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MARASMIELLUS COLLAR ROT OF JAPANESE MINT

W. A. Layton. *Papua New Guin. agric. J.*, 27 (3) : 59-65 (1976)

A description is given of a collar rot of Japanese mint from which *Marasmiellus epochnous* was isolated. Cultural characters of the two isolates are described. The inoculation of two mint cultivars, reproduction of symptoms and re-isolation of the pathogen are reported.

GERMINATION OF SPORES OF *MARASMIELLUS EPOCHNOUS*

Dorothy E. Shaw. *Papua New Guin. agric. J.*, 27 (3) : 67-68 (1976)

Basidiospores of *Marasmiellus epochnous* from fructifications produced in cultures on dead grass stems proved viable when shed on to a nutrient agar surface. Cultures re-established from the germinated spores and built up on sterile dead herbaceous stems caused wilt of healthy Japanese mint (*Mentha arvensis var. piperascens*) when these stem pieces were used as inoculum.

[*continued overleaf*]

EFECT OF FEEDING RATIONS BASED ON COOKED SWEET POTATO AND A PROTEIN SUPPLEMENT TO BROILER AND CROSSBRED POULTRY

W. J. Turner, G. L. Malynicz and H. Nad. *Papua New Guin. agric. J.*, 27 (3) : 69-72 (1976)

Two strains of poultry, a commercial broiler strain and a crossbred multi-purpose strain, were fed *ad libitum* on one of three rations: (1) a 21 per cent crude protein broiler starter control ration; (2) a mixture of three parts by weight of boiled sweet potato to one part protein-vitamin-mineral supplement and (3) free choice boiled sweet potato and protein supplement offered independently. Growth performance, dressing percentage and chemical composition of the carcass at slaughter were estimated. There were significant differences in growth performance due to breed and diet, with broiler birds and control rations being superior. There were few important differences in carcass characteristics.

INVESTIGATION OF SOME COMMON ASSUMPTIONS CONCERNING MUD CRAB (SCYLLA SERRATA) MARKETING IN PORT MORESBY

JOSEPH GLUCKSMAN*

ABSTRACT

A survey of mud crab sales in three Port Moresby markets showed that large crabs did not receive premium prices and that price rises on paydays were insignificant.

INTRODUCTION

Both consumers and vendors of mud crabs in Port Moresby have generally assumed that larger crabs command premium prices, and that prices go up on paydays and days immediately following them.

A survey was designed and conducted to test the validity of these assumptions.

MATERIALS AND METHODS

Nine representative days were chosen for the month of July, 1973 (see *Figure* 1). On these days the crabs for sale at the Koki, Waigani and Gordon markets were sampled. The weight, carapace width and price of all crabs observed were recorded. This information was later converted to price/unit carapace width and price/unit weight for comparison. A total of 87 crabs were examined.

DISCUSSION

Figure 2 seems to bear out the assumption that larger crabs command better prices. However, the amount of meat or shell volume increases geometrically with an arithmetic increase in carapace width so that we see when the size of the crab is calculated by weight and compared with the price per unit weight as in *Figure* 3 a vendor actually receives less for a large crab. This is particularly puzzling when one considers that the percentage of total weight which is inedible shell actually decreases with an increase in size.

The difference in mean price per centimetre of carapace width on pay days and days immediately following as compared with other days of the week (*Figure* 1) is approximately 0.25 toea, or 5 toea for a 20 cm crab. Since all crabs sold are priced to the nearest 10 toea the difference in price can be considered insignificant.

CONCLUSION

Projects such as the rearing of captured mud crabs on trash fish, and marketing on specific days were proposed by those who accepted the previously mentioned assumptions as valid. This study shows that these two steps would be of no or even negative value for the vendor.

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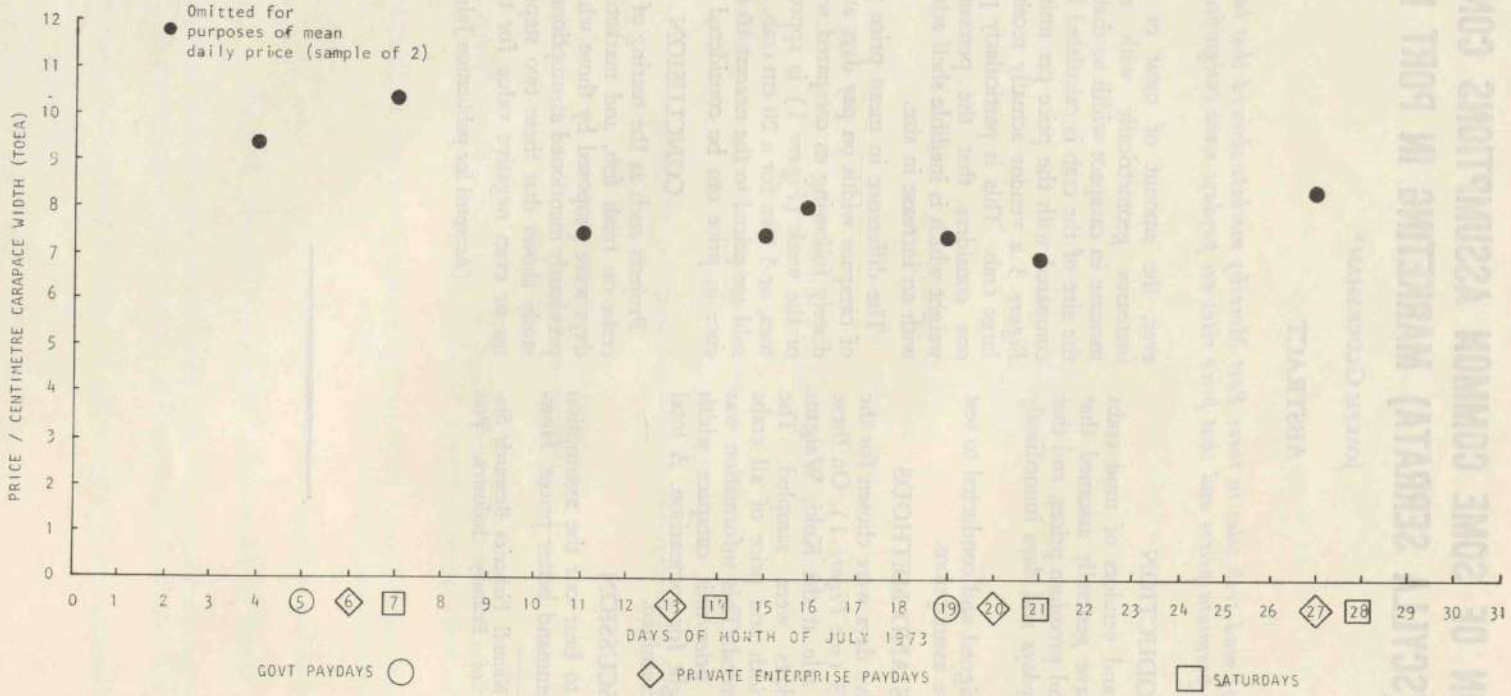

Figure 1—Price of crabs on different days of the week

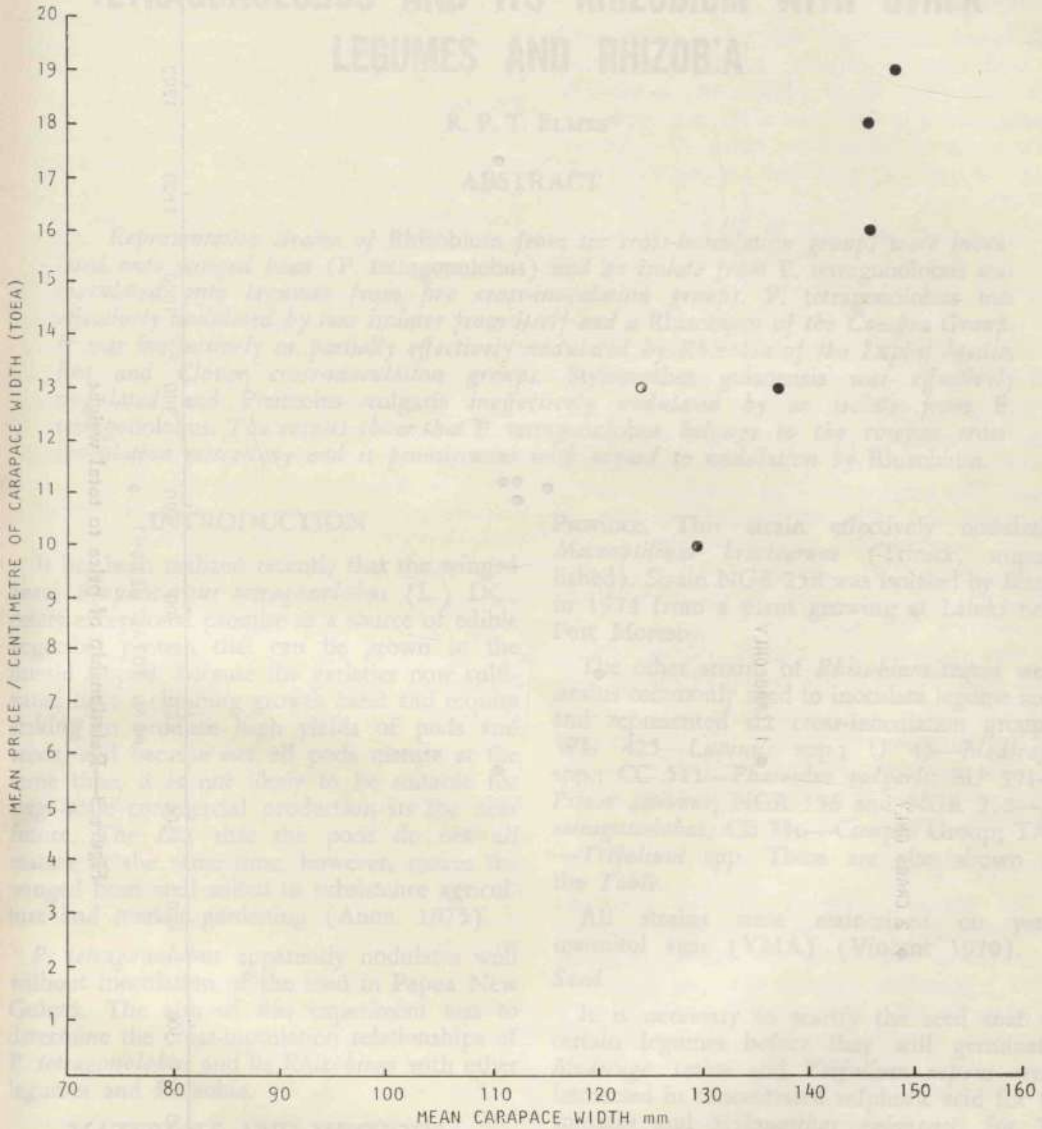

Figure 2—**Increase of price per centimetre of carapace width with increase in size**

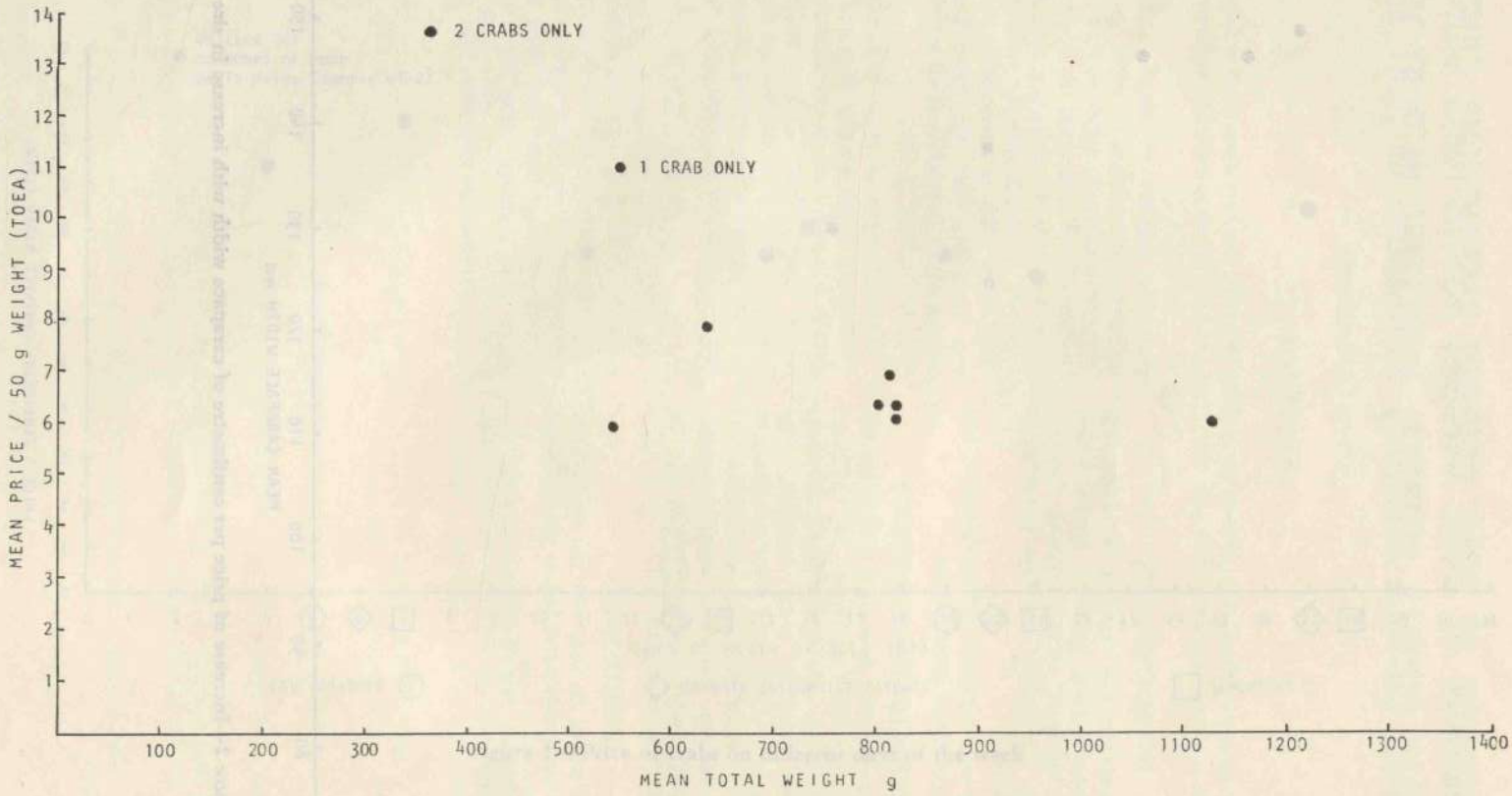

Figure 3—**Relationship of price to total weight**

CROSS-INOCULATION RELATIONSHIPS OF PSOPHOCARPUS TETRAGONOLOBUS AND ITS RHIZOBIUM WITH OTHER LEGUMES AND RHIZOBIA

R. P. T. ELMES*

ABSTRACT

Representative strains of Rhizobium *from six cross-inoculation groups were inoculated onto winged bean* (P. tetragonolobus) *and an isolate from* P. tetragonolobus *was inoculated onto legumes from five cross-inoculation groups.* P. tetragonolobus *was effectively nodulated by two isolates from itself and a* Rhizobium *of the Cowpea Group. It was ineffectively or partially effectively nodulated by Rhizobia of the Lupin, Medic, Pea and Clover cross-inoculation groups.* Stylosanthes guianensis *was effectively nodulated and* Phaseolus vulgaris *ineffectively nodulated by an isolate from* P. tetragonolobus. *The results show that* P. tetragonolobus *belongs to the cowpea cross-inoculation miscellany and is promiscuous with regard to nodulation by* Rhizobium.

INTRODUCTION

It has been realized recently that the winged bean, *Psophocarpus tetragonolobus* (L.) DC., offers exceptional promise as a source of edible vegetable protein that can be grown in the humid tropics. Because the varieties now cultivated have a climbing growth habit and require staking to produce high yields of pods and seeds, and because not all pods mature at the same time, it is not likely to be suitable for large-scale commercial production in the near future. The fact that the pods do not all mature at the same time, however, makes the winged bean well suited to subsistence agriculture and market gardening (Anon. 1975).

P. tetragonolobus apparently nodulates well without inoculation of the seed in Papua New Guinea. The aim of this experiment was to determine the cross-inoculation relationships of *P. tetragonolobus* and its *Rhizobium* with other legumes and Rhizobia.

MATERIALS AND METHODS

Rhizobial Isolates

Two isolates from *P. tetragonolobus* were tested. Strain NGR 156 was isolated by Trinick in 1963 from a plant growing in the Waghi Valley near Mount Hagen, Western Highlands Province. This strain effectively nodulated *Macroptilium bractearum* (Trinick, unpublished). Strain NGR 258 was isolated by Elmes in 1974 from a plant growing at Laloki near Port Moresby.

The other strains of *Rhizobium* tested were strains commonly used to inoculate legume seed and represented six cross-inoculation groups: WU 425—*Lupinus* spp.; U 45—*Medicago* spp.; CC 511—*Phaseolus vulgaris*; SU 391—*Pisum sativum*; NGR 156 and NGR 258—*P. tetragonolobus;* CB 756—Cowpea Group; TA1—*Trifolium* spp. These are also shown in the *Table.*

All strains were maintained on yeast mannitol agar (YMA) (Vincent 1970).

Seed

It is necessary to scarify the seed coat of certain legumes before they will germinate. *Medicago sativa* and *Trifolium repens* were immersed in concentrated sulphuric acid for 10 minutes and *Stylosanthes guianensis* for 20 minutes. The seed of *P. tetragonolobus* was sandpapered. *Phaseolus vulgaris* and *Pisum sativum* were not treated. After treatment with acid the seeds were washed in six changes of tap water.

All seeds were sterilized by immersion for three minutes in 0.1 per cent acidified mercuric chloride followed by washing in six changes of sterile tap water.

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It was intended to test *Lupinus* sp. also but no viable seed could be obtained.

Growing Assemblies

Different assemblies were used depending on seed size, as follows: bottle-jar assembly (*Ph. vulgaris*); 18 oz MacCartney bottle (*P. tetragonolobus*); 255 mm x 50 mm tube (*Pi. sativum*); 8 oz MacCartney bottle (*S. guianensis*); 150 mm x 25 mm tube (*M. sativa* and *T. repens*).

The method used for the bottle-jar assemblies was as described by Vincent (1970) under modified Leonard bottle-jar.

The method used for the 18 oz and 8 oz MacCartney bottles was described by Trinick (1968) for 8 oz flat dispensing bottles.

The method used with the 255 mm x 50 mm tubes followed the principle of the 8 oz bottle method in which the plant tops were unenclosed. The tubes were filled to within about 3 cm of the top with seedling nutrient agar. A sterile, pregerminated seed was placed on the agar surface in each tube and a sterile, inverted jar placed over the mouth of the tube. When the seedling had grown up into the jar, the jar was removed and a loose, sterile cotton-wool plug placed in the mouth of the tube.

The 150 mm x 25 mm tubes were used in the way described by Vincent (1970). Twelve ml of agar were placed in the bottom of the cotton-wool plugged tube and the plant grown entirely within the tube.

Seedling Media

The nutrient solution for the bottle-jar assemblies and the nutrient agar were modified from Trinick (1968). In the non-nitrate media 0.407 g potassium chloride was used instead of 0.141 g. In the nitrate control media 0.141 g potassium chloride was used as per Trinick. The bottle-jar nutrient solution was half the concentration of the nutrient agar.

Experimental Design

All strains of *Rhizobium* listed in the *Table* were inoculated onto *P. tetragonolobus*. The following legumes were inoculated separately with their own strain and strain NGR 258 from *P. tetragonolobus*: *M. sativa*, *Ph. vulgaris*, *Pi. sativum*, *S. guianensis* and *T. repens*.

There were uninoculated controls and nitrate controls for each legume and there were three replications of all treatments.

RESULTS

The *Table* gives the nodulation of *P. tetragonolobus* and the other legumes by the strains tested. The results are based on the abundance, size and internal colour of the nodules.

For *P. tetragonolobus* there were no differences in nodulation between plants inoculated with CB 756 and those inoculated with the *P. tetragonolobus* isolates NGR 156 and NGR 258. All three strains appeared fully effective on this legume. Fairly abundant nodules with white or sometimes light pink interiors were formed on *P. tetragonolobus* by strain WU 425. Strains U 45 and SU 391 formed small, white to light-pink nodules, each in one replication only. TA 1 formed ineffective nodules on *P. tetragonolobus*. Under the conditions of the experiment the nodules were approximately spherical. Effective nodules were 2 to 6 mm diameter and ineffective or partially effective nodules were 1 to 4 mm diameter.

M. sativa was effectively nodulated by U 45 but not nodulated by NGR 258.

Ph. vulgaris was effectively nodulated by CC 511 and ineffectively nodulated in two replications by NGR 258. The other replication inoculated with NGR 258 was not nodulated.

Pi. sativum was ineffectively nodulated by SU 391 in two replications only. It is likely that temperatures were too high for effective symbiosis with this legume.

S. guianensis was effectively nodulated by CB 756 and NGR 258. There did not appear to be any difference in effectiveness between these two strains.

T. repens was effectively nodulated by TA 1 but not nodulated by NGR 258.

DISCUSSION

The results indicate that *P. tetragonolobus* belongs to the cowpea cross-inoculation miscellany of legumes. It was effectively nodulated by CB 756, a strain of *Rhizobium* that nodulates many cowpea miscellany legumes, as well as by its own isolates NGR 156 and NGR 258. Strain NGR 258 effectively nodulated *S. guianensis*, a representative of the cowpea miscellany.

The ineffective or partially effective nodulation of *P. tetragonolobus* by strain WU 425

Table.— Nodulation of P. tetragonolobus and other legumes

Rhizobium strain and recommended host(s)	Legume Inoculated					
	Medicago sativa	*Phaseolus vulgaris*	*Pisum sativum*	*Psophocarpus tetragonolobus*	*Stylosanthes guianensis*	*Trifolium repens*
WU 425 (*Lupinus* spp.)				I*, e†		
U 45 (*Medicago* spp.)	E			e†, —*		
CC 511 (*Ph. vulgaris*)		E		—		
SU 391 (*Pi. sativum*)			I*, —†	e†, —*		
NGR 156 (*P. tetragonolobus*)				E		
NGR 258 (*P. tetragonolobus*)		I*, —†	—	E	E	—
CB 756 (Cowpea Group)				E	E	
TA 1 (*Trifolium* spp.)				I		E
Uninoculated control	—	—	—	—	—	—
Nitrate control	—	—	—	—	—	—

E = effective nodulation

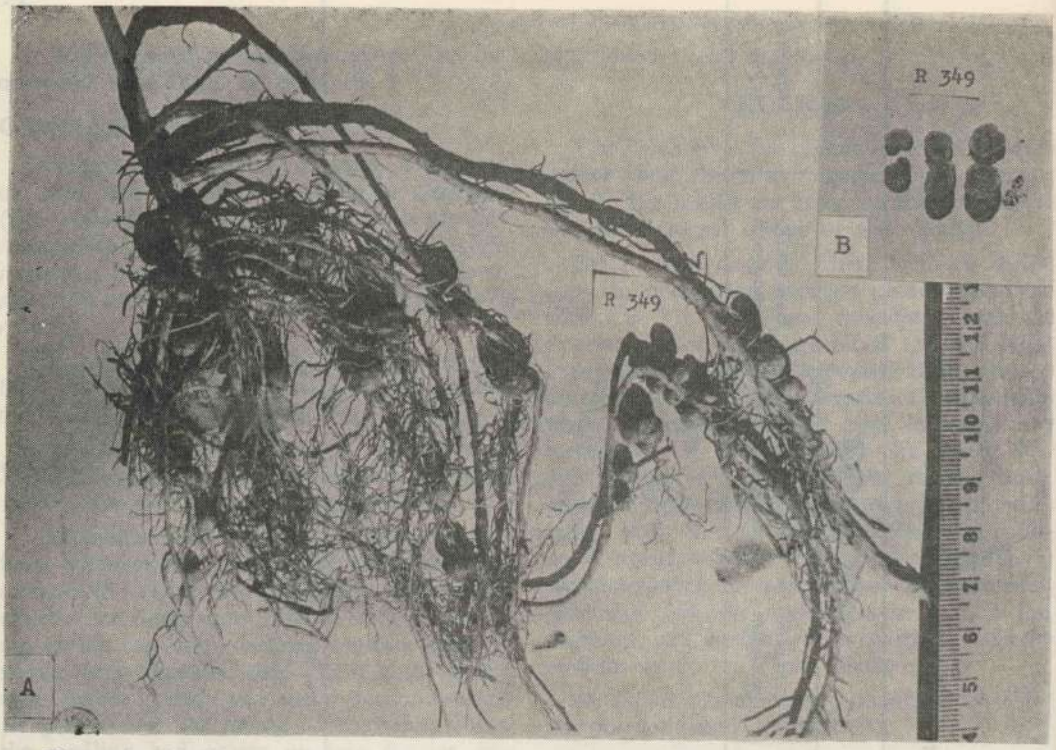
e = partially effective nodulation

I = ineffective nodulation

— = no nodules

* = 2 replications

† = 1 replication



Plate—A. Nodulated roots of winged bean (*P. tetragonolobus*) from a plant inoculated with *Rhizobium* strain NGR 258 and grown in soil. B. Halved nodules of winged bean (*P. tetragonolobus*) showing red-brown interiors which indicate effective nitrogen fixation

(*Lupinus* spp.), U 45 (*Medicago* spp.), SU 391 (*P. sativum*) and TA 1 (*Trifolium* spp.) is interesting as these belong to other cross-inoculation groups. Ineffective nodules were also formed on *Ph. vulgaris* by strain NGR 258. The results of the experiment thus contradict to a certain extent the usual concept of cross-inoculation groups. Wilson (1939), however, reported a number of cases of nodulation between legumes and bacteria in different cross-inoculation groups. For instance an isolate from *T. pratense* nodulated *Desmodium polycarpum, Centrosema virginianum* and *Pueraria hirsuta*, three cowpea miscellany legumes. In Papua New Guinea Trinick (1968) obtained nodulation of *M. sativa* by an isolate from *Leucaena leucocephala* which was also capable of nodulating legumes in the cowpea miscellany. The results obtained here suggest that *P. tetragonolobus* is a promiscuous legume, and that NGR 258, an isolate from it, is also promiscuous in that it nodulated (ineffectively) *Ph. vulgaris*.

CONCLUSION

The results support the field observation in Papua New Guinea that *P. tetragonolobus* usually nodulates well without inoculation. Presumably it would be capable of being nodulated by strains of *Rhizobium* from many tropical legumes of the cowpea cross-inoculation miscellany. Two isolates from *P. tetragonolobus* were no more effective on this host than CB 756. It appears reasonable, therefore, to recommend CB 756 for inoculation of *P. tetragonolobus*.

ACKNOWLEDGMENTS

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MARASMIELLIUS COLLAR ROT OF JAPANESE MINT

W. A. LAYTON*

ABSTRACT

A description is given of a collar rot of Japanese mint from which Marasmiellus epochnous *was isolated. Cultural characters of the two isolates are described. The inoculation of two mint cultivars, reproduction of symptoms and re-isolation of the pathogen are reported.*

INTRODUCTION

Japanese mint (*Mentha arvensis* var. *piperascens* Malinvaud is a recent introduction to Papua New Guinea. Experimental plantings of the two Japanese cultivars Okako and Ryokubi were first made in 1968 at a number of stations. In 1972 wilted patches were noted by Mr P. D. L. Ranson (Agronomist) in plantings at Popondetta on the lowlands of north-east Papua. Specimens were collected in September by Ranson (PNG 8277, cultivar unspecified) and by Dr D. E. Shaw (Chief Plant Pathologist) and Mrs E. G. Cartledge (Plant Pathologist) (PNG 8307, cultivar Okako).

Both collections had a collar rot, and the diseased tissue yielded cultures and fruiting bodies of a basidiomycete. This report describes the disease and inoculation experiments with the isolates.

DISEASE SYMPTOMS

The collar rot is followed by wilting and death of shoots. Rotted tissue is brown, with buff to dull red mycelium over the collar surface. The hyphae of the surface mycelium are thin-walled, with clamp connections.

ISOLATIONS FROM SPECIMENS

Isolates were obtained from the three following kinds of tissue of both accessions: (i) surface mycelium (PNG 8277 only); (ii) collar tissue which had been surface-sterilized with 0.1 per cent mercuric chloride; and (iii) the stipes of fruit bodies which developed both in culture and also on diseased stems incubated in a humid atmosphere. Cultures from all these sources have the same colony and hyphal characters.

Colonies incubated in darkness on 1.25 per cent malt extract agar produce moderate growth of pale-pinkish buff, cottony mycelium which grows up dish sides and over lids. Both on glass and agar, some hyphae aggregate into thin strands, but there is negligible penetration of the medium.

On agar slopes, fruit bodies develop after four weeks. Radial growth of fresh isolates was 8 cm in seven days. Extracellular oxidase, estimated by the guaiacum test (Nobles 1958) is produced at low to moderate levels. Hyphae are thin-walled, 0.5 to 6 *mu* m diameter, with both simple septa and clamp connections; hyphal branches are moderately frequent, often arising opposite clamp connections.

IDENTITY OF THE FUNGUS

Collar tissue from both accessions was maintained in a humid atmosphere and sporophores developed after six weeks. The fructifications are mushroom-like, with a surface diameter of 4 to 10 mm, whitish to buffish-brown, on a stalk (stipe) up to 1 mm wide, with a length 1 to 2.5 times the diameter of the cap (*Plate* I). The full description of the fruit bodies is given below.

Macroscopic Characters

Pileus round to deeply bayed, concave to somewhat undulate, depressed over stipe, margin slightly wavy, downcurved, variably crenate, uniform whitish to whitish-and-buffish-brown in a broad irregular pattern to uniform red-brown with faint brown radial striae corresponding with the gills, diameter 4 to 10 mm, surface dull, smooth to slightly hairy, flesh translucent whitish to buffish-brown; tough when dry, expanding when wet.

Gills of 3 lengths, translucent whitish to buffish when fresh, drying to buff-brown, free collarium

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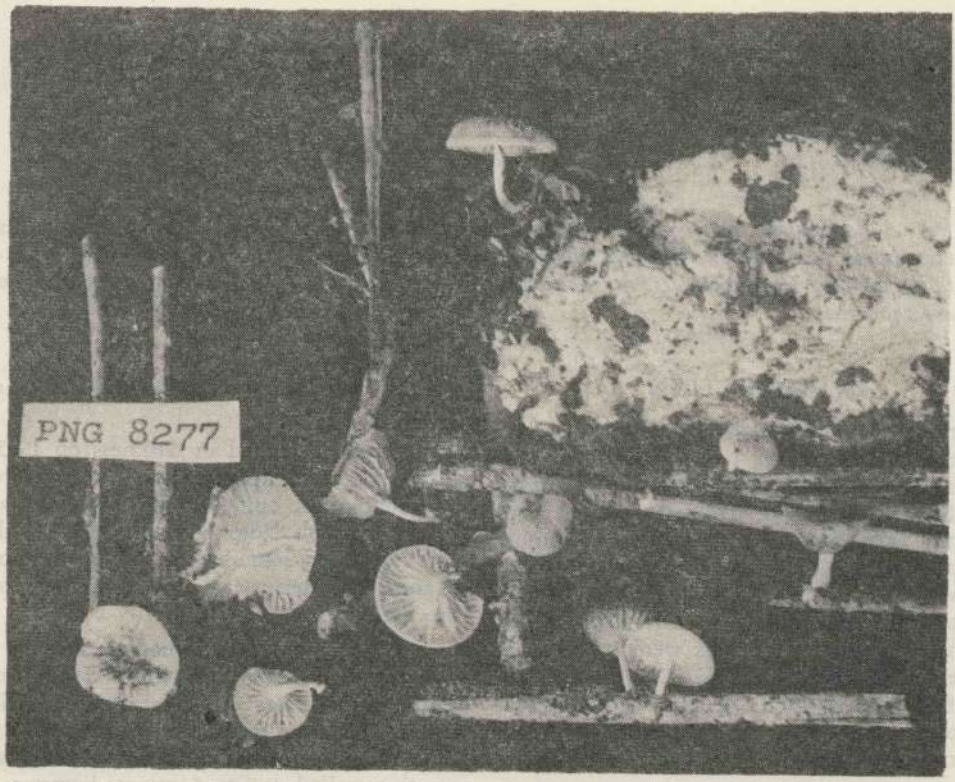


Plate I—Fructifications showing normal habit as well as some inverted to show gills on the under-surface of the pileus (Approx. x 1) (Photo by D. Shaw)

lacking, rather crowded, rather thick, the longer gills occasionally forked but not interveined.

Stipe central (but in one, adjoins deep bay in the pileus), diam. 0.3 to 1.0 mm, not relatively thick or thin, stuffed with paler hyphae, not hollow, concolorous with pileus, surface dull and smooth to slightly hairy, of equal diam. throughout length or wider below, length 1 to 2.5 times diam. of pileus.

Microscopic Characters

Pilear surface hyphae lightly encrusted, pale yellowish, thin-walled, the majority at least of septa being clamp-connections (septa which appeared to be simple may have had clamps below, obscured from view), diam. (3.5-) 5 to 10 *mu* m (*Figure* 1a). Infrequent, emergent, prostrate to erect broom cells (? pilocystidia) with short, simple or branched projections, diam. including projections 7.5 to 13 *mu* m. Projections often on one side only (*Figure* 1b), giving a comb-like appearance. No amyloid reactions in these or any other structures of the fruit body.

Trama of gills a loose weft of branching, thin-walled, broad hyphae, the majority if not all with clamps, staining moderately in lacto-phenol cotton blue (LPCB), becoming more tightly woven in upper gills and pileus.

Gill edge sterile, consisting of clavate, hyaline cheilocystidia (*Figure* 1c) with irregular, rather short, blunt projections, diam. including projections 5.0 to 12.5 *mu* m.

Hymenium of densely packed hyaline, clavate basidia (*Figure* 1d) all with 4 sterigmata, diam. 5.5 to 10.0 *mu*. m Cystidia lacking. Basidial-subhymenial layer 55 to 90 *mu* m deep not forming distinct sublayers, densely staining in LPCB.

Spores (*Plate* IIa and b; *Figure* 1e) hyaline, ellipsoid with one side flattened, apiculate, one-to-several-guttulate, 6 to 10x (3.5-) 4 to 5 *mu*.

Cultures from sporophore tissue were the same as those from diseased plant tissue.

After three years in culture, neither isolate fruited under laboratory conditions, either on agar media (malt extract agar or potato dextrose agar) or on autoclaved grass stems maintained in a humid atmosphere. However, when cultures on autoclaved grass stems were put on moist soil in pots out of doors, fruit bodies developed on the stems after four weeks.

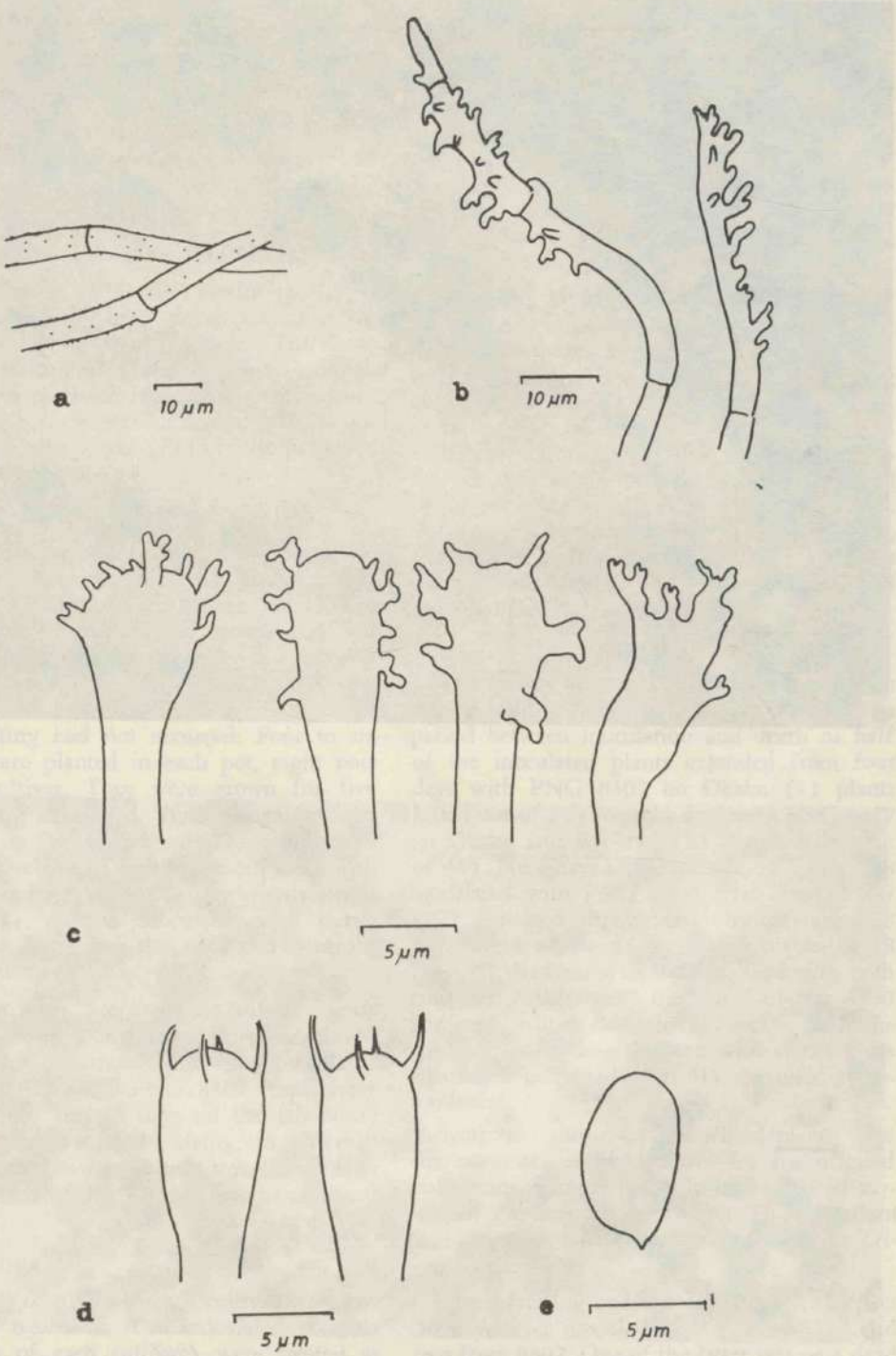
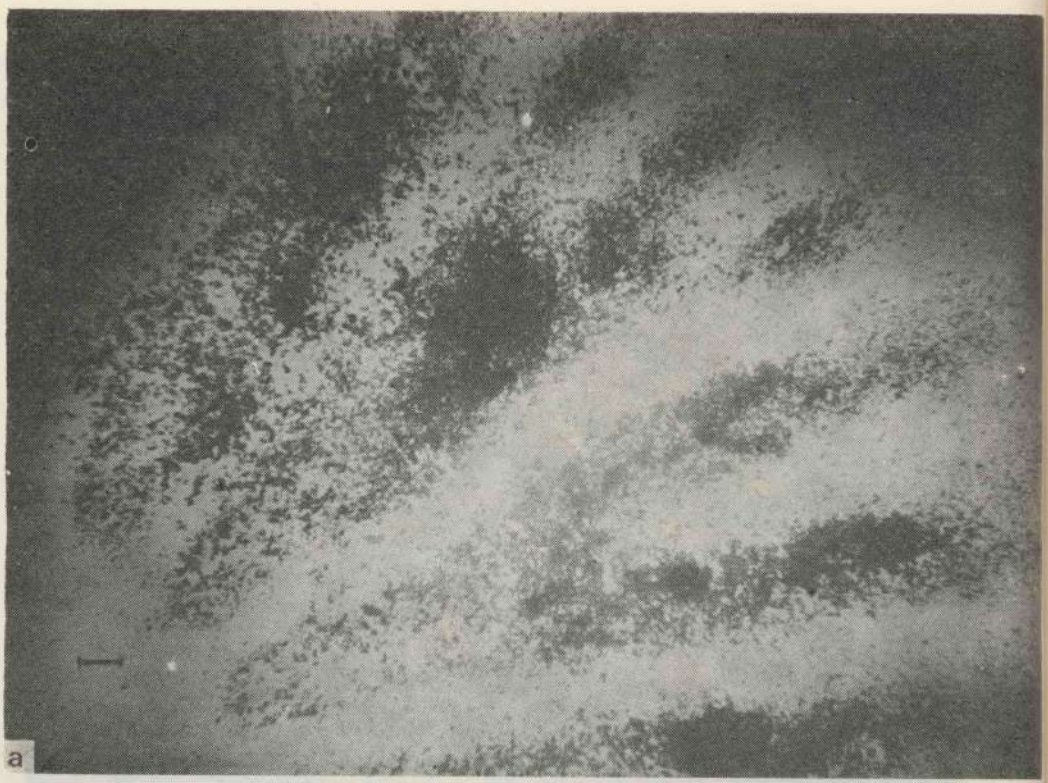


Figure 1—a. Hyphae of pilear surface showing clamps and fine incrustations. b. Broom cells. c. Cheilocystidia. d. Basidia with sterigmata. e. Basidiospore



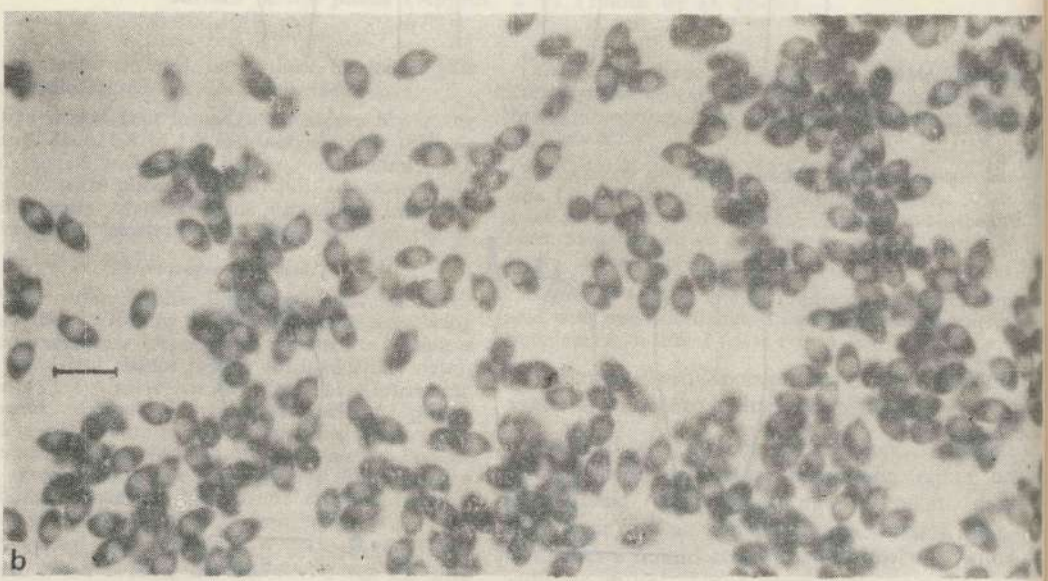


Plate II—a. Portion of spore print from mature pileus, bar = 100 μm. b. Basidiospores in spore print, bar = 10 μm. (Both a and b stained with cotton blue lactophenol) (Photos by D. Shaw)

The fruit bodies were examined by Dr D. N. Pegler of the Royal Botanic Gardens, Kew, who identified them as *Marasmiellus epochnous* (Berk. & Br.) Singer. He stated that they are identical with the original collection of *M. epochnous* from Sri Lanka, and further agree with the subsequent descriptions given by Singer for Central American collections.

FIRST INOCULATION EXPERIMENT

In November, 1972, all 11 mint shoots inoculated with PNG 8307 developed collar rot and severe wilt within nine days. The three uninoculated control plants remained normal. Thirty pieces of tissue from shoots with symptoms were surface sterilized and plated out on potato dextrose agar (PDA); the pathogen was re-isolated from 18.

SECOND INOCULATION EXPERIMENT

Two Japanese mint cultivars were used, Okako and Ryokubi. Sixteen pots, diameter 15 cm, were sterilized with 95 per cent alcohol and filled with unsterilized brown clay soil from the Brown River area. Rooted cuttings of both cultivars showing no symptoms of disease were obtained from areas at Popondetta where wilting had not occurred. Four to six cuttings were planted in each pot, eight pots of each cultivar. They were grown for five weeks, then inoculated. Both fungal isolates were used in the experiment. The numbers of plants of each mint cultivar inoculated with cultures of both accessions (on previously sterile grass stems), controls inoculated with sterile grass stems only, and the untreated controls, are given in the *Table*.

Inoculum was prepared as follows: grass stems on moist cotton wool were autoclaved at 121° C for 15 minutes. They were inoculated with PNG 8277 and PNG 8307 respectively and incubated for 13 days on the laboratory bench, by which time the stems were covered and permeated with whitish mycelium. They were then cut into 5 to 10 mm lengths and used as inocula.

Inoculations

Two pots of plants of each cultivar were not given any treatment. The inoculated controls (two pots of each cultivar) were treated as follows: two to three 10 mm lengths of sterilized grass stem were placed in contact with each mint stem, and covered by about 10 mm of soil. No part of the plant, such as roots or stem, was disturbed or damaged in the process. Inoculated plants (four pots of each cultivar) were treated in the same way as the inoculated controls except that inoculum was substituted for sterilized grass. Pots in saucers were placed on level ground in part shade. Cultivars and treatments were distributed at random over the site.

Inoculum pieces had become attached by hyphae to the majority of inoculated stems by the time symptoms appeared. All such remnants were removed and discarded prior to plating out, and the diseased mint stems then treated as follows. Pieces from the margins of rotted collars were surface-sterilized by immersing in 50 per cent alcohol for 15 seconds followed by 0.1 per cent mercuric chloride for 35 seconds. Following a two-minute rinse in sterile water, tissue from each of the four inoculum-cultivar combinations was cut into 15 pieces and plated out on PDA.

RESULTS

The plants inoculated with *M. epochnous* started wilting three days after treatment. The period between inoculation and death of half of the inoculated plants extended from four days with PNG 8307 on Okako (11 plants killed out of 22) to eight days with PNG 8277 on Okako and Ryokubi (22 plants killed out of 44). Nine days after treatment, all 39 plants inoculated with PNG 8307 were dead. PNG 8277 appeared slightly less virulent; after 28 days, eight of the 44 inoculated plants, or 18 per cent, had no symptoms. Considering both cultivars, 75 of the 83 inoculated plants, or 90 per cent, wilted and died (*Table*). Both the controls (controls inoculated with sterile grass stems and untreated controls) remained symptomless.

Symptoms shown by the wilted plants were the same as described above for the original collections, except that only buff-coloured mycelium was seen on the collars. This mycelium had the same microscopic characters as the original collections.

Three fruiting bodies were noted in the pots 39 days after inoculation, one from 8277 and two from 8307. One of the latter was on a dead mint stem, the other two were growing from pieces of inoculum. The fruiting bodies were

Table—Summary of results of inoculating two mint cultivars with *Marasmiellus epochnous* (isolates PNG 8277 and PNG 8307)

Treatment	Mint cultivar	Plants		Period between inoculation and death of half the number of plants (days)		Plants killed after 28 days		
		No.	Total	No.	Mean	No.	Total	%
Control, untreated	Okako	13		—		0		
	Ryokubi	10		—		0		
	Both cultivars		23	—			0	0
Control, inoculated with sterile grass pieces	Okako	16		—		0		
	Ryokubi	19		—		0		
	Both cultivars		35	—			0	0
Inoculated, isolate PNG 8277	Okako	23		8		18		
	Ryokubi	21		8		18		
	Both cultivars		44		8		36	82
Inoculated, isolate PNG 8307	Okako	22		4		22		
	Ryokubi	17		8		17		
	Both cultivars		39		6		39	100
Both isolates and both cultivars			83		7		75	95

the same as those which developed on the original collections.

Re-isolation of the pathogen

Sixty pieces of collar tissue from wilted plants were surface-sterilized and plated out into nutrient agar. Thirty-six pieces, or 60 per cent, yielded colonies with the same cultural characters as the original isolates.

DISCUSSION

The results show that the fungus isolated from PNG 8277 and PNG 8307 is involved in a wilt disease of at least two cultivars of Japanese mint. *M. epochnous* does not appear to have been recorded previously on this host, nor were records found of Agaricaceae on any *Mentha* species. No records were found of *M. epochnous* on any host.

Singer, Lucas and Warren (1973) described a blight of American beachgrass (*Ammophila breviligulata* Fern.) caused by *M. mesosporus* in which the symptoms are similar to the present disease. The PNG sporophores differ from those authors' description of *M. mesosporus* in having smaller and more numerous projections from the cheilocystidia. The PNG fungus also resembles the description by Sabet, Ashour, Samra and Abdel-Azim (1970) of *M. inoderma* on maize, differing in having hyphae of the epicutis coarsely rather than finely encrusted.

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GERMINATION OF SPORES OF MARASMIELLUS EPOCHNOUS

DOROTHY E. SHAW*

ABSTRACT

Basidiospores of Marasmiellus epochnous *from fructifications produced in cultures on dead grass stems proved viable when shed on to a nutrient agar surface. Cultures re-established from the germinated spores and built up on sterile dead herbaceous stems caused wilt of healthy Japanese mint* (Mentha arvensis *var.* piperascens) when *these stem pieces were used as inoculum.*

A collar rot of Japanese mint (*Mentha arvensis* var. *piperascens* Malinvaud) was described by Layton (1976), the cause being attributed to *Marasmiellus epochnous* (Berk. & Br.) Singer. As reported by Layton, fructifications were produced in axenic cultures built up on sterile grass stems, with massive production of basidiospores.

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As a continuation of the above work, portions of the pileus of fructifications produced as above (isolate PNG 8307) were suspended on

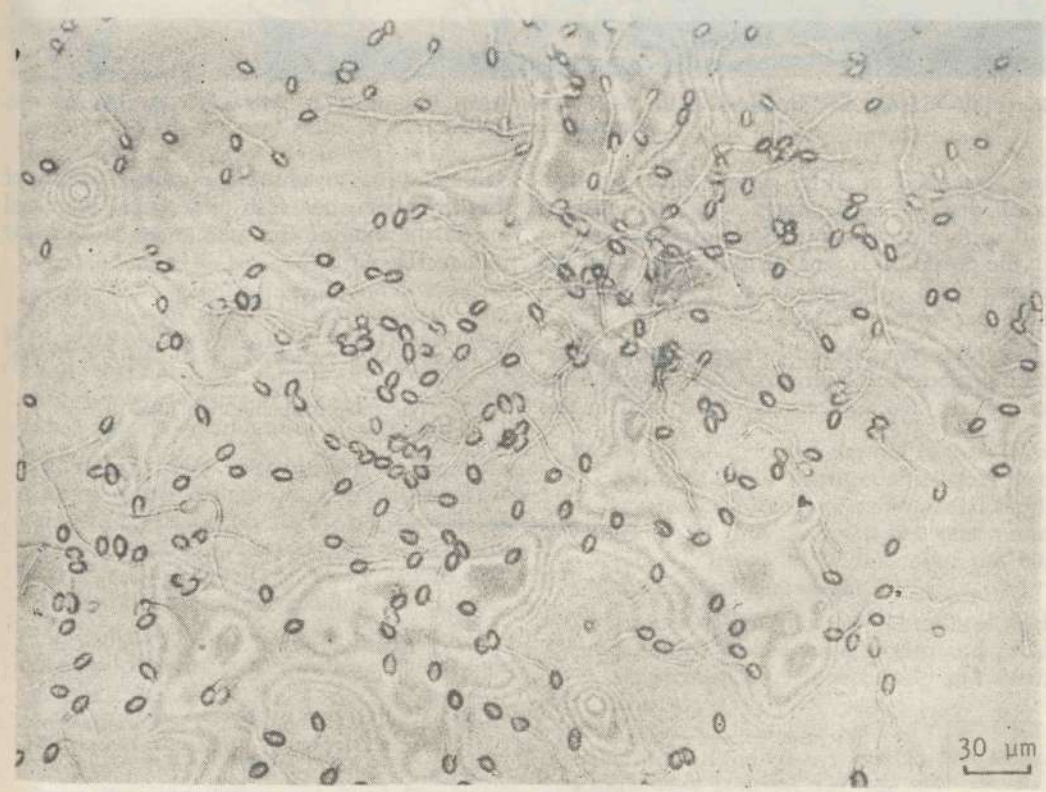

Plate I—Unstained basidiospores of *Marasmiellus epochnous* shed from a fructification on to nutrient agar, germinating with one germ tube per spore

Plate II—Clump of Japanese mint with some stems beginning to wilt after inoculation with *Marasmiellus epochnous*

the inside lid of Petri dishes, adhering in a small drop of sterile water, with the unwetted gill surface downwards. Basidiospores shed on to the potato dextrose agar in the bottom of the plate proved viable, germinating with one germ tube per spore (*Plate* I).

Cultures re-established from massed germinating spores and built up on sterile stem pieces of a herb (*Barleria cristata,* often used in this laboratory as a substrate), caused wilting of healthy mint when such pieces were inoculated on to the base of the mint stems at soil level (*Plate* II).

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LAYTON, W. A. (1976). *Marasmiellus* collar rot of Japanese mint. *Papua New Guin. agric. J.*, 27 (3): 59-65.

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EFFECT OF FEEDING RATIONS BASED ON COOKED SWEET POTATO AND A PROTEIN SUPPLEMENT TO BROILER AND CROSSBRED POULTRY

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ABSTRACT

Two strains of poultry, a commercial broiler strain and a crossbred multi-purpose strain, were fed ad libitum *on one of three rations:* (1) *a 21 per cent crude protein broiler starter control ration;* (2) *a mixture of three parts by weight of boiled sweet potato to one part of protein-vitamin-mineral supplement and* (3) *free choice boiled sweet potato and protein supplement offered independently. Growth performance, dressing percentage and chemical composition of the carcass at slaughter were estimated. There were significant differences in growth performance due to breed and diet, with broiler birds and control rations being superior. There were few important differences in carcass characteristics.*

INTRODUCTION

Grains are the most common constituent of poultry rations. In certain situations, however, cost and availability may make it more attractive to feed alternative feedstuffs, particularly for the provision of the energy component of the ration. Such a situation exists in many parts of Papua New Guinea where the availability of cereals is limited to large-scale intensive poultry and pig units. Under these conditions the use of the Papua New Guinean staple, sweet potato (*Ipomoea batatas*), warrants investigation. This report describes an experiment designed to study two ways of feeding cooked sweet potato with a protein-vitamin-mineral supplement.

Rosenberg and Seu (1952) fed growing chickens sweet potato as a replacement for maize at levels of up to 45 per cent of the ration. A decline in performance was observed with increasing levels of sweet potato. This decline was reduced by cooking the tubers.

Springhall (1964) was able to feel levels of dried milled sweet potato in the ration at levels as high as 20 per cent without adversely affecting performance.

MATERIALS AND METHODS

The design of the experiment was a 2 x 3 factorial with two replicates involving two breeds, a commercial broiler strain[1] and a mixed group of Australorp, Rhode Island Red and New Hampshire breeds and crosses. A total of 300 birds of each breed was used. The second factor investigated was diet. Three diets were used:

1. A commercial broiler starter ration[2] containing 21 per cent crude protein, from day-old to slaughter weight (1 600 g).
2. Broiler starter from day-old to three weeks followed by a mixture of cooked sweet potato and protein-vitamin-mineral supplement[3] to provide a 21 per cent protein ration, offered *ad libitum* until the birds reached market weight.
3. Broiler starter from day-old to three weeks, but with cooked sweet potato and protein supplement offered separately and *ad libitum*.

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[1]Hyline, Ilimo Farm Products Pty Ltd, Port Moresby.

[2]Kainani Feed Mills Pty Ltd, Lae.

[3]Provincial Traders, Brisbane, Queensland, Australia: contained 50 per cent crude protein.

Table 1—Details of composition and consumption per bird per day of rations

Ingredient	Ration			
	Strain*	Control	Mixed	Separate
Broiler starter	B	83.0	—	—
	MP	62.2		
Boiled sweet potato	B	—	138.3	144.2
	MP	—	102.7	140.2
Protein supplement	B	—	46.2	42.2
	MP	—	34.2	31.4

* B=broiler
MP=Multi-purpose

Details of the rations used are shown in *Table* 1. Day-old chicks were wingtagged, weighed and allocated to treatments in such a way that mean body weight and distribution about this mean were similar for each pen.

For the first three weeks of life all birds were kept on broiler-starter rations in kerosene brooders. Records were kept of food consumption during this period. At three weeks birds were re-weighed and treatment groups allocated to 12 deep litter pens in a randomized block arrangement.

The diets described above were fed until check weighing revealed that an average bird of 1 600 g had been reached. Feed consumption records were kept for each pen as were mortality figures. Food consumption and food conversion rations were calculated on a dry matter basis, allowing for 10 per cent moisture in the broiler ration and concentrate and 70 per cent moisture in the sweet potato.

On reaching slaughter weight, all the birds were weighed. Eight birds selected at random from each pen were slaughtered to obtain estimates of dressing percentage.

From the eight slaughtered birds, three were randomly selected and frozen. Each carcass was then cut into 2 cm cubes with a band saw and minced three times. An aliquot of the mince was taken for estimation of chemical composition. Ether extract estimations were obtained by difference. Mean values for each pen were calculated for each parameter and analysed for variance. Differences between means were tested by Duncan's New Multiple range analysis (Steele and Torrie 1960).

RESULTS AND DISCUSSION

Treatment means, growth performance and carcass parameters are shown in *Table* 2.

Breed—Breed differences accounted for the major part of the variation in performance of birds on the experiment. Broiler strain birds grew more quickly, had a higher daily food consumption and converted dry matter to weight gain more efficiently. Carcasses of broiler strain birds contained significantly less crude protein than those of the multi-purpose crosses.

Diet—Chickens on the control diet reached slaughter weight in significantly shorter time than those on the mixed sweet potato and supplement diet. With the exception of dry matter intake of the crossbred chickens on the mixed diet, which was greater than that of other diets, there was little effect of diet on dry matter consumption. Food convertion ratios were significantly better on the control grain rations. The only significant dietary effects on carcass measurements were on dressing percentage and carcass ether extract.

Birds on the mixed ration had a significantly higher dressing percentage than those on the other two treatments. This is a rather surprising finding in view of the greater weight of food consumed by birds receiving sweet potato.

Carcass ether extract was lowest in birds on the separate sweet potato and supplement diets. This is an interesting finding, suggesting that if chickens are allowed to select their own level of energy and protein consumption, less feed will be converted to body fat.

Table 2—**The effect of breed and diet on growth performance and carcass characteristics**

Breed and ration	Feed consumed during three weeks g	Days to reach 1 600 g	Daily dry matter consumption g	Daily sweet potato consumption g	Daily protein concentrate consumption	Feed conversion ratio	Dressing percentage	Carcass dry matter %	Carcass crude protein %	Carcass ash %	Carcass fat %
Broiler—											
Control	404	60	74.7	—	20.0	2.20	71.9	34.7	16.2	3.6	14.9
Mixed	404	66	83.0	92.2	30.7	2.77	75.7	31.2	16.9	3.9	10.4
Separate	429	62	81.3	93.5	27.7	2.47	72.0	34.1	16.4	3.3	14.4
Multi-purpose crossbred—											
Control	343	98	56.0	—	19.5	3.03	74.0	34.0	17.5	3.9	12.7
Mixed	360	106	61.6	84.5	28.2	3.59	72.8	31.3	18.6	3.7	9.1
Separte	332	107	70.4	118.4	26.5	4.21	72.8	35.0	16.8	3.6	14.7
Significance of differences—											
Diet	—	NS	*	—	—	*	*	NS	NS	NS	**
Breed	—	**	**	—	—	**	NS	NS	*	NS	NS
Breed x diet	—	NS	NS	—	—	NS	**	NS	NS	NS	NS

NS = not significant. *=$P<0.05$. ** = $P<0.01$

Breed diet interactions—Although significant differences occurred between individual breed-diet treatments for most of the parameters estimated, the only significant factor interaction was for dressing percentage. This was low for rations containing sweet potato in the multi-purpose birds and high for the broiler strain, suggesting that gut fill on the bulky diets was greater for multi-purpose birds than for the broiler strain. This is not easy to reconcile with their lower daily food consumption. Reference to *Table* 1 shows quite large differences between breeds in the ratio of protein supplement to cooked sweet potato which was selected. Calculating the content of the rations, it appears that the fast-growing broiler strain were selecting a ration containing 21 per cent crude protein, while the multi-purpose birds were selecting a 19 per cent ration. Expressed in terms of consumption of crude protein per day the figures are 18 and 14 g respectively.

It appears from these figures that the fast-growing broiler birds are able to select, not only increased total food consumption, but higher protein intakes as well.

Economic aspects—The slow growth rate and poor food conversion ratio of the crossbred birds show their unsuitability for use in intensive production systems.

A system of free choice feeding gives results which are only about 10 per cent worse than those of the control ration. The cost of production, using a protein concentrate and sweet potato, is very sensitive to the cost of these feeds. From *Table* 1 the amounts required can be calculated. Unless concentrate prices are low, and sweet potato is considered as a free food, it would appear more economic to use a fully prepared ration.

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BOOK REVIEW

FLORISTICS AND ECOLOGY OF THE MANGROVE VEGETATION OF PAPUA NEW GUINEA

MARGARET PERCIVAL AND JOHN S. WOMERSLEY. *Botany Bulletin No.* 8, Department of Forests, Division of Botany, Lae. 96 pp., 3 plates, 68 figs.

In recent years there has been an increasing world interest in mangrove communities. This interest has come about due to the realization of the true ecological and economic significance of these communities. In Papua New Guinea interest has been sharpened by proposals for harvesting mangroves for pulp production and by the possible ecological effects on the mangrove forests of the proposed Purari River hydroelectric scheme. The possibility of these developments has increased the awareness of our ignorance of the ecological functions of mangrove communities. The ecological web of life within the community, the relationships with the surrounding marine, freshwater and terrestrial communities, the productivity, energetics and nutritional flow within, into and out of the mangrove system and all aspects of sedimentation and erosion need study before the environmental impacts of large schemes can be assessed.

Floristics and Ecology of the Mangrove Vegetation of Papua New Guinea is a book which fills a vital need for any mangrove studies. The first three chapters outline some of the environmental conditions influencing mangrove vegetation, the types of specialized root systems which mangroves have evolved, and zonation and succession of mangrove forests. These chapters summarize neatly and succintly the existing state of general knowledge of these aspects. It should be borne in mind, however, that mangrove trees are only part of a complex community which includes numerous other life forms.

The chapter on uses of mangroves is quite brief, perhaps too much so, as the significance of mangroves to man is surely the crux of the whole matter.

Fish, crabs and prawns are the main sources of protein for people living in mangrove areas. Although only slightly exploited at the moment, commercial mangrove fisheries could add significantly to Papua New Guinea's protein production. Moreover, such fisheries require little complex technology or outside expertise, and could be operated by village people themselves. The mention of the development of mangrove areas for fish culture in South-East Asia is interesting, but not particularly relevant to Papua New Guinean conditions as "wild" fish are so numerous and so readily caught.

The great importance of mangroves as nursery areas for marine fish and prawns is referred to. Probably equally important, but omitted, is the nutrient outflow from mangroves to the sea. Large quantities of vegetable matter and small crustaceans can regularly be seen being carried out to sea from mangrove areas.

Land accretion and the prevention of erosion are mentioned as two significant functions of untouched mangroves.

The production of sugar from *Nypa fruticans* may be of potential value to Papua New Guinea, particularly as the emphasis on village cottage industries and self-reliance increases. The other subsistence uses of *Nypa* and of other mangrove vegetation for light building materials and firewood are important in the village economy. The authors leave it unclear whether the medicinal uses of mangroves are followed in Papua New Guinea. If not, this may be an area where experience elsewhere can be used to advantage by Papua New Guineans.

The uses mentioned above all come from comparatively untouched mangroves and demonstrate that, in this state, mangroves are a resource which is already being utilized. Before any decision on commercial harvesting is made the existing value should be considered. Tannin, timber and pulp are commercial products requiring large-scale harvesting of mangrove trees. Tannin is of declining importance, but timber and pulp appear to be potentially viable industries. Whether the short-term value of

these products could outweigh the existing recurrent value of mangrove forests, or whether commercial harvesting could exist side by side with village-based industries needs close study.

The final chapter on the taxonomy of mangrove species in Papua New Guinea takes up two-thirds of the book and is clearly the main reason for its production. This chapter is extremely useful to anyone doing scientific work in mangrove areas. For identification there are keys, descriptions, some photographs and many excellent line drawings. The keys and descriptions are clear and concise and the drawings particularly good—in fact, it is possible to identify most genera directly from the drawings. In short, this is the exact field handbook for mangrove identification that has been needed for so long.

There are two criticisms of the final chapter, however, which should be made. The first is minor: on page 72 the distribution of *Nypa fruticans* is given as NE. New Guinea and the Solomon Islands. No mention is made of the quite extensive *Nypa* stands in the Gulf Province. The other criticism is more important — that is the lack of a glossary of technical terms. For the non-botanist, the number of technical terms used in the species keys is bewildering. A glossary of such terms would have added little to the cost of the book, and greatly increased the convenience of using it.

To sum up, the need for scientific data from our mangrove communities is growing more pressing all the time. This book will prove invaluable to all technical workers in mangrove areas, and also to anybody else who wishes to be better informed about his environment. Workers in Austraila, the Pacific and SE. Asia will find it as useful as those in Papua New Guinea.

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