Figure 3 shows that the drought-prone regions are Punjab, Haryana, Rajasthan and the adjoining areas, large parts of Uttar Pradesh, Gujarat and most of the southern parts of the peninsula east of western ghats. The extreme western parts of west Rajasthan and Gujarat are chronically drought-prone areas. Figure 4 shows that the flood-prone areas are Punjab, Haryana, Rajasthan, Gujarat, West Uttar Pradesh and South-eastern parts of peninsula. There are no chronically flood-prone areas. It may be noted that in general the areas which are prone to droughts and floods are nearly the same. These are the regions of low rainfall and high rainfall variability. The quantitative figures presented here may be useful for planning purposes.

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22 March 1983

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CATENARIA VERMICOLA IN *HETERODERA AVENAE* NEMATODE—A NEW RECORD

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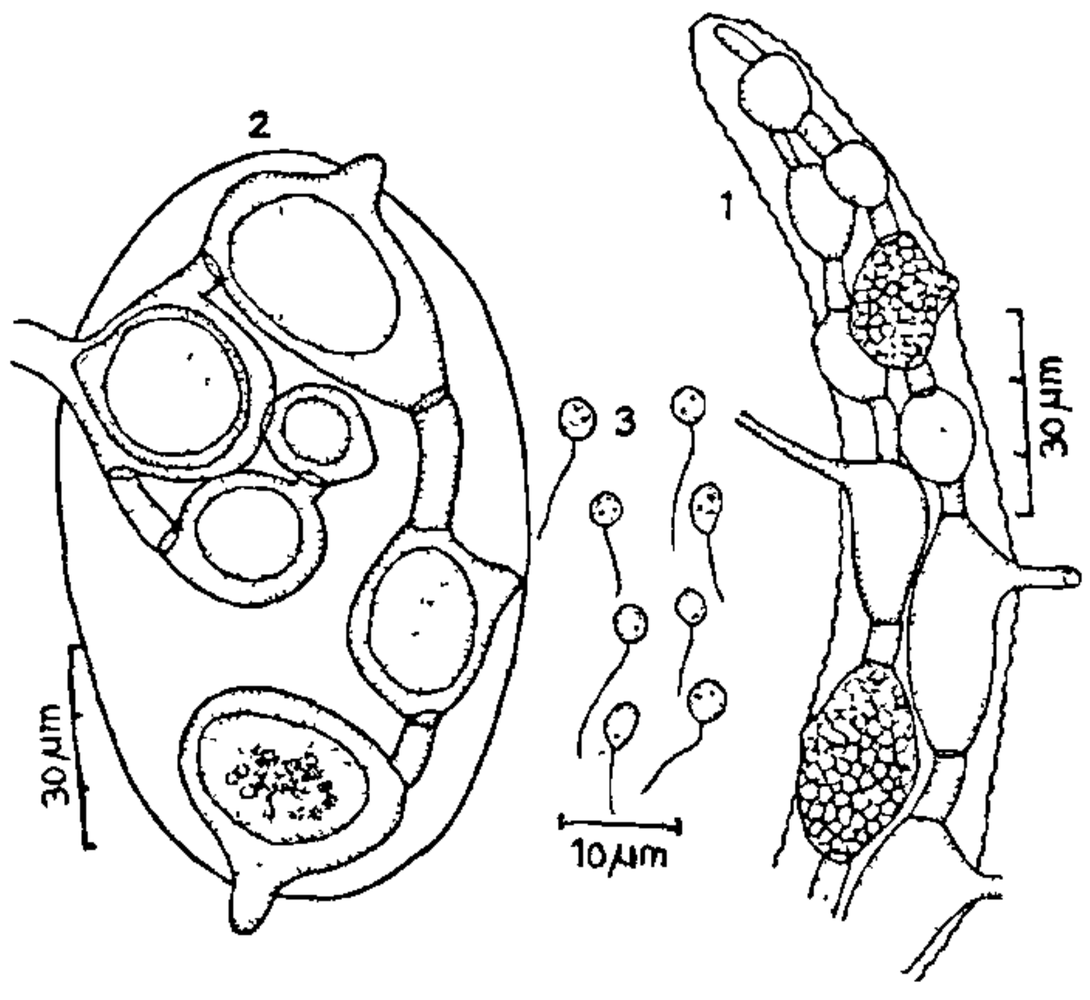
DURING an investigation for parasitic fungi of *Mastigomycotina* (Chytridiomycetes) group, a species of *Catenaria* Sorokin, is being reported in *Heterodera avenae* a parasitic nematode to graminaceous crops. This fungus has been recorded in these nematodes as well as in their eggs for the first time from India. The slide and specimens have been kept in *Herbarium cryptogame Indiae orientalis*, IARI, New Delhi. The taxonomic characters of this fungus have been described as follows.

Catenaria vermicola Birchfield, *Mycopath. Mycol. Appl.*, 1960, 13,331.

Thallus endobiotic, polycentric, consisting of septate mycelium without rhizoids. Sporangia double walled, intercalary, variable in shape, spherical, ovoid or oblong, triangular, 8–70 × 8–25 μm size, proturberances which later form discharge tube by dissolving cuticle and discharge zoospores. Thick walled resting sporangia present. Zoospores posteriorly whiplash, uniflagellate with cluster of lipids, body 2.5–5 μm, oval to oblong in shape and flagellum 7–15 μm long (figures 1–3).



Figures 1–3. *Catenaria vermicola*. **1.** Nematode infected with fungus showing chains of sporangia. **2.** Egg showing resting sporangia. **3.** Zoospores.

In larvae and their eggs (*H. avenae*), Hyatpur village (Gurgaon Distt.), S. C. Dhawan, October, 1981, HCIO 34074.

The above specimen differs from the type description (18–40 × 16–24.4 μm) in having bigger sporangia and in the discharge of zoospores individually than in gelatinous mass.

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SEROLOGICAL TEST FOR THE DIAGNOSIS OF *GANODERMA LUCIDUM*

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SEROLOGICAL methods as a tool for differentiating species or intraspecific strains of fungi parasitising man or animals have been commonly employed, but the reports of their application to plant pathogenic fungi are scanty. A number of reports have emanated in the past elucidating the serological relationship between viruses[1-3] as also against different strains of micro-organisms[4,5]. With the advances in sero-diagnostic techniques, their application to plant pathogenic fungi has been found to be useful[6-10]

In perennial plants like arecanut and coconut, early detection of the disease at the incipient stage assumes overwhelming importance, in view of the long incubation (gestation) period of the fungal pathogen like *Ganoderma lucidum*, before visible symptoms develop on the host plant. In India, a number of hosts are infected by *G. lucidum*[11]; however, no information is available on the variability of the pathogen. Hence, an attempt is made to raise antibodies against *G. lucidum*, infecting the roots of arecanut palms and causing the 'Anabe' disease so as to evolve a suitable early diagnostic technique.

Two cultures of *G. lucidum* used in the study (one was isolated from infected arecanut gardens around Hirehalli, Karnataka, India, and the other was obtained from the Forest Research Institute, Dehradun, India) were grown for 30 days in Waksman's liquid medium, in still conditions, containing 0.025% each of biotin and thiamine at room temperature (30° ± 2°C). The mycelium was filtered through Buchner funnel, dried in folds of filter paper at 40°C in a hot air oven. Dry mycelium (600 mg) was ground in physiological saline for 15–20 min with chilled acid-washed sand and filtered through Seitz filter. The filtrate was made upto 20 ml and stored in the refrigerator at 4°C.

The protein content of the culture filtrate was estimated by Lowry's method[12] using Folin's reagent. A preparation containing 600 μg protein/ml was used for the immunisation of rabbits as described below:

Albino rabbits weighing 1–1.25 kg were used for raising the antiserum against *G. lucidum.* Intravenous injections were given daily to the rabbits (through the marginal ear vein), increasing the dosage gradually. Two ml of the antigen were injected on the 8th, 9th, 10th and 11th days respectively. The antigen was emulsified with an equal volume of Freund's complete adjuvant (Difco) on the 9th and 10th day and administered intravenously. The animals were rested for 7 days. Bleeding was done for 4 days by puncturing the marginal ear vein and 10 ml of the blood was collected. The serum was obtained by centrifugation at 5,000 g and the microprecipitin test was carried out as elucidated below:

Serial dilutions of the antiserum were made in the range 1:100 to 1:25 600. One ml of the antigen was added to an equal volume of the diluted antiserum in test tubes. The tubes were shaken and incubated at 37°C in a water-bath and the precipitation recorded after 24 hr.

The pre-immunisation sera showed no visible precipitate when treated with the corresponding antigen. As compared to this, the antisera obtained after the completion of immunisation schedule showed visible signs of the antigen-anti-body precipitin reaction when treated with the corresponding antigen. The results presented in table 1 show that the immune response is

Table 1 *Precipitin reaction profile of G. Lucidum antigen*

Area	Total protein administered (mg)	Intensity of precipitation* after *24hr incubation with antiserum* Dilution of antiserum									
		1/50	1/100	1/200	1/400	1/800	1/1600	1/3200	1/6400	1/12800	1/25600
Dehradun	13.20	d	d	d	c	c	c	b	b	a	a
Hirehalli	12.00	d	d	d	c	c	b	b	a	e	e

*: No reaction; a: low; b: moderate; c: high; d: intense; e: Undiluted antigen was employed.