

A taxonomic study of the *Penicillium chrysogenum* series

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The taxonomy of the *Penicillium chrysogenum* series is reconsidered. On account of the observations of the available type strains and numerous isolates mainly obtained from food products, *Penicillium notatum* Westling, *P. meleagrinum* Biourge and *P. cyaneofulvum* Biourge are placed in synonymy with *P. chrysogenum* Thom. Synonymy and variability of the species are discussed.

INTRODUCTION

The *Penicillium chrysogenum* series was proposed by Raper and Thom (1949) to include four species: *Penicillium chrysogenum* Thom, *P. meleagrinum* Biourge, *P. notatum* Westling and *P. cyaneofulvum* Biourge. Raper and Thom (1949) stated, however, that while it is extremely difficult to define a species in this series it is obvious that all strains belonging to it cannot be regarded as representing a single species, for many of them differ greatly from one another in almost any character selected as a basis of comparison. Moreover, Thom (1930) had already made the following statement about the type strain of *P. chrysogenum*: “Re-examination of records of observations over the twenty-two years this species has been kept in culture shows as great a range in color in the various recorded experiments as is shown by the whole series of the *Radiata*” (= *P. chrysogenum*-series).

Backus and Stauffer (1955) and Stauffer and Backus (1954) investigated the variability and the improvement of the penicillin-producing strains of *P. chrysogenum* from the so-called Wisconsin family. These strains were obtained as variants of an ancestral strain (NRRL 1951) by spontaneous change or artificial mutation. The variability of these strains led Stauffer and Backus (1954) to suggest that the whole series of *P. chrysogenum* should be regarded as one

variable species. Fassatiová (1970), also studying four representative strains of this Wisconsin family, recommended the broadening of the species concept of *P. chrysogenum* to fit this variability.

For several years, exact identification of the many strains belonging to the *P. chrysogenum* series sent to the Centraalbureau voor Schimmelcultures for determination proved to be extremely difficult because of the above-mentioned variability of the separate strains and the prevalence of intergrading forms. The four species of the *P. chrysogenum* series recognized by Raper and Thom (1949) were separated on the basis of the shape of the conidia, which can range from globose to subglobose and ellipsoidal and of some insignificant differences of cultural characters.

Recently the problems of species delimitation were again encountered when numerous strains isolated from sausages and other meat products (Hadlok et al., 1975) were examined for an exact identification. To elucidate the taxonomy of the *P. chrysogenum* series, all available type strains and numerous other isolates were compared. As a result of these observations, the recognition of one species with the following synonyms is proposed.

Penicillium chrysogenum Thom

? *Penicillium griseoroseum* Dierckx – Annls Soc. scient. Brux. 25: 89. 1901.

? *Penicillium brunneorubrum* Dierckx – Annls Soc. Scient. Brux. 25: 88. 1901.

? *Penicillium citreoroseum* Dierckx – Annls Soc. scient. Brux. 25: 86. 1901.

Penicillium chrysogenum Thom – Bull. Bur. Anim. Ind. U.S. Dep. Agric. 118: 58. 1910.

Penicillium baculatum Westling – Svensk bot. Tidskrift 14: 139. 1910.

Penicillium notatum Westling – Ark. Bot. 11: 55. 1911.

Penicillium meleagrimum Biourge – Cellule 33: 184. 1923.

Penicillium cyaneofulvum Biourge – Cellule 33: 171. 1923.

Penicillium roseocitreum Biourge – Cellule 33: 184. 1923.

Penicillium rubens Biourge – Cellule 33: 249. 1923.

Penicillium chlorophaeum Biourge – Cellule 33: 249. 1923.

Penicillium camerunense Heim, Nouvel & Saccas – Bull. Acad. Belg. Cl. Sci., Ser. 5, 35: 52. 1949 (without latin diagnosis).

Penicillium chrysogenum Thom var. *brevisterigma* Forster – Brit. Pat. 691: 242. 1953 (without latin diagnosis).

Penicillium aromaticum Sopp forma *microsporum* Romankova – Zap. Lenin. Univ. Zhdanov 191: 102. 1955.

Colonies on Czapek agar growing rapidly, attaining a diameter of 4 to 5 cm within 10 days at 25 °C; some strains growing somewhat restrictedly with a diameter of 2.5–4.0 cm, consisting of numerous erect single conidiophores forming a dense velvety felt; colonies are sometimes furrowed or the conidiogenous structures are arranged in a radial pattern, mostly azonate, the margin even or occasionally lobed, the surface in some strains covered by a thin overgrowth