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1.0 INTRODUCTION

1.1 Background to the Study

Jatropha curcas L.often referred to as „Jatrophais one ofthe prospective oil-yielding plantswith vast industrial potential as bio-diesel(Jayanna, 2006). The seeds can be pressed into bio-oil that has goodcharacteristics for direct combustion in compressed ignition engines or for theproduction of bio-diesel (Putten et al., 2010). The bio-oil can also be a rawmaterial for soap making. The pressed residue of the seeds (pressed cake) is agood fertilizer and can also be used for bio-gas production. Jatropha curcasgrows under subtropical conditions and can withstand conditions of severedrought and low soil fertility. It is capable of growing in marginal soil, andit can help to reclaim problematic lands. It is not a forage crop, hence, itplays an important role in deterring cattle as the leaves are not palatable,and thereby, protecting other valuable food or cash crops when used in fencing(Putten et al., 2010). Current interest by farmers and non-governmentalorganizations (NGOs) in Jatropha curcas is mainly due to its potential as anenergy crop. Jatropha curcas grows in tropical and sub-tropical regions,with cultivation limits at 30ºNand 35ºS (FACT, 2007). It also grows in loweraltitudes of 0-500 meters above sea level. It is not sensitive to day length(flowering is independent of latitude) and may flower at any time of the year(Heller, 1996). It is a succulent shrub that sheds its leaves during the dryseason, with deep roots that make it well suited to semi-arid conditions. WhileJatropha can survive with as little as 250 to 300 mm of annual rainfall, atleast 600 mm is needed for flowering and fruit setting (FACT, 2007). Theoptimum rainfall for seed production is considered between 1000 and 1500 mm(FACT, 2007), which corresponds to sub-humid ecology. Higher precipitation islikely to cause fungal attack and restrict root growth in all but the mostfree-draining soils (cited by Achten, 2008).Jatropha curcas is not found in themore humid parts of its area of origin, Central America and Mexico. Rainfallinduces flowering and, in areas of unimodal rainfall, flowering is continuousthroughout most of the year (FACT 2007). Optimum temperatures are between 20Cand 28C. Very high temperatures can depress yields (Gour, 2006). Jatrophacurcas is intolerant of frost. The plant is well adapted to conditions of highlight intensity (Baumgaart, 2007) and is unsuited to growing in shade.

Insect pests and diseases pose a significant threat toJatropha curcas. Observations of free-standing older trees would appear toconfirm this, but incidence of insect pests and diseases is widely reportedunder monoculture plantation, and may be of economic significance. The Jatrophacurcas plants suffer from several diseases, which include damping off, rootrot,leaf spots, frog-eye leaf spot, powdery mildew and Jatropha mosaic virusdisease. Observed diseases, such as collar rot, leaf spots, root rot and damping-off,may be controlled with a combination of cultural techniques (for example,avoiding waterlogged conditions) and fungicides (Achten, 2008). Jatrophamultifida is a known host of African cassava mosaic virus as well as a possiblesource of transmission of the cassava super-elongation diseasecaused bySphaceloma manihoticola (Achten, 2008).

The family Geminiviridae comprises of a group of plantinfecting circular ssDNA viruses that severely constrain agriculturalproduction throughout the World, and a particular serious threat to foodsecurity in sub-Saharan Africa. Worldwide, they are responsible for aconsiderable amount of economic damage to many crops such as cassava, sweetpotato, tomatoes, cowpea, okra, cotton, grain legumes and now Jatropha curcas(Fauquet et al., 2008).

Geminiviruses are distinct in having circular,single-stranded DNA (ssDNA) genomes that are encapsidated within twinnedicosahedral virions. Displaying substantial diversity in terms of their primarynucleotide sequences, genome structures, host ranges and insect vectors, thefamily Geminiviridae has been divided into seven different genera. Besides theBegomoviruses, these include the genera Mastrevirus, Curtovirus, andTopocuvirus (Fauquet et al., 2008) and three additional genera Becurtovirus,Eragrovirus and Turncurtovirus (Varsani et al., 2014).

The genus Begomovirus with over one hundred and ninety tworecognized species, contains more species than all the other geminivirus generacombined (Fauquet et al., 2008; Brown et al., 2011). Whereas begomoviruses aregenerally considered to be either monopartite (onessDNA component) or bipartite(two circular ssDNA components called DNA-A and DNA-B), many apparentlymonopartite begomoviruses are associated with additional subviral ssDNAsatellite components, called alpha- (DNA-1/) or betasatellites (DNA-) (Marieet al., 2012). Geminiviruses are often associated with sub-viral agents calledDNA satellitesthat require proteins encoded by the helper virus for theirreplication, movement and encapsidation. Hitherto, most of the single-strandedDNA satellites reported to be associated with members of the familyGeminiviridae have been associated with monopartite begomoviruses. Thesesatellite molecules completely lack sequence identity to their helper virusesand depend on the helper virus for all or some of the following functions:replication, movement, encapsidation and transmission. Satellite molecules wereinitially reported to be associated with RNA viruses; these satellites are verywell characterized (Simon et al., 2004). In the last decade, more than 500satellite sequences associated with begomoviruses (family Geminiviridae) havebeen isolated from a diverse range of cultivated crops and weeds (Briddon andStanley, 2006; Briddon et al., 2008).

Alphasatellites are 1.3 kb nanovirus-like components that,in some cases, suppress viral disease symptoms. Although alphasatellites encodea replication associated protein, they depend on the helper virus encodedproteins for movement and encapsidation (Briddon and Stanley, 2006;Nawaz-ul-Rehman and Fauquet, 2009). Betasatellites are a diverse set ofsymptom-enhancing, single-stranded DNA (ssDNA) molecules that are 1.3 kb insize and only associated with monopartite begomoviruses from the Old World(OW), namely Asia and Africa (Briddon et al., 2001, 2003, 2008). Most recently,betasatellites have been found associated with a few bipartite begomoviruses(Rouhibakhsh and Malathi, 2005).

Cook in 1931 described the occurrence of Jatropha mosaicdisease for the first time in Puerto Rico (USA). Jatropha mosaic virus wasfirst reported on Jatropha gossypiifolia (Bird, 1957) as a euphorbiaceous weedprevalent throughout the West Indies. Several viruses have been found to affectJatropha curcas. Kashina et al. (2013) reported a complete nucleotide sequenceof a begomovirus (Jatropha Mosaic Nigerian Virus) naturally infecting Jatrophacurcas in Nigeria which is a threat to the realization of the full potential ofthecrop. The symptoms observed were severe mosaic, mottling and blistering ofleaves. Pair-wise comparisons of DNA-A sequences showed that Jatropha mosaicvirus had maximum nucleotide sequence identity (72 %) with a strain of Tomatoyellow leaf curl virus. Ramkat et al. (2011) reported the occurrence of cassavageminiviruses on Jatropha curcas grown in Kenya. Raj et al. (2008a) reportedthe incidence of Cucumber mosaic virus on Jatropha curcas in India. Snehi etal. (2008) identified a new begomovirus on J. gossypifolia in India.

1.2 Justification of the study

The crude oil crisis of the 1970s and the subsequentshortages of petrol-fuels in the world market have brought to light thelimitations of world oil resources (Grimm, 1996; Heller, 1996; Henning, 2000;Pratt et al., 2002). Currently, the world is faced with critical fuel shortagesaccompanied with high prices, as well as, the global warming issue. This hasprompted government, scientists and non-governmental organizations (NGOs) tosearch for alternative sources of energy, which are renewable andenvironmentally safe. In this regard, renewable vegetable fuels have assumedtop priority. Special interest has been shown in the cultivation of thetropical physic nut (Jatropha curcas L., Euphorbiaceae) for oil extraction(Grimm 1996; Heller 1996).Worldwide, Jatropha is gaining more prominenceconsidering its potential as an energy and biofuel crop. Although much of thispotential has not been harnessed fully in Nigeria, elsewhere it has beendemonstrated that the crop can help solve many problems ranging from landreclamation, bio-diesel production and protection of valuable crops such ascash or food crops from cattle (Jayanna, 2006). The potential yield, qualityand value of the croparelowered by pest attack reducing the quality of seeds produced,thereby, affecting its potential of fulfilling the promise of an energy crop.Recently, virus diseases have posed a great threat to the crops potential dueto their insidious nature, which usually results in the development ofepidemics, if not managed properly.

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