A High Polyploid Chromosome Complement of
Ophioglossum nudicaule L. f.

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Summary  The diploid (2n=720) and haploid (2n=360) chromosome numbers were determined in Ophioglossum nudicaule. The somatic chromosome count was made on the plant for the first time. O. nudicaule is a very high polyploid plant, either exhibiting 48-ploidy, if the basic chromosome number is x=15 or a 24-ploid, originating from the basic chromosome number of x=30.

Key words  Ophioglossum nudicaule, Ophioglossaceae, Mitosis, Meiosis, Polyploidy, Basic chromosome number.

Ophioglossum nudicaule L. f. (Slender Adder’s tongue) belongs to Ophioglossaceae, a family of primitive ferns. It is a tiny terrestrial herb found in dense patches on the thin soil cover over laterite boulders in open areas, roadside ditches and lawns. It is distributed throughout Mexico, West Indies, Central America, South America, Asia, Africa and Pacific Islands. In Kerala, it is common in hills and rocky areas all over the Malabar plains and Munnar (Kumar 1998). Previous studies report that homosporous ferns show extremely high chromosome numbers. In O. nudicaule different chromosome numbers, viz. n=120 (Ninan 1958), n=240 (Ninan 1956, Manickam 1984) and n=360 (Ghatak 1977) have been reported. So the present investigation is an attempt to find out the exact somatic and gametic chromosome numbers of O. nudicaule.

Materials and methods

In the present investigation, O. nudicaule that flourishes after the early part of the rainy season were collected from the Calicut University Campus and herbarized (CALI CU.11697). Healthy root tips were collected from young actively growing plants at the time of peak mitotic activity (9–9.30 a.m.). It was washed thoroughly with distilled water and pre-treated in ice-cold distilled water with a trace of saponin. The pretreatment solution was initially chilled at 0–5°C for 5 min and then kept at 12–15°C for 2–3 h under refrigeration. After this, the root tips were washed thoroughly with distilled water and fixed in Carnoy’s fluid (1 acetic acid : 3 ethyl alcohol) for 24 h.

The fixed and stored root tips were washed in distilled water and hydrolyzed with 1 N HCl for 15 min at 60°C. After thorough washing in distilled water the root tips were stained with modified aceto-orcein method (Sharma and Sharma 1990).

Young, developing sporangia from fertile fronds portion of the plants were collected and fixed in 1:3 mixture of glacial acetic acid and absolute ethyl alcohol for 48 h. Meiotic study was made by taking out sporangium, which were hydrolyzed in 1 N HCl for 10 min at 60°C. These hydrolyzed sporangia were smeared by conventional 2% aceto-orcein method (Sharma and Sharma 1990).

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Photographs of well spread preparations were taken with an OLYMPUS CAMEDIA C-4000 (Zoom Digital Camera) attached to an OLYMPUS CX21 Binocular Research Microscope.

Results and discussion

*Ophioglossum nudicaule* possesses a large chromosome complement with numerous, homogeneous chromosomes, \(2n=720\) (Fig. 1). Meiosis was found to be normal with \(n=360\) bivalents at metaphase I stage (Fig. 2).

The chromosomes of *O. nudicaule* were found to be small, with the primary constrictions faintly visible. It is difficult to distinguish chromosomes with secondary constrictions. Close examination of the chromosome numbers reported by earlier workers revealed considerable difference in
the chromosome number. A wide range of haploid chromosome numbers of O. nudicaule were reported viz. \( n = 120 \) (Ninan 1958), \( n = 240 \) (Ninan 1956, Manickam 1984) and \( n = 360 \) (Ghatak 1977). So in the present investigation the diploid chromosome count of \( 2n = 720 \) and the haploid count \( n = 360 \) is confirmed in O. nudicaule.

Base number of the genus Ophioglossum is controversial. Love et al. (1977) considered it to be \( x = 15 \), whereas Khandelwal (1990) gave \( x = 30 \).

Grant (1981) proposes the original primary base numbers of Angiosperms range from \( x_1 = 7 \)–9. According to Fernandes and Leitao (1984) primary, secondary and tertiary basic chromosome numbers exist in plants. So in the present investigation, the very high polyploid number in O. nudicaule might have originated from the primary basic chromosome numbers of \( x_1 = 7 \) and \( x_1 = 8 \). The secondary basic number of \( x_2 = 15 \) may arise either by amphiploidy or by ascending or descending dysploidy (Fig. 3). If we accept this secondary basic chromosome number of \( x_2 = 15 \) as the original base complement, then the somatic chromosome number of \( 2n = 720 \) seems to be a ‘48-ploid’. During the course of evolution, this secondary basic chromosome number of \( x_2 = 15 \) via proto-autoploidy forms the tertiary basic chromosome number of \( x_3 = 30 \). Thus in the present investigation there is a probability that O. nudicaule may be a ‘24-ploid’, having evolved from a tertiary basic chromosome number of \( x_3 = 30 \).

Endomitosis seems to be one of the causes of the high level of polyploidy observed in O. nudicaule. This polyploid fern seems to be thriving well with its original high polyploid chromosome complement without any variations. O. nudicaule seems to be a living example without much evolutionary changes.

**References**


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