

MARGINAL CHLOROSIS, A SEED-BORNE VIRUS OF ARACHIS HYPOGAEA VARIETY "SCHWARZ 21" IN NEW GUINEA

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Observations on the symptoms, effect on yield, and experimental data are given on the seed-borne virus disease of Arachis hypogaea variety "Schwarz 21" in New Guinea. Attempts at mechanical, soil and insect transmission were unsuccessful, but the virus was transmitted through cleft grafts from Schwarz 21 to Red Spanish, White Spanish, Schwarz 21, Virginia Bunch and Natal Common. The virus causes a severe stunting of the affected plants, with marginal chlorosis and crinkle of the leaves.

The yield of affected plants is reduced to half that of healthy plants. Control is readily effected by vigorous roguing at the flowering stage of all affected plants. The virus appears to be a new one previously undescribed and is tentatively named peanut marginal chlorosis.

THE condition was first recorded on Schwarz 21 in 1958 by Mr. K. Newton, in the crop-rotation trials at the Lowlands Agricultural Experiment Station, Keravat, New Britain District. Three per cent. of the peanut plants were affected. Preliminary mechanical inoculation experiments were carried out in 1958, but no transmission was recorded. In late 1958, diseased plants were again noticed in the rotation trials and seed was harvested from diseased plants and from neighbouring healthy plants. The collected seed was germinated in the laboratory in sterilized forest soil and observations carried out on the plants. Seed of both healthy and diseased plants germinated within seven days, and after 14 days seedlings from diseased field plants exhibited a marginal chlorosis of the leaves, and were smaller than seedlings from healthy plants. Subsequent leaves showed crinkle patterns on the leaves. The diseased plants were stunted, but were not rosette in habit. Investigations were then carried out to determine the cause of the marginal chlorosis and the leaf crinkle.

INVESTIGATIONS

Field Symptoms

The first sign of the disease in the field was seen two to three weeks after sowing. The leaves of the diseased plants exhibited a yellowing of

the leaf margin and a crinkling of the leaves. The plants were smaller in size than healthy plants and at maturity bore few nuts. The leaf symptoms were systemic and did not increase in intensity with age.

Effect on yield

Seed from diseased and healthy plants of Schwarz 21 was collected from the field and weighed. Results are given in Table I. From these results it is evident that the disease caused a severe reduction in yield compared with healthy plants.

Table I
Effect of Marginal Chlorosis on Yield of Schwarz 21.

Plant.	No. Plants.	Total Yield. (gm.)	Yield/Plant. (gm.)
Healthy	40	3,023	75.6
Diseased	40	1,326	33.2

Attempted Mechanical Transmission

Attempts were made to transmit mechanically the causal organism to disease-free ground nut plants of Schwarz 21 and Natal Common. The method of mechanical inoculation devised by Storey and Ryland (1955) was tried, but proved unsuccessful. Plants were etiolated for

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60, 72 and 96 hours, 200 plants being used in each test, but no transmission was obtained. Diseased plant material was ground in various composite buffers of strength 0.1M and pH 7.0. No transmission was obtained.

The following plants were inoculated with sap extracted from diseased Schwarz 21, *Nicotiana tabacum* var. White Burley, *Solanum dulcamara*, *Physalis floridana*, *Chenopodium amaranticolor*, *Vicia faba*, *Capsicum annuum*, *Nicotiana glutinosa*, *Lycopersicon esculentum*, *Crotalaria anagyroides* and *Arachis hypogaea* varieties Red Spanish, White Spanish, and Virginia Bunch. No transmission resulted.

Grafting

Diseased and healthy plants of Schwarz 21 were grown in sterilized forest soil in the laboratory and when 10 days old the tops were removed at the collar. Healthy scions were inserted onto diseased root stocks and diseased tops onto healthy root stock. A wedge-shaped graft was used. The plants were kept in a moist atmosphere for 48 hours and then placed in insect-proof cages. Observations were made 28 days after grafting. At the end of the observation period, 10 healthy scions out of 20 successful grafts were diseased and all 20 of the diseased scions remained diseased. A further experiment was set up using healthy scions of five different peanut varieties (Table II). The condition was transmitted to all five peanut varieties. The symptoms recorded on the diseased scions were the same as those recorded on Schwarz 21.

Table II

Transmission of Marginal Chlorosis of Schwarz 21 to Four Peanut Varieties by Grafting.

Variety.	No. Grafts Attempted.	Proportion of Plants Infected.
Red Spanish	18	3/15
White Spanish	18	1/17
Schwarz 21	18	6/17
Virginia Bunch	18	3/18
Natal Common	18	4/18

Attempted Dodder Transmission

Cuscuta campestris Yuncker was established on *Medicago sativa* and tendrils entwined around diseased plants of Schwarz 21. When appressoria were developed, the tendrils were severed

from the host plant. None of the appressoria became fully developed on the peanut plants, although 60 plants were used.

Seed Transmission

Seed was collected from 100 diseased plants in the field. The seed was then planted out and counts made on the number of diseased plants. Germination percentage was also calculated. The percentage of infected progeny from any one parent plant ranged from 31 to 100, with an average of 71. From the original 100 parent plants, 2,355 seeds were collected, of which 1,503 germinated (i.e., 63.8 per cent. germination). This compares with 89.0 per cent. for seed from healthy plants.

Insect Transmission

Wingless and winged adults of *Aphis craccivora* maintained on diseased Schwarz 21 in the laboratory failed to transmit the disease to healthy plants of Schwarz 21 and Natal Common, using the half-seed method adopted by Storey and Ryland (1955). Test feeding times ranging from 10 seconds to five days with and without pre-treatment starvation gave no transmission. Thirty seeds were used to each test.

Attempted Soil Transmission

There is no evidence in the field to suggest transmission of the disease through the soil. However, the possibility of transmission through the soil or by direct root contact was investigated. Infected seedlings of Schwarz 21 growing in the field were lifted with some of their surrounding soil and replanted in large containers. Ten seeds of known uninfected Schwarz 21 were planted in each container, but only five seedlings were retained. The plants were kept under observation for 28 days in insect-proof cages. Ten test pots were set. To eliminate possible insect transmission, the field plants were sprayed with 0.25 per cent. dieldrin. Before lifting, and after the seeds had been planted, the soil surface and plants were sprayed with this insecticide twice weekly. None of the 50 test plants grown developed the disease.

DISCUSSION

The above experimental evidence indicates that the marginal chlorosis and leaf crinkle of the peanut variety Schwarz 21 is induced by a plant virus. That the disease was not attributable to nutrition was indicated by the fact that

diseased and healthy plants were growing alongside each other. There was no evidence of the disease being caused by fungal, or bacterial organisms, nor by insects. As the disease is transmitted by grafts, the disease is not genetical. The virus is not transmitted by *Aphis craccivora*, nor by mechanical inoculation, but it is transmitted by seed and grafting.

Since no mechanical transmission was achieved, no physical properties or host range of the virus was determined. Storey and Ryland (1955) were able to transmit mechanically and by *Aphis craccivora*, ground nut rosette, using Natal Common as the test plants. In tests at Keravat, using the peanut variety Natal Common, no transmission was achieved except by grafting. Comparing the symptoms and methods of transmission of the virus causing marginal chlorosis of peanuts at Keravat with the viruses recorded on peanuts by Storey and Ryland (1957), it is tentatively concluded that this is a new virus previously undescribed.

The name peanut marginal chlorosis is suggested.

DESCRIPTION

Marginal chlorosis on *Arachis hypogaea* is a new virus disease previously undescribed. The disease is dissimilar to that of peanut rosette virus in method of dissemination and symptoms (Storey and Ryland, 1957).

Common name : Marginal Chlorosis of peanut.

Origin : *Arachis hypogaea* var. Schwarz 21, from Keravat, New Britain, Territory of Papua and New Guinea.

Host range :

Arachis hypogaea vars. Schwarz 21, Red Spanish, White Spanish, Virginia Bunch, Natal Common.

Distinguishing symptoms : Marginal yellowing, stunting of growth, leaf crinkle.

Transmission : Grafting and seed.

CONTROL

Since the disease appears to be transmitted only through seed, control is effected by the use of certified disease-free seed. Where diseased plants are found, these should be removed and burnt immediately to ensure that no seed is retained.

REFERENCES

- STOREY, H. H. AND RYLAND, A. K. (1955). Transmission of Groundnut rosette virus. *Ann. appl. Biol.* 43, 423-432.
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