Downy Mildews of Maize

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Downy mildews are found worldwide but they cause serious diseases in Asia and Africa on maize and other grain crops. These diseases cause considerable losses to the yield under favourable conditions of fungal growth. These diseases cause severe damage to hybrid maize like Ganga-3 etc. Several mildews are known as mentioned below:

2. Crazy top downy mildew caused by *Sclerophthora macrospora* (Sacc.) Thirumalachar et al. =*Sclerospora macrospora* Sacc.
4. Philippine downy mildew caused by *Peronosclerospora philippinensis* (W. Weston) C.G.Shaw
7. Sugarcane downy mildew caused by *Peronosclerospora sacchari* (Miyake0 Shirai & Hara = *Sclerospora sacchari* Miyake

**Symptoms:** Downy mildew on maize leaves is characterized by elongated chlorotic streaks with a downy growth of conidia and conidiophores. Symptoms first appear 3–6 days after infection as pale yellow to whitish discolourations on the leaf blade. The sporangia develop on branched sporangiophores which emerge in groups from the plant tissues through stomata. A white mat of the fungal growth can be seen on the lower or both the surfaces of leaves during wet weather. The stem may also be affected if infection occurs during early stages of plant growth. Small to large leaves are noticed in the tassel. Proliferation of auxiliary buds on the stalk of tassel and the cobs is common (Crazy top). Sometimes Tassels may be deformed, and ears may be aborted.

**Pathogens:** *Sclerophthora rayssiae, Peronosclerospora maydis; P. philippinensis; P. sorghi and P. sacchari* are commonly distributed downy mildew pathogens. These pathogens belong to the group Oomycetes and family peronosporaceae. The first two pathogens attack maize but the rest two are the pathogens of sorghum and sugarcane respectively but can also infect maize. The *S. rayssiae* produces sporangia at the tips of sporangiophores at their branches. Sporangia are white in colour in the beginning but turn to greyish light brown later. The sporangia germinate by protruding a germ tube and finally produce zoospores at higher temperature. The *P. philippinensis* fungus produces numerous hyaline, thin walled, ellipsoidal conidia on dichotomously branched conidiophores.
**Disease Cycle:** Downy mildews are soil and seed borne in nature. The spores in the soil or on seeds germinate through a germ tube and infect plant tissues through roots or collar region. This is called as primary infection. The primary source of infection is through oospores in soil and also dormant mycelium present in the infected maize seeds. Secondary spread is through airborne conidia. Depending on the pathogen species, the initial source of disease inoculum can be oospores that over winter in the soil or conidia produced in infected, over wintering crop debris and infected neighboring plants. Some species that cause downy mildew can also be seed borne, although this is largely restricted to seed that is fresh and has high moisture content. The infection becomes systemic and reaches at the upper parts of the plants. The fungus develops sporangia in large numbers on the younger leaves of affected plants. The sporangia blown away by wind or through rainwater or insects and infect healthy plants. This is the secondary spread of the disease where they form zoospores which cause the secondary infection. At the onset of the growing season, at soil temperatures above 20°C, oospores in the soil germinate in response to root exudates from susceptible maize seedlings. The germ tube infects the underground sections of maize plants leading to characteristic symptoms of systemic infection including extensive chlorosis and stunted growth. If the pathogen is seed borne, whole plants show symptoms. Oospores are reported to survive in nature for up to 10 years. Once the fungus has colonized host tissue, sporangiophores (conidiophores) emerge from stomata and produce sporangia (conidia) which are wind and rain splash disseminated and initiate secondary infections. Sporangia are always produced in the night. They are fragile and cannot be disseminated more than a few hundred meters and do not remain viable for more than a few hours. Germination of sporangia is dependent on the availability of free water on the leaf surface. Initial symptoms of disease (chlorotic specks and streaks that elongate parallel to veins) occur in 3 days. Conidia are produced profusely during the growing season. As the crop approaches senescence, oospores are produced in large numbers.

**Control:** The control of mildew diseases is difficult. The sprays with systemic fungicides such as metalaxyl and propamocarb etc. can be used to manage the disease. However, the best control is to use resistant varieties or hybrids, if available.

- Deep ploughing.
- Crop rotation with pulses.
- Rogue out infected plants.
- Treat the seeds with metalaxyl at 3g/kg.
- Spray the crop with Metalaxyl + Mancozeb @ 1kg on 20th day after sowing.
- Grow resistant varieties and hybrids viz. CO1, COH1 and COH2.