Allelopathic effect of leaf extract of *Azardirachta indica* and *Chromolaena odorata* against post harvest and transit rot of tomato (*Lycopersicum esculentum* L)

[1*] Ijato James Yeni, [1]Oyeyemi Sunday Dele, [2]Ijadunola John Ademola, [3]Ademuyiwa Justus Adeniran

[1]Department of Plant Science, Faculty of Science, University of Ado–Ekiti, P.M.B 5363. Nigeria.

E-mail: jamesyeni@yahoo.com; GSM: 08067335124

[2]Federal College of Agriculture, Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Nigeria.

[3]Department of Statistics, Federal Polytechnic, Ado-Ekiti, Nigeria.

Abstract: The aim of the present research was focused on the allelopathic effects of *Azardirachta indica* and *Chromolaena odorata* via *in vitro* approach. The aqueous and organic solvents (water and ethanol) extracts from leaves of *Azardirachta indica* Adr.Juss (*Meliaceae*) and *Chromoolaena odorata* (*Asteraceae*) where tested against fungal pathogens of rotten tomato (*Aspergillus niger*, *Fusarium oxysporum*, *Rhizopus stolonifer* and *Geotrichum candidium*) by poisoned food method. The results showed promising antifungal activity against the fungi tested. Among the various solvents with varying concentrations, aqueous extracts of 80% *Azardirachta indica* was found to have more inhibitory effect (65.20%) against *Rhizopus stolonifer* compared with other concentrations of 80% *Chromolaena odorata* (52.60%). Ethanol extracts of 30% *Azardirachta indica* had the best inhibitory effect (83.30%) against *Aspergillus niger* followed by 30% ethanol extract of *Chromolaena odorata* (80.00%) against *Geotrichum candidium* comparatively, 20% ethanol extract of *Azardirachta indica* (75.20%) against G. candidium inhibited than 20% ethanol extract of *Chromolaena odorata* (69.80%) against *Geotrichum candidium*. This finding proved the potentiality of the plant extracts for the control of post harvest and transit fungal rot of tomato fruit.

Ijato James Yeni, Oyeyemi Sunday Dele, Ijadunola John Ademola, Ademuyiwa Justus Adeniran. **Allelopathic effect of leaf extract of *Azardirachta indica* and *Chromolaena odorata* against post harvest and transit rot of tomato (*Lycopersicum esculentum* L).** Journal of American Science 2010;6(12):1595-1599]. (ISSN: 1545-1003). http://www.americanscience.org.

Keywords: *Azadirachta indica*, *Chromolaena odorata*, allelopathy, tomato fungal rot, Pathogens.

Introduction.

Tomato (*Lycopersicum esculentum*) originated from the Central America where it was then cultivated as an ornamental plant. Tomato belongs to the family *Solanaceae*. As a common vegetable crop, it rated second in significance to potato in many countries. Tomato is an important commercial crop in the world. Nutritional value of tomato makes it a widely accepted vegetable by consumers. Nevertheless, tomato is a very perishable crop with a short shelf life as well as high vulnerability to mycotic diseases. During extended storage, tomato fruits are prone to post harvest disease caused by various fungal pathogens. Control of tomato fruit rot has been by application of synthetic chemicals. However, these days' consumers request less use of chemicals and still want food devoid of corruptions, microbial growth, toxins as well as other qualities-deteriorating factors (Lingk, 1991).

Ripe tomato fruit has high vitamin C and potassium. More importantly, previous researches indicated that consumption of cooked tomatoes reduced cholesterol related cardiac diseases (Simon and Schuster, 1996). Tomato is essential in human diet; it can be prepared into stew, puree, salad etc. Despite the human need of tomato, its low yield as a result of disease infestation has being source of serious concern. Natural plant products and their analogues have been found as important sources of agricultural bio-pesticide which serve as antimicrobial properties of plant extracts (Cardelina, 1995, Okigbo 2009).

Antifungal properties of *Azardirachta indica* and *Chromolaena odorata* on fungal rot pathogens of post harvest tomato fruits are therefore aimed at in this finding. This is to serve as a relative alternative to the use of synthetic chemicals to extend the shelf life of tomato so as to reduce or eliminate loss due to post

harvest rot caused by phyto pathogens mainly fungi and the resultant economic loss to the farmers, traders and consumers.

Materials and Methods.

Collection of tomato fruits

Tomato fruits with symptoms of rot were randomly collected from the market stalls at Ado-Ekiti, Ekiti state, Nigeria. Softness of tissues of tomatoes was identified as being biologically deteriorated. Fresh and healthy tomatoes were also collected and packed into a sterile polythene bag already lined with soft paper and taken to the laboratory for further studies.

Collection of plant materials.

Azardirachta indica and *Chromolaena odorata* were collected in the premises of the University of Ado- Ekiti, Ekiti state Nigeria. These plants were taken to the herbarium unit of the University for Identification

Isolation of spoilage fungi from rotten tomato fruits.

Pieces of tomato were washed in a running tap these were cut from the periphery of a rotten tomato, these were surface sterilized in the plate with 70% ethanol for just 1minute, dropped on sterile soft paper and culture out on (Potato dextrose agar) already mixed with streptomycin. A minimum of four replicates pieces from each of the rotten tomato were cultured out. The Petri-dishes were incubated at 28 $\pm$ 2^0c for five days and observed for fungal growth. Fungi associated were re-cultured to obtain pure culture and the pure isolates stored in slant for further use. The frequency of occurrence was determined using the method of Okigbo and Ikediugwu (2000).

Pathogenicity test.

Cylindrical cores of 1cm deep were taken away from different spots of a fresh and healthy tomato fruits with the aid of sterile 5mm cork borer and then disc of 4mm was taken from the periphery/ core of a colony of five days old test fungus was placed downward into each hole in the tomato fruit. The core of the tomato fruit was replaced after 2mm pieces had been cut off to compensate for the thickness of the agar inoculum and then replaced core sealed with Vaseline (jelly). Sterilized potato dextrose agar (PDA) was used in place of the culture discs in the control set up**.**

Preparation of leaf extracts.

Azardirachta indica (leaf) and *Chromolaena odorota* (leaf) were collected and washed thoroughly under running water and allowed to air-dry for 7 days. These were grounded separately. Thirty grams of each sample was added to 15ml of distilled water in separate flasks. This was vigorously shaken and left to stand for 24hrs. The sample was filtered with 3-layer cheese cloth and filtrate extract preparation of 80% and 60% concentrations were used as the extracts. The same procedure was used for 30% and 20% ethanol extract.

Effect of plant extracts on mycelia growth of fungi

The approach of Amadioha and Obi (1999) was used to evaluate the allelopathic effect of the extracts on fungal growth by creating four equal sections on each plate by drawing two perpendicular lines at the bottom of the plate. The point of intersection indicated the centre of the plates. This was done before dispensing PDA into each of the plates. The extracts were poured into the flask, plugged with cotton and heated for about 10minutes to avoid contamination (Madari and Singh, 2005). About 2ml of the extract of various plant materials was separated introduced into the Petri-dish containing the media, (poisoned food method) (Nene and Thapilyal, 2002). A disc of 4mm diameter of the pure isolate each was placed on the extract in plate with PDA at the point of intersection of the two perpendicular lines drawn at the bottom of the plate. Control experiments were without addition of any plant extract but sterile distilled water. Fungitoxicity was determined in term of percentage colony inhibition % = $\frac{DC - DT}{DC} \times \frac{100}{1}$

Where DC - Average diameter of control

DT - Average diameter of fungal colony with treatment

Results

"Table 1 Percentage inhibition of radial growth of rot fungi cultured in potato dextrose agar poisoned with aqueous plant extracts of 60% and 80% concentrations."

Table 1. Plant extracts (% inhibition of mycelia growth)

Rot Fungi	*Azardirahta indica*		*Chromolaena odorata*		Control (mm)
	60%	80%	60%	80%	
Aspergillus niger	59.90a	60.00a	52.20a	53.30a	16.00
Fusarium oxysporum	48.20bc	62.50a	42.80c	45.20b	15.00
Rhizopus stolonifer	56.40ab	65.20a	54.80a	52.60a	16.00
Geotrichum candidium	46.70c	59.20a	45.60bc	52.30a	17.00

Each of the data is a mean of three replications. Each data followed by the same alphabet along the columns not significantly different at P= 0.05, using (DMRT) Duncan Multiple Range Test to separate the means.

Table 2: Percentage inhibition of mycelia growth of rot fungi grown in potato dextrose agar poisoned with ethanol plant extract of 20% and 30% concentration

Rot Fungi	Plant extract (% inhibition of mycelia growth)				
	Azardirachta indica		*Chromolalena odorata*		Control (mm)
	20%	30%	20%	30%	
Aspergillus niger	63.30b	83.30a	50.00bc	72.60ab	15.00
Fusarium *oxysporum*	69.60ab	79.80a	62.00a	74.70ab	17.00
Rhizopus stolonifer	63.30b	83.60a	47.80c	70.20b	16.00
Geotrichum candidium	75.20a	80.20a	69.80a	80.00a	16.00

Each of the data is a mean of three replacements. Each data followed by the same alphabet along the columns not significantly different at P= 0.05, using DMRT Duncan Multiple Test to separate the means.

The isolated spoilage fungi from infected tissues included: *Aspergillus niger*, *Fusarium* o*xysporum*, *Rhizopus stolonifer* and *Geotrichum candidium*. The results of the pathogenicity test showed that these rot fungi were able to cause deterioration after 7 days of inoculation. Both aqueous and ethanol extracts of the test plants of *Azardirachta indica* and *Chromolaena odorata* were able to reduce the radial growth of the fungal mycelia. (Tables 1 & 2), 80% aqueous extract of both *Azardirachta indica* and *Chromolaena odorata* reduced the mycelia growth more than the compared 60% aqueous extract of the respective plants (Table 1). The same thing was recorded in 30% ethanol extract inhibited in both test plants than 20% ethanol (Table 2).

The highest of 80% aqueous extract of *Azardirachta indica* inhibition of 65.20% was recorded against *Rhizopus stolonifer* (Table 1). *Azardirachta indica* was able to cause inhibition up to 83.60% and 83.30% using 30% ethanol against *Rhizopus stolonifer* and *Aspergillus niger* respectively. Inhibition 75.20% was attained with 20% ethanol extract of *Azardirachta indica* against *Geotrichum candidium*. *Chromolaena odorata* using 30% ethanol extract had the highest inhibition of 80.00% against *Geotrichum candidium*. Higher concentration percentage of ethanol extract favoured better inhibition also aqueous extract. *Azardirachta. indica* seemed to possess more efficacy cumulatively than *Chromolaena odorata* irrespective of the extractive mode (solvents).

Discussion

The microbes linked with the post harvest deterioration in this finding were: *Geotrichum candidium*, *Rhizopus stolonifer*, *Fusarium oxysporum* and *Aspergillus niger*. Both the test plants: *Azardirachta indica* and *Chromolaena odorata* had inhibitory effect on post harvest rot pathogens of

tomatoes in aqueous and ethanol solvent of varied concentrations. Extracts of *Azardirachta indica* and *Chromolaena odorata* have been reported to have antimicrobial properties. *Azardirachta indica* of the family *Meliaceae* contains secondary metabolite of alkaloid and terpenes which can be used to cure dermal diseases.

The derivatives of *Azardirachta indica* are of great use in agriculture, public health, medicine, cosmetics and many more. Its leaves, bark, seed and flower are bitter, astringent, acrid, depurative, refrigerant, demulcent, insecticidal, expectorant, liver tonic etc. *Chromolaena odorata* of the family Asteraceae is used to cure diabetic mellitus and malarial. Hycenth (2008) reported the antifungal effect of *Azardirachta indica* against yam rot pathogens (*Rhizopus stolonifer*). Siva *et al.* (2008) used *Azardirachta indica* to inhibit *Fusarium oxysporum* (wilt pathogen) of *Solanum melogena* (egg plant). Nahed (2007) improved biological control of fusarium root rot in cucumber (*Cucumis sativum* L) by *Azardirachta indica*. Vigorous inhibition of soil borne pathogenic fungal growth using *Azardirachta indica* was reported by Paul and Sharma (2002). Okigbo and Ajalie (2005) inhibited some human pathogens with *Chromolaena odorata*. Amadioha (2000) was able to control rice blast *in vitro* and *in vivo* with extract of *Azardirachta indica.* In Nigeria, plant extracts have been used to inhibit fungal diseases of plants such as cowpea (Alabi, *et al* 2005),banana (Okigbo and Emoghene, 2004), yam (Okigbo and Nmeka 2005), cocoyam (Eunice, et al 2008), and sweet potato (Amienyo and Ataga, 2007) . The extracts of *Azardirachta indica* and *Chromolaena odorata* could be used as bio-pesticides against tomato fruit rot caused by fungal pathogens, these plants are economical and save to handle.

Correspondent Author:

Ijato James Yeni.

Department of Plant Science, Faculty of Science, University of Ado–Ekiti, P.M.B 5363. Nigeria.

jamesyeni@yahoo.com

GSM: 08067335124

References.

Okigbo, R.N. Variation in phytochemical properties of selected fungicidal aqueous extract of some plant leaves in Kogi State, Nigeria. A*merican-Eurasian J. of Sust. Agric.* 2009; 3 (3): 407-409.

Hycenth, N. Effect of different plant extracts in the control of yam (*Dioscorea* sp) in Yola, Adamawa state, Nigeria. *Nigeria. Agric. J.* 2008; 3 (5): 382-387.

Siva, N, Ganesan, S, Banumatty, N and Mutthuchelian. Antifungal effect of leaf extract of some medicinal plant against *Fusarium oxysporum* causing wilt disease of *Solanum melongena* L. *Ethnobot. Leaflets* 2008; 12:156-163.

Paul, P.K and P.D Sharma. *Azardirachta indica* leaf extract induced resistance in barley against leaf stripe disease. *Physiol .Molec. Pl. Pathol.* 2002; 16:3-13

Okigbo, R.N and Ajalie, A.N. Inhibition of some human pathogens with tropical plants extracts *Chromolaena odorata* and *Citrus aurantifolia* and some antibiotics. *Int. J. Mol. Adv. Sci. (Pakistan).* 2005 1 (1): 34-40.

Madari,S and R.P Singh. Management of mushroom pathogens through botanicals. *Ind. Phyto Patho*l. 2005; 58:189-193.

Okigbo, R.N and Ikediugwu, F.E.O. Studies on biological control of post-harvest rot of yam *Dioscorea* spp with *Trichoderma viride*. *J. Phytophathol*. 2000; 148:351-355.

Amadioha, A.C and Obi,V.I. Control of anthracnose disease of cowpea *Cymbopogon citratus* and *Ocimum gratissimum*. *Acta phytopathol. Entomol. Hungeric*a.1999; 34(92): 85-89.

Nahed, Z.H. Improving Biological Control of *Fusarium* root rot in Cucumber (*Cucumis sativus L.*) by allelopathic plant extracts. *Int. J. of Agric. and Biol*. 2007; 1560-8530/2007/09-3-459-461.

Lingk, W. Health risk evaluation of Pesticides contamination in drinking water. *Gesunde Pflaunge*, 1991; 43:21-25.

Cardelina, J.H. Natural products in the search for new agrochemicals. In H. G. Gulter, (Ed). Biologically active natural products. Potential use in agriculture. 1995; Pp 305-311

Nene, Z.H and Thapilyal. Management of mushroom pathogens through botanicals. *Ind. Phytopathol*. 2002; 58:189-193.

Amienyo, C.A and Ataga, A.E. Use of indigenous plant extracts for the protection of mechanically injured sweet potato *(Ipomea batatas* (L) Lam) tubers. *Scientific Research and Essay*. 2007; Vol 2 (5) pp. 169 – 170

Alabi; D.A, Oyero, I. A. Jimoh, Amusa, N.A. Fungitoxic and phytotoxic effect of *Venonia amygdalina* (L), *Bryophllum pinnatum* (known) *Ocimum gratissimum* (Closium) L. and *Eucalytus globule* (Caliptos) Labil water extract on cowpea and cowpea seedling pathogens in Ago-Iwoye, South West Nigeria. *World of Agric Sci*. 2005; (1) 70-75

Eunice O, Nwachukwu, Osuji J.O. Evaluation of plant extract for antifungal activity of *Cassia alata* and *Dennetia tripetala* against *Sclerotina rolfsi* causing cocoyam cornel rot in storage. *J. of Agric and Biol. Sci.* 2008; 4(6): 784-788

Okigbo R. N. and Nmeka A. I. Control of yam tuber rot with leaf extracts of *Xylopia aethiopica* and *Zingiber officinale. Afri. J. Biotechnol.* 2005; 4(8): 804 – 807

Okigbo, R. N and Emoghene A. O. Antifungal activity of leaf extract of some plant species on *Mycospharella fijiensis* merelet, the causal organism of black sigatoka disease of banana (*Musa acuminata*). *KMITL. Sci. J.* 2004; 4:20-31

Amadioha,A. C. Controlling rice *in vitro* and *in vivo* with extracts of *Azardirachta Indica*. *Crop Protection.* 2000; 19:287-290

11/20/2010