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Cytological observations on some West Himalayan Mosses

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Abstract – Cytological observations are made on seven moss taxa belonging to five genera and three families. Chromosome numbers for *Funaria calcarea* Wahlenb. (n = 28), *Brachymenium longicolle* Thér. (n = 11) and *B. ptychothecium* (Besch.) Ochi (n = 20) are provided for the first time. The chromosome number in *Entosthodon wichurae* Fleisch. (n = 28) differs from the earlier counts for this taxon. A heteromorphic h-bivalent is found in *Timmiella diminuta* (C.Müll.) Chen.

Chromosome numbers / West Himalayan / mosses

The present paper is in continuation to our previous study on the cytology of west Himalayan mosses.

MATERIALS AND METHODS

The fruiting materials of the studied taxa were collected from the western Himalaya from July 1995 to September 1996. Meiotic chromosomes were studied by squeezing the sporogenous tissue in 2 % acetocarmine following the usual technique (Verma & Kumar, 1980). The slides were made permanent in euparal. The photomicrographs were taken at a uniform magnification of ×1875. The vouchers are deposited in the Herbarium of the Department of Botany (PAN), Panjab University, Chandigarh, India.

OBSERVATIONS AND RESULTS

Family Pottiaceae

Timmiella diminuta (C.Müll.) Chen — n = 15 (Figs 1, 2), Dharamsala, on way to Triund, alt. 2400 m, on soil, PAN 3761; Narkanda, on way to Hattoo peak, alt. 3000 m, on rock, PAN 3762.

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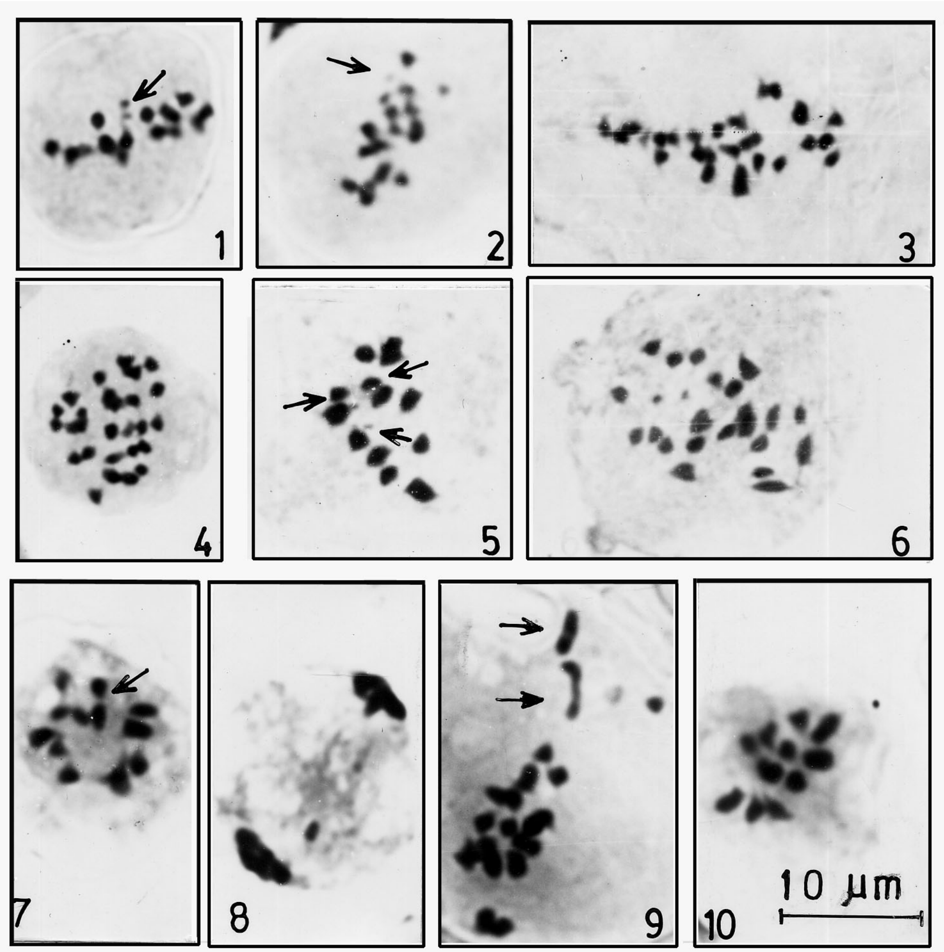
Presently, the fifteen-chromosome complement observed at metaphase-I, included three large, seven medium-sized, four small and one h-type bivalent (Figs. 1, 2). The smallest member of the set disjuncted precociously into two unequal, differentially stained half-bivalents.

Earlier, this taxon is known to exist in three cytological forms n = 14, 15, 14 + m + 1 acc. (*cf.* Fritsch, 1991).



Figs 1,2 : *Timmiella diminuta* –n = 15: Metaphase-I. Note the precocious disjunction of the smallest, heteromorphic h-type bivalent (arrow marked); Fig. 3 : *Entosthodon wichurae* –n = 28: Metaphase-I; Fig. 4: *Funaria calcarea* –n=28: Metaphase-I; Figs 5,6: *Pohlia minor* subsp. *acuminata* –n = 11 + m; 5: Metaphase-I. Note the precocious disjunction of m-bivalent and of another bivalent (arrow marked), 6: Anaphase-I showing regular distribution of 12 chromosomes towards each pole; Figs 7,8: *Brachymenium longicolle* –n = 11; 7: Metaphase-I. Note the precocious disjunction of one bivalent (arrow marked), 8: Late Anaphase-I showing a laggard; Fig. 9: *B. ptychothecium* – n = 20; Metaphase-I. Note two large, rod-shaped bivalents (arrow marked); Fig. 10: *B. sikkimense* –n = 11; Metaphase-I.

Of the five cytologically studied species of *Timmiella*, four show n = 14 (*cf*. Fritsch, 1991). Further studies are needed in order to establish the origin of this chromosome number and its maintenance in this genus.

Family Funariaceae

Entosthodon wichurae Fleisch. — n = 28 (Fig. 3), Shimla, alt. 2000 m, on soil, PAN 3706.

The present chromosome count, n = 28, differs from an earlier report (n = 7, Anand & Kumar, 1986; Kapila & Kumar, 1997) based on another west Himalyan (Dharamsala) population of this species. The complement included four relatively larger bivalents than the remaining ones as observed at first metaphase (Fig. 3). The course of meiosis was found to be normal.

The available cytological data on seven species of this genus (n = 7, 14, 26, 28 — *cf.* Fritsch, 1991; Uniyal, 1996; Kapila & Kumar, 1997) indicate that the genus may be based on × =7 with higher chromosome numbers arisen through polyploidy followed by aneuploid loss of one or two chromosomes.

Funaria calcarea Wahlenb. — n = 28 (Fig. 4), Shimla, alt. 2000 m, on stony wall, PAN 3707.

The complement included twenty-eight fastly stained, well spread bivalents as observed at metaphase-I (Fig. 4). Of these, four bivalents are relatively larger and the remaining ones show gradation in size. The present count differs from an earlier report for *F. calcarea* var. *patula* (B.S.G.) Schimp. — n = 28 (Steere, 1954; Steere *et al*., 1954) but differs from another report recorded for *F. calcarea* var. *mediterranea* (Linds.) C. Jens. & Medel — n = 26 (Griesinger, 1937).

The available cytological data on 22 taxa included in 19 species of *Funaria* (n = 10, 14, 21, 22, 24, 26, 28, 56-*cf*. Fritsch, 1991; Kapila & Kumar, 1997) indicate the prevalence of n=28 (8 taxa). The genus seems to be based on × = 7 which may have vanished in competition with the polyploid and aneuploid numbers.

Family Bryaceae

Pohlia minor* subsp. *acuminata (Hopp. & Hornsch.) Wijk & Marg. — n = 11 + m (Figs 5, 6), Dharamsala, on way to Triund, alt. 2400 m, epiphyte on *Quercus*, PAN 3738.

This taxon has not been described in cytological terms earlier. The chromosome complement comprised twelve fastly stained, well spread bivalents, of which three are large, eight relatively small, and one is an m-bivalent. The m-bivalent and another bivalent showed precocious disjunction (Fig. 5). However, regular distribution of 12 chromosomes towards each pole was observed at anaphase-I (Fig. 6).

This chromosome count is at variance from an earlier count for the same taxon (n = 11 — Lobachevs'ka & Gapon, 1988) and another for *P. minor* Schwaegr. (n = 11 — Anand & Kumar, 1986).

The chromosome numbers recorded for 25 taxa included in 19 species of the genus (n = 10, 11, 13, 14, 20, 21, 22, 23, 40 — *cf.* Fritsch, 1991; Arora & Kumar, 1992; Ramsay & Spence 1996) are highly variable. Of these numbers, n = 11 (18 taxa) or its multiple n = 22 (7 taxa) are of more common occurrence.

Polyploidy and aneuploidy seem to have played a significant role in the evolution and speciation of the genus.

Brachymenium longicolle Thér. — n = 11 (Figs 7, 8), Dharamsala, Triund, alt. 2800 m, on soil, PAN 3733.

The chromosome number of this species was not known previously. Of eleven bivalents, well spread at first metaphase, one large bivalent, showed a tendency to disjunct precociously, but the disjoined half-bivalents remained held together (Fig. 7). One or two laggards, observed at first anaphase (Fig. 8), were later included in the first telophasic nuclei.

Brachymenium ptychothecium (Besch.) Ochi — n = 20 (Fig. 9), Dharamsala, alt. 1800 m, epiphyte on soft wet bark of an angiospermic tree, PAN 3734.

The chromosome number for this species was previously unknown.

The bivalents showed stickiness. Many sporocytes had to be observed to ascertain the correct chromosome count. On the basis of their size, the bivalents comprised two large, eight medium-sized and ten small ones (Fig. 9). The two rod-shaped bivalents (arrow marked) showed a tendency for precocious disjunction.

Brachymenium sikkimense Ren. & Card. — n = 11 (Fig. 10), Dharamsala, P.W.D. Rest House, alt. 2000 m, on soil, PAN 3735.

The present count n = 11 substantiates an earlier report (Anand & Kumar 1986) for another west Himalayan (Shimla) population of this species. Kumar & Verma (1980, 1981) and Arora & Kumar (1992), however, recorded n = 10 in this species. The eleven-chromosome complement comprised three large, two medium, and six small bivalents (Fig. 10).

Of the seven different chromosome numbers, n = 10 (5 taxa), n = 11 (8 taxa), n = 12 (1 taxon), n = 20 (4 taxa), n = 22 (2 taxa), n = 23 (1 taxon) and n = 30 (1 taxon) reported in *Brachymenium* (*cf.* Fritsch, 1991; Talwani & Kumar, 1991; Arora & Kumar, 1992; Ramsay & Spence, 1996), n = 10, 11 and their multiples are of frequent occurrence.

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