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Pythium radiosum, a new species with ornamented oogonia from France

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Abstract. *Pythium radiosum* sp. nov., is described from cultivated soil in France. It is a slow growing species and can be characterised by the presence of intercalary to catenulate sporangia and oogonia, the latter being ornamented with conical to mammiform spines, virtual absence of antheridia, and the presence of aplerotic to plerotic oospores. Taxonomic details and cultural aspects of the fungus are described in this paper.

Résumé. *Pythium radiosum* sp. nov., isolée à partir d'un sol cultivé en France est décrit ici. Le champignon peut être caractérisé par la présence de sporanges et oogones intercalaires ou caténaires. Les oogones sont ornements d'épines coniques ou mammiformes, et les anthéridies sont pratiquement absentes ou très rares et les oospores sont aplérotiques et plérotiques.

Introduction

A perusal of literature reveals that very little work on aquatic and soil phycomycetes has been done in France. Although a number of works relating to the pathology of *Pythium* appears from time to time, the taxonomy of this important genus has been completely neglected.

During the course of investigation on Pythiaceous fungi of France a number of soil samples were collected from the Northern parts of France. A new species of *Pythium* was detected in three of the samples collected from cultivated fields in the region of Beauvais. The fungus has ornamented oogonia, the ornamentations being typically conical to mammiform.

There are quite a number of species of *Pythium* having ornamented oogonia. Plaats-Niterink (1981) in her monograph of the genus *Pythium* has described 21 such species. Since then only one, *P. ornatum*, has been added to this group (Paul 1987). *P. radiosum* fits the group very well. It is closely related to species like *P. echinulatum*, *P. mastophorum*, or *P. polymastum* in some respects, but possesses its own distinctive features allowing the creation of a new taxon.

Materials and methods

Soil samples were collected in sterilized capped bottles and brought to the laboratory. Fungi were isolated from these by using the usual baiting

techniques in water (Paul 1986 a,b; 1987). The baits used were boiled hemp-seed halves introduced to a watery suspension of the soil. Temperature growth relations were observed on solid media like potato carrot agar (PCA) and corn meal agar (CMA). Benomyl was used to suppress the growth of *Fusarium* like fungi (Paul 1991).

Identifications were done with the help of keys provided by Middleton (1943), Waterhouse (1968), and Plaats-Niterink (1981).

Observations and results

Pythium radiosum sp.nov., Plates 1-4.

Mycelium bene ramificatum, sine loculis, hypha principalis 6 μm diam. Sporangia globosa vel subglobosa, prolata, intercalaria, 6-33 μm diam. Oogonia intercalaria, globosa, 9-40 μm diam, ornata spiculis mammiformis 2-15 μm longis. Antheridia interdum absunt. Oogonia continentia unam, vel duas oosporas, pleroticas vel apleroticas, globosas 6-24 μm diam. 0.75-2 μm crassi tunicatas. Incrementum radiale quotidianum 10 mm 25° C in agaro *Solani tuberosi* et *Dauci carotae* (PCA). Secretum ex terra in Beauvais, France. Holotypus in herbario universitatis Lille -II conservatus (F-12).

Mycelium hyaline, well branched, at times bearing conical spines, specially in the vicinity of oogonia. Main hyphae 3-6 μm wide. Colonies on PCA and CMA produce scanty aerial mycelium and show a chrysanthemum pattern of growth. Average daily growth of the fungus at 25° C on PCA and CMA is 10 and 9 mm respectively.

Sporangia are mostly intercalary, often in chains, rarely terminal, globose, ovoid, to cylindrical. The spherical ones measure 6-33 μm in diameter (av. 19 μm), while the elongated ones are of different sizes, up to 45 μm in length. At times these structures are as thin as the vegetative hyphae, the sporangial cell containing dense, coarsely granulated cytoplasm. Occasionally the sporangia are provided with conical to somewhat pointed spines of 1-5 μm length. Production of zoospores was not observed at any time, although the cultures were flooded with water and maintained at different temperatures.

Oogonia are ornamented with conical to mammiform spines of 2-15 μm length and upto 6 μm broad at the base; mostly intercalary or catenulate, rarely terminal, spherical to ovoidal, measuring 9-40 μm in diameter (av. 22.5 μm) and are filled with dense, coarsely granulated protoplasm.

Antheridia are usually absent. On rare occasions hypogynous antheridia are found attached to terminal oogonia which are equally rare.

Oospores are plerotic in smaller oogonia and aplerotic in the bigger ones, spherical, usually one, at times two per oogonium, measuring 6-22 μm in diameter (av. 17.4 μm). The oospore wall is relatively thin, measuring 0.75-2 μm in thickness.

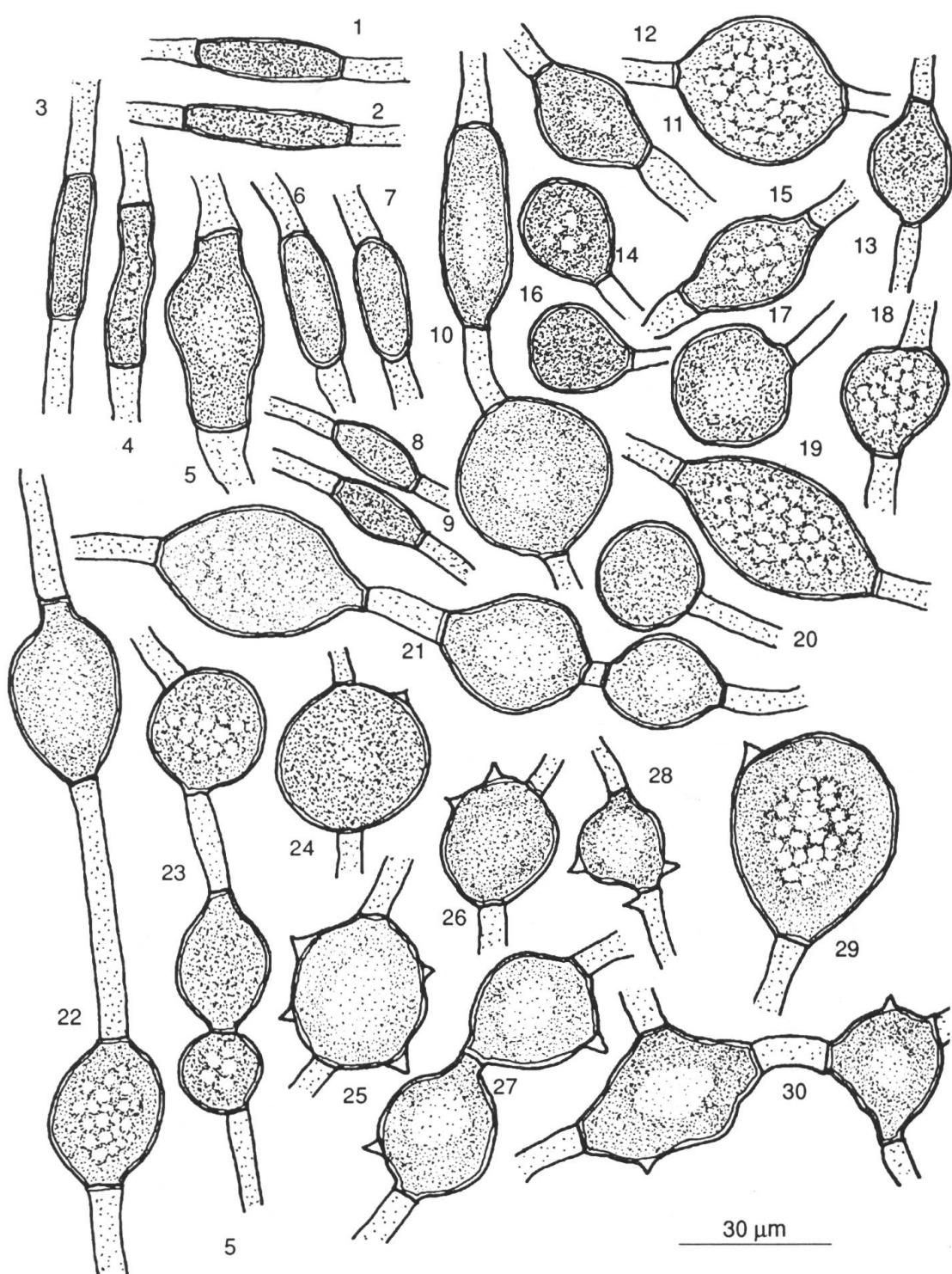
Plate 1: *Pythium radiosum*

Fig. 1-9: Elongated sporangia. Fig. 10: Mixed elongated and spherical sporangia. Fig. 11-20: Globose to ovoidal sporangia. Fig. 21-23: Catenulate sporangia. Fig. 24-30: Ornamented sporangia.

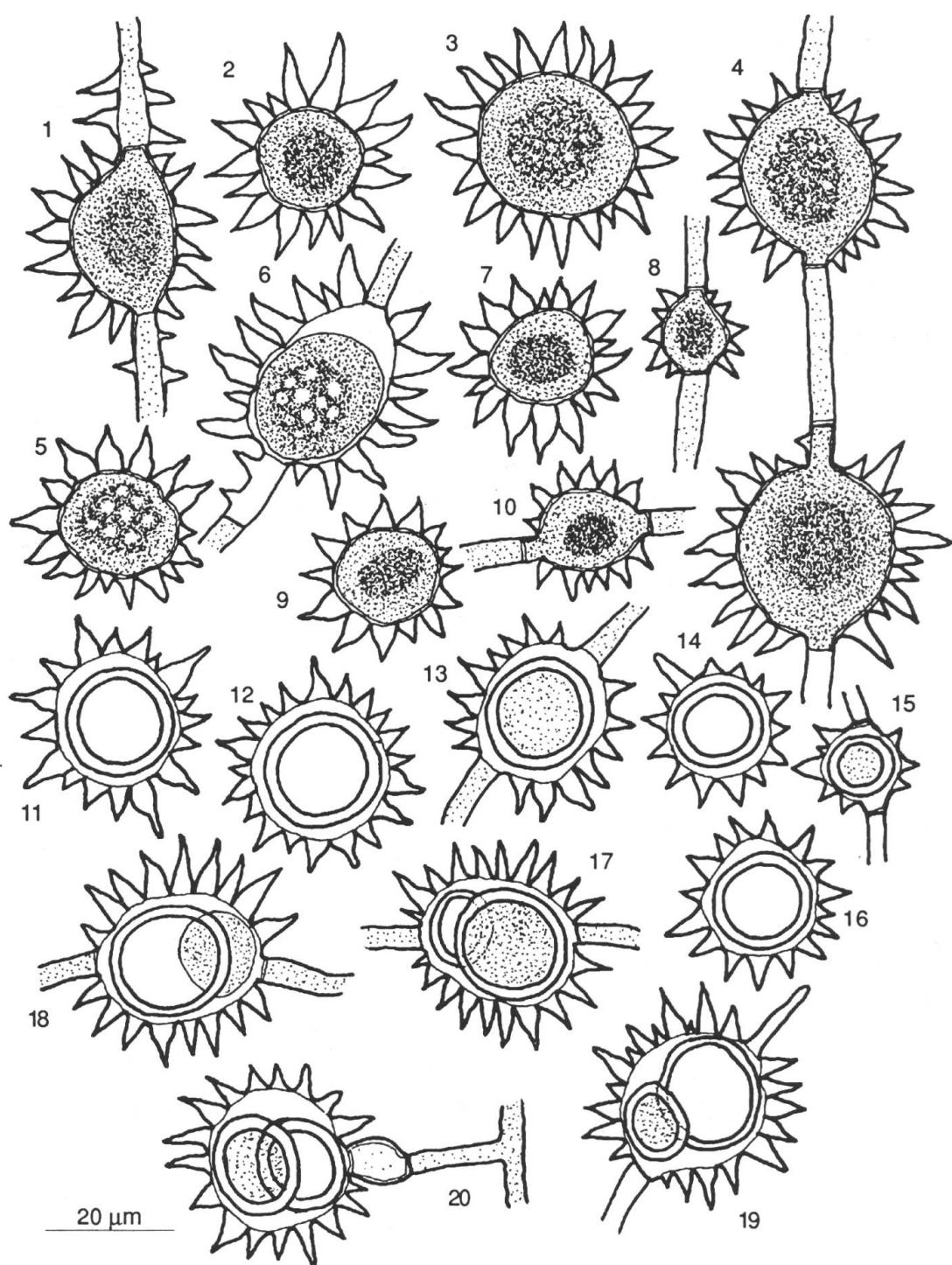


Plate 2: *Pythium radiosum*, Sporangia

Fig. 1-10: Oogonia showing mammiform to conical projections, Fig. 11-16: Oogonia with single oospores. Fig. 17-19: Oogonia containing two oospores. Fig. 20: Oogonium with a hypogynous antheridium.

Discussion

Within the group of *Pythium* having ornamented oogonia *P. mastophorum*, *P. polymastum*, and to some extent *P. prolatum* have mammiform to conical projections on their oogonia. *P. radiosum* differs from *P. mastophorum* in having smaller sporangia (av. 19 μm instead of 33 μm), smaller oogonia (av. 22.5 μm instead of 38.5 μm) and smaller oospores. *P. polymastum* has mostly terminal oogonia measuring up to 69 μm in diameter, while *P. radiosum* has much smaller and mostly intercalary oogonia. *P. prolatum* differs from *P. radiosum* by its faster growth rate, bigger oogonia and smaller spines.

Pythium anandrum, *P. oligandrum*, and *P. amasculinum* lack antheridia like *P. radiosum*. The latter differs from *P. anandrum* and *P. oligandrum* in its temperature growth relationship, both these species are fast growing fungi while *P. radiosum* is a slow growing fungus. Moreover, *P. anandrum* has bigger sporangia and oogonia. On the other hand *P. amasculinum* and *P. oligandrum* have slender and acute spines quite different from the mammiform to conical spines of *P. radiosum*.

Milanez (1978) reported the presence of large catenulate sporangia in his isolate of *P. echinulatum* collected at Full lake, Michigan. It is a slow growing species and thus comes closer to *P. radiosum*. The main differences between these two species resides in the form of oogonial projections. The former species is provided with pointed oogonial projections which are smaller than those of mammiform to conical projections of *P. radiosum*. Moreover catenulate sporangia are not a regular feature of *P. echinulatum* (Plaats-Niterink 1981). Johnson (1972) did not observe any catenulate sporangia in his isolates from Iceland.

Pythium radiosum also differs from other species having spiny oogonia like *P. acanthophoron*, *P. mamillatum* and *P. spinosum* by its slow growth, lack of antheridia, mostly intercalary and bigger oogonia, and longer oogonial spines.

Pythium radiosum thus fits the group of species with ornamented oogonia very well. It is unique in having the character combination of catenulate sporangia and oogonia, mammiform to conical oogonial projections, absence of antheridia, its slow growth, and having at times projections on the sporangia.

Acknowledgements

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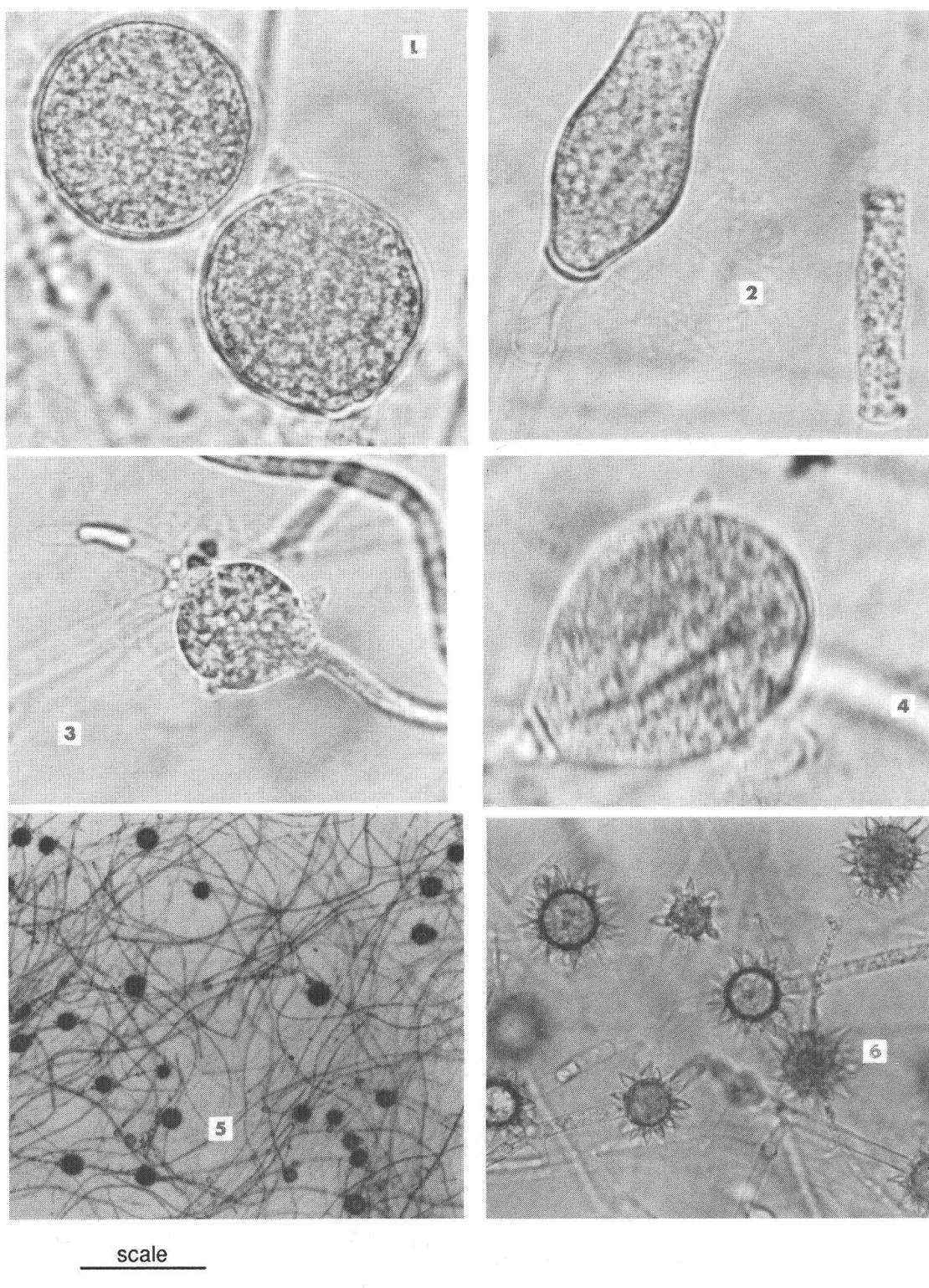
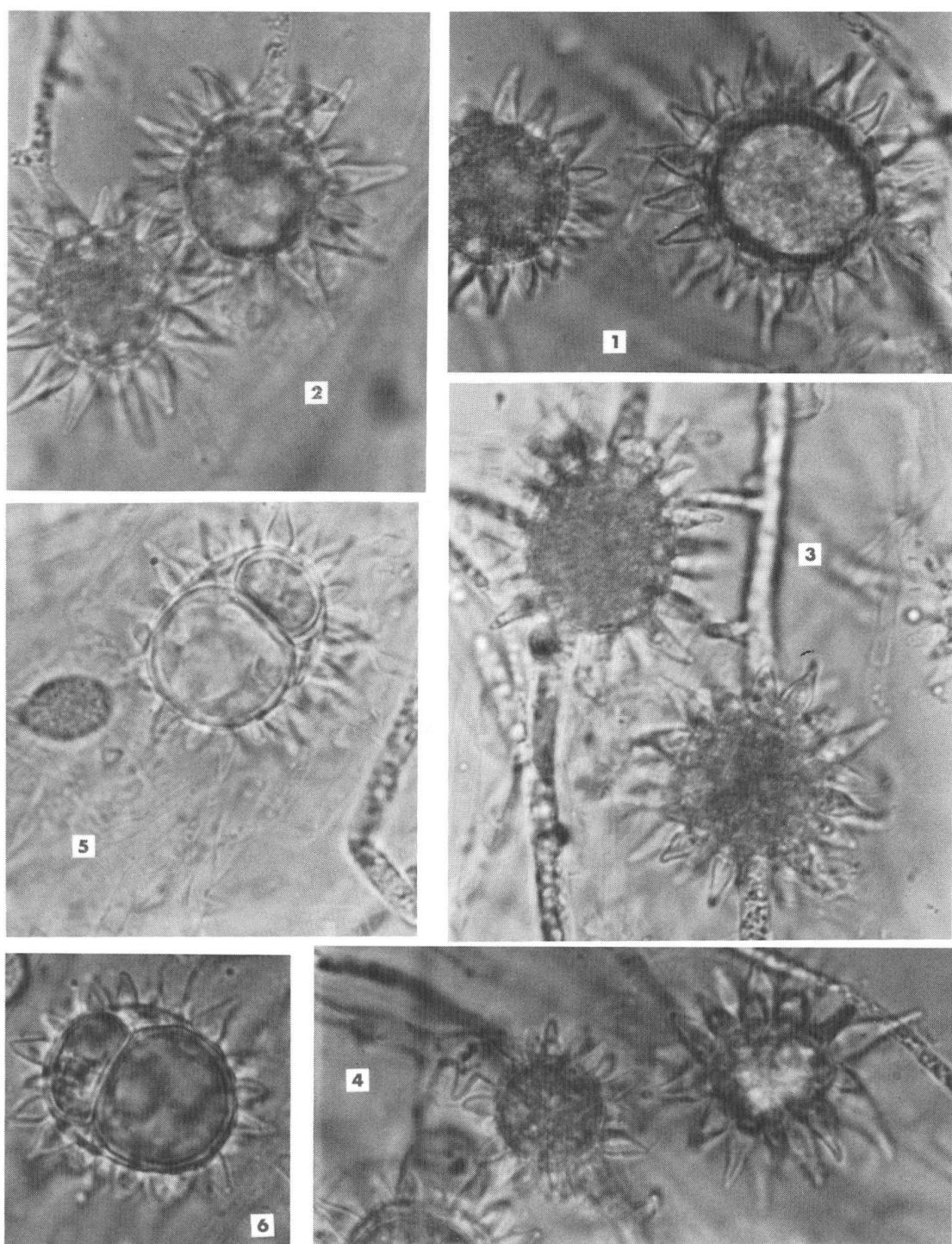


Plate 3: *Pythium radiosum*
Fig. 1: Spherical sporangia. **Fig. 2:** Elongated sporangia. **Fig 3-4:** Ornamented sporangia. **Fig 5-6:** Oogonia. Scales: Fig.1-4: 15 μ m; Fig.5: 150 μ m; Fig.6: 40 μ m



15 μm

Plate 4: *Pythium radiosum*

Fig.1-4: Oogonia with mammiform projections.

Fig. 5-6: Oogonia with two oospores.

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