

could also be attributed to a coumarin derivative instead of a kinetin-like compound. Stimulation of cotyledon enlargement and shoot growth, however, might still depend on a supply of kinetin-like growth factors from the host.

From the reports cited by Börner⁷ of liberation of scopoletin and related compounds from plant roots and the finding of Brown *et al.*⁸ that the *Striga* germination factor was a root-extension stimulator, the possibility that a coumarin derivative is the naturally occurring germination stimulant cannot be overlooked.

Additional indications obtained from work on the chemical nature of the natural stimulant from maize roots (to be published elsewhere) further suggest that it might be a coumarin derivative. Neither of the two active compounds reported here, however, is believed to be present in the natural stimulant. The natural stimulant appeared to be effective at much lower concentrations than were these two compounds, and Goodwin and Taves⁹ reported that most naturally occurring coumarin derivatives isolated appeared not to have substitutions in the four-position. Sunderland¹⁰, however, has recently indicated that the *Striga* stimulant from maize roots may be a complex of substances. Conceivably a coumarin compound could be one of the constituents, possibly the main constituent.

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Production of Fusion Organs by the Species of *Phytophthora* which causes Foot Rot of *Piper nigrum* L. in Sarawak

A SERIOUS root disease of black pepper (*Piper nigrum* L.) was reported to be present in Sarawak by Robertson¹ in 1955. Holliday and Mowat² discovered that the causal organism was a species of *Phytophthora* and suggested the name 'foot rot'. In their communication it was stated that they had been unable to find the oospores of the fungus.

In July 1961, the majority of 31 cultures, remaining from a total of 81 isolates from black pepper, were found to be producing oospores after 2-4 months in pure culture on oatmeal agar. A description of the fusion organs (from isolate 78) of this *Phytophthora* species follows.

Oogonia are terminal or lateral, globose, thin-walled and hyaline when young but become thick-walled and

amber to golden brown when mature; their diameter is 26-45 μ (mean 35 μ); the wall is smooth, or occasionally rough, 1.8-7.5 μ thick (mean 3.8 μ). Antheridia are terminal or lateral, thin-walled, hyaline and amphigynous; 11-15 \times 11-23 μ (mean 13 \times 15 μ). Oospores are spherical, thin-walled and hyaline when young but become thick-walled and amber to golden brown when mature; their diameter is 19-38 μ (mean 26 μ); the wall is smooth, 1.8-5.6 μ thick (mean 3.2 μ).

The identity of the species is still uncertain. Muller³ named a species of *Phytophthora* causing foot rot of black pepper in Indonesia, *P. palmivora* var. *piperis*. Isolates from *Piper betle* L. have been referred to as *P. parasitica* Dast., by McRae⁴, and *P. colocasiae* Rac., by Thompson⁵, while Dastur⁶ gave the name *P. parasitica* var. *piperina* to isolates from *Piper betle* and *Piper longum* L. It is thus obvious that further work is required before the Sarawak species can be finally identified.

I thank the Director of Agriculture for permission to publish this communication. The work on foot rot, initiated by the Sarawak Government, is continuing.

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MICROBIOLOGY

Production of Vitamin B₁₂ and Vitamin B₁₂ Analogues by Pure Cultures of Ruminant Bacteria

MICROBIAL fermentation in the rumen was early recognized as the primary source of vitamin B₁₂ for the cow¹. Rumen contents contain not only the vitamin itself but also certain analogues in which the nucleotide portion of the vitamin is missing or modified by the substitution of a different benzimidazole or a purine for the base (5 : 6-dimethylbenzimidazole). In general, the analogues containing nucleotides with benzimidazole derivatives tend to possess some vitamin activity for animals while those containing purines tend to have activity only for micro-organisms². The relative activities vary with different micro-organisms and even with the particular assay technique used³. In rumen contents, vitamin B₁₂ itself makes up about 10 per cent of the activity for *Escherichia coli*, factor A (containing 2-methyl adenine) composes about 60 per cent, while pseudovitamin B₁₂ (containing adenine), factor B (containing no nucleotide) and factor C (containing guanine) account for most of the remainder⁴. Relatively little work has been reported in regard to the part played in the synthesis of these compounds by the individual species of micro-organisms obtained from the rumen and in general such studies have not included true or functional rumen organisms⁵.

In the present work, the synthetic capability of 48 strains representing 21 different species of functional rumen micro-organisms have been tested for the