The fungus identified as *Beauvaria brongniartii* has been reported for the first time on root grub *Holotricha serrata* from India. The pure culture of this fungus has also been deposited in the Commonwealth Mycological Institute, Kew, Surrey, England, and in the collections maintained in the Department of Plant Pathology, Agricultural College, Bangalore.

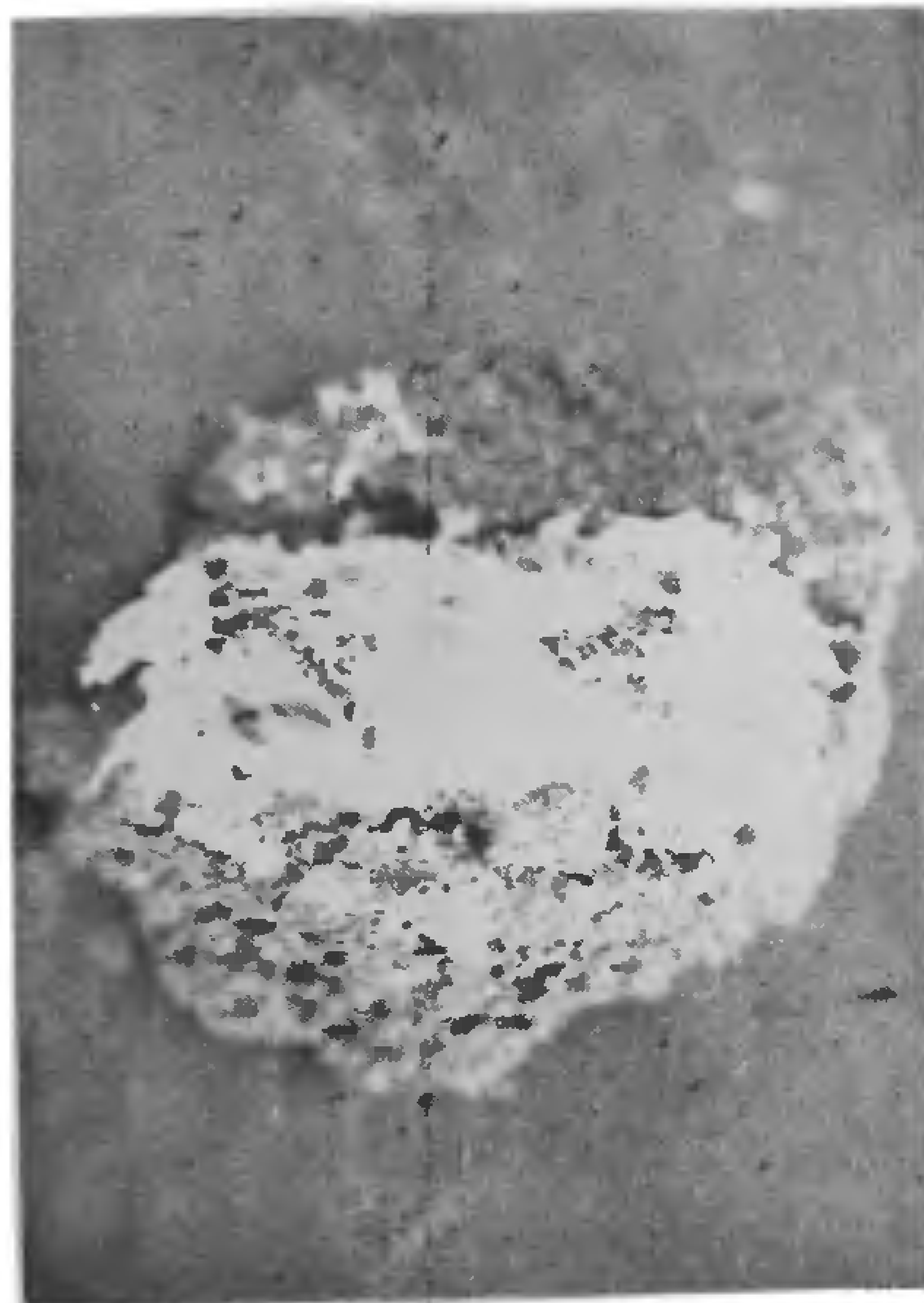

Fig. 1. Root grub infected with *Beauvaria brongniartii* (Sacc.) Petch showing white pulpy mass of mycelium.

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LIPASE PRODUCTION BY THE RICE BLAST PATHOGEN

Presence of abundant phospholipid globules in the chlorophyll containing parenchyma cells of rice (*Oryza sativa* L.) leaf tissue and their ready discolouration in response to fungal, bacterial, and viral infection has been recently shown[1]. The tissue composition to which the pathogen is adapted influences the enzymes produced by it. Although the production of lipase by many plant pathogenic fungi has long been known[2-8], the ability of the blast pathogen of rice, *Pyricularia oryzae* Cav. to produce lipase and the role of this enzyme in symptom expression is little understood.

Fifty milliliter of Tanaka's medium[9] containing 20 g of glucose (control), 50 g of coconut oil (amendment A) or olive oil (amendment B) per liter as carbon source at pH 7 were placed in 250 ml Erlenmeyer flasks, and sterilized at 15 lb/sq inch pressure for 20 min. The required amounts of thiamine and biotin were then added to each flask under aseptic conditions, inoculated with a 4 mm culture disc of either P 26, the least virulent or P 150, the most virulent Philippine races of *P. oryzae*, selected on the basis of their pathogenicity on Philippine differential rice varieties and incubated at 28° C for 20 days, after which the exo- and endo-cellular lipase activities were assayed. The growth was determined by weighing the harvested mycelia after drying it for an hour in an oven at 100° C.

Enzyme in the culture filtrate was precipitated by the addition of alcohol to get a final concentration of 80% in a cold room at 4–5° C. The flocculent precipitate formed was separated by filtration after standing for an hour at 0–2° C and dissolved in 10 ml of McIlvaine's buffer at pH 7. The endocellular enzyme was prepared by suspending the mycelia in buffer solutions to get 10% extract, homogenized in a Sorvall omni-mixer for 10 min, centrifuged at 3,000 *g* for 30 min in cold and the supernatant liquid was used as the enzyme source. The protein in the enzyme solutions was determined by the method of Lowry *et al.* [10].

Lipase activity was determined by the titrimetric estimation of the fatty acids liberated from the substrate[11]. The reaction mixture contained 5 ml of buffer, 5 ml of 10% egg albumin and one milliliter of the enzyme extract. The blanks were incubated without the enzyme which was added immediately before titration. After incubation at 36° C for 5 hr with occasional shaking, 25 ml of 1 : 1 alcohol-acetone mixture were added and titrated against 0·05 *N* NaOH, using phenolphthalein as indicator. Activity is expressed as the number of lipase

TABLE I

Lipase activity in the culture filtrate and mycelium of two different races of P. oryzae

oryzae race	Treatment	Dry weight of mycelium (mg)	Lipase activity (units mg protein hr)			
			Culture filtrate		Mycelium	
			Substrate for enzyme assay			
			Coconut oil	Olive oil	Coconut oil	Olive oil
	Control	642	1·2	0·9	3·1	2·4
P26	Amendment A*	387	14·3	8·4	56·2	25·7
	Amendment B†	175	5·1	6·7	15·4	21·5
	Control	596	1·1	1·0	3·0	2·3
P150	Amendment A*	455	14·0	8·6	58·4	26·1
	Amendment B†	292	4·9	6·0	14·2	20·6

* Amendment A—Culture grown with coconut oil as carbon source.
† Amendment B—Culture grown with olive oil as carbon source.

units (one milliliter of 0·05 N NaOH taken as 100 lipase units) liberated in one hour by one milligram of protein.

Coconut oil was utilized more effectively by both the races of the pathogen than olive oil (Table I). Both exo- and endo-cellular lipolytic activities increased by the presence of lipids in the culture medium. Maximum enzyme activity was noted with the substrate, that is used for the growth of the organism. However, there was no correlation between virulence of the pathogen and the enzyme activity. More enzyme activity was noted in the mycelium than in the culture filtrates.

The ability of the blast pathogen to produce lipase suggest that the pathogen can readily utilize the lipids present in rice leaves. In and around the blast lesions caused by *P. oryzae* the lipid droplets disappear and the appearance of the brown discolouration of the tissues is preceded by the dissolution of the discoloured lipid globules, suggesting the possible involvement of lipase in pathogenesis. The tissue discolouration is delayed in susceptible type of 'leaf spots' while it reaches a maximum much more quickly, inhibiting the lesion formation in resistant type of leaf spots. The time at which the post-infectional discolouration of the lipid droplets takes place might influence the resistance or susceptibility of rice cultivars to blast disease.

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STRUCTURE AND DEVELOPMENT OF HAIRS IN *AGRIMONIA EUPATORIUM* L. (FAMILY ROSACEAE)*

SEVERAL investigators[1-5] have recognised the taxonomic significance of hairs present on vegetative and floral parts of plants. The members of the family Rosaceae show various types of hairs which may serve as a tool for distinguishing between genera and species. Since nothing is known regarding the ontogeny of the hairs in this family, the present investigation has been undertaken to provide some information which may serve as a taxonomic basis. This note deals with the structure and development of hairs present on floral parts of *Agrimonia eupatorium* L. The floral buds of this species in various stages of development were collected from Bhowali (Kumaon Hills) and fixed