

A BIOMETRIC STUDY OF THE CONIDIA OF
MACROSPORIUM AND *ALTERNARIA*.

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(With 1 Text Figure.)

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Alternaria and *Macrosporium* are closely allied genera of the *Hyphomycetaceæ*, both being included in the section *Dictyosporæ* of the *Dematiæ*. They are differentiated by their methods of conidia-formation. In *Macrosporium* a conidiophore bears at its apex a single conidium, which attains its full size, matures, and finally becomes detached. In the case of *Alternaria*, the conidiophore produces at its apex a chain of conidia, each of which is morphologically identical with the single conidium of *Macrosporium*. This chain of conidia produced by *Alternaria* eventually becomes broken up into individuals which cannot be distinguished from a detached conidium of *Macrosporium*. It is, therefore, only possible to refer a particular species to one or other of these two genera when the manner in which the conidia are produced has been determined. Consequently, many species have been incorrectly placed, owing to inaccurate observations on the conidia and method of conidia-formation.

The abundance of species apparently placed indiscriminately in either genus and having synonyms in the complementary genus is evidence of the fact that these two genera are much confused. Thus *Alternaria solani*, Sorauer=*Macrosporium solani*, E. & M.

The ease with which the concatenate conidia of *Alternaria* become fragmented into free individuals when mounted in water for microscopical examination explains the frequency of inaccuracies in classification. It will be seen that when a species of either genus is mounted in water the resulting "object" is the same, *i.e.*, there will be similar conidiophores and morphologically identical conidia. It will be shown later, however, that these latter may be

differentiated by a simple Biometric method. It has been found possible to determine the mode of origin of such a mass of free conidia from their co-efficient of variability.

VARIATION IN SPORE MEASUREMENTS.

It is usual to include in the diagnoses of fungi measurements of their mature spores, and it is not uncommon to find different authorities quoting different figures as diagnostic characters of one and the same species.

The following measurements for the length of the spores of *Coprinus comatus*, Fries, are taken from publications by the eminent authorities given below:—

COPRINUS COMATUS, Fries.

W. G. Smith	18 μ .
G. Masee	15 μ .
M. C. Cooke	14 μ .
R. Buller	12.6 μ .
Britzelmayer	12 μ -14 μ .
Karsten	11 μ -13 μ .

This lack of uniformity in the published measurements led Masee (1) to re-examine many of the types preserved at Kew. Although a useful character for the differentiation of varicous species, the size of fungus spores is subject to considerable variation. Buller (2) gives an interesting account of differences in form and size of the spores of *Amanatopsis vaginatus*, Bull.

Some time ago, when measuring the dimensions of conidia produced by a *Cladosporium* (3) occurring on wheat, a considerable range of variation was noted. A considerable number were measured very carefully, with the object of determining the limits of size, in order to prepare an accurate diagnosis of the species. Records of several other species were subsequently made. (1) From a casual study of these records it became apparent that in certain species wide variations may occur, whilst in others the range of variation determined was within narrow limits. This ultimately led the writer to make a really critical examination of two common species, with interesting and unexpected results, which are here presented.

(1) Masee, G. "Grevillea," Vol. 21, p. 77.

(2) Buller, R. "Recherches on Fungi"

(3) *Cladosporium graminum*, Corda *Scolecotrichum graminum*, Fuchel.

(4) *Volvaria speciosa*, *Peziza vesiculosa*, *Rhizopus nigricans*, *Fusarium* sp.

The fungi selected for study were *Macrosporium cladosporioides*, Desm., and *Alternaria Brassicæ* (Berk?), var. *Citri*, Penz. Cultures of the former were prepared on onion leaves, and were eight days old when the measurements were made. Conidia of the *Alternaria* were obtained from a fine growth of that species which had appeared on a mandarin which had been under observation in a culture dish. Care was taken that all the conidia measured in the series were taken from the same culture, the same colony or centre of infection, and approximately at the same time.

Five hundred and forty *Macrosporium* conidia were measured, and 321 of *Alternaria*, making a total of 861 measurements. These measurements are tabulated in the table below, which also shows the frequency of occurrence of conidia of certain dimensions. It will be observed that the conidia of *Macrosporium cladosporioides* vary in length from 17μ . to 51μ ., and that the limit of variation observed in *Alternaria Brassicæ*, var. *Citri*, was 9μ . to 44μ . The distribution of frequency in the two cases presents differences which are at once apparent, but they are more strikingly in evidence when the results are plotted. (See graph.)

SPORE-MEASUREMENTS OF *MACROSPORIUM* AND
ALTERNARIA.

MACROSPORIUM

cladosporioides, Desm.

ALTERNARIA

Brassicæ (Berk?), Sacc.,
var. *Citri*, Penz.

Spore Length.	Frequency.		Spore Length.	Frequency.
9	0	..	9	1
10	0	..	10	0
11	0	..	11	4
12	0	..	12	1
13	0	..	13	14
14	0	..	14	6
15	0	..	15	6
16	0	..	16	9
17	1	..	17	13
18	0	..	18	10
19	1	..	19	9
20	3	..	20	21
21	4	..	21	15
22	5	..	22	7

Spore Length.	Fre- quency.	..	Spore Length.	Fre- quency.
23	7	..	23	15
24	8	..	24	4
25	13	..	25	21
26	17	..	26	15
27	26	..	27	13
28	36	..	28	16
29	39	..	29	13
30	45	..	30	24
31	49	..	31	9
32	48	..	32	6
33	35	..	33	15
34	32	..	34	1
35	29	..	35	8
36	26	..	36	2
37	20	..	37	16
38	19	..	38	2
39	15	..	39	2
40	10	..	40	3
41	9	..	41	1
42	8	..	42	0
43	9	..	43	5
44	4	..	44	4
45	4	..	45	0
46	1	..	46	0
47	1	..	47	0
48	2	..	48	0
49	1	..	49	0
50	2	..	50	0
51	1	..	51	0
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Total 540			Total 321	

It will be clearly seen that in the case of *Macrosporium* a curve closely approaching the Normal curve is given. On the other hand, a most complicated figure is given by *Alternaria*. The interpretation of this graph of the measurements of *Alternaria* presents many difficulties, but it is probable that it represents a composite curve, consisting of a series of smaller overlapping and intersecting curves. Each of these smaller curves possibly corresponds to a conidium of fixed position with reference to the conidiophore, and in relation to the other conidia associated in the chain with it. The data accumulated are insufficient, however, to develop these details and confirm this suggestion.

CONCLUSIONS.

- (1) That the variation in length of conidia of *Macrosporium cladosporioides*, Desm., is of the Normal type.
- (2) That the distribution of frequency of spore-lengths in *Alternaria Brassicæ* (Berk?), Sacc., var. *Citri*, Penz., is irregular.
- (3) That the morphologically identical conidia of *Macrosporium* and *Alternaria* may be differentiated by their respective variability. A study of variation in length of detached free conidia will indicate their solitary or concatenate origin.

