

FIRST REGIONAL WORKSHOP ON COFFEE BERRY DISEASE

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DOCUMENTATION

SOME CONSIDERATIONS ON EPIDEMIOLOGY OF CBD IN KENYA AND CAMEROON,
IMPORTANCE OF THE DISEASE, METHODS OF EVALUATION OF LOSSES

by

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I - INTRODUCTION

Studies of epidemiology of a disease are very important to definite a policy of treatment in a given country, depending on sources of inoculum, climatic conditions and phenology of the plant.

Concerning CBD we personally studied that problem in Cameroon but also in Kenya.

II - SOURCES OF INOCULUM

Among the most important factors to be known in epidemiology, are the nature and the efficiency of the sources of inoculum.

Starting our studies in Cameroon in 1958 we were surprised to learn in the kenyan litterature, that, according to Nutman and Roberts "inoculum potential" theory, the main source of primary infection would be the bark

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of the branches where the parasite would be living without giving any damage but producing spores which infect the berries.

Counting the spores produced by the bark (number of spores per cm² per hour) these authors gave curves showing that the production of spores was the most important during the dry season : consequently they advised the farmers to do chemical treatments during that dry period, before flowering.

In some experimental trials we saw that this theory was not good in the conditions of Cameroon where preflowering treatments appeared not efficient at all, as it was to expect ; on the contrary, postflowering treatments were very efficient.

We studied the problem in Kenya (1) first in 1964 (2) and then in 1967, and we concluded in the paper we wrote at this occasion (3) that Nutman and Roberts had done three very great mistakes :

- firstly they confound all the *Colletotrichum* living in the bark of the branches with the CBD pathogen ;

- secondly they measured the production of spores on the bark in laboratory conditions in humid chamber and not in field conditions ;

- thirdly they completely forgot the role of the diseased berries in the production of spores.

Thanks to our study in Kenya, other studies were done in that country by Hindorf and Gibbs ; these studies confirmed our opinions :

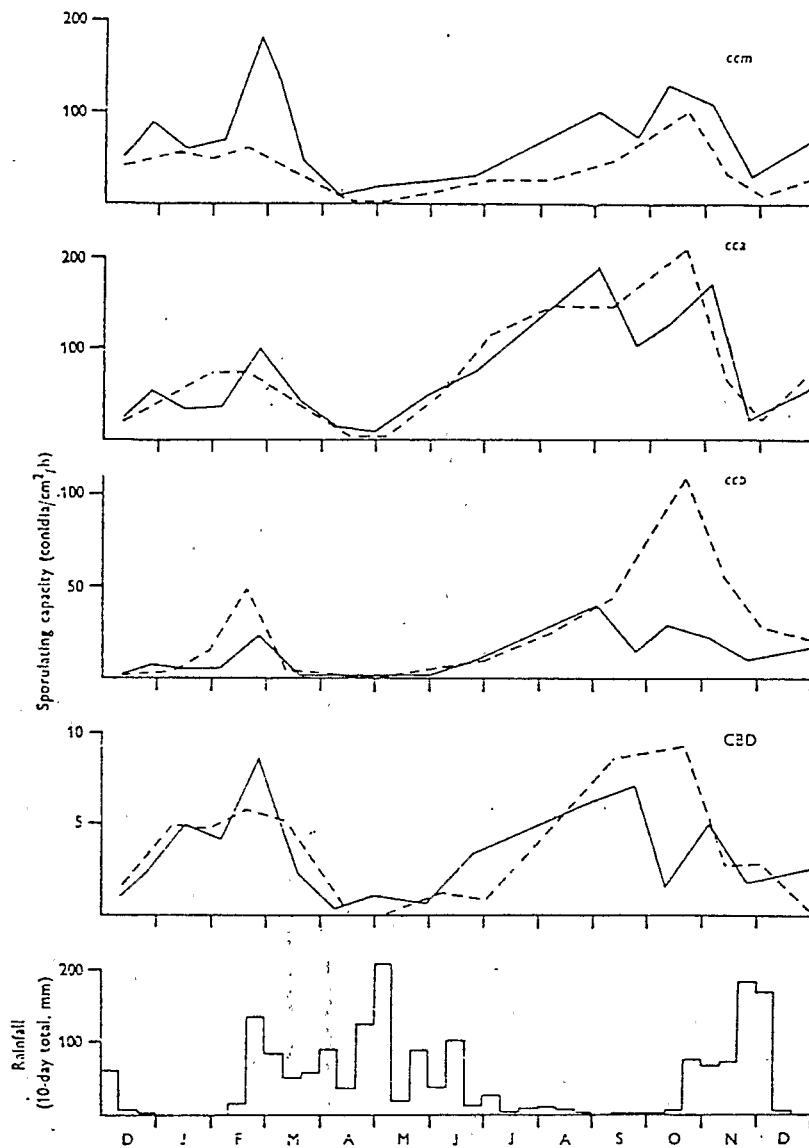
- the bark of the branches contains mainly at least 5 species of *Colletotrichum*, different from the CBD strain which is found only very scarcely in that tissue and not constantly (see the graph of Gibbs where the scale used for the CBD pathogen is 10 to 20 times greater than the scale used for the other species) : in such conditions it is possible to doubt that

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(1) H. VERMEULEN : Coffee Berry Disease in Kenya. Thesis, University of Wageningen, Holland, 1970, p. 25 and p. 95.

(2) First specialist meeting on Coffee Research, Nairobi, 1965.

(3) R.A. MULLER : La lutte contre l'antracnose des baies du caféier Arabica, due à une forme de *Colletotrichum coffeanum* Noack au Kenya. Café-Cacao-Thé, vol. XII, n° 1, 1966.



After GIBBS (Kenya 1968)

Spores production on branches for the different strains of *Colletotrichum* on untreated trees ——— Kamundu 1 - - - - Kamundu 2. The scale used for the CBD strain is 10 or 20 times greater than the others, showing that the production of CBD spores is very few. On the other hand, the sporulation is maximum during the dry season showing that the observation in laboratory is completely different from the natural phenomenon.

this fungus is really deeply living in the bark tissue ; even if it is true it is of very little importance in epidemiology, comparing with the role of the diseased berries themselves :

- the diseased berries are the main source of infection during the campaign because they produce a very great number of spores (from 700 to 900 per cm² per hour according to Gibbs) ;

- but, as we explained in 1967 they are also the main source of primary infection in that country due to the fact that there are 2 flowerings (april and november) giving 2 crops (the early and the late ones) which berries are always coexisting on the branches along the year, the early crop being a very efficient source of infection for the late crop and *vice versa*.

On the other hand it was shown in Cameroon that, among the possible sources of primary infection, the overlapping berries were a very important one. In Cameroon, due to the tropical climate of the CBD area - one dry season from november to late february, one rainy season from march to october - arabica coffee has only one important flowering near the first of march and only one important picking period from november to january.

But it happens, all along the year, that some flowers come and give fruits : these fruits are never picked because they reach their maturity out of time, being too few to justify special pickings. If such fruits are not important in terms of production, they play an important role in the epidemiology : being infected by CBD in an important proportion, they are a kind of bridge for the fungus from one campaign to the following one, as it was show experimentally (Table 1). In plots where that overlapping berries were removed before flowering, CBD was slower to develop than in plots where they remained on the trees.

Table 1 : Percentages of diseased berries 40 days after flowering.

Blocks	Plots	
	Plots without overlapping berries	Plots with overlapping berries
A	9,4	21,0
B	3,0	26,0
Average	6,2 (*)	23,5 (*)

(*) Significant at P = 0,01

It can be concluded that, in the conditions of Cameroon, and in all countries with similar type of climate giving only one annual economical production, the overlapping berries occurring during the year without any economical importance, had to be removed at the moment of the last tour of picking: it is true that this is not sufficient to control the disease but it appears to be a very good auxiliary of the chemical treatment, by reducing and retarding the development of the primary infection. It is obvious that such recommendation may not be made in countries where, as in Kenya, 2 economical crops exist.

Among the other sources of inoculum we think that the diseased berries remaining on the branches from one campaign to another, the diseased berries fallen and remaining on the soil, the fungus staying in the peduncles of the diseased berries remaining on the branches could be important.

We think that it is doubtful that the bark of the branches plays a very significant role — if any — as a source of CBD infection.

III - EVOLUTION OF THE DISEASE IN CAMEROON

When CBD occurs in the french speaking Cameroon in 1958 a study was immediately carried out to know :

- the true levels of the damages due to the disease which was necessary to decide of the opportunity of fungicide treatments ;
- the evolution of infection during the year in relation with the climatic conditions and the phenology of the plant.

This study gave some important informations :

- quantitatively speaking, the rate of infection and the resulting losses appeared to be very variable from one place to another during the same year, due to microclimatic conditions and to some other factors as importance of production, and also from one year to another for the same place, according to the annual variations of the climate ; but the losses may reach 80 % or more of the production ; considering that it is not possible to know

if one year will be very favourable to the disease or not, and due to the fact that the efficient fungicides were only preventive, it was concluded that the disease presented a very high risk and needed to be systematically controlled ;

- qualitatively speaking it was shown that the evolution of the infection was always the same, independently of its amount : infection (in terms of percentage of diseased berries in relation to the number of total berries at the moment of each observation) has three phases :

. a phase of quick increase from the 6th to the 22nd week after flowering, corresponding to the expanding stage of the young green berry :

. a phase of stabilization from the 23rd to the 32nd week after flowering, corresponding to the stage of stabilization of the size of the green berry : during this second phase, new lesions do not occur ;

. a new phase of increase (occurrence of new lesions) later on, during the premature and mature stages of the berries, but at this moment the damages are not important, the pulp of the berry only being rotted.

As a direct consequence it was shown that the losses due to the disease took place during the expanding stage of the berries ; later on the losses were not important or of little importance.

According to these observations it was concluded that the chemical treatments had to be done during the young stages of the berries that means during the first 22 weeks following the flowering and were completely useless later on.

IV - DIFFICULTY TO ASSESS THE CBD LOSSES IN EPIDEMIOLOGICAL STUDIES

For studies of epidemiology, we observed weekly a number of populations of berries, recording every time the total number of fruits, and the number of diseased and healthy ones.

It appears, during that studies, that it was not very easy to evaluate the losses due to CBD. This is due to the fact that the phase of main infection - and therefore the period of main losses - is also the period of

main physiological drops of the berries : when we observe -- as we did -- a given population of berries, it is difficult to know if the berries which disappear between two observations, were CBD-free (physiological drop) or not. Even if the observations are done weekly and branch by branch, comparing the datas recorded one week to those recorded the next one, it is impossible to avoid an over-estimation of the losses.

The only way to avoid this error is to mark each diseased berry by putting a little coloured thread around its peduncle with a very great care to avoid wounding or destructing that berries.

But this difficulty occurs only when one observes evolution of infection and losses on a previously fixed population of fruits, for epidemiological studies. In trials comparing the effectiveness of fungicides or other human interventions, the problem does not exist : if the plots are homogeneous and the trials with a sufficient number of replications, the results have to be mainly recorded in such cases, in terms of percentages of diseased berries on representative samples picked monthly, and finally in terms of weight of the yield.

V - CONCLUSION

The studies we carried out in Cameroon and in Kenya have shown that CBD is a disease of the young stages of the berries coïnciding with a rainy period which allows the pathogen activity.

The main source of contamination is the diseased berries themselves as secondary sources as well as primary source ; comparing with the berries, the bark does not play a very significant role in the contamination.

A great care has to be done to assess the amount of losses due to CBD in studies of epidemiology because of the coïncidence of that losses and the physiological drop which affects the young berries at the same moment.

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