

cent and 6.47 per cent; N: 15.86 per cent and 15.90 per cent; S: 3.96 per cent and 4.03 per cent).

(2) Five recrystallizations of crotoxin did not alter its neurotoxic and hæmolytic activity.

(3) The solubility curve of crotoxin at different ammonium sulphate concentrations<sup>2</sup> shows the straight line typical of pure substances<sup>3</sup>.

(4) Gralén and The Svedberg<sup>4</sup> were able to show that crystalline crotoxin in the ultracentrifuge "behaved in sedimentation and diffusion as a homogeneous substance".

Recently Gosh and De<sup>5</sup> reported one experiment: a solution of 100 mgm. of crude rattlesnake venom secreted was saturated with sodium chlorido. After standing for one night at 6° a precipitate was obtained which contained 8-10 per cent of the original hæmolytic and 2-2.5 per cent of the neurotoxic activity. From this difference of the ratio of neurotoxic to hæmolytic activity in such a precipitate, the Indian authors conclude that our crystalline crotoxin cannot be a homogeneous substance.

We see no reason to discuss such experiments executed with the crude venom secreted since we have already shown how to crystallize the active principle of rattlesnake venom, easily and in good yield.

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<sup>1</sup> Slotta, K. H., and Fraenkel-Conrat, H., *NATURE*, **142**, 213 (1938).

<sup>2</sup> Slotta, K. H., and Fraenkel-Conrat, H., *Ber. Dtsch. Chem. Ges.*, **71**, 1076 (1938).

<sup>3</sup> Cohn, E. J., *Phys. Rev.*, **5**, 349 (1925).

<sup>4</sup> Gralén, N., and The Svedberg, *Biochem. J.*, **32**, 1375 (1938).

<sup>5</sup> Gosh, B. N., and De, S. S., *NATURE*, **143**, 350 (1939).

#### Cytology of the Common Male Fern in Britain

IN a paper which has just come to hand by Döpp<sup>1</sup>, cytological observations of some importance are given with regard to the genus *Dryopteris* (= *Lastrea* = *Nephrodium*) in Europe. In particular, and among other things, apogamy is reported in "*D. paleacea*" from four localities in Germany and Switzerland and the chromosome number in one of these plants is given as "c. 130" in contrast to the sporophytic number for normal *D. Filix-mas* which was previously found by the same author to be c. 160<sup>2</sup>.

These observations are so closely cognate to a large body of work which has been in progress for some years on the British fern flora, that it may perhaps avoid a profitless duplication of effort, if the main facts which I have obtained for *D. Filix-mas* (*sensu lato*) in Britain are summarized in advance of the main paper.

So long ago as 1855<sup>3</sup>, a very shrewd field collector, Wollaston, expressed the view that at least two of the varieties described for the male fern in Great Britain, namely, the varieties *Borreri* and *abbreviata* of Newman, were worthy of specific rank. Newman's varietal names were regarded as synonymous with the varieties *paleacea* and *pumila* of Moore; but to emphasize the idea of specific distinctness Wollaston introduced two new terms, namely, *pseudo-mas* and *propinqua*<sup>4</sup>. These have never penetrated deeply into purely botanical literature, but they have been

(and still are) widely used by amateurs and fern collectors in Great Britain. They are a commonplace of English pteridological handbooks of the older school (for example, Druery<sup>5</sup>) and are represented in the *L. pseudo-mas* var. *polydactyla* Wills and Dadds quoted by Döpp. By modern rules of nomenclature both *pseudo-mas* and *propinqua* are illegitimate, since priority rests with the names of Newman. In view of their historical importance, however, it is necessary that their meaning should be understood.

My own work on this subject began in 1936 with the discovery of an apogamous plant from central Ireland with c. 120 chromosomes. This plant was identified by Mr. Alston of the British Museum as *D. Filix-mas* var. *Borreri* Newm. The cytological findings were at that time so unexpected that field investigations were at once undertaken in order to elucidate them. In the three years which have elapsed, cytological observations have been made on nearly one hundred plants from more than twenty localities in England, Scotland, Ireland and Wales. In carrying out this field exploration, Wollaston's classification has been found to be of the greatest service and has indeed been the only one which could immediately be applied to the problem. The results are as follows:

(1) Wollaston's *L. propinqua* (= *abbreviata* Newm.) has been obtained from England, Ireland and Wales. It reproduces sexually and has a gametic chromosome number of 40-41. This number I regard as haploid and the sporophytic number (c. 80) of this form as diploid.

(2) Wollaston's *L. Filix-mas* proper, the commonest hedgerow type in England, also reproduces sexually, but has a sporophytic chromosome number of c. 160 (as previously reported by Döpp)<sup>2</sup>. This number I regard as tetraploid; but the meiotic behaviour is not that of a recent auto-tetraploid.

(3) Wollaston's *L. pseudo-mas* (= *Borreri* Newm. = *paleacea* Moore) appears to be exclusively apogamous and therefore contains a potentially infinite variety of true-breeding strains. My own first plant with c. 120 chromosomes and presumably also those of Döpp ("c. 130") I interpret as triploids. Local populations of diploids, with c. 80 chromosomes and tetraploids with c. 160, all apogamous and with the morphology of *pseudo-mas*, have since been met with and there may be still higher polyploids to be discovered.

There is strong evidence to suggest that all three of Wollaston's types can hybridize; but I do not consider this to invalidate the conclusion that they could and should be regarded as three distinct species. I therefore agree with Döpp's desire to accord specific rank to *D. paleacea* though this is clearly only a part of a larger problem.

While further discussion must be left to the fuller statement, a word of appreciation may perhaps be allowed here for the abilities of a man like Wollaston who, with only the morphology to guide him, should have correctly divined these relationships, against the views of contemporary botanists.

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<sup>1</sup> Döpp, W., *Planta*, **29**, 481 (June 1939).

<sup>2</sup> Döpp, W., *Planta*, **17**, 86 (1932).

<sup>3</sup> Wollaston, G. B., *The Phytologist*, **1**, 171 (1855).

<sup>4</sup> Wollaston, G. B., *The Phytologist*, **8**, 415 (1862).

<sup>5</sup> Druery, C. T., "British Ferns and their Varieties", London (1910).