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CHROMOSOME NUMBERS OF SOME PLANTS OF PAKISTAN

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Abstract

Meiotic counts of 25 dicot species belonging to 17 genera in 12 families are reported. One new generic (*Schweinfurthia* A. Braun.) and 5 new specific counts are of *Alysicarpus heterophyllus* (Baker) Jafri & Ali n=8, *A. scariosus* Grah. ex Thwaites n=8, *Sida pakistanica* Abedin n=14, *Tamarix pakistanica* Qaiser n=12, and *Schweinfurthia papilionacea* (Burm. f.) Boiss. n=11.

Introduction

Flora of Pakistan is little known cytologically and is of great interest for additional work on chromosome numbers (Raven 1975). Baquar and his coworkers (1965, 1966, 1967, 1968, 1970), Faruqi (1977) and Faruqi et al (1979) have covered only c. 7.5% of the total native species of this area. In the present work, meiotic counts of 25 dicot species are reported including a new genus and 5 new species.

Materials and Methods

The collections were made from Karachi and some adjoining areas. Floral buds of suitable sizes were fixed on the spot in Carnoy's solution (absolute alcohol-acetic acid, 3:1) and stored at 10^{o}C. The slides were prepared by the routine squash technique with propionic-carmine as the stain. The voucher specimens are deposited in Karachi University Herbarium (KUH).

Results

The results are summarized in Table I. Ploidy level in most cases was calculated according to the basic numbers given by Darlington & Wylie (1955).

Discussion

Flora of Pakistan is little known cytologically. It is estimated that the information about the chromosome numbers of 373 species i.e. c.7.5% of the total 4938 native flo-

TABLE – I

Chromosome numbers and level of ploidy.

Species	Basic No. x	Date & time of collection	Locality & collection No.	Present count n	Previous counts with authority n	2n		Ploidy level
Chenopodiaceae								
Haloxylon recurvum Bunge ex Boiss.	9	30. 9. 1979 11–10 AM	K.U. Campus, 17	9	11	–	Baquar et al, 1966	Diploid
				–	–	12	Faruqi, 1977	"
Caesalpiniaceae								
Cassia senna L.	14	29. 3. 1980 9–55 AM	K.U. Campus, 47	14	14	–	Baquar et al, 1966 (as *C. angustifolia)*	Diploid
		18. 10. 1980 *10–05 AM*	K.U. Campus, 91	14	–	28	Faruqi, 1977 *(as C. angustifolia)*	"
Parkinsonia aculeata L.	14	27. 12. 1979 11–30 AM	Keenjhar Lake, (Thatta Dist.), 26	14	14	–	Baquar & Hussein, 1967	Diploid
				–	–	28	Pantulu in Darlington & Wylie, 1955	
				–	–	28	Atchison (1951) in Darlington & Wylie, 1955	
Papilionaceae								
Alysicarpus heterophyllus (Baker) Jafri & Ali	8	7. 8. 1980 10–45 AM	KU Campus, 78	8	–	–	----------	Diploid
		5. 10. 1980 10–10 AM	KU Campus, 92	8	–	–	----------	"
A. monilifer (L.) DC.	8	7. 8. 1980 10–30 AM	KU Campus. 76	8	8	–	Bir & Sidhu (1967) in Moore, 1973	Diploid
				–	8	–	Baquar & Warsi, 1968	"

A. scarious Grah. ex Thwaites		7. 8. 1980 10–40 AM	KU Campus, 77	8	–	–	----------	Diploid
		5. 10. 1980 10–15 AM	KU Campus, 93	8	–	–	----------	"
Indigofera hochstetteri Baker	8	15. 4. 1980	KU Campus, 60	8	–	16	Singh & Roy (1970) in Moore, 1973	Diploid
		9–30 AM		–	–	32	Bhatt, 1974	Tetraploid
I. linifolia (L.f.) Retz.		8.4. 1980	KU Campus, 58	8	–	16	Singh & Roy (1970) in More, 1973	Diploid
		9–40 AM		–	8	–	Bir & Sidhu (1967) in Moore, 1973	"
I. oblongifolia Forsk.		27. 8. 1980 10–50 AM	KU Campus, 89	8 –	7 –	– 16	Baquar et al, 1966 Bhatt, 1974; Singh & Roy in Moore, 1973; Faruqi, 1977	Diploid "
Crotalaria burhia Ham. ex Benth.	8	6. 5. 1980 9–45 AM	KU Campus, 66	8 –	8 8	– 16	Baquar et al, 1965 Ramanathan, 1955	Diploid "
C. medicaginea Lam. var. *luxurians* (Benth.) Baker		7. 8. 1980 10–50 AM	KU Campus, 80	8	7	–	Sarkar et al, 1980	Diploid
Tephrosia uniflora Pers. ssp *petrosa* (Blatter & Hallb.) Gillet & Ali	11	27. 2 1980 10–00 AM	KU Campus, 42	11	–	–	----------	Diploid
		15. 4. 1980 9–40 AM	KU Campus, 61	11	–	–	----------	"
Zygophyllaceae *Zygophyllum simplex* L.	8	30. 9. 1979 11–00 AM	KU Campus, 16	8 –	8 –	– 16	Baquar et al, 1965; Baquar, 1969 Eid, 1970	Diploid "

TABLE – I (contd.)

Species	Basic No. x	Date & time of collection	Locality & collection No.	Present count n	Previous counts with authority n	2n		Ploidy level
Euphorbiaceae								
Euphorbia hirta L.	9	5. 10. 1980	KU Campus, 94	9	9	–	Gill et al, 1970; Choda & Mehra (1972) in Moore, 1974;	Diploid
				–	–	18	Krishnappa & Reshme, 1980	"
				–	–	12	Chopde (1965) in Ornduff, 1967	"
Malvaceae								
Sida ovata Forsk.	7	27. 2 1980 9–45 AM	KU Campus, 43	14	14	–	Baquar & Hussein, 1967 (as *S. grewioides* Guill.)	Tetraploid
		8. 4. 1980 9–35 AM	KU Campus, 56	14	–	28	Skovsted (1941) in Darlington & Wylie, 1955 (as *S. grewioides* Guill L)	"
S. pakistanica Abedin		8. 4. 1980 9–25 AM	KU Campus, 54	14	–	–	----------	Tetraploid
		19. 8. 1980 10–40 AM	KU Campus, 85	14	–	–	----------	"
Tamaricaceae								
Tamarix pakistanica Qaiser	12	15. 10 1980 12–40 PM	1 mile before Hub Dam, 97	12	–	–	----------	Diploid
Umbelliferae								
Anethum graveolens L.	11	30. 3. 1980	KU Campus, 51	11	–	22	Tamamschjan (1933) in	Diploid

		9–55	AM					Darlington and Wylie, 1955	
					–	11	–	Kordyum (1967) in Moore, 1973	
Boraginaceae									
Heliotropium curassavicum L.	?	27. 4.	1980	Near Darbar	13	–	26	Britton (1951) in Darlington & Whlie, 1955	Diploid
		11–45	AM	Soap factory SITE, 62	–	26	–	Bell (1965) in Ornduff, 1967	Tetraploid
		27. 10.	1980	KU Campus, 103	13	–	–	----------	Diploid
		10–15	AM		–	12	–	Subramanyam & Kamble (1967) in Moore, 1973	?
					–	–	28	Schnack & Covas (1947) in Darlingron & Wylie, 1955	?
Solanaceae									
Solanum albicaule Kotschy	12	6. 5.	1980	KU Campus, 65	12	12	–	Baquar (1967) in Moore, 1973	Diploid
		9–35	AM						
S. incanum L.		2. 4.	1980	Malir, 52	12	12	–	Baquar (1967 in Moore, 1973; Gill & Abubakar, 1975	Diploid
		10–30	AM						
S.nigrum L.		4. 11.	1980	KU Campus, 107	12	12	–	Baquar et al, 1965; Baquar, 1968; Baquar. (1967) in Moore, 1973	Diploid
					–	–	24	Hsu (1967) in Moore, 1973	"
					–	24	–	Rao et al (1971) in Moore, 1973	Tetraploid
					–	–	48	Mitra (1968) in Moore 1973	"
					–	–	72	Gerasimenko & Raznkiova (1968) in Moore, 1973;	Hexaploid

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TABLE – I (contd.)

Species	Basic No. x	Date & time of collection	Locality & collection No.	Present count n	Previous counts with authority n	2n		Ploidy level
							Gadella & Kliphius in Moore, 1973	
				–	12	–	Tandon & Rao (1966) in	Diploid
				–	24	–	Moore, 1973	Tetraploid
				–	36	–		Hexaploid
				–	–	24	Bhaduri (1933) in Darli-	Diploid
				–	–	48	ngton & Wylie, 1955;	Tetraploid
				–	–	72	Venkateswarlu & Rao (1972) in Moore, 1974	Hexaploid
Withania somnifera (L.) Dunal	12	17. 1. 1980 10–16 AM	KU Campus, 28	24	–	48	Bhaduri (1933) in Darlingnton & Wylie, 1955	Tetraploid
		26. 1. 1980 11–30 AM	KU Campus, 36	24	24	–	Baquar (1967) in Moore, 1973	"
		29. 1 1980 9–40 AM	KU Campus, 38	24	–	48	Faruqi, 1977	"
		19. 1 1980 9–45 AM	KU Campus, 39	24	–	–	----------	"
		10. 2. 1980 9–30 AM	KU Campus, 40	24	–	–	----------	
		10. 2. 1980 9–35 AM	KU Campus, 40	24	–	–	----------	"

TABLE – I (contd.)

Species	Basic No. x	Date & time of collection	Locality & collection No.	Present count n	Previous counts with authority n	2n		Ploidy level
Scrophulariaceae								
Schweinfurthia papilionacea (Burm. f.) Boiss.	*11*	29. 1 1980 11–55 AM	KU Campus, 37	11	–	–	----------	Diploid
		6. 10. 1980 10–15 AM	KU Campus, 96	11	–	–	----------	"
Compositae								
Tridax procumbens L.	9	23. 3 1980 10–15 AM	KU Campus, 50	18	–	36	Raghavan & V. (1941) in Darlington & Wylie, 1955; Bhattacharrya & Sharma (1970) in Moore, 1974; Rogers (1969) in Moore, 1973	Tetraploid
				–	18	–	Gupta (1969) in Moore, 1973; Powell & King (1969) in Moore, 1973; Tandon & Bhalla (1968) in Moore, 1973; Solbrig et al (1972) in Moore, 1974	"

KU=Karachi University

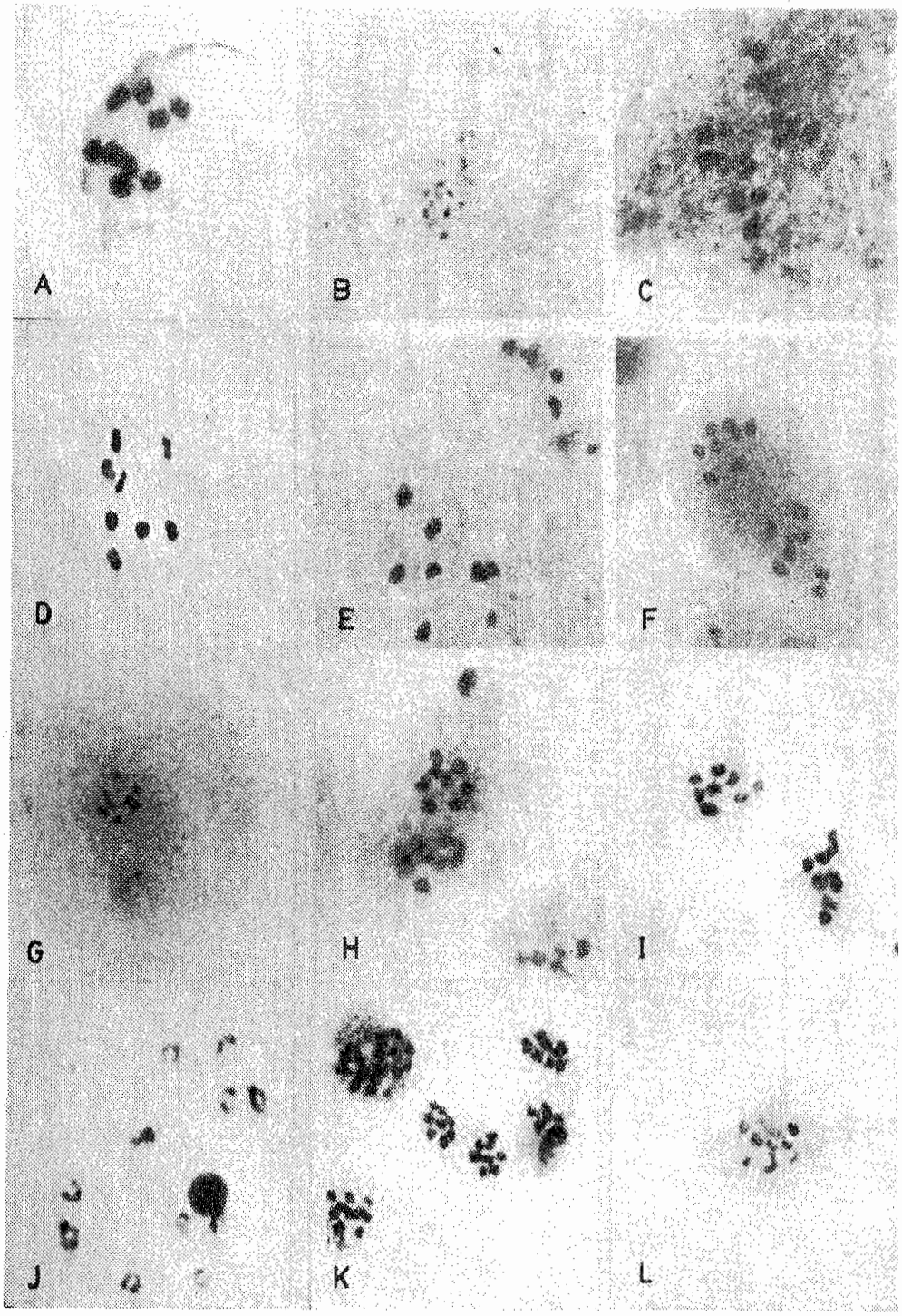

Fig. 1. A. *Haloxylon recurvum* (metaphase-I): n=9, B. *Parkinsonia aculeata* (metaphase-I): n=14, C. *Alysicarpus heterophyllus* (anaphase-I): n=8, D. *Alysicarpus monilifer* (metaphase-I): n=8, E. *Alysicarpus scariosus* (late anaphase-I): n=8, F. *Indigofera hochstetteri* (late anaphase-I): n=8, G. *Indigofera linifolia* (metaphase-II): n=8, H. *Indigofera oblongifolia* (metaphase-II): n=8, I. *Crotalaria medicaginea* var. *luxurians* (early metaphase-II): n=8, J. *Tephrosia uniflora* subsp. *petrosa* (diakinesis): n=11, K. *Zygophyllum simplex* (metaphase-II): n=8, L. *Euphorbia hirta* (metaphase-I): n=9,

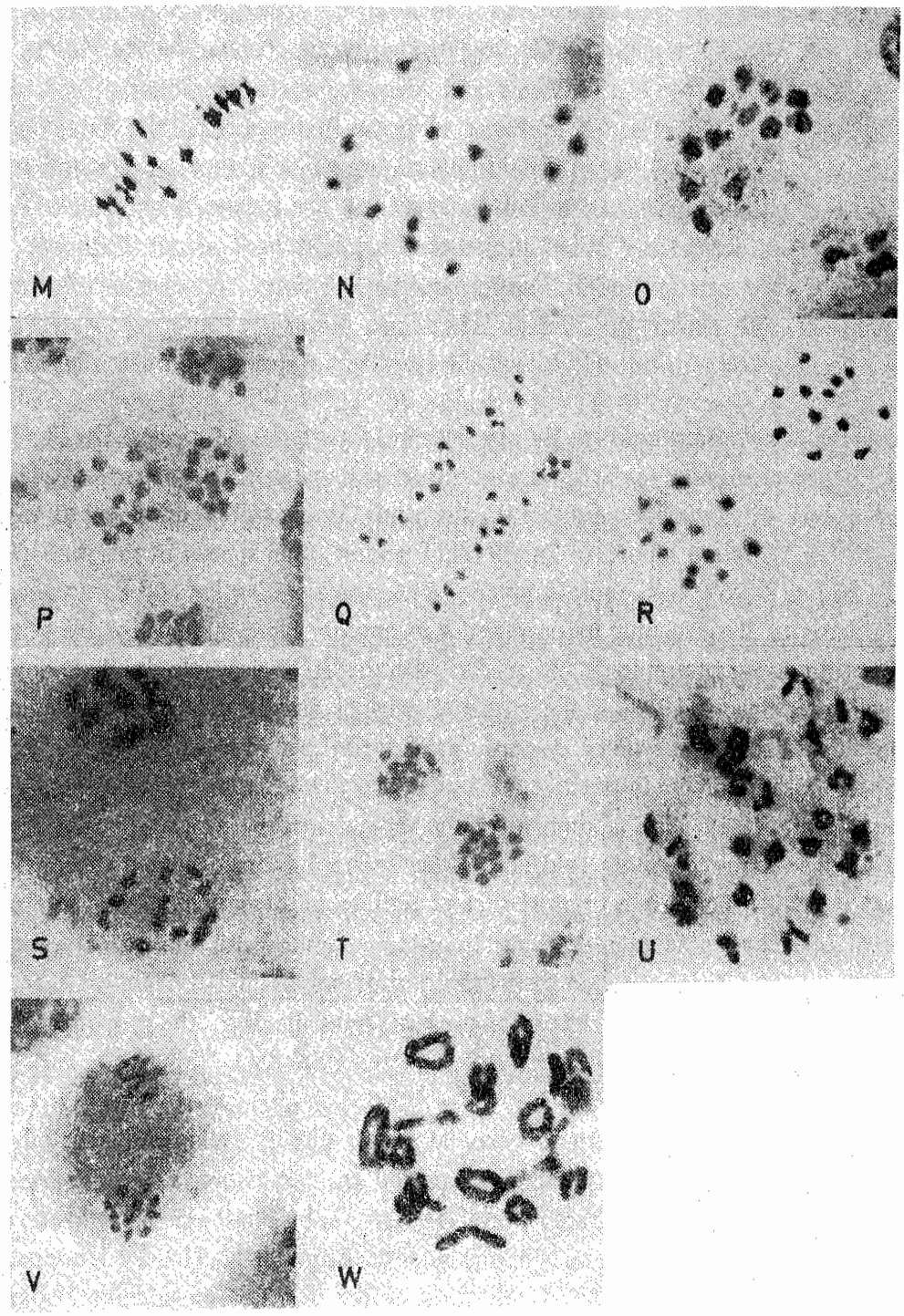

Fig1. M. *Sida ovata* (metaphase-I): n=14, N. *Sida pakistanica* (metaphaes-I): n=14, 0. *Tamarix pakistanica* (metaphaes-I): n=12, P. *Anethum graveolens* (metaphase-II): n=11, Q. *Heliotropium curassavicum* (anaphase-I): n=13, R. *Solanum albicaule* (metaphase-II): n=12, S. *Solanum incanum* (metaphase-II): n=12, T. *Solanum nigrum* (late anaphase-I): n=12, U. *Withania somnifera* (diakinesis): n=24, V. *Schweinfurthia papilionancea* (metaphase-II): n=11, W *Tridax procumbens* (diakinesis): n=18. (x 3200 except B & UB x 1280, U x 2400).

wering plant species are now available (Ali, 1978).In the present work, chromosome numbers for 25 species are reported. Counts for *Alysicarpus heterophyllus, A. scariosus, Sida pakistanica, Tamarix pakistanica* and *Schweinfurthia papilionacea* not hitherto reported are made. Count for *S. papilionacea* is the first report for the genus also. *Alysicarpus heterophyllus* and *Tamarix pakistanica* are endemic species, former being endemic to Sind, the southern providnce of Pakistan (Ali, 1977) and latter is endemic to Pakistan (Qaiser, 1976). Counts for 7 other species viz. *Indigofera hochstetteri, I. linifolia, Crotalaria medicaginea* var. *luxurians, Euphorbia hirta, Anethum graveolens, Heliotropium curassavicum* and *Tridax procumbens* were not previously reported from Pakistan. This brings the total number of cytologically investigated species from Pakistan to 385.

Our observations confirm the chromosome counts for 13 species. The ploidy level of *Zygophyllum simplex* (n=8) however seems to be debatable. Darlington & Wylie (1955) have proposed 11 as the baisc number for the genus. Moore (1973) has listed some species with 2n=18. There are reports of 2n=20 also for some other species of this genus (Baquar, 1969). Baquar (1969) has reported n=8 for *Zygophyllum simplex* and *Z.coccineum* and on the basis of these counts he proposed 4 as another basic number for the genus, the species with n=8 as tetraploids and species with 2n=20 as pentaploids. Basic number as defined by Swanson (1958) is the ancestral original number from which polyploid or aneuploid numbers have evolved. According to Love & Love (quoted by Davis & Heywood, 1963) the basic numbers in practice are usually calculated from the lowest diploid number in the group (i.e. the 'n' number of the diploid species). Inference of a theoretical basic number requires certain evidences either internal or from related genera (Davis & Heywood, 1963). There is no report of n=4 neither in *Zygophyllum* nor in any other genus of Zygophyllaceae. Mere calculation of basic number without satisfactory evidence may lead to false representation of distribution of polyploidy. It therefore seems more plausible at present to regard 8 as one of the basic numbers. If so, the genus may be regarded as tetrabasic with basic numbers forming a series from 8-11.

Some species are known to occur at higher ploidy levels from areas other than Pakistan, but todate, only diploids are reported from Pakistan, e.g. *Indigofera hochstetteri* (x=8) is reported at tetraploid level (i.e. 2n=32) by Bhatt (1974). *Solanum nigrum* has been investigated by several workers such as Baqur et al, (1965), Hsu (in Moore, 1973), Rao et al (in Moore, 1973), Mitra (in Moore, 1973), Gerasimenko & Raznikova (in Moore, 1973), Bhaduri (in Darlington & Wylie 1955), Venkateswarlu & Rao (in Moore, 1974) and individuals at diploid, tetraploid and hexaploid level are known to occur in nature (Table I). In case of *Heliotropium curassavicum* (x=13) also, Bell (in Ornduff, 1967) has reported n=26. Further, there are reports of n=12 (Subramanyam & Kamble in Moore, 1973) and 2n=28 (Schnack & Covas in Darlington & Wylie, 1955). If these counts are correct, n=12 represents a diploid individual with x=12 and individual with 2n=28 may be a tetraploid with x=7 in view of the range of basic numbers (7-13) proposed by Darlington & Wylie (1955) for the genus. If it is so, there seems to be an aneuploid

variation in basic numbers within the species. Further studies may reveal whether the different chromosome races of the above mentioned species do occur in our area or not.

Some of the counts reported earlier are not in conformity with the present counts. For *Indigofera oblongifolia*, Baquar et al (1966) have reported n=7 (present count n=8), for *Crotalaria medicaginea* var. *luxurians*, Sarkar et al,(1980) have reported n=7 (present count n=8), for *Euphorbia hirta*, Chopde (in Ornduff 1967) has reported 2n=12 (present count n=9), for *Haloxylon recurvum*, three different numbers are reported, i.e. n=9 (present count) n=11 (Baquar et al, 1966) and 2n=12 (Faruqi,1977). Gametic numbers 11 and 6 are uncommon in the genus *Haloxylon*, for there are reports of 2n=18 for *H. ammodendron* (C.A. Mey.) Bge. by Hanelt (1973), for *H. articulatum* (Cav.) Bge. by Bhattacharya et al,(1971) and by Murin & Chaudhri (in Moore, 1973) and for *H. salcornicum* (Moq.-Tand.) Bge. by Murin & Chaudhri in Moore (1973). It may be mentioned that 9 is the basic number for most genera of Chenopodiaceae.

Variation in chromosome number within the same species however is not very uncommon (Davis & Heywood, 1963) and is more likely to occur within species of wide distribution (Heywood, 1967; Stebbins, 1971). Numerous examples of intraspecific or intravarietal chromosome variation are available (Ladizinsky, 1978; Uhl, 1972; Ornduff, 1979; Gould, 1979; Jalas & Uotila 1976). Such differences may either be euploidal or aneuploidal. Usually the chromosome variants occur in different localities, but they may also occur in the same locality. In view of this, the counts available for a considerable proportion of our widely distributed species investigated outside Pakistan may indeed indicate the presence of chromosome races distributed in different geographical areas. It therefore seems necessary to investigate the local members of these species. Another reason for the revaluation of older counts is the suspicion of error in the previous works, which may be due to faulty cytology, faulty taxonomy or both (Moore, 1968). It would suggest that investigation of cytologically unknown species and need for a reappraisal of older counts usually does exist.

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