CHAPTER 1.10

Madagascar

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Introduction

Cassava mosaic disease (CMD), caused by cassava mosaic begomoviruses transmitted by the whitefly *Bemisia tabaci* (Gennadius) and through virus-infected planting material (Harrison, 1987), is the most important viral disease of cassava (*Manihot esculenta* Crantz) in Madagascar. The disease was first reported in Madagascar in 1932, although it was of only minor importance at this time (François, 1937). Epidemics were first reported in 1934, from an area to the west of Lake Alatroa on the central plateau and, between this time and the end of the 1930s, the epidemic spread to cover all cassava-growing areas of the island (Cours, 1951). Symptoms in local varieties were very severe and cassava cultivation was abandoned on a wide scale. The impact was so great that the government ordered urgent attention to be given to the problem (Frappa, 1938) and a major programme for the development of resistant varieties was initiated (Cours, 1951; Cours-Darne, 1968). The first of these varieties was widely disseminated in the mid-1940s. Since this time, CMD appears to have become a problem of relatively minor significance.

Sweetpotato virus disease (SPVD) results from co-infection of sweetpotato (*Ipomoea batatas* [L.] Lam.) by whitefly-transmitted *Sweetpotato chlorotic stunt virus* and aphid-transmitted *Sweetpotato feathery mottle virus* (Gibson et al., 1998). SPVD has not been reported as a major problem in Madagascar, although the country is one of the largest producers of sweetpotato in Africa.

In order to provide a basic understanding of the incidence of whiteflies, CMD and SPVD in Madagascar, a study was conducted in four survey areas that represent the major cassava and sweetpotato growing areas: Antananarivo (central mid-altitude plateau), Fianarantsoa (eastern humid coast), Toliara (south-western semi-arid coast) and Mahajanga (northern sub-humid coast) (Figure 1). This initial phase of the study aimed at documenting the status of whiteflies and whitefly-transmitted viruses and at describing producer knowledge of these problems on cassava and sweetpotato, with a view to prioritizing further actions and eventually developing integrated management strategies to tackle the most serious problems identified. The survey was carried out during the months of June and August 1998.

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Figure 1. Cassava- and sweetpotato-growing areas surveyed for whitefly incidence in Madagascar.

Increased Biological Understanding

Whitefly species and abundance

Two whitefly species, *B. tabaci* and B. *afer* (Priesner and Hosny) were identified on both cassava and sweetpotato. Of 415 whitefly samples collected on the two crops, 118 were *B. tabaci* and 297 were *B. afer*. Adult whitefly populations on cassava were greatest in the Antananarivo survey area and lowest in Mahajanga (Table 1, see also Figure 3 in Chapter 1.14, this volume). Whiteflies were very scarce on sweetpotato.

Disease incidence and symptom severity

The highest disease incidence (71%) was recorded in Fianarantsoa, while the lowest (31%) was recorded in Antananarivo (Table 1). The planting of infected cuttings was much more important than whitefly transmission as a source of infection and comprised 86% of total infection. CMD symptom severity was relatively mild in Antananarivo but was severe elsewhere.

SPVD was of very low incidence or absent, except in the Toliara survey area, where an incidence of 18% was recorded. SPVD symptoms were severe in Antananarivo but very mild where the disease occurred elsewhere.

Increased Socio-Economic Understanding

Farmers' assessment of whitefly-related problems

Thirteen percent of cassava farmers but only 3% of sweetpotato farmers recognized whiteflies. Scarcely any of these farmers considered whiteflies to be a problem on either crop. Almost one fifth (19%) of cassava farmers were able to recognize CMD as a disease of cassava and gave the disease a range of local names, whereas no sweetpotato farmers recognized SPVD. Only 6% of cassava farmers considered CMD as a production constraint to cassava. They noted that the disease occurs yearly and that it was becoming more severe. Climate affects CMD and SPVD incidence according to 30% of cassava farmers and 5% of sweetpotato farmers. In particular, 19% of cassava farmers noted that disease is more severe during periods of little rain and high temperature but sweetpotato farmers did not report this effect. None of the farmers could estimate the level of yield loss attributable to either disease. The lack of recognition of CMD, first as a disease and second as a constraint to production, is

Table 1. Incidence of cassava mosaic disease (CMD) and sweetpotato virus disease (SPVD), disease severity and whitefly abundance on cassava and on sweetpotato in selected regions of Madagascar, 1998.

Province	Cassava[a]						Sweetpotato[a]			
	No. fields	Whitefly counts	CMD				No. fields	Whitefly counts	SPVD	
			Whitefly infection	Cutting infection	Total incidence	Severity			Incidence	Severity
Antananarivo	35	7.1	5.6 (7.8)	25.5	31.0	2.6	11	0.01	2.6	3.3
Fianarantsoa	22	4.3	7.1 (21.9)	63.9	71.0	3.5	15	0	2.4	2.0
Toliara	12	5.9	6.4 (11.2)	39.7	46.0	3.2	7	0.10	17.6	2.3
Mahajanga	42	2.5	6.9 (11.0)	34.0	41.0	3.3	6	0	0	-
Mean		5.0	6.5 (11.6)	40.8	47.3	3.1	-	0.03	5.7	2.5

a. Figures are means for each province. Whitefly counts, whitefly abundance on cassava (number of whiteflies per top five leaves) and on sweetpotato (per minute count); whitefly infection, figures in parentheses transformed to multiple infection units to allow for multiple infection (Gregory, P. H. 1948. The multiple infection transformation. Ann. Appl. Biol. 35:412-417); severity of disease measured on an ascending 1-5 scale, from low to severe.

surprising, particularly given the history of previous CMD epidemics in Madagascar and the severity of the disease symptoms observed.

Managing whiteflies and whitefly-transmitted viruses

Selection of clean planting material was the only disease management approach used—as reported by 40% of cassava farmers and 13% of sweetpotato farmers. Sixteen percent of cassava farmers and 3% of sweetpotato farmers used the absence of disease symptoms as selection criterion but both considered the method to be only partially effective. Only 27% of cassava farmers and 3% of sweetpotato farmers were able to recognize differences between varieties of their respective crops and even fewer (only 2% of cassava farmers and no sweetpotato farmers) could describe or characterize these differences. Cassava farmers growing improved varieties noted that their performance was only slightly better than the local varieties. Only 4% of cassava farmers and no sweetpotato farmers received technical assistance in whitefly or disease management. None of the farmers considered that environmental factors such as certain patterns of weather gave them any idea about what whitefly populations or disease levels would result and most were unwilling to change the planting dates of their crops even if it might help reduce the effects of whiteflies and/or disease. The farmers' reluctance is understandable, however, given the relatively short rainy season in much of Madagascar that leaves them little scope to adjust planting dates.

Conclusions

The incidence of CMD was low in many farmers' fields, compared with figures reported from countries on the African mainland, at least in three of the four survey areas. Infection was mainly attributable to the use of diseased planting material. However, the high severity of the symptoms in plantings where the disease does occur suggests that farmers are probably sustaining significant yield losses. It would be valuable to quantify yield losses in local cultivars being grown in each of the target areas. Such an exercise should be carried out with the full participation of farmers and could be used simultaneously to introduce new germplasm and evaluate its performance and acceptability.

The sharp disparity in SPVD incidence between Toliara and the other three survey areas is difficult to explain. Although the abundance of whitefly adults was greatest in this target area, whitefly populations were generally very low compared to those recorded in other countries. In addition, at the time the survey was conducted, *B. afer*, a non-vector, was the predominant species on both cassava and sweetpotato. More detailed epidemiology and population dynamics studies investigating changes in abundance of the two whitefly species and disease spread over time would be required in order to identify the reason(s) behind this difference.

Both cassava and sweetpotato farmers had inadequate knowledge of the principal diseases and the options available for managing them. A participatory research and training effort would enhance farmers' knowledge and would help researchers understand the constraints to farmers' adoption of resistant varieties and other potential management tactics. It would be valuable also to continue to monitor the incidence of the two diseases in the country and strengthen the national breeding program, to compare local sources of resistance

with those available elsewhere and so develop resistant varieties acceptable to farmers.

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References

Cours, G. 1951. Le manioc à Madagascar. Mémoires de l'Institut Scientifique de Madagascar Série B Biol. Vég. 3:203-400.

Cours-Darne, G. 1968. Improving cassava in Africa. The Abidjan Conference. Agr. Res. Prior. Econ. Dev. Afr. 2:330-339.

François, E. 1937. Un grave peril: La mosaïque du manioc. Agron. Colon. 26:33-38.

Frappa, C. 1938. Les insectes nuisibles au manioc sur pied et aux tubercules de manioc en magasin à Madagascar. Rev. Bot. Appl. 28: 17-29.

Gibson, R. W.; Mpembe, I.; Alicai, T.; Carey, E. E.; Mwanga, R. O. M.; Seal, S. E.; Vetten, H. J. 1998. Symptoms, aetiology and serological analysis of sweetpotato virus disease in Uganda. Plant Pathol. 47:95-102.

Gregory, P. H. 1948. The multiple infection transformation. Ann. Appl. Biol. 35:412-417.

Harrison, B. D. 1987. Properties and geographical variation of geminivirus isolates from mosaic-affected cassava. *In*: African cassava mosaic disease and its control. Procs. International Seminar, 4-8 May 1987, Yamoussoukro, CI. Centre Technique de Coopération Agricole et Rurale, Wageningen, NL, and Institut Français de Recherche Scientifique pour le Développement en Coopération, Paris, FR. p. 270.