Greener Journal of Agricultural Sciences
ISSN: 2276-7770; ICV: 6.15
Vol. 3 (10), pp. 743-747, October 2013

http://gjournals.org/GJAS

Research Article

The Influence of African Mistletoe (*Tapinanthus bangwensis*) on the Conservation Status and Productivity of *Irvingia gabonensis* in Moor Plantation Area of Ibadan, Nigeria

Edagbo David E.*, Ighere Dickson A. and Michael Clement

Plant Genetic Resources Unit, National Centre for Genetic Resources and Biotechnology, Moor Plantation, Apata, PMB 5382, Ibadan, Oyo State, Nigeria.

ARTICLE INFO

Article No.: *101013896*
DOI: *10.15580/GJAS.2013.10.101013896*

Submitted: *10/10/2013*
Accepted: *22/10/2013*
Published: *29/10x/2013*

****Corresponding Author***
Edagbo David E.
E-mail: *dedagbo @yahoo.com*
Phone: *+234-8028753717*

Keywords:
Host, infestation, parasite, susceptibility, Girth size

ABSTRACT

A preliminary study of the host parasite relationship between *Tapinanthus bangwensis* and its host, *Irvingia gabonensis* was carried out to gain an understanding of the impact and outcome of their co-habitation on the host plant. Assessment of the physiological interaction was conducted via a study of some of the physiognomy and reproductive capacity of infested and uninfested hosts. The parasitic infestation it was observed vary between adjoining locations of the host stands because of differences in eco-habitat, physiognomy of susceptible hosts and as well as the capacity of the interacting host and parasitic plants to carry out their routine physiological activities. The incidence of the parasitic plant population on the host plantation in this study indicated marginal loss in value of the conserved host plants with correlated loss in productivity. Ultimately, the presence of *Tapinanthus* on its *Irvingia* host in this study would serve not only as a source of decline in the conservation status and productivity of the host plants but could also lead to the death of many susceptible hosts if proliferation of the parasite is not kept in check.

INTRODUCTION

Irvingia gabonensis and *Irvingia wombulu* commonly called bush mango or dika nut are indigenous fruit trees in Africa that produce edible fruits and seeds (Harris, 1996; Atangana *et al*., 2001, 2002). The fruit of *I. gabonensis* has a sweet mesocarp which is eaten fresh while that of *I. wombulu* is sour. The seed cotyledons (edible kernels) from both are used for culinary purposes. Nigerians distinguished between kernels from *I. gabonensis* and *I. wombulu,* referring to the former as 'ugiri' in Igbo or "apon" in Yoruba (Ladipo *et al*., 1996), "ujuru" in Idoma and the later as "ogbono" in Igbo (Okafor, 1975), "upi" in Idoma. In Nigeria and some other parts of West and Central Africa sub-region, the kernels are used as a condiment and are highly valued for their food thickening property and their commercial value (Ndjouenekeu *et al*., 1996; Asaah *et al*., 2003). Some studies conducted in the West and Central Africa established that there exist substantial local and regional markets for non-woody forest products of certain indigenous trees, such as *Irvingia* species (Asaah *et al*., 2003), and it was noted that the centre of diversity for *I. gabonensis* is in southern Cameroon and southeast Nigeria, while that of *I. wombolu* is in southeast Cameroon and western Nigeria (Lowe *et al*., 2000).

Irvingia gabonensis has been used wholly or as supplement in the treatment of type II diabetics and in reducing obesity (Omoruyi *et al*., 1994; Judith *et al*., 2005). Ofoefule *et al*., (1997) reported that dika fat, a vegetable oil obtained from the kernel are also used in the formulation of sustained released frusimide granules and a highly gross energy is obtained from it compared to other tropical seeds, this is as a result of its high fat content. Leakey (1999) had also reported on the nutritional value of *I. gabonensis* fruit and kernel. Other services derived from the *Irvingia* tree species include: fresh bark being considered to be a powerful antibiotic against scabies, a cure for diarrhoea when mixed with palm oil, a toothache remedy and intercropping with other crops in farm systems for shelter (Asaah *et al*., 2003).

The parasitic plant family of the Loranthacean mistletoe (including *Tapinanthus bangwensis* (Engl. and K. Krause) Danser and other species which are known to be of widespread occurrence even in Nigeria have been reported attacking a number of many wild and domesticated tree and shrub species of which *I. gabonensis* is one of the susceptible host plant (Bright and Okusanya, 1998; Ayuba, 2000; Bako *et al*., 2001; Wahab *et al*., 2010). Mistletoes grow attached to branches and stems of host trees by means of specialized absorbing organ called the haustorium, which penetrates into host's living tissues and functions for translocation of various materials (water and mineral nutrients) from the host into the parasite. It thus deprives the host of essential nutrients that may be utilized for photosynthetic and other metabolic activities (Benzing 1990; Polhill and Wiens, 1998). When one part of the host is intensively attacked by mistletoe, the reproductive and photosynthetic potential of the part distal to the infestation declines leading to death of the part. But the extent of damage caused to the host depends on size of the parasite, the growth rate and metabolic activity of the parasite, the degree of dependency on the host for resources, and the stage of development of the host (Aliero and Ismaila, 2002; Davcota, 2005; Kwon-Ndung and Ismaila, 2009). Going by the nature of the relationships between mistletoe and its host tree(s), this study was therefore carried out to examine the impact of the mistletoe (*Tapinanthus bangwensis*) infestation on the conservation status and productive output of the stands of *Irvingia gabonensis*.

MATERIALS AND METHODS

The study was carried out in the *Irvingia gabonensis* plantation of the National Centre for Genetic Resources and Biotechnology (NACGRAB) within the Moor Plantation complex, Ibadan, South-West, Nigeria between November 2011 and June 2013. The collected parasitic plant samples of the *Tapinanthus* species of mistletoe were identified at the herbarium of NACGRAB. The *Irvingia* plantation was mapped out into two with 50 selected stands each from the two wings of the plantation. Girth size of all the *Irvingia* trunks was determined by measuring the diameter at height of primary branches using a measuring tape. The number of host trees infested and those uninfested at each range of girth size was determined and percentage infestation was calculated. The severity of infestation was estimated according to the amount of plant crown area infested by mistletoes on a visual scale of 1 to 4, by standing at a distance of 3 to 6m to the host tree from four different directions. Total numbers of fruits on the infested and uninfested *Irvingia* were determined by plucking and counting of the fruits. The extent of impact/loss in the tree productivity was evaluated by random sampling of three infested and three uninfested trees from each range of girth size and counting the number of fruits produced by each at maturity with the mean of the productivity calculated for each group.

RESULTS

The rate of infestation of the mistletoe, *Tapinanthus bangwensis on Irvingia* in the study site (Table I) vary sharply from a 58% high at the West to a modest 14% level at the East.

Table I: Rate of infestation of *Tapinanthus bangwensis on Irvingia gabonensis* at the two studied wings of the plantation

Location	Total No. of Trees Surveyed	Total No. of Trees Infested	Percentage (%) Infestation
West wing	50	29	58
East wing	50	07	14

In Table II, the severity of the mistletoe infestation on the *Irvingia* plantation showed a trend of gradual build up in the intensity of the parasitism. At the West Wing, from the aggregate population of 29 infested host trees; a greater proportion of 15 stands were of low infestation, 10 stands fairly high infestation, 2 stands on high and another 2 stands on very high infestation effect on the population. The scale of severity for the East Wing was in sharp contrast to the prominent spread of the parasitic infestation noticed at the West Wing. It had just a minute fraction of its population infested with a 7 stand host infestation, 5 stands were of low infestation and the remainder 2 host trees on fairly high infestation regime.

Table II: Severity of infestation of the infested *Irvingia* stands across its plantation

Location	Total No. of Trees Infested	EFFECT ON CROWN AREA AMONG INFESTED POPULATION			
		Low (1)	Fairly high (2)	High (3)	Very high (4)
West wing	29	15	10	2	2
East wing	07	5	2	0	0

The parasitic relationship between *T. bangwensis* and its host *I. gabonensis* based on stem girth was presented in Table III. The stem girth at 0-20cm had 0% infestation, a further 21-40cm and 41-60cm girth range had 22.2% and 23.3% infestation rates respectively. The higher girth range classification of 61-80cm and 81-100cm offered greater infestation of 51.4% and 60% in tune with the sequence of the incremental size.

Table III: Classification of *Irvingia gabonensis* based on the girth size and rate of *Tapinanthus* infestation

Girth size (cm)	No of trees surveyed	No. of trees infested	Percentage (%) infestation
0-20	03	00	00
21-40	09	02	22.2
41-60	43	10	23.3
61-80	35	18	51.4
81-100	10	06	60

The mean of numbers of fruits produced by *I. gabonensis* based on the girth size and on the presence or absence of infestation (Table IV) generally portrayed a situation in which fruit production increased with increases in girth size and decreased with infestation except in the rare case of a deviation. Hence at 0-20cm, an average of 2 fruits was produced by uninfested trees while there was no sample population of infested trees at that girth range. Uninfested *Irvingia* stands at 21-40cm range had 36 fruits while infested stands yielded 8 fruits. However, for the 41-60cm girth range, the sample population for the uninfested trees yielded 163 fruits to the 46 fruits produced by the infested population. 61-80cm had 119 fruit production receipt for the uninfested and 255 fruits for infested while 81-100cm girth range had an output of 468 fruits for uninfested and 149 fruits for infested host trees. The cumulative total fruit production for the uninfested sample population stood at 788 fruits and the infested was 458 fruits and thus gives a distinction of over 20% output higher for the uninfested as against the infested hosts.

Table IV: The mean of the productivity of fruits produced by *Irvingia gabonensis* based on the girth size and on the presence/absence of *Tapinanthus* infestation

Girth size (cm)	No. of fruits produced by uninfested trees (Mean)	No. of fruits produced by infested trees (Mean)
0-20	002	–
21-40	036	008
41-60	163	046
61-80	119	255
81 -100	468	149
Cumulative Total	788	458

(Mean), Mean of data of three random samples; –, Absent

DISCUSSION

The nature of the parasitic infestation of the African Mistletoe, *Tapinanthus bangwensis* across the *Irvingia* plantation presented a phase of advanced infestation by the parasite at the West wing while the East Wing was still at the phase of primary infestation; hence the sharp differences in the percentage infestation rate. The *Irvingia* trees on the plantation were of same age of establishment but were at different phase of mistletoe infestation because of prevailing ecological peculiarity of each wing of the plantation. The plantation at the West Wing had their edges in close proximity to a roadside which transverse the *Irvingia* plantation and an older *Citrus* orchard which harboured mistletoe population. By and large, the dispersal agent of *Tapinanthus spp*, the tinker birds (*Pogoniulus* spp.) would have introduced the parasite early to *Irvingia* at the West axis because of ease of accessibility (Norton and De Lange, 1999). Conversely, the edge of the plantation at the East axis was shielded by the predominant presence of *Dacryodes edulis, Penthaclethra macrophylla* and *Spondias mombin*. These trees therefore offered some form of cover at the East which minimized the exposure of the *Irvingia* to the dispersal agent of the parasitic plant hence much less infestation.

A critical overview of the severity of parasitic infestation on the *Irvingia* plantation was indicative of gradual increase in the activities and population of *Tapinanthus bangwensis.* More often than not, assessment of the severity of infestation usually gives a pointer to the phase of parasitic infestation in the sampled host population. An infestation rated to be at the level 4 (very high) effect on the crown of the host tree(s) tells of advanced phase of infestation while infestations at 1 (low) or 2 (fairly high) effect could be ascribed as being at the primary phase of infestation. With a conducive edapho-climatic condition, the parasitic infestation as observed in the East Wing of the *Irvingia* plantation at the primary phase of infestation progressively degenerate to the advanced phase as seen in the West Wing when external factors of limitation or control are not introduced into the ecosystem. Oftentimes and in accordance with the assertion of Mourão *et al*., 2009, it would be that for an interactive nature like the type so described above; the negative effects of the parasite may occur in cascade, because an accentuated parasitism may lead, prior to host death, to loss of foliage cover and indirectly reduced photosynthetic rates.

The incidence rate of infestation by *Tapinanthus bangwensis* on the *Irvingia* host trees across the select range of girth sizes reflected correlated rise in the percentage infestation rate; thus there were progressions from the least girth size (0-20cm) to the highest (81-100cm). This observation corroborate the findings of similar work carried out by other researchers (Kwon-Ndung and Ismaila, 2009; Edagbo *et al*., 2012) that plant parasitic infestation increase with increase in girth size of host plants. This would imply that enlarged stem (increases in girth size) provides a platform for more nutrient flow, increased physiological activities and structurally more surface medium for increased parasitic infestation.

The mean of the productivity for fruit yield in consideration of different girth sizes and actual infestation status of the susceptible host trees generally tell of correlated increases in reproductive output in both the infested and uninfested hosts with increase in girth size. It was however observed that at the same category of girth sizes for infested and uninfested host trees, the output were much higher for the uninfested hosts. This invariably implied that the presence of *Tapinanthus bangwensis* constitute some measure of considerable depleting force on the productive capacity of the *Irvingia* host trees. The infested hosts could therefore be said to manifest loss in productivity when compared to similar uninfested hosts. And in this vein, the comparative total cumulative output in fruit yield from the result of this study was that of lower yield for the infested hosts and hence reduced productivity. It therefore could be seen that as had been noted in earlier research findings (Tennakoon and Pate, 1996; Press *et al*., 1999; Aliero and Ismaila, 2002; Howell and Mathiasen, 2004), besides the lower fruit yield, susceptible hosts which are in states of severe infestation usually display reduced foliage, damaged allometry and architecture with even deprived growth at branches with domineering parasitic activities. All these features and many other attributes associated with the presence of *Tapinanthus bangwensis* on its host, constitute a major means of loss and value depreciation in the conservation status of *Irvingia gabonensis*.

CONCLUSION

Parasitic plants such as *Tapinanthus bangwensis* when left to blossom on susceptible host plants like *Irvingia gabonensis* may alter the rates of survival and fecundity of their hosts and hence modify the structure and dynamics of their populations thereby becoming a serious threat to their sustenance and conservation (Press and Phoenix, 2005). Host plants with trunks of larger girth size provide enlarged platform for increased flow of nutrients and proportionally favourable and enriched surface area for attachment and growth of the infective parasite and are thus the more frequent recipient of parasitic infestation. With the affirmed influence of *Tapinanthus bangwensis* on its host nonetheless, there is need to ecologically manage their population for biodiversity conservation, ecosystem stability and exploitation of their ethno-botanical value.

REFERENCES

Aliero B.L. and Samaila A., 2000. The occurrence of parasitic mistletoe *(Tapinanthus spp*) on *Parkia biglobosa* (Jacq.) Benth (African Locust Bean Tree) in Yauri Local Government Area, Kebbi State, *Nigerian Journal of Basic and Applied Sciences,* 9: 5-10.

Asaah, E. K., Tchoundjeu Z. and Atangana, A. R., 2003. Cultivation and conservation status of *Irvingia wombolu* in humid lowland forest of Cameroon. *Food, Agriculture & Environment* 1 (3&4): 251-256.

Atangana A. R, Tchoundjeu Z, Foldout J. M, Asaah E, Dumb M, Leakey R. R. B., 2001. Domestication of *Irvingia gabonensis*: 1.Phenotypic variation in fruit and kernels in two populations from Cameroon. *Agroforestry Syst*. 53: 55-64.

Atanngana A. R., Ukafor V., Anegbeh P. O., Asaah E., Tchoundjeu Z., Usoro C., Fondoun J. M., Ndoumbe M., Leakey R. R. B., 2002. Domestication of *Irvingia gabonensis*: 2. The selection of multiple traits for potential cultivars from Cameroon and Nigeria, *Agroforestry Syst*. 55: 221- 229.

Ayuba, I., 2000. *A Survey of Occurrence, Distribution and Effects of African Mistletoe (Tapinanthus spp.) on Parkia biglobosa (Jacq) and Butryospermum Paradoxum (Gaertn. F.) Hepper* in Yauri Local Government Area of Kebbi State. M.Sc. Dissertation, UDUS Sokoto State.

Bako S.P, Onwuchekwa B. N, Bako L.S.P., Iortsuun D. N., 2001. Physiology of the African Mistletoe (*Tapinanthus dodoneifolius* (DC) Danser) and its influence on the metabolism of two hosts (*Albizia lebbeck* Benth and *Citrus sinensis* L.), *Nig. J. Agric. Environ.*, 2: 1081-1092.

Benzing, D. H., 1990. *Vascular Epiphytes*. Cambridge Tropical Biology Series. Cambridge University, Press.

Bright, E.O. and Okusanya, B. A., 1998. Infestation of economic plants in Badeggi by *Tapinanthus dodoneifolius* (D.C) Danser and *T. globiferus* (A. Rich)Van Tiegh. *Nigerian Journal of Weed Science,* 11:51-56.

Devkota, Mohan Prasad, 2005. Biology of mistletoes and their status in Nepal Himalaya. *Himalayan Journal of Sciences* 3(5): 85-88.

Edagbo David, E., Ajiboye, T. O., Borokini Temitope, I., Ighere Dickson, A., Alowonle Ahmed, A. and Michael Clement, 2012. The Influence of African Mistletoe (*Tapinanthus bangwensis*) on the Conservation Status of *Citrus sinensis* in Moor Plantation Area of Ibadan, Nigeria. *International Journal of Current Research,* 4(12): 484-487.

Fabiana Alves Mourão, Claudia Maria Jacobi1, José Eugênio Côrtes Figueira1 and Eugênia Kelly Luciano Batista, 2009. Effects of the parasitism of *Struthanthus flexicaulis* (Mart.) Mart. (Loranthaceae) on the fitness of *Mimosa calodendron* Mart. (Fabaceae), an endemic shrub from rupestrian fields over ironstone outcrops, Minas Gerais State, Brazil, *Acta bot. bras.* 23(3): 820-825.

Harris D. J., 1996. A revision of the Irvingiacea in Africa, *Bulletin du Jardin Botanique National de Belgique*, 65 (1-2): 55-64.

Howell B. E. and Mathiasen R.L., 2004. Growth impacts of *Psittacanthus angustifolius* Kuijt on *Pinus oocarpa* Schiede in Honduras. *Forest Ecology and Management,* 198: 75–88.

Judith L. N., Julius E. O., Samuel R. M., 2005. The effect of *Irvingia gabonensis* seeds on body weight and blood lipid of obese subject in Cameroon, *Lipids Health Dis*., 4: 12.

Kwon-Ndung E.H. and Ismaila A., 2009. Prospects Of Host Resistance In Improved And Domesticated Species of *Parkia biglobosa* To African Mistletoes (T*apinanthus spp*.) In Central Nigeria, *EJEAFChe,* 8 (5): 382-388.

Ladipo D. O., Foudoun J. M., Ganga N., 1996. Domestication of bush mango (*Irvingia* spp). Some exploitable intraspecific variations in West and Central Africa. Food and Agriculture Organization, Rome. Italy.

Leakey, R. R. B., 1999. Potential for novel food products from agroforestry trees: A review. *Food-Chemistry,* 66 (1): 1-14.

Lowe A J, Gillies A C M, Wilson J, and Dawson I K., 2000. Conservation genetics of bush mango from central/west Africa: implications from random amplified polymorphic DNA analysis, *Moleculary Ecology,* 9: 831-841

Ndjouenekeu R., Goycoolea F. M., Morris E. R., Akingbala J. O., 1996. Rheology of Okra (*Hibiscus esculentus*) and dika nut (*Irvingia gabonensis*) polysaccharides, *Carbonhydrate Polymer,* 29: 263-269.

Norton, D.A. and De Lange, P.J., 1999. Host specificity in parasitic mistletoes (Loranthaceae) in New Zealand. *Functional Ecology,* 13: 552-559.

Ofoefule S. I., Chuckwu A., Okore U. C., Ugwali M. O., 1997. Use of dika fat in the formulation of sustained released frusimide – encapsulated granules.1: Boll. *Chem farm*. 136(10): 646-650.

Okafor J. C., 1975. Varietal delimitation in *Irvingia gabonensis* (Irvingiaceae): *Bulletin du Jardin Botanique National de Belgique* 45(1-2): 211-221.

Omoruyi F. O., Adamson I., 1994. Effect of dika nut (*Irvingia gabonensis*) and cellulose on plasma Lipid in streptozotocin induced diabetic rat, *Nutr. Res*, 14: 537-544.

Polhill Roger and Delbert Wiens, 1998. *Mistletoes of Africa*, The Royal Botanic Gardens, Kew Ed. ISBN. pp. 370.

Press M. C., Scholes J. D. and Watling J. R., 1999. Parasitic plants: physiological and ecological interactions with their hosts. In: Press, MC, Scholes, JD, Barker, MG, eds. *Physiological Plant Ecology*. Oxford, UK: Blackwell Science, 175–197.

Press, M. C. and Phoenix, G. K., 2005. Impacts of parasitic plants on natural communities. *New Phytologist,* 166: 737-751.

Tennakoon K. U. and Pate J. S., 1996. Effects of parasitism by a mistletoe on the structure and functioning of branches of its host. *Plant, Cell & Environment,* 19: 517–528.

Wahab, O. M., A. E. Ayodele and J. O. Moody, 2010. TLC phytochemical screening in some Nigerian Loranthaceae, *Journal of Pharmacognosy and Phytotherapy*, 2(5): 64-70.

Cite this Article: Edagbo DE, Ighere DA and Michael C (2013). The Influence of African Mistletoe (*Tapinanthus bangwensis*) on the Conservation Status and Productivity of *Irvingia gabonensis* in Moor Plantation Area of Ibadan, Nigeria**.** Greener Journal of Agricultural Sciences, 3(10): 743-747, http://doi.org/10.15580/GJAS.2013.10.101013896**.**