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Full Length Research Paper

The struggle against *Phragmanthera capitata* (Sprengel) S. Balle (Loranthaceae) parasite of agroecosystems' fruit trees in Cameroon

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In Central Africa sub region, *Phragmanthera capitata* (Sprengel) S. Balle (Loranthaceae) is better adapted to the conditions of environment modified by man. This species causes often considerable loss of harvests. Struggle methods used in the littoral region of Cameroon against *P. capitata* are manual removal of tufts and the "ethephon" chemical struggle. Impacts of these promising struggle methods used are discussed. Agroecology which favours fauna and flora of all in improving the agricultural productions is proposed for the sustainable development.

Key words: *Phragmanthera capitata,* struggle methods, impacts, agroecology.

INTRODUCTION

The Loranthaceae described by Balle (1982), are chlorophylian epiphyte shrubs, which live as hemi-parasites on trees and shrubs, wild or cultivated. The tufts of such plants are anchored in the host wood through a sucker that permits to establish functional links with the conductor apparatus of the host (Sallé et al., 1998). So the parasite takes water, mineral salts and organic material supplement which it needs. The Loranthaceae belong to the parasite Angiosperms which represent only 2% of all the seed plants (Raynal-Roques and Paré, 1998). But in certain conditions, they can become real flails. Their distribution and the damages they cause are variable. *Phragmanthera capitata* (Sprengel) S. Balle is widely spilt in Africa, notably in Cameroon, Nigeria, Gabon and Ivory Coast (Engone et al., 2005; Engone and Sallé, 2006). This species reduces the outputs appreciably or affects the quality of harvests (Dibong et al., 2008). The mechanical removal of the host parasitized branches and the chemical struggle have shown their limits in hevea agroindustrial plantations. These failures arouse questions, for the green churchyards of the species parasitized by the Loranthaceae which are remarkable and worrying in the agroecosystem. How to reconcile the necessity of protecting our cultures with the necessity of protecting our agroecosystems? On the one hand, we need to preserve the biosphere resources, which are limited; we need to increase the productivity to feed the world population. Therefore, the present work was attempted to bring answers to the questions above.

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MATERIALS AND METHODS

Study areas

The present study was carried out in two regions as Douala and Nyette between January and July, 2009.

Douala

Douala (latitude: 03°40 - 40°11'N; longitude: 09°16' - 09°52'E; altitude: 13 m) has a climate named as Cameroonian, which is characterized by two seasons: a long rainy season (at least 9 months) and an abundant precipitations (about 400 mm per year). The annual mean temperature is 26.7°C. The minimum mean temperature in Douala for 30 years (1961 - 1990) was 22.6°C in July and the maximum mean of temperature 32.3°C in February. The relative humidity of the air remains high in all the months of the year and similar to 100% (Din et al., 2008).

Nyette

Nyette is located 02°45'N of latitude, 10°03'E of longitude and 20 m of altitude. The climate of the region is relative to two modes, marked by the monsoon in the second season. The rainy season (about 2195.9 mm per year) goes from February to November. The annual mean of temperature is 27.3°C. The minimum mean temperature was calculated for 30 years (1976 - 2003) is 23.4°C in September and the minimum mean of 26.5°C in February. The relative humidity of the air remains high in all the months of the year with a mean of 82.6%. The smallest value occurred about of 60% in February and the highest of 100% during the rainy seasons (Hevecam, 2006).

METHODOLOGY

Prospecting of the homogeneous vegetable groupings

The homogeneous vegetable groupings studied were the agricultural plantations made up of *Hevea brasiliensis*. These plantations are located at Nyette 35 km from the north-east of Kribi and they are divided into many areas which are separated by marshes. Each area is represented by a village, abbreviated by a letter V followed by an identification number (for example V14). Each area is made up of a variable number of blocks chosen by the farmers by two numbers a and b, under the form a/b; followed by a capital letter of the French alphabet (for instance, 20/15 C).

Prospecting of mixed vegetable groupings

Four sites of the region of Douala have been prospected:

1. An orchard at Makondo and a peasant agricultural plantation of *Cola nitida*, at penja, in which the sampled surface is 0.5 ha for each site;
2. Two gardens of huts (Logbessou and Aeroport-Bonadjo crossroad) where in turn by turns, a surface of 10000 m² (2000 × 50 m) has been marked off.

Method of study

The work realised on the site had as objective in the identification of the Loranthaceae on the woody essences of a diameter (DBH) ≥ 5 cm for mixed vegetable groupings. Hevea trees are uniform and their average diameter is of 35 cm. The estimation of the impacts of the struggle methods practised against the Loranthaceae was made, followed by many interviews with the implied targets.

RESULTS

The manual destruction of tufts

Homogeneous vegetal groupings are more parasitized by *P. capitata*, 63.64% (mean parasitism) versus 35.05% for heterogeneous vegetal groupings. Thus, these groupings form important sources of priding from which adapted struggle strategies are essential in keeping with sustainable development. In the agroecosystems of the littoral region, the technique of struggle practised is mechanical. The pruning of the branches of the parasitized host is practised when the parasitism is advanced. Some peasants practise it rigorously by eliminating the parasitized branch up to the level situated upstream from the point of insertion of the parasite, in order to eliminate totally the absorption system. Other peasants only apply it approximately by simple suppression of the parasite tufts. The sucker saved regenerate very quickly new branches of the parasite after few weeks. However, Cocoa and Coffee plantations neglected and hardly parasitized by Loranthaceae, make illusory this curative fight. The agroecosystems and in particular Hevea monogeneous plantations constitute real tanks of scattering birds which perpetuate the Loranthaceae parasitism.

Chemical fight

The presence of the agroindustrial companies which practise Heveaculture reduce more chances of success of the mechanical fight. For the Loranthaceae parasitism, it is all the more so severe as cultures are monogeneous. The prospection made at Hevecam showed that it does not exist Hevea clones resistant to the Loranthaceae. Moreover, the choice of certain varieties of great income but sensible (GT1, PB 235) to the *P. capitata* parasitism, reduce more the chances of success of such an approach. They install themselves in the Hevea, Cocoa and Coffee plantations, real green church yards which maintain an inexhaustible stock of scattering birds. In 1995, the chemical struggle against the Loranthaceae by using "ethephon" has been practised in the Hevea plantations at Nyette. They consisted on injecting in the trunks of the host trees this substance which has no effect on *P. capitata*. In fact, the daubed notch of "ethephon" to stimulate the production has not prevented the parasite presence.

DISCUSSION

The fight against phanerogamic parasites can be done in a preventive or curative way (Sallé and Aber, 1986). The highest number of infested wood host by the Loranthaceae in Burkina Faso, Cameroon, Gabon (Boussim, 2002; Dibong 2009a, b, c, d; Engone and Sallé, 2006) make the curative fight by manual destruction not very promising. The Loranthaceae parasitism is all the more severe as the culture are monogeneous (Sallé, 1994; Dibong, 2008; Engone and Sallé, 2006; Engone et al., 2009). However, it permits to save the trees not yet infested, decreasing the infestation sources and reducing parasite seeds stock (Boussim et al., 1993). Yet this technique is proved to be effective for fighting against *Tapinanthus bangwensis* in the *Cola nitida* plantations (Clerk, 1978) and in Switzerland for eliminating the *Viscum album* (Sallé et al., 1998). The destruction for being final, must concern the parasitized branch up to a level situated upstream from the point of the parasite insertion, in order to eliminate completely the absorption system (Dibong et al., 2009e).

The use of “ethephon” is sometimes proposed for the chemical fight against the Loranthaceae by injection in the host trees trunks (Coder, 2003). This product has no effect on *P. capitata* since the daubed notch of “ethephon” for stimulating the production, does not prevent the parasite presence. In Europe, the chemical fight against the mistletoe (*V. album* L.) tested on conifer leaves gives good results (Baillon and Frochot, 1987). Boussim et al. (1993) think that it is illusory for the moment to apply it to the karate problem in Burkina Faso, considering the high level of trees infestation, the highest cost of the treatment and the lack of African agroforestery technology.

Among the techniques of struggle, chemical treatments have seduced by their effectiveness and their simplicity. Nevertheless, agrochemistry has his limits. The non reasoned and intensive usage of the products has diminished their effectiveness, whence a race to the last chemical family, widely exploited by the biochemical industry (Deguine et al., 2008).

The genetic fight is a part of the preventive solutions advocated in West and Central Africa (Boussim et al., 1993; Engone and Sallé, 2006; Dibong et al., 2008) to defavourise the Loranthaceae implantation on their hosts. The research of varieties of hevea resistant to the *P. capitata* parasitism from artificial infestations (Hariri, 1989) have permitted to show that the RRIM 600 and the PB 260 were less sensible at Hevecam (Sallé, 1994). These obtained results are in agreement with those published in Gabon (Engone and Sallé, 2006). Anatomical (phenolic components) parameters explaining these differences of sensibility have been highlighted (Hariri et al., 1992). Such works, which permit to obtain a gradient of sensibility to the Loranthaceae of fruit trees of economic importance (citrus fruit, avocado, guajava trees) of agroecosystem should be encouraged and pursued. The usage of host species less sensible to the Loranthaceae parasitism in the agroecosystem reforestation would avoid the spectre of “green churchyards” which prosper beyond the littoral region studied.

The biological fight would consist on influencing the avian population intervening in the scattering and predatoring of seeds. It is all about reducing the population of scattering birds by making the male sterile or favourising those implied in the predatoring of Loranthaceae seeds (Boussim et al., 1993). However, it is always dangerous to disturb the ecological balances in place, in fear of chain reactions. Invertebrates are important predatorings of the Loranthaceae in Australia and in New Zealand (Patrick and Dugdale, 1997) though their quantitative impact is limited. In *Paxarilla Colensoi*, 3.4 - 4.7% of annual loss of leaves is attributed to a grazing invertebrate. Most of predatorings are attributed to the Lepidoptera grubs (Platt and Edwards, 1992). De Lange (1997) argues that the decline of two butterflies feeding on Loranthaceae at the west of the Australian corn circular was due to the decline of Loranthaceae. Lepidoptera grubs and leaves-cutting ants are also flower predatorings, developed fruits and seeds of some Australian and neotropical Loranthaceae (Sargent, 1995). The foliage and flowers of Loranthaceae are grazed by many arborescent “marsupials” notably the “possum” with the bush tail (*Trichosurus vulpecula*), the “possum” with sounding common tail (*Pseudocheitrus peregrinus*), the great glider (*Petauroides volans*), and the Koala (*Phrascolarctos cinereus*) (Evans, 1992).

The work of Paardekooper (1989) and of Vincent et al. (2000) have shown that big trees produce more latex. Engone et al. (2009) confirm it by establishing a link between the latex production, the circumference of trees trunk and the notch length go in the same sense. The biggest and the most productive trees, being also the most parasitized, we would think first of a parasitism stimulating effect, not only on their development but also on the yield. However, for dwarf and parasitized trees having comparable circumferences, the U statistic of Mann-Whiney shows no significant difference of their productivity (Engone et al., 2009).

For economic and environmental reasons, other solutions are wanted. A complicated research showed that the biological phenomenons which push a bioagressor to attack the harvests are not well known. In the host species/Loranthaceae/ants associations, many ants exploit the Homoptera and / or Lepidoptera grubs (Samways, 1990). These associations cause considerable damages on the vegetative organs of the plant (roots, stems, leaves, flowers, and fruits (Dejean et al., 1997). In the plantations ants-Homoptera associations can be indirectly beneficial to host plants and /or to Loranthaceae which can so found themselves protected against phytophage herbivorous (Perfecteo, 1990).

Unfortunately, these associations cause frequently the proliferation of Homoptera and consequently damages to host trees (Samways, 1990). Moreover, some Homoptera are vehicles of plants diseases as it is the case of the delphacide of maize, *Peregrinus maidis* (Ashmed), (Fulgoromorpha, Delphacidae) which is the vehicle of two viral diseases of maize known at present in the world (maize mosaic virus and maize stripe virus) and equally vehicle of virus non-specific to maize (Nault, 1986). It is to point out that an association between Homoptera on a given vegetable species is not necessarily beneficial for another essence. On *Ficus* for instance, the association of ant and Tettigometridae, *Hilda patruelis* is beneficial for the plant (Compton and Robertson, 1988). Yet in Rhodesia, the same association is rather harmful to peanut cultures (Weaving, 1980).

Conclusion

In this prospect, an analysis of the role of different types of agroecosystem adjustments which favours the fauna and flora all in improving the agricultural production must be proposed for a suitable development. For that, the necessity of continuing the researches to evaluate the effectiveness and the ecological risks imposes itself. In fact the abundance of the Loranthaceae notably of *P. capitata* can be controlled by many series of changes that affect the environment or new factors introduced in it. It is necessary to promote agroecology which studies the body of actors and their interactions in agriculture.

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