Journal of the Minnesota Academy of Science

Volume 53 | Number 3 Article 8

1988

The Synoptic Key: Cercospora and Allied Genera

Elwin L. Stewart
University of Minnesota, St. Paul

F. L. Phleger
University of Minnesota, St. Paul

The Synoptic Key: *Cercospora* and Allied Genera

ELWIN L. STEWART* AND F. L. PFLEGER*

ABSTRACT—The advantages and disadvantages of the synoptic key are discussed and a synoptic key to *Cercospora* and 15 allied genera is presented.

Introduction

Biologists historically have constructed keys for use in identifying members of a taxonomic grouping. The dichotomous key is the type that has most often been constructed and used by taxonomists. This may be based in part on historical precedent or lack of an efficient alternative. An example of this is Chupps (1) classic monographic work on the genus *Cercospora* Fres. (2). In our research on *Cercospora* and allied genera we noted a sole reliance on the use of dichotomous keys. In most cases, these keys failed to provide adequate means of critically accessing generic limits. Therefore, we initiated a search for taxonomic keys with attributes superior to or at least equal to that of the dichotomous key. We discovered that a number of types of taxonomic keys are available, such as punch cards, computer-generated, and synoptic keys. Based on our use of these we found the synoptic keys to have a number of advantages over the others, based on ease of construction, use, and accuracy.

Leenhouts (3) presented synoptic keys as an alternative to the dichotomous key in his exceptional publication on "Keys in Biology." Korf (4) reviewed the Leenhouts manuscript and provided a detailed account on how to construct and use the synoptic key. Rhoades (5) developed a computer program for constructing synoptic keys that we have found to be an excellent teaching and research tool. We have used the computer program to generate keys for use in our mycology teaching program, Plant Disease Clinic, and in our research laboratory.

The synoptic key is composed of a series of characters that describe the taxa. Each character is further elaborated by a number of character states. For example, in the following key for *Cercospora* and allied genera, a character called "conidium color in transmitted light" has 10 different character states associated with it, ranging from hyaline to deep olivaceous brown. Ideally, the characters and character states in a synoptic key provide a compact description of the taxa included in the key. Each genus included in the key is assigned a number. Following each character state in the key is a list of the numbers of the genera that display that state. In our key, genera are entered alphabetically so ascending numbers correspond to progression through the key.

*Professors, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108

The following example illustrates the use of the synoptic key to key out an unknown. Assume that with the microscope one observes the presence of stromata, brown-colored conidiophores, and hyaline conidia, with acrogenous conidia on the conidiogenous cell. One approach is to locate "stroma," which is character number two, and record the numbers 1,2,3,4,8,9,10,12,13,14, since stromata are present. The conidiophores (character eight) are brown so record 1,2,4,7,9,11,13,16. The numbers common to both lists are 1,2,4,9,13 and therefore are retained on the list of possible genera for our unknown. Conidium color (character 15) is hyaline, so record the numbers 2,3,4,7,8,14,16. The numbers in common with this list and the previous one are 2 and 4. Acrogenous conidia on the conidiogenous cell (character 16) gives us the numbers 1,2,6,9,10,13,15. Number 2 is then the remaining number in our list. That number corresponds to *Cercospora* in our list of genera. Other unknowns are identified in a similar fashion.

The synoptic key presented here is the first effort to synthesize the taxonomic criteria of *Cercospora* and allied genera into a usable key.

Synoptic Key: *Cercospora* and Allied Genera

1-*Cercoseptoria* Petrak 2-*Cercospora* Fres. 3-*Cercosporella* Sacc. 4-*Cercosporidium* Earle 5-*Elletevera* Deighton 6-*Eriocercospora* Deighton 7-*Mycocentrospora* Deighton 8-*Mycovellosiella* Rangel 9-*Pantospora* Cif. 10-*Paracercospora* Deighton 11-*Passalora* Fr. 12-*Phaeoisariopsis* Ferraris 13-*Pseudocercospora* Speg. 14-*Pseudocercosporella* Deighton 15-*Pseudocercosporidium* Deighton 16-*Stenospora* Deighton

Genera are described by these states, arranged in 18 characters:

1 Hyphae on host
- internal
  - (1,2,3,4,5,7,8,9,10,11,12,13,14,15)
- external
  - (6,16)

2 Stroma
- present
  - (1,2,3,4,8,9,10,12,13,14)
- absent
  - (5,6,7,8,10,11,14,15,16)

3 Colony surface texture on agar
- velvety
  - (7,8,11,13)

hairy
(2,7,12,13)
floccose
(2)

4 Colony Color on Agar
white
(2,7)
white over dematiaceous hyphae
(2)
brown/dark brown
(2,7)
greyish
(8,13)
olivaceous brown
(7,8,11,12)

5 Conidiophore relative to somatic hyphae
micronematous
(14)
semi-macronematous
(8)
macronematous
(1,2,3,4,5,6,7,8,10,11,12,13,14,15,16)
mononematous
(2,3,4,5,6,7,8,10,11,12,13,14,15,16)
synnematous
(9,12,13)
fasciculate
(1,3,4,5,7,9,10,14)
caespitose
(2,11,12,13)

6 Conidiophore shape and branching habit
straight and tapering at apex
(10,11,14)
straight and cylindrical
(7,12,14,16)
erect
(10,12,14,15)
ascending
(15,16)
flexuous
(7,10,11,13,14,16)
Laxly erect with swollen apex
(15)
Intertwining, may be rope-like
(8)
not branched
(7,11,12,13,14,16)
sparingly branched
(11,15,16)

7 Conidiophore septation
non-septate
(10,13)
euseptate
(1,2,3,4,5,6,7,8,11,12,13,14,15,16)
hyaline septa
(3,14,16)
dematiaceous septa
(1,2,4,5,6,7,8,9,11,12,13,15)

8 Conidiophore color in transmitted light
hyaline
(3,7,14,15,16)
pale greenish
(3,14,15)
pale brown
(5,6,8,12,13)
brown
(1,2,4,7,9,11,12,13,16)
very pale olivaceous brown
(10)
olivaceous brown
(2,8,11,12,13)

9 Proliferation of conidiogenous cell
percurrent
(1,9,13)
sympodial
(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)

10 Conidiogenous cell surface
smooth
(1,6,9,10,13,14)
cicatrized (covered with scars)
(2,3,4,5,7,8,11,12,15,16)

11 Scars on the conidiogenous cells
thin, but visible
(1,9,12,13,14)
thickened and conspicuous
(2,3,4,5,6,7,8,11,15,16)
thick/conspicuous; minute frill
(15)
A narrow rim of raised tissue
(10)

12 Conidiogeny/conidiogenous cell
holoblastic
(2,3,4,5,6,7,8,10,11,12,13,14,15,16)
monoblastic
(13)
polyblastic
(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)
annelidic
(1,9)
integrated
(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)

13 Conidiogenous cell on conidiophore
terminal
(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)
intercalary
(8,11,15,16)

14 Saccardoan spore group
amerospores
(6,8,11)
didymospores
(3,4,5,6,8,10,11,15)
phragmospores
(2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)
dictyospores
(9)
scolecospores
(1,16)

15 Conidium color in transmitted light
hyaline
(2,3,4,7,8,14,16)
pale green
(3)
pale brown
(1,4,5,6,7,8,13)
brown
(7,8,9,12,13,15)

deep brown
(15)
very pale olivaceous brown
(10,11,12)
olivaceous brown
(8,11,12,15)
deep olivaceous brown
(15)
olivaceous
(12,15)

16 Conidia on conidiogenous cell

produced singly
(1,2,3,4,5,6,7,9,10,11,12,13,14,15,16)
catenulate
(8,14)
basocatenate
(8)
acrogenous
(1,2,6,9,10,13,15)
acropleurogenous
(2,3,4,5,7,8,11,12,13,14,16)

17 Conidium surface

smooth
(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16)
rough
(4,12,13)

18 Conidium shape

ellipsoid
(8,9,11)
fusiform
(4,6,8,9)
clavate
(4,5,6,9)
cylindrical
(3,5,6,7,10,12,14)
obclavate
(2,3,4,6,7,8,9,10,11,12,13,14,15)
acicular
(1,16)
straight
(1,2,3,4,5,6,8,14)
curved
(1,2,3,4,5,7,14,16)
appendiculate
(7)
rostrate
(7,13)
apex round, base truncate
(3,4,5,6,8,9,10,12,14,15,16)
apex tapering, round, base truncate
(1,4,5,6,7,11,13,16)
base with protuberant hilum
(3,4,5,16)
conspicuous scars at the base and or apex
(8)
hilum; a narrow thickened rim
(10)
ramo-conidia
(8)

Discussion

Our efforts to construct a number of different types of taxonomic keys to *Cercospora* and allied genera made it apparent that the synoptic key has a number of distinct advantages over other kinds. These include the ability to add new character and character states to an existing key without rewriting the entire key. It is a simple matter to evaluate all existing taxa in the key, relative to the new character and character states added. Adding similar information to a dichotomous key would probably require a major revision. It also is possible to add and delete taxa to a completed key by including or excluding the name and adjusting the numbers accordingly, whereas adjustments of this magnitude on a dichotomous key would probably require a complete reworking of the key.

Missing numbers for some character states indicate that the information relative to that character state is unknown. When that information is available, it can be added to the key. Korf (4) pointed out that incompletely known taxa can be brought to the attention of taxonomists by placing the taxon number in parentheses in all character states where doubt exists. The parentheses are removed once the unknown information has been acquired.

Also, when using the synoptic key, it is not necessary to start with the first character. Entry into the key may be at any point, based on the character being examined. However, with the dichotomous key one must always initiate the identification of an unknown at the beginning.

Korf (4) suggested that the biggest disadvantage of the synoptic key is that it becomes cumbersome when too many taxa are considered. However, we have found that the use of computer-accessed synoptic keys remove any limitation imposed by large numbers of taxa.

Acknowledgements

This study was made possible by funds provided by the University of Minnesota Experiment Station Project #22-78 and research funds of the Graduate School of the University of Minnesota.

References

1. Chupp, C. 1954. A monograph of the fungus *Cercospora.* Ithaca, New York.
2. Fresnius, G. 1863. Beitrage zur Mykologie. 3:91.
3. Leenhouts, P.W. 1966. Keys in biology. I-II. A survey and a proposal of a new kind. *Proc. Kon. Ned. Akad. Wetensch., Amsterdam, Sect. C,* 69:571-596.
4. Korf, R. P. 1972. Synoptic key to the genera of the Pezizales. *Mycologia* 64:681-936.
5. Rhoades, F. 1986. PC-Taxon: A taxonomic data base. Wentworth, New Hampshire: Compress.