

A REVIEW

Survey and studies on fungal diseases of groundnut (*Arachis hypogaea* L.) and their management in eastern U.P.

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SUMMARY

Groundnut is one of the important oil seed crop in arid and semi arid area of India. In Uttar Pradesh it is grown as rainfed crop in Eastern U.P. and Bundelkhand. In eastern U.P. it is mainly grown in Gorakhpur, Deoria, Balrampur, Shravasti and Bahraich not as an oilseed crop but as a dietary supplement or confectionary. The major constraints in its production are diseases caused by Bacteria, Fungi, Virus and Nematodes. Among these Tikka-leaf spot, Rust, Anthracnose, Wilt, Stem rot, Root rot, Collar rot and Yellow mold is noticed as most destructive diseases for yield loss. Among all these Tikka disease and rust are most common and destructive to reduce the quantity as well as quality of produce. To minimize the loss caused by this pathogen various measures are applied. Among all these measures biological control is most beneficial.

Key Words : Groundnut, Tikka diseases, Leaf spots, Rust, root rot, Stem rot, Anthracnose

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Groundnut (*Arachis hypogaea* L.) is commonly known as peanut, manila nut, pignut and monkey nut. It belongs to family Legumenaceae or Fabaceae (sub family Papilionaceae).

Groundnut being a nitrogen-fixing crop through the root nodule bacteria is considered as an important crop to be cultivated in crop rotations all over the country (Desai *et al.*, 1980). It is the source of all the nutrients required for proper growth and development, therefore,

known as poor men's cashew nut. It contains carbohydrates, fat, protein, vitamins and minerals. It is also a major source of edible oil and the kernel contains 44 to 50 % oil and 25 to 30 per cent protein.

In Eastern Uttar Pradesh, groundnut is grown in kharif seasons and is one of the most important cash crops for farmers. In 2013, the world peanut production was 45.7 million tonne from 25.4 million ha, area with an average productivity of 1796.2 kg/ha (FAO, 2013). The average yield of *Rabi* peanut is around 1929 kg/ha, whereas *Kharif*-peanut is around 1712kg/ha which is lower than major peanut growing countries (GOI, 2014). Groundnut is called as the "king of oilseed" and from the groundnut seed many food products are prepared like peanut oil, peanut butter etc. Its seed is used as a source of cooking oil and in confectionary products for human consumption (Naab *et al.*, 2005).

Large number of fungal diseases caused by fungi such as *Cercospora*, *Alternaria*, *Colletotrichum*, *Gloeosporium*, *Septoria*, *Helminthosporium*, *Sphaceloma* and many more, which create more loss of yield due to damage of leaves, stem, root and pods. *Anthraxnose* of groundnut caused by *Colletotrichum dematium*, which was first reported by Subramanyam *et al.* (1985). The symptom shows black lesions, usually sunken spots. The imperfect fungi produce conidia in acervuli which are hyaline, one celled (Jha and Tiwari, 2012).

India occupies the first place, both in regard to the area and the production in the world. About 7.5 million hectares are put under it annually and the production is about six million tones. Seventy per cent of the area and seventy five per cent of the production has been concentrated in the four states *i.e.* Gujarat, Tamil Nadu, Andhra Pradesh and Karnataka. Among oil seeds crops in India, groundnut accounts for about 50% of area and 45% of oil production. In India, about 75% of the groundnut area lies in a low to moderate rainfall zone (parts of peninsular region and western and central regions) with a short period of distribution (90-120 days).

Groundnut (*Arachis hypogaea* L.) is affected by early leaf spot (*Cercospora arachidicola* Hori), late leaf spot (*Phaeoisariopsis personata* (Berk. and Curtis, V. Arx) and rust (*Puccinia arachidis* Speg.) all over the world including India (Jackson, 1983; Melouk *et al.*, 1984; Munda *et al.*, 1997 and Subhramanyam *et al.*, 1985). Among foliar diseases 3 fungal foliar diseases like, Early leaf spot, Late leaf spot and Rust are economically important diseases.

These diseases occur wherever the groundnut crop is grown. But their incidence and severity varies with season and location and there can be both short and long term fluctuations in their relative proportion (Mc Donald *et al.*, 1985). Both ELS and LLS cause damage to the plant by reducing the photosynthetic area, intense lesion formation and by stimulating leaflet abscission (Ghewande *et al.*, 1991). Bunting *et al.* (1974) estimated that early and late leaf spot alone can cause a loss of about 3 million ton of kernel per year. Mc Donald *et al.* (1985) reported that the yield losses caused by these diseases is very high and ranged from 10% to 50%.all over the world but vary considerably from place to place and between seasons (Ghewande, 1989a and 1989b). Various studies report 50% or more yield loss due to these foliar diseases (Ghunge *et al.*, 1981; Subhramanyam *et al.*, 1980 and Patel and Vaishnav, 1987).

In India losses in yield due to the leaf spots have been estimated to be in the range of 15 to 59% (Butler, 1914; Chohan, 1974 and Chohan *et al.*, 1973). In semi-arid tropics where chemical control is rare, average losses exceeding 50% are quite usual (Garren *et al.*, 1973). The losses caused in combination with rust is substantial (Ghewande *et al.*, 1983).

Cumins and Smith (1973) reported besides the loss in yield of kernel the value of the fodder is adversely affected. According to Sundaram (1965), severe intensity of leaf spot leads to a reduction in yield upto 22%. Leaf spot can cause yield losses of 50% - 70% in West Africa and upto 50% worldwide (Waliyar, 1990).

Woodruff (1933) designated the disease caused by *Cercospora arachidicola* early spot and that caused by *Cercosporidium personatum* late spot, based on relative time of their appearance in the USA.

MATERIAL AND METHODS

Survey:

The survey was conducted in *Kharif* season of 2020-2021 at different intervals after 15 /30/60/90/120 days. In random moving field survey farmers field of Deoria, Balrampur, Shravasti and Bahraich district of Uttar Pradesh.

Disease cycle and management :

During survey plants materials collected and studied in laboratory regarding symptomatology of disease development and control measures. Disease inoculums

are also maintained in research field of Botany Department of M. L. K. (P.G) College, Balrampur.

RESULTS AND DISCUSSION

The detail discussion about disease cycle and control measures of some important disease are as follow as :

Tikka leaf spots:

Early leaf spot :

Causal organism :

Cercopora arachidicola (Sexual stage: *Mycosphaerella arachidis*).

Late leaf spot :

Causal organism :

Phaeoisariopsis personata (Syn: *Cercospora personata*) (Sexual stage: *Mycosphaerella berkeleyii*)

Symptoms :

The disease occurs on all above ground parts of the plant, more severely on the leaves.

The leaf symptoms produced by the two pathogens can be easily distinguished by appearance, spot colour and shapes. Both the fungi produce lesions also on petiole, stem and pegs. The lesions caused by both species coalesce as infection develops and severely spotted leaves shed prematurely. The quality and yield of nuts are drastically reduced in severe infections.

Pathogen *Cercospora arachidicola*:

The pathogen is intercellular ahaustoriolate and become intracellular when host cells die. The fungus produces abundant sporulation on the upper surface of the leaves. Conidiophores are olivaceous brown or yellowish brown in colour, short, 1 or 2 septate, unbranched and geniculate and arise in clusters.



Survey of different crop field at different locations and their microscopic observations

Conidia are sub hyaline or pale yellow, obclavate, often curved 3-12 septate, 35- 110 x 2.5 - 5.4 µm in size with rounded to distinctly truncate base and sub-acute tip. The perfect stage of the fungus produces perithecia as ascostromata. They are globose with papillate ostiole. Asci are cylindrical to clavate and contain 8 ascospores. Ascospores are hyaline, slightly curved and two celled, apical cell larger than the lower cell.

P. Personata (C. personata) (Sexual stage: M. berkeleyii) :

The fungus produces internal and intercellular mycelium with the production of haustoria. The conidiophores are long, continuous, 1-2 septate, geniculate, arise in clusters and olive brown in colour. The conidia are cylindrical or obclavate, short, measure 18-60 x 6-10 µm, hyaline to olive brown, usually straight or curved slightly with 1-9 septa, not constricted but mostly 3-4 septate. The fungus in its perfect stage produces perithecia as ascostromata which are globose or broadly ovate with papillate ostiole. Asci are cylindrical to ovate, contain 8 ascospores. Ascospores are 2 celled and constricted at septum and hyaline.

Favourable conditions :

- Deficiency of Mg in soil.
- Heavy doses of nitrogen and phosphorus fertilizers.
- Low temperature (20 C) with dew on leaf surface.
- Prolonged high relative humidity for 3 days.

Disease cycle :

The pathogen survives for a long period in the infected plant debris through conidia, dormant mycelium and perithecia in soil. The volunteer groundnut plants also harbour the pathogen. The primary infection is by ascospores or conidia from infected plant debris or infected seeds. The secondary spread is by wind blown conidia. Rain splash also helps in the spread of conidia.

Management :

- Eradicate the volunteer groundnut plants.
- Grow moderately resistant varieties like ALR 1.
- Spray Carbendazim 500g or mancozeb 2 kg or Chlorothalonil 2 kg/ha and if necessary, repeat after 15 days.
- Keep weeds under control.
- Remove and destroy the infected plant debris.
- Treat the seeds with Carbendazim or Thiram at

2g/kg.

Rust :

Calusal organism : Puccinia arachidis

Symptoms :

The disease attacks all aerial parts of the plant. The disease is usually found when the plants are about 6 weeks old. Small brown to chestnut dusty pustules (uredosori) appear on the lower surface of leaves. The epidermis ruptures and exposes a powdery mass of uredospores. Corresponding to the sori, small, necrotic, brown spots appear on the upper surface of leaves. The rust pustules may be seen on petioles and stem. Late in the season, brown teliosori, as dark pustules, appear among the necrotic patches. In severe infection lower leaves dry and dropper maturely. The severe infection leads to production of small and shriveled seeds.

Pathogen:

The pathogen produces both uredial and telial stages. Uredial stages are produced abundant in groundnut and production of telia is limited. Uredospores are pedicellate, unicellular, yellow, oval or round and echinulated with 2 or 3 germ pores. Teliospores are dark brown with two cells. Pycnial and aecial stages have not been recorded and there is no information available about the role of alternate host.

Favourable conditions:

- Heavy rainfall.
- Low temperature (20-25°C).
- High relative humidity (above 85%).

Disease cycle :

The pathogen survives as uredospores on volunteer groundnut plants. The fungus also survives in infected plant debris in soil. The spread is mainly through wind borne inoculum of uredospores. The uredospores also spread as contamination of seeds and pods. Rainsplash and implements also help in dissemination. The fungus also survives on the collateral hosts *like Arachis marginata, A. nambyquarae and A. prostrate.*

Management :

- Avoid mono culturing of groundnut.
- Grow moderately resistant varieties like ALR 1.
- Remove volunteer groundnut plants and reservoir hosts.
- Spray Mancozeb 2 kg or Wettable Sulphur 3 kg

or Tridemorph 500ml or Chlorothalonil 2kg/ha.

Root rot :

Causal organism : Macrophomina phaseolina

Symptoms :

In the early stages of infection, reddish brown lesion appears on the stem just above the soil level. The leaves and branches show drooping, leading to death of the whole plant. The decaying stems are covered with whitish mycelial growth. The death of the plant results in shredding of bark. The rotten tissues contain large number of black or dark brown, thick walled sclerotia. When infection spreads to underground roots, the sclerotia are formed externally as well as internally in the rotten tissue. Pod infection leads to blackening of the shells and sclerotia can be seen inside the shells.

Pathogen:

The fungus produces hyaline to dull brown mycelium. The sclerotia are thick walled and dark brown in colour.

Favourable conditions:

– Prolonged rainy season at seedling stage and low lying areas.

Disease cycle:

The fungus remains dormant as sclerotia for a long period in the soil and in infected plant debris. The primary infection is through soil-borne and seed-borne sclerotia. The secondary spread of sclerotia is aided by irrigation water, human agency, implements and cattle etc.

Management:

- Treat the seeds with thiram or carbendazim 2g/kg or Trichoderma viride at 4g/kg.
- Spot drench with Carbendazim at 0.5 g/lit .

Stem rot :

Causal organism : Sclerotium rolfsii

Symptoms :

The first symptom is the sudden drying of a branch which is completely or partially in contact with the soil. The leaves turn brown and dry but remain attached to the plant. Near soil on stems white growth of fungus mycelium is appeared. As the disease advances white mycelium web spreads over the soil and the basal canopy of the plant. The sclerotia, the

size and colour of mustard seeds, appear on the infected areas as the disease develops and spreads. The entire plant may be killed or only two or three branches may be affected. Lesions on the developing pegs can retard pod development. Infected pods are usually rotted.

Management:

- Crop rotation with wheat, corn and soyabean may minimize the incidence of stem rot.
- Cultural practices such as deep covering or burial of organic matter before planting, nondirting cultivation by avoiding movement of soil up around the base of plants and preventing accumulation of organic debris are extremely useful in reducing the disease.
- Seed treatment with Trichoderma viride formulation (4g/kg) followed by application of 2.5kg Trichoderma viride formulation mixed with 50kg farm yard manure before sowing.
- Seed treatment with Carbendazim / Thiram / Captan 2-3 g/kg seed.

Anthracoze :

Causal organism : Colletotrichum dematium and C. capsici.

Symptoms:

Small water-soaked yellowish spots appear on the lower leaves which later turn into circular brown lesions with yellow margin 1 to 3 mm in diameter. In some cases lesions enlarge rapidly become irregular and cover the entire leaflet, and extend to the stipules and stems. Brownish grey lesions occur on both the surfaces of leaflets. Infection spreads to stipules, petioles and branches.

Disease cycle:

The pathogen is seed, soil and air-borne.

Management:

- Deep summer ploughing.
- Removal of plant debris.
- Seed treatment with copper oxychloride at 3g/kg seed or carbendazim at 2g/kg seed.
- Use healthy certified seeds.

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