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Cytomorphology of Some Medicinal Sedges from North West India



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ABSTRACT

In recent years ethnobotanical and traditional uses of natural compounds, especially of plant origin received much attention. The sedge species belonging to family Cyperaceae are used as a decoction, paste, powder or poultice in the treatment of various diseases like dysentery, stomach ache, malarial fever, whooping cough, heart diseases, tumours, etc. *Cyperus rotundus* powder called musta, mustak or mustaka is used as medicine for treating fever and digestive system disorders and as an ingredient in herbal honey, ashokarishta, and anti-aging Ayurvedic nutraceutical chyavanprash. Keeping in view the significant economic and ethnobotanical importance of sedges present study on the chromosome number, their meiotic behavior, pollen fertility and medicinal importance of 10 species from the North West India is carried out. The species studied have shown chromosome numbers like *Bulbostylis barbata* (n=5), *Cyperus alternifolius* (n=16), *Cyperus compressus* (n=24), *Cyperus fuscus* (n=24), *Cyperus iria* (n=29), *Cyperus kyllingia* (n=28), *Cyperus rotundus* (n=40), *Fimbristylis dichotoma* (n=10), *Fimbristylis miliacea* (n=5) and *Kyllingia brevifolia* (n=30). The medicinal uses along with the cytological analysis of these sedges are studied for the first time from the study area.

INTRODUCTION

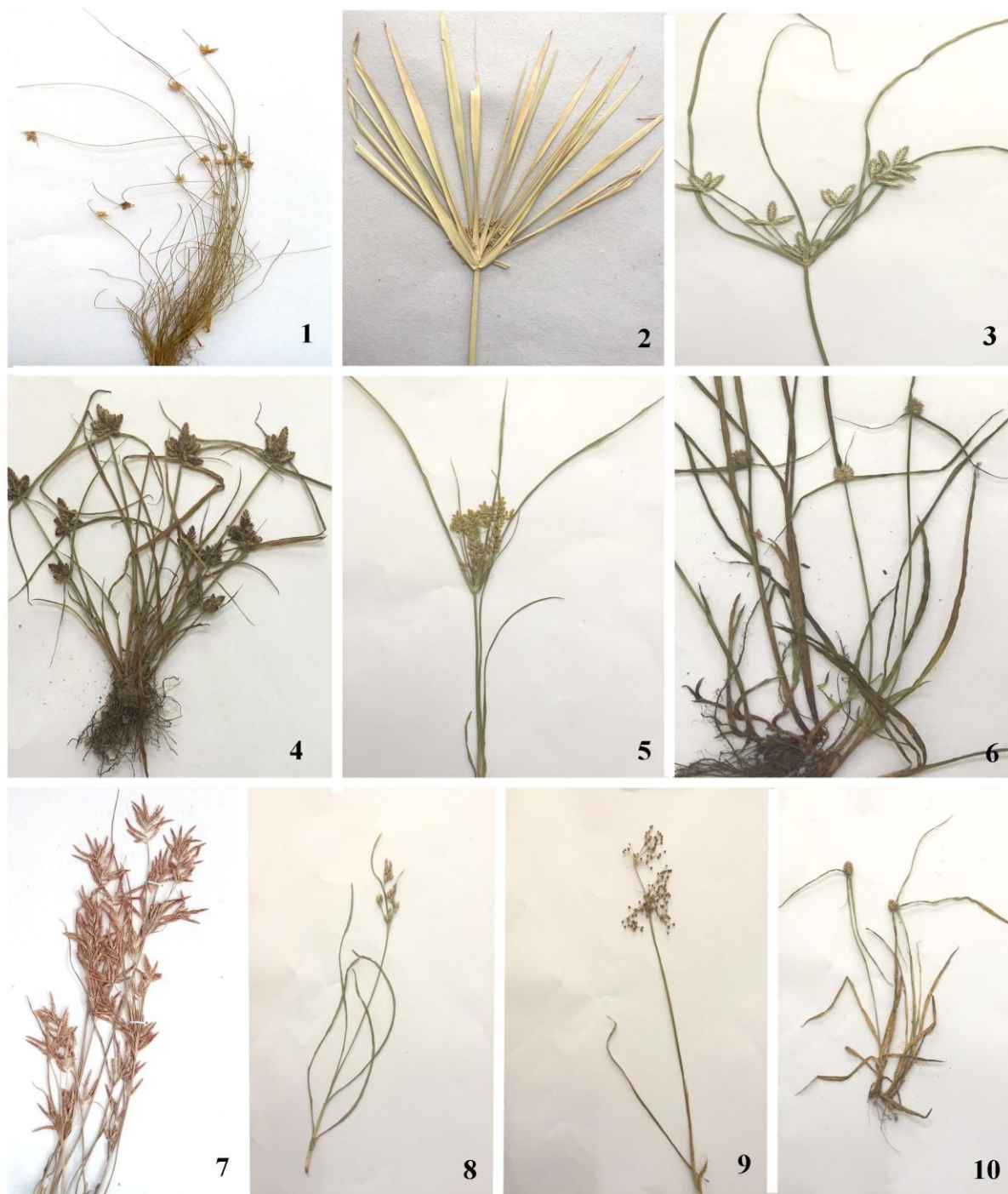
Cyperaceae is a 7th largest family in the angiosperms and 3rd largest in the monocots with approximately 5,400 species in 103 genera currently recognized ^[1]. In India, around 400 species of the family are found as the dominant constituent of the marshy flora. The members are cosmopolitan in distribution occurring in a wide range of altitudes from sea level up to 5000m in the Himalayas and are present in the broad range of habitats. The dominant genera of the family are *Carex* L. (ca. 2000spp.), *Cyperus* L. (ca. 700spp.), *Scirpus* L. (ca. 200spp.) *Rhynchospora* Vahl (ca. 200spp.), *Eleocharis* R. Br. (ca. 150spp.), *Fimbristylis* Vahl (ca. 125spp.) and *Scleria* Berg. (ca. 100spp.). Cyperaceae has significant economic and ethnobotanical importance and nearly 10% of the family is put to use by humans ^[2, 3] with focus on use in the tropics. Ten species studied presently have various therapeutic uses. These are used as the decoction, paste, powder or poultice in a treatment of various diseases like dysentery, stomach ache, malarial fever, whooping cough, heart diseases, tumours, etc. as shown in Table 1. The rhizomes of *Cyperus rotundus* are used as a powder in Ayurvedic medicine, usually called musta, mustak, or mustaka and is mentioned in the ancient *Charaka Samhita* (ca. 100 A.D.). Its uses in modern Ayurvedic medicine are primarily for treating fevers and digestive system disorders (diarrhea, vomiting, indigestion, etc.). It is an ingredient in popular Ayurvedic formulas such as the herbal honey, chyawanprash, the women's blood tonic and uterine regulating formula ashokarishta. It is an important ingredient of anti-aging Ayurvedic nutraceuticals chyawanprash in India ^[4]. Various studies have proved it as the analgesic, antibacterial, anticancer, anticonvulsant, anti-diarrheal, anti-emetic, antihyperglycemic, anti-inflammatory, antimalarial, antimicrobial, antimutagenic, anti-obesity, antioxidant, antipyretic, gastroprotective, hepatoprotective, hypolipidaemic, hypotensive, tranquilizer and wound healer ^[5].

Table 1. Data showing Ethnobotanical and ethnomedicinal uses of some species of sedges from North-West India

Sr.No.	Botanical name	Fig.	Accession number (PUN)	Part used	Ethnobotanical and ethnomedicinal uses
1.	<i>Bulbostylis barbata</i> Kunth	1	60906	Whole plant	The decoction of the plant is used in dysentery. Plant also shows antibacterial activity
2.	<i>Cyperus alternifolius</i> Linn.	2	60901	Rhizome	Powdered rhizome of plant is given to children for stomach ache, malarial fever and paste is applied to wounds as disinfectant
3.	<i>Cyperus compressus</i> Linn.	3	60904	Tuber	Roasted tubers made into paste and mixed with coconut oil for killing lice
4.	<i>Cyperus fuscus</i> Linn.	4	60905	Leaves	Leaves are used against stomach related problems and indigestion
5.	<i>Cyperus iria</i> Linn.	5	60903	Rhizome	Rhizome juice is taken for fever and as stimulant and tonic
6.	<i>Cyperus kyllingia</i> Endl.	6	60900	Rhizome	Rhizome is used in case of diarrhea, fever, treating measles and ulcers
7.	<i>Cyperus rotundus</i> Linn.	7	60954	Whole plant	A decoction of plant parts is used as a diuretic. It is widely used in curing circulatory system disorders, digestive system disorders, diabetes, menstrual disorders, mental and nervous system disorders, nutritional disorders and respiratory system disorders. It is also useful in childbirth and as the antidote for snake poison. A decoction of the whole plant is given to cure malarial fever. Dried rhizome powder is

					commercially marketed by companies as 'Musta root powder'. Due to the presence of cyperone, it is used as tonic for heart diseases
8.	<i>Fimbristylis dichotoma</i> (Linn.) Vahl	8	60908	Leaves	Crushed leaves are rubbed onto the hair to maintain and encourage hair growth
9.	<i>Fimbristylis miliacea</i> Vahl	9	60909	Leaves	Leaves are used for poulticing in the fever
10.	<i>Kyllinga brevifolia</i> (Rottb.) Endl.	10	60907	Whole plant	Aerial parts of plant macerated in cold water are useful for curing diarrhea, tumours, stomach and intestinal problem. Paste of rhizome is used to relieve external sores and swellings





Figs. 1-10: 1: *Bulbostylis barbata*; 2: *Cyperus alternifolius*; 3: *Cyperus compressus*; 4: *Cyperus fuscus*; 5: *Cyperus iria*; 6: *Cyperus kyllingia*; 7: *Cyperus rotundus*; 8: *Fimbristylis dichotoma*; 9: *Fimbristylis miliacea*; 10: *Kyllinga brevifolia*.

Attempts have been made to study cytomorphology of sedges from North West India but no work has been done on the ethnobotanical aspect of these plants. The present study is focused on medicinal value, chromosome count and meiotic behavior of the sedges from the study

area. The species studied, the locality with altitude, chromosome number, previous chromosome number reports and pollen fertility % age are given in Table 2.

Table 2: Data showing Taxa, Locality with altitude, Chromosome number reports, and Pollen fertility %age

Sr. No.	Taxa	Locality with altitude (m)	Chromosome number reports (n)		Pollen fertility % age
			Present	Previous	
1	<i>Bulbostylis barbata</i>	Tiuni (1200) Uttarkhand	5	5	73.57
2.	<i>Cyperus alternifolius</i>	Patiala (250) Punjab	16	16	86.40
3	<i>Cyperus compressus</i>	Patiala (250) Punjab	24	56,57,64	95.80
4	<i>Cyperus fuscus</i>	Palampur (1472) Himachal Pardesh	24	18,24,36	85.40
5	<i>Cyperus iria</i>	Machivara (260) Punjab	29	36,54,58, 64	76.47
6	<i>Cyperus kyllingia</i>	Narkanda (2710) Himachal Pardesh	28	43,56,60,62	83.69
7	<i>Cyperus rotundus</i>	Ludhiana (262) Punjab	40	48,50,54,64,7 6	65.71
8	<i>Fimbristylis dichotoma</i>	Prola (1200) Uttarkhand	10	10	86.12
9	<i>Fimbristylis miliacea</i>	Palampur (1472) Himachal Pardesh	5	5	89.12
10	<i>Kyllinga brevifolia</i>	Patiala (250) Punjab	30	43,58,60,86	83.57

MATERIALS AND METHODS

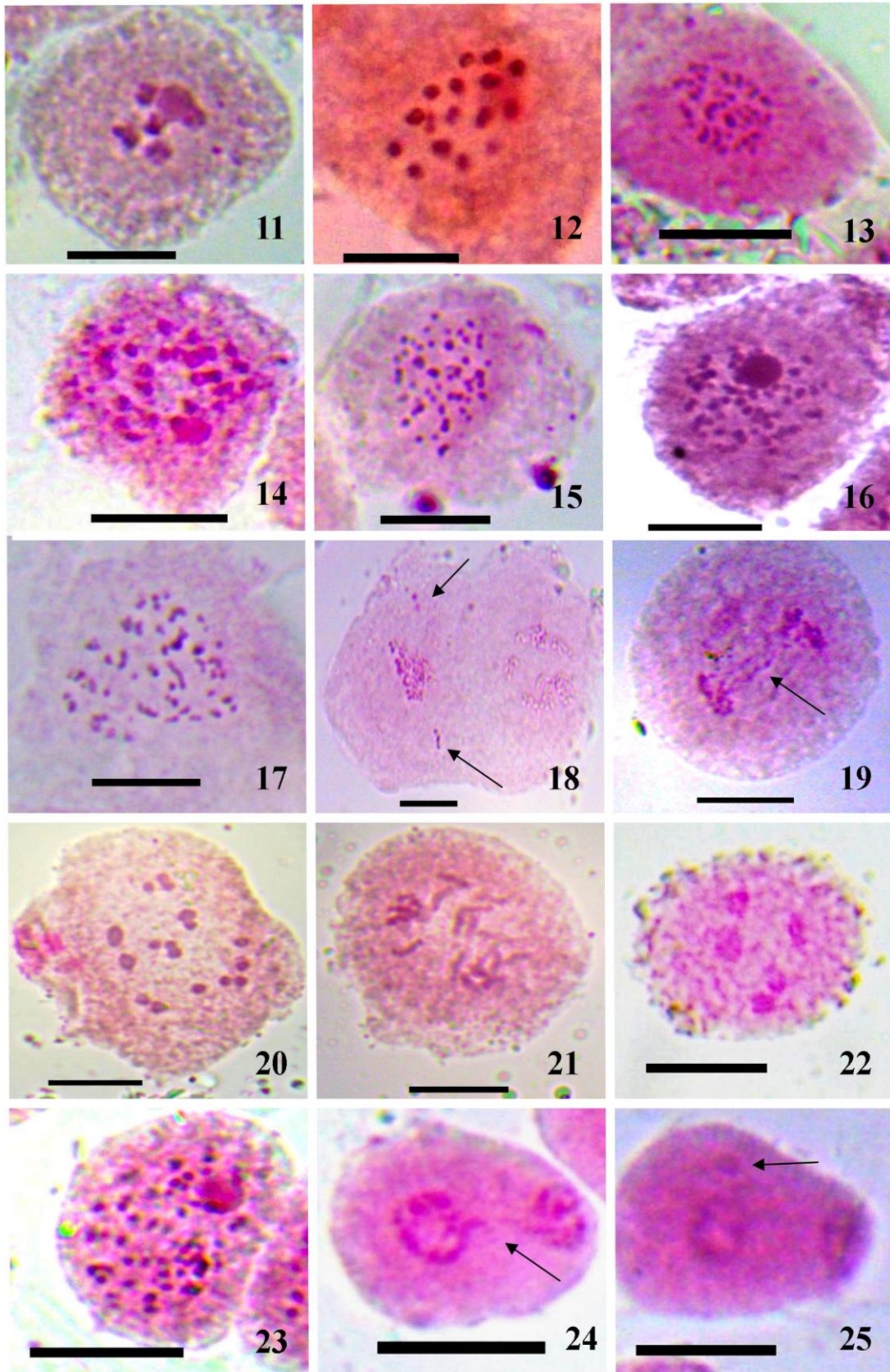
Study area

The present study was undertaken in different localities of North West India i.e. Punjab ($31^{\circ} 8'49''$ N to $75^{\circ}20'28''$ E), Himachal Pradesh ($31^{\circ}6'17''$ N to $77^{\circ}10'24''$ E) and Utrakhand ($30^{\circ}4'0.31''$ N to $79^{\circ}1'9.48''$ E). Systematic surveys were conducted to collect different sedge species during June -September months.

Methodology

For meiotic studies, young spikes of appropriate sizes were collected during June-September from different localities. The plant specimens were identified with the help of regional floras and comparison with herbarium specimens in Punjabi University herbarium (PUN). The young unopened spikes were fixed in Carnoy's fixative for 24 hours and then stored in 70% alcohol at 4°C until use. For meiotic studies, anthers were squashed in 2% acetocarmine. Pollen fertility was estimated using the glycerol-acetocarmine technique. Photomicrographs were made from freshly prepared slides using Magnus MLX Plus Microscope.





Figs. 11-25: 11: *Bulbostylis barbata*.

A PMC showing 5 bivalents at Diakinesis; 12: *Cyperus alternifolius*. A PMC showing 16 bivalents at Metaphase; 13: *Cyperus compressus*. A PMC showing 24 bivalents at Metaphase; 14: *Cyperus fuscus*. A PMC showing 24 bivalents at Diakinesis; 15: *Cyperus iria*. A PMC showing 29 bivalents at Metaphase; 16: *Cyperus kyllingia*. A PMC showing 28 bivalents at Diakinesis; 17: *Cyperus rotundus*. A PMC showing 40 bivalents at Metaphase; 18: A PMC showing laggards Anaphase I; 19: A PMC showing cytoplasmic bridge at Anaphase I; 20: *Fimbristylis dichotoma*. A PMC showing 10 bivalents at Metaphase; 21: A PMC showing pollen mitosis; 22: *Fimbristylis miliacea*. A PMC showing 5 bivalents at metaphase I; 23: *Kyllinga brevifolia*. A PMC showing 30 bivalents at Diakinesis; 24: A PMC showing cytoplasmic bridge at Anaphase I; 25: A PMC showing laggards Anaphase I

RESULTS AND DISCUSSION

***Bulbostylis barbata* Kunth**

Bulbostylis barbata is commonly called hair sedges. The plant is densely tufted and without rhizome. Culms are erect and slender in shape. This plant shows antibacterial activity and aerial parts are used for curing dysentery. The plant was collected from the Tiuni (1200m). The meiotic study reveals chromosome count of $n=5$. The present report is in conformity with the previous report [6, 7, 8, 9]. The meiotic study is normal and pollen fertility is 73.57% (fig.11).

***Cyperus alternifolius* Linn.**

Cyperus alternifolius known as umbrella plant is found near the ponds. The stem of the plant is triangular and can grow up to 72 inches. Aerial parts of the plant are used for the treatment of stomach ache and malarial fever. The plant was collected from Patiala (251 m). The Chromosome count of $n=16$ is conformity with the previous reports [10]. The species shows normal meiosis and pollen fertility is 86.40 % (fig. 12).

***Cyperus compressus* Linn.**

Cyperus compressus is an annual plant with triangular stem and fibrous roots. Inflorescence of the plant is simple anthela type. Powder of roasted tuber of plant mixed with coconut oil is used for killing lice. The plant was collected from Patiala (251m) and meiotic studies reveal

chromosome count $n=24$ which is reported for the first time. The previous reports were 56, 64^[11]; 56^[12] and 57, 64^[13]. Pollen fertility was reported 95.80% (fig. 13).

***Cyperus fuscus* Linn.**

Cyperus fuscus is the annual plant with fibrous roots and smooth leaves. The inflorescence is deep brown in colour. Aerial parts of the plant are used for curing stomach ache and indigestion problem. Plants were collected from Palampur for meiotic studies and chromosome count of $n=24$ is in conformity with the previous reports 18^[14], 24^[15] and 36^[13]. Pollen fertility was reported 85.47% (fig. 14).

***Cyperus iria* Linn.**

Cyperus iria is annual plant found near the grasslands, margins of mountain slope and paddy fields. The culm of the plant is compressed triangular. The leaves of the plant are shorter than the culm. Plant extract is used in fever and act as a stimulant. Meiotic studies revealed the chromosome count $n=29$, which is first time reported. The previous counts were 64^[16]; ca.36^[9]; 54, 64^[12]; 54, 58^[11] and 36^[15]. Pollen fertility was reported 76.47% (fig. 15).



***Cyperus kyllingia* Endl.**

Cyperus kyllingia collected from Narkanda (2900 m) is an annual sedge having long creeping rhizome and grows along streams and shaded meadows. Inflorescence of the plant is spherical in shape arched over by three-four unequal leaves. Plant parts are used for the treatment of diarrhea, fever, measles, and ulcer. Meiotically, the species showed chromosome count of $n=28$ which is reported for the first time. The previous chromosome number reports for the species are 56^[11]; 60^[12]; 62^[17]; 43, 60^[18]. Pollen fertility was reported 83.69% (fig. 16).

***Cyperus rotundus* Linn.**

Cyperus rotundus is common perennial sedge, which looks like grass with tuberous roots. Three leaves are present at the base of the triangular stem of the plant. *C. rotundus* has a number of medicinal properties^[5, 19]. It is widely used in curing circulatory system disorders, digestive system disorders, diabetes, menstrual disorders, mental and nervous system disorders, nutritional disorders and respiratory system disorders. It is also useful in childbirth and as an antidote for snake poison. A decoction of the whole plant is given to cure malarial

fever. Dried rhizome powder is commercially marketed by companies as 'Musta root powder'. Due to the presence of cyperone rhizomes are used as tonic, diaphoretic, diuretic, hypotensive and anti-inflammatory agent. Plant collected from Ludhiana show $n=40$ which is first time reported. It has chromosomal abnormalities as cytoplasmic bridges and laggards, which are recorded for the first time. The previous reported number of chromosome counts are 54^[20]; 48^[17]; 76^[21]; 50, 64^[22] and 50^[23]. Pollen fertility was reported 65.71% (figs. 17-19).

***Fimbristylis dichotoma* (Linn.) Vahl**

Fimbristylis dichotoma is a tufted, erect, annual or perennial. Plant stems are about 2 mm in diameter, slightly three-angled, compressed below the inflorescence. The plant inhabits open grasslands, marshes and paddy fields. The leaves of the plant are used to enhance hair growth. Plant collected from Parola (1200 m) Uttarakhand showed diploid chromosome count $n=10$ at metaphase-I. Pollen mitosis is also recorded in the species. The present report confirms the previous report^[6, 24, 25, 26, 27]. Pollen fertility was reported 86.12% (figs. 20-21).

***Fimbristylis miliacea* Vahl**



Fimbristylis miliacea is an annual plant with the triangular stem. Leaves are of the same size as the stem. Plants were mainly found near wet rivers side and rice fields. Medicinally the leaves of the plant are used for dressing in fever. Plant collected from Palampur revealed chromosome count of $n = 5$. The present report confirms the previous report^[6, 11]. Pollen fertility was reported 89.12% (fig. 22).

***Kyllinga brevifolia* (Rottb.) Endl.**

Kyllinga brevifolia is a perennial, long creeping sedge with 3 angled culms. This plant grows mostly under shrubs, grasslands, swamps, meadows, mountain slopes, wet places, shallow water and paddy fields. Aerial parts of plants are used for curing diarrhea, tumour and intestinal diseases. A paste of rhizome helps to get relief from swelling. The species collected from Patiala (251m) shows chromosome count of $n=30$ which is first time reported. The previous reports for this species are 86^[11]; 60^[20, 12] and 43, 58, 60^[18]. Chromosomal abnormalities as cytoplasmic bridges and laggards are also recorded in this species for the first time. Pollen fertility was reported 83.57% (figs. 23-25).

CONCLUSION

The present exploration gives useful information regarding the chromosome number and various meiotic irregularities and the medicinal importance of sedges. New chromosome numbers have been reported in 5 species namely, *C. compressus*, *C. iria*, *C. kyllingia*, *C. rotundus* and *K. brevifolia*. Chromosomal abnormalities as cytoplasmic bridges and laggards have been observed in *C. rotundus* and *K. brevifolia*.

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