Imported diseases of chilli (Capsicum annum L.) in coastal regions and their management

Management of chilli diseases

Any of the above diseases may occur during the crop growth period as the coastal climatic conditions are very congenial to the development of these diseases. Hence we recommend an integrated disease management approach rather than individual disease management. The following measures are recommended for chilli disease management.

- Adjust the date of sowing so as to avoid vector population build up.
- Grow resistant varieties.

Management in nursery

- Raise nursery in fungigated soil.
- Seed treatment: Imidacloprid @ 5-10g per kg of seeds + Thiram @ 2g per kg seeds.
- Nursery application: Talc formulation of Trichoderma/ Bacillus (Geo-Bio-1 & 2) @ 50g per m² before sowing.
- Cover the nursery area with insect proof net.
- Vector control in nursery: Spray Acephate @ 1g per litre of water or Metasystox @ 1ml per litre of water at 15 days after sowing.

Management in main field

- Soil amendment with lime @ 8-10t per ha.
- Avoid frequent watering and flooding.
- Raise barrier crops like maize/ sorghum in the borders and inside if the field is large.
- Soil application/ seedling drench during transplanting: Talc formulation of Trichoderma/ Bacillus (Geo-Bio-1 & 2) @ 1.25 to 1.5g per plant.
- Follow insect/ vector and other disease control in the field as per the schedule given below.

<table>
<thead>
<tr>
<th>Spray No.</th>
<th>Insecticide</th>
<th>Dose</th>
<th>Spray date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Imidacloprid</td>
<td>0.3ml per litre</td>
<td>15 DAT</td>
</tr>
<tr>
<td>2</td>
<td>Acephate +</td>
<td>2g per litre</td>
<td>30 DAT</td>
</tr>
<tr>
<td></td>
<td>Bicofol</td>
<td></td>
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<tr>
<td>3</td>
<td>Dimethoate(And)</td>
<td>1ml per litre</td>
<td>45 DAT</td>
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<tr>
<td></td>
<td>Wettable sulphur</td>
<td>3g per litre</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Piperonil +</td>
<td>0.5ml per litre</td>
<td>60 DAT</td>
</tr>
<tr>
<td></td>
<td>Carbendazim</td>
<td>2g per litre</td>
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</tr>
</tbody>
</table>

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Powdery mildew (Leveillula taurica)

Symptoms

- Symptoms first appear on older leaves and progress to younger leaves.
- White to grey powdery growth is seen on the underside of the leaves. Corresponding upper surface of the leaf shows chlorotic/ necrotic spots.
- The necrotic lesions gradually turn brownish black with the appearance of fungal fructifications.
- Severe infection leads to defoliation and severe yield loss.
- Dieback of twigs and branches and stunting of plants followed by fruit drop in case of severe infection.

Management

- Grow resistant varieties.
- Avoid over watering and under watering.
- Treat the seeds with biological agents like Trichoderma, Bacillus @ 10g/100g seed.
- Biological control: In nursery, apply Talc formulation of bio-agent (Geo Bio-2)/ Trichoderma @ 50 g m⁻² (soil application or mixed with water and apply if plants are established). In main field, apply the bio-agent @ 1.25-1.5g per plant as drenching.
- Drench the root zone soil with tebuconazole @ 0.1%, carboxin @ 0.25% after 7-10 days after transplanting for S. rofus management. Drench Thiophanate-methyl @ 0.2-0.3%, mefenoxam 0.1% for Phytophthora management.

Leaf margins die and dry off.
- Presence of light to dark brown lesions and discoloration on the lower portion of the stem adjacent to the ground. This is followed by drooping and wilting of infected leaves and gradual wilting of the whole plant.
- Shredding of bark in the collar region can be seen in few cases.
- Roots appear dark brown or black and few or no healthy, white roots or root tips.
- Root system is partially or fully decayed and the plant could be removed with little effort.
- In case of Schizotoma rufaL infection, thick, white mycelia threads along with brown sclerotial structures can be seen on the stem near the soil surface.

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Chilli (Capsicum spp.) is an important commercial spice and vegetable crop. Chilli is extensively cultivated and is an indispensable ingredient in the cuisines of India and many other countries. Among the five cultivated species of the genus Capsicum, C. annuum is the most widely cultivated in India for its pungent (chilli syn. Hot pepper) and non-pungent (sweet pepper syn. Capsicum, Bell pepper) fruits. The cultivation of C. frutescens, C. chinease, and C. baccatum is limited and usually restricted to homestead cultivation.

Diseases of chilli have been a major limitation to its cultivation. Following are the major and important diseases of chilli cultivated in the Coastal regions.

1. Bacterial wilt
2. Viral diseases
3. Fusarium wilt
4. Fungal root rot disease
5. Powdery mildew
6. Fruit rot / anthracnose

**Bacterial wilt (Ralstonia solanacearum)**

**Symptoms**
- Symptoms manifest initially as leaf drooping followed by withering of entire plant within a few days.
- Recently wilted plants look green, a distinct symptom when compared to other vascular wilt diseases which develops yellowing of the leaves.
- Vascular discoloration (brown) is also seen in the wilted plant.
- Disease develops very rapidly in warm weather.
- Symptoms are very clear during morning or immediately after irrigation.

**Management**
- Plant chilli in a disease-free field.
- Grow resistant varieties.
- Soil amendment with lime @ 8-10t per ha.
- Prevent spread of pathogens by removing the infected plants from the field and avoiding field irrigation.
- Biological control: In Nursery, apply talc formulation of bio-agent (Goa Bio-2) @ 50 g/m² (soil application or mixed with water and apply if plants are established). In main field, apply the bio-agent @ 1.25-1.5 g per plant as drenching.

**Viral diseases** (Rogovivirus, Potevirus, Tospovirus)

Symptoms vary depending on the viruses present, the variety infected, environmental conditions and age of plant at the time of infection. Field plants are usually infected by more than one virus. Multiple infections result in symptoms more severe in appearance and more complex than those caused by a single virus. General symptoms include, upward and downward curling of leaf margins and leaves, puckering or presence of dark green blesters in the leaves, mosaic pattern and yellowing of the leaves, leaf distortion and thick leaves, small sized leaves, clustering and dwarf plants, small and twisted or deformed fruits, presence of insect vectors viz. aphids, whitefly and thrips. Major viral diseases are described below.

**Chilli leaf curl disease (Rogovivirus: Chilli leaf curl virus)**

**Vector**: Whitefly (Bemisia tabaci)

**Symptoms**
- Upward curling of leaves, puckering and reduced size of leaves.
- Shortening of internodes, vein clearing, vein swelling, vein thickening, and stunted growth.
- As infection progresses, symptoms of chlorosis, mosaic and mottling develop, and distortion is more prominent.
- The size of leaves and branches is reduced considerably in severely affected plants resulting in a bushy appearance. Such plants bear very few flowers and very few fruits.
- Severely affected plants are stunted and produce no fruit or fruitlets are small, discolorated and distorted.
- If the disease persists later in the life cycle, flower buds will abort and anthers will set with pollen grains, which ultimately result in poor fruit setting, resulting in distorted or underdeveloped fruit.

**Management of viral diseases**
- Use seeds from virus-free sources.
- Grow resistant varieties.
- Control insect vector spread by practicing the following measures.
  - Soil treatment: Limicloid @ 5-10g per kg of seeds
  - Cover the nursery area with insect proof net.
  - Raise barrier crops like maize / sorghum in the borders and inside if the field is large.
- Vector control in nursery: Spray Acephate @ 1g per litre of water or Metamitox @ 1ml per litre of water at 15 days after sowing.
- Vector control in main field: Four sprays of insecticides starting from 15 days after planting and at 15 days interval.

**Necrosis virus disease** (Tospovirus: TSWV, GBNV, WRBV, CaCV)

**Vector**: Thrips (Thrips tabaci, Frankliniella schultzei, Scirtothrips dorsalis)

**Symptoms**
- Yellow spots or patches followed by occasional chlorotic concentric rings on leaves.
- Bronzing and veinal necrosis of leaves.
- Necrosis of terminal bud / die-back of shoots is the characteristic symptoms.
- Plants infected early are bushy, stunted and die prematurely. In older plants, the symptoms are restricted to a few branches only.
- Leaf distortion in some cases.
- Chlorotic and necrotic spots and rings on leaves and fruits.

**Management**
- Grow resistant varieties.
- Avoid use of high nitrogen fertilizers and use a slow-release organic fertilizer.
- Remove the weeds as many weed species host the disease pathogen.
- If the disease persists, remove the entire plant and solarize the soil before planting again. To solarize the soil, spread a clear plastic tarp on the soil surface for 4-6 weeks during the hottest part of the year.
- Drench the root zone soil with Carbendazim / Benomyl / Thiophanate-methyl @ 0-2-0.3%
- Biological control: In Nursery, apply talc formulation of bio-agent (Goa Bio-2) / Trichoderma @ 50 g/m² (soil application or mixed with water and apply if plants are established). In main field, apply the bio-agent @ 1.25-1.5 g per plant as drenching.

**Fungal root rot disease (Phytophthora capsici, Scleroderma rolfsii, Macrophoma phaseolina, Rhizoctonia solani)**

Root rot disease of chilli is a complex problem caused by more than one fungus and hence proper diagnosis of the causal agent is important to select the proper management strategy.

**Symptoms**
- Seedlings affected by this infestation die soon after germination.
- Growth of infected plants is retarded compared to healthy plants.
- Yellowing of older leaves and falling of the leaves.