A DISEASE OF SOME LEGUMES IN PAPUA NEW GUINEA CAUSED BY *SCLEROTIUM* SP.

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ABSTRACT

A leaf and stem disease of peanut (groundnut, Arachis hypogaea*), is reported from New Britain. It is caused by a clamped fungus, with no perfect state known as yet, which is designated* Sclerotium *sp. at present. Large sclerotia, distinct from those of the common sclerotial species, up to 6 mm long, very irregular in shape and pale tan to orangy tan in colour, but never dark brown, were found on the surface of the soil and on moribund parts of* Xanthosoma *sp. in the field, and formed on the soil surface after inoculation and sparsely on nutrient agar. Peanut, cowpea and Poona pea* (Vigna unguiculata), *snake or yard long bean* (V. unguiculata *ssp.* sesquipedalis), *snap or dwarf bean* (Phaseolus vulgaris) *and* Crotalaria anagyroides *were susceptible when inoculated with four different isolates from the sclerotia and the peanut, while* Xanthosoma *sp. was immune.*

In January 1976, Mr S. Rangai, an officer at the Lowlands Agricultural Experiment Station, Keravat, New Britain (P.N.G.), forwarded a deteriorated corm of *Xanthosoma* sp. (Araceae) to Konedobu for examination. It was found to have sclerotia about 2 mm in diameter on the rotted tissue, some on the outside of the corm, and many on the dead leaves. Apparently the sclerotia were first noticed on the material in the field by Dr C. Prior. Sclerotia were surface sterilized with mercuric chloride (1: 1000), washed in sterile water and after plating on potato dextrose agar (PDA), the fungus was obtained in culture (PNG 10090) by Mr W.A. Layton. The sclerotial fungus was not obtained from surface sterilized tissue taken from the margin of the rotted and the symptomless tissue of the corm.

In March 1976, Mr Rangai forwarded another unthrifty *Xanthosoma* plant from the same area, and a culture (PNG 10131) was established by G.R.K. from sclerotia loosely attached to the corm.

In the same month, Mr Rangai found sclerotia on the surface of the soil around healthy *Xanthosoma* plants at Site U in another part of the Gazelle Peninsula of New Britain, and from these, culture PNG 10140 was established by G.R.K.

The sclerotia received from the field were up to 6 mm long, very irregular and angular (*Plate* I), pale tan to orangy tan in colour, not becoming brown at any stage, and therefore differing from sclerotia of *Sclerotium rolfsii* in shape, size and colour.

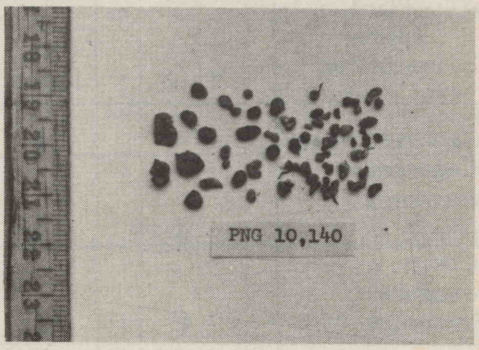

Plate I Sclerotia from the surface of the soil around healthy *Xanthosoma* plants in the field

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Mr Rangai was asked by the senior author to check other crops at Site U and in late March 1976, forwarded diseased peanuts (*Arachis hypogaea* L.) from that site. He had noted that the leaves were chlorotic and necrotic and that the stems were dying off above ground level, and that sclerotia were present in large numbers on affected stems. When examined, the plants were found to have a rot at the collar and on some leaves, with white mycelium evident to the naked eye, especially on the collar. No perfect state was present on the material. Culture PNG 10164 was established by D.E.S. from diseased stem tissue after alcoholic dip.

All the isolates from the above accessions were similar or nearly so in culture, having vigorously growing white mycelium, slightly fluffy and somewhat stringy on PDA and with clamps. On PDA small sclerotia (1 to 2 mm diameter) formed in isolates PNG 10090 and 10140, formed sparsely in 10164, and did not form in isolates 10140 and 10164 in later subcultures; no perfect state formed in any isolate.

Inoculations were carried out on healthy *Xanthosoma* sp., and on taro (*Colocasia esculenta* (L.) Schott) (both Araceae) and on coconut (*Cocos nucifera* L.) using isolates PNG 10090 and PNG 10131 (both derived from sclerotia loosely attached to unthrifty *Xanthosoma* plants) and PNG 10140 (derived from sclerotia from the surface of the soil around healthy *Xanthosoma*). The inoculum consisted of pieces (about 5 mm square) cut from young vigorously growing cultures on PDA, applied to the base of the petioles, and on to the surface of the soil, and incubated under plastic for 48 hours after spraying with tap water; controls were inoculated with PDA pieces without fungus and incubated, while other control plants were untreated in any way.

The results of the inoculations are summarized in *Table 1*. Mycelium from the inoculum pieces grew vigorously, especially from those on the surface of the soil; mycelium from the latter also produced sclerotia similar to the largest

Table 1. — Summary of results of first inoculation test carried out with sclerotial isolates

Plant species inoculated	Number of plants						Rating
	Controls*+	Inoculated				Infected	
		Isolates#					
	Total	PNG 10090	PNG 10131	PNG 10140	Total	Total	
Xanthosoma sp.	14	6	2	2	10	0	Immune
Colocasia esculenta (taro)	4	2	2		4	0	Immune
Cocos nucifera (coconut)	4	2			2	0	Immune
	22	10	4	2	16	0	

* Controls included plants inoculated with PDA only and incubated, and others without any treatment or incubation

\+ No infection occurred on any control plant

\# See text for origin of isolates

forwarded from the field. However, neither the *Xanthosoma*, nor the taro, nor the coconut became infected with any of the three isolates. It was concluded, therefore, that the sclerotial fungus had probably been growing as a saprophyte on the dead leaves in the field, and was not a pathogen of the *Xanthosoma*. (Studies on the unthriftiness of the *Xanthosoma* are being reported elsewhere.)

In the second inoculation experiment, two of the isolates used above (PNG 10090 and PNG 10140) and isolate PNG 10164 from diseased peanut tissue were inoculated on to *Xanthosoma* sp., peanut, cowpea and Poona pea (*Vigna unguiculata* (L.) Walp.), snake or yard long bean (*V. unguiculata* ssp. *sesquipedalis* (L.) Verdc.), snap or French dwarf bean (*Phaseolus vulgaris* L.) and *Crotalaria anagyroides* H.B. & K.. The inoculation procedure was similar to that of the first experiment, except that the pieces were usually about 3 x 3 mm square, and some were placed directly on the upper surface of the leaflets.

The results are shown in *Table 2*. *Xanthosoma* sp. was again immune to all three isolates. Cowpea and Poona pea, snake bean, snap bean, and *Crotalaria anagyroides* were classed as very susceptible; peanut, which did not wilt in this test, although it developed leaf lesions, was classed as moderately susceptible.

Table 2. — Summary of results of second inoculation test carried out with sclerotial isolates

Plant species inoculated	Number of leaflets								Rating
	Controls*+	Inoculated				Infected			
		Isolates#							
	Total	PNG 10090	PNG 10140	PNG 10164	Total	Total	%	Comments	
Xanthosoma sp.	6	2	2	3	7	0	0	no infection	Immune
Vigna unguiculata (cowpea)	16	8	7	4	19	19	100	all wilted	Very susceptible
V. unguiculata (poona pea)	10	30	15	18	63	63	100	all wilted	Very susceptible
V. unguiculata ssp. *sesquipedalis* (snake or yard-long bean)	25	10	13	10	33	33	100	wilted 27; with lesions 6	Very susceptible
Arachis hypogaea (peanut)	21	5	5	5	15	15	100	with lesions (none wilted)	Moderately susceptible
Phaseolus vulgaris (dwarf bean) "Royal Windsor"	10	10	10	10	30	30	100	all wilted; some basal infection of stems	Very susceptible
Crotalaria anagyroides	18	7	4	3	14	14	100	all wilted	Very susceptible
	106	72	56	53	181	174	96.1		

* Controls included plants inoculated with PDA only and incubated, and others without any treatment or incubation

\+ No infection occurred on any control plant

\# See text for origin of isolates

The mycelium from the inoculation pieces grew very vigorously on susceptible hosts, and on the surface of the soil, appearing as cobwebby to ropy white strands (*Plate* II, B) and on the soil produced sclerotia, large (up to 5 mm long) and irregular in shape, pale tan to orangy tan, similar to those originally received from the field.

The reaction on the most susceptible hosts was so severe that wilt of the leaves and stems occurred even within 48 hours (*Plate* II, A). On peanut, or on the other susceptible hosts where the inoculum piece had been placed on the leaflets, round, slightly zonate lesions up to 5 cm diameter occurred in the laminae (*Plate* III).

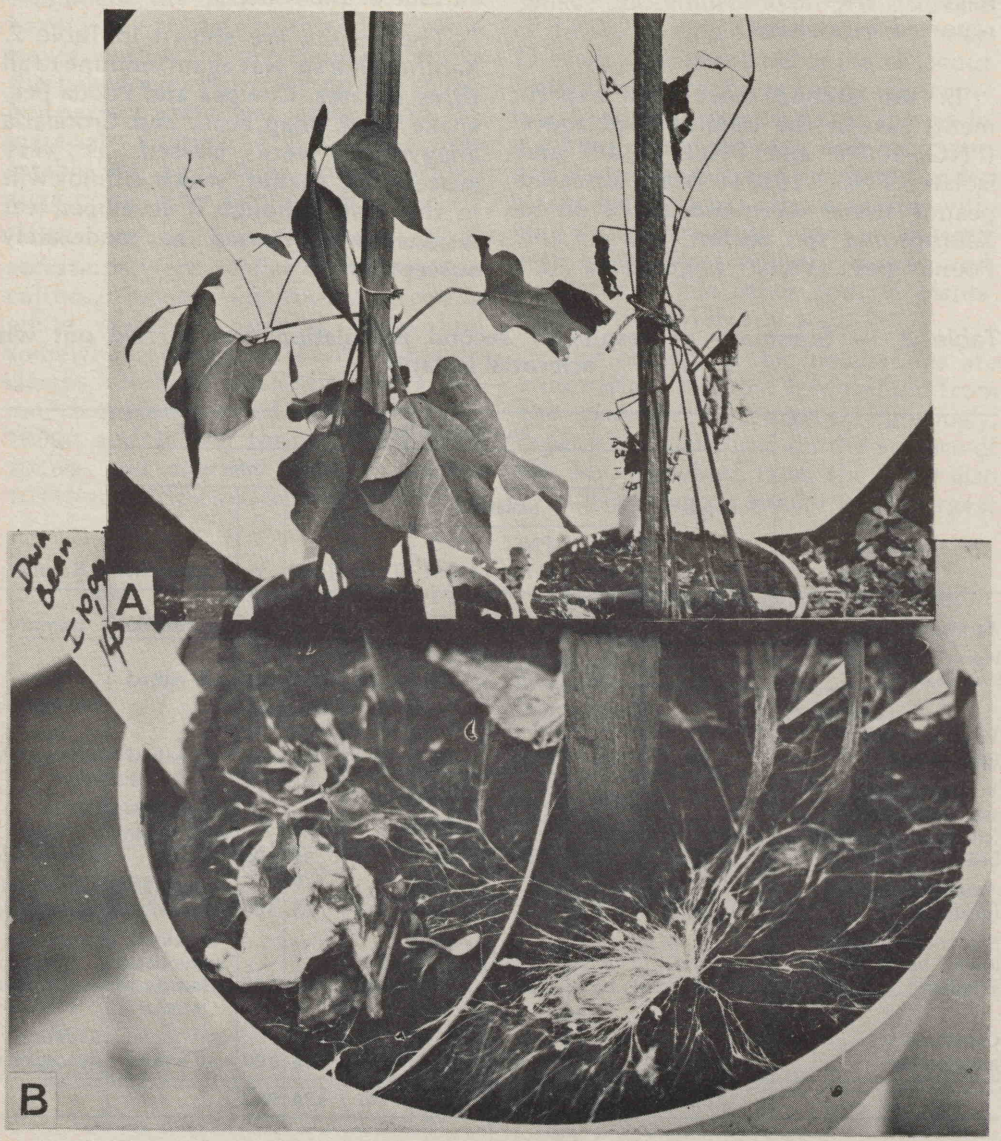

Plate II Dwarf beans (*Phaseolus vulgaris*) after inoculation with isolate PNG 10040 of *Sclerotium* sp.

A. Right: severe wilting of inoculated plants; left: control plants.

B. Base of plants in right hand pot in A; note white mycelium at base of two plants (arrows) and ropy white strands and young sclerotia on the surface of the soil.

Some of the leaf tissue infected after inoculation was surface sterilized as described previously, and on PDA yielded cultures similar to those originally isolated.

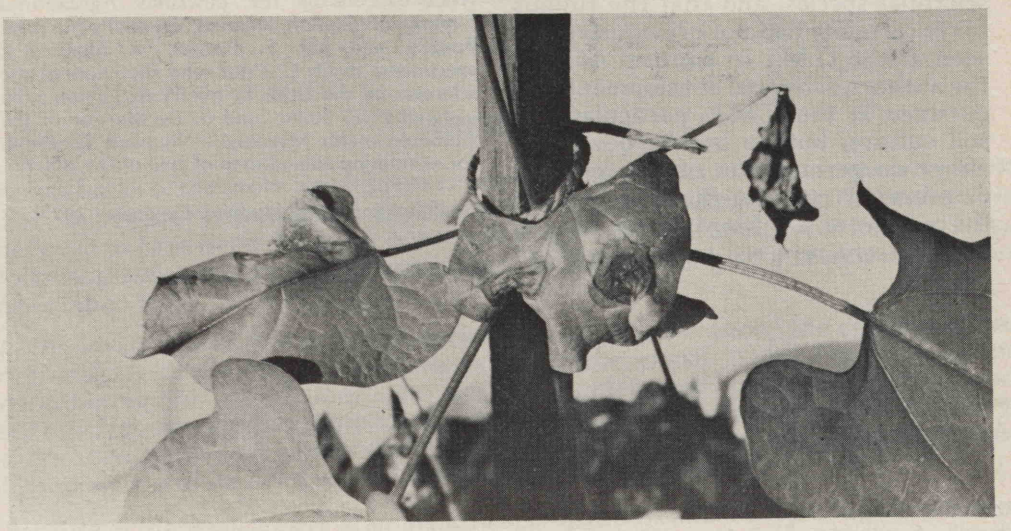

Plate III Snake bean after inoculation with isolate PNG 10040 of *Sclerotium* sp. showing leaf wilt of one plant, and two slightly zonate lesions on one leaflet.

DISCUSSION

The inoculations carried out with the three accessions derived from sclerotia originally found loosely attached to unthrifty *Xanthosoma*, and from the surface of the soil around healthy *Xanthosoma*, showed that the plants of this genus used in the tests were immune to these isolates. It is concluded, therefore, that the fungus was using the dead leaves and other moribund tissue in the field as a saprophyte, and was not invading the healthy parts of the plants. It is probable that sclerotia are able to form on dead parts of other plant species in the field.

On the other hand, the fungus obtained from the leaf and stem rot of the peanut in the field was very closely associated with the affected tissues. Also, it was well able to attack healthy peanut leaves in the inoculation test, and is therefore considered a pathogen of *Arachis hypogaea*. The three isolates from the *Xanthosoma* accessions were also able, like the isolate from peanut, to infect several healthy legumes, such as cowpea and Poona pea, snake bean, dwarf bean and *Crotalaria anagyroides* as well as peanut, which supports the view derived from macroscopic and microscopic examination of the cultures, that these isolates and those derived from the infected peanut tissue are the same fungus.

The fact that species in four genera of the Papilionaceae (Leguminosae), three at least being widely separated taxonomically, were susceptible in the inoculation tests reported in this paper, probably indicates that the fungus is able to attack a wide range of legumes, perhaps given suitably high conditions of humidity. Whether species in other plant families are susceptible to this fungus remains to be determined.

Subcultures of PNG 10140 (IMI 202759) and PNG 10164 (IMI 202758) were sent to the Commonwealth Mycological Institute (C.M.I.) for

examination, and Dr Mordue reported that the structure of the sclerotia was distinct from that of any of the common sclerotial species, and that the fungus fairly certainly had not previously been seen at the C.M.I. in culture. As with the authors, sclerotial development was obtained at the C.M.I., particularly in soil culture, but no basidia developed either on germination of the sclerotia or on other parts of the colonies. On the advice of Dr Mordue the fungus is at present referred to as *Sclerotium* sp.

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