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A Review on Diseases of Groundnut (*Arachis Hypogia*) and Their Biological Management

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Abstract

Groundnut is an economically and commercially important crop in India and used over world with attention. Some diseases are broadly distributed and cause economic crop losses while others are restricted in distribution. Groundnut crop suffers from a variety of fungal, bacterial, nematode and viral diseases accounting for heavy crop losses. The important diseases accounts for heavy crop losses due to diseases such as Collar rot, Stem rot, Aflaroot , Dry root rot, Leaf spot, Rust, Leaf blight, Bacterial wilt, Groundnut bud necrosis, Groundnut stem necrosis and Root knot have been reported. To find effectual disease management measures is the biggest challenge on the field of crop increasing negative impact on environment due to excessive use of chemical pesticides. It is the require of time to draw the attention towards biological control of the diseases. Use of disease free seed inoculums, crop rotation, plant extracts, disease resistant varieties and fertilizers are some non-harmful remedies to control these diseases. The present study summaries significant appliance of biological control strategies to achieve a sustainable and eco-friendly management of groundnut diseases.

Keywords: *Arachis hypogia*, Biological control, Diseases, Eco-friendly.

Introduction

Groundnut is an important crop which is grown throughout the world. The crop is attacked by various diseases to a much larger area which limits the yield. Various pathogens have been reported to affect groundnut. Some diseases are widely distributed and cause economic crop sufferers while others are restricted in distribution. Among fungal foliar diseases, such as leaf blight and rust which are widely distributed can cause losses in disposed genotypes to the extent of 70-80 percent when both of them occur together (Subrahmanyam *et al.,* 1981). Similarly, seed and soil-borne diseases Collar rot and Bacterial wilt, Stem rot, Dry root rot have been realized as main constraint in crop production. These diseases have been reported to cause severe seedling mortality resulting in erratic crop stands in sandy loam soils and reduce the yields by 30-40 percent (Ajeigbe *et al.,* 2015). Many important virus diseases like bud necrosis, mottle and groundnut clump disease are also of great concern. Bud necrosis and groundnut mottle disease with broad host range caused by virus are a serious threat to the crop. Some nematode diseases are also reportedon groundnut. However, Root knot disease reported to cause damage in various parts of the world.

Aim of the Study

To know about the different disease's of groundnut and it's biological control methods.

Major Diseases of Groundnut and Their Management

Various eco-friendly andeconomical disease contral apprroaches such as use of disease resistant varieties, culture methods, physical methods, crop rotation and biological management have been established for several groundnut diseases. Present study discussed the integrated disease management for major diseases including management of aflatoxins. The role of groundnut diseases in reducing yield has been widely reported (Subramaniyam *et al.,* 1985). More than fifty five pathogens (including viruses) have been reported to affect groundnut.

Fungal Diseases of Groundnut

Collar Rot

The causal agent of disease is *Aspergillus niger*. The inoculum of pathogen present in soil or on seed surface germinate and attacks the seeds before its germination and causes pre-emergence rotting. It also causes rotting of hypocotyls, post-emergence seedling blight, rapid wilting of entire plant or its parts which are characteristic diagnostic symptoms of the disease. Bacteria associated with 6 habitats of groundnut were evaluated for their broad-spectrum antifungal activity and suppression of collar rot (*Aspergillus niger*) of groundnut. Three hundred and ninety-three strains were tested against 8 fungal pathogens of groundnut including 5 necrotrophic fungi, *Aspergillus flavus, A. niger, Rhizoctonia bataticola, Rhizoctonia solani,* and *Sclerotium rolfsii,* and 3 biotrophic fungi, *Cercospora arachidicola, Phaeoisariopsis personata,* and *Puccinia arachidis* (Haas *et al.,* 2003). The cell-free culture filtrates of these bacteria were fungicidal and induced mycelial deformations including hyphal bulging and vacuolization in necrotrophic fungi. The cell-free culture filtrates at 10% concentration significantly inhibited the spore germination of biotrophic fungi. Ninety-day-old peat formulation of *Pseudomonas aeruginosa* GSE 18 had biocontrol ability comparable with the Midol-phase cells (Hankin *et al.,* 1975). *P. aeruginosa* GSE 18, tolerant to thiram, in combination with the fungicide had an improved collar rot control (Agnihotri *et al.,* 1972).

Stem Rot

It is caused by *Sclerotium rolfsii*. When stem or branches that are in contact with the infected soil, wilting symptoms are shown on plant body. The pathogen is spread by many host ranges. *S. rolfsii* can colonize both living plant tissues and plant debris. Sclerotia, which is survive near soil surface, remain viable for many years. Defoliated leaves can also serve as a bridge to facilitate plant to plant spread (Higgiens, 1927). In dual culture of *Trichoderma viride* and *Pseudomonas fluorescens* were inhibitory to the growth of *Sclerotium rolfsii*, the causal agent of stem rot of groundnut (Babu and Kumar 2008). Due to the antagonistic effect of the biocontrol agents were also poor for a germination of sclerotia. Enhanced concentration of defence-related enzymes viz., peroxidase (PO) and polyphenoloxidase (PPO) were observed in infected plants more than in healthy ones. Although induction both of PO and PPO were noticed in diseased plants, additional increase concentration of these enzymes were observed in plants treated with either *P. fluorescens* or *T. viride* (Biswas *et al.,* 2000).

Leaf Spot

Causal agent of this disease is *Cercospora arachidicola*. Initially symptoms of this disease that develop of chlorotic spots, brown in color and surrounded by yellow halo on upper surface of leaf. Most sporulation occurs on the upper surface of leaflet. Normally infected leaves may drop off prematurely. The lesion may extend to the stem and branches. Plant debris and pod shell are protect the conidia of the pathogen for next contamination. Volunteer groundnut plants are also protect the conidia from one season to another on (Mc Donald *et al*., 1985). Among the treatments of BAU-Biofungicide, extracts of neem leaf, datura leaf and debdaru leaf showed excellent performance in controlling leaf spot and increasing pod yield by 53.61, 51.91, 40.85 and 38.72%, respectively as compared to control (Hossain, 2011).

Rust

It is caused by *Puccinia arachidis*. Initially symptoms of this disease that chlorotic spots develop on the upper surface and orange colored pustules shows on the lower surface of the leaf (Earnshaw and Rao 1992). The disease reduces seed size and oil content of groundnut. Most favorable temperature of 20°C, delayed leaf wetness and high moisture is positive discrimination for the rust disease. Spread of the disease within growing crops is facilitated by air, rain spatter, and insects (Mc Donald *et al*., 1985). Rust disease of groundnut is significantly reduced by *Trichoderma harzianum* on apart groundnut leaves. *T. harzianum* colonized better on uredosori which were post-treated with the antagonist than on pustules developed on pre- and mixed treated leaves. As biocontrol agents bacteria *Pseudomonas fluorescens* strains and *Bacillus subtilis* and botanicals viz. *Azadirachata indica*, *Lantana camera*, *Calotropis procera*, *Ocimum sanctum*, *Allium cepa*, and *Allium sativum* have been reported to extensively reduce mycelial growth of the pathogenic fungus (Prasad *et al*., 2017).

Virul Diseases

Some virus diseases such as Peanut bud necrosis disease (PBND), Tobacco streak disease (TSD), Peanut mottle disease (PMD) and peanut clump disease (PCD) have been reported on the groundnut. These diseases are caused by *Peanut bud necrosis virus* (PBNV), *Tobacco streak virus* (TSV), *Peanut mottle virus* (PMV) and *peanut clump virus* (PCV) (Adams And Kuhn, 1977). *Peanut bud necrosis virus* belongs to the genus *Tospovirus* and transmitted effectively by *Thrips palmi*. Characteristic symptom of the PBND is occurs a necrosis on the terminal buds (Amin *et al.,* 1981). Widespread of the numerous genotypes by released varieties and wild species at the hot spots has exposed the field (Akram *et al.,* 2004). Peanut stem necrosis disease (PSND) is caused by the TSV of the genus *Ilarvirus* of the family Bromoviridae. Most characteristic symptoms of this disease are necrotic lesions on fatal leaflets, complete stem necrosis and often total necrosis of whole plant . The Peanut stem necrosis disease is spread generally through the weed of crop species. The peanut clump disease of groundnut is caused by the *peanut clump virus(* PCV) of the genus *Pecluvirus*, family Virgaviridae. Initially symptoms are appeared on newly emerged leaves of 2-3 week-old seedlings plant. The host assortment of PCV includes several monocot and dicot crop plants and weed species. PCV is transmitted by the compel fungal parasite (*Polymyxa graminis*) which is soil borne. Peanut mottle virus disease has been reported to occur on rabi/summer groundnut. Initially symptoms of this disease that the newly formed leaves show

mild mottling and vein clearing, while older leaves show upward curling and interveinal despair with dark green islands. The *Peanut mottle virus* (PMV) occurs in nature on numerous important legume crops and aphids are competent vectors of PMV. *Peanut stripe virus* (PSV) has also quarantine importance of the viral diseases. Transgenic approaches to engineer resistance to viruses by expressing the glycoproteins of *Tospoviruses* in transgenic plants to block virus gaining by thrips, by expressing truncated or modified forms of movement protein of heterologous viruses, or by expressing virus-specific antibody genes may be adopted to tackle the viral diseases in groundnut (Amin, PW 1988). In a study it was observed that extracts of plants like *Azadirachta indica, Caleotropics procera, Eucalyptus globuls, Allium sativum, Datura stramonium, Aloe barbadensis* have antagonistic latent against *Bemisia tabaci* and cotton leaf curl virus disease under field conditions (Ali *et al*., 2010). It is also reported that *Azadirachta indica* extract, mustard oil and Salicylic acid are very effective against *Bacillus tabaci* (Arif *et al.,* 2004)

Nematode Diseases

Nematode disease are caused by root-knot nematodes (*Meloidogyne hapla* and *M. arenaria*) and root-lesion nematodes (*Pratylenchus brachyurus*). Root-knot nematodes are enter and harm to groundnut roots, pegs, and pods. Roots and pegs are enlarged on the infected plants. Galls develop into various sizes. Knobs, protuberances and small warts are developed on infected pods. Infected plants may show various degrees of stunting and chlorosis. *Meloidogyne hapla* and *M. arenaria* are caused similar symptoms on the plants. Root is reduced and vascular systems of infected tissues are disrupted. Resulting of this the poor flow of water and nutrients from the roots to the shoot. Infected plants have a propensity to wilt under drought conditions (Mc Donald *et al.,* 1985). Root-lesion nematodes (*Pratylenchus brachyurus*) are small vermiform nematodes. Lesion nematodes are emigrant as a endoparasites and attack on roots, pegs, and pods of the plants. They feed inside parenchymatous tissues. Both mechanical and chemical harm of the tissue resulting from the nematodes feeding. Root lesions are developed. Presence of large nematode populations these lesions causing extensive discoloration and hurt that results in reduced growth and pod production. The pod lesions begin as little, tan to brown, locate areas on the surface. By the nematodes feed and replicate, the affected area becomes bigger and dark. Old lesions are identified by their spotty appearance and vague margins. Sometime nematodes are established in the roots without visual symptoms on the groundnut and cause yield reduction. For the control of causal agents, nematicides are used in groundnut as fumigant and non-fumigant types with contact properties. Generally ethylene dibromide (EDB) is use as a fumigant nematicide and aldicarb, carbofuran and phenamiphos are use as non fumigant nematicides. These nematicides are effective when applied at sowing. The best results are obtained when applications of nematicides are made in a crew 17-25 cm wide and built-in 2-4 cm into the soil. Soil solarization during the hot dry season, also helps to control nematodes (Amin, PW 1988).

Bacterial Diseases

The bacteria may be seed-borne, soil-borne, air-borne, and water-borne. Sometimes insects also transmit bacterial cells. Bacterial infection in the plants causes bacterial wilt disease. Bacterial wilt is a soil-borne disease which is caused by *Ralstonia solanacearum*. Wilts symptoms can be observed within 2-3 weeks after sowing. The first sign of this disease is a minor drooping or curling of one or more leaves. In more advanced stages the plants may bend over at the tip and ultimately turn brown and die. Infected plants have discolored and decayed of the roots and pods. Infected young plants can result in sudden wilting and death, but the leaves stay green. Result of infection of mature plants, the losses of turgidity and leaves become light green and curl at the tips. Ultimately leaflets become brown but remain attached to the plant. In a few instances only a single branch may wilt and die. The diagnostic characteristics of this disease are the dark brown discoloration in the xylem, pith and the streaming of 'bacterial ooze' (Matre *et al.,* 2002). Bacterial wilt is a most important constraint to groundnut production. Causal agent (*Ralstonia solanacearum*) is an aerobic, non-spore-forming, stick shaped, gram- negative bacterium. Virulent isolates are mostly non-flagellate and non-motile while a virulent isolates generally bear 1-4 polar flagella and are highly motile. General fimbriae are often present in both virulent and a virulent isolates. Even if it does not produce fluorescent pigments, it produces a brown diffusible pigment on a variety of agar media containing tyrosine (Zhu *et al.,* 2004). The bacterium grows at a wide range of temperatures from 25 to 35°C. The bacterium is mainly disseminated through infested soil, water and infected seed. Bacterial wilt is a most important constraint to groundnut production in the world (Ajeigbe *et al.,* 2015).

Conclusions

Groundnut is known as an important oil crop playing a dominant role in the economy of many countries. It suffers from a variety of diseases worldwide which affects its quality as well as economy of the dependent stake holders. As a requirement of human and environment health, application of biocotrol measures are being implemented. In groundnut crop also, these management strategies have performed well with the application botanical extracts such as *Azadirachta indica, Lowsonia alba*, *Solenum dulcamara*, *Moringo oleifera, Datura alba*, *Curcuma longa, Caleotropics procera, Eucalyptus globuls* L*., Allium sativum* L, *Datura stramonium* L *and Aloe barbadensis*. Similarly microbes such as *Bacillus subtilis* and *Trichoderma viridae, Verticillium chlamydosporium, Paecilomyces lilacinus, Pseudomonas aeruginosa* have been reported to effectively control groundnut plant pathogens. Present study reviewed the latent bioagents and plant parts to control various disease of ground.

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