

CYTOLOGY OF OPHIOGLOSSUM VULGATUM

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The present account is a continuation of the author's cytogeographic studies on the archaic genus *Ophioglossum* (cf. VERMA 1958) and comprises cytological observations on material of *Ophioglossum vulgatum* L. received from the Netherlands. It is indeed the only species of the genus occurring in that country (cf. v. OOSTSTROOM 1948). According to Dr. K. U. KRAMER¹⁾ (Utrecht), it is widespread and rather common in the whole region of the dunes which extend along the West and the North (islands!) coast. It also occurs in a few scattered inland localities, particularly in the West and along the Eastern border; in-fact there is no extensive part of the country where it is lacking. The fertile specimens were gathered by Dr. van Heerdt in Aug. 1957 from "Koegelwieck" near Lies, isl. Terschelling (prov. Friesland) and fixed in 1 : 3 acetic alcohol. The fixed material along with two pressed specimens, one from exactly the same locality as the alcohol material, were kindly sent by Dr. KRAMER. Acetocarmine squashes were prepared according to the usual procedure (cf. MANTON 1950) at Amritsar in Nov. 1957. The mature spores from the pressed specimens were mounted in glycerine (50 %) after treating them in lactic acid at 55° C for about two hours. This gave a sufficient degree of clarity.

OBSERVATIONS

Ophioglossum vulgatum has generally a quite thick and fleshy (or leathery) sterile blade which with its base envelops the peduncle of the fertile segment; this blade has an obscure reticulate venation. Some of the pressed specimens seem to be quite membranaceous with their veins distinct. In one of the specimens (Fig. 1, a) the base of the sterile blade does not envelop the peduncle. Such a variation is allowed in *O. vulgatum* (cf. CLAUSEN 1938), but it should be realized that such features occur also in certain populations of *O. petiolatum* Hk. and *O. reticulatum* L. One of the pressed specimens from isl. Terschelling (Fig. 1, b) approaches *O. reticulatum* in the form of the sterile blade. Furthermore, it may be pointed out that the aforesaid three species are sympatric through most of their range, and as far as the writer's observations on the Indian taxa are concerned, in external morphology the three species intergrade, though the extremes can always be readily spotted out. However, the mesh-work structure or sculpturing of the exine of the spores in the genus

¹⁾ Personal communication.

Ophioglossum has been considered by HARA (1934) to present good specific distinctions. With the help of this very character HARA has separated *O. thermale* Kom. from *O. vulgatum*. Dr. Makoto Nishida ¹⁾ too, firmly believed in the reliability of this character when he framed his key for the Japanese species. The present writer has found it to

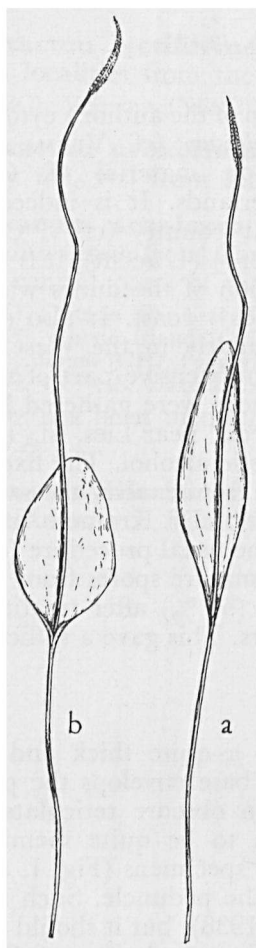


Fig. 1. Two variants of *Ophioglossum vulgatum* L., isl. Terschelling (prov. Friesland, Netherlands) population. *a.* showing sterile blade not enveloping the peduncle. *b.* sterile blade approaching *O. reticulatum* L. in broad outline. Venation (not shown) in both the cases is distinct in the pressed specimens. $\frac{1}{2} \times$ natural size.

be a dependable character with the Indian taxa too. It is interesting that SLADKOV (1955), while investigating the morphological characters of spores of Adder's tongue ferns of the U.S.S.R. territory, recognized the character of the surface coat of spores as one of the important criteria in the classification. The spore structure of all the present specimens (incl. variants) is identical and very closely resembles that of the Japanese, the Polish and the N. Indian samples of *O. vulgatum*. The exine of the spore has a coarse network and is tubercular in

¹⁾ Personal communication, Chiba University, Chiba, Japan.

outline (Fig. 2). In the related species, however, the exine possesses a fine reticulation, and it is smooth in outline.

Cytologically the material from the Netherlands is of a rather uniform nature. Meiosis is regular and at diakinesis in the majority

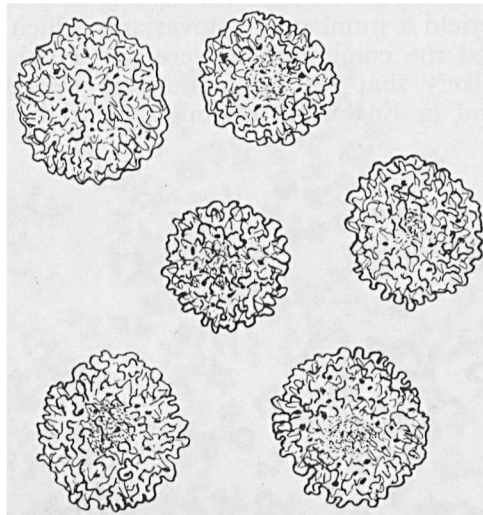


Fig. 2. Magnified mature spores to show the sculpturing of the spore coat, here rough and tuberculate. $\times 450$.

of the mothercells 240 bivalents are clearly discernible (Fig. 3). A spore mother-cell from another spike, though the preparation is not exceptionally clear, seems to present at least 247 bivalents (Fig. 4); very likely the number lies between 247 and 251. However, the interest lies in the point that in vegetatively reproducing organisms one is dealing with individual clones rather than with the species as a whole. The inconstancy of the gametic chromosome number has already been observed by various authors (cf. ABRAHAM and NINAN 1954, VERMA 1956, 1958) in the genus, and has been ascribed to the efficient vegetative reproduction (here by root buds), which is well suited for the preservation of such cytological variants. Comparison with the earlier cytological data recorded for the various species (cf. VERMA 1958, Table I) suggests 240 as the correct gametic number for the present taxon. The only material that has already been worked out cytologically from these latitudes is the Manchester (53.28° N, 2.12° W, England) population which was studied by MANTON (1950), who mentioned a gametic number between 250 and 260. This number, however, falls within the same range of ploidy as that of the Netherlands specimens.

The origin of cytological variants in a local population is in all probability due to an irregular disjunction at meiosis, which results in the production of spores with lower as well as higher chromosome numbers. This is supported by the present writer's unpublished observations on the Indian *Ophioglossum polyphyllum* A. Br. apud

Seubert (= *O. aitchisonii* (Clarke) d'Almeida, cf. Pichi-Sermolli 1954) and *O. vulgatum* (VERMA 1956). MANTON's (1950 collection of the sexual generation in ample quantities both from Manchester and Cheshire is of great importance in this connection. In view of the above findings, one could surmise that a single act of sexual reproduction would yield a number of cytovariants which could multiply further, provided the combinations were not lethal.

It is quite likely that the populations of *Ophioglossum vulgatum* which are found in England are similarly variable, and it would

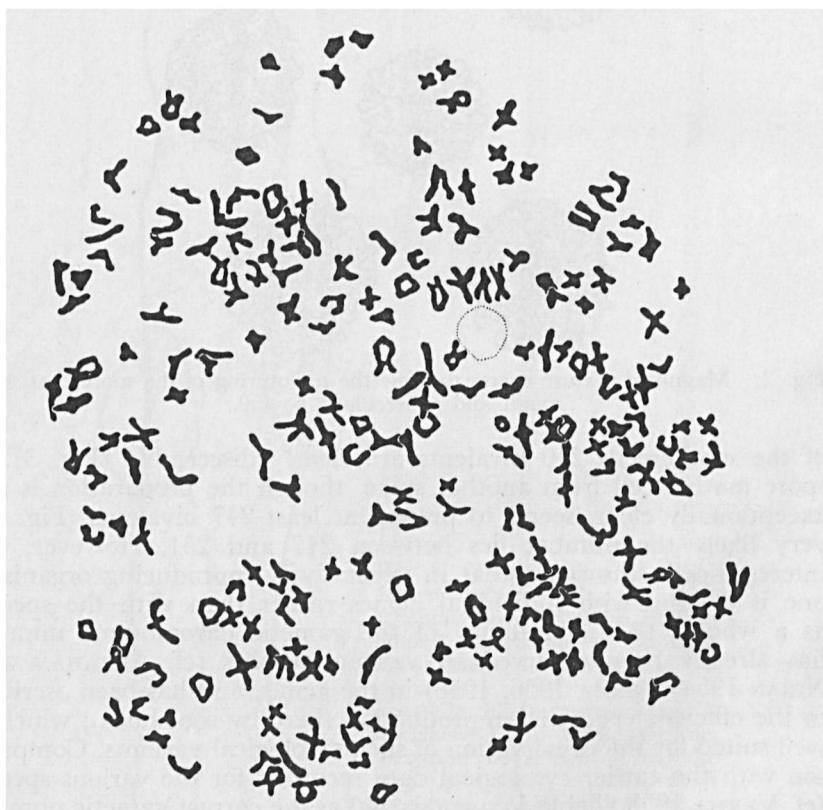


Fig. 3. Diakinesis in a spore mother-cell of *Ophioglossum vulgatum* L. (isl. Terschelling) showing $n = 240$. $\times 1040$.

not be surprising if the supposed parent population with $n = 240$ (based on available data) still exists there. Furthermore, CLAUSEN (1938) referred to the various forms and varieties of this species, based largely upon the size of the plant and the shape of the sterile blade, as representing normal variations occurring in any local population. It would not be unreasonable to assume at this stage that such morphological differences may in fact be connected with variations in chromosome number. The author (VERMA, 1956)

indeed, has observed a definite correlation between chromosome number and individual size in the N. Indian specimens.

The chromosome number of the Netherlands specimens of *Ophioglossum vulgatum* further supports the view that there is a gradual increase in chromosome number from Northern to Southern latitudes

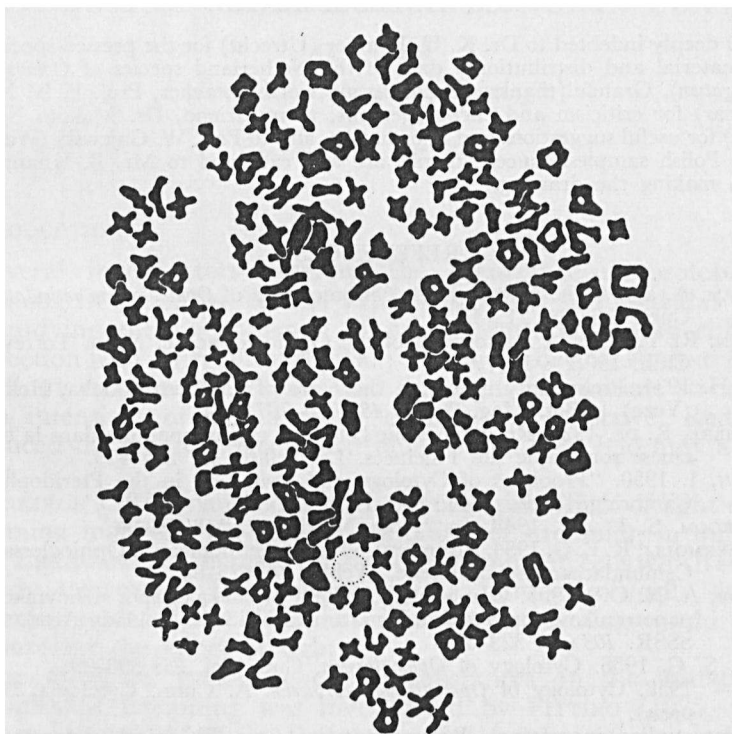


Fig. 4. A spore mother-cell showing 247–251 (c. 248) bivalents at the first meiotic division in another spike of *O. vulgatum* (isl. Terschelling population). $\times 1575$.

in the widely distributed species of *Ophioglossum*; this view was expressed earlier in connection with *O. coriaceum* A. Cunn. (VERMA 1958). Forms of *O. vulgatum* with high chromosome numbers occur in India (VERMA 1956). In this connection it may be added that the South Indian populations of *O. reticulatum* possess very high numbers ($n = 436$ to c. 631, ABRAHAM and NINAN 1954) whereas the European representatives have only 200–240 as the $2n$ number (cf. DE LITARDIÈRE 1921).

SUMMARY

The chromosome number for the Terschelling population of *Ophioglossum vulgatum* L., the only Netherlands species of the genus, has been worked out. The original gametic number seems to be 240. Clones with higher numbers also exist in the area, as c. 248 bivalents have been found in a spore mother-cell of another spike of the same sample. On the basis of spore structure, the morphological variants are held to belong to the same species. Comparison with the earlier records is

made, and a suggestion as to the origin of the various cytotypic clones is advanced. The writer's earlier contention of a "gradual increase in the chromosome number from Northern to Southern latitudes in widely distributed species" (VERMA 1958) seems to be well supported by the present sample.

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- ¹⁾ Not studied in original. Reference taken from Biological abstracts 1957 (Vol. 31), abstract number 29130.