Incidence and Severity of Foliar Diseases of *Jatropha curcas* in Abuja, Nigeria

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Abstract

A survey of major foliar diseases of physic nut (*Jatrophacurcas* L.) family Euphorbiaceae was conducted in the Federal Capital Territory (FCT), Abuja, Nigeria. Data were collected from the six area councils consisting of 180 fields with 900 samples of *Jatrophacurcas* plants. At each field, five cultivated *J. curcas*plants were studied in order to establish the occurrence and prevalence of foliar diseases of *J. curcas* in the area. Results revealed the presence of Jatropha Mosaic Disease (JMD) and Jatropha Leaf spot disease (JLSD) in all the surveyed areas of the Area Councils. Jatropha Mosaic Disease (JMD) incidence ranged between 0% during the raining season and 99.06% during the dry season and varied significantly (P<0.05) between the different locations and growing season. JMD and JLSD incidence was significantly higher in the dry season than in the raining seasons. The findings of the survey indicated that JMD and JLSD were prevalent in Kwali and Abaji area councils. The outcome of this study could serve as base information for necessary disease control measures.

Key words: Incidence, Severity, foliar diseases, *Jatrophacurcas*, FCT-Abuja

Introduction

Physic nut, a deciduous monoecious shrub of up to 5-8 m tall, is widely cultivated plant in the tropics as a living fence in fields and settlements as it is not usually browsed by grazing animals (Farooqi, 1999). It can be grown in areas with low rainfall and non-croppable sites and can grow without protection. Jatrophacan adapt to marginal areas with poor soils, where it grows without competing with annual food crops, thus filling an ecological niche (Hudge and Datar, 2010).

Preparations of all parts of the plant including seeds, leaves and bark, fresh or as a decoction are used in traditional medicine and veterinary purposes. An important use of this specie is for erosion control, checking desertification and more importantlyfor oil production. Heller(1996) reported that its considerable potential as an oil crop for bio-fuel purposes at relatively low costs and modest demands on the local agro-ecosystem has received much attention in recent years(Patil and Singh,1991). *Jatropha* latex is reported to be effective against fungal pathogen. Another argument for the cultivation of the oil crop for energy purposes is the increasing global warming/greenhouse effect. When these fuels are burned, the atmosphere is not polluted by carbon dioxide, since this has already been assimilated during the growth of these crops. The CO_2 balance, therefore, remains equable (Hudge and Datar,2010).

Investigation into the biotic problem of the plant serving as alternative host to some crops disease and pest is germane. There are scanty reports on the pest and diseases of *Jatrophacurcas* in Nigeria, thus this study assessed the incidence and severity of foliar diseases of *J.curcas* in the FCT Abuja, Nigeria. This could serve as base information for necessary control measures.

Materials and Methods

Study area

A survey of incidence and severity of foliar diseases of *J. curcas* in the six area councils of the FCT-Abuja was carried out in raining season in September, 2011 and dry season in March, 2012. The studied area was the six area councils namely:Gwagwalada,Abaji, Kuje, AMAC, Bwari and Kwali.It is geographically located in the heartland of Nigeria and falls between Lat. 08^{o} 25^{l} and 09^{o} 21^{l} N of the Equator and Long. 6^{o} 45^{1} and 7^{o} 39^{1} E of the Greenwich Meridian in the southern Guinea Savanna agro-ecological zone of Nigeria.

Survey procedure

Assessment of the number of diseased plants and leaveswere done randomly on 180 plants per area council. The total number ofdiseasedplants per sampled plant were counted and expressed as percentages. The number of diseased leaves on both the buds and the main stem was obtained from five randomly tagged plants per location andwas expressed as a percentage.

Disease severity (DS) for leaf spot was assessed at the two seasons through the count of lesion number per leaf and rating of symptom expression with the aid of a visual scale (Table 1). For the count of lesion number, five plants per plot were selected and on each plant, the number of lesions on a quarter (¼) of the area of one leaf at the second node was counted (Enikuomehin*et al*. 2010). Treatment means were compared using ANOVA and significantdifferences were identified through Duncan's multiple range test (DMRT).

Scale rating leaf spot characteristics

0: No disease No trace of infection
1: Trace of infection Small lesions on lower leaves only
2: Slight infection Small lesions on upper and lower leaves and stem
3: Moderate infection: Advanced lesions on upper and or lower leaves, with or without new infections on stem and petiole. Advanced lesion is characterised by a dark to dark-brown spot with a whitish to straw-coloured or perforated center (Enikuomehin*et al*. 2010).
4: Severe infection Advanced lesions on upper and lower leaves, flower, buds, flowers,
stems, petioles and slight infection of pod
5: Very severe infection all features of above five with severe infection of pod

Disease assessment of JMD

Disease assessment included scoring plants for the presence of disease symptoms (JMD incidence) and degree of symptom expression (JMD severity). Within each field, 10 sampling quadrants of 8m x 8m (c.81 to 120 plants) were randomly chosen. Each plant in the quadrant was examined for the presence of JMD symptoms. JMD incidence was determined by counting the number of infected plants in each quadrant and expressed as the proportion of infected plants in the quadrant. The average of the 10 quadrants was used as disease incidence for each field. Similarly, JMD symptom severity was determined on each plant in the 10 quadrants and their average used as disease severity per field. A scale of 1 to 5, where 1 represents symptomless (healthy) plants and 5 very severely affected plants, with leaf chlorosis, reduce leaf size and stunting of plants (Legg and Raya, 1998) was used to determine disease severity.

Statistical Analysis

Incidence and severity data from different locationswere compared using a one-way analysis of variance (ANOVA) in SPSS version 17 computer programme.

Result

Table 1 shows that the percentage incidence of Jatropha Mosaic Disease (JMD) and Leaf Spot Disease(JLSD) in the six Area Councils surveyed were higher in the dry season than in the raining season. The highest incidence of JMD in the raining season was in observed in Gawu (43.23%) while the least was in Kubwa in Bwari Area council (4.03%). During the dry season, the highest incidence of JMD was observed on the Jatropha field in Phase III in Gwagwalada (93.58%). For the JLSD, the highest incidence in the raining season was in Sheda, Kwali (45.76%) while there was none in Chukuku field (0%). The incidence of JLSD was highest during the raining season in FGGC, Abaji with 99% incidence.

Other minor diseases of Jatropha of minor importance in the FCT, Abuja are Fusarium wilt and root-rot diseases which are common during seedling stage.

Table 1: Incidence of Jathropha Mosaic and Leaf Spot Diseases in Six Area Councils of the FCT, Abuja

		Jatropha Mosaic Disease Incidence		Leaf Spot Disease Incidence	
Area Council	**Location**	**Raining season (2011)**	**Dry season (2012)**	**Raining season (2011)**	**Dry season(2012)**
Gwagwalada	Zuba	9.00	78.67	31.78	73.55
	Paiko-kore	12.85	52.68	12.62	40.00
	Phase III	20.07	93.58	17.89	65.33
	Giri	18.73	75.05	19.17	50.09
	Dobi	20.44	76.88	2.18	12.30
	Dukpa	10.66	22.78	5.86	15.23
Kuje	Chukuku	4.73	42.30	0.00	6.05
	Chibiri	12.34	35.45	12.21	21.88
	Rubochi	18.66	46.57	18.67	33.00
	Gwagwada	17.56	56.09	23.56	40.66
	Kuje	20.00	45.88	16.78	50.98
	Saagi	15.66	40.02	21.43	44.34
Bwari	Kubwa	4.03	48.34	13.45	12.08
	Bwari	21.34	58.35	23.61	22.38
	Sere	12.68	46.05	22.00	45.57
	Ijah	17.33	46.52	18.13	62.24
	Dutse	28.52	65.07	12.77	43.21
	IITA, Kubwa	18.26	65.07	19.65	72.97
Kwali	Dobi	38.15	99.06	38.27	91.44
	Sheda	24.56	79.66	45.76	72.84
	Kwali	29.74	82.51	30.34	83.67
	Kilankwa	40.67	69.90	32.72	88.87
	Piri	39.64	88.76	24.65	77.19
	FGC	24.78	87.08	35.86	98.59
Municipal	UniAbuja farm	7.43	54.28	3.45	12.98
	Karu	10.83	45.48	8.26	33.02
	Jabi	20.56	36.57	19.55	28.18
	Yanyan	17.35	46.11	13.86	44.65
	Kuchingoro	18.15	55.00	22.88	22.98
	Area 10	12.36	50.03	21.80	47.93
Abaji	Gawu	43.23	78.99	32.23	80.55
	Yaba	34.56	69.56	35.26	62.75
	Abaji	38.78	72.54	40.54	82.97
	Pandagi	42.87	69.95	42.13	78.88
	FGGC, Abaji	29.65	78.86	44.27	99.00
	Dangara	34.98	77.98	38.97	88.54
Mean		21.98	62.17	22.85	52.91

[a]Incidence represents average population of infected plants (%). All values are the means of six fields at each location.

It was shown that the percentage severity of JMD and JLSD in the six Area Councils surveyed were also higher in the dry season than in the raining season (Table 2). All the fields had a symptom of the JMD but with varied degree of severity. The highest severity index of JMD in the raining season was in observed in Piri in Kwali area council (3.08) while the least was in Paiko-kore in Gwagwalada Area council (0.91). During the dry season, the most severe JMD field was observed on the Jatropha field in Pai, Kwali (4.88). For the JLSD, the field with highest severity in the raining season was in Sheda, Kwali (2.87) while the severity was zero in Chukuku, Kuje field (0.0). The severity of JLSD was highest during the dry season in Pai, Kwali with 4.82 severity index.

The mean incidence of JMD in the raining season on jatropha field in Abaji was significantly ($P \leq 0.05$) higher than other fields in the FCT, Abuja (Table 3). During the dry season, it was Kwali fields that significantly ($P \leq 0.05$) had the highest number of infected plants. The severity of JMD on Bwari ,Abaji and Kwali was not significantly ($P > 0.05$) different from each other in raining season. Though the incidence of JMD was high in Abaji during the raining season, it was not as severe as that of Kwali, Gwagwalada and Bwari. It was observed in the raining season that the incidence of JLSD was significant ($P \leq 0.05$) higher on Abaji fields than all other fields. During the dry season, the incidence was also significantly high in Abaji just like that of Kwali.

Table 2 Severity of Jathropha Mosaic and Leaf Spot Disease in Six Area Councils of the FCT, Abuja

		Jatropha Mosaic Disease Severity[b]		Leaf Spot Disease Severity	
Area council	**Location**	**Raining season (2011)**	**Dry season (2012)**	**Raining season(2011)**	**Dry season (2012)**
Gwagwalada	Zuba	1.10	4.12	1.24	4.31
	Paiko-kore	0.91	3.34	1.34	4.66
	Phase III	1.17	4.67	1.21	3.03
	Giri	2.36	3.45	1.00	3.12
	Dobi	2.22	4.23	0.89	1.26
	Dukpa	1.12	3.66	0.45	1.95
Kuje	Chukuku	1.56	2.89	0.00	1.04
	Chibiri	2.12	2.97	1.98	1.45
	Rubochi	1.67	3.30	1.18	1.83
	Gwagwada	2.20	3.05	1.99	2.32
	Kuje	2.30	3.47	2.15	2.38
	Saagi	2.13	2.21	1.97	4.38
Bwari	Kubwa	2.21	3.83	1.43	2.14
	Bwari	2.64	4.45	1.34	2.32
	Sere	2.90	4.18	1.67	2.98
	Ijah	2.00	3.63	1.17	3.29
	Dutse	1.76	3.90	1.56	2.56
	IITA, Kubwa	2.65	3.35	1.14	4.43
Kwali	Pai	2.23	4.88	2.57	4.82
	Sheda	2.11	4.56	2.87	4.32
	Kwali	2.10	3.32	1.50	4.87
	Kilankwa	2.67	4.34	1.95	4.76
	Piri	3.08	4.36	2.63	4.34
	FGC	1.20	3.64	2.54	4.91
Municipal	UniAbuja T&R farm	1.78	2.33	1.00	1.34
	Karu	2.56	3.34	1.09	2.54
	Jabi	2.53	2.62	1.98	1.94
	Yanyan	1.65	3.21	1.33	4.06
	Kuchingoro	2.03	4.13	1.97	2.08
	Area 10	1.97	3.98	1.20	4.00
Abaji	Gawu	2.14	2.74	1.52	4.45
	Yaba	2.54	2.54	2.23	3.81
	Abaji	2.53	2.93	2.06	4.49
	Pandagi	2.42	2.42	2.72	4.21
	FGGC, Abaji	1.92	2.12	2.07	4.72
	Dangara	2.18	2.78	1.78	4.10
Mean		2.15	3.42	1.63	3.31

[b]Severity based on 0-5 scale where 1 = no symptoms and 5 = severe infection on the number of lesions on a quarter (¼) of the area of one leaf. All values are the means of six fields at each location.

Table 3: Incidence and Severity of Jatropha Mosaic and Leaf Spot Diseases in Six Area Councils of the FCT, Abuja

Area Council, FCT	**Jatropha Mosaic Disease** Incidence		Severity		**Leaf Spot Disease** Incidence		Severity	
	Rain season (2011)	Dry season (2012)	Rain season (2011)	Dry season (2012)	Rain season (2011)	Dry Season (2012)	Rain season (2011)	Dry Season (2012)
Gwagwalada	15.29c	66.61c	1.48c	3.91a	14.92c	42.75b	1.02d	3.06b
Kuje	14.83c	44.39e	1.97b	2.98bc	15.44c	32.81c	1.55c	2.33d
Bwari	17.03c	54.90d	2.36a	3.89a	31.32b	43.08b	1.39c	2.95b
Kwali	32.92b	84.58a	2.23a	4.18a	34.60b	85.43a	2.34a	4.67a
Municipal	14.44c	47.91e	2.09b	3.27b	14.97c	31.67c	1.42c	2.66cd
Abaji	37.35a	74.65b	2.28a	2.59c	38.90a	82.13a	2.06b	4.40a

All values are the means of six locations at each Area Council. In each column, the means followed by the same letter(s) are not significantly different (P=0.05) when subjected to Duncan's Multiple Range Test (DMRT).

Figure 1 indicated that the mean incidence and severity of Jatropha mosaic and leaf spot diseases were more severe in dry season than in the raining season in the Federal Capital territory, Abuja.

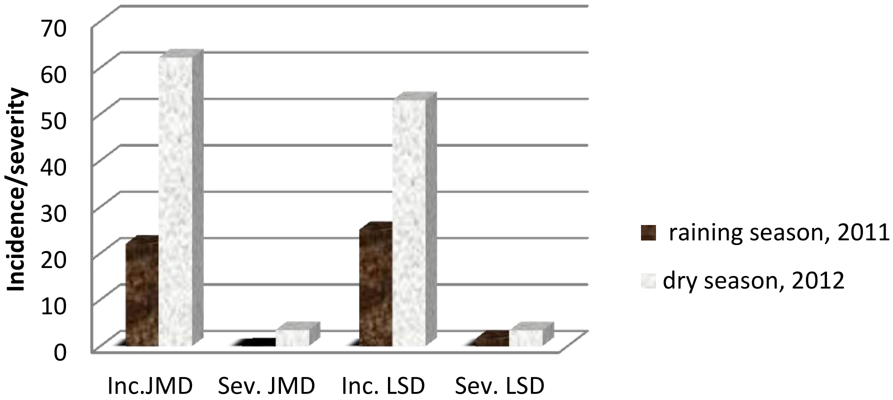

Fig. 1. Incidence (Inc.) and Severity (Sev.) of Jatropha Mosaic Disease (JMD) and Leaf Spot Disease (LSD) in Jatropha field in Abuja, Nigeria

Discussion

Some authors claim that few, if any, pests and diseases afflict *Jatropha*. This is generally attributed to the plant's toxicity and insecticidal qualities (Shanker, 2006; Nielsen, 2007).These claims have been quite roundly disproven byempirical evidence from the field, which shows that *Jatropha*is susceptible to many pests and diseases (Benge,2006).However, several authors reported varied foliar diseases observed on physic nut plants. Among them is*Phytophthora* spp., *Pythium* spp., damping- off, Fusarium wilt and *Clitocybetabescens*root-rot diseases(Heller, 1992). Others are *Helminthosporiumtetramera* leaf spots and *Pestalotiopsisparaguarensis* leaf spots (Patti and Singh, 1991);*Cercosporajatrophae-curces* leaf spots (Liu *et al*., 1996). However, it should be pointed out that the physic nut is a host for cassava viruses that can be transmitted. Okoth (1991) states that cassava superelongation disease (*Sphacelomamanihoticola*) can be transmitted from the physic nut. He further reported that another *Jatropha*species, *J. multifida*, is an alternate host plant for African Cassava Mosaic Virus (ACMV), which is transmitted by whiteflies (*Bemisiatabaci*) in India and East and West Africa. It can be assumed that this also applies to physic nut. Since this plays an important role in disease epidemiology, physic nut should not be used to fence in cassava fields (Crothers, 1994; Hudge, 2010). In Zimbabwe and Kenya, powdery mildew damages leaves andflowers, *Alternaria*causes premature leaf fall and "frogeye" fungus (*Cercospera*spp.), which iscommon in tobacco plants, have been reported(Tewari and Nayak, 1991).

In contrast to our observation of severe infection of JMD in the surveyed area, Tewari and Shukla, (1982) reported that the latex from the twig was strongly inhibitory to watermelon mosaic virus.Some seed-borne fungi were found in association with *J. curcas*seedlings since there is low or no latex formed at seedling stage (Garcia and Lawas, 1990). Also, Liu *et al*., (1996)found that the extracts from crushed seeds showed some fungicidal properties.

In conclusion, Jatropha grown in Abuja, Nigeria are mainly infected with JMD and JLSD while others are such as Fusarium wilt are minor ones. Breeding of improved disease resistant-cultivars of Jatropha is imperative. Also, standard pathological techniques such as immunosorbent assay fro JMD incidence should be employed in identifying the specific causal organism of the leaf spots in Jatropha fields. This could serve as basis for the use of appropriate control measures. What to do to reduce the incidence and severity of these diseases such as artificial irrigation of jatropha plantation during dry season should be looked into.Also all various biological, use of resistant varieties and chemical control methods of Jatropha diseases should be experimented in the studied territory.Finally the effect of the disease infection on the shoot biomass and oil profile of the infected plant deserves investigation.

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