

KARYOMORPHOLOGICAL STUDIES IN *GASTROCHILUS CALCEOLARIS* (BUCH HAM) D. DON (ORCHIDACEAE)

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Gastrochilus D. Don, A Vandoideae taxa of Orchidaceae, attains a position with ten species in India. The present paper deals with karyomorphological study on *G. calceolaris* (Buch.- Ham.) D. Don, first time from the area, revealed the somatic number to be $2n = 38$ and some tetraploid and octaploid cells of $2n = 76$ and 152 and gametic number $n = 19$. The meiosis is regular. On the basis of chromosome number reports for eight Indian species from North-East Himalaya, North-West Himalaya, Peninsular India and the present study, the earlier proposed basic number $x = 19$ is supported. It seems that the speciation in the genus has occurred through chromosomal repatterning and polyploidy/aneuploidy, on this basic number.

Key Words : *Gastrochilus*, Orchid, Karyomorphology.

The genus *Gastrochilus* D. Don (Sub. fam. Vandoidac) have 15 epiphytic species and is widely distributed in tropical and subtropical regions of the world. Cytodata available in the genus are based on chromosome number alone. The present investigations briefly reports the chromosome number and karyotype details in *G. calceolaris* (Buch. = Ham ex Sm) D. Don.

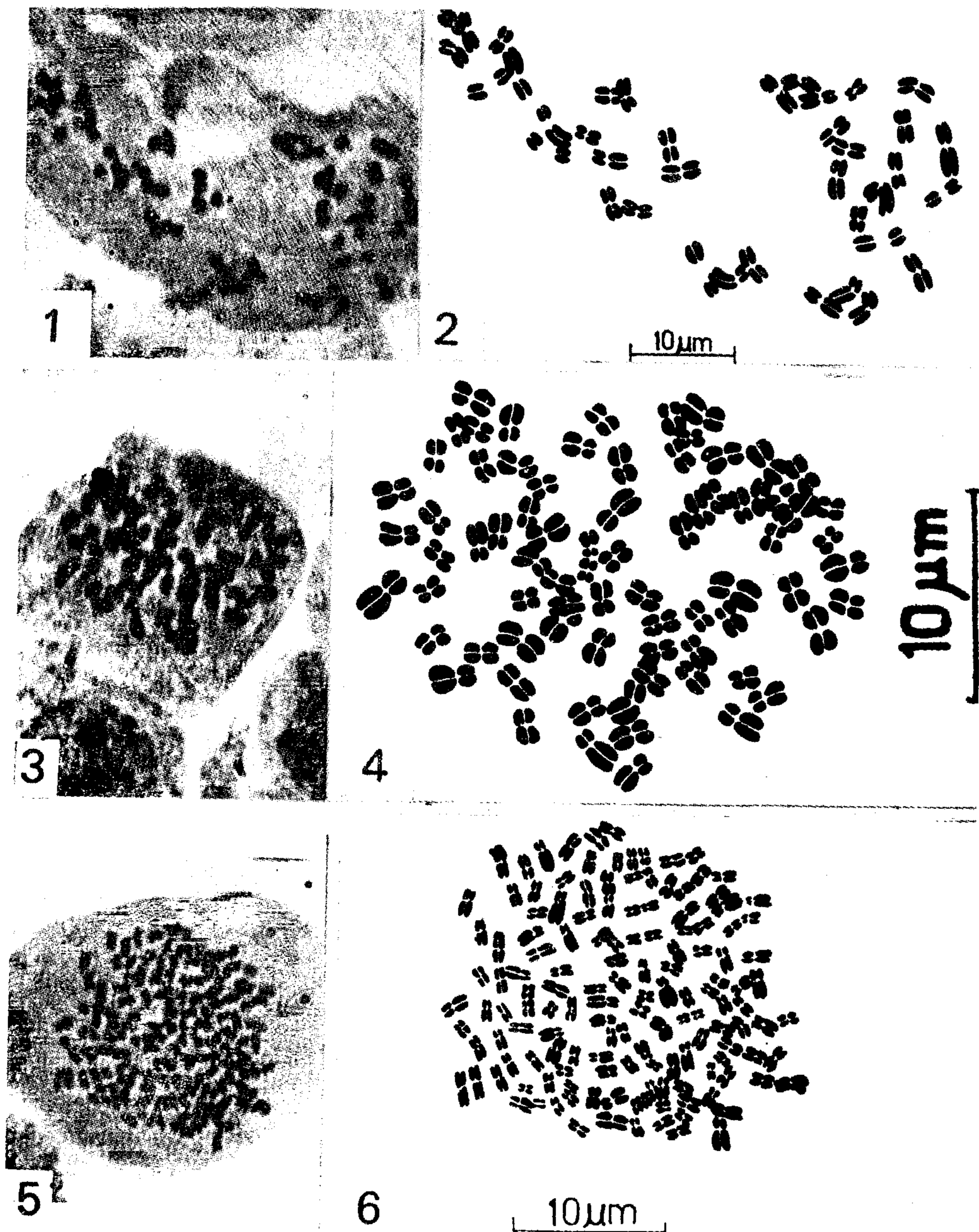
MATERIALS AND METHODS

G. calceolaris, an epiphytic orchid with root creeping or short stemmed, was collected from Rajpur Road, (Dehra Dun) and Agrakhal (Tehri-Garhwal) or Shiwaliks. Excised root tips after removing the velamen are pretreated with 0.002 M 8-Hydroxy quinoline for 3½ hrs at 12-16°C and fixed in acetic alcohol (1:3) for 24 h. They were stained in 1% aceto-carmin and squashed were made following Tanaka (1959). The metaphase plates were observed and immediately photographed. Camera lucida drawings of 10-12 well spread plates were made at table level. The chromosome number were counted and their morphology was determined following Levan *et al.* (1964) and Tanaka (1980). For a comparative study, the chromosomes are broadly classified as long (above 5 µm), medium (2-5µm) and short (below 2 µm). The long, medium and short chromosomes are abbreviated as L, M and S respectively. Centromere positions at median point, median, submedian and subterminal are given in parenthesis as M, m, sm and st in karyo-

typic formulac. Meiotic studies are done using pollen mother cells (PMCs).

OBSERVATIONS

The normal somatic number in *G. calceolaris* is $2n = 38$ (Figs. 1, 2). Some tetraploid with $2n = 76$ (Figs. 3, 4) and octaploid cells $2n = 152$ (Figs. 5, 6) have also been confronted. In normal case of $2n = 38$, all chromosomes are of medium size, range between 2.21 µm-4.86 µm in length. Of the 19 pairs, 6 pairs have centromere exactly at the median point (6th, 7th, 8th, 15th, 16th and 17th pairs). The remaining 13 chromosome pairs are either have centromere in median (1st, 4th, 5th, 10th-14th, 18th and 19th pairs) or sub-median regions (2nd, 3rd and 9th pairs). The total chromosome length (TCL) of the complement is measured as 62.32 µm. The karyotype is symmetrical (Fig. 7) and represented as follows : $K : 2n = 2x = 38$ 6M(M*) + 10(m) + 3M(sm). Interaploid number ($2n = 76$), chromosomes are of medium and short size, range between 1.326-2.652 µm in length. Of the 38 pairs, 19 pairs have centromere exactly at the median point (6th, 7th, 14th-25th, 34th-38th pairs). The remaining 19 pairs are either have centromere in median (1st - 5th, 8th - 13th and 26th 32nd pairs) or sub-median regions (33rd pairs). The TCL of the complement is measured as 67.18 µm. The karyotype is symmetrical (Fig. 8) and represented as follows : $K : 2n = 4x = 76 = 2$ M(M*) + 5M(m) + 17 S(M*) + 13 S(m) + 1S(sm).



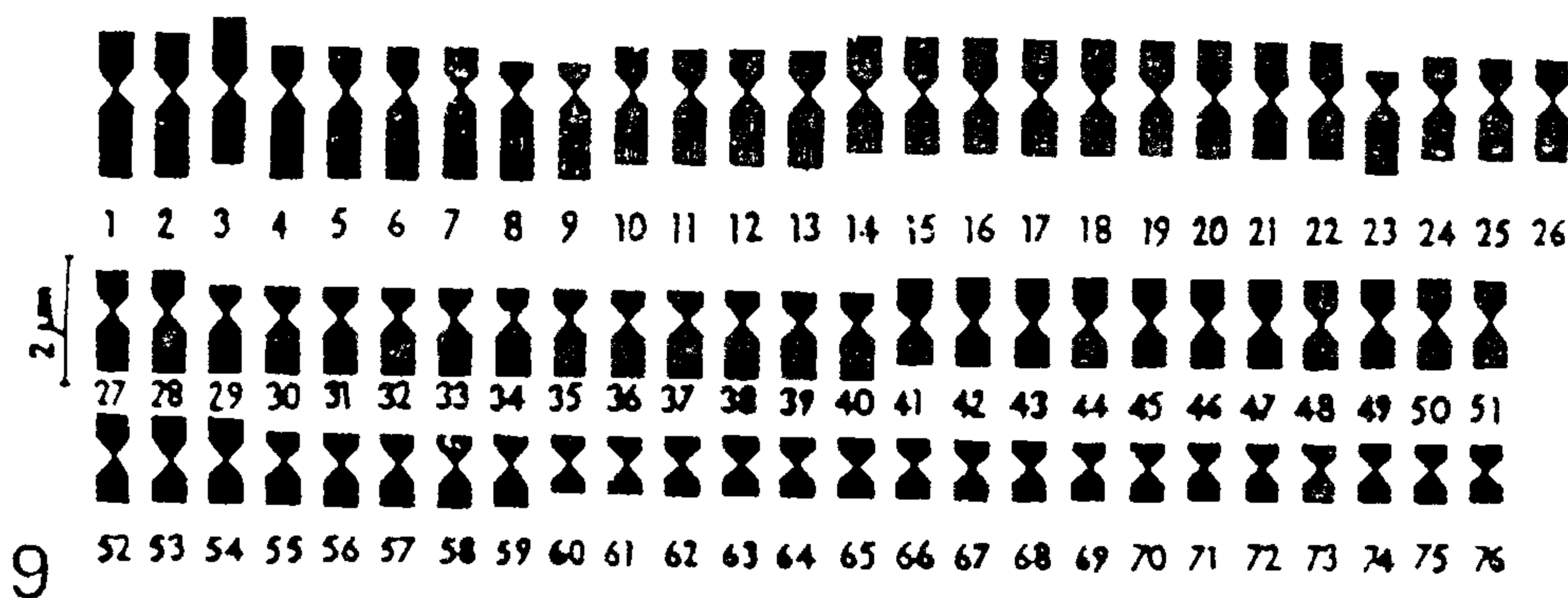
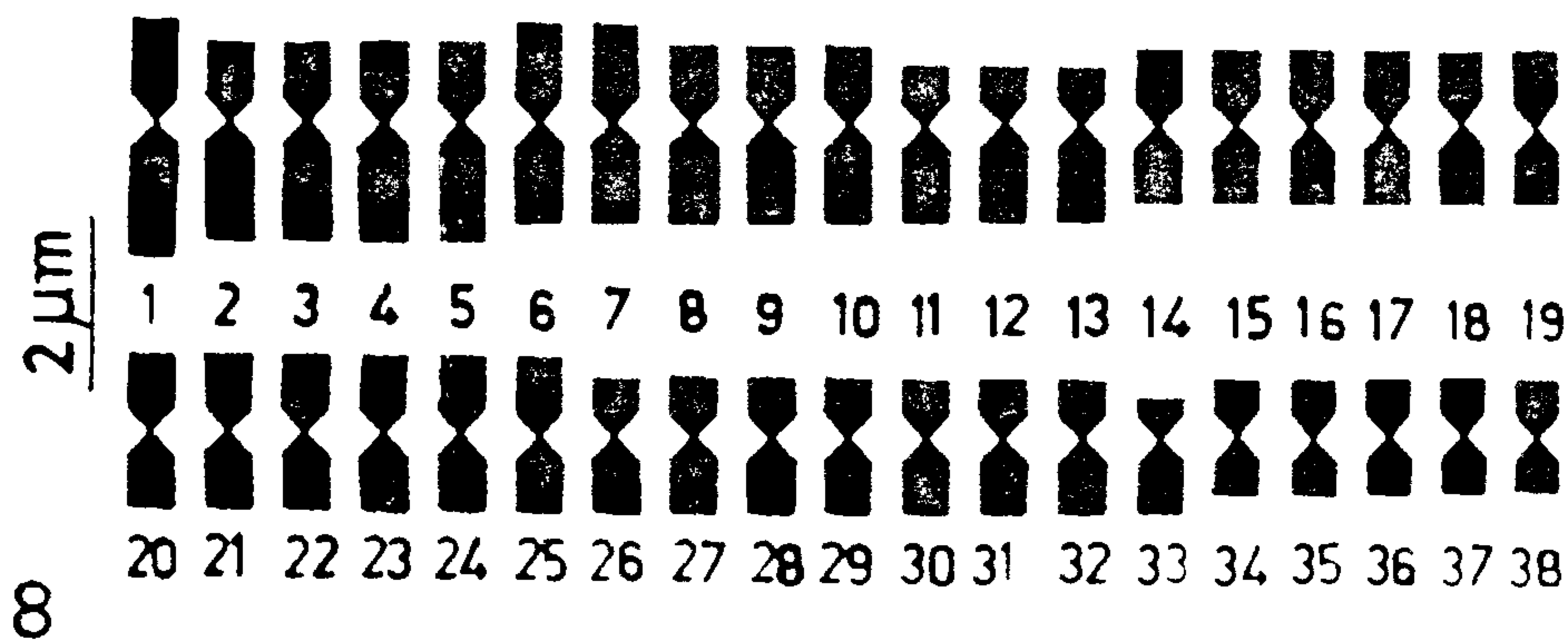
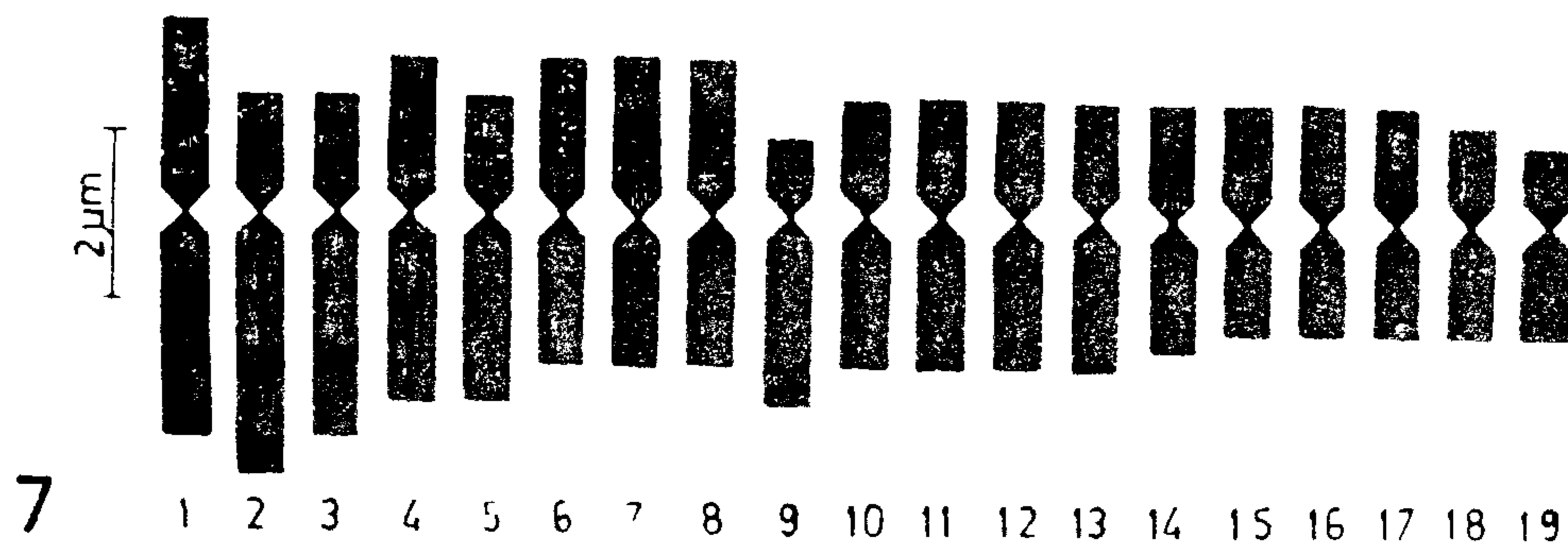
Figures 1-6. Photomicrographs and camera lucida drawings of chromosomes in *G. calceolaris* : 1-2, $2n = 38$; 3-4, $2n=76$; 5-6, $2n=152$.

In case of octaploid number, all chromosomes are of short size, range between $0.884 \mu\text{m}$ - $1.326 \mu\text{m}$ in length. Of the 76 pairs, 52 pairs have centromere exactly at the median point (3rd, 14th - 22nd, 29th-54th and 60th-76th). The remaining 23 chromosome pairs are either have centromere in median (1st, 2nd, 10th-13th, 24th -28th and 55th-59th pair) or sub-median regions (4th-9th and 23rd

pairs). The total chromosome length of the complement is measured as $105.41 \mu\text{m}$. The karyotype is symmetrical (Fig. 9) and represented as follows :

$$K : 2n=8x=152=53 S(M^*) + 16 S(m) + 7 S(sm).$$

Meiosis is almost regular. During anaphase - I regular disjunction of chromosomes to the poles is noted (Fig. 10).



Figures 7-9. Telegrams in *G. calceolaris* : 7, 2n=38; 8, 2n=76; 9, 2n=152.

DISCUSSION

Chromosome number and basic number : Of the taxonomically established 10 Indian species in the genus *Gastrochilus*, the chromosome number and/or karyotypes are reported in eight (Table-I). The available somatic chromosome number reports in *G. calceolaris* are 2n = 34-38, 38, 40, 76 and 152 (Table - I). The normal meiosis without any

sort of irregularities and consistently observed n = 19 (Table -I) chromosome number in various species of the genus, on record, force us to think that the basic number of the genus is x = 19. The somatic counts like 34-38 and 40 may be aneuploid on this basic number.

Karyomorphology and speciation : Krishnamohan and Jorapur (1986) gave karyomorphology in the

Table 1: Chromosome numbers in *Gastrochilus* D. Don.

Taxon	Phytogeographic region of investigation	Chromosome number		Author(s)
		n	2n	
1. <i>G. acutifolius</i> (Lindl.) O. Ktze	NEH	19	-	Viz <i>et al.</i> , 1976a; Shekhar, 1984
2. <i>G. calceolaris</i> (Buch.-Ham.) D. Don	NWH	19	-	Arora, 1971; Mehra and Kashyap, 1979; Viz <i>et al.</i> , 1981
		19	38	Mehra and Kashyap, 1984d
		19	38	Authors (32 m) + 6 (sm))
			76	Authors
			152	Authors
	NEH	19	-	Vij and Mehra, 1976
3. <i>G. dalzellianus</i> (Sant.) Sant. and Kap.			38	Mehra and Vij. 1970
		PI	-	38 Krishnamohan and Jorapur, 1986 (22(m) + 16 (sm))
4. <i>G. dasypogon</i> (Sm.) O. Ktze.	NEH	19	-	Shekhar, 1984
	NEI	-	38	Sharma and Chatterji, 1966
		19	34-38	Mehra, 1983
			40	Jorapur and Hegde, 1980
5. <i>G. distichus</i> (Lindl.) O. Ktze	PI	-	38	Jorapur and Kulkarni, 1980
	NEH	19		Mehra and Vij. 1970; Vij and Mehra, 1976
6. <i>G. inconspicua</i> (Hk. f.) Seidenf.	NWH	19	38	Shekhar, 1984
	NEH	19		Mehra and Kashyap, 1979, 1984d.
		19		Mehra and Vij. 1970; Vij and Mehra, 1976; Vij and Shekhar, 1983.
7. <i>G. maculatus</i> O. Ktze.	NEI	19	Ca-42	Mehra, 1983
	PI		38	Krishnamohan and Jorapur, 1986 (30 (m) + 8 (sm))
8. <i>G. pseudodistichus</i> (King and Pantl.)	NEH	19		Mehra and Vij. 1970; Vij and Mehra, 1976
			19+2-78	Shekhar, 1984.

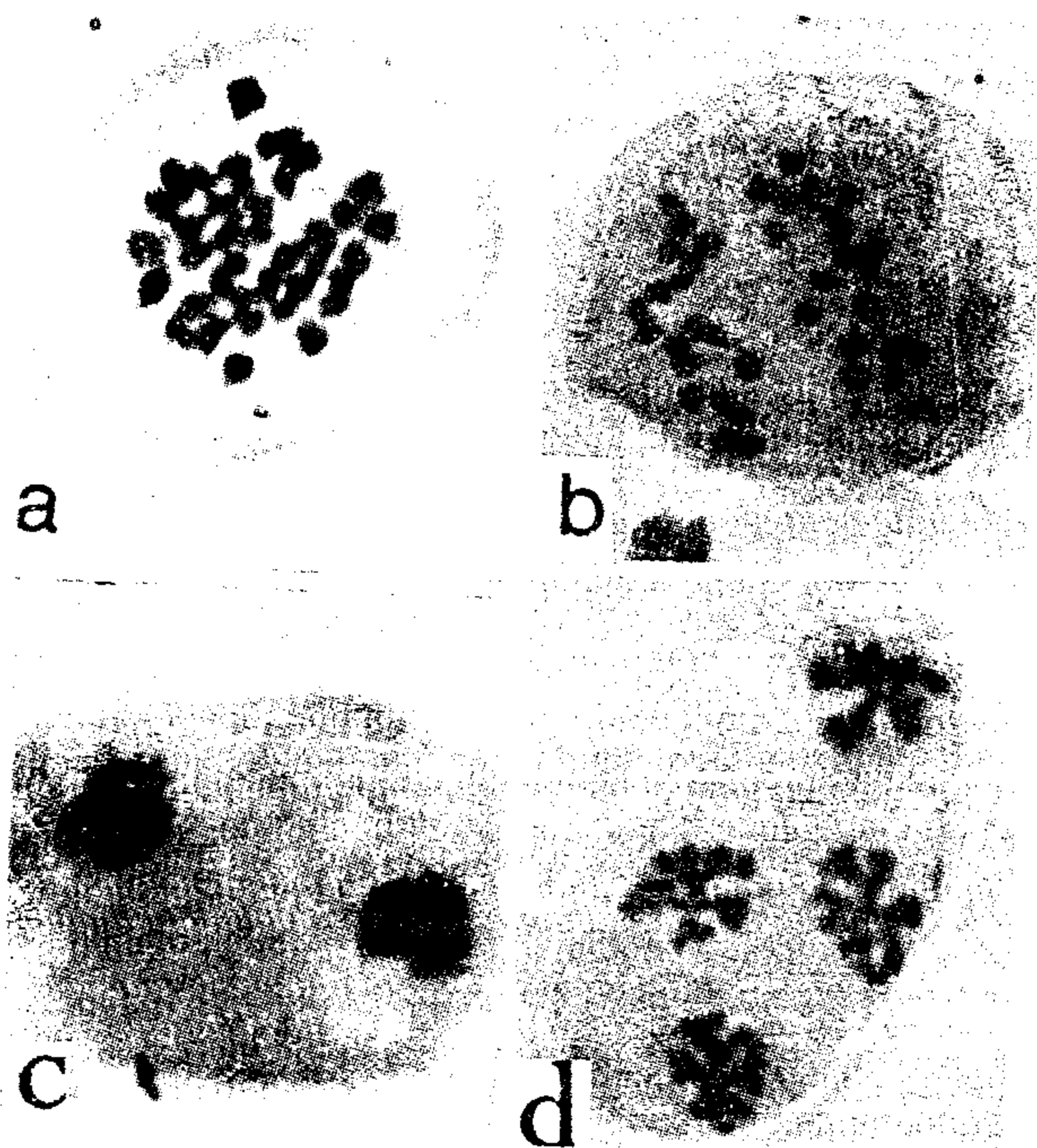


Figure 10. *G. calceolaris*, meiotic stages : (a), Late metaphase-I showing 38 chromosomes; (b), Equal disjunction of chromosomes (19 at each pole) at Anaphase; (c), Telophase-I; (d), Telophase-II equal distribution of chromosomes.

two species of the genus *G. dalzellianus* and *G. maculatus*. While comparing the karyotype of the present study with the above two, it is noted that the two species of Peninsular India and one of the present study with $2n = 38$ from the N-W Himalaya show the preponderance of medium size chromosome with mostly median and submedian centromeres (Table 1). This indicates that the N-W Himalaya and peninsular India *Gastrochilus* species have co-evolved and establish as species with the impact of geographical distribution.

Polyploidy : The occurrence of polyploid cells with $2n = 76$ and 152 with different karyotypes in the present study and different chromosome numbers observed by other workers is a significant feature to believe that aneuploidy and polyploidy have played a role in speciation - a common feature of Orchids.

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