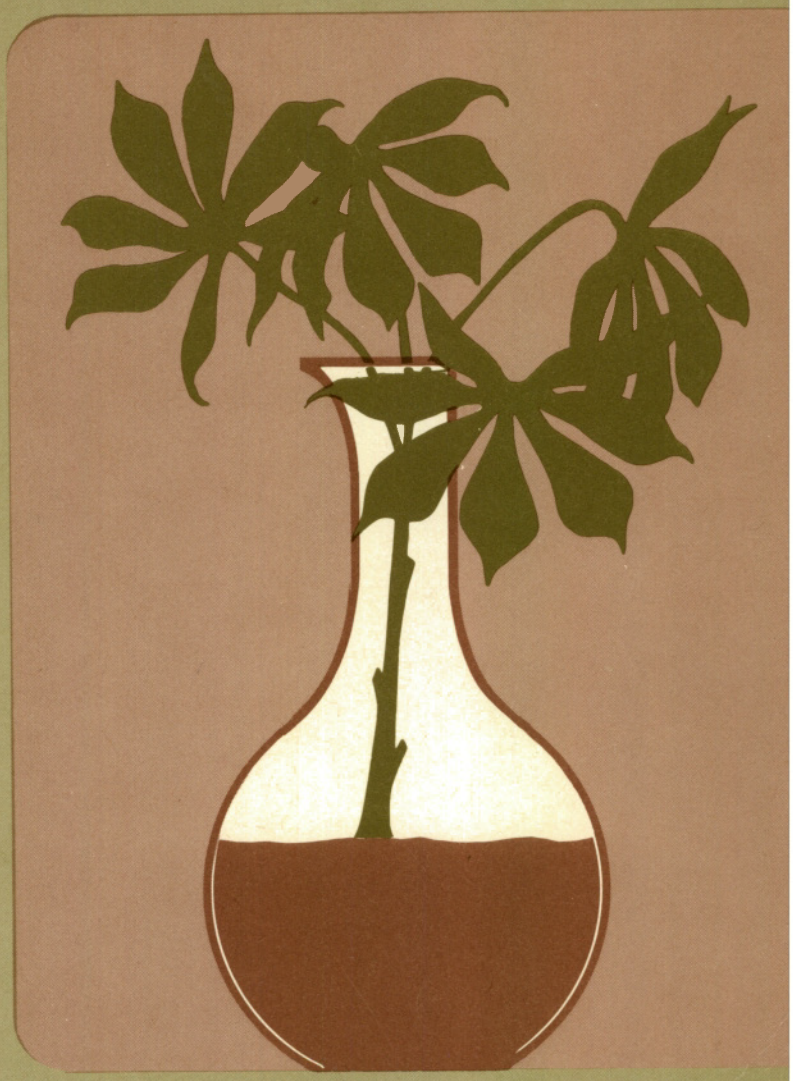
CASSAVA BACTERIAL BLIGHT

report of an
interdisciplinary workshop
held at
IITA, Ibadan, Nigeria,
1-4 November 1976.



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/IDRC publication/. Report of a workshop on the /cassava/ /bacteria/l blight (CBB) /plant disease/ in /Africa south of Sahara/ — discusses the /diagnosis/ and /geographic distribution/ of CBB, influence of shade (/solar radiation/) and /intercropping/ on its incidence, /plant breeding/ for /disease resistance/; /disease control/ efforts in /Nigeria/, /Zaire/ and /Ghana/. Includes /bibliography/s, /list of participants/ and country statements from /Benin PR/, /Congo PR/, Ghana, and /Togo/.

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Editors: **Gabrielle Persley, Eugene R. Terry, and Reginald MacIntyre**

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Distribution and Importance of Cassava Bacterial Blight in Africa

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In Africa, cassava (*Manihot esculenta*) is affected by two major diseases: mosaic, of unknown origin, and cassava bacterial blight (CBB) caused by *Xanthomonas manihotis*. CBB has been recognized as a damaging disease in South America since the early 1900s (Lozano 1975), but was first confirmed in Africa in 1972 (Williams et al. 1973). It now occurs with certainty in seven countries of West or Central Africa. It was first recognized in Nigeria in 1972 (Williams et al. 1973), in Zaire in 1973 (Hahn and Williams 1973), and subsequently in Cameroon (Terry and Ezumah 1974), Benin (Desmidts, personal communication), Togo (Adam, personal communication), Ghana (Doku, personal communication), and Congo Brazzaville (Batsimba and Mabanza, personal communication). With the exception of Congo Brazzaville, I have observed the disease in all these countries and have isolated the bacterium, confirmed the pathogenicity, and characterized it sufficiently to identify it as *X. manihotis*. Cultures from these countries have been deposited at the Commonwealth Mycological Institute (CMI), London.

Bacterial leaf spots on cassava were reported earlier from Madagascar (Bouriquet 1946), Mauritius (Orian 1948), Malawi (Wiehe and Dowson 1953), Uganda (Hansford 1938), and Zaire (Buyckx 1962). Examination of these reports indicates that there is a high probability that a bacterial leaf spot occurred in each case. However, in most instances, the bacteria isolated were not adequately characterized, nor were reference cultures deposited in an accessible culture collection for use by later workers. Therefore, the identity of the pathogen(s) remains uncertain.

One exception is the 1953 report from Malawi by Wiehe and Dowson, where the pathogen isolated was examined and described by Dowson at CMI. He found it to be a yellow xanthomonad, and named it *X. cassavae* Wiehe and Dowson. The description of the symptoms indicates that they differ from those attributed to *X. manihotis*. However, because of the absence of any further records of this disease from Malawi or elsewhere in Africa, it remains an enigma. The report of *X. manihotis* on cassava in Mauritius is probably correct, in that its pathogenicity was determined by Orian and its identity as *X. manihotis* confirmed by Starr (Orian 1948). However, there have been no further references to any of these bacterial diseases in these countries.

This paper presents information on the geographic distribution of CBB, based on recent surveys in Benin, Cameroon, Ghana, Nigeria, and Togo. The possible origin and recent changes in disease severity are also discussed.

Distribution

The first confirmed report of CBB in Africa was in Nigeria in 1972. The known distribution at present and first records of CBB in Africa are shown in Fig. 1.

Cameroon

A detailed survey of CBB in Cameroon was made in June 1976. Data were collected from 155 farms, which were selected by making spot checks at regular intervals along the route, usually every 20 km. At each site, the presence or absence of CBB, mosaic, anthracnose caused by *Glomerella manihotis*, and fungal leaf spots caused by *Cercospora* spp. were noted. In addition, the vegetation, soil type, topography, cropping system, companion crops, age, and vigour of the cassava were recorded.

The farms were given a rating for each disease on a 0–5 scale, based on the frequency and severity of symptoms: 0 — no disease, none; 1 — occasional occurrence, mild; 2 — moderate occurrence, mild; 3 — moderate occurrence, some severe; 4 — frequent occurrence, mostly severe; 5 — very frequent occurrence, severe. Severity was assessed on the basis of symptoms on the aerial parts of the plants.

The incidence of a disease in a particular area was based on the percentage of farms inspected in which the disease was recorded. The severity index in a district was estimated as a percentage of the maximum possible score if all the farms were severely affected: severity index = sum of farm scores on 0–5 scale × 100/total no. of farms × 5. Detailed results of the survey are available elsewhere (Persley 1976).

The route followed and the occurrence of CBB in different vegetation zones are illustrated in Fig. 2.

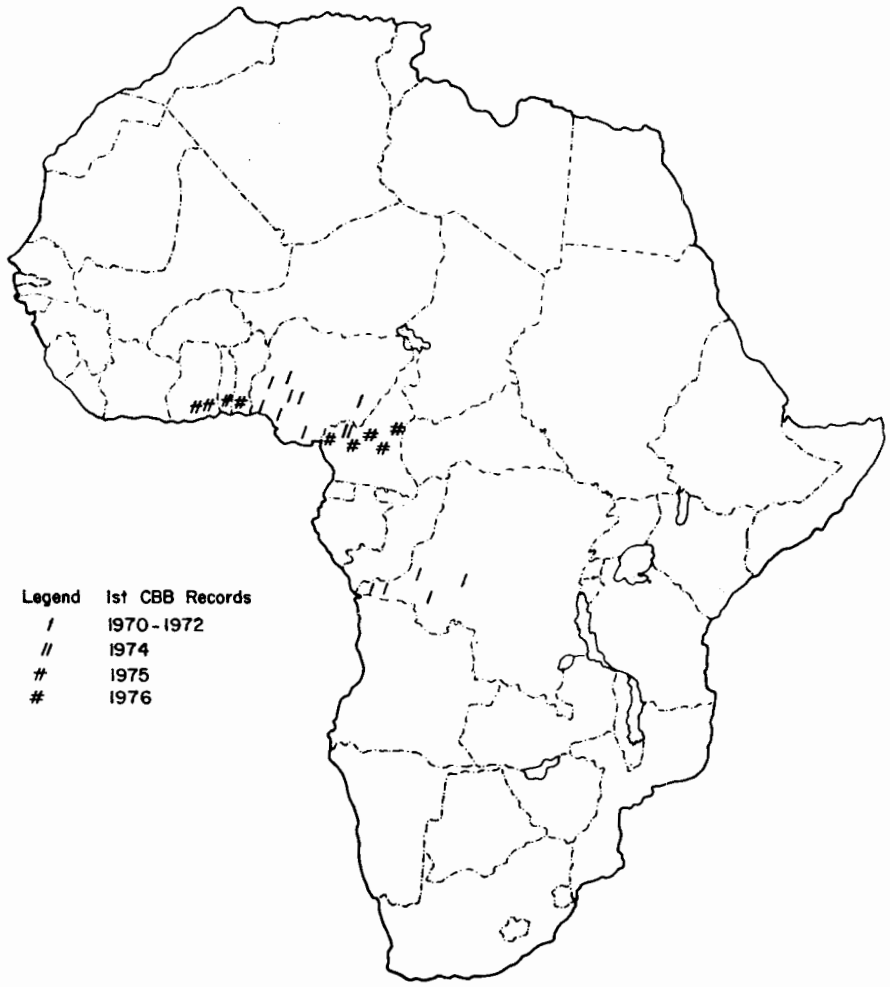

Fig. 1. Known distribution of cassava bacterial blight in Africa (October 1976).

The observed incidence and severity of CBB in Cameroon are summarized in Table 1. The disease occurs in both forest and savanna regions but is more prevalent in the savanna where cassava is grown as a monocrop. It is widely distributed, occurring from the highland savanna around Bamenda and Wum (1700 m altitude), eastwards across the guinea savanna to Garoua Boulai, near the border with the Central African Republic, a distance of some 600 km. It also occurs in a localized area around Victoria and Buea in the west of the country. The high frequency and severity near the border with the Central African Republic suggest that the disease is also likely present in that country.

The disease was not found in cassava examined west of Bamenda to Ekok on the Nigerian border nor for a further 40 km on the Nigerian side of the border. It was also absent from farms inspected between Mamfe and Kumba, an area parallel to the border. Its apparent absence from this part of western Cameroon suggests that it is unlikely that the pathogen moved via this land route from Nigeria to Cameroon or vice versa.

The widespread distribution of CBB in Cameroon, where it sometimes occurs on peasant farms in isolated areas, suggests that it has been there for many years, although its presence was not reported until 1974. CBB is rare in the forest areas between Douala and Bertoua, where cassava is grown on a 12-mo cycle mixed with several other crops. In contrast, the highest incidence and most

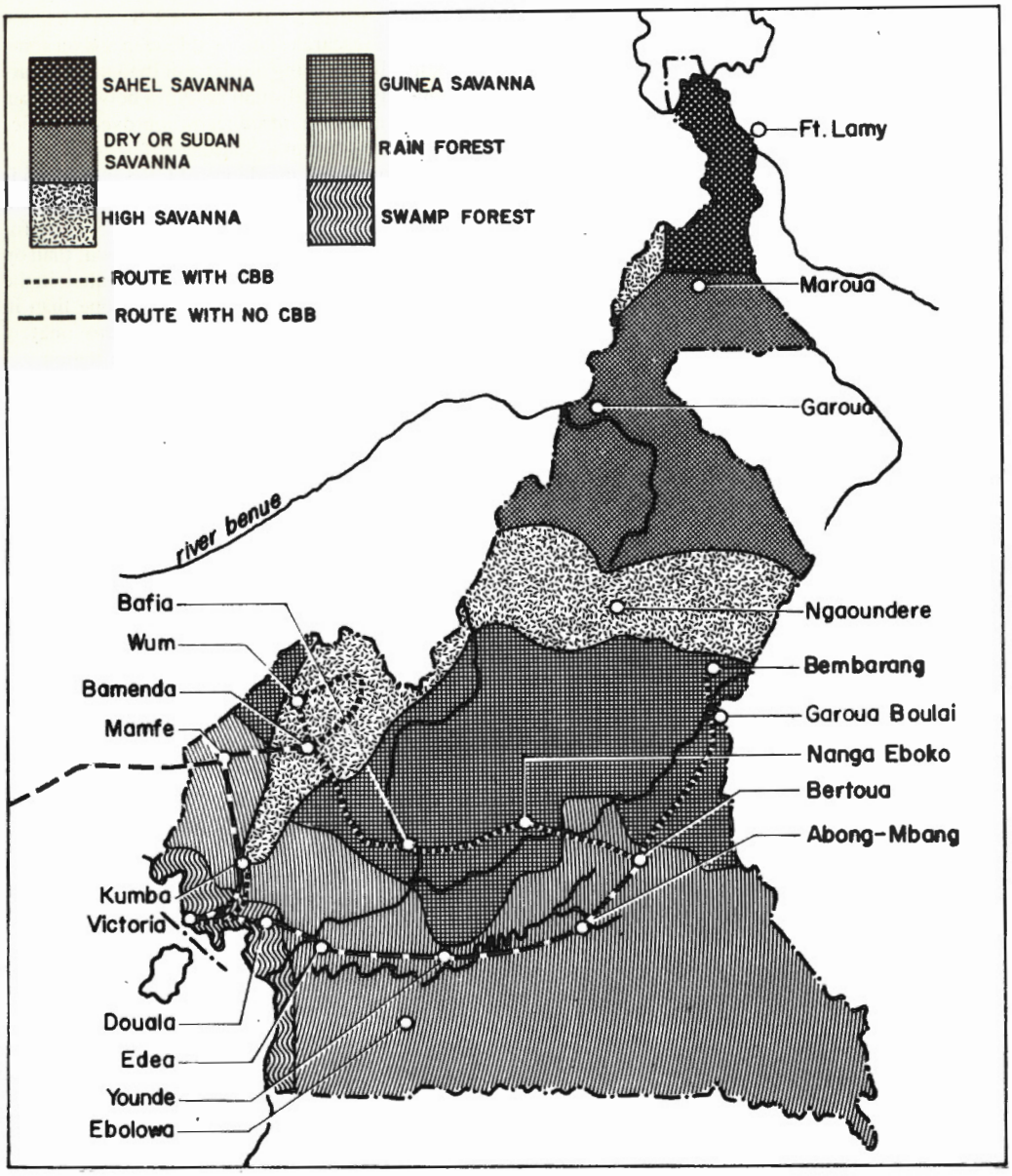

Fig. 2. Distribution of cassava bacterial blight and vegetation zones in Cameroon.

severe symptoms occur in monocropped cassava growing in the savanna region between Bertoua and Garoua Boulai. The cassava here is grown for 18–24 mo before harvest in contrast to a 12-mo cycle in the forest. These observations suggest that there is a correlation between disease development, cropping pattern, and environmental factors.

Cassava was first introduced into Cameroon in the early 1800s, and was an important staple food, especially in the central and eastern regions by 1945 (Jones 1959). However, considering the long history of communications between Latin America and West Africa since 1500, it is possible that cassava may have been introduced much earlier in Cameroon. A cassava variety reported to be resistant to a blight disease that was causing serious damage in southern Cameroon was introduced in the Ebolowa region in 1920. This variety later

became widespread throughout the southern part of Cameroon (Reeves, personal communication). There has been no recent widespread movement of planting material nor introduction of improved varieties in the country.

Nigeria

CBB occurs in most cassava-growing regions, but is reportedly most damaging in eastern Nigeria (Ezeilo 1977). The disease has been most severe on the improved varieties 60444 and 60447, which were released by the Ministry of Agriculture in 1967, although it also occurs on some local farmers' varieties.

In the Umuahia region of eastern Nigeria, I saw the disease in many varieties at the agricultural research station at Umudike, and in field plots established for extension purposes with cuttings taken from the station. It was not seen on cassava growing as a mixed crop on some peasant farms examined in the same area.

From Enugu to Asaba, north of Umuahia, in the forest/savanna transition zone, CBB was more prevalent than in the Umuahia region, occurring on Otuocha Agricultural Station, and on local small farms.

In midwestern Nigeria, the improved cultivars 53101, 60444, and 60447 at Agbarho Agricultural Station near Warri were severely affected by CBB in 1973 and 1974 (Heys 1977). However, the incidence and severity of the disease have fallen drastically over the past 2 yr. There is presently little disease at the station, even in susceptible cultivars such as 60447.

In the western region, CBB occurs on agricultural research stations at Ibadan and on some farms locally. Moving north from Ibadan, it occurs infrequently on local small holdings between Ilorin and Mokwa, and in introduced, improved varieties at Mokwa Agricultural Station.

In summary, the incidence of CBB in Nigeria is higher on government farms and experiment stations, where varieties released since 1960 for high yield and mosaic tolerance are grown, than on peasant farms. The disease is more prevalent in the savanna or forest/savanna transition zone than in the deep forest. It has been found on approximately 40% of farms examined in the savanna region.

People's Republic of Benin

CBB is widely distributed in the south of the country, occurring frequently between Cotonou and Abomey, and in the Savé region, near the Nigerian border, where it was observed in October 1976. In most instances, cassava was being monocropped. There appears to be considerable informal trade of cassava cuttings from western Nigeria to the People's Republic of Benin, especially in the Savé region.

Togo

CBB was seen in the cassava collections at the IRAT stations at Davié and Amoutochou. At Davié, it was present in several blocks, whereas at Amoutochou, it was apparent only in cultivars introduced from Malagasy Republic and an adjacent collection of local cultivars. The material was introduced into Davié in vegetative form in 1970 and later distributed to other IRAT stations,

Table 1. Incidence (% of farms on which disease was recorded) and severity of CBB in Cameroon.

Route	Distance (km)	No. farms	Vegetation type	Incidence (%)	Severity index
Ekok-Batibo	85	19	Rain forest	0	0
Mamfe-Kumba	178	14	Rain forest	7	4
Ekona-Victoria	31	10	Swamp forest	70	32
Nkapa-Loum	35	6	Rain forest	50	30
Douala-Edea	94	7	Rain forest	28	11
Edea-Yaounde	180	7	Rain forest	0	0
Yaounde-Abong-Mbang	300	12	Rain forest	8	2
Bertoua-Bafia	390	24	Rain forest and guinea savanna	33	17
Bertoua-Bembarang	330	15	Guinea savanna	80	64
Bafia-Bamenda	272	13	Guinea savanna to high savanna	15	8
Bamenda-Wum-Nkambe-Batibo	340	28	High savanna	39	21
Total	2255	155		30	17
Forest		99		19	21
Savanna		56		45	31

including Amoutochou. CBB was observed on a local farm near Amoutochou station. At the time (December 1975), CBB appeared to be more common on experiment stations than in farmers' fields. There have been other reports of angular leaf spots, presumably caused by CBB, on local farms along the coast, between Agbessie and the Ghana border (Adam, personal communication).

Ghana

In December 1975 CBB had a limited distribution, occurring in the Volta region, near the Togolese border, and in the Pokoase region, west of Accra, where many of the settlers have come from the Volta region. It has since been found in the coastal savanna areas of central and eastern regions (Korang-Amoakoh, personal communication). Thus it presumably occurs at least from the Togolese border to Swedru, west of Accra.

Discussion

On the basis of the disease surveys, it may be concluded that CBB has been present in limited areas of West Africa for many years, as suggested by its presence on village farms in isolated areas in parts of Cameroon. It was probably introduced on one or several occasions in vegetative material from Brazil at least as far back as the early part of this century. Many of the introductions to francophone countries have come via the Malagasy Republic where angular leaf spots were first reported on cassava in 1935 (Bouriquet 1946, 1973). However, a recent report says that such leaf spots are not now seen on cassava in Madagascar (Arradeau, personal communication).

In Ghana, Nigeria, and other areas of West Africa, the disease was apparently introduced more recently, and spread through attempts to popularize new varieties developed since 1955. In some areas, CBB occurs but is a relatively unimportant disease. There may have been some farmer selection for tolerance among local varieties following introduction and spread of the pathogen. The disease has become more important in other areas with the release of more susceptible varieties. This probably occurred in midwestern and eastern Nigeria after the release in the 1960s of improved varieties 53101, 60444, 60447, and others that were highly susceptible to CBB. Once such varieties were infected the disease spread easily to new areas in infected planting material.

The possibility of introducing CBB into new areas along with cuttings of improved varieties, especially tolerant ones that show few symptoms, should be taken into account during their distribution. Such introductions may intensify the occurrence of CBB even in a localized area. There are some relatively simple means of freeing plants of CBB by rooting shoot-tips under high humidity (Lozano and Wholey 1974). These can form the basis of a clean-seed scheme, provided proper indexing for disease is conducted.

The damage due to CBB may have been exaggerated at times, due to the confounding of defoliation and tip dieback caused by drought, salinity effects, insect damage or other diseases, especially anthracnose, with CBB effects. The presence of angular leaf spots is the most certain symptom indicating presence of CBB, but it is not diagnostic. Leaf wilting and stem exudate are additional diagnostic aids but are less certain. Confirmation must include isolation and characterization of the pathogen.

In relation to introduction and promotion of new varieties, it is important to know the areas of high, medium, and low damage caused by CBB. In addition, it is important to determine the epidemiological competence of the pathogen in different climatic zones with their differing cropping patterns. In areas of low incidence, exclusion becomes useful. In areas of high pathogen competence, resistance becomes increasingly reliable and necessary.

Acknowledgments

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