THE EXOTIC PESTS IN THE FOREST SYSTEM OF EASTERN AFRICA: QUARANTINE AS A TOOL FOR EXCLUDING FORESTRY PESTS IN THE REGION

A PAPER PRESENTED TO THE 9TH MEETING AND SCIENTIFIC CONFERENCE OF THE AFRICAN ASSOCIATION OF INSECT SCIENTISTS: MAJOR SYMPOSIUM ON EXOTIC PESTS IN AFRICA; THEIR PREVENTION AND CONTROL

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S U M M A R Y

Many exotic species from temperate zones have been introduced to tropical highlands of Eastern Africa, owing to their relatively faster growth compared to the indigenous species. Although the bulk of industrial plantation crops are found in Kenya, currently, standing at about 165,000 ha of man made forests, the entire land mass stretching from Sudano - Sahelian belt to the heart of South Africa, (a distance of about 10,000 km) and from Eastern Zaire to Arabuko - Sokoke forests off the Indian Ocean on the East Coast of Kenya, (a distance of 3,000 km), support large tracts of industrial plantations.

With growing sophistication and affluence in external travel and trade, the danger of entry of alien organisms through commercial, private shipment of plant materials and travellers, has become a more pressing problem to forest managers in all parts of the world. Movement of vegetative material for propagation or seed which may be diseased or infested and clothing, soil, humus, peat, compost and lumber are important carriers of all stages and categories of plant enemies. Through movement of these materials, man has facilitated transcontinental spread of many pernicious pests and diseases.

The dilemma between introducing beneficial foreign plants and the danger of introducing alien pernicious organisms has called for the introduction of quarantine systems and international co-operation phytosanitary services. The evolution of plant quarantine systems in East Africa is reviewed and the laws and phytosanitary regulations in Kenya are discussed.

The paper summarises the major foreign pests found in Eastern and Southern Africa. While recognizing that foreign pests cannot be excluded fo ever, it is noted that delay of any duration in entry of any pernicious organism means that resources for control are saved.

In conclusion, the paper recommends: (a) the establishment of Eastern Africa Sub-Regional Plant Quarantine Services to promote uniform and common phytosanitary services for the countries of the region; (b) promotion of international co-operation on plant phytosanitary practices be supported by improved scientific liaison and information exchange on forest pests, their management, and the maintenance of constant surveillance of crops and phytosanitary inspection at points of exit and entry, to ensure valid phytosanitary guarantees and pedigree work of the exporting and receiving countries; (c) limiting exchange of plant material to seeds and budwood tc be introduced through a quarantine station; (d) screening of materials carried by travellers, greater education of the travelling public and provision of comprehensive appeals on the importance of providing honest declaration on imported plant materials etc.

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I N T R O D U C T I O N

With growing sophistication and affluence in external travel and trade, the danger of entry of alien organisms through commercial, private shipment of plant materials and travellers, has become a pressing problem to forest managers in all parts of the world. Movement of vegetative material for propagation or seed which may be diseased or infested and clothing, soil, humus, peat, compost and lumber are important carriers of all stages and categories of plant enemies. Through movement of these materials, man has facilitated transcontinental spread of many pernicious pests and diseases.

The consequence of spread of foreign pests has been exercabated by the expansion of industrial forest plantations of fast growing exotic species, particularly conifers and eucalypts. This paper examines incidences of past introduction of pernicious forest pests into the region, and the role of phytosanitary regulations in restricting entry of foreign pests and diseases into East Africa.

THE VULNERABLE FOREST CROP IN THE REGION

The small area of reserved forest land in many tropical countries has forced forest management to invest on plantations with fast growing exotic tree species. In Kenya, it was recognised as early as 1909 (Hitchins 1909) that the indigenous forests could not meet the demand for forest products on sustainable basis and the trials with fast growing exotic species were began.

Subsequent silvicultural research concentrated on increasing the yield of this small area of productive forests by converting the non-productive woodlands to fast growing softwood plantations. By 1927 Kenya launched a programme of high-yielding compensatory plantations. Several species of eucalypts and tannin producing acacias were introduced to provide woodfuel and poles. Eucalypts have become established as the windbreak trees in farm holdings beside being the normal source of domestic and industrial woodfuel. Eucalyptus saligna and E. grandis are well established in the highlands and moist low land areas; E. citrodoea is extensively grown as an ornamental tree around Lake Victoria, where it is climatically well adapted. During the last decade E. camaldulensis and E. tereticornis have been successfully introduced in the marginal lowland areas.

Sensational success has been obtained with certain exotic soft-wood species, especially Cupressus lusitanica, Pinus patula and P. radiata in the highland areas. Growth rates are very high herce necessitating specified pruning and thinning treatments in the saw-log circles. Among the pines, P. radiata though the easiest to raise, and a bigger yielder has been gradually displaced by P. patula since 1962 due to its susceptibility to Dothistroma pini.

Several other species of pines have been introduced in Kenya. Among these P. caribaea, P. khasya and P. oocarpa have been earmarked for afforesation programmes in the lowland areas. Today about 165,000 ha are under man-made forests, comprising some 73,000 ha cypress, 59,600 ha pines and 15,800 ha eucalypts. The rest consist of various indigenous and exotic hard wood species.

Grivellea robusta has become a farm forestry tree of choice that is prefered by farmers in all agroclimatic zone where rainfed crop cultivation is possible. Other exotic agroforestry trees that are cultivated in the region include: Leucaena leucocephala, Calliandra calothyrsus and Gliricidia sepium.

Similar developments have occurred in nearly all countries in the region. Today the exotic forest crops in the region extend from the Southern Sudan and Ethiopia on the North to the heart of South Africa (a distance of about 10,000 Km) and from Eastern Zaire to the Arabuko-Sokoke forests off the Indian Ocean on the East Coast of Kenya (a distance of 3,000 Km).

The vast extension of single crops over large areas in the region, makes forest resources extremely vulnerable being exposed to invasion and establishment of many potential pests and diseases of foreign origin. This situation is exacerbated by the greatly increased speed of travel and the ever increasing number of travellers and traffic of goods from different parts of the world. Addis-Ababa, Nairobi, Dar-es-Salaam, Lusaka and Harare lie along the cross-roads of Africa. These are among some of man's activities that may inadvertently aid dissemination and establishment of foreign plant pests and diseases in the region.

EXOTIC FOREST PESTS OCCURRING IN THE REGION

Table I summarizes insect pests of economic importance to forestry in the region. Icerya purchasi was reported to be causing damage to Acacia mollisima in late 50's but was effectively controlled by the predacious coccinellid Rodilia cardinalis and the Agromyzid fly Cryptochaetum inceryae that were introduced from Australia. According to Le Pelley (1968) Orthezia insignis was accidentally introduced into Kenya and Tanganyika many years ago. In the 50's O. insignis caused serious damage to Jacaranda mimosifolia but was later controlled by a bettle Hyperasia jacosa introduced from Hawaii.

Pineus pini was first discovered in Kenya and Tanzania in 1969 (Odera 1974). This pest occurs on about 39 species of pines. P. pini is a formidable exotic pest which in the absence of effective control measures attacks and kills healthy trees. Pinus contorta, P. elliotti, P. halapensis, P. massoniana and P. radiata are its most favoured hosts.

Today combined efforts of indigenous predacious insects, an introduced predator Tetraphleps raoi, and absense of its preferred host trees, such as P. massoniana and P. radiata, appears to keep its numbers within endemic proportions.

Eucalachnus rileyi is the second conifer aphid that has been reported in the region (Layttyniemi, 1970; Machant, 1982; Ondendaal, 1989 and Odera 1991). The third pest and indeed the most devastating pest of softwoods in the region, Cinara cupressi, (the cypress aphid) has been reported from Burundi, Kenya, Malawi, Rwanda, Uganda and Zimbabwe (Odera 1991).

PERNICIOUS EXOTIC PESTS AFFECTING FORESTS AND FOREST PRODUCTS IN EASTERN, CENTRAL AND SOUTHERN AFRICA

TABLE I

A LIST OF PERNICIOUS FOREST PESTS REPORTED FROM EASTERN, CENTRAL AND SOUTHERN AFRICA

(Recorded from East Africa)	(Recorded from Southern Africa)
Gonipterus scutallatus Introduced from Australia through South Africa on blue gums, is currently controlled by an egg parasite and cultural measures.	Has been in S.A. for some time.
Icerya perchasi on Jacaranda. Cryptotermes dudleyi attacking construction wood in use.	Has been in S.A. for some time.
Orthezia insignis - introduced into E. Africa in the 50's and caused damage to Jacaranda mimosifolia - is controlled by Hyperasis jacosa bettle introduced from Hawaii.	Has been in S.A. for some time.
Not reported frm E.A.	Pissodes nemorensis on pines, Ernobius mollis on pines, and Cinara cronartti on pines etc.
Stromatium barbatum attacking construction wood in use, (not reported from Central Africa).	Not reported from South Africa.

Pineus pini - a primary pest that attacks pines, is partially controlled by an introduced predator, Tetraphleps raoi and silvicultural practices etc.	Also occurs in Central and Southern Africa.
Eulachnus rileyi attacks pines - effect mild to average.	Also occurs in Central and Southern Africa.
Cinara cupressi - has devastating effects on members of Cupressaceae. No known sustainable control	Also occurs in Central and Southern Africa.

Restococcus invadens attacks mangoes in West Africa, still unknown in Eastern or Central, or S. Africa; Hymenopterous wasp (Gyranusoidea tebygi) has been introduced for its control.

THE MAJOR AVENUES OF TRANSCONTINENTAL INTRODUCTION OF PLANT PESTS AND DISEASES

The danger of entry of alien organisms may be through two main sources: commercial and private shipment of plant materials and travellers. Man may facilitate the spread of plant pests and diseases through movement of nursery stock for planting, vegetative material for propagation or seeds which may be diseased or infected. Soils, sand, stones, humus, peat, compost and lumber are also important carriers of all stages and categories of plant eremies.

Packing cases, cardboard boxes, bags including dunnage and other containers in which plants are conveyed can likewise harbour pest and disease organisms etc including arthropods, gastropods, nematodes, viruses, fungal spores and bacteria. Similarly transport carriers, such as, ships, aircrafts, railway waggons, lorries and cars directly carry pests and diseases across frontiers, either in the cargo or as stoaways.

Countless organisms arrive in baggage, cargo, packing materials, mail and personal effects from foreign lands. Although the bulk of such organisms is bound to be depleted by a high mortality rate, the risk upon quite fortuitous transport is ever present. The development of interstate railways and road net works, such as, the proposed transfrican Mombasa-Nigeria highway or the Nairobi-Addis Ababa road would have similar effects on insect and pest dissemination. The phenomenal development in aviation and traffic of foreign planes and tourists today pose a situation which defies the resourcefulness of those engaged in plant quarantine enforcement. A plant cutting can be safely carried from any part of the world into East Africa within a very short time. Air travel passengers resent a detailed and a slow-moving inspection. Moreover the effectiveness of the inspection depends on customs inspectors who often concentrate on valuable commercial objects.

Plant materials may also be carried by amateur gardeners, horticulturists, plant breeders and tourists, scmetimes as rooted plants and even in pots i.e. in their most dangerous form. Most collectors carry the material in ignorance of the rules and the danger that might be done, but some do so with the knowledge that it is illegal.

THE EVOLUTION OF PLANT QUARATINE REGULATION AND PRACTICE IN EAST AFRICA

In the field of forestry, exotic species from temperate zones have been introduced to tropical highlands owing to their relatively faster growth compared to the indigenous species. Unfortunately, introduction of plants has been accompanied by infiltration of pests and diseases, such as Dothistroma blight of Pinus radiata and pine woolly aphid and a revitalization of endemic parasites e.g. Armillaria root disease of pines which is generally a soil saprophyte (Gibson 1962). The dilemma between introducing beneficial foreign plants and the danger of introducing hitherto none existent pests and diseases has called for the introduction of quarantine systems in many countries.

The plant quarantine service provides the country's ultimate defence line against infiltration of alien pests and diseases while ensuring sound phytosanitary conditions of materials exported.

In a historical sense the development of plant quarantine is relatively recent. Fulling (1934) reported that about 1660 French farmers near Rouen secured passage for a law requiring destruction of barberry bushes in wheat to control rust disease. Similar ordinances were later issued elsewhere in Europe. In the United States early defence measures were taken on a local basis by individual communities or colonies and later by states against the European barberry in a bid to protect wheat crops from rust disease (Fulling 1943).

Just as the quarantine in Europe, USA, Japan and elsewhere had their inception in the need to exclude crop pests and diseases, Kenya's plant quarantine effort was also borne of necessity. The plant quarantine service has been used as the country's ultimate defence line set up to prevent ifiltration of new pests and diseases from abroad and to ensure sound phytosanitary conditions of export plants to foreign countries.

Caresche et al (1969) has noted that measures dealing with most notorious diseases were adopted in territories under both English and French administration as early as 1913. The governments of the day developed, in time, appropriate phytosanitary services.

Kenya, Tanzania (then Tanganyika) and Uganda agreed in 1934 to impose identical restrictions affecting introduction of plant materials from other countries. According to Sheffield (1965) between 1931 and 1951 vegetatively propagated materials of certain specified plants were quarantined by the Pathology Department of East African Agricultural Research Station, which was initially at Amani in Tanzania. In 1954 the East African Governments jointly established a new station at Muguga in Kenya. Several batches of scion materials of forest trees consisting of Pinus spp. from Australia, New Zealand, Rhodesia and South Africa have since been handled by the East African Plant Quarantine Station. It is noted that following the collapse of the East African Community, Tanzania and Uganda have continued to rely on the quarantine station at Muguga. But it is not clear to what extent the two countries enforce phytosanitary regulations in the movement of plant materials.

In parallel with the increase in international trade on plants and plant products the International Plant Protection Convention was inaugurated in 1951 under the aegis of the FAO to promote global co-operation (Caresche et al 1969). In accordance with the Convention, all contracting states undertake to abide by its stipulations and to follow a model phytosanitary certificate.

The countries of Africa South of the Sahara were brought together in 1954 for the purposes of plant protection by the Phytosanitary Commission for Africa (IAPSC). The IAPSC became operational in 1956, and has since provided model phytosanitary legislation for member governments (Caresche 1963). This Commission has subsequently been expanded to include all African countries through the integration of the Phytosanitary Commission with the Organization of African Unity (OAU), through its Scientific Technical and Research Commission (STRC).

To achieve its main role of keeping out from a given region dangerous pests and diseases, the Plant Quarantine Services employ a number of ways and means. Basically, the services capitalise on the International Plant Protection Convention, which is administered by FAO. The convention provides for international co-operation in controlling plant pests and diseases and for preventing their international spread. Member parties are charged with providing Import Permits and Phytosanitary Certificates in compliance with the International Plant Protection Convention. These documents constitute a written agreement between the Government and the person or institution engaged in growing, handling, or moving of plants or plant products or the business of importing or exporting of plants or plant products. The written agreement, legally binds the person to comply with the plant health provisions carried in the documents. Regretfully, experiences from the region confirm that very few countries are operating phytosanitary regulations or practices.

THE LAW AND PHYTOSANITARY REGULATIONS IN KENYA

Sheffield and Jones (1965) have listed plant pests and diseases considered dangerous and hence to be excluded from East Africa. Attempts aimed at excluding only known dangerous organisms would not adequately protect our forests which are in a state of high risk and susceptibility. An insect, fungal or viral organism that is relatively innocuous in its native habitat may become injurious when introduced into a new locality or given a new host. Moreover, many temperate pests tend to be more virulent when introduced to the tropics. Consequently, the government has enacted laws to control the importation of all plant material likely to carry foreign organisms.

Phytosanitary Regulations governing the imports or plant materials into Kenya are published under the Plant Protection Act Cap. 324 of the Laws of Kenya. This act sets out the procedures for importation of any form of plant material, seed, fresh fruits, flowers, plantlets etc. The main tenent of the Act insists that:

- All intending importers wishing to bring into Kenya plant materials must obtain a plant import permit from Kenya prior to shipment of such plants from origin regardless of whether they are duty free, gifts, or for commercial or experimental purposes. The permit specifies the requirements for plant health indicating prohibitions, restricted quarantine importations and additional declaration with regard to pre-shipment treatments.

- Any plant consignment arriving in Kenya, must be accompanied by a copy of an import permit and additional health certificate (Phytosanitary Certificate, International model or its equivalent) in full adherence to the specifications set out in the import permit.

- Plant material arriving in Kenya without authority and correct accompanying documents is not allowed entry and may be destroyed or reshipped at owner's cost.

- It is illegal to import plants into Kenya without a proper authority.

R E C O M M E N D A T I O N S

It is evident that the role and potential of exotic tree species in forestry development in the region will continue to promote expansions of large plantations of these species in monocultures or under different social forestry systems.

For many years the forests in the region have remained effectively sealed off from Europe and Asia, to the North by the Sahara desert, to the East by the Indian Ocean, and southward from Southern Africa by an expansive scrubland and to the West by the tropical rain forests. Within this zone there is no obvious impediment to pest and disease dispersal. Difficulties in preventing pest and disease spread between countries in the region, through a continuous land mass clearly show that the introduction of a destructive alien organism into any one country constitutes as great a threat to any other country. It is important to note that introduction of pests or disease into any country in the region will eventually spread into the neighbouring countries.

It must be recognized that no matter how efficient and effective enforcement of phytosanitary services may be or no matter how careful an inspector may be, there is the ever present danger that some pest may escape his eye. Moreover, an insect that is relatively innocuous in its indignous habitat may become injurious when introduced into a new locality.

Admittedly, foreign diseases or pests cannot be excluded for ever from areas where suitable conditions prevail, but delay of any duration in entry of any pernicious organism means that money for its control is saved. Moreover, during the intervening period scientists have time to develop control methods including developments of resistant varieties.

Regional Collaboration

Since the Eastern Africa countries (Kenya, Uganda, Tanzania and Ethiopia) share the same geographical land mass and are still free from some disastrous forest pests and dsiseases, it is recommended that the

four countries should set up an Eastern Africa Sub-Regional Plant Quarantine Services whose common purpose would be to keep foreign pests and diseases out of the region.

FAO has supported the establishment of Sub-Regional Plant Quarantine Services in Zimbabwe, for SADCC countries, and in Mali, for Sahelian countries. FAO should consider giving similar support and assistance to enable the setting up of Sub-Regional Plant Quarantine Services for the Eastern Africa countries. At an appropriate stage, a Sub-Regional Plant Quarantine Services for the Central Africa should also be considered. In this way, the phytosanitary services in Africa, under the umbrella of the Inter-African Phytosanitary Council of the OAU, would be greatly strengthened.

International Co-operation

It is imperative that each country and indeed the entire region should be able to rely on the validity of phytosanitary guarantees and pedgree work of the exporting country and region and vice versa. Recent experiences in the region have tended to cast doubt on the actual value of foreign certification as a means for preventing or lessening the introduction of harmful alien organisms. It appears that the procedures are not free from risks and however, competently and faithfully carried out, they cannot assure complete exclusion Browne (1948) reported an instance in 1947 when Malayan timber with a good deal of red frass arrived at an Australian port and was inspected by an entomologist who cleared them as harmless. The first observation of infestation of the pine woolly aphid or imported scions at the plant quarantine station at Muguga in 1968 was dismissed as spider webs (Odera 1969).

The importance of developing common and indeed uniform plant phytosanitary systems in all the countries of the region is an urgent and imperative task, that must be addressed now. The countries should also take steps to improve scientific liaison and information exchange on forest pests and their management.

The efficiency of inspection and certification at the point-of origin further relies on the abilities of all countries to maintain adequate plant disease and insect surveys and free exchange of information on the occurence and status of these organisms. Constant surveillance of crops would further enable an early detection of any new pest and a good propsects of quick elimination of infestation at source both within the country and abroad. Scientists working on forest protection should be urged to provide information on prevailing forest pests and diseases in their countries and region regularly. This would enable governments to discover alien organisms while still localized or in an incipient stage and hence amenable to eradiction.

A second inspection at the point-of-entry conducted by a competent official provides considerable additional support. It is important for plant inspectors to have adequate knowledge regarding foreign diseases and pests. Indeed, phytosanitary inspection at both ends must involve the services of specialists in plant enemies, particularly in diagnosis of pests and diseases and scientific advice. Scientists and inspectors should maintain an unimpeded flow of information particularly covering first-hand information on pests and diseases, methods of inspection and changes in the phytosanitary regulations.

Extra Restriction on Importation of Vegetative Material

Where permanent and complete exclusions is the aim, quarantine procedures must attain an exactitude which cannot be approximated by routine certification methods. It is stressed that quarantine regulations should encourage importation of seed instead of vegetative materials. Vegetative materials including woody cuttings and scions representing some years of growth are bound to be infested by numerous plant enemies that may be difficult to detect or to eliminate by conventinal treatment. Some countries through fear of introducing foreign pathagens and pests have developed a very conservative policy on the importation of vegetative materials. However, total embargo on the importation of new genetic material is bound to harm gainful tree improvement programmes. Understandably, breeders are constantly striv-

ing to improve the gene pool through introduction of wild type varieties and selected cultivars for breeding and tree improvement programmes. Importation of cuttings and scion materials must, therefore, be replaced by materials less prone to carry plant enemies.

Phytosanitary risks may be considerably reduced or even eliminated by limiting imported propagating materials to budwood to be introduced through a quarantine station. Budwoods are usually clean of plant enemies and indeed, this can be effectively assured through disinfection treatment and conveyance in sterile media. Imported budwood can be easily mass propagated by meristem tissue culture techniques under post-entry quarantine conditions in the importing country.

Screening of Materials Carried by Travellers

It is often noted that infringements of Plant Import Regulations largely occur as a result of ignorance. This involves nationals, visitors and members of diplomatic and aid missions. In order to protect our agricultural and forestry crops from the threat of foreign pest invasion, the custom officials must liaise closely with the plant inspectors, and competent plant inspectors should be posted at all entry ports.

Wider Education of the Travelling Public

It may be impractical to require that travellers' luggage be treated in the same manner as commercial shipments, so co-operation and understanding by the individual traveller is necessary to prevent the spread of pests. Air travel passengers resent detailed and slow-moving inspections. To enable effective co-operation the plant quarantine service should launch public education campaigns at all levels on the functions of plant inspectorate and quarantine services, dangers and risks associated with unrestricted importation of live plant materials. Educational literature should be prepared and passed to heads of departments of the universities, national research stations, national missions abroad and resident diplomatic and aid missions.

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