.33 |
| Karsena | 2.67 |
| Mean | **10.89** |
| **Grand Mean** | **10.93** |

**Fig 1. Prevalence of stem rot disease of cluster bean in Gwalior districts.**

**Fig 2. Prevalence of stem rot disease of cluster bean in Morena districts.**

**Fig 3. Prevalence of stem rot disease of cluster bean in Shivpuri districts.**

The findings of the present investigation align with previous reports. Gyanendra *et al.* (2022) documented variable collar rot incidence in chickpea across Madhya Pradesh, ranging from 18.2% in the Batiyagarh block of Damoh to 8.08% in the Gotegaon block of Narsinghpur. Likewise, Somani and Chauhan (1996) observed consistent prevalence of sclerotium rot caused by *Sclerotium rolfsii* in Gwalior during three consecutive cropping seasons (1988–1991). Muthukumar *et al.* (2022) also reported stem rot incidence in cluster bean crops across multiple districts of Tamil Nadu-namely Cuddalore, Dindigul, Namakkal and Salem-during 2020–2021, with disease levels ranging from 7.33% to 18.33%.

Priyanka *et al.* (2021) also documented disease incidence ranging from 17.50% to 25.52% in different cluster bean-growing areas of Rajasthan. Additionally, Anahosur and Kulkarni (1997) reported a diverse incidence pattern of *S. rolfsii* across several localities in the Belgaum and Dharwad districts. Latha and Rajeswari (2019) observed Jasmine Sclerotium wilt during surveys conducted between December 2015 and March 2016 with incidence levels between 5.27% and 17.00%, the highest being in Pavuthampalayam (17.00%) followed by Dhandapalayam (15.65%) and Sultanpet (14.66%). These findings are consistent with the results of the present study.

**CONCLUSION**

Stem rot disease in cluster bean shows varying levels of distribution and severity across different districts. This emerging disease poses a serious threat to cluster bean production. To effectively manage and mitigate its impact, further in-depth investigations are required to identify and understand the underlying factors contributing to its widespread occurrence.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

**REFERENCES**

Soman, A.K. and Chauhan, R.K.S. (1996). Potato tuber rots in Gwalior, Madhya Pradesh. *J. Indian Potato Assoc*. **23**(3-4): 144-148.

Akram, M; Saabale, P.R.; Kumar, A. and Chattopadhyay, C. (2015). Morphological, cultural and genetic variability among Indian populations of *Sclerotium rolfsii*. *J. Food Legumes.* **28**(4):330-334.

Anahosur, K.H. and Kulkarni, S. (1997). Survey of potato Sclerotium within parts of Karnataka. *Indian Phytopathological Society*, 18-29.

Anonymous. (2020). Directorate of Economics and Statistics, Government of Rajasthan, Jaipur.

Anonymous. (2021). An analysis of performance of guar crop in India. CCS National Institute of Agricultural Marketing, Jaipur.

Gahlot, V.S.; Kumhar, D.R.; Godara, S.L.; Kumar, D. and Kumari, N. (2022). Biochemical analysis of clusterbean against stem rot incited by *Sclerotium rolfsii.* *The Pharma Inno. J.* **11**(2):1602-1607.

Gyanendra, Singh; Khare, U.K.; Babbar, Anita; Wasnikar, A.R.; Kumar, Ashish and Amrate, Pawan, K. (2022). Present status of collar rot in major chickpea growing state of India. *Bio. Forum - An Int. J.* **14**(2): 1095-1101pp.

Kator, L.; Hosea, Z. Y. and Oche, O. D. (2015). *Sclerotium rolfsii*: Causative organism of southern blight, stem rot, white mold and sclerotia rot disease. *Annals Biological Research,***6**: 78-89.

Kumar, D. and Rodge, A.B. (2012). Status, scope and strategies of arid legumes research in India: A Review. *J. Food Leg*. **25**:255-272.

Latha, P. and Rajeshwari, E. (2019). Evaluation of biocontrol agents, fungicides and organic amendments against Sclerotium wilt (*Sclerotium rolfsii* Sacc) of jasmine (*Jasminium sambac* (L.) Aiton). *J. Pharma. Phytochem*. **2**:897-902.

Ludwig, R. and Haltrich, D. (2002). Cellobiose dehydrogenase production by Sclerotium species pathogenic to plants. *Lett Appl Microbiol.* **35**: 261-6.

Mahata KR, Singh DP, Ismail AM. (2009). Crop and natural resource management for high and stable productivity in coastal saline areas. Limited Proceedings.

Muthukumar, A.; Sudha, A. and Suthin, Raj, T. (2022). Survey, virulence, inoculum levels and susceptible stage on the incidence of stem rot of Cluster bean (*Cyamopsis tetragonoloba*L.) caused by *Sclerotium rolfsii* Sacc*. Pharma Inno*. **11**(9):2844-2848.

Priyanka; Mathur, A.C.; Sharma, R.S.; Meena, A.K. and Bagri, R.K. (2021). Survey of five clusterbean growing districts of Rajasthan to know the status of dry root rot caused by *M. phaseolina.* *The Pharma Inno. J.* **10**(7): 178-180.

Punja, Z. K.; Huang, J. S. and Jenkins, S. F. (1985). Relationship of mycelial growth and production of oxalic acid and cell wall degrading enzymes to virulence in *Sclerotium rolfsii*. *Canadian J. Pl. Pathol.* **7**: 109-17.

Ronakkumar TV and Sumanbhai CM. (2014). First report of stem roton cluster bean in Gujarat. *Trends in Bioscience*.**7**:23.

Sachslehner, A.; Haltrich, D.; Nidetzky, B. and Kulbe, K. D. (1997). Production of hemicellulose- and cellulose degrading enzymes by various strains of *Sclerotium rolfsii.* *Appl. Biochem. Biotechnol*, **63-65**: 189-201.

Sun, S.; Sun, F.D.; Deng, X. Zhu; Duan, C. and Zhu, Z. (2020). First report of southern blight of mung bean caused by *Sclerotium rolfsii* in China. *Crop Protection,* **130**: 105055.