Passive Movements of Newly Formed Acrogenous Spores in *Verticillium* and Some Other Genera of the Hyphomycete Fungi

THE development of the spores in two species of *Verticillium*, namely, *V. Malthousei* Ware and *V. psalliotae* Treschow, both parasitic on the cultivated mushroom *Psalliota* sp., was reported by Treschow¹ to be different. He observed the spores of *V. psalliotae* lying transversely across the tips of the phialides on which they were developed. He concluded from this observation that the spores, which originated as a minute globule, grew out on either side perpendicular to the long axis of the phialide. He did not observe this transverse arrangement in *V. Malthousei* Ware, and neither did Ware² himself. It was, however, recorded in illustrations of this fungus by Atkins and Bulloch³. My own observations from time to time confirmed this record. More recently, I decided to compare the development of the spores in both these species under similar conditions, by continuous observation, using a moist chamber placed on slide cultures.

SEQUENCE OF EVENTS OCCURRING DURING SPORE DEVELOPMENT IN *Verticillium psalliotae* TRESCH. (DIAGRAMMATIC)

In both *V. Malthousei* and *V. psalliotae* the spores develop similarly. They appear first as a globule at the tip of the phialide and then elongate, usually in the long axis of the phialide, but sometimes obliquely until they attain approximately their full size and shape and contain a central vacuole. Spore development up to this stage lasts about one hour. The spore then tilts over gradually to form with the long axis of the phialide an angle of about 120°. Eventually, it continues to tilt, but more rapidly, sometimes even suddenly, to an angle of 90° or less. Then, after a short interval, while remaining in the plane perpendicular to the long axis of the phialide, it suddenly describes an arc through an angle of 90°, but sometimes 180°, and then almost immediately slips across the tip of the phialide to lie in the transverse position recorded by Treschow for *V. psalliotae* and by Atkins and Bulloch in their illustrations of sporulating phialides of *V. Malthousei*. In agreement with these various authors, I observed that in *V. Malthousei* many spores developed in succession at the tip of the same phialide, the first formed becoming levered out of its horizontal position by the second spore, which followed later. These spores remained clustered together in a drop of fluid. In the case of *V. psalliotae* I have not so far observed the formation of more than one spore at the tip of each phialide,

except in an isolated instance where two were formed in succession.

These spore movements which I have described for two species of *Verticillium* explain the misinterpretation by Treschow of the transverse position of the spore relative to the phialide in *V. psalliotae* and the uninterpreted illustrations of *V. Malthousei* by Atkins and Bulloch.

From preliminary observations of spore development in some other genera of Hyphomycetes bearing non-pedicellate spores, notably *Cylindrocarpon*, *Fusarium* and the *Clonostachys* form of *Gliocladium*, it seems that movements of a similar nature and occurring in the same sequence are not confined to the genus *Verticillium* but probably occur in many other genera. I have, however, observed movements of a different nature often occurring in *Cylindrocarpon* and in *Fusarium* as an alternative to those I have described.

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¹ Treschow, C., *Dansk Bot. Arkiv*, 11, Nr. 1, 1 (1941).

² Ware, W. M., *Ann. Bot.*, 47, No. 188 (1933).

³ Atkins, F. C., "Verticillium on Mushrooms" (Midland Group of Mushroom Growers, Yaxley, Peterborough, 1945).

Regulation of the Sodium-Potassium Ratio in Insects

THE variability of the sodium-potassium ratio in the coelomic fluid of different species of insects and its association with the normal diet has been pointed out in previous papers^{1,2}: the vegetarians having a high potassium concentration, the carnivorous insects a high sodium concentration in their coelomic fluid.

In order to ascertain the nature of this association, the following hypotheses were tested: (1) The sodium-potassium ratio of the food might have a direct influence on the composition of the coelomic fluid through lack of regulatory mechanisms in the insects. This possibility was suggested by the similarity between the sodium-potassium ratio of the coelomic fluid and that of the diet; thus it is greater than 1 in the carnivorous insects and in animal fluids, less than 1 in vegetarian insects and in plant cells and saps. Carnivorous insect (*Calliphora erythrocephala*) and vegetarian insects (*Ephestia Kühniella*, *Pieris rapae* and *Vanessa urticae*) were raised from young to full-grown larvae on diets with modified sodium-potassium ratio, all other factors being equal. This was done either by dialysing meat and wheat flour against solutions of various ionic

TABLE 1. NA/K REGULATION IN THE COELOMIC FLUID OF INSECTS

Insects and diets	Ions concentration in equiv./kgm.			
	In the diet		In coelomic fluid	
	Na	K	Na	K
<i>Calliphora erythrocephala</i> (6 days on dialysed meat)	0.082 0.010	0.007 0.111	0.158 0.083	0.037 0.040
<i>Ephestia Kühniella</i> (35 days on dialysed flour)	0.098 0.098 0.008 0.008	0.011 0.011 0.115 0.115	0.030 0.027 0.016 —	0.047 0.056 0.059 0.065
<i>Pieris rapae</i> (5 days on cabbage)	0.006 0.006 0.027 0.027	0.077 0.077 0.061 0.061	0.010 0.013 0.009 0.010	0.075 0.074 0.080 0.077
<i>Vanessa urticae</i> , 2 days on : Leaves Leaves coated with NaCl Leaves coated with KCl	0.010 0.366 0.010	0.100 0.088 0.700	0.022 0.058 0.021	0.043 0.049 0.080