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Groundnut Crinkle, a new Virus Disease observed in Ivory Coast

By

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With 2 figures

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A virus causing crinkling and stippling symptoms on groundnut plants (*Arachis hypogaea* L.) was observed in 1976—1977, near Dabou, Abidjan and Bingerville, all along the lagoons of the south of Ivory Coast, often with a high frequency (90 % of diseased plants). Symptoms were very discrete and easily observed when plants were young and growing vigorously. The disease could not be observed three months after sowing, in the fields where it was first noticed and marked on young seedlings one month after sowing; old plants were chlorotic and attacked by fungi, mites and groundnut rosette disease.

Symptoms were described on one month old plants growing in screen-houses. The leaves of *Arachis hypogaea* cv. Te3 showed crinkling, as if the main vein was too much little. This crinkling was more or less important, and, even sometimes absent. In combination with crinkling, a very delicate stippling was observed: very small, irregular and light-green spots. Little reduction in size of leaves or plants was noticed. The diseased plants flowered and produced seeds.

None of the groundnut diseases reported in the literature shows more or less identical symptoms, except groundnut rugose leaf curl disease (GRYLLS 1954). This disease was observed in Ivory Coast (MONSARRAT 1976, personnal communication); intensity of deformation of the limb was more and more important and no stippling was noticed.

Present study deals with some experiments to identify the virus causing this new-observed disease.

Materials and Methods

In host range studies, all mechanical inoculations were made by dusting plants with 600 mesh carborundum and abrading their leaves with inoculum. Inocula were prepared by triturating infected groundnut leaves in a mortar, at —16 °C, with sand and 1 % potassium phosphate buffer containing 12.5 mg/ml magnesium bentonite and 0.01 M diethyldithiocarbamate. Attempts were made to recover virus from all inoculated test plants by inoculating Te3 groundnut variety.

Aphis craccivora and *A. citricola* collected on groundnut plants, and *A. gossypii* collected on *Eupatorium* sp. were used as test vectors. Before testing they were reared on groundnut seedlings.

For in vitro inactivation the original inoculum was held at 4 °C and inoculated to Te3 variety at 24 h intervals. Heat inactivation was determined after exposing the original inoculum to 35, 40, 45, 50, 55, 60, 65, 70 and 75 °C for 10 min.

Unpurified leaf extracts and leaf dip preparations were observed with a Philips EM 300 electron microscope after negative staining with 1 % uranyl acetate.

No antiserum to groundnut crinkle virus (GCV) was prepared. The microprecipitation reaction under paraffin oil in Petri dishes was used (VAN SLOGTEREN 1954). For testing, normal serum of rabbit and healthy plant proteins (purified preparations from healthy groundnut plants) were used. Virus preparations were tested against antisera to groundnut viruses, potyviruses, potexviruses and carlaviruses (HARRISON et al. 1971).

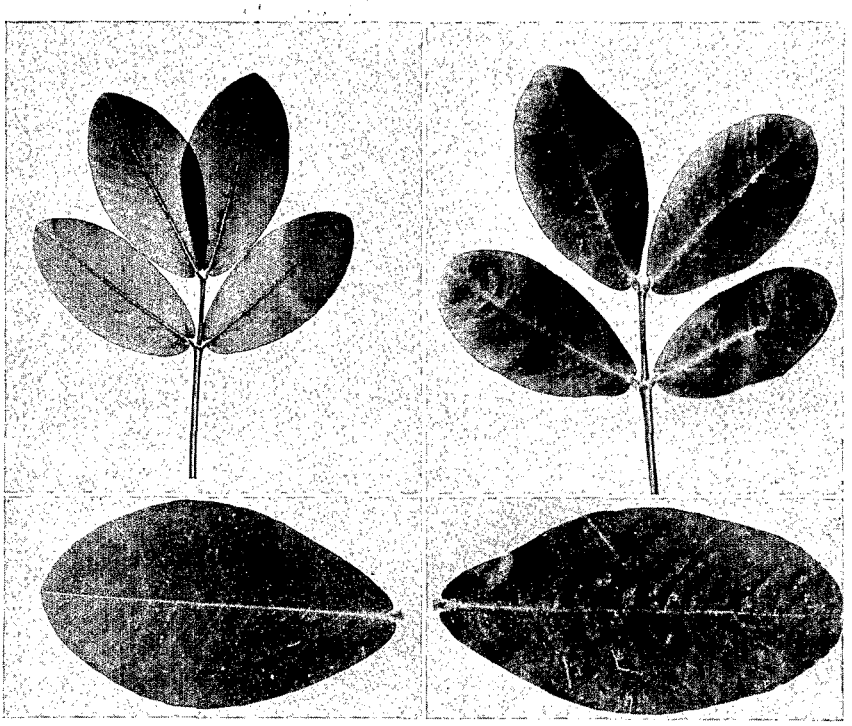

Fig. 1. Symptoms of GCV in *Arachis hypogaea* L. cv. Te3, mechanically inoculated. Left: healthy leaf. Right: infected leaf showing crinkling and stippling

Results

Mechanical transmission

The crinkle disease was not easily transmitted by mechanical means, but constantly 10—30 % of the inoculated groundnut seedlings were infected. Symptoms were developed on the newly-formed leaves 20 days, and more frequently 30—40 days, after inoculation. Symptoms did not disappear when infected plants became old.

The crinkle disease infected *Arachis hypogaea* cv. Te3, *Centrosema pubescens*, *Soja max*, *Vigna sinensis* cv. Black Eye, *Canavalia ensiformis*, *Dolichos jacquinii* and *Psophocarpus tetragonolobus*; the disease could be recovered from these plants and infect groundnut seedlings. *Desmodium polycarpum*, *Cassia occidentalis*, *C. obtusifolius* seemed to be also infected but the disease could not be recovered.

Other legume plants were tested and not infected: *Stylosanthes gracilis*, *Phaseolus vulgaris*, *P. mungo*, *Crotalaria juncea*, *C. pallida*, *Clitoria ternatea*. Plants from other families were also tested but none were infected: Compositae, Chenopodiaceae, Aizoaceae, Scrophulariaceae, Cucurbitaceae, Malvaceae, Solanaceae and Passifloraceae.

In vitro properties

Infectivity of *A. hypogaea* extract was not lost after three days at about 4 °C and infectivity of extract freshly expressed from inoculated groundnut leaves was much decreased after 10 min at 65 °C and was abolished after 10 min at 70 °C.

Aphid transmission

Only these three aphid species were used: *Aphid craccivora*, *A. citricola* and *A. gossypii*. In the preliminary attempts, aphids were reared on diseased plants, and, the late instar apterous aphids and the new-borne adults were transferred to healthy plants where they stayed until they died. In this case, the disease was never transmitted.

Electron microscopy

Flexuous threads were found in infective groundnut extract and in leaf dip preparations. The modal diameter of the particles was 12.5 nm and the length was about 650 nm.

Serology

Clarified virus preparations were tested against antisera to groundnut viruses: peanut mottle (Bock 1973, Kuhn 1965), peanut stunt (Mink 1973), peanut clump (Thouvenel et al. 1976), groundnut eyespot (Dubern and Dollet 1978), groundnut chlorotic rosette viruses, against antisera to potyviruses: potato Y (Brandes and Bercks 1965), passionfruit ringspot (de Wijs

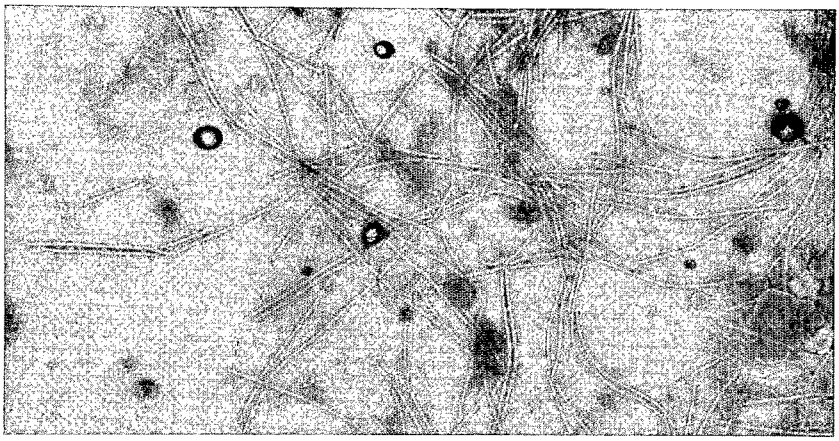

Fig. 2. Electron micrograph of a clarified suspension of GCV. Particle length of 650 nm

1974), pepper veinal mottle (DE WIJS 1973), guineagrass mosaic (THOUVENEL et al. 1976) viruses, and against antisera to potato virus X. No reaction was observed with antisera to carlaviruses: passiflora latent (WETTER and BRANDES 1963), potato M and potato S (WETTER 1971 and 1972) viruses.

Discussion

Many groundnut diseases have been described. None of them seem identical to the crinkle disease. Only groundnut rugose leaf curl disease (GRYLLS 1954) has related but not identical symptoms; however this disease was not mechanically transmissible.

Microscopical and serological studies showed that the crinkle disease was associated with a virus belonging to the carlaviruses (HARRISON et al. 1971). In this group, only cowpea mild mottle virus (BRUNT and KENTEN 1974) infects groundnut; however its properties are different: symptoms on groundnut plant, host range, in vitro and serological properties are different.

From this studies it results that the crinkle disease of groundnut seems related with a newly-described virus. Its proposed name is groundnut crinkle virus (GCV).

Summary

A disease causing crinkling and stippling on groundnut plants was observed in the south of Ivory Coast. The disease was sap transmissible. Attempts to transmit the disease by *Aphis craccivora*, *A. citricola* and *A. gossypii* failed. The first observation on biological properties and electron micrographs showed that this disease might be a new disease of groundnut, caused by a carlavirus, and named groundnut crinkle virus.

Zusammenfassung

Die Kräuselkrankheit, eine Virose der Erdnüsse im Süden der Elfenbeinküste

Im Süden der Elfenbeinküste wurde an Erdnüssen eine neue Krankheit beobachtet. Sie verursacht ein schwaches Kräuseln und eine feine Fleckung der Blätter. Diese Krankheit ist mechanisch übertragbar. Übertragungsversuche mit *Aphis craccivora, A. citricola* und *A. gossypii* verliefen negativ. Erste Untersuchungen über die biologischen Eigenschaften und elektronenmikroskopische Beobachtungen zeigen, daß die Krankheit durch ein neues, bisher unbekanntes Virus verursacht wird. Dafür wird der Name „groundnut crinkle virus (GCV)" vorgeschlagen.

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