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Full Length Research Paper

A parasitic study of *Phragmanthera capitata* (Sprengel) S. Balle (Loranthaceae) in the anthropic environments: The case of the Ndogbong chieftain's compound orchard (Douala, Cameroon)

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Loranthaceae are parasite plants which represented in Cameroon by 26 species gathered into seven genera. An ecological and flora study consisting in the research on factors bound to parasitism of *Phragmanthera capitata* (Sprengel) S. Balle had been led at Ndogbong chief's compound orchard at Douala (Cameroon). A total of 49 woody plants belonging to 11 species, 9 genera and 8 families were identified. Among these species, 10 were exotic and only one, *Spondias mangifera Willd.* was indigenous host and most infested. Scatterings of *P. capitata* were observed to be vertical and horizontal. Two types of hosts had been identified: not infested and the infested ones. Three species are not infested and were called resistants: *Dacryodes edulis*, *Manniophyton fulvum* and *Mangifera indica.* Eight were infested species in the orchard and were called sores: *Citrus* spp., *Garcinia cola*, *Persea americana*, *Psidium guajava*, *Theobroma cacao* and *Spondias mangifera*. Resistant species had possessed 15 woody plants (30.61%) and sore species, 34 plants (69.38%). The consequences of the parasitism of *P. capitata* in the orchard demonstrate the need for establishing comprehensive ecosystem management programs.

Key words: *Phragmanthera capitata*, biotic factors, human habits, orchard.

INTRODUCTION

Loranthaceae are epiphyte chlorophylian small plants that are hemiparasitic on cultivated and uncultivated plants (Balle, 1982). These plants that present themselves in the form of bunches, are anchored in the host's wood through a sucker which enables the establishment of functional connections with the host's conducting device (Sallé et al., 1998). The parasite levies the mineral salt and the organic complement it needs. Loranthaceae belong to angiosperm parasites that constitute only 2% of the whole seed plants (Raynal-Roques and Pare, 1998). The damages caused are variables. *Phragmanthera capitata* is widely spread in Africa, especially in Cameroon, Nigeria, Gabon and Ivory Coast (Engone Obiang and Salle, 2006; Dibong et al., 2008, 2009 a,b,c,d,e,f; Mony et al., 2009, 2010 a,b). The settlement cultures such as hevea, avocado tree, cocoa, coffee, citrus fruits appear heavily infested and the yielding losses are often sizeable (Neumann and Salle, 2003; Dibong et al., 2010a). The mechanical suppression of the

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branches infested of the host proves illusory. The more promising control method can only be successful if the mechanisms that adjust the Loranthaceae's adaptation to their cultivated or spontaneous hosts are identified and elucidated.

With the aim of elaborating the strategies to fight against infestation of *P. capitata* on host plants in the orchard, the specific objectives of this research are: (1) to take an inventory of host trees infested by *P. capitata* (Loranthaceae); (2) to determine the ecological factors that influence the spatial distribution of parasitic plants and (3) to identify the specific relations between hosts and parasite.

MATERIALS AND METHODS

Study area

The study area is an orchard located in the Ndogbong chief's compound in the east of Douala town. Douala has a climate that belongs to the equatorial domain of a particular type called Cameroonian which is characterized by two seasons with a lengthy rain season (at least 9 months), abundant rainfalls (about 4000 mm per year) elevated medium temperatures at 26.7°C and constant. The minimal average of temperatures in Douala over 30 years (1961 - 1990) is 22.6°C in July and the maximal average is 32.3°C in February. The relative humidity throughout the year is almost 100% (Din et al., 2008).

Methodology

The orchard which was a former cocoa plantation occupies about 2ha and is now for the landlords' consumption.

Flora inventory

The study was conducted from June to December 2008. Investigations had been conducted by using 20 x 20 m plots. All infested plants of DBH (diameter at breast height) greater or equal to 5 cm had been inventoried. Those infested plants were marked and their diameter determined as well as the number of parasite tufts. Infested host trees were classified according to the following number of tufts of the parasite:

1: 1-2 tufts; 2: 3-5 tufts; 3: > 5 tufts.

The percentage of orchard's parasitism (Pp) is given by the following relation:

Pp = number of infected trees/total number of trees x100.

RESULTS

Inventory of host plants

Overall, 49 woody plants belonging to 11 species, 9 genera and 8 families were identified (Table 1). Among these species, 10 were exotic and only one, *Spondias mang ifera* Willd. belongs to the original indigenous forest. The most abundant species were *Theobroma cacao* L., *Mangifera indica* L. and *Citrus* spp. with 16, 10 and 39 plants respectively. These species were constituted 81.63% of the flora in the orchard. The remnant, 18.37% represented the less abundant species with three plants each (*Persea americana* Mill and *Psidium guajava* Linn.) or rare with only one plant (*Dacryodes edulis* (G. Don) H. J. Lam, *Garcinia cola* Heckel, *Manniophyton fulvum* Mull.- Arg. and *Spondias mangifera* Willd.).

Scatterings of *P. capitata*

Scatterings of *P. capitata* were observed to be vertical and horizontal.

Vertical scattering in C. maxima and C. reticulata

C. maxima and *C. reticulata* had a diameter between 10 to 19 cm with 1 to 2 tufts of the parasite for the former species mentioned above and 3 to 5 tufts for the latter. The two hosts were located under *Spondias mangifera's* foliage. Thus, when *P. capitata's* berries were riped, they detached themselves from the boughs carrying them and landed on *C. maxima* and *C. reticulata's* boughs or fell on the ground. Seeds stringing up by one line of viscin were observed on *C. reticulata*. This way of scattering was called vertical and was reinforced by the disseminators' activities.

Horizontal scattering with other host species

Avian disseminators, concerned with displacements, were oriented according to the positions occupied by the woody plants that produced berries. Consequently, the rank smells of ripe berries attracted disseminators. These later settled on the host tree boughs and were infested by plants laying down their excrements containing *P. capitata's* seeds.

Parasitism of *P. capitata*

Two types of hosts had been identified: not infested and the infested ones. Three species were not infested and were called resistants: *D. edulis*, *M. fulvum* and *M. indica*. Eight infested species in the orchard were called sores: *Citrus* spp., *G. cola*, *P. americana*, *P. guajava*, *T. cacao* and *S. mangifera*. Resistant species had possessed 15 woody plants (30.61%) and sore species, 34 plants (69.38%).

Sore species had possessed 21 infested plants shown in Table 2. Amongst these, some were called very sores and were showed all the infested plants (*G. cola, P. americana P. guajava*, and *S. mangifera*) and others less sores (*C. sinensis* Arancio and *T. cacao*). *S. mangifera*

Table 1. Parasitism linked to *P. capitata* (Sprengel) S. Balle of woody species of the Ndogbong chief's compound.

Host species	Healthy plants	Parasitized plants	Total
Anacardiaceae			
M. indica L.	13	0	14
S. mangifera Willd.	0	1	
Burseraceae			
D. edulis (G. Don) H.J. Lam	1	0	1
Clusiaceae			
G. cola Heckel	0	1	1
Euphorbiaceae			
M. fulvum Müll.-Arg.	1	0	1
Lauraceae			
P. americana Mill.	0	3	3
Myrtaceae			
P. guajava Linn.	0	3	3
Rutaceae			
C. maxima Obsbeck	0	1	10
C. sinensis Arancio	2	6	
C. reticulata Blanco	0	1	
Sterculiaceae			
T. cacao L.	11	5	16
Total	28	21	49

Table 2. Level of parasitism linked to *P. capitata* of host species in the Ndogbong chief's compound orchard.

Host species	Circumferences (cm)												No. of plants
	0 - 9	10 - 19		20 - 29			30 - 39		40 - 49		≥ 50		
C. maxima		1											1
C. reticulata		2											1
C. sinensis				3			2	3	3	3	3		6
G. cola				1									3
P. americana		2					2				3		3
P. guajava		3		3							3		3
S.mangifera											3		1
T. cacao		1	2	3	3	3							5
Number of plants		5		7			3		2		4		21

1: 1 to 2 tufts of the parasite ; 2: 3 to 5 tufts of the parasite ; 3: more than the 5 tufts of the parasite.

was the most infested indigenous host. It was equally the most elevated and the most developed of the encampment. Two infested host plants belonging to *C. sinensis* and *C. maxima* were located under the *S. man-gifera* foliage. The distances between *S. Mangifera* a nd those host plants were 4 and 7 m, respectively.

DISCUSSION

Parasitism by *P. capitata* in the orchard had *S. mangifera*

as origin, because the encampment is located in the urban area. *S. mangifera* is indigenous and the only plant so elevated with a big diameter in the immediate perimeter. The avian disseminators were roosted on and took food. The frugivore birds were most often seen on these infested plants and they passed most of their time there (Aukema and Martinez del Rio, 2002). Out of the site it was observed that most part of *S. mangifera* were produced but were infested by *P. capitata*. The same trend was observed with *P. americana* and *P. guajava* plants. Carlo et al. (2003) noted that frugivores fed themselves better with fruits of one or many specific host plants and visited them more often than others. Subsequently, this was the case with avocado and guava plants. This hypothesis was reinforced by the high parasitism of the avocado tree by *P. capitata* in the Douala (Dibong et al., 2008) and Yaounde area (Sonke et al., 2000). These hosts by their great height constituted good poles of feeding for disseminators (Aukema and Martinez del Rio, 2002). More, trees acumulated parasitism with their age (Overton, 1994). According to Yan (1993), the compatibility of a parasite depends on the susceptibility of the host to parasitism and on the possibility of the parasite on parasitism. Thus, compatibility between the parasite and its potential hosts predisposes it to infestation (Roxburgh and Nicolson, 2005).

Loranthaceae showed great variation in their degree of specificity according to the hosts they infested, in whole, locally. In the littoral areas, *P. capitata* infested creeper host species (Dibong et al., 2008). Other Loranthaceae like *Tapinanthus ogowensis* infested only a limited host's species group and this was done locally (Dibong et al., 2009a). In a host family, species could be an opponent to parasitism of a Loranthaceae such as the Anacardiaceae's family, which had possessed two species in the site: *M. indica* and *S. mangifera*. The former was not infested at all while the latter was infested. However, other researches had shown that species of the Mimosoidae's subfamily into the Fabaceae's family had a general propensity to the parasitism of Loranthaceae (Aukema and Martinez del Rio, 2002).

The specificity of the parasite to the host could be linked to the plant itself. It was the case of *T. ogowensis* which was a specialized Loranthaceae of *D. edulis*. So whatever the number of *P. capitata* seeds were laid down on the host, parasitism did not inevitably appear: for that, the laid down seeds should be those of a specific Loranthaceae (Roxburgh and Nicolson, 2005). The fixation of *P. capitata* needed dispersion of the diaspore on a suitable site of the host plant. The specialists of the avian disseminators were generally more effective and the most likely for Loranthaceae. However those that were frugivores in general could also scatter diaspore without damages (Ladley and Kelly, 1996). The *P . capitata's* fixation intervened, very often, on small boughs of the host, 3 - 20mm of diameter (Dibong et al., 2009e). The fixation depended also, on the genetic compatibility between the germination and its host, with a variation of sensitiveness of the host to parasitism of the sitting on both at the plant and population levels (Yan and Reid, 1995). The light, host water and nutrient relations were decisives to germination, fixation and growth of Loranthaceae (Dibong et al., 2010b, c). The germination rate was generally more elevated in the light than in the gloom and some species were germinated only in the light (Dibong et al., 2009a).

Conclusion

The study of *P. capitata* at the Ndogbong orchard showed the biotical factors linked to anthropisation of the original forest landscape. All these factors must accompany the training/vulgarization shutter in the understanding of interactions between host plants and *P. capitata*. The consequences of the parasitism of *P. capitata* in the orchard demonstrate the need for establishing comprehensive ecosystem management programs.

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