Chapter 1.5

Cameroon

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Introduction

Cassava mosaic begomoviruses transmitted by *Bemisia tabaci* and causing cassava mosaic disease (CMD) are among the most important vector-borne pathogens of crop plants in sub-Saharan Africa (Geddes, 1990). Yield losses attributable to CMD are estimated at 28%-40% (Thresh et al., 1994). Fauquet and Fargette (1990) reported yield losses ranging from 20% to 95% for particular varieties of cassava (*Manihot esculenta* Crantz) under specific conditions. The incidence and effects of CMD in different ecozones are influenced by environmental factors, the intensity of cassava cultivation, the relative susceptibility and sensitivity to infection of cassava genotypes grown, and the virulence and abundance of virus and vector species (Fargette and Thresh, 1994). Disease epidemiology may be influenced also by the incidence of *Bemisia tabaci* (Gennadius), the principal vector of CMD, and of *B. afer* (Priesner and Hosny), a non-vector species that also occurs on cassava (Robertson, 1987; Fishpool and Burban, 1994; Legg, 1995), as well as by man through the transport and replanting of infected cassava cuttings. In Cameroon, Fondong et al. (1997), using infection of initially CMD-free cuttings as an indicator, showed that the spread of the disease was more rapid in the lowland forest than in the mid-altitude forest and savannah areas. It was also observed that CMD spreads faster in monocultures of cassava or when cassava is intercropped with cowpea (*Vigna unguiculata* [L.] Walp.) than in cassava intercropped with maize (*Zea mays* L.) (Fondong et al., 1997). In a regional CMD epidemiology trial covering Benin, Cameroon, Ghana and Nigeria, varietal differences in the rate of CMD infection were observed among improved and local varieties (James et al., 1998).

Given that many factors influence CMD epidemiology, a detailed understanding of the various cassava agro-ecologies, the associated whitefly species composition and the cultivation practices of the farmers may be helpful in designing the most appropriate CMD control strategy. Furthermore, since the disease is prevalent in almost all the major cassava production areas of Africa, potential advantages are to be gained in collecting such baseline data from different areas using a common

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protocol, to enable valid comparisons to be made between countries and thus facilitate the search for effective solutions. This chapter reports the status of the CMD problem, the species composition and relative abundance of *Bemisia* whitefly populations, and the cassava production practices in three major cassava agro-ecologies of Cameroon.

Surveys carried out in November and December 1997, and later in March 1998, followed the methods previously agreed among project partners. Seventy fields were surveyed in three cassava growing regions chosen to represent the major agro-ecological regimes under which cassava is grown in Cameroon: South-West Province, representing rainforest (26 fields); Central/South Province, representing transition forest (28 fields); and North-West Province, representing wet savannah (16 fields) (Figure 1).

Figure 1. Areas surveyed for whitefly incidence and cassava mosaic disease in Cameroon.

Increased Biological Understanding

Two whitefly species, *B. tabaci* and *B. afer*, were identified on cassava in Cameroon. *B. tabaci* was the prevalent species, comprising at least 92% of whitefly adult collections in each of the zones surveyed. Whitefly abundance averaged 4.1 adults per cassava shoot tip in the rainforest, 3.1 in the transition forest and 2.4 in the wet savannah. Logarithm-transformed whitefly counts were significantly lower in the wet savannah than in each of the other ecozones ($t > 3.11$; $P < 0.05$). Two parasitoid species, *Encarsia sophia* (Girault and Dodd) and *Eretmocerus* sp. were hatched from *Bemisia* mummies; *E. sophia* predominated in the collections.

Total CMD incidence averaged 44% in the rainforest, 72% in the transition forest and 45% in the wet savannah. Incidence of stem cutting infection contributed far more to total CMD incidence than did whitefly infection (Figure 2) and was significantly higher in the transition forest than in either of the other ecozones ($t = > 3.09$; $P < 0.05$). A possible reason for the high incidence of cutting infection observed in the transition forest is that at least 90% of farmers in the region grow CMD-susceptible local cassava varieties whose tender leaves are consumed as leafy vegetables. The incidence of whitefly infection, transformed to allow for the effect of multiple infection (Gregory, 1948), was significantly lower in the transition forest than in either of the other ecozones ($t > 6.27$; $P < 0.05$). In all ecozones, most of the diseased plants had a mean damage severity score of 2 (“slight damage”, on an ascending damage severity scale of 1 to 5) and the proportion of plants with damage severity score 4 was negligible; there were no plants with damage score 5 (Figure 3).

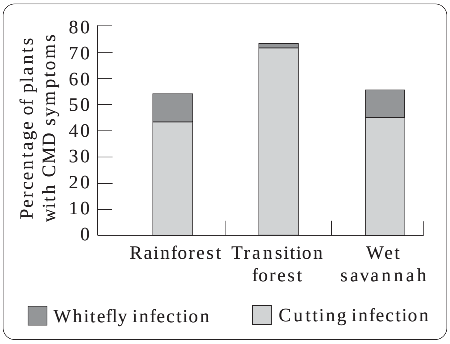

Figure 2. Cassava mosaic disease (CMD) incidence and source of infection in the ecozones of Cameroon.

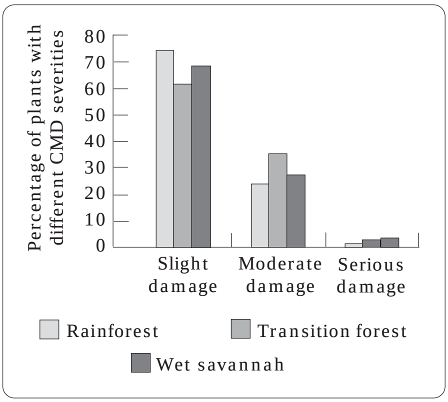

Figure 3. Cassava mosaic disease (CMD) damage severity in the ecozones of Cameroon.

Increased Socio-Economic Understanding

Cassava farmers were mostly women (87%). Sixty-six percent of farmers owned land whilst 20% rented land for farming; the remaining 14% offered no response on the issue of land tenure. Farm size averaged 0.29 hectares (2.5 nearby fields) in South West Province, 0.6 hectares (2.4 nearby fields) in Central/South Province and 0.32 hectares (4.2 nearby fields) in North-West Province. Farmers grew cassava mostly on land that had been worked for more than 5 years (60% of sites). Fourteen percent of the farms were on land that had been worked for between 2 and 5 years, and 26% on land that had been cultivated for less than 2 years. Only 21% of cassava farmers practiced crop rotation. Nineteen percent of farmers ranked cassava as the most profitable crop and 90% of farmers sold all or part of their cassava crop.

Farmers generally attached no significance to whiteflies and in their local languages they simply referred to them as “flies” or “white insects”. In contrast, 51% of farmers recognized CMD as a problem and in local languages referred to the disease symptoms variously as “crazy disease”, “curl”, “jelly cassava”, “leaf curl”, “leprosy”, *kalle*, *khumbo*, *nome* or *pama*. Use of these local names, which describe the symptoms, will be helpful in training farmers to improve their understanding of the causes and nature of the disease.

No farmer reported total yield losses attributable to CMD; however, 16% of farmers reported losses of 25% in the first season, 20% reported 50% losses and 10% reported 75% losses. These figures are surprising in view of the mild damage observed in the survey, which, based on experience elsewhere, would not be expected to lead to significant yield loss. Most farmers indicated that climate affected whitefly/CMD problems and stated that the problem was most severe during the early growth stages of cassava. This period corresponds to March-April during the first season and to August during the second growing season in Cameroon. Even though most farmers recognized CMD as a problem that occurs every year, 61% of them had received no technical information or assistance on the problem.

Farmers undertook various measures to combat the whitefly/CMD problem. The common practices were roguing, choice of resistant varieties, selection of planting material and the application of wood ash or of fertilizers (Figure 4). Less than 2% of farmers used pesticides against whiteflies and/or CMD. Even though it might be supposed that the high incidence of cutting infection observed in the survey would make roguing an unattractive strategy, it was nevertheless the predominant practice.

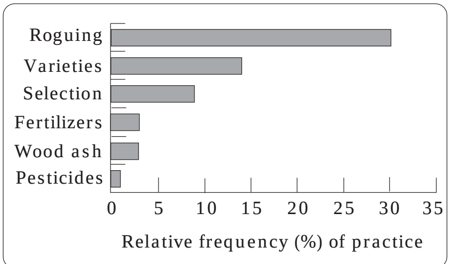

Figure 4. Cassava mosaic disease management practices used by farmers in Cameroon.

In their choice of varieties, 86% of the farmers were aware of the differences in susceptibility to the disease among cassava varieties. Among improved varieties recommended for their disease resistance, “Agric” (of International Institute of Tropical Agriculture, Nigeria [IITA] origin), chosen by 47% of farmers, was the most commonly selected. The variety Pawpaw leaf was the single most frequently planted CMD-resistant local variety (chosen by 9% of farmers). Other CMD-resistant local varieties cited were Metta agric, Mfont and Ndongo.

Most farmers (96%) indicated that in selecting planting materials they intentionally chose parent plants with minimal or without CMD symptoms. This practice would inherently favour CMD-resistant varieties. Farmer-led rapid multiplication schemes to produce CMD-resistant varieties may therefore be relatively easy to promote under such circumstances by building upon previous technology transfer experiences and farmer training programmes in the country (Dahniya et al., 1994; Akoroda, 1997; Bakia et al., 1999). In selecting planting material, the five most important criteria were yield (34.3% of farmers), followed by stem health (25.7% of farmers), absence of diseases (17.1% of farmers), stem size (5.7%) and stem maturity (4.3%). Most farmers expressed willingness to change planting dates for CMD control but 30% of them indicated unwillingness to alter planting date.

Conclusions

There was only limited evidence of CMD being spread by its whitefly vector in farmers’ fields in Cameroon. Infected planting material was the major source of CMD and a major extension effort will be required to encourage farmers to select disease-free and healthy planting materials. If effective measures to improve crop health are to be developed, the importance of latent infection will have to be investigated. The expressed willingness of farmers to alter planting dates and their conviction that CMD incidence varies with climatic conditions paves the way for participatory action research to optimize times of planting in the various ecozones so as to reduce CMD incidence and damage. In such studies, it may be useful to monitor the population dynamics of *B. tabaci* to see whether its abundance varies at the different planting times. Evaluation of parasitism by existing natural enemies (*E. sophia*, for example) may help show whether biological control contributes significantly to regulating populations of the vector. Such information will contribute to understanding the role of *B. tabaci* in the epidemiology of CMD.

Even though the CMD damage observed in the survey was slight, farmers provided high yield loss estimates. This suggests the need for farmer participatory yield loss trials to quantify losses both of storage roots and leaves, especially since the latter are widely consumed as leafy vegetables, but losses have been little studied. Farmer participatory varietal selection trials also need to be conducted on the local cassava varieties (such as Pawpaw leaf), which farmers report to be CMD-resistant, and comparisons made with cultivars whose response to CMD is well documented. Such studies will provide valuable input into breeding programmes that aim to achieve sustainable high yields in varieties preferred by farmers and to increase adoption of such varieties.

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