Tanzania NTS Project Training Programme

Unique Royal Hotel, Dodoma, Tanzania

27 February to 1 March 2025

PLANT HEALTH

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EXPECTATIONS

1. Seed health testing
2. Common diseases which attack seedlings
3. Insects which cause damage to seedlings
4. Pesticides for protecting seedlings from diseases and pests
5. Common diseases which attack trees
6. Common insects which attack trees

1. Seed health testing

Health of seed refers primarily to the presence or absence of disease causing organisms, such as fungi, bacteria and viruses and animal pests, such as worms and insects.

1. Seed health testing

Health testing of seed is important for three reasons:

1. Seedborne diseases may develop progressively in the field and reduce the commercial value of the crop.
2. Imported seedlots may introduce diseases into new regions. Test to meet quarantine requirements may therefore be necessary.

1.Seed health testing

3. Seed health testing may throw light upon seedling evaluation and causes of poor germination or field establishment and thus supplement germination testing.

1. Seed health testing

The general groups of organisms or other conditions of health to be considered are:

- Pathogenic fungi or bacteria in, or growing out of, the seeds or attacking the seedlings.
- Insects, including the larval stage within seeds, and evidence of those which may have emerged (X-ray method may be used for this purpose).

1.Seed health testing

- Physiological disturbances as indicated by dead or discolored spots in the centre of the cotyledons and/or by necrotic plumules.

Major groups of seed-borne pathogens

- Fungi

Externally seed associated fungi

Examples: Botrytis, Fusarium

Cause seed-rot and seedling diseases

Not host specific

1. Seed health testing

- Seed borne and seed transmitted

Fungi may cause deterioration of seed quality, pre-and post emergence mortality of seedlings.

1. Seed health testing

- May become established as pathogens of the host tree.

Example: *Alternaria, Aspergillus, Botytis, Phoma, Botryodiplodia, Cephalosporium, Fusarium, Ascochyta, Phomopsis* etc.

1.Seed health testing

2. **Bacteria**

Examples: *Pseudomonas phaselicola, Pseudomanas pisi, Pseudomonas phaseoli, Xanthomonas phaseoli*.

1. Seed health testing

3. Virus

Bean common mosaic virus (BCMV), Cucumber mosaic virus (CMV), Tobacco Ring spot (TRSV),

Tomato mosaic virus (TOMV). Tomato Black Ring virus (TBRV)


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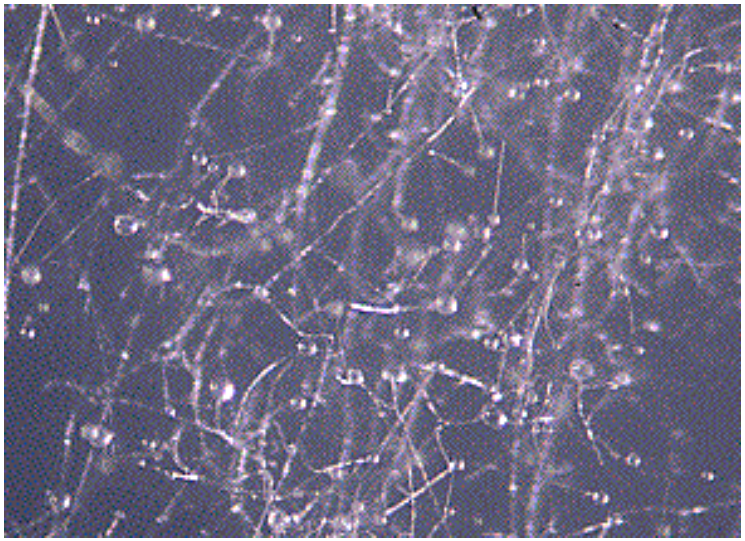
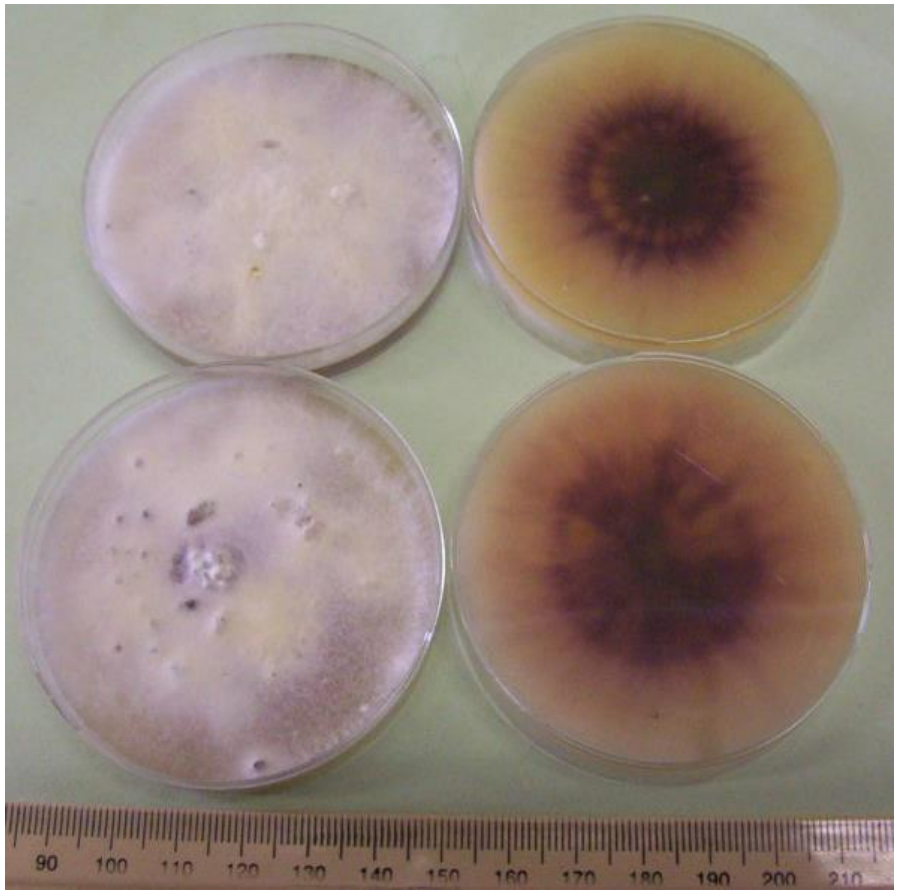
Examination after incubation



Fungi

Examination after incubation



In vitro cultures (a) Top view of *Fusarium moniliforme*, isolated from seed of *Bridelia micrantha* (b) Bottom view (inverted Petri dish) (c) Top view of *Fusarium oxysporium,* isolated from stored seed of *Sorindeia madagascariensis* (d) Bottom view (inverted Petri dish).

Pathenogenicity Test

Two months old seedlings of *Faidherbia albida;* healthy looking (left) and severely affected (right) by *Fusarium moniliforme*

Pathenogenicity Test

***Acacia tortilis* seedling attacked by *Botrytis cinerea* (see arrows)**

2. COMMON DISEASES WHICH ATTACK SEEDLINGS

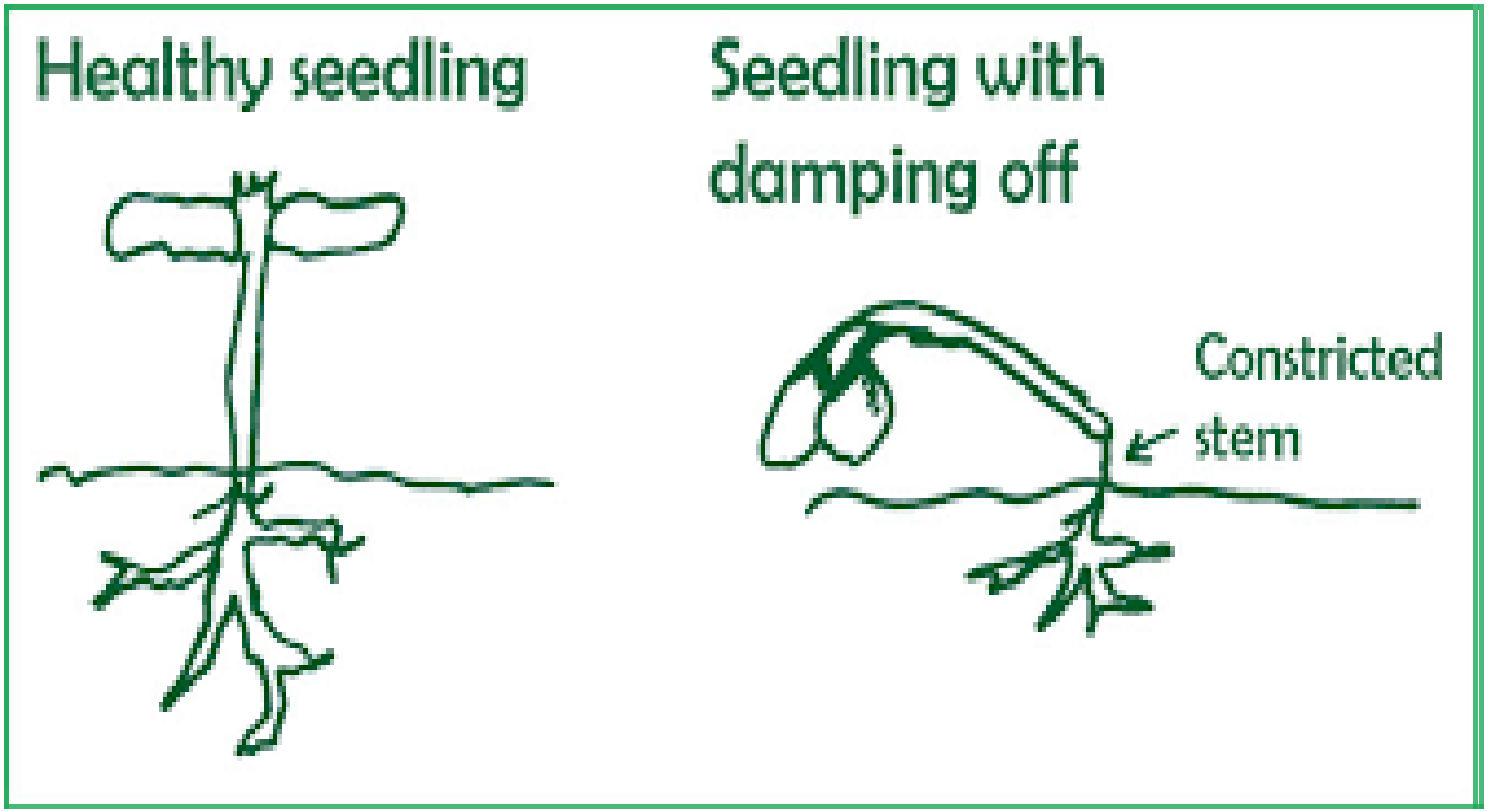
2.1 DAMPING-OFF

Pathogen: *Pythium* spp. *and Fusarium* spp.

Species attacked: *Pinus* spp., *Eucalyptus spp., Milicia excelsa, Maesopsis eminii etc.*

Disease symptoms : Attack seeds (Pre-emergeny damping-off) and causes the seed to rot. Attack seedlings (Post-emergeny damping-off) and causes the seedling to wilt, collapse and die

DAMPING-OFF


Healthy seedling
Seedling with damping off
Constricted stem

2. COMMON DISEASES WHICH ATTACK SEEDLINGS contd...

2.1 DAMPING-OFF contd...

Control: Spray the seeds before sowing and continue to spray the seedlings before pricking out. Fungicides which are recommended include: Funco 500 W Perenox, Agrosan GN, Dithane M – 45, Bayleton, Bayfidan etc. Another alternative is to make sure that the seedlings are not congested in the seed bed. Avoid over watering and over shading.

2. COMMON DISEASES WHICH ATTACK SEEDLINGS contd...

2.2 VIRUSES AS DISEASE CAUSING ORGANISMS IN PLANTS Viruses are infectious agents (often causing disease), invisible with the light microscope small enough to pass through a bacterial filter, lacking a metabolism of their own and depending on living host cells for multiplication

3. INSECTS WHICH CAUSE DAMAGE TO SEEDLINGS

3.1 TERMITES

Species attacked: All species except *Azadrachta indica* and *Senna siamea*

Damage: Seedlings are attacked in the stem and roots. Eventually the seedlings wilt and die.

Control: Destroy all termite mounds near the nursery. Apply pesticides such as: Termifix (Imidacloprid),GoldBan 505 EC, Confidor WG70, Dimiprid 200 SL, Metro 200 SC.

3. **INSECTS WHICH CAUSE DAMAGE TO SEEDLINGS**

3.2 Grasshoppers and locusts

Species attacked: Almost all species except *Azadrachta indica*

Damage: The leaves are chewed and eventually the seedling's growth is returded.

Control: Apply Gamalin, Malathion, Malathion, Golan SL

3. **INSECTS WHICH CAUSE DAMAGE TO SEEDLINGS**

3.3 Aphids

Species attacked: *Leucaena* spp (*Heteropsyla cubana*), *Cupressus* spp (*Cinara cupressivora*). *Pinus* spp (Wooly aphid) etc.

Damage: Aphids suck the foliage leaves and cause the seedling growth to be stunted

Control: Fumigate with Farmguard 344 SE, use resistant cultivar.

3. **INSECTS WHICH CAUSE DAMAGE TO SEEDLINGS contd...**

3.4 **Caterpillar /Larva of butterflies**

Species attacked: Almost all species except *Azadrachta indica*

Damage: The leaves are chewed and eventually the seedling's growth is returded.

Control: Apply Gamalin, Malathion, Golan SL

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

(See full list of pesticides at the end – confirm with TPHPA)

3.1 Examples of insecticides

Termifix (Imdacloprid)

Thiodan

Sumithion

Actellic 25% EC

Dimecron

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

4.2 Examples of fungicides

Dithane M-45

Bravo

Ridomil

Benlate

Kocide 101

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

- **4.3 Examples of nematodecides**

Furadan

Nemacur

Ferracur

Nematox

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

4.4 Examples of rat poisons

Klerat

Zinc phosphate

Indocid !!!

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

- **4.5 Examples of pesticides for seed storage**
- Kynakil
- Actellic 1%
- Delgramo
- Fernasan – D
- Agrosan

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

PRECAUTION FOR USING PESTICIDES

- Make sure that the pesticides you buy is the proper for the problem you have in your farm or store.
- Read the instructions on the label
- Wear a shirt with long sleeves, long trouser, hat/cap
- Cover the nose with a mask/handkerchief
- Wear gloves/nylon bags on your hands

4. PESTICIDES AND METHODS OF PROTECTING SEEDLINGS FROM DISEASES AND PESTS

- Spray insecticides when facing the direction of the wind.
- Do not spray if the wind is very strong
- When you are spraying do not smoke, eat or drink any thing
- Do not touch and food before you wash your hands with water and soap
- Harvest crops before the pre-harvest period.

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Aphids	Monitor 2 times weekly. Look on underside of leaves and on tips of new stems.	Shoot prune vigorous tender growth as needed. Watch for outbreaks in early summer months.	Plants have distorted new growth, sticky honey dew, and sooty mold.	Use aphid midges, aphid parasites, lady bugs, Safer soap applied every 6 days, pyrethrins.
Bacterial diseases	Inspect new plants coming into greenhouse. Look for water-soaked, dark brown to black leaf spots on leaves and wilted stem tips. Confirm diagnosis with a laboratory.	Increase spacing between containers as crop grows larger. Water only in the morning or use sub-irrigation. Keep humidity low	Plants are stunted with swollen or misshapen leaves. Look for water-soaked leaf spots or angular lesions on the stems.	Remove infected leaves as soon as problem is detected. Isolate infected trays of plants from the rest of the crop.

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Botrytis blight	Concentrate monitoring where crop is closely spaced and air circulation is poor, and on tender leafy species. Look for die-back, stem cankers, and powdery gray mold on leaves.	Increase spacing between containers as crops grows larger. Water only in the morning or use sub-irrigation. Keep humidity low	Plants have leaf blights, stem cankers, gray mold.	Apply *Trichoderma harzianum* (Plant Shield), *Streptomyces griseoviridis* (Mycostop).
Caterpillars	If moths are seen in the greenhouse, look for caterpillars. Look for fecal droppings, bites taken out of leaves and webbing (tent caterpillars).	Screening.	If damage is seen, look for caterpillars under containers or in growing media. Many caterpillars feed at night and hide during the day.	Apply BT *Bacillus thuringiensis* ssp. *Kurstaki* (Pro DF) as needed, pyrethrins.

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Crown and root rots	Monitor weekly for wilted, off-colored plants with discolored root systems. Pay attention to media that stays wet. Check soluble salt levels.	Do not overwater crop. Increasing spacing between containers as crop grows larger. Keep humidity low.	Plants are stunted, wilted, and off-color. Roots are discolored and turn brown or black. Main stem becomes weak and water soaked in appearance.	Apply *Trichoderma harzianum* (Plant Shield, Root Shield), *Trichoderma virens* (Soil Guard), *Streptomyces griseoviridis* (Mycostop).

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Damping-off disease	Monitor daily during germination and establishment phases. Look for seeds that do not germinate and seedlings that collapse at soil line just after emergence. Discard infected containers immediately.	Cleanse seeds and growing area. Use sterile media and containers. Avoid over-sowing, crowding of seedlings, or planting seeds too deeply. Keep green-house and media temperatures warm during germination and establishment. Keep humidity low.	Seeds do not germinate; seedlings collapse at soil line just after emergence. Dark dead spots appear on stems at soil line of emerged seedlings. Infected plants may later develop crown and root rot.	Use *Trichoderma harzianum* (Plant Shield, Root Shield), *Trichoderma virens* (Soil Guard).

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Fungal leaf spots	Monitor weekly for leaf spots. With a hand lens, look for small fungal fruiting bodies. Confirm problem with a laboratory.	Use mesh benches to encourage airflow. irrigation. Keep greenhouse floor clean and free of pooled water. Water only in the morning or use sub-irrigation. Do not overwater crop. Keep humidity low. Increase spacing between containers as crop grows larger.	*Alternaria* leaf spots are usually brown or black with a yellow border. *Septoria* leaf spots are small gray to brown with a dark brown edge.	Apply *Trichoderma harzianum* (Plant Shield). Remove infected leaves as soon as problem is detected. Isolate infected trays of plants from the rest of the crop.

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Fungus gnats	Monitor every other day, especially during germination and establishment phases. Look for tiny winged flies near growing media surface. Use yellow sticky cards to detect adults.	Keep greenhouse floor clean and free of pooled water and algae, do not overwater crop. Use yellow sticky cards and a good seed mulch.	Plants have weak or stunted growth, seeds that do not germinate, root damage on seedlings.	Apply BT *Bacillus thuringiensis* ssp. *israeliensis* Gnatrol) applied every 7 days as a drench, mite predators, parasitic nematodes.

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Fusarium wilt	Look for downward bending leaves or "cupping" of leaf margins. Can be confused with water stress, root rot. Send sample to laboratory to confirm.	Use mesh benches to encourage airflow. Do not overwater crop. Keep humidity low	Leaves cup downward or stems bend in a crook. In later stages, brown streaks can be seen on the leaves. Orange spores may be on stem.	Apply *Trichoderma harzianum* (Plant Shield, Root Shield),*Streptomyces griseoviridis* (Mycostop) as a soil drench. Remove and isolate infected plants as soon as problem is detected.
Mealy bugs	Look for small, ova l, soft-bodied insects covered with a white, wax-like layer on the underside of leaves.		Plants may have white cottony residue. Sticky honeydew on leaves and sooty mold may develop	Use predatory beetles, parasitic wasps; pyrethrins

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Rusts	Look for yellow and rusty orange spots on the upper and lower leaf surface.	Group susceptible species where temperature and humidity can be easily controlled. Increase spacing between containers as crop grows larger. Keep humidity low	Rust brown spots or stripes may be seen on lower and upper leaf surface.	Isolate plants immediately.
Slugs	Look for chewed holes on leaves and trails of slime. Slugs hide under dense foliage and under containers and benches.	Keep plants on raised benches or pallets. Space containers as needed so that slugs can be detected easily.	Plants may have chewed holes on leaves with smooth edges and slime that dries into silvery trails on foliage.	Pick slugs off plants. Keep containers on benches. Use saucers filled with beer to attract slugs away from plants.

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Soft scales	Look for yellow brown to dark brown scale insects along veins and stems.		Honeydew and sooty mold develop if scales are present. Plants may have light-yellow Use predatory mites, predatory	Use parasitic wasps, Safer soap, pyrethrins.
Spider mites	Look on undersides of leaves especially along veins. Use a hand lens to look for webbing, egg clusters, and red adult mites. Look in areas of that are hot and dry, near the heaters and vents.	Lower greenhouse temperatures and raise humidity levels, especially in the south and west edges of the greenhouse and near vents and furnaces.	Plants may have light-yellow flecking of leaves, discolored foliage. Leaf drop and webbing occur during outbreaks and severe infestation.	Use predatory mites, predatory midges. Apply Safer soap every 6 days

Common diseases and pests, symptoms, prevention, and treatment measures

Pest	How To Monitor	Prevention	Signs and Symptoms	Biological and Organic Control Options
Thrips	Use blue or yellow sticky cards placed just above canopy foliage for detection.	Increase container spacing on leafy crops as needed to detect problems early.	Plants may have distortion of new leaves, buds, and shoot tips. White scars on expanded leaves.	Use predatory mites, pirate bugs, lacewings, Safer soap, and pyrethrins.
Viruses	Monitor weekly. Inspect all incoming plants. Send sample to laboratory to confirm.	Usually not a problem with native plants; can be a problem on cultivated varieties, ornamentals, plants grown by tissue culture.	Look for mosaic patterns on foliage, leaf crinkle or distortion, streaking, chlorotic spots and distinct yellowing of veins and stunted plants.	None. Remove and discard all infected plants immediately. Thoroughly clean area of greenhouse where infected plants were growing.
White flies	Use yellow sticky cards to detect adults. Look for adults on the uppermost tender leaves. Immature larvae are found on the underside of leaves.	Plants may have distorted new shoot and leaf growth.	Use predatory beetles, whitefly parasites, Safer soap applied every 7 days; pyrethrins.	White flies Use yellow sticky cards to detect adults. Look for adults on the uppermost tender leaves. Immature larvae are found on the underside of leaves.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Common disease which attack trees and their control

Disease name	Disease causing organism	Trees affected	Disease symptom	Control
Needle blight	*Dothistroma pini*	*Pinus radiata*	Affected trees show growth of moulds on the leaves and eventually the tree dies	Avoid planting this tree
Diplodia die-back	*Diplodia pinea*	*Pinus* spp	Terminal dieback	Use disease free seeds
Terminal Crook Cypress canker	*Colletotrichum accututum Phynchosphaeria cupressi*	*Pinus* spp *Cupressus microcarpa*	Terminal crook of branches	Avoid planting this tree, use good breed seed

Root rot	*Armillaria mellea (Honey – fungus)*	*Acacia mearnsii, Senna siamea, Pinus spp*	White mycelium seen under the bark of stem and roots. Leaves wilt and change from green to yellow-brown later falls off and the tree dies.	Avoid suppression due to undrhinning. Remove the whole tree (branches, stem and roots) from the forest and burn them.

Phomopsis	*Phomopsis* spp.	*Senna siamea,*	The stem bark becomes black and crakcs. Weakening of foliage and change from green to yellow. Eventualy the tree dies.	Remove the whole tree (branches, stem and roots) from the forest/garden and burn them.
Gummosis		*Acacia mearnsii, Eucalyptus saligna*	The stems and branches bark of attacked tree cracks and produce a black gum. The trees do not die but become weak	Heavy thinning to allow air circulation which will prevent fungal growth. Affected trees should be removed from

Damping off	*Pythium, Fusarium* spp., *Rhizoctonia* spp.	*(Pinus* spp*., (Eucalyptus* spp*.,* (*Milicia excelsa), (Maesopsis eminii) etc.*	Attacks seedlings in the nursery by decaying the root collar. The seedlings wilt, lie down and eventually die.	Traat seeds with fungicide powder Spary seedlings with fungicide. Avoid seedling congestion in the seed beds and seedling beds reduece shade and watering.

Leaf wilt	*Botrytis cinerea*	*(Eucalyptus* spp)., *(Acacia* spp).,	Attacks seedlings , wilting of foliage leaves. The seedlings respond by producing many lateral branches and become useless for planting.	Treat seeds with fungicide powder before sowing. Spray seedlings with insecticide. Avoid seedling congestion in the seed beds and seedling beds reducce shade and watering.

Fruiting bodies *of Armillaria mellea* on an old trunk *Milicia excelsa* tree, Morogoro

Armillaria mellea **growing on stump in a** ***Cupressus lusitanica*** **stump in a plantation. Western Mt. Meru.**

5. Common insects which attack trees

5.1. COLEOPTERA

5.1.1 ***Bostrichidae*** are borers and attack dry sapwood of hardwoods, softwoods and dry bamboo. They occur in the forests in logs and stumps, in timber yards and in finished wood.

5. Common insects which attack trees

5.1.2 *Lyetus beetles* ***(Lyctidae)*** are closely related to the *Bostriehids* and have similar food requirements in that they bore into sapwood containing starch. The interior of the wood may be almost entirely reduced to powder, hence the name "Powder Post" beetles.

5. Common insects which attack trees

5.1.3 *Platypodidae* "Pinhole" or *"Ambrosia"* beetles. They are cylindrical beetles from about 2.5 to 12.5 mm long. The adult beetles bore into freshly felled logs, after a few hours of felling to months later, as long as the wood has a moisture content above 40%. The moisture content will determine whether attack may occur later and whether it will die out if already present.

5. Common insects which attack trees

5.1.4 The family ***Scolytidae*** These beetles are also known as bark or engraver beetles.

5. Common insects which attack trees

5.1.5 ***Cerambycidae*** *Oemida gahani* is one of the major pests of exotic softwood plantations.

Control : Reduction of the naturally occurring population of the pest by the destruction of all woody debris in an area before planting, reduction in the size of wounds by early pruning and by the elimination of big game activity.

5. Common insects which attack trees

5.1.6 *Buprestidae* *D*oes not appear to be too important to the Forester. Some tunnel in living sterns of some species, but the majority feed under bark and make only shallow pupal cells in the sapwood.

5. Common insects which attack trees

5.1.7 *Curculionidae* or weevils. A defoliator of some *Eucalyptus* such as *E. globulous, E. maidenii, E. robusta* and slightly *with E. saligna. Corymbia citriodora.*

Tops of attacked trees show a scorched appearance and new growth springs from the base of the tree. There is a loss of increment although the tree may later recover from attack.

5. Common insects which attack trees

5.1.8 *Scarabaeidae* In the larval stage these insects are capable of causing considerable damage in nurseries.

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5. Common insects which attack trees

2.1 **Isoptera** The famly *Termitidae*. Termite damage in trees quite high . In all cases, cellulose is the basic food item.

5. Common insects which attack trees

5.3.1 Lepidoptera Most *L.* are leaf-eaters, and some species are dangerous as whole forests can be defoliated. Others bore in seeds, some attack living trees, some attack seedlings, e.g. cutworms.

There are very many families: *Noctuidae , Lasiocampidae, Lymantriidae, Psychidae, Pyralidae.*

5. Common insects which attack trees

5.4.1 Orthoptera These include grasshoppers, locusts etc. with biting mandibles. Young are regarded as nymphs. Locusts have an immense influence on agriculture.

5. Common insects which attack trees

5.5.1. Hemiptera These are bugs with sucking mouth parts. Young are regarded as nymphs. There are many families, some of which influence on the forest, e.g. *Phytolamata (*Mvule gall fly), *Heteropsyla cabana (Psyllidae)* which attack *Leucaena leucocephala, Cinara cupresivora which* attack *Cupressus lusitsnica* and *Wooly aphids which attack Pine* spp.

5. Common insects which attack trees

5.6.1 Hymenoptera A large order including wasps, bees, ants, parasites, etc.

Xylocopidae or Carpenter bees can cause great damage to buildings. They make large runnels in which they lay their eggs, providing pollen and nectar for the grubs to feed on. These insects do not actually feed on the wood.

5. Common insects which attack trees

5.7.1 Diptera Some attack seeds while others are leaf-miners. Very important to the Forester are the *Tachinidae* parasites which feed on the larvae, caterpillars and other insects, reducing their numbers.

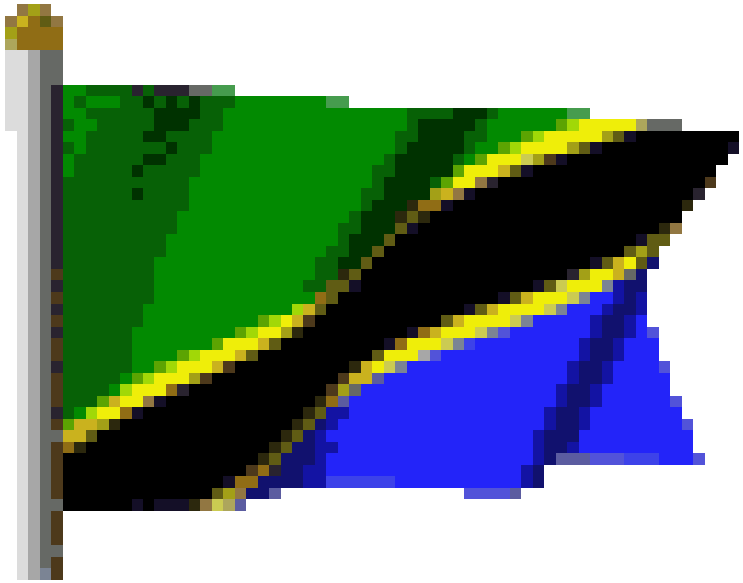
5. Common insects which attack trees

5.8.1 Odonata These insects feed on other living organisms. e.g. dragon flies.

CONCLUSION AND RECOMMENDATION

Currently there are no regular disease and pests surveys and monitoring in the country, thus some diseases and pests may go unnoticed and sometimes the impact can be detrimental.

It is therefore important to deploy long term strategies including preparedness for handling disease outbreaks and applying well known techniques for forest disease control.



Asanteni kwa kunisikiliza

Thank you for your attention

MERCI BEAUCOUP DE VOTRE AIMABLE ATTENTION