POWDERY MILDEW OF RUBBER IN PAPUA

DOROTHY E. SHAW*

ABSTRACT

The first record in Papua of powdery mildew of rubber, caused by Oidium heveae, *was made in September, 1967. How, where or when the fungus entered the country is not known. A survey carried out during the subsequent two months showed that the disease was present in the Central, Gulf, Milne Bay and Northern Districts, with the heaviest infections leading to leaf fall and flower blight in the Central District, nearest to the main port of entry. In an endeavour at least to slow down the spread of the disease to the islands and isolated areas an internal restriction on movement of unprotected rubber material was proclaimed in December, 1967.*

FIRST RECORD

ON 13th September 1967 Mr. R. Shepherd (Harrisons and Crosfield, Malaysia) and Messrs. A. E. Charles and A. van Haaren (Department of Agriculture, Stock and Fisheries) noted powdery mildew on young rubber flushes at Sogeri, a plateau mainly devoted to rubber growing, approximately 25 miles by direct line from Port Moresby.

The identification of *Oidium heveae* Steinmann was confirmed by microscopic examination in the laboratories at Port Moresby. A survey carried out immediately confirmed that much of the new season's growth throughout the Sogeri rubber areas was infected. Many of the trees were wintering but no mildew was detected on the old hardened leaves still remaining on some trees.

TERRITORY SURVEY

In an endeavour to determine how far the disease had already spread, collections were obtained from most of the rubber areas in both Papua and New Guinea. The results are shown in *Tables* 1 and 2.

The specimens were mainly collected at random (marked R in the column labelled "Collector" in *Table* 1) by agricultural officers and plantation managers, and in same cases by pathologists and rubber crop specialists (marked S in *Table* 1). Most collections were forwarded to Port Moresby in plastic bags by air and a few local ones by road or ship. Most arrived in good condition. The first few each averaged about 40 leaflets; larger collections were then requested and the numbers of leaflets recorded.

The material was examined macroscopically and microscopically in Port Moresby and the presence or absence of mildew noted (marked "Infected" or "—" respectively in *Table* 1). An assessment of the severity of the infection in each collection was attempted, the scoring being given in the last column of *Table* 1. The scale used was as follows:

1 Sparse—only a few leaflets with one infection each; no spores present when examined.
2 Slight—small portion of some leaflets infected; few spores present.
3 Medium—about one half of total number of leaflets and about one half of each leaflet surface infected; spores present.
4 Heavy—practically the whole surface of many young flush leaflets infected; spores abundant.

The data in *Table* 1 are summarised in *Table* 2. In *Fig.* 1 the locations of the main rubber plantings in the Territory are given with their relative sizes indicated diagrammatically by the size of the circles; the percentages of collections infected are also shown diagrammatically.

INTERPRETATION OF THE RESULTS OF THE SURVEY

From a study of the Tables and the Figure it will be noted that the area with the most widespread infections and the greatest spore production on the leaflets was the Sogeri Plateau. This area is probably the most heavily affected to date, even considering the facts that most of the collections there were

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Table 1.—Results of the examination of rubber flush collections* during two months after the first record of powdery mildew.

Map Reference.	Locality	Distance from Sogeri (Miles)	Collector	No. of collections examined	No. of leaflets	Powdery mildew	Severity of infection
1.	SOGERI PLATEAU						
	Bisianumu		S	Many	Many	Infected	3
	Mageri		S	Many	Many	Infected	4
	Ilolo		S	1	39	Infected	4
	Koitaki		S	2	65	Infected	4
	Sogeri		S	2	60	Infected	4
	Itiki		S	1	36	Infected	3
	Eilogo		S	1	48	Infected	4
	S.A.		S	1	39	Infected	2
	Subitana		R	4	120	—	—
	Daradai	7	R	2	70	1 —	—
						1 Infected	1
	Jawarere	7	R	2	60	1 Infected	1
						1 Infected	2
2.	BROWN RIVER	20					
	"2 Mile Block"		S	2	48	—	—
	"4 Mile Block"		S	3	72	2 Infected	1
						1 —	—
3.	GALLEY REACH	40					
	Lolorua		R	3	120	2 —	—
						1 Infected	2
	Nusa		R	1	40	Infected	1
	Doa East		R	1	40	Infected	2
	Moale		R	1	40	Infected	1
	Kanosia		R	3	120	2 —	—
						1 Infected	1
	Rubberlands		R	2	80	—	—
	Veimauri		R	4	160	—	—
	Mariboi		R	8	300	5 —	—
						2 Infected	1
						1 Infected	2
4.	KEREMA	145					
	Epo		R	6	72	4 Infected	1
						2 —	—
	Murua (several sites)		R	5	296	—	—
	Cupola		R	1	22	—	—
5.	KIUNGA	460					
	Several sites		R	1	52	—	—
	Mepu		R	1	14	—	—
	Timindemasuk		R	1	24	—	—
	Drimdemasuk		R	1	48	—	—
6.	RIGO SUBDISTRICT	30					
	Kapogere		R	15	580	10 —	—
						5 Infected (62 spots on 42 leaflets)	1

* Collections were not obtained from the following areas:

Kabuna — v in Fig. 1.
Kikori — w in Fig 1.
Daru — x in Fig 1.
Wewak — y in Fig. 1
Buin — z in Fig. 1.

Table I Contd.

Map Reference.	Locality	Distance from Sogeri (Miles)	Collector	No. of collections examined	No. of leaflets	Powdery mildew	Severity of infection
	Poligolo		R	2	255	1 —	—
						1 Infected (6 spots on 6 leaflets)	1
7.	CAPE RODNEY	90					
	Several sites		R	5	about 144	—	—
8.	EAST PAPUA						
	Mariawatte	200	R	2	80	1 —	—
						1 Infected	1
	Sagarai	220	R	2	77	2 Infected	1
9.	KOKODA	45					
	Kokoda (several sites)		R	2	81	—	—
	Mamba		R	1	21	—	—
10.	POPONDETTA	80					
	P.A.T.I.		R	5	152	—	—
	Plantation 1.		R	2	about 18	—	—
	Plantation 2.		R	2	about 18	—	—
	Awala		R	4	54	2 —	—
						2 Infected	1
	Sangara		R	3	48	2 —	—
						1 Infected	1
	S.S. blocks		S	2	24	—	—
11.	LAE	190					
	Bubia		R	1	about 36	—	—
12.	LORENGAU MANUS ISLAND	500					
	Tamat		R	1	21	—	—
13.	NEW IRELAND*	520					
	Kavieng		R	7	about 319	—	—
			S	4	272	—	—
			R	7	about 319	—	—
			S	4	272	—	—
	Kavieng, Tokapi		S	1	60	—	—
	Kapsu	22 miles ex Kavieng	S	2	188	—	—
	Fissoa	60 ,, ,,	S	1	96	—	—
	Soubu	63 ,, ,,	S	1	135	—	—
	Bolegila	73 ,, ,,	S	1	84	—	—
	Libba	76 ,, ,,	S	2	239	—	—
	Lossu	80 ,, ,,	S	1	69	—	—
	Pinikindu	92 ,, ,,	S	1	54	—	—
	Suma	115 ,, ,,	S	2	162	—	—
		132 ,, ,,	S	2	128	—	—
	Namatanai	164 ,, ,,	S	2	57	—	—
14.	BOUGAINVILLE	600					
	Aropa 5 sites		R	1	40	—	—

* The New Ireland plantings were checked by a second specialist in the field in November, 1967.

Table 2.—Summary of information on collections in Table 1.

Map Reference	Locality	Total Colls.	No. Infected	Percentage Infected
1.	Sogeri	Many	All except 5	over 90%[1]
2.	Brown River	5	2	40
3.	Galley Reach	23	8	35
4.	Kerema	12	4	33
5.	Kiunga	4	0	0
6.	Rigo Subdistrict	17	6	35
7.	Cape Rodney	5	0	0
8.	East Papua	4	3	75
9.	Kokoda	3	0	0
10.	Popondetta	18	3	17
11.	Lae	1	0	0
12.	Manus Island	1	0	0
13.	New Ireland	38[2]	0	0
14.	Bougainville	1	0	0

[1] Collections mainly made by specialists with experience in disease collection.

[2] Areas in New Ireland re-checked by second specialist in the field one month after check by first specialist and microscopic examination.

made not at random but by specialists with some experience in collection, and also that they usually reached Port Moresby more quickly than those from other areas, which may have accounted to some extent for the large number of spores found on the leaflets.

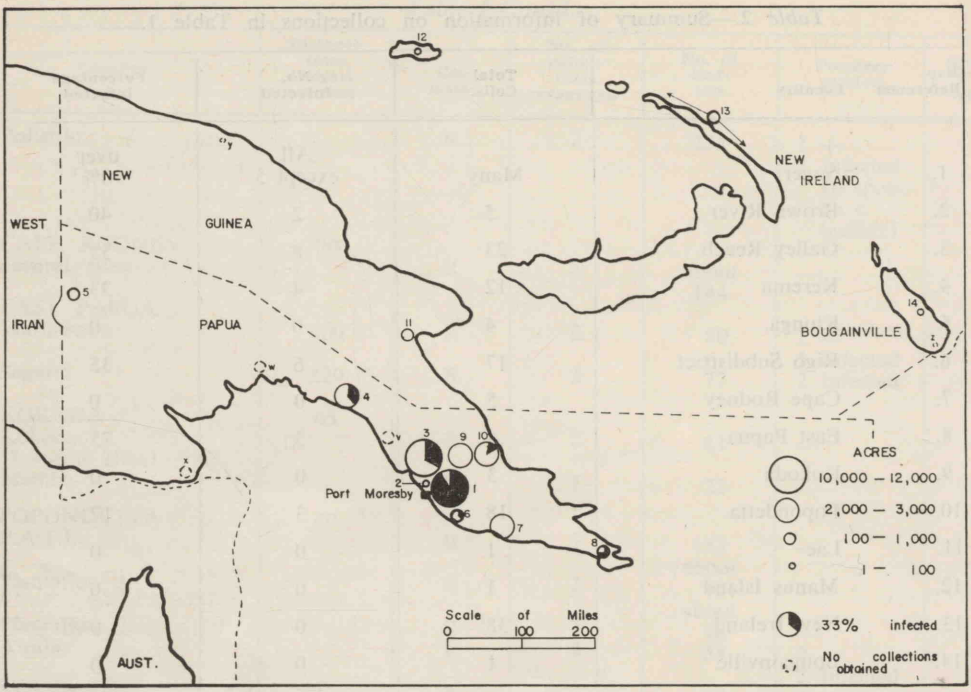
Even one positive recording in an area with many negative recordings indicates that the disease is present in the locality, although incidence may be low. Negative recordings for all the collections examined from an area, however, only means that no infections were found on those collections—it does not necessarily mean that there was no mildew in the area.

Bearing this in mind, it is probable that the disease was already present in Areas 7 (Cape Rodney) and 9 (Kokoda). On the other hand the negative findings from the large number of collections examined for Area 13 (New Ireland) coupled with nil recordings in field examinations of the rubber plantings by two specialists one month apart indicates that this island was probably still free from the disease.

SYMPTOMS

The majority of infections consisted of diffuse, slightly translucent areas on the leaflets when held to the light, affected areas appearing slightly paler green by reflected light; they ranged in size from about half a centimetre in diameter to the whole leaflet surface.

On the undersurface of the leaflets the site of the infection can be distinguished with experience as an interruption to the homogeneous green texture of the healthy area. This effect is difficult to describe and photograph.



In only one case to date were infections seen which could be called even slightly 'powdery' to the naked eye. They were found while carrying out spot checks on a plantation in the Sogeri area and occurred on a few leaflets of very young flushes produced early in the season, but appeared powdery macroscopically only when the leaflets were held at a certain angle to catch the light. No examples at all have been found as yet resembling the 'whitewash' spots illustrated by Wijewantha (1965).

Under the stereomicroscope the surface mycelium of infected areas is easily discernible in fresh specimens as a sparse network of fine glistening threads on the upper surface of the leaflets. Spore production is most clearly visible as a short, stiff pile along the sides of the midrib on the undersurface if the midrib bisects an infected area.

To date infections have been most evident on the young bronze-green leaflets and especially on the light-green immature leaves. Leaf fall was reported from seven plantations in the Sogeri area during the month after the first record. It was especially evident by the carpet of young wilted leaves on some plantation roadways. Samples of fallen leaves examined by the author revealed the presence of mildew, not *Gloeosporium albo-rubrum,* although this latter fungus occurred in some areas during this growing period, and in the past has caused leaf spotting, tip curling and some defoliation.

Flower attack occurred at Sogeri but no information on this aspect is yet available from the other rubber-growing areas of the Territory, since most of the collections received lacked flowers. It may be possible to estimate the amount of flower attack later in the season by comparing yield of seed set during the period when the first infections were noticed with the yields in previous years, unless adverse weather conditions also affect seed yield during the season.

By the end of November it was becoming difficult to find infections even at Sogeri, which, besides being the area apparently most heavily infected, is at an altitude of approximately 1,700 feet; the temperature at that

altitude is lower, particularly during the night, than in the lowland rubber areas, the lower range being more favourable to the fungus. By March, 1968, spot checks by two specialists and the author found it difficult to locate the disease even on young leaves at Sogeri.

Therefore, while mildew will probably cause infection of young leaves with some leaf fall as well as flower blight at the refoliation period each year, it is hoped that diminution of severity will occur once the first flush leaves have fallen or hardened. This, in fact, is what occurs in most seasons in Malaya.

ENTRY OF THE FUNGUS

It is not known when, where, or how the fungus entered the Territory. Seed has been imported from Malaysia for many years but has had to be dusted with sulphur before despatch otherwise it was not permitted entry. Budwood had been imported from Malaya up till July, 1964, but such importations were also prohibited without fungicide treatment in Malaya—usually alcoholic mercuric chloride solution, followed after drying by dusting with sulphur.

Within the Territory there has been unrestricted movement of seed mainly from two sources on the Sogeri Plateau and limited movement of budwood and budded stumps from one source on the Sogeri Plateau. There has also been limited movement by personnel between rubber areas. Areas 1, 2 and 6 are joined by road and the sites in Area 13 (New Ireland) are scattered along 165 miles of coastal road. Communication and passage of goods between all other areas is by air with limited sea transport.

Since 1955, when the pathology service was established, specimens of wilted and occasionally abscissed rubber leaves have been examined from time to time. Hitherto they were always found to be infected with *G. albo-rubrum*. It is possible that mildew infections were present but not identified before September, 1967. However, when leaf fall was reported, collections were made early in the morning so that spores if present should have been undesiccated. Also, spores were deliberately sought-for microscopically, with mildew in mind, during the examinations of any leaf fall specimen.

As abundant spores did occur on the collections made at Sogeri in September, 1967, it is difficult to see how infections would have been missed had they occurred previously on specimens from the area.

SIGNIFICANCE OF THE OUTBREAK

During the last five years first records of three important crop diseases have been made in Papua and New Guinea, viz., blister smut of maize (*Ustilago maydis*) in 1963, coffee leaf rust (*Hemileia vastatrix*) in 1965*, and powdery mildew of rubber (*Oidium heveae*) in 1967.

It is interesting to note, and probably significant, that the first record of *U. maydis* was made near the most important port on the north coast of New Guinea and the first records of *H. vastatrix* and *O. heveae* were both made near the most important port of entry for both aircraft and ships in Papua and New Guinea, despite rigorous surveillance by the quarantine staff.

As increases occur in the speed of air and sea transport and in the diversity of ports of embarkation and routes to the Territory, as well as in the number of travellers, the risk of accidental importation of foreign diseases also increases. The fullest co-operation of the public in conforming to the requirements of the Plant Quarantine Ordinance 1953 will be necessary to support the vigilance of the quarantine staff in order to obviate further accidental importations of diseases of plants of economic importance to this Territory.

INTERNAL RESTRICTION ON RUBBER PLANTING MATERIAL

The survey revealed that the plantings in New Ireland and the small plantings in a few other isolated areas were apparently still free from the disease. In an endeavour to slow down its spread, a prohibition was proclaim-

* A previous authenticated record of *H. vastatrix* was made in 1903, but as far as is known there was no connection between the two outbreaks (Shaw, 1968).

ed in December, 1967, on the movement of any rubber plant or part of the plant from the Central, Gulf, Milne Bay and Northern Districts to the other Districts of the Territory without a permit from the Department certifying prior treatment with sulphur or another approved fungicide.

ACKNOWLEDGEMENTS

Grateful acknowledgement is made to the following: Mr. R. Shepherd (Harrisons and Crosfield, Malaysia) who brought in the first specimens of mildew; the managements of many plantations for forwarding specimens promptly on request; officers of the Department of Agriculture, Stock and Fisheries (especially Mr. W. Hastie, Mr. A. van Haaren and Mr. R. M. Burnett) for collection of specimens and for field checks; to Mr. M. Johnson for mapping assistance and to Mr. A. W. Charles for critically reading the paper.

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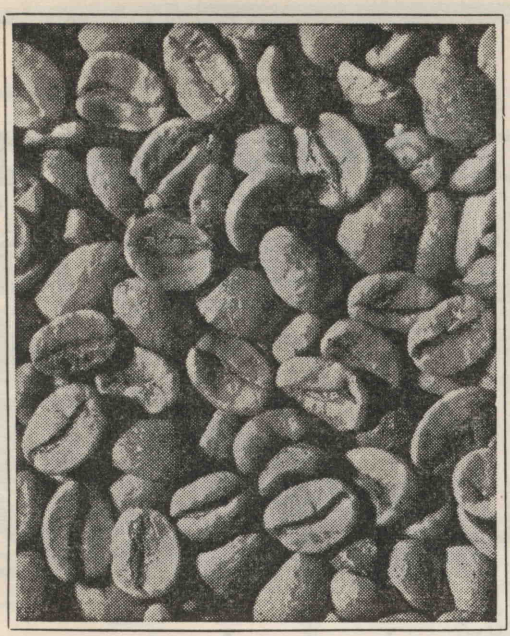

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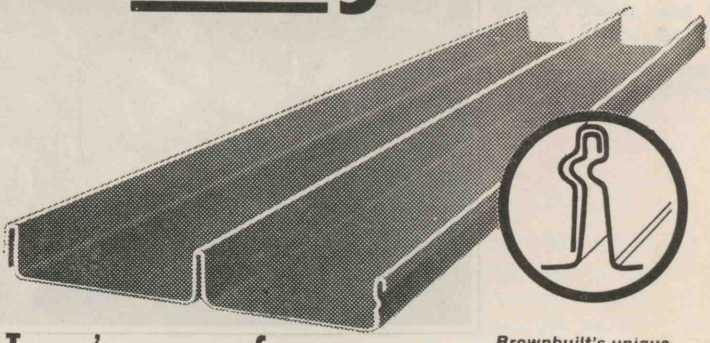

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