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PESTS OCCURRING IN AFRICA

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1.0 INTRODUCTION

In nature, pests have their own natural means of dispersal and spread, but this is confined by geographic barriers such as mountain ranges and seas, or climatic barriers. For the African region, the spread of pests from Europe and Asia is less favorable as the continent is effectively sealed by the Sahara desert. East Africa in particular is almost effectively isolated to the north by the Arid and Semi Arid Lands and to the east by the Indian ocean. Although to the south the extensive bushland may be an effective barrier, this has in the recent past not been effective for forest tree pests. Pests such as *Cinara cupressi* which has devastated *Cupressus* species and their related genera have spread from the southern countries. Furthermore, the tropical rain forest of Zaire may be an avenue for dispersal of forest pests from Central Africa.

In addition, current rapid international travel and subsequent ease of exchange of plant material in all forms (e.g. seeds and cuttings) has made geographical barriers less significant to the spread of pests. This lends a great risk to the introduction of serious pests to any point within the African region. There has also been a rapid expansion of industrial forest plantations, and together with the subsequent desire to experiment with new species and clones in order to increase productivity, has led to a higher need to exchange material for testing. This calls for stringent phytosanitary regulations that would restrict entry of foreign pests which may occur with concurrent import of exotic tree species.

2.0 EXOTIC TREES AND PESTS IN THE AFRICAN REGION

2.1 Exotic trees

Early in the century, it was recognized in many tropical countries that indigenous forests could not meet the demand for forest products on a sustainable basis. In East Africa, trials with fast growing exotic tree species were subsequently started and their

growth rates proved impressive (Odera 1991). By the middle of the century, many exotic species were extensively planted especially on land clearfelled of natural forests and also in areas with non-productive woodlands. In Kenya, these species included *Cupressus macrocarpa, C. lusitanica, Pinus patula, P. radiata, Acacia mearnsii* and *Eucalyptus grandis, E. saligna* and their hybrids (Sheffield and Jones 1965). Indigenous species such as *Juniperus procera, Ocotea usambarensis* and *Maesopsis eminii* were also extensively planted, while other exotic species were established on trial scales. Similar exotic species were grown in the other East African countries (Uganda and Tanzania), while similar programs were initiated in other parts of Africa.

In Kenya to date, of the 2.2 million ha. forests (or 2% of total land area) approximately 167,000 ha. are manmade. Out of these plantations, 73,000 ha. are cypresses, 55, 000 ha are pines and 16,000 ha are eucalypts.

The different species were found most suitable for various uses. In Kenya, among the cypresses, the most successful species in the highlands were *Cupressus lusitanica* and *C. macrocarpa* which were most popular for the timber industry. Unfortunately both species were later found to be highly susceptible to pests. By the fifties , *C. macrocarpa* which was the most productive industrial species, succumbed to the cypress canker caused by *Monochaetia unicornis*, leading to its discontinuity in the planting program. Although *C. lusitanica* was until 1990 considered to be one of the more resistant exotic species to pests, its high susceptibility to *Cinara cupressi* has been a blow to the East African timber industry. In Kenya, until 1990, it constituted approximately 44% of the 167,000 of the industrial plantations, in addition to the 10,000 ha. dispersed in private farms as shelter belts, live fences and shade trees (Ciesla 1991).

The pines were equally successful in the highland areas with *Pinus patula* being the more popular as a timber species, while *P. radiata* had high qualities for the pulp and paper industry. As with *C. macrocarpa, P.radiata* planting was also discontinued in the early sixties due to its high susceptibility to *Scrrihia pini (Dothistrorna pini*), although in Kenya, it still remains the most popular species for the pulp and paper industry.

Other species of pines such as *P. oocarpa* and *P.caribaea* have also been introduced and successfully grown on a smaller scale in the lowland areas.

To date, among the economically important cypresses and pines, *P. patula* is probably the only species that has not succumbed to attacks by pests.

While the pines and cypresses have been established mainly for sawn timber, peeler logs and for the pulp and paper industries, the eucalypts are most popular for domestic and industrial fuelwood, building and transmission poles and posts, ornamentals and more recently for pulp and paper. Different species of eucalypts have been successful in different parts of the country. *Eucalyptus grandis*, *E. saligna* and their hybrids are well established in the highlands. *E. citriodora* is extensively grown in the lowlands, while *E. camaldulensis* and *E. tereticornis* have been successfully introduced in the semi-arid lowland areas.

Other exotic species such *as Gravelly robust* are extensively grown on farms over a wide range of ecozones. Additional exotic species grown on farms include *Leuceana leucocephala*, *Glericidia sepium*, *Azadirachta indica* and *Calliandra calothyrsus*. In addition, farmers still grow indigenous species some of which have comparative growth rates to the exotic species. These include *Acacia* species, *Markhamia* spp and *Sesbania sesban*. Among the species, *G. robust* is prone to attack by *Apate indistica*, *Leuceana leucocephala* to the leucaena psyllid *Heteropsylla cubana*, while mangoes which may be considered as agroforestry species are also susceptible to *Restococcus invadens*. *Sesbania sesban*, an indigenous species that is popular in agroforestry systems has also been reported to be susceptible to a beetle *Mesoplatys ochoptera*.

From the above account it is clear that pest management and prevention of introduction of exotic pests is critical to the forest industry in the African region.

2.2 Exotic pests

Trees may be attacked by pests at any stage in their development. For example, seeds may be attacked on the trees and during storage; seedling roots, stems and foliage in the nursery and in the field may be destroyed by various pests, while young and adult trees are also prone to attack by defoliators, bark beetles, borers and root pathogens. Dry wood is also subject to attack by many kinds of wood destroying pests.

In the African region, most of the serious pest attacks that have occurred on an epidemic level have been on exotic tree species that are fast growing, high yielding and grown in extensive monocultures. The most serious pests have also been noted to be of exotic origin. While those pests indigenous to a country may significantly damage indigenous species, attack on the exotic tree species is more severe. Tables 1 and 2 summarize pathogens and insect pests respectively of economic importance to forestry occurring in the African region. Some pests important to agroforestry are also included (* denotes species of exotic origin).

2.2.1 Pathogens

Among the stem and root pathogens, *Armillaria mellea* which causes root rot and *Monochaetia unicornis* which causes stem canker are the only species that may be of some economic importance in Kenya. *Endothia gyrosa*, a well known pathogen of the woody plants including *Eucalyptus* spp. has been reported in South Africa for the first time. It is recorded to be consistently associated with cankers on eucalypts (Westhuizen *et. al.* 1993). These cankers are distinct from those of *Cryphonectria cubensis* which is also reported to cause more severe cankers on eucalypts in plantations. *E. gyrosa* is exemplified from *C. cubensis* by cracked and slightly swollen areas with less severe damage. It is reported to be widespread in South Africa. *Stereum sanguinoletum* which causes wilts, diebacks etc in pines was first recorded in Kenya in 1964 (Gibson 1966) to attack the trees through big game wounds.

TABLE 1 DISEASES OF ECONOMIC IMPORTANCE IN AFRICAN

Pathogen	Hosts
Seedlings	
Pythium spp.	*Pinus* spp
Phytophthora cinnamomi	*Pinus* spp
Fusarium subglutinans	*Pinus* spp
F. subglutinans f.sp. pini	*Pinus spp.*
Coniothyrium oratum	*Eucalyptus* spp
Phaeseptoria eucalypti	*Eucalyptus* spp
Helicobasidium compactum	*Pinus* spp and *Cupressus* spp
H. purpureum	*Pinus* spp
Rhizoctonia solani	*Pinus* spp
Rosellinia necatrix	*Pinus* spp and *Cupressus* spp
Ustulina deusta	*Pinus* spp and *Cupressus* spp.
Clindrocladium scoparium	*Eucalyptus* spp. and *Pinus* spp.
Stems and roots	
Armillaria mellea	*Eucalyptus* spp; *Pinus* spp; *Cupressus* spp;
Cyrphonectria cubensis	*Eucalyptus* spp
Discula platani	*Platanus hybrida* syn. *P. acerifolia*
Endothia gyrosa	*Eucalyptus* spp.
Ganoderma colossum	*Pinus* spp, *Callitris* spp. *Eucalyptus* spp.
Helicobasidium compactum	*Pinus* spp
Monochaetia unicornis	*Cupressus* spp and related genera
Pseudophaeolus baudonii	*Eucalyptus* spp and *Pinus* spp
Stereum sanguinolatum	*Pinus* spp
Shoots and foliage	
Apion ghanaense	*Triplochiton scleroxylon*
Bostrytis cinerea	*Pinus* spp, *Eucalyptus* spp - very severe
*Cercospora pini-densiflorae**	
(Mycosphaerallla gibsonii)	*Pinus* spp.
Lobobunea epithyrena	*Populus deltoides*
Lophodermium spp	*Pinus*
*Mycosphaerella nubilosa**	*Eucalyptus* spp.
M. pinicola	*Pinus* spp
*M. molleriana**	*Eucalyptus* spp
Mycosyrinx nonveilleri	*Triplochiton scleroxylon*

(TABLE 1 CONTINUED)

Pathogen	Hosts
*Naemacyclus niveus**	*Pinus* spp
*Phoma conorum**	*Pinus* spp
Puccinia psidii	*Eucalyptus* spp
*Sclerophoma pithyophila**	*Pinus* spp
*Sphaeropsis sapinea (Diplodia pinea)**	*Pinus* spp.
*Scrrihia pini (Dothistroma pini)**	*Pinus radiata*
Dothistroma septospora (*Mycosphaerella pini*)	*Pinus* spp

For the shoot and foliage pathogens the most economically important exotic species is *Scrrihia pini (Dothistroma pini*) which causes severe blight in *P. radiata* and whose effect was so devastating that *P. radiata* was discontinued as a plantation species in East Africa in the early 1960's. *S. pini* has also been reported in Southern Africa. Another exotic pathogen of economic importance in this group is *Sphaeropsis sapinea (Diplodia pinea)* which was first reported in Kenya in 1973 and also causes severe dieback especially to *P. radiata* and numerous other pine species. *Botrytis cinerea* also causes severe blight in seedlings of major *Eucalyptus* spp. in Kenya except *E. citriodora* in Kenya.

Mycosyrinx nonveiller is also another pathogen of economic importance in this category. It penetrates all flower parts eventually reducing the number of fruits produced. The pathogen has been reported in West Africa on *Triplochiton scleroxylon* (Odeyinde 1976). The causal agent for Cercospora needle blight include *C. pini - densiflorae* (*Mycosphaerella gibsonii*) attack young trees of a wide range of *Pinus* spp. The pathogen is widely distributed in Asia, Africa and America may be controlled by fungicide such as maneb and benomyl (Kobayashi 1987).

Among the eucalyptus leaf diseases, *Phaeoseptoria euclaypti* is probably the most important. It is a serious nursery pathogen on *Eucalyptus* species of the subgenus symphyomyrtus especially *E. tereticornis* and *E. grandis* (Nichol *et. al.* 1992). The pathogen, first reported in South Africa in 1987 can cause complete defoliation of an entire plantation and death of seedlings. Species of the subgenus monocalyptus are resistant

(Nichol *et al.* 1992). *Cylindrocladium scoparium* has also been reported in South Africa to cause shoot blight symptoms in *Pinus* spp. and *Eucalyptus* spp. in nurseries, but these symptoms have not been observed in plantations. Surveys have shown that other species of Cylindrocladium and Cylindrocladiella also occur (Crous et. al. 1991).

There are several pathogens that have lately been reported in the African region that may be of potential economic importance although they still have to be confirmed as the cause of the various diseases. These include *Ceratocysti fimbriata* which has been reported for the first time in Southern Africa and is thought to cause gummosis and wilt of *Acacia mearnsii* resulting in dieback (Morris et. al. 1993). *A. mearnsii* is an important plantation tree in several African countries although it may also be an invasive weed. *Fusarium subglutinans* f. sp. *pini* (Viljoen *et. al.* 1994) has also been reported in South Africa to cause root rot in pine seedlings. This is the first report of *F. subglutinans* sp. *pini* causing root rot of pine seedlings in the nursery, and the first record of the fungus in the Southern Hemisphere (Viljoen et. al. 1994).

Other potentially important fungi associated with needle and shoot diseases of *Pinus* spp include *Colletotrichum acutatum* which causes shoot dieback of seedlings of *P. radiata*. *Dothistroma septospora [Mycosphaaerella pini)* is also associated with needle blight of *P. radiata*, while the genus Lophodermium includes important pathogens of *Pinus* species.

2.2.2 Insect pests

Among the exotic sapsuckers, *Orthezia insignis* is reported to have been incidentally introduced into Kenya and Tanzania many years ago (Le Pelley 1968). and by the 1950's caused serious damage to *Jacaranda mimosifolia*. It was later controlled by a beetle *Hyperasis jocosa* introduced from Hawaii. *Icerya purchasi* which was introduced from Australia was also reported to have caused damage to *Acacia mollisima* in the late 1950's, but it was also effectively controlled by the predacious coccinellid *Rodilia cardinalis* and the Agromyzid fly *Cryptochaetum iceryae*. Both *O. insignis* and *I. purchasi* have been recorded in Southern and East Africa.

TABLE 2 INSECT PESTS OF ECONOMIC IMPORTANCE IN AFRICAN

Insect	Host
Seed	
Brachidius spp.	African *Acacia* spp
Seedlings	
Agrotis spp.	Seedlings of nearly all species
Euzoa segetis	Seedlings of nearly all species
Microtermes spp.	Seedlings of nearly all species
Bark beetles and wood borers	
Oemida gahani	*Cupressus* spp and *Juniperus procera*
Stenosclelis spp.	*Juniperus procera*
Chlorophorus carinatus	*Cupressus* spp
Phloeosinus aubei	*Cupressus* spp; *Juniperus procera*
Apate spp.	Many species
Apate indistica	*Gravelly robust*
Restococcus invadens	*Mangifera indica*
Salagena discata	*Sonneratia alba*
Defoliators	
Nudaurelia guensii	*Eucalyptus* spp., *A. mearnsii*
N. cythera capensis	*Pinus* spp; other tree species
Acanthopsyche junodi	*Acacia ducurens* var. *mollisima*
*Gonipterus scutellatus**	*Eucalyptus* spp.
Gonometa podocarpii	*Pinus* spp.
Imbresia epemethea	*Acacia* spp.
Lechriolepsis basifura	*Pinus* spp.
Orgia hopkinsii	*Pinus* spp.
O. mixta	*Pinus* spp.
Pachypasa papyrii	*Pinus* spp
Semimantha aethopsis	*Pinus* spp.
Epicerura pulverulenta	*Terminalia ivorensis*
Heteropsylla cubana	*Leuceana leucocephala*
Sapsuckers	
Coccus hesperidium	*Pinus* spp.
*Icerya purchasi**	*Acacia* spp. and citrus fruit trees
Lygidolon elegans	*Acacia mearnsii*
L. hacate	*Acacia mearnsii*
*Orthezia insignis**	Jacaranda mimosifolia, Coffea arabica

(TABLE 2 CONTINUED)

Insect	Host
*Pineus pini**	*Pinus* spp.
Eucalachnus rileyi	*Pinus* spp.
Cinara cupressi	*Cupressus* spp., other tree species
Heteropsylla cubana	*Leucaena* spp.
Drywood borers	
*Crytotermes dudleyi**	Almost all species
*Stromatium barbatum**	Almost all species

The aphids have been among the most devastating insect pests in the region. The pine woolly aphid *Pineus pini* is an important pest that occurs on many pine species, and its most favored host are *Pinus contorta, P. halepensis, P. massoniana* and *P. radiata,* which to date in Kenya have either been established on a trial scale or no longer widely planted. It was first discovered in Kenya and Tanzania in 1969 probably by accidental introduction from Australia or South Africa (Odera 1974) and it attacks and kills healthy trees. Presently, *P. pini* occurs in endemic proportions due mainly to the absence of its preferred hosts, combined with indigenous predacious insects, and an introduced predator *Tetraphleps raoi*. *Eucalachnus rileyi*, also a conifer aphid has been reported in the region (Loyttyniemi 1970; Marchant 1982; Ondendaal 1989; Odera 1991) although its attack is mild. Both *P. pini* and *E. rileyi* have been reported in Central, East and Southern Africa.

The third and probably to date the most devastating of the aphids is the cypress aphid *Cinara cupressi*, which is native to Europe and the Mediterranean region, attacks members of the Cupressacea family in southern, Central Africa and East Africa (Ciesla 1991; Odera 1991). In Kenya, *C. lusitanica* has been one of the most susceptible species to *C. cupressi*. Biological control using *Pauesia juniperorum* is being explored (Day pers. comm.).

Comparatively, the indigenous sapsukers *Coccus hisperidium* and *Lygidolon* spp. cause sporadic damage to young trees but no outbreaks have been reported.

However, some indigenous lepidopteran defoliators cause damage to exotic tree species. Among these are *Orgyia hopkinsii, O. mixta, Gonometa podocarpi, Pachypasa papyri,* and *Semimanatha aethiops* which have been reported to attack some of the exotic species sporadically. These pests may generally be controlled effectively by nuclear polyhedral viruses and a number of parasitic insects that occur naturally. Their effective control may be due to their long life cycles.

Exotic defoliators such as the eucalyptus snout beetle *Gonipterus scutellatus* which was introduced from Australia through South Africa (Gardiner 1957), is a pernicious defoliator both as a larva and as an adult of eucalypts especially *E. globulus, E. maidenii, E. regnans* and *E. viminalis*. It has been effectively controlled by the combined efforts of an introduced egg parasite *Anaphoidea nitens* and a reduction in planting of the highly susceptible eucalyptus species. It has been recorded in South and East Africa.

In West Africa, *Epicerura pulverulenta* has been reported as a serious defoliator of *Terminalia ivorensis* and *T. catappa*, the first outbreak having been recorded in Nigeria in 1979-1983 (Matanmi 1991). Larvae have been found to be infected with an unidentified small non-occluded viral pathogen, parasitized by the tachinid *Palexorrista* spp. and preyed on by several non-insect predators. *Nudaurelia cytherea capensis* has also been recorded to cause damage but it has been effectively controlled by a non-occluded virus which infects the adults, pupae and larvae (Tripconey 1970)

In Kenya, there are to date no exotic bark beetles of economic importance (Odera 1991). The only indigenous species that is of economic importance is *Philoeosinus aubei* which attacks indigenous African pencil cedar *Juniperus procera* and also *C. lusitanica*. *Acanthopsyche junodi* has also been reported to cause serious damage to the black wattle *Acacia mollisima* in South Africa (Ossowski 1958). It is controlled by a polyhedral virus and it also has a number of insect parasites and predators, arthropods , birds and mammals which are important in reducing its numbers. Fresh infestations may also be prevented by growing unpruned wattle or *Pinus patula* as a protective barrier and also by chemical control using toxaphene, endrin, etc.

Among the wood borers, those of economic importance is *Oemida gahani* which

occurs in the natural forests in the Kenya highlands , has a wide host range and attacks living trees in plantations. The most susceptible species to *O. gahani* are indigenous species such as *Podocarpus spp, Olea spp, J. procera* and also *C. lusitanica*. In its larva stage, it essentially causes serious damage to seasoned wood but it may also attack living trees where oviposition is in dead wood caused by pruning operations or scars (Gardner et. al. 1953). By 1962, it was considered the most important forest pest in Kenya but it has effectively been controlled by improved pruning techniques. Other beetles of *Bruchidius* spp. have also been reported to severely attack seeds of various African Acacias (Southgate 1978).

In West Africa, *Apate* spp have been reported to cause damage to a number of species in young plantations (Atuahene 1976; Becker 1980). *Apate monachus* was reported in 1966 to be the main cause of damage to peeled veneers, while *A. monachus* and *A. terebrans* have also been reported to damage trees in plantations and natural stands (Atuahene 1976). This pest has been effectively controlled by preventive measures such as packing in polyethylene before dispatch, in combination with chemical control. The most commonly attacked species are *E. alba, T. ivorensis, Melia composita, Khaya senegalensis, Triplochiton scleroxylon* and *Tectona grandis*. Removal of debris from plantation sites and destruction of heavily infested trees has been used as a preventive measure as this has been found to be the breeding ground of the pest.

Some tree species in the arid and semi-arid areas are particularly prone to attack by termite species especially those of the *Microtermes* spp., while exotic insects pests such as *Cryptotermes dudleyi* and *Stromatium barbatum* introduced from the Far East and India attack and rapidly destroy structural wood in use. *Stromatium barbatum* has been reported only in East Africa, while *Cryptotermes dudleyi* has been reported in East and Southern Africa. Furthermore, the mangrove species *Sonneratia alba* has been reported to be seriously damaged by *Salagena discata* (Owuor, pers. comm.).

Some pests such as *Cryptotermes dudleyi* (from Far East via India), *Gonipterus scutellatus* (from Australia via South Africa), *Icerya purchasii* (from Australia), *Stromatium barbatum* (from Indian Ocean region and Far East) and *Chlorocarpus spp.*

(from America) have become established in East Africa (Sheffield and Jones 1965). Other insect pests that are of minor importance and have been reported only in Southern Africa on pines are *Pissodes nemorensis, Ernobius mollis* and *Cinara cronartii*.

3.0 PLANT QUARANTINE SERVICES IN AFRICA

The African region has had quarantine services since the 1950's due the realization of the rapid increase of trade in plants. Historically the International Plant Protection Convention under the aegisis of FAO was inaugurated in 1951 to promote global cooperation (Careche et. al. 1969). In accordance with the convention, all member countries are obliged to follow certain set regulations.

As countries in the same region are part of a large land mass, it is important that neighboring countries should take similar precautions. It is for this reason that the Inter-African Phytosanitary Commission (IAPSC) was established in 1954, to ensure cooperation between countries and also to ensure that minimal precautions necessary to protect the agricultural and forestry crops of countries in Africa South of the Sahara are undertaken (Sheffield and Jones 1965). The IAPSC which became operational in 1956, has since provided model phytosanitary legislation for member governments (Careche 1963). It has also subsequently expanded to include all African countries by integration of the Phytosanitary Commission with the Organization of African Unity through its Scientific, Technical and Research Commission (STRC) (Odera and Arap Sang 1980).

To date, some African countries such as Nigeria, Mozambique, South Africa, Zimbabwe, Kenya and Malawi have well operational quarantine stations. In most other African countries, quarantine stations are not well established mainly due to lack of facilities and trained personnel.

4.0 PLANT QUARANTINE SERVICES IN EAST AFRICA

In East Africa (Kenya, Uganda and Tanzania) to date, many of the worlds serious pests especially on agricultural crops have not yet been detected. This is because the East African countries were aware of the dangers of unrestricted movement of plants before the development of intensive agricultural practices and also these countries have operated plant import restrictions since 1934. At this time, a station was opened in Amani, Tanzania (then Tanganyika) to ensure that imported plants were free from pests (Sheffield 1965). Precautions such as plant inspection and treatment were undertaken at this station. In 1954, the three countries which also belonged to the East African Community (EAC) agreed to move the station to Muguga, Kenya to take advantage of scientists at the East African Agricultural and Forestry Research Organization located at the same place. The station, later named as the East African Plant Quarantine Station (EAPQS) provided high quality quarantine facilities for the three EAC countries.

After the break up of the EAC in 1977, the station was renamed as the Kenya National Quarantine Station (KNPQS) and is presently directly under the control of the government. It still continues to provide high quality services to Kenya and also to Uganda and Tanzania although to a lesser extent. Presently, Uganda and Tanzania undertake minimal quarantine procedures as their quarantine services are not well established in terms of personnel and facilities. At the KNPQS all plant materials continue to be inspected and relevant tests and treatments made, and whenever necessary, entire consignment may be destroyed. Plants have also been listed into various categories such as prohibited and restricted.

5.0 CONCLUSIONS AND RECOMMENDATIONS

With the ever increasing intercontinental travel, world trade and population and the desire to experiment with plant material from other regions of the world, man has rapidly changed the pattern of plant association as well as plant parasites between various

geographical zones. In the African region, exotic species from temperate and other tropical countries have been introduced for higher productivity. Although the performance of these species has been outstanding, there has unfortunately been a subsequent introduction of exotic pests which have in most cases devastated the exotic species while some exotic pests have also attacked indigenous species. On the other hand some indigenous pests that were originally of little significance in the forest industry have become economically important on exotic tree species. The need to prevent the subsequent introduction of exotic pests with desirable germplasm has resulted in the establishment of quarantine services in many countries.

In the African region an Inter-African Phytosanitary Commission was established to enable neighboring countries to undertake similar precautions. Although some countries offer high quality quarantine services, others still do not have well established phytosanitary facilities and trained personnel. This poses a danger to the entire region as countries are part of a large land mass and introduction of a pest in one country may easily spread to the rest of the region. It is highly recommended that quarantine services in the African region be strengthened in terms of personnel and facilities, and also subregional quarantine centres be established.

Regional collaboration is essential for the mutual protection of our intercontinental and zonal barriers against introduction of pests. While in some cases total prevention of an exotic pest may not be possible, its delay saves on resources, and during such a period scientist may have developed a control method such as development of resistant varieties or identified a predator or parasite of the pest.

On the national level, although importation of plant material including seeds and cuttings may be under stringent control, there is lack of awareness by the general public about the existence of these services and their importance. It is essential that the general public, Diplomatic Missions, Scientists, farmers and horticulturalists, the Custom Officers, Government Dignitaries and visitors to each country in the region be made aware of the dangers of importation of any plant material for whatever purpose. Such awareness should also include the various categories of plant material such as:

1. Imports which are made under permit;
2. Imports made through the plant quarantine station; and
3. Importations that are totally prohibited.

People should also be made encouraged to make honest declarations of the plant material they may carry

Nationally, campaigns should be organized in every form (e.g. television shows, posters, radio talks, etc.) to sensitize all those involved in the importation of plant material to these dangers. International travellers also have to be screened and Customs Officers should be able to recognize various plant materials and advice travellers accordingly.

International collaboration is also essential as each country and region should be able to rely on the validity of the phytosanitary guarantees. There also has to be an easy exchange of information regarding various pests such as scientific developments in their detection and control.

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