

2. Diseases of Sorghum

Downy Mildew - *Peronosclerospora sorghi*

Symptoms

The fungus causes systemic downy mildew of sorghum. It invades the growing points of young plants, either through [oospore](#) or [conidial infection](#). As the leaves unfold they exhibit green or yellow colouration. Abundant [downy](#) white growth is produced on the lower surface of the leaves, which consists of [sporangiophores](#) and [sporangia](#).

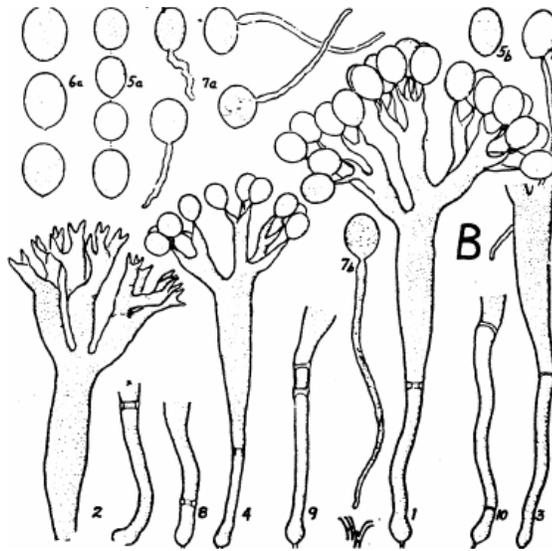


Symptoms

Normally three or four leaves develop the [chlorotic](#) downy growth. Subsequent leaves show progressively more of a complete bleaching of the leaf tissue in streaks or stripes. As the infected bleached leaves mature they become [necrotic](#) and the interveinal tissues [disintegrate](#), releasing the resting spores ([oospores](#)) and leaving the vascular bundles loosely connected to give the typical shredded leaf symptom.

Pathogen

P. sorghi is an [obligate parasite](#) systemic in young plant. The mycelium is [intercellular](#), [non-septate](#). [Sporangiophores](#) emerge through the stomata in single or in clusters which are stout and [dichotomously branched](#). Spores are single celled, hyaline, globose and thin walled. [Oospores](#) are spherical, thick walled and deep brown in colour.



Sporangia and sporangiophores

Favourable Conditions

- Maximum sporulation takes place at 100 per cent relative humidity.
- Optimum temperature for sporulation is 21-23°C during night.
- Light drizzling accompanied by cool weather is highly favourable.

Disease Cycle

The primary infection is by means of oospores present in the soil which germinate and initiate the systemic infection. Oospores persist in the soil for several years. Secondary spread is by air-borne sporangia. Presence of mycelium of the fungus in the seeds of systemically infected plants is also a source of infection. The disease has been known to occur through a collateral host, Heteropogen centortus on which the fungus perpetuates of the host. The breakdown of tissue causes shredding. The oospores either fall to the soil or are wind blown, often within host tissue. They can remain viable in the soil for 5-10 years. Conidia are formed at night in large numbers. The optimum temperature for production is 20-23°C.



Symptoms

The straw coloured centre becomes darker during sporulation. The lesions can be several centimeters long and wide. Many lesions may develop and coalesce on the leaves, destroying large areas of leaf tissue, giving the crop a burnt appearance.

Pathogen

The mycelium is localised in the infected lesion. [Conidiophores](#) emerge through stomata and are simple, olivaceous, septate and geniculate. [Conidia](#) are [olivaceous](#) brown, 3-8 septate and thick walled.

Favourable Conditions

- Cool moist weather.
- High humidity (90 per cent)
- High rainfall.

Disease cycle

The pathogen is found to persist in the infected plant debris. Seed borne conidia are responsible for seedling infection. Secondary spread is through wind-borne conidia.

Management

- Use disease free seeds.
- Treat the seeds with [Captan](#) or [Thiram](#) at 4 g/kg.
- Spray [Mancozeb](#) 1.25 kg or [Captafol](#) 1 kg/ha.

Rectangular Leaf spot - [Cercospora sorghi](#)

Symptoms

The symptoms appear as small leaf spots which enlarge to become rectangular [lesions](#) (which can be 5-15 mm long by 2 to 5 mm wide) on the leaf and leaf sheath. Usually the lower

leaves are first attacked. The lesions are typical dark red to purplish with lighter centers. The lesions are mostly isolated and limited by veins. The colour of the spots varies from red, purple, brown or dark depending upon the variety.

Pathogen

Mycelium of the fungus is hyaline and septate. Conidiophores emerge in clusters through stomata, which are brown and simple, rarely branched. Conidia are hyaline, thin walled, 2-13 celled and long obclavate.

Favourable Conditions

- Cool moist weather.
- High humidity (90 per cent)
- High rainfall.

Disease cycle

The conidia survive up to 5 months. The disease spreads through air-borne and seed-borne conidia.

Management

- Use disease free seeds.
- Treat the seed with Captan or Thiram at 4 g/kg.
- Spray Mancozeb 2 kg /ha.

Anthracnose and red rot - [Colletotrichum graminicolum](#)

Symptoms

The fungus causes both leaf spot ([anthracnose](#)) and stalk rot ([red rot](#)). The disease appears as small red coloured spots on both surfaces of the leaf. The centre of the spot is white in colour encircled by red, purple or brown margin.





Symptoms

Numerous small black dots like [acervuli](#) are seen on the white surface of the lesions. Red rot can be characterized externally by the development of circular [cankers](#), particularly in the inflorescence. Infected stem when split open shows discoloration, which may be continuous over a large area or more generally discontinuous giving the stem a marbled appearance.

Pathogen

The mycelium of the fungus is localised in the spot. [Acervuli](#) with setae arise through epidermis. Conidia are hyaline, single celled, [vacuolate](#) and [falcate](#) in shape.



Favourable Conditions

- Continuous rain.
- Temperature of 28-30°C.
- High humidity.

Disease cycle

The disease spread by means of seed-borne and air-borne conidia and also through the infected plant debris.

Management

- Treat the seeds with Captan or Thiram at 4 g/kg.
- Spray the crop with Mancozeb 2 kg/ha.

Rust - *Puccinia purpurea*

Symptoms

The fungus affects the crop at all stages of growth. The first symptoms are small [flecks](#) on the lower leaves (purple, tan or red depending upon the cultivar). [Pustules \(uredosori\)](#) appear on both surfaces of leaf as purplish spots which rupture to release reddish powdery masses of [uredospores](#). [Teliopores](#) develop later sometimes in the old uredosori or in telisori, which are darker and longer than the uredosori. The pustules may also occur on the leaf sheaths and on the stalks of inflorescence.



Symptoms on leaves and stalk

Pathogen

The [uredospores](#) are [pedicellate](#), elliptical or oval, thin walled, echinulated and darkbrown in colour. The [teliospores](#) are reddish or brown in colour and two celled, rounded at the apex with one germ pore in each cell. The teliospores germinate and produce [promycelium](#) and [basidiospores](#). Basidiospores infect [Oxalis corniculata](#) ([alternate host](#)) where [pycnial](#) and [aecial stages](#) arise.

Favourable Conditions

- Low temperature of 10 to 12°C favours teliospore germination.
- A spell of rainy weather favours the onset of the disease.

Disease cycle

The [uredospores](#) survive for a short time in soil and infected debris. Presence of alternate host helps in perpetuation of the fungus.

Management

- Remove the alternate host [*Oxalis comiculata*](#).
- Spray the crop with Mancozeb at 2 kg/ha.

Grain smut/Kernel smut / Covered smut / Short smut - *Sphacelotheca sorghi*

Symptoms

The [individual grains are replaced by smut sori](#). The sori are oval or cylindrical and are covered with a tough creamy skin ([peridium](#)) which often persists unbroken up to thrashing. [Ratoon](#) crops exhibit higher incidence of disease.



Symptoms

Loose smut/ kernel smut - *Sphacelotheca cruenta*

Symptoms

The affected plants can be detected before the ears come out. They are shorter than the healthy plants with thinner stalks and marked tillering. The ears come out much earlier than the healthy. The glumes are [hypertrophied](#) and the [earhead gives a loose appearance](#) than healthy.

The sorus is covered by a thin membrane which ruptures very early, exposing the spores even as the head emerges from the sheath.



Symptom

Long smut - [Tolyposporium ehrenbergii](#)

Symptoms

This disease is normally restricted to a relatively a small proportion of the florets which are scattered on a head. The sori are long, more or less cylindrical, elongated, slightly curved with a relatively thick creamy-brown covering membrane ([peridium](#)). The peridium splits at the apex to release black mass of spores (spore in groups of balls) among which are found several dark brown filaments which represent the vascular bundles of the infected ovary.



Symptoms

Head smut - *Sphacelotheca reiliana*

Symptoms

The entire head is replaced by large [sori](#). The sorus is covered by a whitish grey membrane of fungal tissue, which ruptures, before the head emerges from the boot leaf to expose a mass of brown smut spores. Spores are embedded in long, thin, dark colored filaments which are the vascular bundles of the infected head.



Symptoms

Management for all smuts

- Treat the seed with Captan or Thiram at 4 g/kg.
- Use disease free seeds.
- Follow crop rotation.
- Collect the smutted ear heads in cloth bags and bury in soil.

Ergot or Sugary disease - *Sphacelia sorghi*

Symptoms

The disease is confined to individual spikelets. The first symptom is the [secretion of honey dew from infected florets](#). Under favourable conditions, long, straight or curved, cream to light brown, hard sclerotia develop. Often the honey dew is colonised by *Crerella sorghivulgaris* which gives the head a blackened appearance.



Symptom

Pathogen

The fungus produces septate mycelium. The honey dew is a concentrated suspension of conidia, which are single celled, hyaline, elliptic or oblong.

Favourable Conditions

- A period of high rainfall and high humidity during flowering season.
- Cool night temperature and cloudy weather aggravate the disease.

Disease Cycle

The primary source of infection is through the germination of sclerotia which release ascospores that infect the ovary. The secondary spread takes place through air and insect-borne conidia. Rain splashes also help in spreading the disease.

Management

- Adjust the date of sowing so that the crop does not flower during September- October when high rainfall and high humidity favor the disease.
- Spray any one of the following fungicides viz., Mancozeb 2 kg/ha (or) Carbendazim at 500 g/ha at emergence of ear head (5-10 per cent flowering stage) followed by a spray at 50 per cent flowering and repeat the spray after a week, if necessary.

Head mould/Grain mould/Head blight

More than thirty two genera of fungi were found to occur on the grains of sorghum.

Symptoms

If rains occur during the flowering and grain filling stages, severe grain moulding occurs. The most frequently occurring genera are *Fusarium*, *Curvularia*, *Alternaria*, *Aspergillus* and *Phoma*. *Fusarium semitectum* and *F.moniliforme* develop a fluffy white or pinkish coloration. *C. lunata* colours the grain black. Symptom varies depending upon the organism involved and the degree of infection.



Symptoms

Favourable Conditions

- Wet weather following the flowering favors grain mould development.
- The longer the wet period the greater the mould development.
- Compact ear heads are highly susceptible.

Disease cycle

The fungi mainly spread through air-borne conidia. The fungi survive as parasites as well as *saprophytes* in the infected plant debris.

Management

- Adjust the sowing time.
- Spray any one of the following fungicides in case of intermittent rainfall during earhead emergence, a week later and during milky stage.
- Mancozeb 1 kg/ha or Captan 1 kg + *Aureofungin*-sol 100 g/ha.

Phanerogamic parasite - *Striga asiatica* and *Striga densiflora*

It is a [partial root parasite](#) and occurs mainly in the rainfed sorghum. It is a small plant with bright green leaves, grows up to a height of 15-30 cm. The plants occur in clusters of 10-20/host plant. [S. asiatica produces red to pink flowers](#) while. [S. densiflora](#) produces white flowers. Each fruit contains minute seeds in abundance which survives in the soil for several years.

The root exudates of sorghum stimulate the seeds of the parasite to germinate. The parasite then slowly attaches to the root of the host by [haustoria](#) and grows below the soil surface producing underground stems and roots for about 1-2 months. The parasite grows faster and appears at the base of the plant. Severe infestation causes yellowing and wilting of the host leaves. The infected plants are stunted in growth and may die prior to seed setting.



Symptoms

Management

- Regular weeding and intercultural operation during early stages of parasite growth.
- Spray Fernoxone (sodium salt of 2, 4-D) at 450g /500 litre of water.