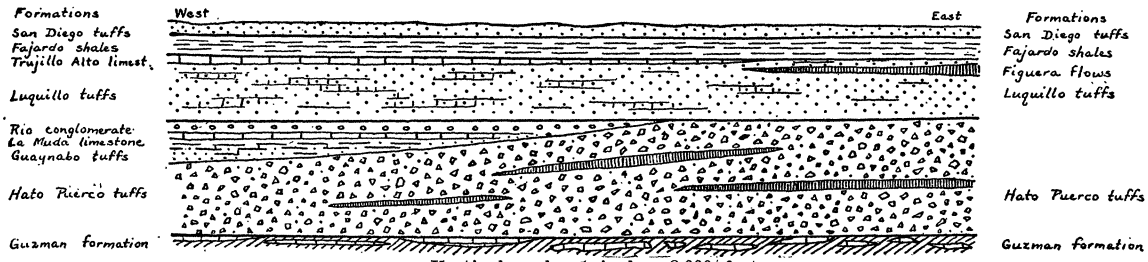
has been found to be the La Muda limestone, repeated on the flank of one of the several folds which rib the island. It lies neither at the base nor at the top, but slightly below the middle of the 10,000 to 11,000 feet of pre-Oligocene volcanics and sediments in this part of the formations undergo. The accompanying restored section will illustrate the type of lateral change that occurs in northeastern Porto Rico within a distance of thirty miles. The geological age of the basal formation is not known; the others are Upper Cretaceous but do not include the highest members of the pre-Oligocene sequence.



Vertical scale: 1 inch = 8,000 feet.

FIG. 1. Restored section of the Upper Cretaceous rocks between Bayamon and Fajardo, P. R.

of Porto Rico. The limited evidence available indicates that they are all Upper Cretaceous in age.

It must be assumed that the designation of the rocks in the vicinity of Fajardo and Cape San Juan as limestones was an inadvertent slip, for the outcrops in this region consist of the Fajardo ashy shales and of a formation of stratified tuffs for which the name "San Diego" is herewith proposed. There are no limestones nearer than the valley of Rio Sabana, six miles to the west, where a thin wedge of the Trujillo Alto limestone is present.

The writer is not familiar with the structural and stratigraphic details in central and western Porto Rico, but the facts published suggest that some caution is necessary in formulating a geologic section which utilizes stratigraphic units from those portions of the island. Hodge placed the Rio Jueyes series in the Eocene on the strength of a single specimen identified as *Venericardia alticosta* Conrad,[3] and Maury apparently accepts his conclusion. Above the Rio Jueyes series lie the Coamo tuff-limestone and the Rio Descalabrado series, which both authors have necessarily referred to the Eocene. Yet, in the calcareous strata of this entire sedimentary series, which outcrops on the southern slopes of the Cordillera Central, G. J. Mitchell has reported abundant specimens belonging to the rudistid genus, *Radiolites*.[4] No better index fossil of the Cretaceous can be found, and in view of the presence of rudistids in the Rio Jueyes and Rio Descalabrado series, their assignment to the Eocene may well be questioned. The presence of Eocene rocks in any part of Porto Rico thus appears to be extremely dubious, although the possibility of their existence has not yet been completely eliminated.

At the present time the information in print is not adequate for the development of a stratigraphic succession that will apply to the pre-Oligocene rocks of the entire island. Determination of such a sequence is rendered triply difficult by the large intrusions which cut the section, by the complexity of the structure and by the baffling lateral gradation which some

[3] *Idem*, pp. 193–194.

[4] G. J. Mitchell, "The Geology of the Ponce District, Porto Rico," *idem*, pp. 255–257, 1922.

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THE PROPER TAXONOMIC CLASSIFICATION OF CERTAIN PYTHIACIOUS ORGANISMS

THE literature of mycology and plant pathology of the last few years contains many such phrases as "Pythium-like fungus causing this or that disease."[1] It is unfortunate to find in highly technical papers such expressions as the above, that tend to confuse rather than clarify the true taxonomic position of a group of organisms of great economic importance, since many of them are very aggressive plant pathogenes. This group of Pythium-like fungi is represented by such species as *P. gracile* Schenk,[2] *P. monospermum* Pringsh.,[2] *P. Butleri* Subram.,[3] *P. aphani-*

[1] B. B. Branstetter, "Corn Root Rot Studies," Res. Bulletin 113, Agr. Exp. Sta. Univ. of Missouri, 1927; C. W. Carpenter, "Pythium in Relation to Lahaina Disease and Pineapple Wilt," *Hawaiian Planters' Record*, 23: No. 3, pp. 142–174, 1920; C. W. Carpenter, "Morphological Studies of the Pythium-like Fungi Associated with Root Rot," Hawaiian Bulletin Exp. Sta. Hawaiian Sugar Planters' Association, Bot. Series, Vol. 3, Part I, pp. 59–65, 1921; C. W. Edgerton, E. C. Tims and P. J. Mills, "Relation of Species of Pythium to the Root Rot Disease of Sugar-cane," *Phytopath.*, 19: 549–564, 1929; Helen Johann, James R. Holbert and James G. Dickson, "A Pythium Seedling Blight and Root Rot of Dent Corn," *Jour. Agr. Res.*, 37: 443–464, 1928.

[2] Alfred Fischer, "Die Pilze: Phycomycetes," pp. 383–410 in Rabenhorst's "Kryptogamen Flora von Deutschland, Oesterreich and der Schweiz," IV. Abtheilung, Leipzig, 1892.

[3] L. S. Subramanian, "A Pythium Disease of Ginger, Tobacco and Papaya," Memoirs of the Dept. of Agriculture in India, Bot. Series, Vol. I0, No. 4, 1919.

dermatum (Edson) Fitzpatrick[4] and *P. arrhenomanes* Drechsler.[5]

This group of organisms has been called "Pythium-like" because it possesses, on the one hand, certain likeness to the true Pythium organisms, and on the other, certain dissimilarities. Fischer[2] recognized this fact and created the subgenera Aphragmium, Nematosporangium and Sphaerosporangium, the first two to take care of the "Pythium-like" organisms and the last of the true Pythium organisms. Schröter[6] later divided the genus Pythium into the genera Nematosporangium and Pythium, the former including Fischer's subgenera Aphragmium and Nematosporangium and the latter only the subgenus Sphaerosporangium. The basis of differentiation between the genera Nematosporangium, Pythium and Phytophthora lies in the morphological difference existing in their zoospore-producing organs.

There are three morphologically different organs, the prosporangium, emission collar and zoosporangium. The prosporangium serves as reservoir of the protoplasm intended for the development of zoospores, and the zoosporangium for the full development and discharge of zoospores. The emission collar separates the prosporangium from the zoosporangium and serves for the passage of the protoplasm from the former to the latter organ. The wall of the prosporangium is a continuation of and identical with the exterior wall of the hypha supporting this organ, whereas that of the zoosporangium is not, but constitutes a part of the so-called ectoplast or protoplasmic membrane of the prosporangium. The zoosporangium is of short duration; it emerges from the emission collar almost simultaneously with the flowing protoplasmic contents of the prosporangium and lasts until the zoospores are completely formed and have escaped into the surrounding medium.

The three genera may be differentiated on this basis, as follows:

Nematosporangium: Prosporangia not well defined, nematoid, alantoid or rarely subspherical, intra- and extra-marginal; emission collar very long; zoosporangia spherical, size variable; zoospores few to many.

Pythium: Prosporangia well defined, spherical to ovoid, mostly extra-marginal, rarely intra-marginal; emission collar short; zoosporangia spherical, size variable; zoospores few to many.

[4] H. M. Fitzpatrick, "Generic Concepts in the Pythiaceae and Blastocladiaceae," *Mycologia*, 15: 166–173, 1923.

[5] Charles Drechsler, "*Pythium arrhenomanes* n. sp., A Parasite Causing Maize Root Rot," *Phytopath.*, 18: 873–875, 1928.

[6] J. Schröter, "Pythiaceae," in Engler-Prantl, "Natürliche Pflanzenfamilien," pp. 104–105, 1897.

Phytophthora: Prosporangia well defined, lemon shaped to spherical, mostly extra-marginal of different sizes; zoosporangia developing within the walls of prosporangia; emission collar entirely lacking or rarely slightly developed; zoospores few to many.

Furthermore, species of the genus Nematosporangium are differentiated by their rapid or slow production of oospores in culture media and tissues of hosts, by the filling or not filling of the oogonium by the size of oospore, number of antheridia and other characters.

Fitzpatrick[4] strongly recommended the adoption of the generic name Nematosporangium instead of Pythium in *Rheosporangium aphanidermatum* Edson, but unfortunately this recommendation has not been adhered to by more recent workers.

The writer, on the basis of extensive studies on all the well-known "Pythium-like" organisms or Nematosporangium spp., and, in addition, on eight more new species obtained from diseased pineapple roots, is absolutely convinced that the morphologic differences existing between the Nematosporangium organisms, on the one hand, and the Pythium ones, on the other, are sufficiently significant to merit generic distinction.

It is proposed, therefore, that those organisms, known heretofore as *Pythium aphanidermatum* (Eds.) Fitz., *P. Butleri* Subramanian and *P. arrhenomanes* Drechsler be renamed as *Nematosporangium aphanidermatum* (Eds.) Fitz. comb. nov., *N. Butleri* (Subram.) comb. nov. and *N. arrhenomanes* (Drechsler) comb. nov.

Such organisms as *Pythium gracile* de Bary, *P. dictyospermum* Rorciborski and *P. monospermum* Pringsheim have been placed already by Schröter in the genus Nematosporangium.

The writer is preparing a paper which will soon be published wherein eight new species of this genus are described and the taxonomic features of this genus are thoroughly discussed.

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