

# CHROMOSOME NUMBERS IN SOME TAXA OF FABACEAE MOSTLY NATIVE TO PAKISTAN<sup>1</sup>

Bushreen Jahan,<sup>2</sup> Ahsan A. Vahidy,<sup>3</sup>  
and S. I. Ali<sup>2</sup>

## ABSTRACT

Chromosome numbers are reported for 60 taxa belonging to 35 genera of Fabaceae; 44 of these are native to Pakistan, while the rest are cultivated. Chromosome numbers of seven taxa viz.: *Argyrolobium stenophyllum* ( $n = 13$ ); *Astragalus bicuspis* ( $n = 8$ ); *Astragalus ptilocephalus* ( $n = 8$ ); *Chesneya parviflora* ( $n = 8$ ); *Indigofera caerulea* var. *caerulea* ( $n = 8$ ); *Sophora mollis* subsp. *griffithii* Ali ( $n = 9$ ); and *Taverniera glabra* ( $n = 8$ ), are reported for the first time. Counts for 35 additional taxa are the first reports for plants native to Pakistan.

In Pakistan, Fabaceae, the third largest family of flowering plants, is represented by 104 genera and 514 species (Ali, 1973a, b, 1977) of which only 35 species (i.e., 6.8%) have been examined chromosomally (Baquar et al., 1965, 1966; Baquar & Husain, 1967; Baquar & Warsi, 1968; Baquar & Askari, 1970; Quraish & Faruqi, 1970; Faruqi, 1977; Khatoon & Ali, 1982, 1991). The chromosome numbers for 60 taxa belonging to 35 genera of Fabaceae from Pakistan are reported. Counts for seven taxa are reported for the first time and counts for 35 species are new records from this country.

## MATERIALS AND METHODS

The meiotic and mitotic materials (i.e., the floral buds and seeds respectively) of wild species were collected from various regions of Pakistan. A number of cultivated species were also included in our study (Table 1).

For meiotic chromosome counts, floral buds were fixed in Carnoy's solution (3 parts of absolute ethanol:1 part of glacial acetic acid) for 24 hr. and then stored in a refrigerator. Slides were prepared by routine squash technique using 1% acetocarmine or 1.8% aceto-orcein.

For mitosis, root tips from germinating seeds were pretreated with 0.002 M 8-OH quinoline (for 4–6 hr.), fixed in Carnoy's solution for 1 hr., hydrolysed in 1 N HCl for 6–12 min. and squashed in 1.8% aceto-orcein.

Most photomicrographs were taken from temporary mounts. Preparations were made permanent by mounting in euparal. Voucher specimens, identified with the help of the Flora of Karachi (Jafri, 1966) and the Flora of Pakistan (Ali, 1973a, b, 1977), are deposited in Karachi University Herbarium (KUH).

## OBSERVATIONS AND RESULTS

Chromosome counts for 60 taxa in 17 tribes of Fabaceae are presented in Table 1. Counts new to science and new to the flora of Pakistan are specified on the basis of a survey of IPCN (Moore, 1973; Fedorov, 1974; Goldblatt, 1981b, 1984, 1985, 1988). The tribes are arranged according to Goldblatt (1981a).

## DISCUSSION

In the present study most of the chromosome counts that are in conformity with earlier reports have not been commented upon.

In Sophoreae, *Sophora mollis* subsp. *griffithii* has  $n = 9$  (Fig. 1), reported here for the first time. This accords with the most frequent number in the genus in which  $n = 14, 11, 9$ , and possibly 8 have also been found (Goldblatt, 1981a).

In Tephrosieae, *Milletia peguensis* has  $n = 11$ , corresponding with the basic number  $x = 11$  suggested by Goldblatt (1981a) for the tribe. *Tephro-*

<sup>1</sup> We thank S. Khatoon, Z. A. Razaq, A. Ghafoor, S. Omer, T. Ali, M. Moinuddin, and N. Ahsan of the Department of Botany, University of Karachi, for their help in identification of vouchers and collecting cytological material. This paper is a part of the work supported by National Science Foundation grant INT 8510318.

<sup>2</sup> Department of Botany, University of Karachi, Karachi-75270, Pakistan.

<sup>3</sup> Department of Genetics, University of Karachi, Karachi-75270, Pakistan.

TABLE 1. Chromosome numbers in Fabaceae. K.U. = Karachi University. D. G. Khan = town of Dera Ghazi Khan.

Taxon	Chromosome number <i>n</i>	Basic number <i>x</i>	Voucher
Subfamily Caesalpinioideae			
Tribe Caesalpinieae			
<i>Parkinsonia aculeata</i> L. (cultivated)	14	14	K.U. Campus: Siddiqui 36
Tribe Cassieae			
<i>Cassia holosericea</i> Fresen	14	14	K.U. Campus: Siddiqui 1
* <i>Cassia occidentalis</i> L. (cultivated)	14		K.U. Campus: Jahan 13; Hasanabdal: Ghafoor 3889
Subfamily Mimosoideae			
Tribe Ingeae			
* <i>Pithecellobium dulce</i> (Roxb.) Benth. (cultivated)	13	13	K.U. Campus: Siddiqui 17
Subfamily Papilionoideae			
Tribe Sophoreae			
** <i>Sophora mollis</i> (Royle) Baker subsp. <i>griffithii</i> (Stocks) Ali (Fig. 1)	9	9	Panjgur: Omer 2057
Tribe Tephrosieae			
* <i>Millettia peguensis</i> Ali (cultivated)	11	11	K.U. Campus: Siddiqui 35
* <i>Tephrosia apollinea</i> (Delile) Link (Fig. 2)	22	11	Khushab: Ghafoor 3762
* <i>Tephrosia purpurea</i> (L.) Pers.	11	11	Kashmir: T. Ali 15; Layyah: Ghafoor 3735
<i>Tephrosia purpurea</i>	22		Makran: Omer 2106
<i>Tephrosia strigosa</i> (Dalzell) Sant. & Maheshw.	11	11	K.U. Campus: Jahan 32
<i>Tephrosia subtriflora</i> Baker	11		K.U. Campus: Siddiqui 10, 54, Jahan 56, 47; Safari Park, Karachi: Siddiqui 68, Jahan 24
Tribe Robinieae			
* <i>Gliricidia sepium</i> (Jacq.) Steud. (cultivated)	11	11	K.U. Campus: Siddiqui 23
* <i>Sesbania bispinosa</i> (Jacq.) W. Wight	6	6	Kathore: Jahan 71
* <i>Sesbania sesban</i> (L.) Merrill (cultivated)	6, 2 <i>n</i> = 12		Darsanochano: Siddiqui 93; Safari Park, Karachi: Siddiqui 59; Sajawal: Ahsan 22
Tribe Indigofereae			
<i>Cyamopsis tetragonoloba</i> (L.) Taubert (cultivated) (Figs. 3 & 4)	7	7	Bhawalpur: Ghafoor 3577; Muzaffargarh: Ghafoor 3606; K.U. Campus: Moin. 61
** <i>Indigofera caerulea</i> Roxb. var. <i>caerulea</i> (Fig. 5)	8	8	K.U. Campus: Siddiqui 37
* <i>Indigofera cordifolia</i> Heyne ex Roth	8		K.U. Campus: Ahsan 4; D. G. Khan: Ghafoor 3730
<i>Indigofera hochstetteri</i> Baker (Fig. 6)	8		Bawana: Ghafoor 3689; Darsanochano: Jahan 31; Kathore: Jahan 70; K.U. Campus: Razaq 140

TABLE 1. Continued.

Taxon	Chromosome number <i>n</i>	Basic number <i>x</i>	Voucher
<i>Indigofera oblongifolia</i> Forssk.	8		K.U. Campus: <i>Siddiqui</i> 16, 52; Safari Park, Karachi: <i>Siddiqui</i> 66; Darsanochano: <i>Siddiqui</i> 77; Thatta: <i>Siddiqui</i> 107
Tribe Desmodieae			
<i>Alysicarpus heterophyllus</i> (Baker) Jafri & Ali (Fig. 7)	8	8	K.U. Campus: <i>Moin.</i> 45
<i>Alysicarpus monilifer</i> (L.) DC.	8		K.U. Campus: <i>Siddiqui</i> 27, <i>Ahsan</i> 2
* <i>Alysicarpus ovalifolius</i> (Schumacher) J. Léonard	8		K.U. Campus: <i>Moin.</i> 60
* <i>Alysicarpus rugosus</i> (Willd.) DC.	8		Ghotki: <i>Ghaffoor</i> 3515
* <i>Desmodium elegans</i> DC.	11	11	Kashmir: <i>T. Ali</i> 236
* <i>Desmodium gangeticum</i> (L.) DC.	11		Kashmir: <i>T. Ali</i> 130
* <i>Lespedeza juncea</i> (L.f.) Pers. var. <i>sericea</i> (Thunb.) Lace & Hemsl.	10	10	Kashmir: <i>T. Ali</i> 471
Tribe Phaseoleae			
* <i>Cajanus cajan</i> (L.) Millsp. (cultivated)	11	11	K.U. Campus: <i>Moin.</i> 11
* <i>Clitoria ternatea</i> L.	8	8	Malir, Karachi: <i>Moin.</i> 19
* <i>Flemingia fruticulosa</i> Wall. ex Benth.	11	11	Murree: <i>Ghaffoor</i> 4135
* <i>Glycine max</i> (L.) Merrill (cultivated)	20	20	K.U. Campus: <i>Razaq</i> 137
* <i>Phaseolus vulgaris</i> L. (cultivated)	11	11	D. G. Khan: <i>Ghaffoor</i> 3690
* <i>Rhynchosia capitata</i> (Heyne ex Roth) DC.	11	11	K.U. Campus: <i>Razaq</i> 131
<i>Rhynchosia minima</i> (L.) DC.	11		K.U. Campus: <i>Siddiqui</i> 18
<i>Rhynchosia pulverulenta</i> Stocks	11		K.U. Campus: <i>Siddiqui</i> 38
* <i>Vigna mungo</i> (L.) Hepper (cultivated)	2 <i>n</i> = 22	11	K.U. Campus: <i>Moin.</i> 29
* <i>Vigna trilobata</i> (L.) Verdc.	11		K.U. Campus: <i>Razaq</i> , 129; Manghopir: <i>Razaq</i> 155
* <i>Vigna unguiculata</i> (L.) Walp. subsp. <i>unguiculata</i> (cultivated)	11		K.U. Campus: <i>Razaq</i> 136
Tribe Aeschynomeneae			
* <i>Arachis hypogaea</i> L. (cultivated)	20	10	K.U. Campus: <i>Razaq</i> 130
Tribe Galegeae			
<i>Alhagi maurorum</i> Medikus	8	8	K.U. Campus: <i>Moin.</i> 14; Sajawal: <i>Ahsan</i> 25; Thatta: <i>Siddiqui</i> 96, 128, 147
** <i>Astragalus bicuspidis</i> Fisch. (Figs. 8a & b)	8	8	Gilgit: <i>Omer</i> 2470
* <i>Astragalus leucocephalus</i> Graham ex Benth.	8		Shangla, N.W.F.P.; <i>Ghaffoor</i> 4008
** <i>Astragalus ptilocephalus</i> Baker	8		Chitral: <i>Ghaffoor</i> 2567

TABLE 1. Continued.

Taxon	Chromosome number <i>n</i>	Basic number <i>x</i>	Voucher
** <i>Chesneya parviflora</i> Jaub. & Spach (Fig. 9)	8	8	Panjgur: Omer 2076
* <i>Oxytropis lapponica</i> (Wahl) Gay	8	8	Chitral: Ghafoor 3154
Tribe Hedysareae			
<i>Taverniera cuneifolia</i> (Roth) Arn. (Fig. 10)	8	8	K.U. Campus: Ahsan 54
** <i>Taverniera glabra</i> Boiss. (Fig. 11)	8	8	Panjgur: Omer 2073
Tribe Viciaeae			
* <i>Lathyrus aphaca</i> L. (Fig. 12)	7	7	K.U. Campus: Razaq 149
* <i>Vicia faba</i> L. (cultivated)	6	6	Chitral: Ghafoor 3200
Tribe Cicereae			
* <i>Cicer arietinum</i> L. (cultivated)	8	8	K.U. Campus: Moin. 28
Tribe Trifolieae			
* <i>Medicago falcata</i> L.	16	8	Astor: Omer 2311
* <i>Medicago lupulina</i> L.	8		K.U. Campus: Siddiqui 30; Dir: Ghafoor 2426; Swat: Ghafoor 4007
<i>Medicago sativa</i> L.	8		Thatta: Siddiqui 104
<i>Medicago sativa</i>	16		Chitral: Ghafoor 2848, 3108; K.U. Campus: Jahan 16; Mustuj: Ghafoor 3003; Arkari: Ghafoor 2799
<i>Melilotus alba</i> Desr.	8	8	K.U. Campus: Siddiqui 28; Thatta: Siddiqui 127, 113
<i>Melilotus indica</i> (L.) All.	8		K.U. Campus: Siddiqui 6; Thatta: Siddiqui 125; Darsanocho: Siddiqui 92
<i>Melilotus officinalis</i> (L.) Pall.	8		Astor: Omer 2428; Naltar: Omer 2582; Avarik: Ghafoor 2735
* <i>Trifolium resupinatum</i> L. (Fig. 13)	8	8	Malakand: Ghafoor 3914; Thatta: Siddiqui 140
* <i>Trigonella foenum-graecum</i> L. (cultivated) (Fig. 14)	2 <i>n</i> = 16	8	K.U. Campus: Moin. 24
Tribe Crotalarieae			
<i>Crotalaria burhia</i> Buch.-Ham. ex Benth.	8	8	K.U. Campus: Siddiqui 47, 51; Cholistan: Ghafoor 3543; Darsanocho: Siddiqui 75
* <i>Crotalaria juncea</i> L. (Fig. 15)	8		Khushab: Ghafoor 3813
* <i>Crotalaria medicaginea</i> Lam. var. <i>medicaginea</i> (Fig. 16)	16		Kashmir: T. Ali 390
Tribe Genisteae			
** <i>Argyrolobium stenophyllum</i> Boiss. (Fig. 17)	13	13	Khushab: Ghafoor 3829

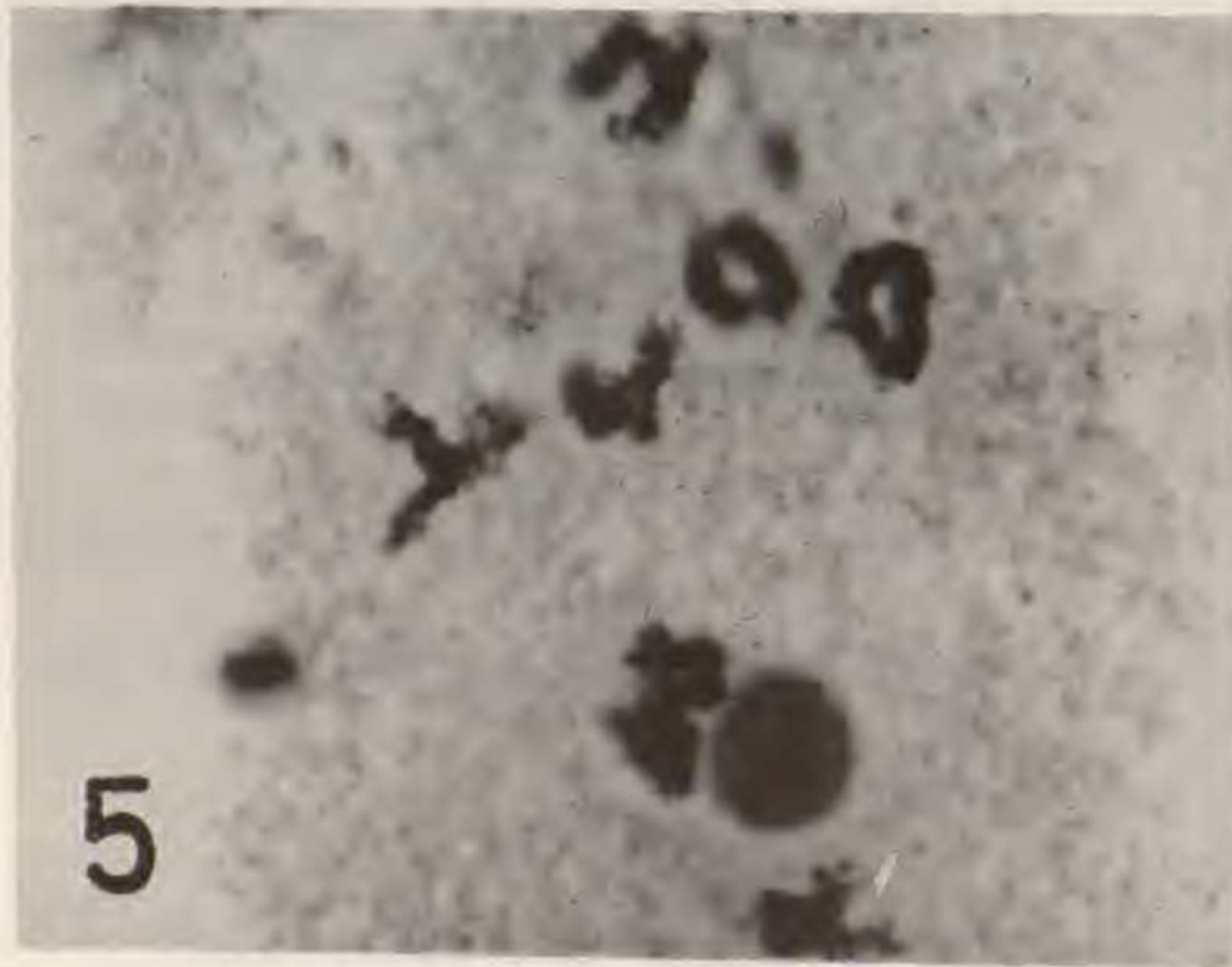
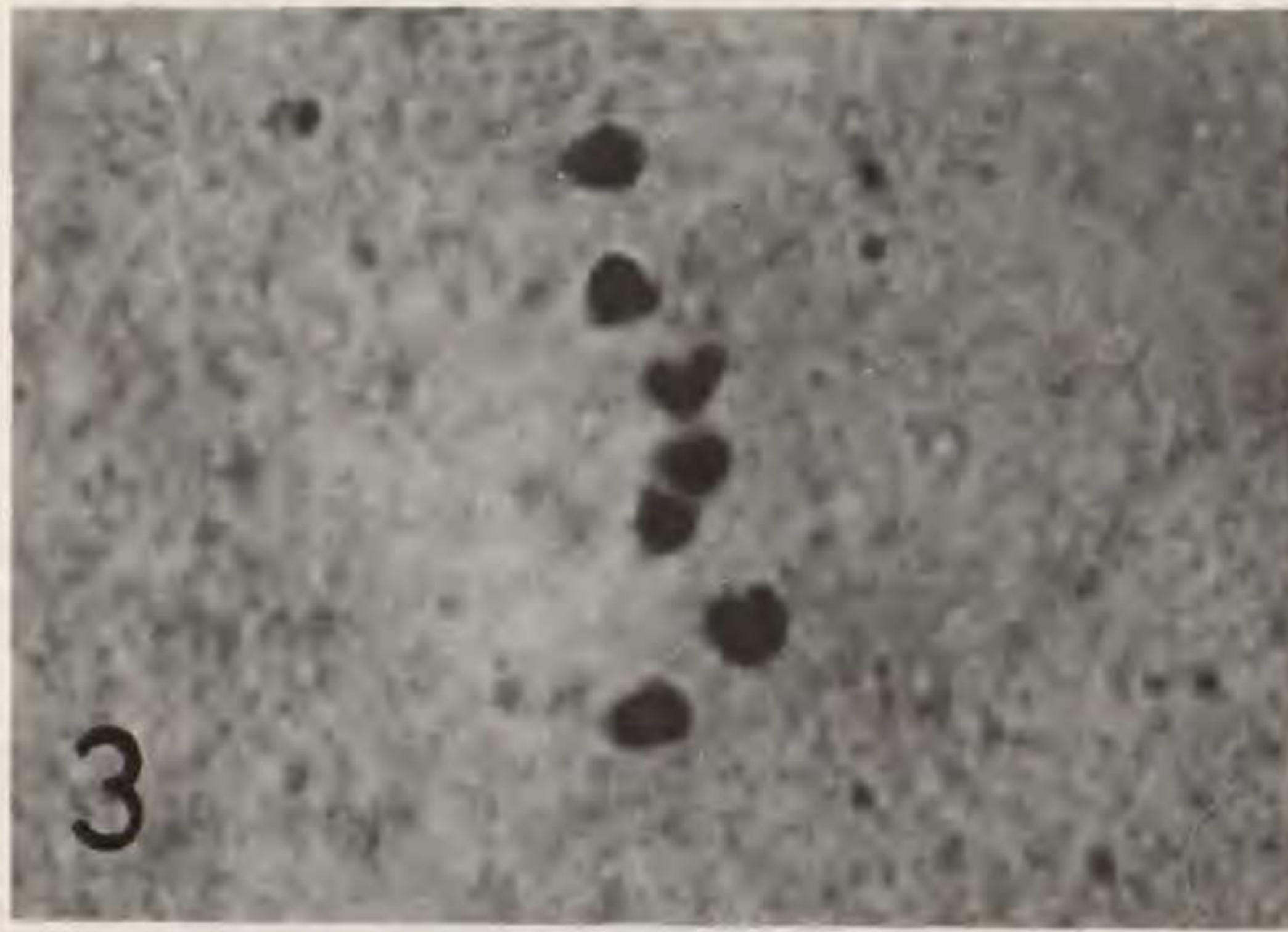
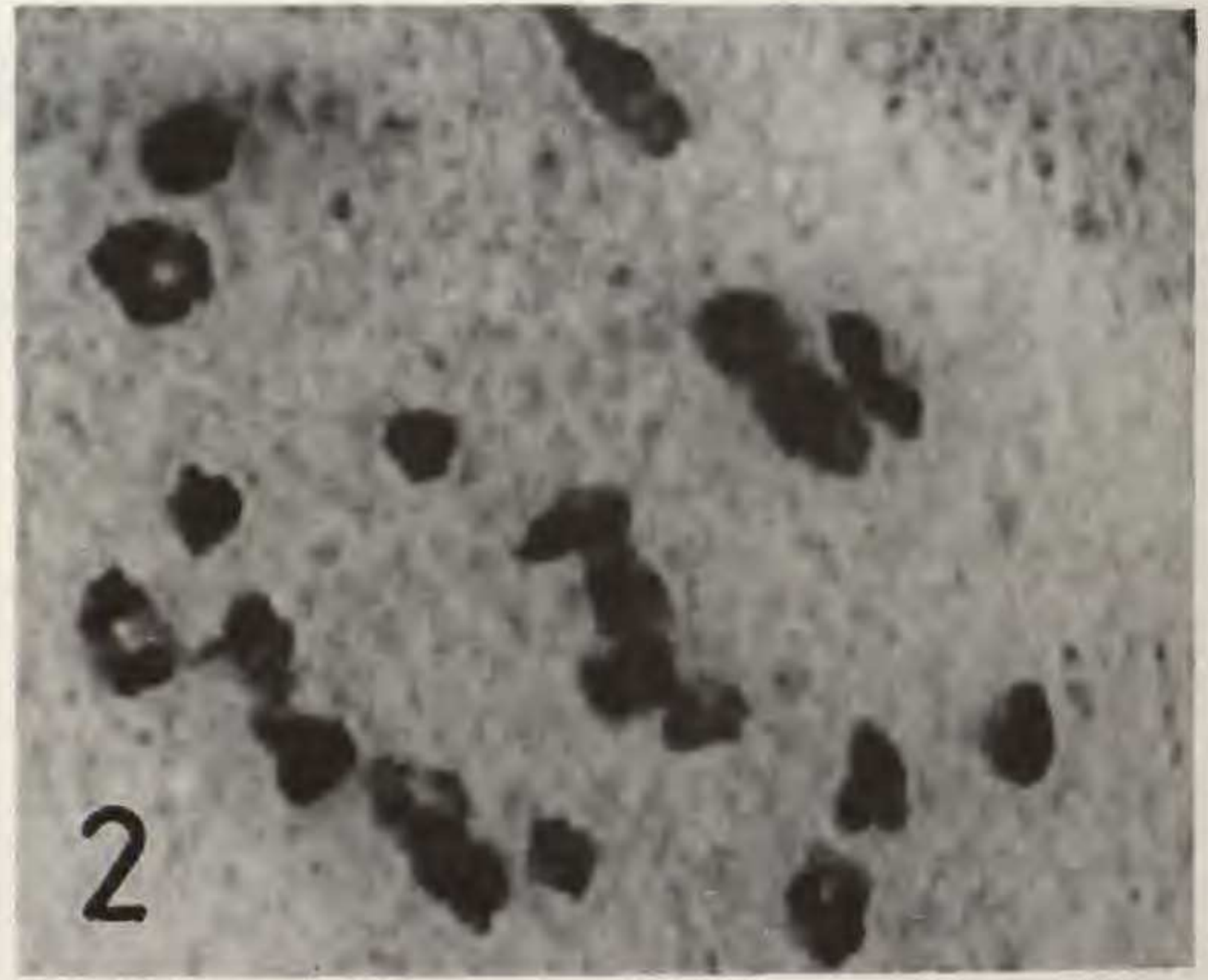
\* Count new to flora of Pakistan.

\*\* Count being reported for the first time.

*sia subtriflora* and *T. strigosa* also have *n* = 11, while *T. purpurea* has both *n* = 11 and *n* = 22, confirming the observations of Srivastav & Raina (1986). In *T. apollinea* we find *n* = 22 (Fig. 2),

previously reported as *n* = 11 (Srivastav & Raina, 1986); therefore the present report is the first of a tetraploid cytotype in this species.

In Robineae, *Gliricidia sepium* has *n* = 11.



FIGURES 1-6. Pollen mother cell meiosis in members of Fabaceae.—1. *Sophora mollis* subsp. *griffithii* (Omer 2057), metaphase I,  $n = 9$ .—2. *Tephrosia apollinea* (Ghafoor 3762), diakinesis,  $n = 22$ .—3. *Cyamopsis tetragonoloba* (Ghafoor 3577), metaphase I,  $n = 7$ .—4. *Cyamopsis tetragonoloba* (Ghafoor 3606), metaphase II,  $n = 7$ .—5. *Indigofera caerulea* var. *caerulea* (Siddiqui 37), diakinesis,  $n = 8$ .—6. *Indigofera hochstetteri* (Ghafoor 3689), metaphase I,  $n = 8$ .

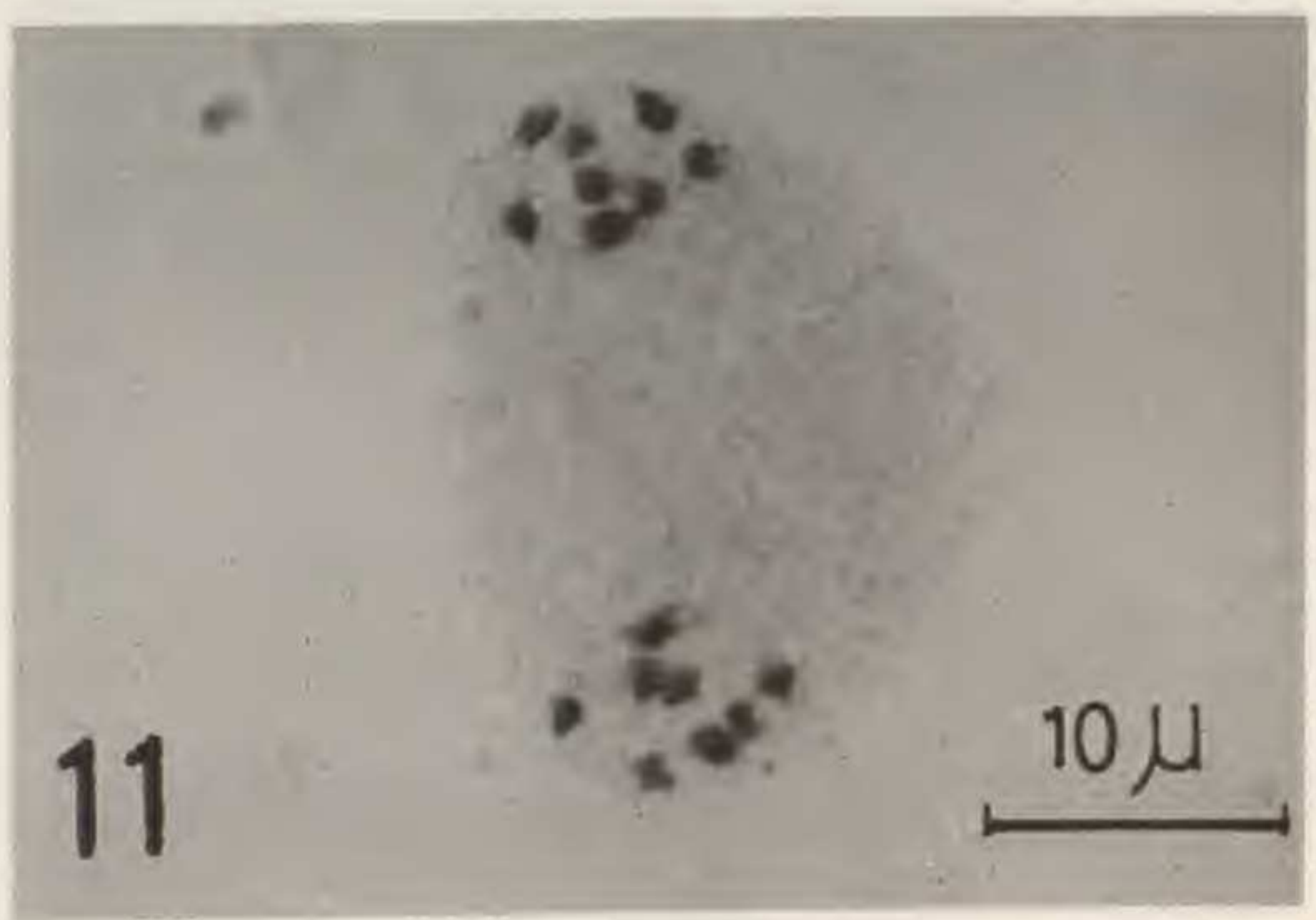
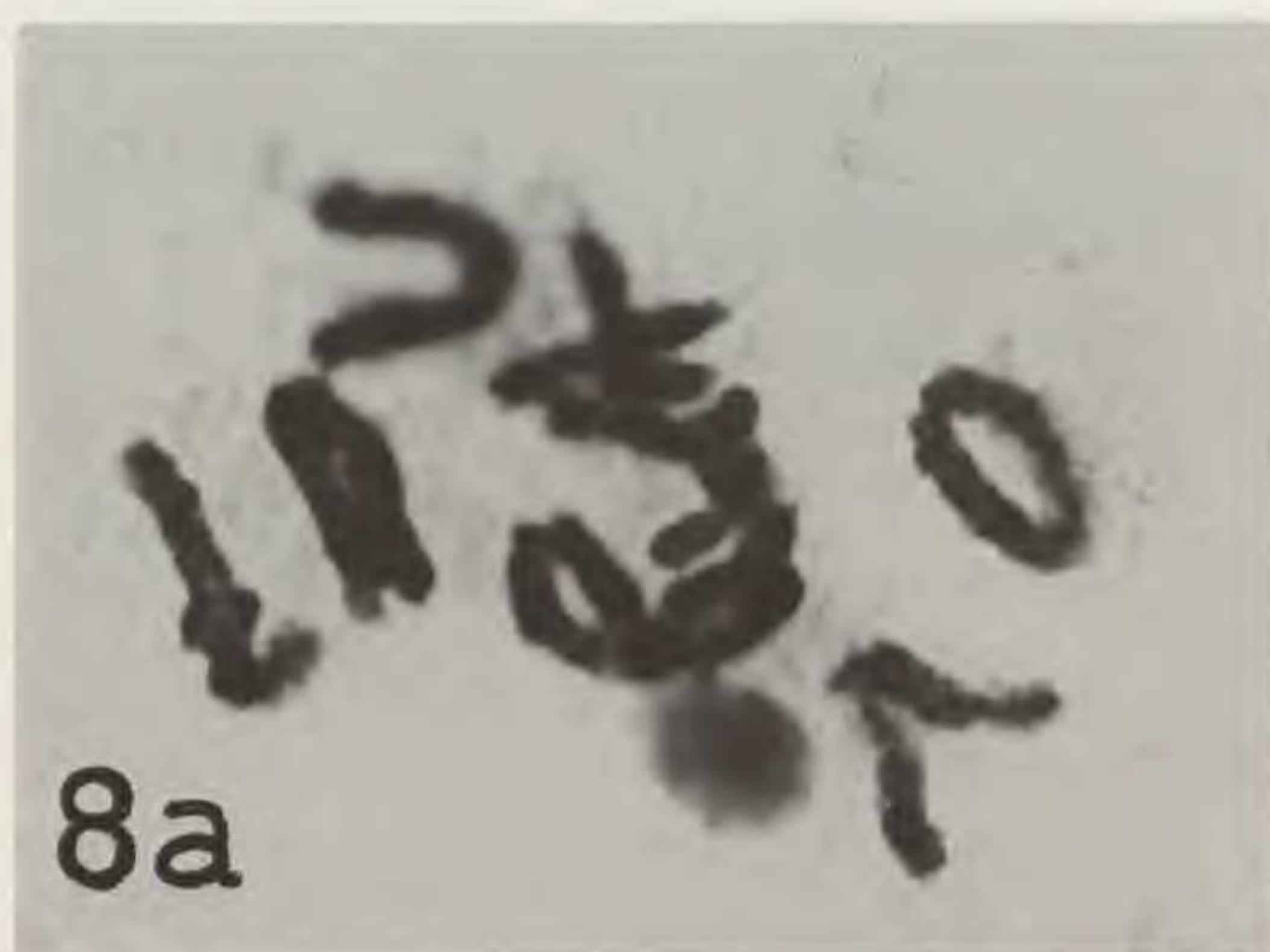
Both  $n = 11$  and  $10$  have been reported for many cultivated species (Goldblatt, 1981a).

In Indigoferaeae, four species of *Indigofera* examined have  $n = 8$  (Table 1), corresponding to the base number for the genus (Goldblatt, 1981a). The count for *Indigofera caerulea* var. *caerulea* ( $n = 8$ ; Fig. 5) is the first report for this species.

Most genera studied by us in Phaseoleae have  $n = 11$ , except *Glycine max* with  $n = 20$  and *Clitoria ternatea* with  $n = 8$  (Table 1). Counts of

$x = 11$  are the most common base number reported in the literature for this tribe (Goldblatt, 1981a) in which  $x = 11$  is almost certainly basic.

In Galegeae, all of our accessions of *Alhagi maurorum* have  $n = 8$ , which accords with earlier records (Amin, 1979; Khatoun & Ali, 1990). Our observations of  $n = 8$  in *Astragalus bicuspidis* (Fig. 8a & b) and  $n = 8$  in *Chesneya parviflora* (Fig. 9) are first chromosome number determinations for these species.



FIGURES 7-11. Pollen mother cell meiosis in members of Fabaceae.—7. *Alysicarpus heterophyllus* (Moin. 45), metaphase I,  $n = 8$ .—8a. *Astragalus bicuspis* (Omer 2470), diakinesis,  $n = 8$ .—8b. *Astragalus bicuspis* (Omer 2470), metaphase I,  $n = 8$ .—9. *Chesneya parviflora* (Omer 2076), early anaphase I,  $n = 8$ .—10. *Taverniera cuneifolia* (Ahsan 54), late anaphase I,  $n = 8$ .—11. *Taverniera glabra* (Omer 2073), late anaphase I,  $n = 8$ .

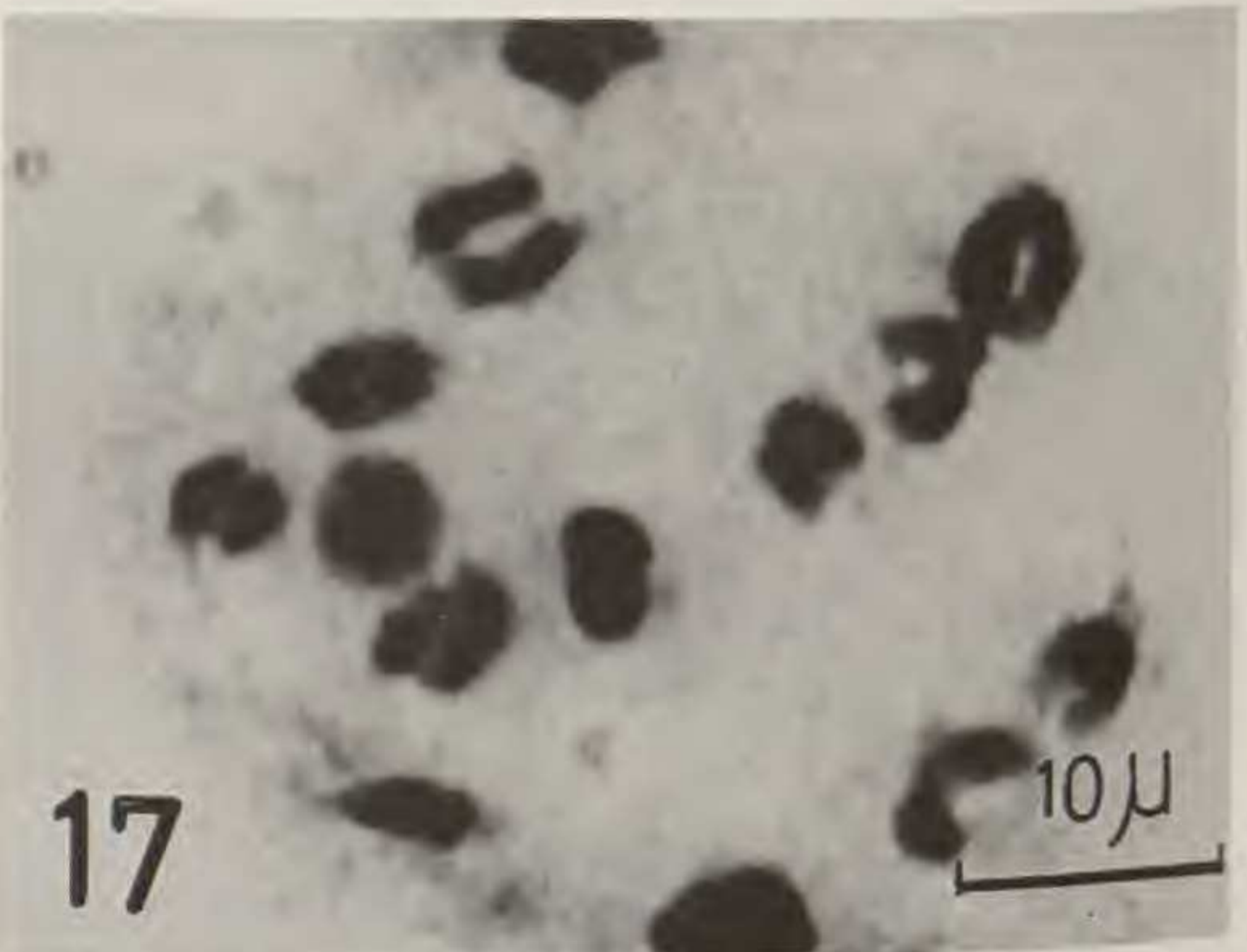
Chromosome numbers of two species of *Taverniera* (Hedysareae) have  $n = 8$ , consistent with the basic number for the tribe (Goldblatt, 1981a). The present count for *T. glabra* ( $n = 8$ ; Fig. 11) is new to science.

In the monogeneric Cicereae our count of  $n = 8$  for *Cicer arietinum* confirms the basic number ( $x = 8$ ) for the species and tribe (Goldblatt, 1981a).

Trifolieae are important in agriculture and already well studied cytologically. *Medicago falcata*

and *M. sativa* have polyploid races. *Medicago falcata* has diploid and tetraploid cytotypes, but the material studied by us is at tetraploid level only. *Medicago sativa* has been extensively studied by various workers, and cytotypes from  $2x$  to  $8x$  have been reported in the literature. We found two cytotypes, i.e.,  $2x$  and  $4x$ , in our accessions. We did not find any polyploid in the rest of the genera of this tribe.

In Crotalarieae our counts for three species of



FIGURES 12-17. Pollen mother cell meiotic and root tip mitotic chromosomes in members of Fabaceae.—12. *Lathyrus aphaca* (Razaq 149), metaphase I,  $n = 7$ .—13. *Trifolium resupinatum* (Ghafoor 3914), metaphase I,  $n = 8$ .—14. *Trigonella foenum-graecum* (Moin. 24), mitotic metaphase,  $2n = 16$ .—15. *Crotalaria juncea* (Ghafoor 3813), metaphase II,  $n = 8$ .—16. *Crotalaria medicaginea* var. *medicaginea* (T. Ali 390) prophase II,  $n = 16$ .—17. *Argyrolobium stenophyllum* (Ghafoor 3829), diakinesis,  $n = 13$ .

*Crotalaria* (Table 1) confirm the earlier reports for the species (Bir & Kumari, 1978; Khatoon & Ali, 1991). In *C. medicaginea* (Fig. 16) both diploids and tetraploids are recorded (Bir & Sidhu, 1975; Bir & Kumari, 1978).

In Genisteae the count for *Argyrolobium stenophyllum*,  $n = 13$  (Fig. 17), is the first for the species. Goldblatt (1981a) suggested  $x = 8$  as the base number for this genus and regards the gametic numbers 15 and 13 as hypotetraploid.

#### LITERATURE CITED

- ALI, S. I. 1973a. Mimosaceae. In: E. Nasir & S. I. Ali (editors), *Flora of Pakistan* 36: 1-40.  
 ———. 1973b. Caesalpiniaceae. In: E. Nasir & S. I. Ali (editors), *Flora of Pakistan* 54: 1-47.  
 ———. 1977. Papilionaceae. In: E. Nasir & S. I. Ali (editors), *Flora of Pakistan* 100: 1-389.  
 AMIN, A. 1979. Chromosome numbers of ten flowering plants of Egypt. *U.A.R. J. Bot.* 22: 73-75.  
 BAQUAR, S. R. & S. H. A. ASKARI. 1970. Chromosome studies in some flowering plants of West Pakistan. II. *Genét. Ibér.* 22: 41-51.

- & A. HUSAIN. 1967. Chromosome studies in some flowering plants of West Pakistan. I. *Phyton* (Buenos Aires) 24: 49-55.
- & B. A. WARSI. 1968. Chromosome Number Reports XV. *Taxon* 17: 91-104.
- , S. AKHTAR & A. HUSAIN. 1965. Meiotic chromosome numbers in some vascular plants of the Indus delta. I. *Bot. Not.* 118: 289-298.
- , A. HUSAIN & S. AKHTAR. 1966. Meiotic chromosome numbers in some vascular plants of the Indus delta. II. *Bot. Not.* 119: 24-32.
- BIR, S. S. & S. KUMARI. 1978. Chromosome Number Reports LIX. *Taxon* 27: 53-61.
- & M. SIDHU. 1975. Weed flora of cultivable lands in Punjab maize fields in Patiala district. *Acta Bot. Indica* 3: 136-141.
- FARUQI, S. A.. 1977. Chromosome numbers of some plants from Pakistan. *Libyan J. Sci.* 7A: 71-72
- FEDOROV, A. A. (editor). 1974. *Chromosome Numbers of Flowering Plants*. Otto Koeltz Science Publishers, West Germany (reprinted).
- GOLDBLATT, P. 1981a. Cytology and the phylogeny of Leguminosae. Pp. 427-463 in R. M. Polhill & P. H. Raven (editors), *Advances in Legume Systematics, Part 2*. Royal Botanic Gardens, Kew.
- (editor). 1981b. Index to Plant Chromosome Numbers 1975-1978. *Monogr. Syst. Bot. Missouri Bot. Gard.* 5: 1-553.
- . 1984. Index to Plant Chromosome Numbers 1979-1981. *Monogr. Syst. Bot. Missouri Bot. Gard.* 8: 1-427.
- . 1985. Index to Plant Chromosome Numbers 1982-1983. *Monogr. Syst. Bot. Missouri Bot. Gard.* 13: 1-224.
- . 1988. Index to Plant Chromosome Numbers 1984-1985. *Monogr. Syst. Bot. Missouri Bot. Gard.* 23: 1-264.
- JAFRI, S. M. H. 1966. *The Flora of Karachi*. Book Corporation, Karachi.
- KHATOON, S. & S. I. ALI. 1982. Chromosome numbers of some plants of Pakistan. *Pakistan J. Bot.* 14: 117-129.
- & ———. 1991. Chromosome numbers in subfamily Papilionoideae (Leguminosae) from Pakistan. *Willdenowia* 20: 159-165.
- MOORE, R. J. (editor). 1973. Index to Plant Chromosome Numbers for 1967-1971. *Regnum Veg.* 90: 1-539.
- QURAISH, H. B. & S. A. FARUQI. 1970. Genetic system in *Rhynchosia minima* and *R. memnonia* (Leguminosae). *Pakistan J. Bot.* 2: 65-82.
- SRIVASTAV, P. K. & S. N. RAINA. 1986. Cytogenetics of *Tephrosia* VI. Meiotic systems in some taxa. *Cytologia* 51: 359-373.