Diseases of Elephant Foot Yam

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Elephant foot yam (*Amorphophallus paeoniifolius*), belonging to the family Araceae, is herbaceous perennial C_3 crop. It is cultivated in eight states in India which include, Andhra Pradesh, West Bengal, Gujarat, Kerala, Tamil Nadu, Maharashtra, Uttar Pradesh, and Jharkhand. Elephant foot yam (EFY) local cultivars are grown and generally used for making vegetable pickles or other dishes and for medicinal preparations for various diseased conditions (Ravi et al, 2011). EFY is widely used in folk and ethnomedicinal practices as well as in ayurvedic preparations by different tribes for the treatment of many serious diseased conditions such as anti-inflammatory, anti-haemorrhoidal, hepatoprotective stomachic, analgesic, cytotoxic, antihelminthic, antifungal, anti-bacterial, antiprotease and CNS (Rahman et. al, 2021). This crop can be dried and used for the treatment of piles and dysentery, where the fresh root of the plant acts as an acrid stimulant and expectorant. Also, it is much used in our country India in the treatment of acute rheumatism (Amit et. al 2016). The crop is also cultivated as an intercrop along with turmeric and under coconut or banana. The production yield of the elephant foot yam is 50-80 t/ha (Utomo, et. al, 2021). In Kerala, elephant foot yam is planted in February and harvested during November-December under rainfed conditions (Ravi et. al, 2011). Elephant Foot Yam corms are a major part of the crop which is used as seed and as a food source; it exhibits dormancy for about 3-4 months after harvest (Ravi et. al, 2009). Even though this plant has a wide range of advantages, like every other plant, EFY is also susceptible to many diseases. The disease which infects this plant causes a huge amount of yield loss in this plant. Major diseases which affect EFY include, collar rot, post-harvest rot and Dasheen mosaic virus. These diseases are fast-spreading in nature, very common and cause heavy yield loss.

In this article, the common diseases seen in EFY, their causative organism and major symptoms are discussed.

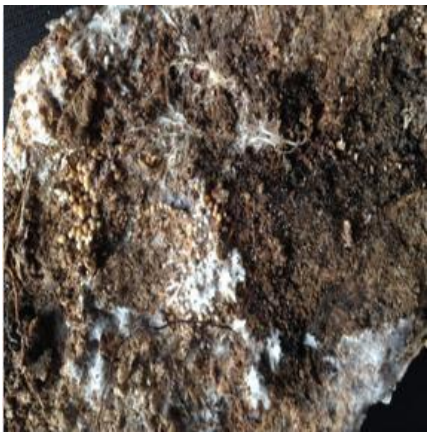
Collar rot

Causative organism:
Sclerotium rolfsii Sacc.

S. rolfsii is a soil-born fungal pathogen (Gogoi et. al, 2002), the species attack more than 500 species including vegetables and cereals (Kumar et. al, 2017). The disease is more severe in the rainy season and is followed by warm dry weather (Jambure et. al, 2020). The organism is polyphagous, ubiquitous and omnivorous. Collar rot can cause a yield loss of 20 to 100% (Kumar et. al, 2023). The growth rate of this fungus is high in tropical and subtropical areas since the conditions of these areas are optimum for the survival of this organism (Veena et. al, 2019).

Symptoms: The pathogen invades the collar region resulting in development of water-soaked lesions on the pseudostem just above the soil surface. The leaves turn yellow from the tip which steadily extends to other portions causing complete chlorosis of the plant. Finally, the pseudostem shrinks and the plant collapses due to rotting of the collar region. A thick, white mycelial mat of the pathogen with globular dark brown mustard seed like structures called sclerotia can be seen all around the affected tissues. The pathogen is capable of causing sudden death of the plant under favourable conditions (Srinivasulu et. al, 2009, Veena et al., 2023a). Also, deep cracks in roots with the shredding of roots can be observed on close observation (Naveen et. al, 2023). The hyphae of the organism grew upward on the surface of the infected plant and were covered with a cottony, white mass of mycelium, scattered inside and outside of the infected stem and also on the nearby soil surface. Tissue maceration is followed by an interruption in water transport which leads to the yellowing of leaves and wilting (Billah et. al, 2017).

Post-harvest rot



Causative organisms:
Fourteen fungi and a bacterium,

Erwinia carotovora cause post-harvest rot in EFY. Major fungal pathogens are *Sclerotium rolfsii, Lasiodiplodia theobromae, Rhizo ctonia solani, Colletotrichum gloeosporioides* and *Fusarium* spp. (Veena et al., 2023b).

Post-harvest rot begins from soil and appears during storage of corm after harvest.Thisdisease causes a yield loss of 80% (Baleba et. al, 2024). Post-harvest rot limits the shelf life of corm, and the loss of crops depends on their moist rate and metabolic rate (Rutuja et.al, 2023). The mechanical injury caused during harvest and transport makes them more prone to the infection.

Symptoms: Usually there will be no symptoms visible.Infected crops show tissue softening, discolouration and rotting (Veena et. al, 2023b). Alter the taste of the crop and reduce nutrition value (Belaba et. al, 2024).

Yam mosaic virus

Causative organism: This disease is caused by Dasheen mosaic virus (DsMV) which belongs to Potyvirus group (Jeeva et al., 2023).

Potyvirus belongs to the family Potyviridae, having single-stranded RNA, positive sense RNA with flexuous and filamentous particles. They spread by vegetative propagation or sap because of mechanical spreading. They can cause a yield loss of 97% (Gogile et. al, 2024). This virus is transmitted by aphids (Amusa et. al, 2003)

Symptoms: Chlorosis, mosaic, mottling, leaf puckering, leaf thickening and stunting (Jeeva et al., 2023), (Gogile et. al, 2024). Some of the other symptoms include vein banding, curling, mottling, green-spotting, and flecking (Amusa et. al, 2003).

Anthracnose

Causative organism: *Colletotrichum siamense*

Colletotrichum is a wide genome

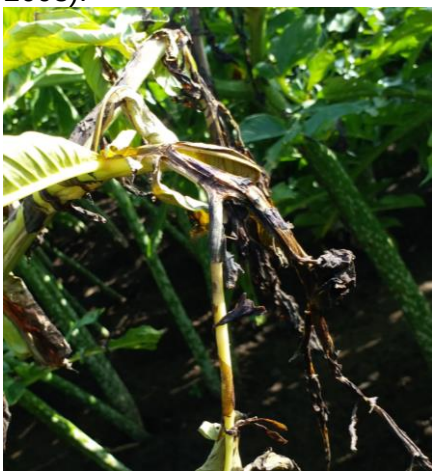
with 1000 species known worldwide (Ntui et. al, 2021). This disease is also referred to as scorch disease because the withered leaves and stem give the plant a scorch-like appearance. Anthracnose-inducing pathogen is a ubiquitous pathogen causing infection in several other species (Amusa et. al, 2003).Prasad et al.(2017) reported anthracnose of elephant foot yam caused by Colletotrichum siamense from India. The organism is soil-borne, airborne and also tuber borne (Veena et. al, 2021).

Symptoms: Appearance of dark brown or black watery lesions on leaf, stem and petiole. Also, the chlorotic halo enlarges and coalesces. Finally, leaf necrosis occurs and stems dieback (Amusa et. al, 2003). It also causes cupping of the leaves due to necrosis (Veena et. al, 2021).

Root rot and leaf blight

Causative organism: *Pythium helicoides*.

Symptoms: Symptoms of affected plants range from chlorosis, stunting to a complete blight as the disease progresses. Necrotic root symptoms begin at the tip, progresses quickly and eventually kills the whole root. The cortex of severely affected roots can be easily sloughed off, leaving only parts of the vascular system intact (Guha et. al, 2008).



Management strategies

Early and precise identification of the disease play a major role in disease management. Common management strategies for the diseases include use of healthy and disease free planting material, maintenance of field sanitation, the cleanliness of the field plays a very important role in acquiring disease. Crop rotation and intercropping are other methods to keep the crops infection-free.

Encouraging the growth of friendly microbes in the field will provide natural protection. Corms can be treated in Trichoderma or other biocontrol agents before planting. To manage high disease incidences, fungicides can also be used.

References

- Amusa, N.A., Adigbite, A.A., Muhammed, S. and Baiyewu, R.A., 2003. Yam diseases and their management in Nigeria. African Journal of Biotechnology, 2(12), pp.497-502.
- Baleba, C.C., Bedine, M.A.B., Kouam, I.D., Aghofack, K.K., Béyégué, H. and Yaouba, A., 2024. Efficacy of ginger (Zingiber officinale) in controlling fungi causing postharvest deterioration in yam tuber. Trends in Horticulture, 7(1).1-14
- Billah, K.M., Hossain, M.B., Prince, M.H. and Sumon, M.M., 2017. Pathogenicity of Sclerotium rolfsii on a different host, and its overwintering survival; A mini-

review. International Journal of Advances in Agriculture Sciences, 2(1).1-6

- Dwivedi, S.K. and Prasad, G., 2016. Integrated management of Sclerotium rolfsii: an overview. European Journal of Biomedical and Pharmaceutical Sciences, 3(11), pp.137- 146.
- Gogile, Check spelling A., Kebede, M., Kidanemariam, D. and Abraham, A., 2024. Identification of yam mosaic virus as the main cause of yam mosaic diseases in Ethiopia. Heliyon.
- Gogoi, N.K., Phookan, A.K. and Narzary, B.D., 2002. Management of collar rot of elephant's foot yam. Indian Phytopathology, 55(2), pp.238-240.
- Jambure, D.D., Bhagwat, R.G., Khanvilkar, M.H., Bhagwat, S.R., Desai, S.D., Marchande, N.A., Phondekar, U.R. and Bhave, S.G., Screening of elephant foot yam varieties against collar rot of elephant foot yam caused by Sclerotium rolfsii Sacc. 2020; 9(1): 345-347.
- Jeeva, M.L., Veena, S.S., Jayanta Tarafdar, Harish, E.R., Kesava Kumar, H. and Makeshkumar,T. 2023.Compendium of Diseases and Pests of Tropical Tuber Crops in India, Techncal Bulletin No. 92, ICAR- Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala, India,56 p.
- Kumar, P., Bharty, S. and Kumar, K. 2017. Management of collar rot of elephant foot yam caused by Sclerotium rolfsii Sacc.-A Review. Journal of Pharmacognosy and Phytochemistry, 6(6S), pp.723-728.
- Kumar, P.N., Kumar, C.S.K., Rao, S.N. and Mamatha, K., 2023. In vitro evaluation of fungicides and bioagents against Sclerotium rolfsii causing collar rot in elephant foot yam.1651-1656
- Lal, H.C., Praveen, K., Sengupta, S., Savita, E. and Niraj, K., 2015. Integrated disease management of collar rot in elephant foot yam (EFY) caused by Sclerotium rolfsii Sacc. Journal of Mycology and Plant Pathology, 45(3), pp.309-313.
- Ntui, V.O., Uyoh, E.A., Ita, E.E., Markson, A.A.A., Tripathi, J.N., Okon, N.I., Akpan, M.O., Phillip, J.O., Brisibe, E.A., Ene-Obong, E.O.E. and Tripathi, L., 2021. Strategies to combat the problem of yam anthracnose disease: Status and prospects. Molecular Plant Pathology, 22(10), pp.1302-1314.
- Prasad L, Javeria S, Kumar B, Sharma P. 2017 – First report of anthracnose of elephant foot yam caused by Colletotrichum siamense in India. New Dis Rep, 36:,21, http://dx.doi.org/10.5197/j.2044-0588.2017.036.021
- Rahman, S.S., Muhsin, M.M., Karim, M.R., Zubaer, M., Rahman, M.H. and Rouf, S.M., 2021. Proximate composition, phytochemical screening and anti-hyperglycemic effect of elephant foot yam (Amorphophallus paeoniifolius) tuber on alloxan-induced diabetic rats. Progress in Nutrition, 23(2), pp.1-9.
- Ravi, V., Ravindran, C.S. and Suja, G., 2009. Growth and productivity of elephant foot yam (Amorphophallus paeoniifolius (Dennst.) Nicolson): an overview. J Root Crops, 35(2), pp.131-142.
- Ravi, V., Ravindran, C.S., Suja, G., George, J., Nedunzhiyan, M., Byju, G. and Naskar, S.K., 2011. Crop physiology of elephant foot yam (Amorphophallus paeoniifolius (Dennst. Nicolson). Advances in Horticultural Science, 25(1), pp.51-63.
- Roy, S.G., 2007. The first finding of pythium root rot and leaf blight of elephant foot yam (Amorphophalluspaeonifolius) in India.
- Singh, A., Chaurasiya, A. and Mitra, S., 2016. Assessment of nutritional composition in elephant foot yam (Amorphophallus paeoniifolius Dennst-Nicolson) cultivars. International Journal of Food Studies, 5(2).
- Utomo, J.S. and Ginting, E., 2021, July. Physico-chemical characteristics of elephant foot yam (Amorphophallus campanulatus) germplasm. In IOP Conference Series: Earth and Environmental Science (Vol. 803, No. 1, p. 012044). IOP Publishing.
- Veena, S.S., Chandra, C.V., Jeeva, M.L. and Makeshkumar, T., 2021. Postharvest Diseases of Tropical Tuber Crops and Their Management. In Postharvest Handling and Diseases of Horticultural Produce (pp. 397-414). CRC Press.
- Veena, S.S., Jeeva, M.L. and Byju, G. 2023a. Collar rot of elephant foot yam. Technical Folder, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala.
- Veena, S.S., Jeeva, M.L. Byju, G. 2023b. Postharvest rot in elephant foot yam. Technical Leaflet, ICAR–Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala.
- Veena, S.S., Sheela, M.N., Karthikeyan, S., Sreelatha, G.L. and Vishnu, V.R., 2019. Microbial Diversity in Rhizosphere Soils of Tropical Tuber Crops: Utilization for Pathogen Suppression and Growth Promotion. Journal of Root Crops, 45(1), pp.53-63.