

## Taxonomic criteria in the genus *Cephalosporium*

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### INTRODUCTION

Species of the genus *Cephalosporium* are mainly saprophytic, growing on organic debris and in soil. But it also contains a few species pathogenic on plants and more rarely on man and animals. The morphological specialisation of these pathogenic species is not clear at all. Amongst the saprophytes one would not expect any host or substrate specialisation. For a taxonomic study it is therefore quite essential to start with morphological criteria. There are apparently very few distinctive ones known. The taxonomist must therefore search for more suitable characters. In other words, he must attempt to find terms for very minute structures he observes under a good microscope with some experience and intuition.

It is preferable to base a systematic arrangement on microscopic structures, which a skillful observer can find within a few seconds under a high power lens, rather than on colour reactions on various culture media, visible to the naked eye, which show up after rather long time. Furthermore the cultural method requires more laboratory work and the results are sometimes very imprecise. Moreover macroscopic characters are usually more variable than certain microscopic characters.

Working with pure cultures, one has to use a certain range of culture media, at least in the beginning. On these one finds a much greater variation than if one tries to separate e.g. a wild strain into pure lines by single spore cultures. With some experience it will however become possible to decide which media are most suitable for the development of typical and expressive characters. I have found, that oat

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meal agar gives generally good results. But e.g. with *C. sclerotigenum* it is essential to use lupine stems as well, to induce sclerotium formation.

The ideas developed by Appel & Wollenweber (1910) about Hochkultur are equally applicable to *Cephalosporium*. There are certain criteria indicative of a good development, e.g. rich sporulation, uniform shape of conidia, good development of possible asymmetries, distinctive conidial base etc.

#### CHARACTERS OF TAXONOMIC VALUE

Now I should like to point out just a few characters of particular interest.

1. Types of Phialides: Hughes (1953) emphasized the importance of conidiophore structures in taxonomy. He had defined in 1951 a phialide as "A cell which develops one or more open ends from which

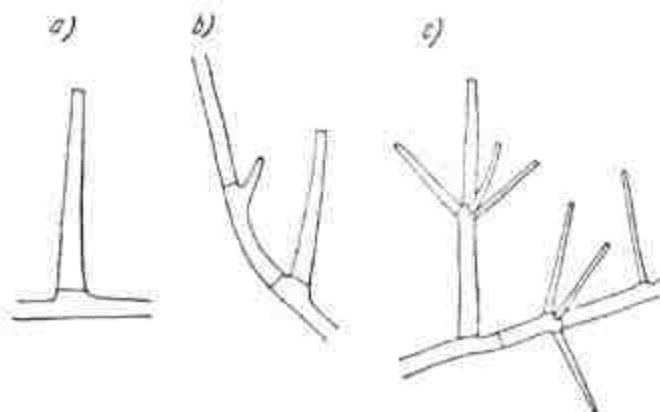


Fig. 1. Types of phialides:

a — orthophialides; b — plagiophialides; c — verticillate aggregation of plagiophialides

a basipetal succession of conidia (phialospores) develops without an increase in length of the phialide itself". In the present work it was found useful to distinguish several types of phialides: Orthophialides stand at a right angle on the supporting hypha with a basal crosswall, but usually without other crosswalls in the vicinity in the supporting hypha (Fig. 1a). The basal diameter of the phialide is usually greater than that of the supporting hypha.

A plagiophialide (Fig. 1b) is produced obliquely below a crosswall in the supporting hypha and separated by a crosswall as in the previous case. Various patterns can be produced by aggregation or verticillation of plagiophialides (Fig. 1c). Fungi with plagiophialides produce frequently also solitary orthophialides whose basal diameter

is usually smaller or equal to that of the supporting hypha. Several other types or phialides can be distinguished.

There are obviously more distinctive features in the phialides than in the spores. Some of them are already incorporated in the present definition of the genus *Cephalosporium* (sensu Fresenius): A genus of *Hyphomycetes* with hyaline, equally tapering orthophialides (or solitary plagiophialides) with one-celled phialospores produced mostly in heads.

In addition the orthophialide can be straight or somewhat curved, strongly or slightly tapering. In some cases the cell wall is thickened. When this is the case, the thickening provides an excellent species character.

2. Another feature very suitable for defining groups is the behaviour towards stains. With anilin blue or cotton blue in lactic acid or lactophenol, the base of the phialide stains sometimes intensely violet (metachromophilic), due to excretion of slimy substances. In some other species the conidia stain strongly.

3. There are several spore characters like in any moniliceous mould with one-celled spores.

4. It is also important to examine the vegetative mycelium: hyphal diameter and the presence or absence of chlamydo-spores.

#### DISCUSSION

Experience shows, that there is a hierarchy of characters, according to their importance for a) "natural" grouping, b) identifying a species. Having examined a sufficient number of strains, I hope to reach a species concept which allows a reliable identification of at least a certain number of species. I do not find it necessary to use adansonian principles and numerical techniques in this case.

The different value of some characters may become clearer with an example. In most *Cephalosporium* cultures one finds only orthophialides and in others solitary plagiophialides together with orthophialides. In *Verticillium* and some other genera there are frequently verticillate plagiophialides together with orthophialides (Fig. 1c). Sometimes these plagiophialides are very rare and difficult to observe. Nevertheless it is essential for a good identification to find them. Fortunately there are usually supplementary characters which help in the decision. It applies for several characters, that one has to look carefully for the possible occurrence of the character with the higher content of information.

There is still another principle useful for assessing the value of different characters: proportions between single measurements ("Ge-

staltsmerkmale") are more important than absolute figures; e.g. the index length: breadth of spores has more value than one measurement only. This principle can save a great deal of spore statistics, if its application leads to a thorough observation of other features. Colour shade was also found a more reliable character than colour intensity which can vary from one isolate to another in a given group.

The taxonomy of *Cephalosporium* is not becoming very easy. But still I am hopeful that a species identification will become possible and even easier than e.g. in *Penicillium*. My work is yet far from complete. I am still trying to get many more cultures for study. I wanted to draw your attention to this work, so that any one who has cultures could contribute them. I have isolated numerous strains myself, but experience has shown, that those obtained from other workers and other localities are usually more interesting.

My thanks are due to Dr. N. Okafor for improvements of this text.

#### LITERATURE

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#### *Taksonomiczne kryteria w rodzaju Cephalosporium*

##### Streszczenie

Autor zajmuje się od strony taksonomicznej rodzajem *Cephalosporium*. Zwraca szczególną uwagę na typ fialid, barwienie się konidiów lub podstawy fialid, rodzaj położenia konidiów na trzonku konidialnym, na średnicę strzępek i obecność lub brak chlamydospor jako na cechy ułatwiające rozróżnianie gatunków.