*Enhancing Phytosanitary Systems for Healthy Plants, Safe & Sustainable Trade"*

## Sub-theme:

Emerging Innovations in Phytosanitary systems

## Title:

**Integrated Pest Management Decision Support System (IPM-DSS) Using technology to manage tree diseases and pests in Kenya**

## Presented by:

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# Introduction

Kenya Forestry Research Institute was established in 1986 with a mandate to conduct research on forestry and allied natural resources.

Forest Pathology and entomology dating back to 1952 when the departments were established under the East African Agricultural and Forest Research Organization (E.A.A.F.R.O).

The information was collected across Kenya on seedlings in nurseries, plantations, natural forests and sawmills.

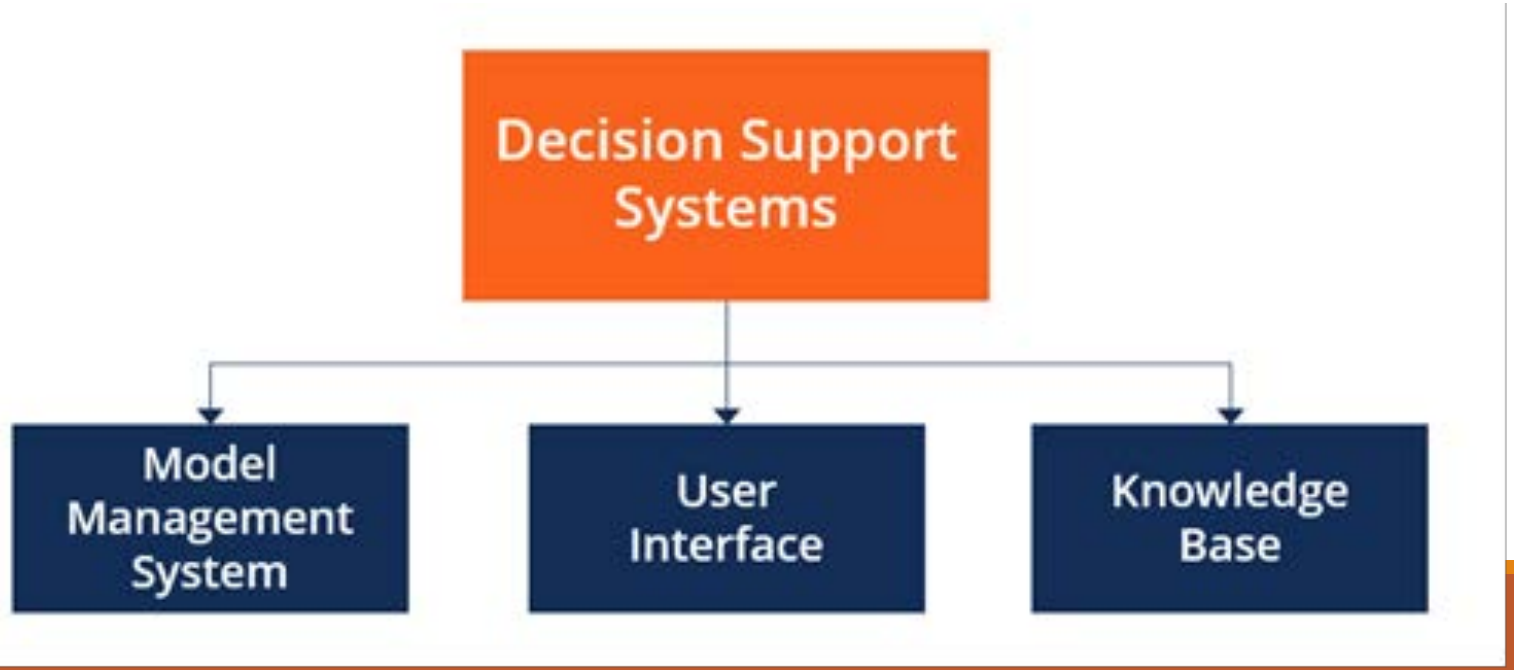
It mainly documents insect pests and micro-organisms affecting trees and wood products for ease of their identification and for development of control and management techniques

# Introduction cont’

The information was entered into excel sheets and used to develop a query facility that will be web-based

The stakeholder keys in a tree species name and the symptom recorded as defined in photos to retrieve information about the pest or disease and its control mechanisms

A decision support system (DSS) uses a series of questions to help determine a desired course of action in problem solving. The KEFRI DSS specifically answers to tree insect pests and disease identification and control



# Problem Statement

- To create a repository of information on tree pests and diseases in Kenya
- Need to make it easy for the farmers to identify diseases and pests on farm and for commercial forestry purposes
- Use the system to collect data using citizen science from the users of the query system for ease of monitoring & surveillance
- Need to create a network of tree farmers for ease of communication on emerging pests and diseases

# Justification

Tree diseases and pests lead to 30% losses in yield for wood and wood products

The average farmer depends on the investment made in tree farming for their livelihood

Late diagnosis of disease or pest attack leads to more losses as the pests attack bigger areas and spread to neighboring farms and can escalate to an outbreak leading to species wipeouts e.g. *Dothistroma pini* on *Pinus radiata* in East Africa 1970s

The decision support system will be open for use by different user groups:

- Scientists for further research and collaboration
- Students for their university education and research needs
- Farmers for diagnosis and control of various diseases and insect pests affecting trees

# Objectives

- To create an archive for forest pathology and entomology research
- To provide quick diagnosis and control measures of tree diseases
- To aid research, monitoring and surveillance in Kenya on tree pests and diseases

# Methodology

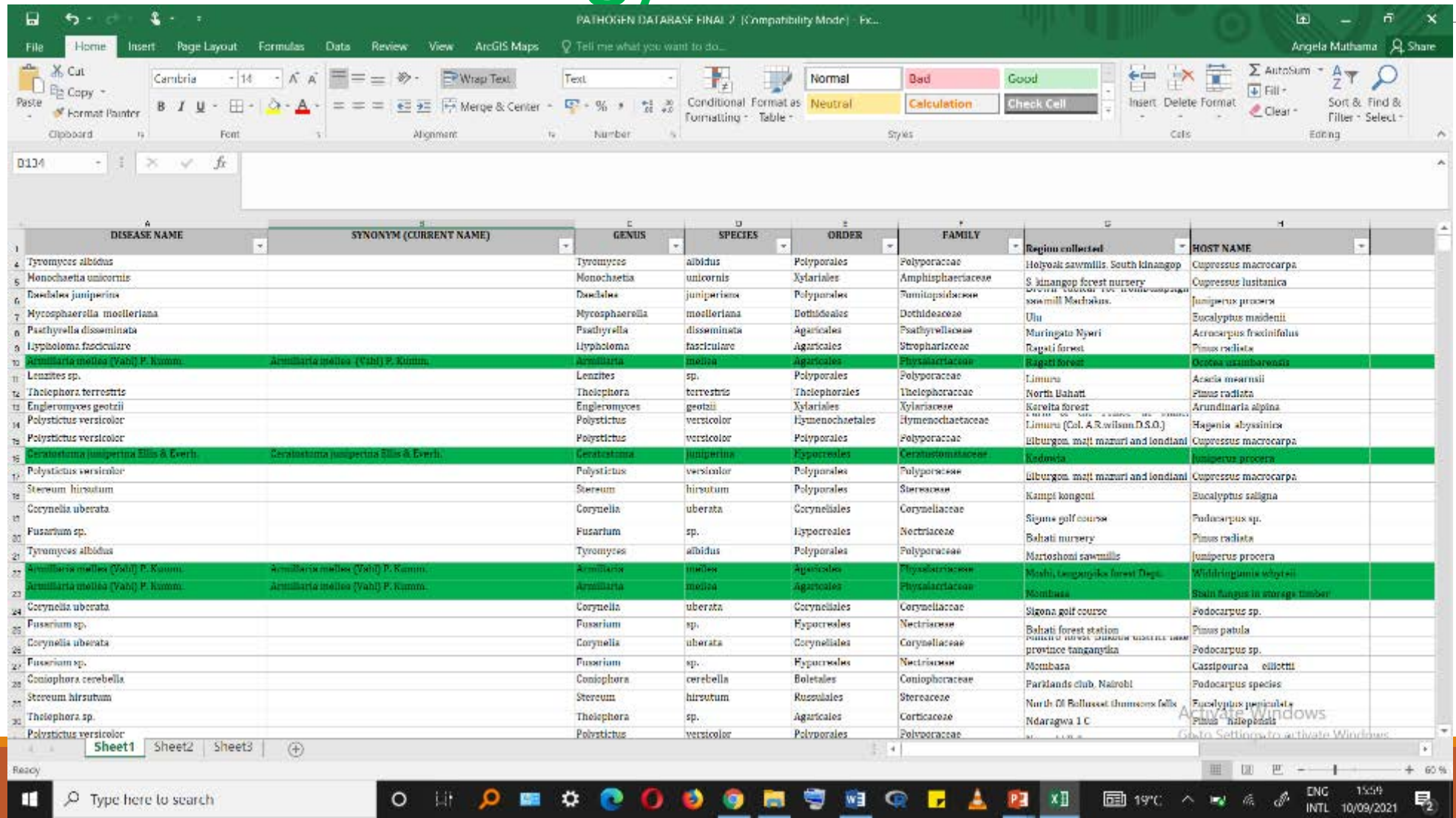
Data was entered from cards to Excel sheets

The data in MS Excel will then be imported onto a MySQL database with Specify ® being used for Insect pests information

Disease reports which are summaries from the recorded diseases and pests will be generated for quick information

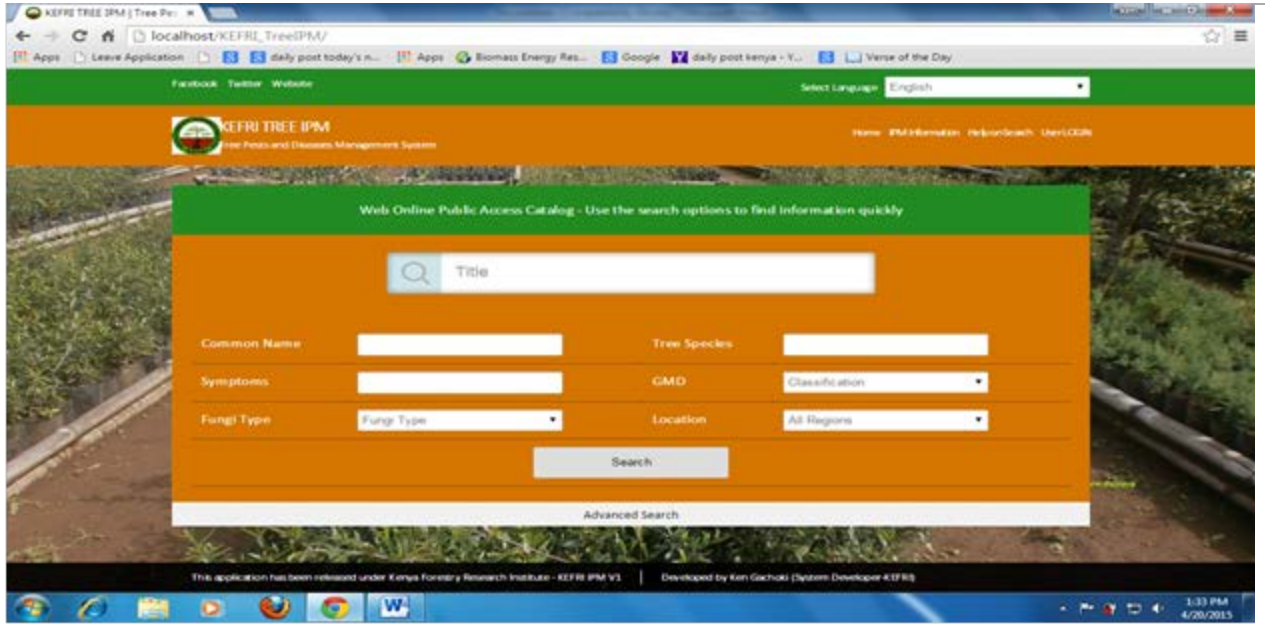
A bulk SMS service has also been developed for communication of pest alerts

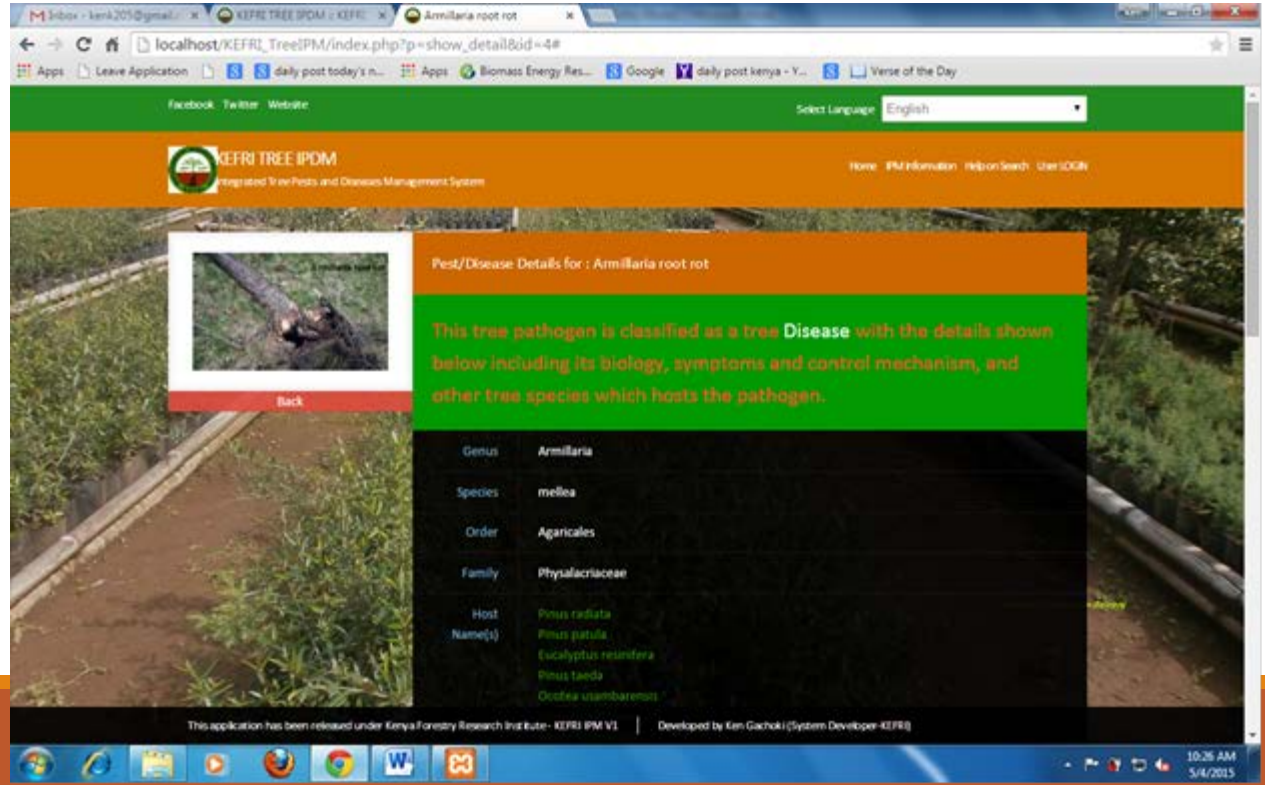
# Methodology cont'



| DISEASE NAME | SYNONYM (CURRENT NAME) | GENUS | SPECIES | ORDER | FAMILY | Region collected | HOST NAME |
|---|---|---|---|---|---|---|---|
| Tyromyces albidus | | Tyromyces | albidus | Polyporales | Polyporaceae | Holyoak sawmills. South kinangop | Cupressus macrocarpa |
| Monochaetia unicornis | | Monochaetia | unicornis | Xylariales | Amphisphaeriaceae | S. kinangop forest nursery | Cupressus lusitanica |
| Daedalea junipertina | | Daedalea | junipertina | Polyporales | Fomitopsidaceae | sawmill Machakos. | Juniperus procera |
| Mycosphaerella mosleriana | | Mycosphaerella | mosleriana | Dothideales | Dothideaceae | Ulu | Eucalyptus maidenii |
| Psathyrella disseminata | | Psathyrella | disseminata | Agaricales | Psathyrellaceae | Muringato Nyeri | Acrocarpus fraxinifolius |
| Lyopholoma fasciculare | | Lyopholoma | fasciculare | Agaricales | Strophariaceae | Ragati forest | Pinus radiata |
| Armillaria mellea (Vahl) P. Kumm. | Armillaria mellea (Vahl) P. Kumm. | Armillaria | mellea | Agaricales | Physalacriaceae | Ragati forest | Ocotea usambarensis |
| Lenzites sp. | | Lenzites | sp. | Polyporales | Polyporaceae | Limuru | Acacia mearnsii |
| Tholephora terrestris | | Tholephora | terrestris | Thelephorales | Thelephoraceae | North Bahati | Pinus radiata |
| Engleromyces geotzii | | Engleromyces | geotzii | Xylariales | Xylariaceae | Kereita forest | Arundinaria alpina |
| Polystictus versicolor | | Polystictus | versicolor | Hymenochaetales | Hymenochaetaceae | Limuru (Col. A.R.wilson D.S.O.) | Hagenia abyssinica |
| Polystictus versicolor | | Polystictus | versicolor | Polyporales | Polyporaceae | Elburgon. majt mazuri and londiani | Cupressus macrocarpa |
| Ceratostoma juniperina Ellis & Everh. | Ceratostoma juniperina Ellis & Everh. | Ceratostoma | juniperina | Hypocreales | Ceratostomataceae | Kedowia | Juniperus procera |
| Polystictus versicolor | | Polystictus | versicolor | Polyporales | Polyporaceae | Elburgon. majt mazuri and londiani | Cupressus macrocarpa |
| Stereum hirsutum | | Stereum | hirsutum | Polyporales | Stereaceae | Kampi kongoni | Eucalyptus saligna |
| Corynelia uberata | | Corynelia | uberata | Corynelliales | Corynelliaceae | Sigona golf course | Podocarpus sp. |
| Fusarium sp. | | Fusarium | sp. | Hypocreales | Nectriaceae | Bahati nursery | Pinus radiata |
| Tyromyces albidus | | Tyromyces | albidus | Polyporales | Polyporaceae | Martoshoni sawmills | Juniperus procera |
| Armillaria mellea (Vahl) P. Kumm. | Armillaria mellea (Vahl) P. Kumm. | Armillaria | mellea | Agaricales | Physalacriaceae | Moshi, tanganyika forest Dept. | Widdringtonia whytei |
| Armillaria mellea (Vahl) P. Kumm. | Armillaria mellea (Vahl) P. Kumm. | Armillaria | mellea | Agaricales | Physalacriaceae | Mombasa | Stain fungus in storage timber |
| Corynelia uberata | | Corynelia | uberata | Corynelliales | Corynelliaceae | Sigona golf course | Podocarpus sp. |
| Fusarium sp. | | Fusarium | sp. | Hypocreales | Nectriaceae | Bahati forest station | Pinus patula |
| Corynelia uberata | | Corynelia | uberata | Corynelliales | Corynelliaceae | province tanganyika | Podocarpus sp. |
| Fusarium sp. | | Fusarium | sp. | Hypocreales | Nectriaceae | Mombasa | Cassipourea elliottii |
| Coniophora cerebella | | Coniophora | cerebella | Boletales | Coniophoraceae | Parklands club, Nairobi | Podocarpus species |
| Stereum hirsutum | | Stereum | hirsutum | Russulales | Stereaceae | North Of Ballinsat thomsons falls | Eucalyptus paniculata |
| Tholephora sp. | | Tholephora | sp. | Agaricales | Corticaceae | Ndaragwa 1 C | Pinus halepensis |
| Polystictus versicolor | | Polystictus | versicolor | Polyporales | Polyporaceae | | |

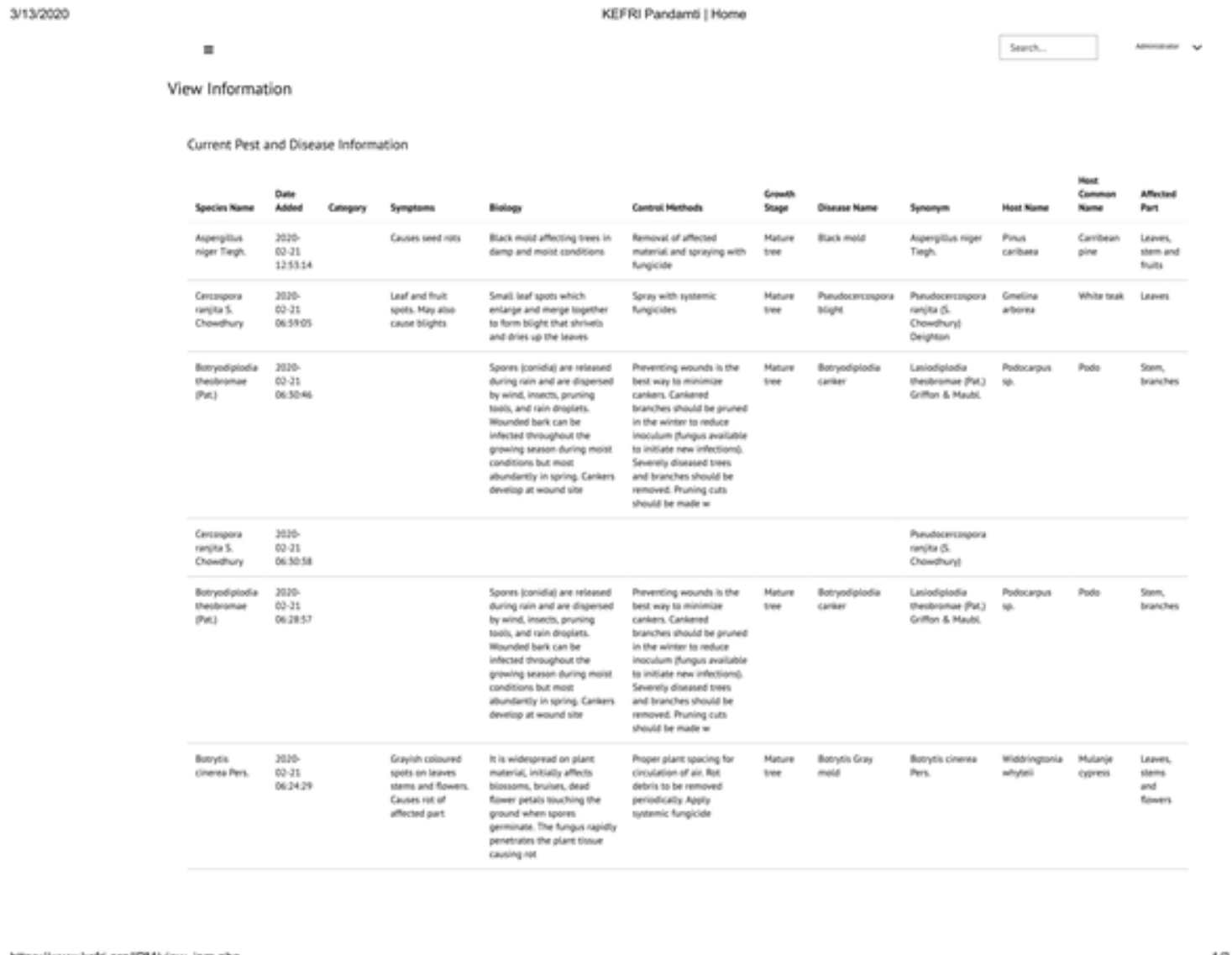
# Results


KEFRI TREE IPM
Web Online Public Access Catalog - Use the search options to find information quickly
Title
Common Name
Tree Species
Symptoms
GMO
Fungi Type
Location
Search
Advanced Search


KEFRI TREE IPDM
Pest/Disease Details for : Armillaria root rot
This tree pathogen is classified as a tree Disease with the details shown below including its biology, symptoms and control mechanism, and other tree species which hosts the pathogen.
Back
Genus Armillaria
Species mellea
Order Agaricales
Family Physalacriaceae
Host Name(s) Pinus radiata
Pinus patula
Eucalyptus resinifera
Pinus taeda
Ocotea usambarensis

# Results cont’

https://www.kefri.org/IPM/view_ipm.php



3/13/2020 KEFRI Pandamti | Home

View Information

Current Pest and Disease Information

| Species Name | Date Added | Category | Symptoms | Biology | Control Methods | Growth Stage | Disease Name | Synonym | Host Name | Host Common Name | Affected Part |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspergillus niger Tiegh. | 2020-02-21 12:53:14 | | Causes seed rots | Black mold affecting trees in damp and moist conditions | Removal of affected material and spraying with fungicide | Mature tree | Black mold | Aspergillus niger Tiegh. | Pinus caribaea | Carribean pine | Leaves, stem and fruits |
| Cercospora ranjita S. Chowdhury | 2020-02-21 06:59:05 | | Leaf and fruit spots. May also cause blights | Small leaf spots which enlarge and merge together to form blight that shrivels and dries up the leaves | Spray with systemic fungicides | Mature tree | Pseudocercospora blight | Pseudocercospora ranjita (S. Chowdhury) Deighton | Gmelina arborea | White teak | Leaves |
| Botryodiplodia theobromae (Pat.) | 2020-02-21 06:50:46 | | | Spores (conidia) are released during rain and are dispersed by wind, insects, pruning tools, and rain droplets. Wounded bark can be infected throughout the growing season during moist conditions but most abundantly in spring. Cankers develop at wound site | Preventing wounds is the best way to minimize cankers. Cankered branches should be pruned in the winter to reduce inoculum (fungus available to initiate new infections). Severely diseased trees and branches should be removed. Pruning cuts should be made w | Mature tree | Botryodiplodia canker | Lasiodiplodia theobromae (Pat.) Griffon & Maubl. | Podocarpus sp. | Podo | Stem, branches |
| Cercospora ranjita S. Chowdhury | 2020-02-21 06:50:58 | | | | | | | Pseudocercospora ranjita (S. Chowdhury) | | | |
| Botryodiplodia theobromae (Pat.) | 2020-02-21 06:28:57 | | | Spores (conidia) are released during rain and are dispersed by wind, insects, pruning tools, and rain droplets. Wounded bark can be infected throughout the growing season during moist conditions but most abundantly in spring. Cankers develop at wound site | Preventing wounds is the best way to minimize cankers. Cankered branches should be pruned in the winter to reduce inoculum (fungus available to initiate new infections). Severely diseased trees and branches should be removed. Pruning cuts should be made w | Mature tree | Botryodiplodia canker | Lasiodiplodia theobromae (Pat.) Griffon & Maubl. | Podocarpus sp. | Podo | Stem, branches |
| Botrytis cinerea Pers. | 2020-02-21 06:24:29 | | Grayish coloured spots on leaves stems and flowers. Causes rot of affected part | It is widespread on plant material, initially affects blossoms, bruises, dead flower petals touching the ground when spores germinate. The fungus rapidly penetrates the plant tissue causing rot | Proper plant spacing for circulation of air. Rot debris to be removed periodically. Apply systemic fungicide | Mature tree | Botrytis Gray mold | Botrytis cinerea Pers. | Widdringtonia whytei | Mulanje cypress | Leaves, stems and flowers |

https://www.kefri.org/IPM/view_ipm.php 1/3

# Results cont’

20 Fungal species have been categorized as most pathogenic to trees species in Kenya

- Botryosphaeriaceae ( with 13 key families )causing dieback and canker on a wide host range
- Fusarium causing rots on fruits, roots and sown seeds
- Nectriaceae rots and blights
- *Armillaria mellea* causing root rots

# Results cont'

Main control mechanisms as summarized from the data were:

- Proper species site matching to prevent plant stress which increases susceptibility to pests and diseases
- Use of clean certified seed for sowing
- Proper hygiene in the tree nursery
- Use of sterilized tools and techniques when pruning and thinning
- Use of resistant varieties and species for plantation establishment
- Use of fungicides for control of nursery diseases
- Cultural control through removal of diseased parts and plants and burning them to prevent spread of spores through wind and water
- Biological control of cankers using *Trichoderma asperellum* fungus

# Conclusion

- The KEFRI IPM DSS will be launched in December 2021 once development is complete
- Collaboration is being sought in order to reach as many farmers as possible through extension service providers
- The key information to be provided is quick diagnosis of the diseases and pests and their control
- Proper Identification of diseases and pests is key in ensuring timely management and control of the disease

# Recommendations

Once launched create an account by registering to allow access

Use platform to report disease and pest occurrences and contact KEFRI for advisory services

Ensure proper species site matching by using available apps for information i.e. KEFRI App

Promote tree and plant health by preventing spread of disease and insect pests

# Acknowledgements


**Theme**: *"Enhancing Phytosanitary Systems for Healthy Plants, Safe & Sustainable Trade"*

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