SHORT COMMUNICATION

Diseases of Endod (*Phytolacca dodecandra*) At Gemadro Locality, Illubabor Zone, Ethiopia

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Abstract

Survey of endod disease was conducted on newly established endod plantation at Gemadro locality Illubabor Zone, Ethiopia in the year 2000. Disease incidence was assessed on Getiba, Metti and E-44 types of endod and diseased roots and soil samples from the rhizospheres were also collected for disease identification. The results revealed that about 27.7% of type Getiba endod plants wilted and died, while type Metti and type E-44 were free from wilting. Subsequent laboratory investigations on root and soil samples evidenced the presence of a fungus, *Fusarium oxysporum* and parasitic nematodes namely *Rotylenchulus* sp, *Tylenchorhynchus* sp., *Helicotylenchus* sp., *Aphelenchoides* sp., and *Aphelenchus avenae*. It was therefore concluded that *Fusarium oxysporum* and parasitic nematodes were the causal agents of wilting and death in type Getiba endod plants. Using resistant stalks and avoiding infected fields can reduce the damage caused to endod plants.

Keywords: Diseases, endod, *Phytolacca dodecandra*, molluscicidal agents
Running title: Diseases of endod

Introduction

Endod is an Ethiopian vernacular name for the soapberry plant *Phytolacca dodecandra* of Phytolaccaceae family. Endod is a perennial, dioecious, and climbing plant with hanging branches. Under favourable conditions in Ethiopia, it fruits twice a year (Belli et al. 1994, Birgit 1989, Shibru 1994). The genus *Phytolacca* has a worldwide distribution and contains about 36 recognized species (Dalziel 1963). *P. dodecandra* has been reported in several countries of Africa south of the Sahara, some parts of South America and Asia (Dalziel 1963). According to Legesse and Kloss (1989), the ecological distribution of endod in Ethiopia is limited to highland regionshaving altitude of 1600–3000 meters and is rarely reported below 1400 m. It has small berries that are traditionally used for laundry purpose instead of soap. Besides its use for washing clothes, different parts of the plant are also widely recognized for their medicinal values, including their use as emetics, purgatives, abortifacients, antisyphilitic, and other purposes (Gelahun 1989). Endod was not a cultivated plant, but grows at the edges of forests, along roads, on river banks, and in barren areas near residentials (Belli et al. 1994). It has attracted the attention of plant researchers since its discovery by Aklilu Lemma in 1964 as mulluscicidal agent. It is useful in the control of intermediate hosts of important Schistosomes of man (Shibru 1994). This discovery has led to the initiation of research in the agronomy, chemistry, technology, medicine, and toxicology of endod (Belli et al. 1994, Shibru 1994).

Attacks of insect-pests, nematodes, fungi, and bacteria have been noted on different endod types grown at different experimental plots (Legesse 1994). But, the only identified insect-pest on endod so far in Ethiopia was *Gitona* spp. (Mediterranean fruit fly), which infests the apical buds. Nematodes and *Alternaria* sp. problems were reported in Zambia and Swaziland, respectively (Shibru 1994). But, there is no other information on diseases or pests of endod in various countries. Ethiopian Coffee and Tea Plantation and Marketing Private Limited Company has observed wilting and death on the newly planted endod plants in early 2000 and approached the Plant Protection Research Center for identification of the causal agents. Apart from the Mediterranean fruit fly, the occurrence of other insect-pests and diseases affecting endod has not been assessed in Ethiopia. The aim of this survey was to identify diseases that cause wilting and death of endod plants grown at Gemadro, Illubabor Zone, Ethiopia.

Materials and Methods

Disease survey was conducted in September 2000 at Gemadro, Illubabor Zone on endod plantation owned by Ethiopian Coffee and Tea Plantation and Marketing Private Limited Company. The area has an altitude of 2040 m. About 2071 type Getiba, 460 type Metti and 164 type E-44 endod plants have occupied about 2 ha of land. Incidence of wilted and dead plants was assessed on the three types of endod. Root and soil samples were collected for studies in the laboratory to determine whether the death of endod plants was due to biotic agents or abiotic stresses.

Samples were taken by classifying the endod plants into three arbitrary groups so that they represent different plant growth stages: transplanted, but at early growth stages; middle-aged; and old-aged plants. Samples were not collected from seedlings on nursery beds because they were raised in plastic pots and were not infected by the diseases. A total of 6 plant samples were taken, of which one was from the first, two from the second and three from the third group. Plants, which just started wilting, wilted and completely dead ones were included in the samples. The soil around each sample plant was dug out until all the roots were freed from the soil and the roots were pulled out.

Root samples were plated on potato dextrose agar (PDA) for isolation of bacteria while root and soil samples were tested for the presence of nematodes using maceration and Cobb's sieving and decanting methods, respectively (Southey 1986). In maceration method, the roots were cut into small pieces, i.e. 1–2 cm and blended with water and run for 30–60 seconds to isolate the nematodes. In the later method, the soil was crushed in a litre of water in a pan and stirred and left for 10 seconds to allow heavier particles to settle down. The suspension was then passed through 20-mesh sieve held horizontally. The filtrate was collected in another pan. The particles in the first pan were washed again and passed through the same sieve into the previously collected suspension. The solution in the second pan was then passed through 60-mesh sieve and the residue on the sieve was collected in a beaker using a thin stream of water. The residue suspension from 100-mesh sieve was carefully poured on double layer of facial tissue paper which was spread on aluminium netting, wetted with water and its edges turned up. The nettings having suspensions on them were placed inside petri plates containing water. This was allowed to stay for 24–48 hours and the nematodes found in the water in petri plates and those extracted from the roots were poured in small vials, and sealed. These specimens and roots of each sampled plant were sent to Plant Diagnostic and Advisory Service of CABI Bioscience, United Kingdom, for pathogens identification.

Results

Disease incidence was thoroughly assessed on the tree types of endod plants. Out of 2071 transplanted type Getiba endod plants, about 500 were pulled out before the survey was conducted because they were infected by the disease; 73 plants wilted and died during the survey. Totally, 27.7% of the plants wilted and died (Table 1). Most of the wilted plants were from old aged group and were found on the sloppy area of the field, with a negligible number scattered here and there in the plantation. Neither wilted nor dead plants were observed on types Metti and E-44 plants.

Table 1. Incidence of wilted and dead plants on the three types of endod, 2000

Type	No. of plants	Wilted & dead plants*	% incidence
E-44	164	0.0	0.0
Metti	460	0.0	0.0
Getiba	2071	573	27.7
Total	2695	573	-

* Out of 573 wilted and dead plants, 500 were pulled out before the survey.

The main roots or tap roots of most of the sampled plants were affected, mostly near the soil surface, showing a decay or rotting symptom. When the surface of these roots was touched by hand, the epidermis run out leaving the internal part of the roots with mucus like substance. Bacteria isolated from such roots and inoculated on the leaves of the test plants of tomato and tobacco seedlings showed a pathogenic reaction. However, subsequent inoculation of the bacteria isolates on seedlings of type Getiba did not show any positive reaction. So, it was concluded that the bacteria were saprophytic. From six root samples sent to Plant Disease Diagnostic and Advisory Service of CABI Bioscience of the United Kingdom, *Fusarium oxysporium* Schlecht was isolated from the middle and old aged plant samples and did not infect the plant from an early growth stage. A secondary pathogen, *F. pallidoroseum*, was also identified from a sample of the old age group (Table 2). Apart from fungi, parasitic and non-parasitic nematodes were found from the soil and root samples of type Getiba endod plants. At early growth stage, endod plant was free also from parasitic nematodes. The non-parasitic nematode *Rhabditid* was identified from this sample. One sample from the middle age group was affected by the fungi, but not by parasitic nematode. Another one from the middle age and all from the old age groups were infected by the fungus *F. oxysporum* as well as by different parasitic nematodes. The parasitic nematodes involved were *Rotylenchulus* sp., *Tylenchorhynchus* sp., *Helicotylenchus* sp., *Aphelenchoides* sp. and *Aphelenchus* . *avenae* Bastian. *Dorylaims* sp. that consist and include parasitic and non-parasitic species were also identified. The non-parasitic nematodes identified were *Rhabditid* and *Cephalobid* spp (Table 2).

Table 2. Pathogens and saprophytes isolated from the soils and roots of type Getiba endod plants, 2000

Sample	Fungus	Nematodes
Early growth stage	None	*Rhabditid*
Middle age growth stage	*F. oxysporium* Schlecht	*Cephalobid*
Middle age growth stage	*F.oxysporum*	*Aphelenchus avenae* Bastian *Helicotylenchus* sp. *Dorylaims, Rhabditid*
Old age growth stage	*F. oxysporum* & *F. pallidoroseum*	*Aphelenchoides* *Tylenchorhynchus*
Old age growth stage	*F. oxysporum*	*Rotylenchulus*
Old age growth stage	*F. oxysporium*	*Rotylenchulus*

Discussion

Type Getiba was free from the wilt disease at 2400–2500 m. but it was affected at altitude of 2040m where the plantation was located. Type Metti was originated from a low altitude area and it was not infected when it was planted at the plantation site that has a similar altitude. The change from high altitude areas to low altitude areas results in the changes in temperature, rainfall and soil environment. This might have created a favourable condition for the development and virulence of the fungus *Fusarium* and parasitic nematodes to infect type Getiba plants. These conditions might have aggravated the wilt disease on type Getiba plants. To the contrary, it is also possible to speculate that type Metti was not affected by the diseases because of the similarity of the environment of the place of origin and plantation site.

Fusarium oxysporum has a worldwide distribution. It occurs mainly as a soil saprophyte and survives as mycelial or chlamydospores (Booth 1971). Numerous strains of *Fusarium* species are serious pathogens of many crop plants. According to Booth (1971), pathogenic isolates of *Fusarium oxysporum* are able to infect the vascular system of susceptible plants, and cause symptoms that are consistent with wilting and plant death. These together with saprophytic strains have the ability to live almost indefinitely in soil with the result that normal crop rotation is not a practical solution (Booth, 1971). Chaube and Singh (1991) and Manners (1993) reported that *F. oxysporum* is often associated with nematode invasions.

Some plant parasitic nematodes form disease complexes with pathogenic fungi and bacteria. *Rotylenchulus* sp. can interact with *Fusarium* and *Verticillum* wilts of cotton. In an experiment, 81% of cotton plants susceptible to the nematode developed wilt in soil inoculated with both the nematode and *Fusarium*, where as only 10% of plants suffered wilt in soil inoculated with the fungus alone (Whitehead 1998). *Tylenchorhyncus,* and *Helicotylenchus* are parasitic on the roots of crops and many species of plants including several trees. *Aphelenchus avenae* occurs commonly in soil and infects the cortex of roots, especially if they are infected with fungi such as *Fusarium solani*, *F. oxysporum*, *Armillaria melea.* Even though there is no literature on diseases of endod plants, the aforementioned reports confirm that the fungi and nematodes can cause disease either singly or both to many species of plants as well as to type Getiba. In the later case, there could be synergistic effects on the disease development and death of the infected plants. This was true to the endod plants infected by both pathogens.

Incidence of several root-rotting fungi increases on the presence of nematodes. The *Fusarium* enters through wound caused by nematodes that reach the vascular system. These root symptoms are accompanied by reduced plant growth, wilting and reduced yield (Manners 1993). Symptoms observed on the above ground parts of the plants and on roots as well as the pathogens identified from the soil and roots of the susceptible type Getiba endod were similar with the ones described in literature. However, *F. oxysporum* does not typically cause the decay of the root cortex, and these symptoms suggest invasion by secondary pathogens like *Pythium* sp., and rot fungi (Manners 1993).

The results showed that wilting and death of type Getiba endod plants were outcomes of infections by either or both parasitic nematodes and *F. oxysporum*. Therefore, selected resistant endod stocks should be used for plantation. It is also important not to use the infected field for plantation or to use it as a sick plot for the selection of resistant endod types.

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