Fungal Seed Borne diseases of Jatropha curcas and their *in-vitro* Control Measures

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Abstract

Laboratory studies were conducted to determine the prevalent fungi on the leaves and seeds of *Jatropha curcas.* Also, biocidal effect of leaves and seeds of *J. curcas* was carried out on the predominant fungal isolates. The medium used for the isolation of fungi was Potato Dextrose Agar (PDA). Identification of the fungi was by morphological and cultural characteristics. The result showed that the predominant fungi which occurred on leaves and seeds of *J. curcas* include: *Fusarium oxysporium, Rhizopus stolonifer, Penicillium sp.* and *Aspergillus niger.* The result on the percentage frequency of fungi demonstrated that *Fusarium oxysporium* (20.8%) had the highest percentage frequency, followed by *Rhizopus stolonifer* (14.8%); *Penicillium sp.* (7.2%) and the least *Aspergillus Niger* (8.3%). 5ml concentration of *Jatropha* leaf and seeds extracts had the highest inhibitory effect on the isolated fungi. This study therefore, suggests that some pathogenic fungi do occur on *J. curcas.* Also, control of these fungi is possible through the use of plant leaf and seed extracts of *J. curcas*. The method is cheap, environmentally friendly and affordable to local farmers.

Keywords: Jatropha curcas biocidal, fungal pathogens, inhibitory

Introduction

Jatropha curcas (Linn) is a species of flowering plant in the spurge family Euphobiacae. *Jatropha* is native to the American tropics, Mexico and Central America. It is cultivated in tropical and subtropical regions around the world, becoming naturalized in some areas. The specific name *curcas*, was first used by Portuguese doctor, Garcia de Orta more than 400 years ago and is of uncertain origin. Common names include Barbados Nut, Purging Nut, Physic nut, or JCL (abbreviation of *Jatropha curcas* Linnaeus).

J. curcas is a drought resistant shrub or small tree with a grey bark that grows up to 20 meters tall under favourable conditions with spreading branches. It has yellow-green flowers and large heart-shaped (pale) green leafs, arranged alternately. The inflorescence is formed in the leaf axil; flowers are formed terminally, individually, with female flowers usually slightly larger (Duke and Ayensu 1985).

Fig. 1: *Jatropha curcas* plant

There are male and female plants of this plant and pollination is done by insects (bees). The seed pod (a three, bi-valved cocci) contains 2-3 large black, oily seeds. These seeds, about 2 ½ cm, long, become mature when the fruit changes from green to yellow (Duke and Ayensu, 1985).

Fig. 2: *Jatropha curcas* seeds

The black, thin shelled seeds are considered toxic, they contain the toxalbumin curcin and this makes them fatally toxic; there are however non toxic varieties. Roasting the seeds though seems to kill the toxic. However, they also contain a high percentage of clean oil used for candles, soap and biofuel production. *J. curcas* has insecticidal – and fungicidal properties. It has latex that contains an alkaloid (jatrophine) which shows anti-cancerous properties. The constituents are: alkaloids, tannins, sapogenins, ethereal oils, toxalbumins and cyanogenic compounds (Little,1974).The plant *Jatropha curcas* has several economic importance, which include, non-edible oil extraction from the seeds (biodiesel), live fence stick etc. Physic nut is a folk remedy for burns, convulsions, cough, dermatitis, diarrhea, dropsy, dysentery, dyspepsia, eczema, fever, gonorrhoea, inflammation, pneumonia, rash, rheumatism, scabies, sores, stomach ache, syphilis, tetanus, thrush, tumors, ulcers, whitlows, and yellow fever (Duke and Wain, 1981). *J. curcas*, though a tropical rainforest species, is not common in our environment, the few that are found cannot flower and fruit frequently due to pests/fungal attack, thereby hindering its growth and development. Several important diseases which attack *Jatropha curcas*, among others are spots on seedling, Alternaria spots, rust, Cercospora, leafspots, Fusarium wilt, Botrytis spoiled and bacteria leaf spots (Mitchell and Rook, 1979).This research is therefore focused on studying the fungal seed borne diseases of *Jatropha curcas*. To determine the percentage frequency of the predominant fungi on *Jatropha curcas* seeds and to control the predominant fungi, using *Jatropha curcas* seed and leaf extracts.

Materials and Methods

(1) Determine of predominant fungi/ percentage frequency of the predominant fungi on the seeds of *Jatropha curcas.*

Ten seeds were placed on wet-blotter paper and incubated at room 25^0C for 7 days for sporulation. A total of ten Petri-dishes were used for this experiment. Percentage frequency (%) was determined using the method below:

$$\% \text{ frequency} = \frac{\text{No. of fungi on each Petri dish}}{\text{Total no. of fungi on all the Petri Dishes}} \times 100$$

(2) Control of predominant fungus using

***Jatropha curcas* seeds and leaf extracts.**

The seeds of *Jatropha curcas* were collected and placed on [Potatoe Dextrose Agar (PDA) in Petri-dishes and incubated for 7 days, at 25^0C. The emerging fungi were isolated and identified using stereo-binocular and compound microscope. 10gm each of healthy *Jatropha curcas* leaves and seeds were collected, ground with 5ml distilled water to get the extract: 1ml, 2ml, 3ml, 4ml, 5ml extract of the leaves and seeds and pipetted on PDA containing the predominant fungi and incubated at 25^0C for 7 days. Lateral growth (cm) of the predominant fungi was measured using a calibrated ruler.

3.2 **Experimental design**

Statistical method used was Duncan's Multiple Range Test (DMRT). Complete randomized block design (CRD) was used as the experimental design.

Results and Discussion

Isolation and identification of fungi from dried seeds of *Jatropha Curcas*

Fusarium oxysporium, Rhizopus stolonifer, Penicillium sp., Aspergillus niger were fungal pathogens identified on dried seeds of *Jatropha curcas* based on their morphological and conidial characteristics. This result is shown on Table 1.

Table 1: Isolation and identification of fungi from dried seeds of *J. curcas*

S/N	Fungal Isolates
	Fusarium oxysporium
	Rhizopus stolonifer
	Penicillium sp.
	Aspergillus niger

The result on percentage frequency of fungi on the seeds of *Jatropha curcas* indicated that *Fusarium oxysporium* had the highest percentage frequency (20.8%), *Rhizopus stolonifer* (14.8%) followed by Penicillium sp. (7.26%) while *Aspergillus niger* (8.3%) was the least (Table 2).This result conforms to the works carried out by Mitchell and Rook (1979).These Authors showed that *Fusarium oxsporium*, *Cercospora* species are pathogenic on *J.curcas* seedlings.

Table 2: Percentage frequency of isolated fungi on *J. curcas* seeds

S/N	Fungal Isolates	Percentage (%) Occurrence
	Fusarium oxysporium	20.8
	Rhizopus stolonifer	14.8
	Penicillium sp.	7.2
	Aspergillus niger	8.3

Effects of Leaf Extracts of Jatropha curcas on Fungi Growth

The effects of leaf extracts of *Jatropha curcas* on the pathogen showed that at 5ml concentration, the extract inhibited the mycelial growth of *Fusarium oxysporium* (1.03cm); followed by *Rhizopus stolonifer* (1.20cm); *Penicillium sp.* (2.82cm); *Aspergillus niger* (3.45cm) while 0ml (untreated fungi) had the highest mycelia growth. Ukoima *et al* (2012) showed that leaf extracts of J.curcas inhibited the growth of *Lasdiplodia theobromae,Penicillium citrinum,Aspergillus niger and Paecilomyces lilacinus* at 100% concentration. The inhibitory effect was attributed to the presence of quinone,terpenoid and saponin by these Authors.

Table 3: Effect of Leaf Extracts of *J. curcas* on fungal growth

S/N	Fungal Isolates	Leaf Extracts			
		0ml	2ml	4ml	5ml
1.	*Fusarium oxysporium*	6.24^b	5.41^b	1.35^d	1.03^c
2.	*Rhizopus stolonifer*	7.02^a	4.88^c	2.26^c	1.20^c
	Penicillium sp.	6.29^b	6.08^a	3.10^b	2.82^b
	Aspergillus niger	7.89^a	6.47^a	4.23^a	3.45^a

Mean values with similar letters per column are not significantly different (P < 0.05) by DMRT.

Effect of *Jatropha Curcas* Seed Extract on Fungi Growth

Results on the seed extracts of *Jatropha curcas* showed that at 5ml concentration, there was significant reduction on the growth of *Rhizopus stolonifer* (1.00cm); *Fusarium oxysporium* (1.02cm); *Aspergillus niger* (1.90cm); *Penicillium sp.* (2.11cm) while 0ml which served as the control had the highest growth of the fungal pathogen. This result agrees with the works of Ukoima *et al* (2012) as the works of Pendey *et al* (1983),who extracted oil from caecilian axillaries which was reported to be superior to eight synthetic fungicides and it exhibited the strongest toxicity against the leaf spot disease of virile caused by *Helminthosporium ovyde* .This result is demonstrated on table 4.

Table 4: Effect of *Jatropha curcas* Extracts on Fungi Growth (cm)

S/N Fungal Isolates Seed Extracts				
	0ml	2ml	4ml	5ml
1. *Fusarium oxysporium*	6.86^{a}	5.88^{a}	3.02^{a}	1.02^{b}
2. *Rhizopus stolonifer*	5.29^{b}	4.53^{b}	3.26^{a}	1.00^{b}
3. *Penicillium sp.*	4.62^{b}	3.51^{c}	3.31^{a}	2.11^{a}
4. *Aspergillus niger*	3.81^{c}	1.95^{d}	1.42^{b}	1.90^{a}

Mean values with similar letters per column are not significantly different (P < 0.05) by DMRT.

CONCLUSION AND RECOMMENDATION

This research revealed that the predominant f ungi which occurred on the seeds of J.curcas were; *Fusarium oxysporium, Rhizopus stolonifer, Penicillium sp.* and *Aspergillus niger* .Also, the effect of leaf extract of *Jatropha curcas* on the pathogens showed that at 5ml concentration, the extracts inhibited the mycelial growth of the isolated fungi. This is important especially as there is an increasing interest in biological control research. More so, the use of leaves of *Jatropha curcas as* biocides and its seeds have proven a strong approach to leafy vegetable disease management. Indeed, it provides a good alternative to chemical pesticides. It is therefore recommended that more research should be done in the area of biochemical properties of *J.curcas*.

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