Forestry Department

Food and Agriculture Organization of the United Nations

Forest Health & Biosecurity Working Papers

OVERVIEW OF FOREST PESTS

KENYA

January 2007

Forest Resources Development Service
Forest Management Division
Forestry Department

Working Paper FBS/20E
FAO, Rome, Italy

DISCLAIMER

The aim of this document is to give an overview of the forest pest[1] situation in Kenya. It is not intended to be a comprehensive review.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

[1] Pest: Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO, 2004).

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Background

This paper is one of a series of FAO documents on forest-related health and biosecurity issues. The purpose of these papers is to provide early information on on-going activities and programmes, and to stimulate discussion.

In an attempt to quantify the impacts of the many factors that affect the health and vitality of a forest, the Global Forest Resources Assessment 2005 (FRA 2005) asked countries to report on the area of forest affected by disturbances, including forest fires, insects, diseases and other disturbances such as weather-related damage. However, most countries were not able to provide reliable information because they do not systematically monitor these variables.

In order to obtain a more complete picture of forest health, FAO continues to work on several follow-up studies. A review of forest pests in both naturally regenerating forests and planted forests was carried out in 25 countries representing all regions of the world. This *Overview of forest pests* represents one paper resulting from this review. Countries in this present series include Argentina, Belize, Brazil, Chile, China, Cyprus, Colombia, Ghana, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Malawi, Mauritius, Mexico, Moldova, Mongolia, Morocco, South Africa, Sudan, Thailand, Romania, Russian Federation, Uruguay; this list will be continuously updated.

Comments and feedback are welcome. For further information or if you are interested in participating in this process and providing information on insect pests, diseases and mammals affecting forests and the forest sector in your country, please contact:

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All contributions will be fully acknowledged.

Acknowledgements

The information with regards to Kenya was considered by Eston Mutitu, Linus Mwangi, and Beryl Otieno of the Kenya Forestry Research Institute; their efforts are acknowledged. The information was compiled by G. Maynard and B. Moore.

KENYA

Introduction

Kenya's forest cover in 2005 was estimated at 3.5 million hectares or 6 percent of the total land cover (FAO, 2006). Treed vegetation cover was estimated at 85 percent (FAO, 2006). Most of the forests are based around the water catchment areas of streams and rivers that form Kenya's water supply. Therefore disturbances that significantly affect the forests lead to broader effects on the population through potential alteration of available water quality and quantity.

Much of Kenya has a semi-arid climate. Naturally regenerating forests occur primarily along the wetter coastal areas and in the highlands. With few exceptions, timber harvesting in Kenya's naturally regenerating forests have been banned. Today, almost all of the country's needs for wood products are met by plantations of fast-growing exotic trees. The choice of plantation species has changed over time. Currently, the main species used in government planted forests are species of *Cupressus* (45 percent), *Pinus* (31 percent) and *Eucalyptus*. The main product harvested in government plantations is timber. Two-thirds of private plantations in Kenya consist of *Acacia mearnsii*, which is planted for its bark, and *Eucalyptus* spp. A number of forest insects and diseases have been accidentally introduced into Kenya and, as a result, have caused severe damage to the country's planted forests.

Forest pests

Naturally regenerating forests

Insects

Indigenous insects

***Amyna punctum* Fah.**
Other scientific names:
Lepidoptera: Noctuidae
Common names:
Host type: broadleaf
Hosts: *Croton megalocarpus*

Since 1940, *Amyna punctum* has been reported defoliating *Croton megalocarpus* in many areas of Kenya such as Nairobi, Ngong, Murang'a, Nakuru, Namanga Hills, Isiolo, Kakamega, Tsavo National Park, Marsabit, Mtito Andei, Sokoke Forest, Bomet and Muguga. The insect pest defoliates the tree starting from the upper canopy. Older trees are particularly susceptible to attack compared to young trees. Within a period of one to two weeks, attacked trees can exhibit 100 percent foliage loss which can lead to mortality if the trees become stressed as a result of an extended dry spell. Outbreaks of the pest are sporadic and cyclic occurring in years when conditions are favourable for increased pest populations.

***Gonometa podocarpi* Aurivillius, 1925**

Other scientific names:
Lepidoptera: Lasiocampidae
Common names: emperor moth
Host type: conifer
Hosts: *Podocarpus* sp.

While *Gonometa* species occur in many parts of Africa, *Gonometa podocarpi* appears to be confined to East Africa. *G. podocarpi* was first reported in 1925 in Mt. Kenya where the larvae were defoliating the indigenous *Podocarpus* sp. Since 1977, the pest has caused four outbreaks in the Mt. Elgon area of Kenya. The life span of *G. podocarpi* is 6 to 9 months. The defoliating larvae are the most destructive stage of the pest. The pest is widespread in the highlands of Kenya, Uganda and Tanzania.
http://www.fao.org/forestry/site/26061/en/
https://kb.osu.edu/dspace/bitstream/1811/5728/1/V72N05_301.pdf

***Oemida gahani* Dist.**
Other scientific names:
Coleoptera: Cerambycidae
Common names: longhorn beetle
Host type: conifer
Hosts: *Podocarpus gracilio*; *Juniperorum procera*

Oemida gahani is a tree stem borer that lays its eggs in batches on the pruning scars and game damage areas of trees. The small larvae move inwards to the inner part of the tree where they make galleries up and down the stem. Incubation period is about 38 days. *O. gahani* can complete its life cycle in living trees. The shortest life cycle recorded is 14-15 months but in Kenya it is about 2 years.

Oemida gahani was first noticed damaging *Podocarpus gracilior* timber in Kenya in 1937. In the 1950s and early 1960s, this beetle was a serious pest in Kenya. It is widely distributed in all the highland forest areas of Kenya, i.e. Nairobi, Eldoret, Lodiani, Nyeri, Thomsons Falls and Kisumu.
http://www.fao.org/docrep/24847e/24847e05.htm

***Salagena discata* Gaede**
Other scientific names:
Lepidoptera: Cossidae
Common names: wood moth
Host type: broadleaf
Hosts: *Sonneratia alba*

Salagena discata is a large wood-boring moth whose larvae cause significant damage to the mangrove species *Sonneratia alba* in Kenya (Ciesla *et al.*, 1995). The larvae of this moth initially tunnel into the bark of the trees then into the wood. Sometimes there are aggregations of larvae feeding at the one site. It causes branch dieback and repeated attacks have been known to cause tree mortality. The wounds caused by the larvae also provide entry points for secondary invasive species. The pest has been recorded in Tiwi, Mombasa and Gazi Bay in the Kwale District.
http://www.afae.org/html/NewPestK.html

Introduced insects

No information was available on introduced insects in naturally regenerating forests of Kenya.

Diseases

Indigenous diseases

***Armillaria* spp.**

Other scientific names:
Basidiomycota: Marasmiaceae
Common names: shoestring root rot; honey mushroom; honey agaric; Armillaria root rot
Host type: broadleaf
Hosts: *Ocotea usumbarensis*; *Cassipourea* spp.

In Kenya, some indigenous trees such as camphor (*Ocotea usumbarensis*) and *Cassipourea* spp. have been attacked by *Armillaria* spp. This fungus usually attacks trees that have been stressed or weakened by some other factor such as drought or insect attack. In healthy trees the fungus is isolated by resin to small areas. The infection commences by entering fine root hairs and then spreads throughout the tree. The infection kills the fine root hairs in weakened trees leading to the loss of nutrient and water uptake by the tree. Infection can lead to dieback of limbs or death of the tree. Tree death can take several years. *Armillaria* is a soil borne fungus and the rhizomorphs can grow up to 3m out from the infected tree. It can be difficult to identify the fungus from early symptoms as they are similar to those presented from several causes such as other diseases or physiological stress. Identification of *Armillaria* as a causal agent is often at a relatively late stage in the disease.
http://www.na.fs.fed.us/spfo/pubs/fidls/armillaria/armillaria.htm
http://www.ipm.uiuc.edu/diseases/series600/rpd602/

Introduced diseases

No information was available on introduced diseases of naturally regenerating forests of Kenya.

Other pests

Indigenous other pests

Anecdotal evidence exists of elephants causing severe damage to naturally regenerating forests by pulling up saplings, stripping bark, rubbing against trees and trampling.

Introduced other pests

No information was available on introduced other pests (e.g. mites, nematodes, mammals, etc.) of naturally regenerating forests of Kenya.

Diebacks and other conditions

During the mid 1900s, extensive dieback and mortality of *Juniperus procera* forests was detected in the highlands of central Kenya. Symptoms included a slow, progressive dieback of the branches beginning in the upper crown. Affected trees eventually die. In some locations, up to 80-90 percent of the junipers were affected. Damage was heaviest at the lower elevations and there were indications that the dieback began in the early 1980s (Ciesla, Mbugua and Ward, 1994; Ciesla, Mbugua and Ward, 1995). The exact causes of this dieback are unknown but possible causal factors include local climate change, stand dynamics and secondary biotic agents.

Planted forests

Insects

Indigenous insects

Apate indistincta Murray 1867

Other scientific names:
Coleoptera: Bostrychidae
Common names: false powder post beetle; shot hole borer
Host type: broadleaf
Hosts: *Eucalyptus* spp.

Apate indistincta was first reported in Kenya in 1950 and has since been reported in the districts of Kajiado, Nyandarua, Laikipia, Nakuru, Kuja River, Kiambu and Isiolo. Bostrychidae species are known as false powder post beetles since they bore in dry and seasoned wood and completely destroy the sapwood. They are generally polyphagous. Adult *Apate* species usually attack living but likely unhealthy trees while larvae have only been found in dead wood. Young trees have been found very susceptible to attack. Active boring is indicated by presence of frass at the tree base. The attack starts from the bottom of the stem and spreads towards the crown. Damaged and weak crowns are prone to break under windy conditions. The borers are most active during the dry season and on dry trees. Resin production from frass injection holes on affected trees is a defense mechanism against further insect attact.

Dysmicoccus brevipes Cockerell

Other scientific names: *Dactylopius ananssae*; *Dactylopius brevipes*; *Dactylopius bromeliae*; *Dysmicoccus cannae*; *Dysmicoccus pseudobrevipes*; *Pseudoccus ananassae*; *Pseudococcus brevipes*; *Pseudococcus bromeliae*; *Pseudococcus cannae*
Hemiptera: Pseudococcidae
Common names: pineapple mealybug
Host type: broadleaf
Hosts: *Casuarina equisetifolia*; *Ananas comosus*; *Elaeis guineensis*; *Glycine max*; *Mangifera indica*; *Saccharum officinarum*; *Musa* spp.; *Phoenix dactylifera*; *Coffea robusta*

Dysmicoccus brevipes is a polyphagous mealybug. The feeding as well as the phytotoxic affects of the saliva causes damage to host plants. This pest is a vector of mealybug wilt virus. In Kenya it is apparently the cause of mortality of planted forests of *Casuarina equisetifolia*. It is found primarily on root systems but sometimes colonies migrate to foliage and fruit. These mealybugs are attended and protected by ants on some hosts. Distribution of *D. brevipes* is circumtropical and subtropical.
http://www.afae.org/html/98-206.html

Introduced insects

***Cinara cupressivora* Watson & Voegtlin, 1999**

Other scientific names:
Hemiptera: Aphididae
Common names: giant cypress aphid; cypress aphid
Host type: conifer
Hosts: *Chamaecyparis* spp.; *Cupressus* spp.; *Juniperus* spp.; *Thuja* spp.; *Cupressocyparis* spp.

Cinara cupressivora is a significant pest of cypress species. It was thought to have established first in Africa in Malawi in 1986. Since then it spread rapidly throughout East and southern Africa causing significant damage. It first appeared in Kenya in 1990 and the most recent record is from Ethiopia in 2004. Damage to hosts includes browning and defoliation, which in some cases causes dieback and tree death.

In Kenya, the giant cypress aphid is considered to be one of the most damaging introduced insects, where it has caused extensive damage to planted cypress forests. A secondary problem caused by aphid feeding is the copious quantities of honeydew which encourages the growth of sooty mould. A successful biological control programme by the introduction of *Pauesia juniperorum* in Kenya and Malawi has significantly reduced the impact and spread of this pest. Exotic conifers attacked include species in the genera *Chamaecyparis*, *Cupressus*, *Juniperus*, *Thuja* and the hybrid genus *Cupressocyparis* (Watson *et al*., 1999). Heavy foliar damage and tree mortality occurs on *Cupressus macrocarpa.* This insect has also caused extensive damage to planted forests of *Cupressus lusitanica* in eastern and southern Africa.

Insects were initially identified as *C. cupressi,* however, detailed diagnostic work determined that they belonged to a new species (which was described as *Cinara cupressivora* by Watson and Voegtlin in 1999). [Note that numerous references (Web sites and texts) use the name *Cinara cupressi*. These are frequently misidentified specimens of *Cinara cupressivora.* As well, some references incorrectly synonymize these two species.]
http://www.spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=161&langdisplay=english
http://www.issg.org/database/species/ecology.asp?si=121&fr=1&sts=
http://www.invasive.org/browse/subimages.cfm?sub=3636
http://www.afae.org/html/98-202.html

***Cinara pinivora* Wilson, 1919**

Other scientific names*:*
Hemiptera: Aphididae
Common names: giant conifer aphid
Host type: conifer
Hosts: *Pinus* spp.

Cinara pinivora is sap-sucking aphid native to North America and is now found in Argentina, Australia, Brazil, Kenya, Malawi, Tanzania and Uruguay. This species has recently been introduced into Kenya where they infest month old plants through to 3-4 year old saplings and the tips of older plants. A secondary problem is the promotion of sooty mould growth. The aphid poses a clear threat to the planted pine industry as well as to the paper industry (Maina, 2005).

The aphid's dense colonies are found distributed on all parts of the plant. The damage starts as discolouration and premature fall of needles with some branches turning brown. Inflammation of branches and mortality of plants has been observed in Brazil (Patti and Fox, 1981). Reduced photosynthetic surface results in stunting. Populations are extremely reduced in periods of high temperatures and only damage is observed (Lázzari *et al*, 2004). They have very short life cycles and can multiple very rapidly. Some forms reproduce asexually and can thus build up numbers quickly. The winged forms are weak fliers, but are readily carried by the wind over considerable distances. As adults or juveniles, they do not survive off the host plant material for very long.

According to Penteado (1995), biological control has been achieved in Brazil through insect predators of the families Coccinellidae, Syrphidae, Chrysophidae, Staphilidae, Dermaptera and some Heteroptera.
http://www.doaj.org/abstract?id=18926&toc=y

***Eulachnus rileyi* (Williams, 1911)**

Other scientific names: *Lachnus rileyi* Williams
Hemiptera: Aphididae
Common names: pine needle aphid
Host type: conifer
Hosts: *Pinus* spp.

Eulachnus rileyi attacks several species of *Pinus*. Typically, this insect causes only minor damage where it has been introduced, however, it has the potential to cause serious damage. Heavy infestations cause needles to turn yellow and drop prematurely, resulting in growth reduction.

All life stages feed on the underside of pine needles. In temperate climates, both sexual and asexual forms exist. Adults are normally wingless, but winged forms are sometimes produced. Populations tend to increase during dry periods.

These insects could be moved with scion material. Once established in a new location, they are subject to wind dispersal.
http://www.ipgri.cgiar.org/publications/pdf/828.pdf
http://www.cabicompendium.org/NamesLists/FC/Full/EULARI.htm

***Gonipterus scutellatus* Gyllenhal, 1833**

Other scientific names:
Coleoptera: Curculionidae
Common names: eucalyptus weevil; eucalyptus snout beetle; gum tree weevil
Host type: broadleaf
Hosts: *Eucalyptus* spp.

Gonipterus scutellatus is a leaf-feeding beetle that is is a major defoliator of eucalypts. In Australia, where this beetle is a native, some eucalypt plantations have significant problems because of attacks by this beetle. It was probably introduced into South Africa in shipments of apples from Australia. By 1924, the beetles had spread throughout the eucalypt growing areas. In Africa, it has been reported from Kenya, Mauritius and South Africa. Attack by this beetle can cause tree mortality, reduction in growth, coppicing, and stunting of trees though some *Eucalyptus* spp. are more susceptible to damage than others.

The females lay eggs in batches on both surfaces of mature leaves; the eggs are covered by a blackish-brown capsule. The larvae emerge and feed on leaves and twigs then pupate in the soil. Adults also feed. There is usually more than one generation per year, with females living for about three months and larval development taking between 30 and 80 days. In some places there are continuous generations. Dispersal is by adult flight, adults hitch-hiking on non-plant material, and movement of infested plant material or soil.
http://www.eppo.org/QUARANTINE/insects/Gonipterus_gibberus/DSGONPSP.pdf
http://www.forestry.sa.gov.au/privateforestry/insect_fact_sheets/Fact_Sheet_html/FHS%2007%20Eucalyptus%20Weevil.htm
http://fabinet.up.ac.za/biennialreport/docs/report1.pdf
http://acwm.co.la.ca.us/pdf/Eucalyptusweevileng_pdf.pdf
http://webs.uvigo.es/adolfo.cordero/PDF/Forestry_vol_73_pp_21-29_(2000).pdf

***Heteropsylla cubana* Crawford**

Other scientific names: *Heteropsylla incisa* (Sulc.)
Hemiptera: Psyllidae
Common names: Leucaena psyllid
Host type: broadleaf
Hosts: *Leucaena* spp.; *Leucaena leucocephala*; *Albizia* spp.; *Mimosa* spp.; *Samanea saman*

Heteropsylla cubana is a significant pest of *Leucaena leucocephala* in several regions of the world. It is native to Central and South America but has spread to Africa, Asia and the Pacific. It was discovered in Kenya in 1992 (Reynolds and Bimbuzi, 1992). *H. cubana* feeds on young growth and occasionally older growth and flowers. It causes dieback of terminal shoots and stunting. At times the damage can lead to defoliation and death of plants.
http://www.cifor.cgiar.org/publications/pdf_files/Insect-pests.pdf
http://www.forestpests.org/subject.html?SUB=307
http://www.ento.csiro.au/aicn/name_s/b_1961.htm
http://www.afae.org/html/98-201.html

http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=PSYLLOIDEA;pstrTaxa=105;pstrChecklistMode=2

***Leptocybe invasa* Fisher & LaSalle, 2004**

Other scientific names:
Hymenoptera: Eulophidae
Common names: blue gum chalcid
Host type: broadleaf
Hosts: *Eucalyptus saligna*; *E. grandis*; *E. deanei*; *E. globulus*; *E. nitens*; *E. botryoides*; *E. camaldulensis*; *E. gunii*; *E. robusta*; *E. bridgesiana*; *E. viminalis*

The blue gum chalcid, originally identified as *Ophelimus eucalypti*, is native to Australia. It has become a pest of planted eucalypt forests in various parts of the world including Africa and New Zealand. It was discovered in eucalypt plantations in western Kenya in November 2002 where it has had a significant impact. The distribution and severity pattern of this pest has been reported in five of the eight provinces in Kenya namely Western, Nyanza, Rift Valley, Central and Coast. This insect is also causing problems in planted forests in Morocco and Uganda and was discovered in Tanzania in 2005.

L. invasa lays eggs in the bark of shoots or the midribs of leaves. The eggs develop into minute, white, legless larvae within the host plant. Damage is caused when the developing larvae produces galls on the leaf midribs, petioles and twigs. The galls can cause the twigs to split, destroying the cambium. Small circular holes indicating exit points of adults from pupae are common on the galls. Repeated attacks lead to loss of growth and vigour in susceptible trees. Severely attacked trees show gnarled appearance, stunted growth, lodging, dieback and eventually tree death (Mendel *et al*., 2004). The blue gum chalcid has a relatively narrow host range (Mendel *et al*., 2004). Host range studies in Kenya are underway.
http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/x5387e/x5387e07.htm
http://www.hortnet.co.nz/publications/nzpps/proceedings/00/00_339.pdf
http://fabinet.up.ac.za/tpcp/newsletters/TPCP_Newsletter_Nov_2005.pdf

Pineus pini

Other scientific names: *Pineus laevis* (Maskell, 1885) Börner, 1907; *Aphis pini* Gmelin, 1790; *Kermes pini* Macquart, 1819; *Anisophleba pini* Koch, 1857; *Kermaphis pini* var. *laevis* Maskell, 1885; *Pineus pini* (Macquart, 1819) Börner, 1907; *Pineus sylvestris* Annand, 1928; *Pineus havrylenkoi* Blanchard, 1944; *Pineus simmondsi* Yaseen & Ghani, 1971; *Pineus boerneri* Annand, 1928
Hemiptera: Adelgidae
Common names: pine woolly aphid; red pine adelgid
Host type: conifer
Hosts: *Pinus* spp.

The pine woolly aphid feeds on the shoots of *Pinus* spp., at times causing tip dieback. It occurs in Africa, Australia, Europe, New Zealand and North and South America. This aphid was first detected in Kenya in 1969 in pine plantations at the Kenya Forest Research Centre arboretum near Muguga. Attempts to eradicate infestations by

destroying diseased pines were unsuccessful (Odera, 1974; Odera and Arap Sang, 1975; Odera and Arap Sang, 1980). Control of this pest by biological control is variable - in some areas this method has been highly successful and significantly less so in others. This aphid has moved into new areas mostly by movement of infested planting stock.
http://www.cabicompendium.org/NamesLists/FC/Full/PINEPI.htm

Diseases

Indigenous diseases

***Lepteutypa cupressi* (Nattrass, C. Booth & B. Sutton) H.J. Swart**

Other scientific names: *Cryptostictis cupressi*; *Monochaetia unicornis*; *Pestalotia unicornis*; *Rhynchosphaeria cupressi*; *Seiridium cupressi*; *Seiridium unicorne*
Ascomycota: Amphisphaeriaceae
Common names: diplodia blight; sphaerosis blight
Host type: conifer
Hosts: *Chamaecyparis* spp.; *Cupressus* spp.; *Juniperus* spp.; *Thuja* spp.; *Cupressocyparis* spp.

Lepteutypa cupressi is a fungus that affects both planted forests and natural stands of conifers. An epidemic of disease caused by this fungus in Kenya meant that planted forests of *Cupressus macrocarpa* became uneconomic. The fungus causes cankers, branch deformation, and branch and twig dieback. The disease caused by this fungus can lead to tree mortality. The fungus infects plants during warm wet weather when spores enter via small cracks or wounds. Although there is some variability in susceptibility of individual trees, stressed plants tend to be more susceptible to infection by this fungus.
http://www.country-wide.co.nz/article/200.html
http://www.indexfungorum.org/Names/NamesRecord.asp?RecordID=316564

Introduced diseases

***Armillaria heimii* Pegler (1977)**

Other scientific names: *Armillariella elegans* (R. Heim) J.B. Taylor, J.E. Hawkins & McLaren (1974); *Clitocybe elegans* R. Heim
Basidiomycota: Marasmiaceae
Common names: Armillaria root rot; honey root rot
Host type: broadleaf and conifer
Hosts: *Pinus patula*

Armillaria species are among the most serious causes of root rots of trees and plants in tropical Africa where they have been reported to affect tea, coffee, cocoa, rubber, softwood timbers and other trees. *Armillaria heimii* is one of the most widespread *Armillaria* species recorded in Africa.

Armillaria heimii was originally described from the Malagasy Republic and has since been reported from Cameroon, Côte d'Ivoire, Madagascar and the Central African Republic, where it was regarded as a parasite on plantation crops (Pérez-Sierra *et al*., 2004). It has also been reported from Tanzania and Uganda as a non-parasitic woodland

species growing in tufts on dead wood (Pérez-Sierra *et al*., 2004). Among the main plantation species in Kenya, *Pinus patula* is more susceptible. Infection has lead to death of trees.
http://www.indexfungorum.org/Names/SynSpecies.asp?RecordID=308926
http://www.blackwell-synergy.com/doi/pdf/10.1111/j.0032-0862.2004.00999.x
http://www.cabicompendium.org/NamesLists/CPC/Full/ARMIHE.htm

***Armillaria mellea* (Vahl) P. Kumm.**

Other scientific names: *Agaricus melleus* Vahl; *Agaricus sulphureus* Weinm.; *Armillaria mellea* var. *glabra* Gillet; *Armillaria mellea* var. *maxima* Barla; *Armillaria mellea* var. *minor* Barla; *Armillaria mellea* var. *sulphurea* (Weinm.) Fr.; *Armillariella mellea* (Vahl) P. Karst.; *Clitocybe mellea* (Vahl) Ricken; *Lepiota mellea* (Vahl) J.E. Lange
Basidiomycota: Marasmiaceae
Common names: Armillaria root disease; honey mushroom; shoestring root rot
Host type: broadleaf and conifer
Hosts: *Pinus patula*

Armillaria mellea is a common pathogen of trees, woody shrubs and some herbaceous plants, causing root, root-collar and butt rot. They invade trees through the bark of the major roots, progressively destroying the living root tissues and leading to serious decline and ultimate death of their hosts. Symptoms of infestation are premature autumn coloration and leaf drop, stunting of growth, yellowing or browning of the foliage, a general decline in the vigour of the plant, and twig, branch and main stem dieback. Such a decline usually occurs over several years but may appear to progress very quickly as the tree shows advanced symptoms of decline and death. As decline progresses, decay of the buttress roots and the lower trunk is evident. Small plants die quickly after the first symptoms appear with large trees surviving for a number of years. A severely infected tree also exudes resin, gum or a fermenting watery liquid from the lower trunk.

A. mellea is mainly a pathogen of broadleaved trees in ornamental parklands, natural woodlands, fruit orchards, etc, but it can kill young coniferous trees (pines, spruce, etc.) planted in sites where the broadleaved species were felled. Among the main plantation species in Kenya, *Pinus patula* is more susceptible. Infection has lead to death of trees.
http://www.na.fs.fed.us/spfo/pubs/fidls/armillaria/armillaria.htm
http://www.forestryimages.org/browse/subimages.cfm?sub=821
http://www.mykoweb.com/CAF/species/Armillaria_mellea.html
http://www.mushroomexpert.com/armillaria_mellea.html
http://web.aces.uiuc.edu/vista/pdf_pubs/602.pdf
http://helios.bto.ed.ac.uk/bto/microbes/armill.htm

***Botryosphaeria* spp.**

Other scientific names:
Ascomycota: Incertae sedis
Common names:
Host type: broadleaf
Hosts: *Eucalyptus grandis*; *E. camaldulensis*

Species in this genus are found in all temperate, tropical and subtropical regions of the world. They occur on a wide range of hosts and can cause diebacks, cankers, witches' brooms and leaf blights, or they can be endophytes. In Kenya, *Botryosphaeria* spp. have been recorded on *Eucalyptus grandis*, *E. camaldulensis* and hybrids of *E. grandis* and *E. camaldulensis*. *Botryosphaeria* spp. are frequently described as weak or opportunistic pathogens that cause disease in stressed hosts, though certain strains can be primary pathogens.
http://www.crem.fct.unl.pt/botryosphaeria_site/index.htm

***Ceratocystis* spp.**

Other scientific names:
Ascomycota: Ceratocystidaceae
Common names:
Host type: broadleaf
Hosts: *Eucalyptus grandis*

The genus *Ceratocystis* includes a number of important bark beetle-vectored plant pathogens that are associated with sap stain in both broadleaf and conifer trees. In Kenya, *Ceratocystis* spp. have been found infesting *Eucalyptus grandis*.

***Mycosphaerella pini* Rostrup**

Other scientific names: *Cytosporina septospora*; *Dothistroma pini*; *Dothistroma pini var. keniense* [as '*keniensis*']; *Dothistroma pini var. lineare*; *Dothistroma septosporum* [as '*septospora*']; *Dothistroma septosporum var. keniense*; *Dothistroma septosporum var. lineare*; *Dothistroma septosporum var. septosporum*; *Eruptio pini*; *Mycosphaerella pini*; *Septoria septospora*
Ascomycota: Mycosphaerellaceae
Common names: pine needle blight; dothiostroma needle blight; red band needle blight
Host type: conifer
Hosts: *Pinus* spp.

Mycosphaerella pini is a fungus that infects and kills the needles of *Pinus* spp. The infection can lead to significant defoliation. It has been found to affect trees in both planted forests and natural stands. It is spread by rain splash and can take up to 2 years to complete its life cycle.

In 1960, *M. pini* was discovered in Kenya where it is especially damaging to *Pinus radiata* in Kenya because the tree is adapted to a winter rainfall regime and is especially susceptible to fungal infections during rain and warm weather. The occurrence of this species in Kenya led to the suspension of *P. radiata* as a plantation species, resulting in a heavier dependence on *P. patula* and *Cupressus lusitanica.* The fungus is found around the world.
http://www.indexfungorum.org/Names/SynSpecies.asp?RecordID=282775
http://www.eppo.org/QUARANTINE/fungi/Mycosphaerella_dearnessii/SCIRSP_ds.pdf
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=39&langdisplay=english
http://www.na.fs.fed.us/spfo/pubs/fidls/dothistroma/doth.htm
http://www.forestryimages.org/browse/subimages.cfm?SUB=688
http://www.pfc.cfs.nrcan.gc.ca/diseases/ctd/Group/Needle/needle5_e.html

http://www.glfc.forestry.ca/treedisease/red_band_needle_blight_e.html
http://www.cbwinfo.com/Biological/PlantPath/DP.html

***Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton**

Other scientific names: *Botryodiplodia pinea*; *Diplodia conigena*; *Diplodia pinastri*; *Diplodia pinea*; *Diplodia sapinea*; *Granulodiplodia pinea*; *Granulodiplodia sapinea*; *Macrophoma pinea*; *Macrophoma sapinea*; *Phoma pinastri*; *Sphaeria pinea*; *Sphaeria sapinea*; *Sphaeropsis ellissi*; *Sphaeropsis ellisii var. ellisii*; *Sphaeropsis pinastri*; *Sphaeropsis pinastri*
Ascomycota: Incertae sedis
Common names: stem canker
Host type: conifer
Hosts: *Pinus* spp.

Sphaeropsis sapinea causes tip dieback, bole and stem cankers, shoot blight, root disease and blue stain. It attacks wounded and stressed trees as well as young healthy trees; infection can lead to stunting and tree death. It is an opportunistic fungus and initiation of infection is particularly high in warm wet weather. The fungus causes disease in pines in Africa, Australia and New Zealand. This fungus was first detected in Kenya in 1973. It affects the survival, growth and height of infected trees. Blue stain affects the quality of timber produced. There is a difference in susceptibility between trees. This fungus is especially damaging to *Pinus radiata* in Kenya because the tree is adapted to a winter rainfall regime and is especially susceptible to fungus infections during rain and warm weather. The fungus occurs at high elevations above 1500m asl.
http://www.forestryimages.org/browse/subimages.cfm?SUB=706
http://www.na.fs.fed.us/spfo/pubs/pest_al/sphaeropsis/sphaeropsis.pdf
http://www.glfc.forestry.ca/treedisease/diplodia_tip_blight_of_conifers_e.html
http://www.fabinet.up.ac.za/tpcp/pamphlets/pdf/sphaeropsis.pdf
http://ipm.uiuc.edu/landturf/diseases/sphaeropsis/index.html
http://www.umassgreeninfo.org/fact_sheets/diseases/sphaeropsis_diplodia_blight.pdf

Other pests

Indigenous other pests

Elephants and baboons are known to cause damage to planted forests, especially to young trees.

Introduced other pests

No information was available on introduced other pests (e.g. mites, nematodes, mammals, etc.) affecting planted forests in Kenya.

Diebacks and other conditions

No records were available for diebacks and other conditions affecting Kenya's planted forests.

Capacity for forest health protection

Government level

Responsibility for the protection of forests from damaging insects and diseases is assigned to the Forest Department of the Ministry of Environment and Natural Resources (MENR). The Kenya Forest Health Management Centre of the Forest Department provides overall leadership to this programme. Research on forest insects and diseases is conducted at the Kenya Forestry Research Institute (KEFRI) located in Muguga.

Monitoring and detection

Most monitoring and detection activities are informal and based on field observations by foresters and forest workers. Aerial surveys have been used to map damage caused by the cypress aphid and to identify severely damaged plantations for salvage harvesting.

Data management

Most of the information on forest insects and diseases in Kenya is qualitative in nature. However, as part of the cypress aphid pest management programme, data on levels of damage in cypress plantations, obtained from aerial surveys, was managed using a geographic information system.

Pest management

A range of pest management techniques have been used against insects and diseases affecting planted forests in Kenya. These range from removal and destruction of infested trees (in an attempt to eradicate pine woolly aphid), substitution of alternate species resistant to pests in forest plantations, and classic biological control programmes (to manage cypress aphid and leucaena psyllid) (Allard *et al*., 1993; Ciesla, Mbugua and Ward, 1995).

Private landowners

Only about 20 percent of Kenya's forest area is in private ownership. The remainder is publicly owned. Private landowners rely on the Kenya Forest Department for technical assistance and management of damaging forest pests.

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OSN = Other Scientific Name (other names, synonyms, other combinations, etc. that have been used for this species)