Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 02 (MAR-APR, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Damping off Disease of *Withania somnifera*: Disease Distribution, Symptomology and Management

(*Kartar Singh[1], Vijay Singh Meena[1], Neelam Shekhawat[1], Dama Ram[2], Manoj Choudhary[3], Mahendra Kumar Saran[4], Mahavir Prasad Chawla[1] and Manoj Sharma[1])
[1]ICAR-National Bureau of Plant Genetic Resources, Regional Station, Jodhpur (Raj.)
[2]Agricultural University, Jodhpur (Raj.)
[3]ICAR-National Center for Integrated Pest Management, New Delhi, India
[4]Choudhary Charan Singh Haryana Agricultural University, Hisar, Haryana
*Corresponding Author's email: kartar1532@gmail.com

Withania somnifera (L.) also known as Indian ginseng, winter cherry and locally as Ashwagandha belongs to Solanaceae family. It is used in Indian Ayurved and Unani system and one of the most powerful medicinal plants for more than 3,000 years. Ashwagandha (Withania somnifera) is cultivated commercially for glycowithanolides rich roots in India. Among the various alkaloids, withanine is the main constituent. The other alkaloids are somniferine, somnine, somniferinine, withananine, pseudowithanine, tropine, pseudo-tropine, 3-a-gloyloxytropane, choline, cuscohygrine, diisopelletierine, anaferine and anahytrine. It flourish well in dry and sub-tropical regions of India, Sri Lanka and Bangladesh. In India it thrives well in Rajasthan, Punjab, Haryana, Uttar Pradesh, Gujarat, Madhya Pradesh and Maharashtra. An average market price of roots is Rs. 398.85 per Kg in Indian market. Considering of its market potential, government andsome non-government organization have taken mass program to cultivate areas of Rajasthan farmers. *Withania somnifera* suffers from many fungal diseases which include Leaf spot by *Colletotrichum gloeosporioides*, seedling blight caused by *Alternaria alternata*; leaf blight and die back caused by *Alternaria alternata*, leaf spot caused by *Myrothecium roridum*; wet rot caused by *Choanephora cucurbitarum* and damping off disease caused by *Rhizoctonia solani*.

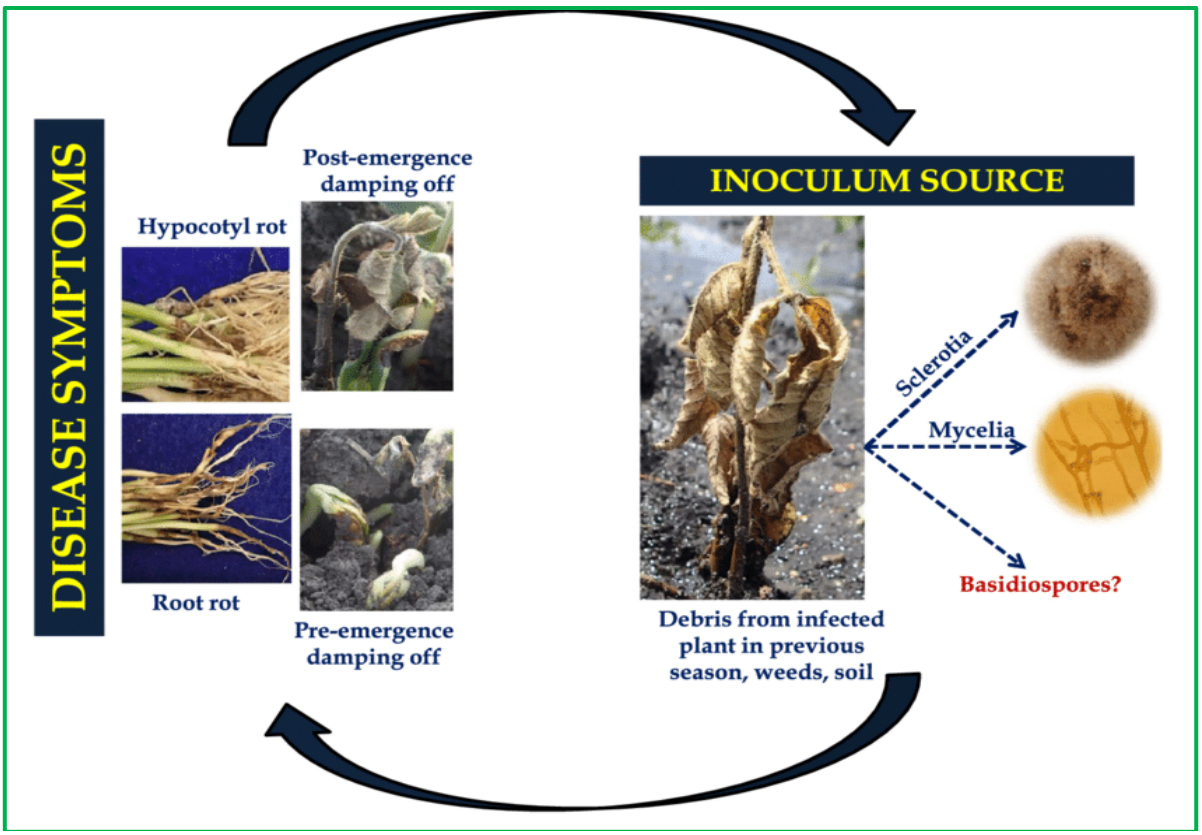
Geographical origin, distribution and crop losses: In January 2016, symptoms of damping-off such as water-soaked, necrotic lesions on the basal stem were reported first time from India on ashwagandha seedlings (Saroj and Samad 2019). Pure fungal colonies were dark brown with abundant sclerotia, hyphae branch at right angles, with distinct constriction at the origin of branching, a septum near the originating point of the hyphal branch, and hyphae were multinucleate. The fungus was morphologically identified as *Rhizoctonia solani* Kühn (Sneh et al. 1991). The *R. solani* was earlier reported as epiphyte on ashwagandha (Krishnamurthy et al. 2008). The pathogen is known to cause serious plant losses by attacking primarily the roots and lower stems of plants. Although it has a wide range of hosts, its main targets are herbaceous plants.

Casual organism and key characteristics: *Rhizoctonia solani* is a plant pathogenic fungus with a wide host range and worldwide distribution. It was discovered more than 100

years ago. *R. solani* frequently exists as thread-like growth on plants or in culture, and is considered a soil-borne pathogen. Most symptoms of the pathogen do not occur until late summer, thus most farmers do not become aware of the diseased crop until harvest. A combination of environmental factors has been linked to the prevalence of the pathogen, such as presence of host plant, frequent rainfall/irrigation, and increased temperatures in spring and summer. In addition, poor drainage of the soil (whether caused by parent soil texture, or by compaction) is also known to create favorable environments for the pathogen. The pathogen is dispersed as sclerotia, and these sclerotia can travel by means of wind, water, or soil movement between host plants.

The vegetative mycelium of *R. solani* and other *Rhizoctonia* fungi are colorless when young but become brown colored as they grow and mature. The mycelium consists of hyphae partitioned into individual cells by a septum containing a dough-nut shaped pore. *R. solani* does not produce spores, hence it is identified only from mycelial characteristics or DNA analysis. Its hyphal cells are multinucleated. It produces white to deep brown mycelium when grown on an artificial medium. The hyphae are 4–15 µm wide and tend to branch at right angles. A septum near each hyphal branch and a slight constriction at the branch are diagnostic. It forms club-shaped basidia with four apical sterigmata on which oval, hyaline basidiospores are borne.

Symptoms: *R. solani* primarily attacks below ground plant parts such as the seeds, hypocotyls, and roots, but is also capable of infecting above ground plant parts (e.g. pods, fruits, leaves and stems). The most common symptom of Rhizoctonia disease is referred to as "damping-off" characterized by non-germination of severely infected seed whereas infected seedlings can be killed either before or after they emerge from the soil. Infected seedlings not killed by the fungus often have cankers, which are reddish-brown lesions on stems and roots. In addition to attacking below ground plant parts, the fungus will occasionally infect fruit and leaf tissue located near or on the soil surface. This type of disease often occurs because the mycelium and/or sclerotia of the fungus are close to or splashed on the plant tissue.



Disease cycle and epidemiology: *R. solani* can survive for many years by producing small (1 to 3-mm diameter), irregular-shaped, brown to black structures (called sclerotia) in soil and on plant tissue. *R. solani* also survives as mycelium by colonizing soil organic matter as a saprophyte, particularly as a result of plant pathogenic activity. Sclerotia and/or mycelium present in soil and/or on plant tissue germinate to produce vegetative threads (hyphae) of the fungus that can attack a wide range of food and fiber crops.

The fungus is attracted to the plant by chemical stimulants released by actively growing plant cells and/or decomposing plant residues. As the attraction process proceeds, the fungal hypha will come in contact with the plant and become attached to its external surface. After attachment, the fungus continues to grow on the external surface of the plant and will causes disease by producing a specialized infection structure (either an appresorium or infection cushion) that penetrates the plant cell and releases nutrients for continued fungal growth and development. The infection process is promoted by the production of many different extracellular enzymes that degrade various components of plant cell walls (e.g. cellulose, cutin and pectin). As the fungus kills the plant cells, the hyphae continue to grow and colonize dead tissue, often forming sclerotia. New inoculum is produced on or in host tissue, and a new cycle is repeated when new substrates become available.

Management

- Complete control of *Rhizoctonia* species is not possible, but the severity of the pathogen can be limited.
- Controlling the environment, crop rotation, using resistant varieties, and minimizing soil compaction are effective and noninvasive ways to manage disease.
- One specific chemical option is a chemical spray of pentachloronitrobenzene (PCNB), which is known to be the best solution to reducing damping off of seeds on host plants.
- To minimize disease, certified seed free of sclerotia can be planted. Seed growers should only purchase sclerotia-free seeds when planting their crops since sclerotia can overwinter in the soil and may not show symptoms right away.
- Although fungicides are not the most effective way to manage this pathogen, a few have been approved by the USDA for control of the pathogen. Chemical company representatives can recommend which group of fungicides would be most effective with crops in regard to *R. solani*.
- As long as seed growers stay clear of wet, poorly drained areas while also avoiding susceptible crops, *R. solani* is not usually a problem. Diseases caused by this pathogen are more severe in soils that are moderately wet and a temperature range of 15–18 °C (59–64 °F).
- Minimum disease attack was observed in fungicide seed treatment with Mancozeb 63% + Carbendazim 12%. This combined fungicidal seed treatment also increases the germination (plant stand), fresh and dry root weight, shoot and root length and alkaloid content.
- In case of bio agents, *Trichoderma viride* was more efficient than *Pseudomonas fluorescens* in arresting the growth of pathogen, as compared to their individual applications over the un-treated control (Borade et al. 2018).
- Integration of soil amended with Neem cake manure @ 500 g/m2 + seed treatment with fungicide Mancozeb 63% + Carbendazim 12% (SAAF) @ 0.2% plus with *T. viride* talc based formulation @ 10g/kg resulted in the highest germination, minimum root rot and maximum quality root yield.

References

1. Borade AS, Ingle RW, Kendre VP (2018). Management of Ashwagandha root rot disease with bioagents and fungicides. International Journal of Chemical Studies 6(1): 2050-2054.
2. Krishnamurthy YL, Naik SB, Jayaram S (2008). Fungal communities in herbaceous medicinal plants from the Malnad region, southern India. Microbes Environ 23(1):24–28.
3. Pokhar R, Singh RP, Lekha (2014). Integrated Root Rot Management of Ashwagandha (*Withania somnifera* (L) Dunal). Asian Resonance. 3(3): 108-114.
4. Saroj A, Samad A. (2019). First report of ashwagandha damping-off caused by *Rhizoctonia solani* Kühn AG - 2- 2 in Uttar Pradesh, India. J Plant Pathol 101, 1279.
5. Singh S. and Kumar S. (1998). *Withania somnifera*: The Indian ginseng Ashwagandha, Central Institute of Medicinal and Aromatic Plants, Lucknow, India.
6. Sneh B, Burpee L, Ogoshi A (1991). Identification of Rhizoctonia species. American Phytopathological Society Press, St. Paul.