Indian J. Genet., **51** (3): 301–305 (1991)

CYTOLOGICAL STUDIES ON SOME *FISSIDENS* FROM WESTERN HIMALAYAS

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(Received: February 1, 1990; accepted: August 20, 1990)

ABSTRACT

Cytological investigations were made on six species of *Fissidens* from the Western Himalayas, i.e. *F. biformis* Mitt., n = 12; *F. bryoides* var. *schimidii* C. Muell., n = 12; *F. rambii* Gang., n = 10; *F. curvatoinvolutus* Dix., n = 12; *F. zippelianus* Doz. et Molk., n = 12; and *F. grandifrons* Brid., n = 10.

Key words: *Fissidens*, meiosis, bivalents, somatic tetrad.

Fissidens Hedw. is a large cosmopolitan genus divided into four subgenera, namely, *Fissidens, Aneuron, Pachyfissidens* and *Octodiceras*. The present study deals with five members of the subgenus *Fissidens* and one of *Pachyfissidens*.

MATERIALS AND METHODS

The plants studied were collected from different localities of the Western Himalayas from August to October. The smear preparations of meiotic stages from sporogenous tissues were obtained using 2% acetocarmine. For somatic studies, regenerants were raised in the laboratory and pretreated in 0.2% colchicine solution for 2–3 h and then fixed in 1 : 3 acetic acid : alcohol mixture for 20–24 h. The meristamatic tissues were hydrolysed in 1 N HCl for 10–12 min at 60°C. After washing in distilled water, the material was immersed in Fuelgan stain and kept in dark for about an hour. The stained apical portions were dissected in 45% acetic acid on a clean glass slide and squashed in 2% acetocarmine. The slides were made permanent in Euparol. The photomicrographs were taken at a uniform magnification of x1800. Voucher specimens have been deposited in the herbarium of the Department of Botany, Punjab University, Chandigarh (PAN Nos. indicated here).

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RESULTS AND DISCUSSION

Subgenus *Fissidens*
Section *Fissidens*

Fissidens biformis Mitt., n = 12 (Fig. 1:1), Dharamsala, elev. 1500 m, PAN 3993.

This taxon, collected from Dharamsala, was found growing as an epiphyte. Morphologically, it is distinguished from other taxa included in the section *Fissidens* by straight apical lamina, dorsal lamina almost reaching leaf insertion and erect capsules.

The present count, n = 12, conforms to an earlier report [1] based on another West Himalayan population of this species. The complement included one peripherally located, large bivalent which did not display precocious disjunction. Two other bivalents were also relatively larger than other members of the set, which in turn showed little gradation in size among themselves. The meiotic behaviour was normal.

Fissidens bryoides var. *schimidii* C. Muell., n = 12 (Fig. 1:2) Dharamsala, elev. 2842 m, PAN 3848.

The material, collected from Dharamsala (Triund), was found growing on wet soil. It differs from typical *F. bryoides* in having flexuose leaves with dorsal lamina often decurrent, shorter border cells and lamina cells with convex surface.

The present count, n = 12, is at variance with earlier reports of n = 6 [2] as *F. schimidii* and n = 13 (12+m) [3] based on some other Himalayan populations of this species. The genome included one peripherally located, comparatively larger, faintly stained bivalent, which did not show precocious disjunction as in the preceding species. The smallest bivalent of the complement, presumably h-bivalent, showed weak staining at first metaphase. This bivalent also did not show precocious disjunction. The remaining members of the set showed little gradation in size among themselves.

Fissidens rambii Gang., n = 10 (Fig 1:3), Kasauli, elev. 2000 m, PAN 3992.

This taxon, gathered from Kasauli, was found growing on wet soil. Two-rowed limbidium all around the leaf and relatively longer setae borne on short lateral shoots facilitated an easy identification of this species.

The chromosome number n = 10 agrees with the only earlier report [4] based on a Shimla population of this species. The bivalents did not show any appreciable difference in size. The meiotic cycle was normal.

Section *Serridium*

Fissidens curvato-involutus Dix., n = 12 (Fig. 1:4, 5), Dharamsala, elev. 2178 m, PAN 3905.

This species, collected from Dharamsala (Mcleodganj), was found growing as an epiphyte on an Angiospermic tree. The decurrent dorsal lamina with a fold at the base and curved capsules with distinct apophysis provided distinctive characters to enable its separation from its closely related *F. involutus*.

The chromosome number, n = 12, is in accordance with an earlier report [4] based on a study of the Shimla population of this species. The R.L. and F% values of the somatic chromosomes at metaphase are given in Table 1.

Section *Crispidium*

Fissidens zippelianus Doz. et Molk., n = 12 (Fig 1:6), Mussoorie, elev. 2100 m, PAN 3907.

This polymorphic species, collected from Mussoorie (Suvakholi), was found growing under flowing water. Morphologically, it is characterized by the absence of limbidium, small lamina cells and the presence of glandular structures in the leaf axils.

Table 1. Measurements of somatic chromosomes of *Fissidens curvato-involutus* at metaphase

Chromosome	Length in μm			R.L.*	F %**
	short arm	long arm	total length		
1	2.86	2.97	5.73	15.15	49.0
2	2.36	3.30	5.66	14.71	41.7
3	0.88	2.75	3.63	9.63	24.2
4	1.92	2.64	4.56	11.85	42.1
5	—	—	1.92	4.99	—
6	—	—	1.98	5.14	—
7	1.10	1.92	3.02	7.85	36.4
8	1.37	1.65	3.02	7.85	45.4
9	—	—	2.75	7.15	—
10	1.37	1.92	3.29	8.55	41.6
11	—	—	1.37	3.56	—
12	—	—	1.43	3.71	—

*R.L. (relative length) = $\frac{\text{Total length of the chromosome}}{\text{Total chromosome length in the set}} \times 100$

**F % (form percent) = $\frac{\text{Short arm of the chromosome}}{\text{Total length of the chromosome}} \times 100$

The present count, n = 12, disagrees with some earlier reports showing n = 6 [5] as *F. elimbatus* [6]. It agrees with one earlier report based on a study of the Himalayan material with n = 12 [7] as *F. sylvaticus*. On the basis of their size, the bivalents may be rated as: three large, eight medium, and one small. Meiosis was normal.

Subgenus *Pachyfissidens*

Fissidens grandifrons Brid., n = 10 (Fig 1:7, 8), Badrinath, elev. 3100 m, PAN 3919.

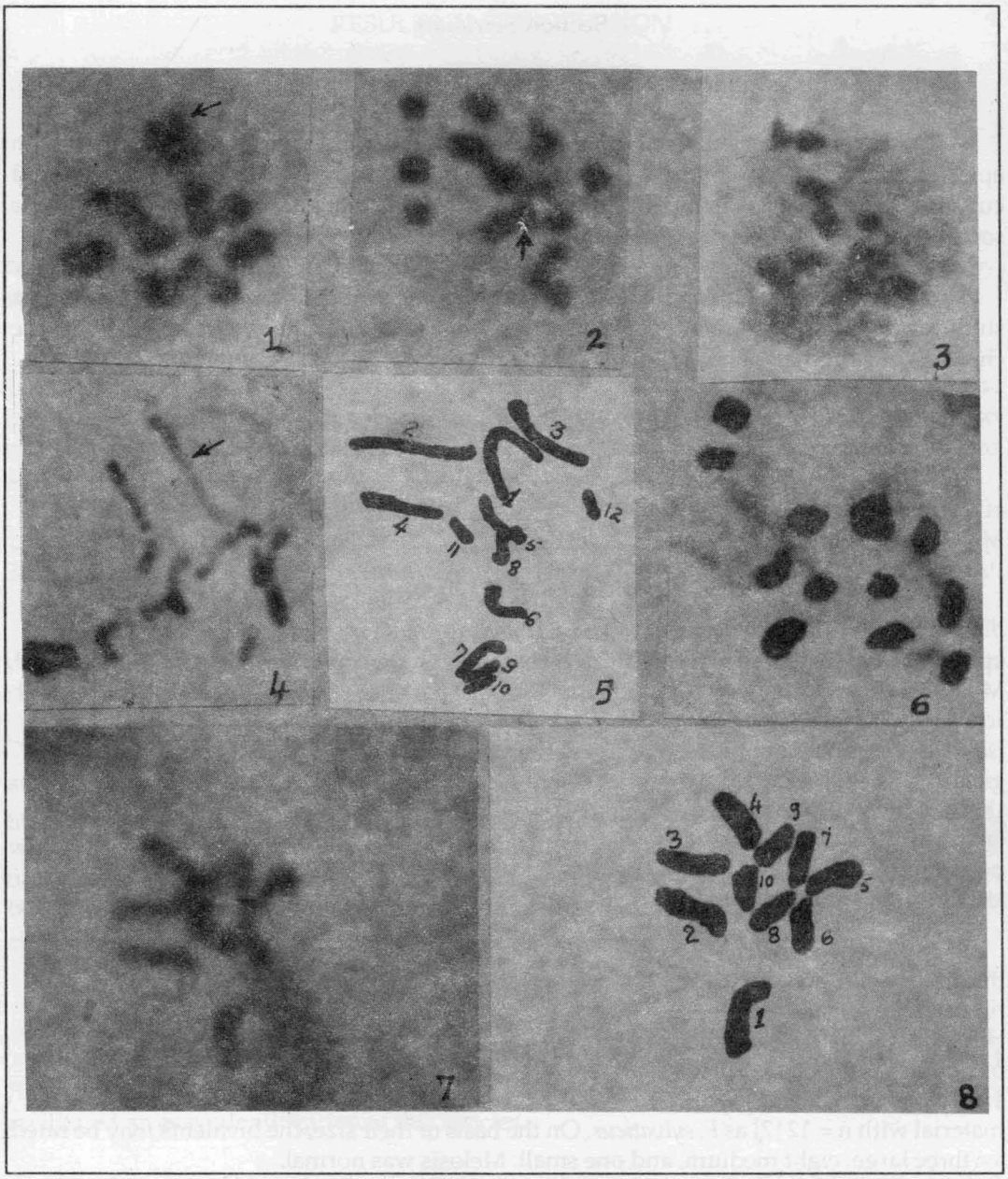

Fig. 1. Metaphase chromosomes of six *Fissidens* species from the Western Himalayas.
1) *Fissidens biformis*, n = 12, note the largest ring-shaped bivalent; 2) *F. bryoides* var. *schimidii*, n = 12, metaphase I showing one largest peripheral bivalent; 3) *F. rambii*, n = 10, metaphase I; 4) *F. curvato-involutus*, n = 12, somatic metaphase; 5) explanatory diagram of Fig. 1, 4; 6) *F. zippelianus*, n = 12; 7) *F. grandifrons*, n = 10, somatic metaphase; and 8) explanatory diagram of Fig. 1, 7.

This taxon, often found along mountain sides under flowing water, was collected from Badrinath. It is easily recognised by its robust nature and stiff leaves. The stems without central strand and leaves with multistratose lamina and unistratose leaf margins provide additional features of distinction.

The present chromosome count n = 10, based on somatic studies, is at variance with the previous reports of n = 16 [2] and n = 12 [6]. The R.L. and F% values of the chromosomes are given in Table 2.

Table 2. Measurements of somatic chromosomes at metaphase of *Fissidens grandifrons*

Chromosome	Length in μm			R.L.*	F %**
	short arm	long arm	total length		
1	0.55	1.65	2.69	13.18	22.4
2	0.82	1.59	2.41	11.80	34.0
3	0.66	1.65	2.31	11.31	28.6
4	—	—	2.25	11.02	—
5	0.44	1.15	1.59	7.79	27.7
6	—	—	2.20	10.78	—
7	0.60	1.92	2.52	12.34	23.8
8	—	—	1.10	5.39	—
9	0.55	1.65	2.20	10.78	25.0
10	—	—	1.15	5.63	—

*,** See note to Table 1.

Of the various chromosome numbers found (*Pachyfissidens* with n = 12, 14, 16; *Aneuron* with n = 10; *Fissidens* with n = 5, 6, 7, 10, 12, 24), n = 6, and n = 5 (and their multiples) are of frequent occurrence [6, 8]. The presence of n = 6 and its multiples in the subgenera *Pachyfissidens* and *Fissidens*, and n = 5 and its multiples in *Aneuron* and *Fissidens* suggests that n = 5 and n = 6 are fairly common in the genus *Fissidens* and may be regarded as the base number of this genus.

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