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KARYOLOGY OF INDIAN VARIETIES OF *CAPSICUM ANNUUM* LINN. (SOLANACEAE)

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Most of the Indian authors have classified Indian *Capsicum* into two species, *C. annuum* Linn. and *C. frutescens* Linn. (HAINES 1922, PRAIN 1903, RICHHARIA 1957, CHOPRA *et al* 1955, WETH. IND. 1950). The common Indian varieties of *C. annuum* are: Var. *acuminata* Fingh., Var. *grossum* Sendt., Var. *longum* Sendt., Var. *conooides* Irish. and Var. *cerasiforme* Irish. (WETH. IND. 1950).

Discrete cytological investigations are found in records. A comparative study of the karyotypes of all common varieties and forms has been attempted here.

MATERIALS AND METHODS

The varieties of *Capsicum annuum* Linn. included in the present investigation are: (1) Var. *acuminatum* Fingh. (2) Var. *conooides* Irish. - conical form. (3) Var. *conooides* Irish. oblong conical form. (4) Var. *cerasiforme* Irish. (5) Var. *longum* Sendt. - a very long form. (6) Var. *grossum* Sendt. - « Californian Wonder » (hort.). (7) Var. *grossum* Sendt. - « Ruby King » (hort.). (8) Var. *grossum* Sendt. - « Elephant's Trunk » (hort.). (9) Var. *grossum* Sendt. - « Chinese Giant » (hort.).

For the study of somatic chromosomes from root-tips the aceto-orcein-HCL technique after pretreatment with aesculin (SHARMA and SARKAR, 1955) was followed.

Observations were made under oil immersion lens. Figures were drawn with camera lucida at a magnification of 2500 approximately.

RESULTS AND CONCLUSIONS

Chromosomes of the varieties vary in number and length, as well as in the position and number of secondary constrictions. The important features have been summarized in Table I.

TABLE I

Varieties	2n	chromosome length (n), μ	Position of Pr. constricts.	No. of chr. with sec. constricts. (2n)
<i>acuminatum</i>	24	83.20	M, S (nearly ST in one pair)	10
<i>conoides</i> - conical	24	73.60	M, S (nearly ST in one pair)	4
<i>conoides</i> - oblong - conical	36	65.00	M, S (nearly ST in one pair)	4
<i>cerasiforme</i>	24	71.00	M, S (nearly ST in two pairs)	8
<i>longum</i>	24	30.00	M, S.	4
<i>grossum</i> - « Californian Wonder »	24	62.75	M, S.	6
<i>grossum</i> - » Ruby King »	36	53.40	M, S.	6
<i>grossum</i> - « Elephant's Trunk »	36	73.75	M, S, nearly ST	10 (including 2 sup.)
<i>grossum</i> - « Chinese Giant »	48	104.75	M, S, nearly ST	22 (including 4 sup.)

M = median; S = submedian; ST = subterminal;
Sup. = Chromosomes with supernumerary constrictions.

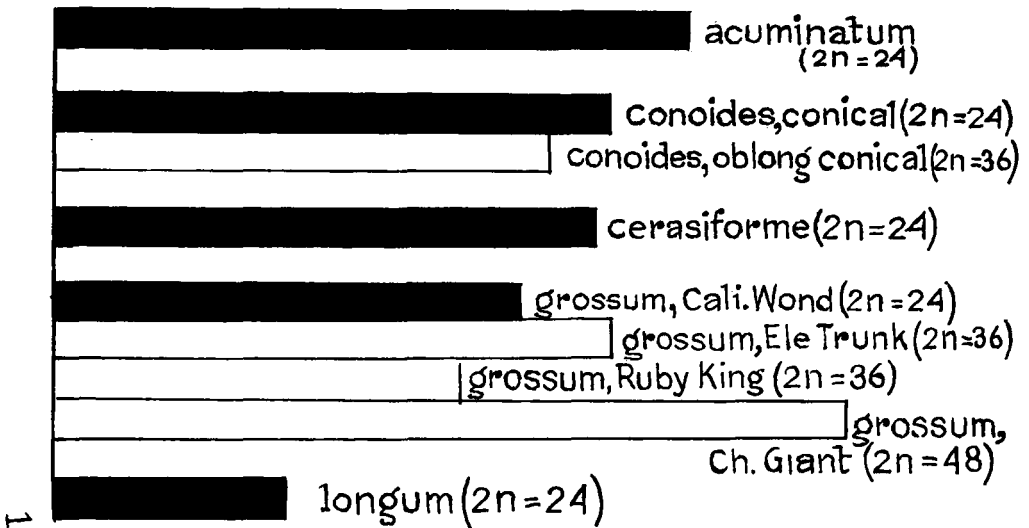


Fig. 1. — Histogram showing total haploid chromatin length of different varieties and forms of *Capsicum annuum*.

On the basis of the relative size, and of the position of primary and secondary constrictions, the chromosomes found here may be classified into 12 distinct types. Fig. 2 clearly represents them.

The chromosome types found in different species are:

- Var. *acuminatum* Fingh: ($2n=24$) 2C, 4D, 2F, 2G, 6H, 8I. (Figs. 3 & 4).
 Var. *conoides* Irish. (conical): ($2n=24$) 2D, 2F, 4H, 14I, 2J. (Figs. 5 & 6).
 Var. *conoides* Irish (oblong-conical): ($2n=36$) 2C, 2D, 16H, 12I, 2J, 2K (Figs. 7 & 8).
 Var. *cerasiforme* Irish: ($2n=24$) 2C, 2D, 4F, 8H, 4I, 4J (Figs. 9 & 10).
 Var. *longum* Sendt.: ($2n=24$) 4D, 6H, 10I, 4K. (Figs. 11 & 12).
 Var. *grossum* Sendt. « Californian Wonder »: ($2n=24$) 2B, 4D, 6H, 12I. (Figs. 13 & 14).
 Var. *grossum* Sendt. « Ruby King. »: ($2n=36$) 4C, 2D, 10H, 18I, 2L. (Figs. 15 & 16).
 Var. *grossum* Sendt. « Elephant's trunk »: ($2n=36$) 2B, 6D, 2S, 8H, 8I, 4J, 2K, 4L. (Figs. 17 & 18).
 Var. *grossum* Sendt. « Chinese giant »: ($2n=48$) 2A, 2B, 10C, 4D, 2S, 2G, 2H, 12I, 6J, 2K, 4L. (Figs. 19 & 20).

Different chromosome number has been reported by different authors for this species e.g. $2n=24$ (PAL *et al.* 1941, SINHA 1950, DIXIT 1931, RAGHAVAN and VENKATASUBBAN 1940, BANERJI 1932), $2n=36$ and 48 (PAI *et al.* 1941). Reports on other species of *Capsicum* (vide DARLINGTON and WYLIE 1955) are also either 24 or 48 chromosomes ($2n$). The present investigation also reveals the same numbers ($2n=24$, 36 or 48). It is apparent therefore that the basic number for the species is 12, and polyploidy has played an important role in speciation and evolution of different varieties and forms.

In spite of the homogeneity in chromosome morphology, each variety or form is characterized by its own peculiarities in chromosome morphology.

These factors indicate clearly that structural changes of chromosomes have no doubt played an important role in the evolution of the varieties. An examination of the histogram (Fig. 1) also brings out the fact that the multiplication of chromosome number is not correlated to the increase in chromatin length. This proves that the evolution has not been brought about by simple polyploidy, but also by alteration of chromosome length by deletion, fragmentation etc.

From the numerical point of view, the possible trend of evolution is from low number of chromosomes to high number. It has now-a-days been established that presence of long chromosomes with median or submedian

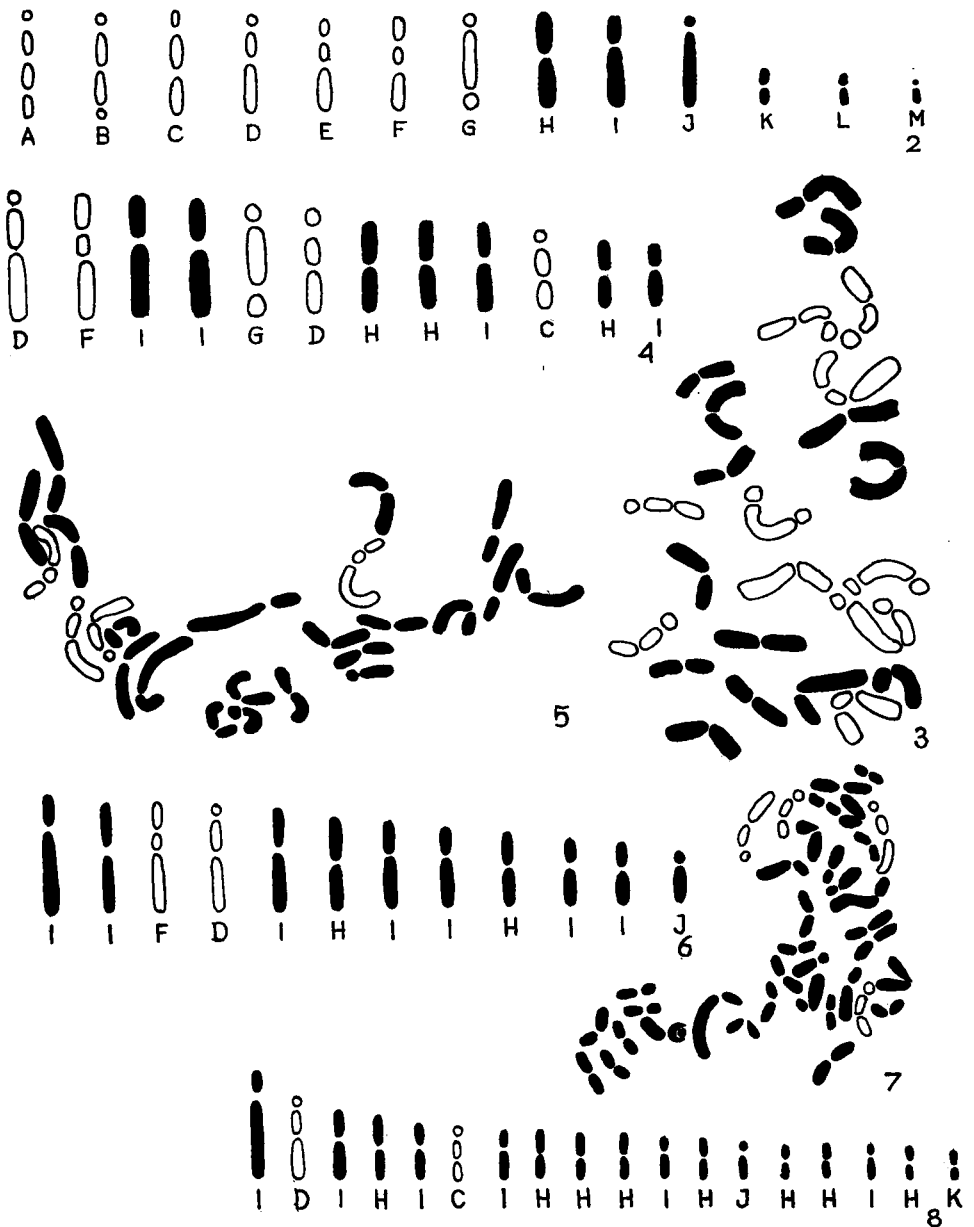
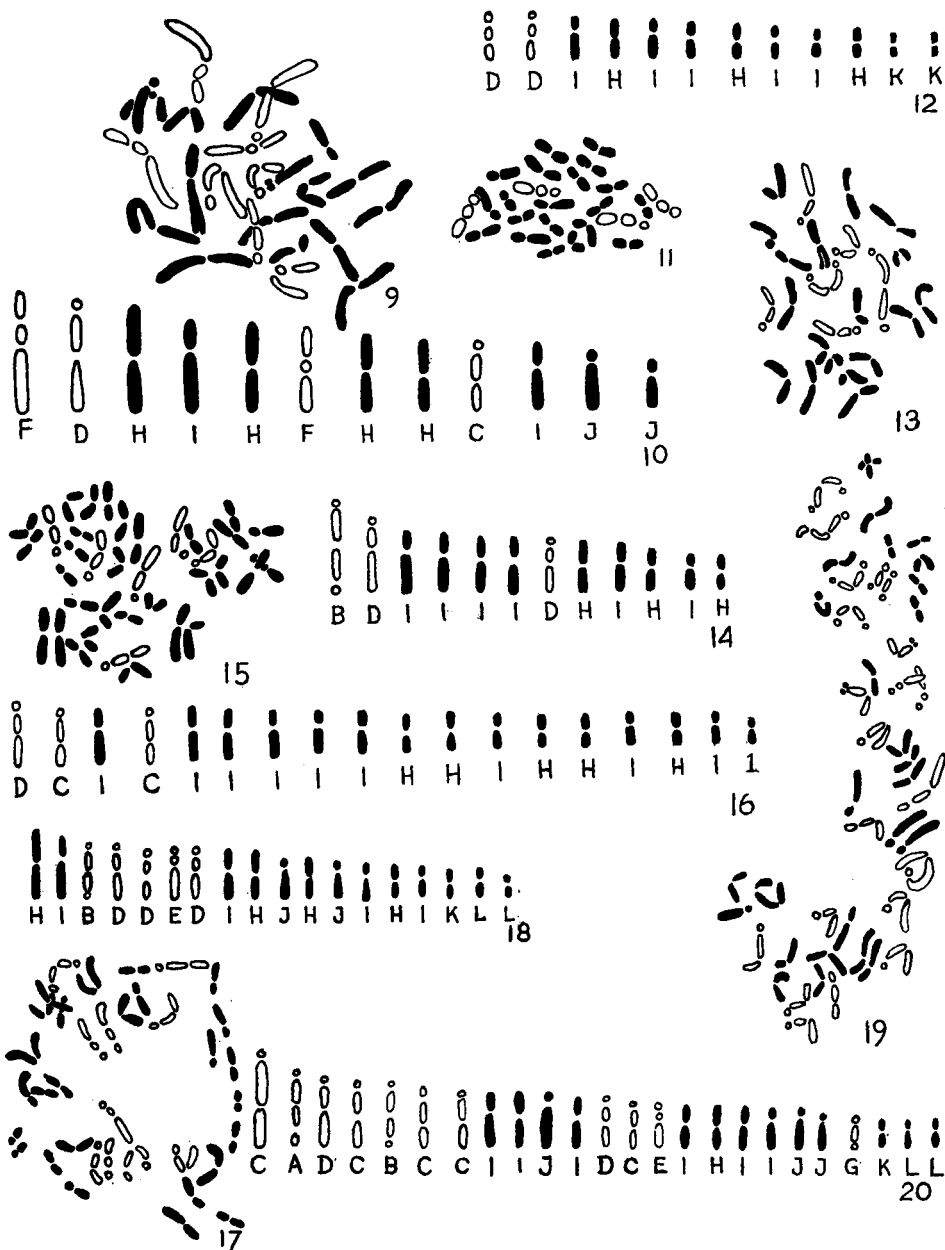


Fig. 2. — Chromosome types found in the present study.
 Figs. 3 & 4. — Var. *acuminatum*. Somatic metaphase plate and idiogram respectively.
 Figs. 5 & 6. — Var. *conoides* (Conical). Somatic metaphase plate and idiogram respectively.
 Figs. 7 & 8. — Var. *conoides* (Oblong-conical). Somatic metaphase plate and idiogram respectively.



Figs. 9 & 10. — Var. *cerasiforme*. Somatic metaphase plate and idiogram respectively.

Figs. 11 & 12. — Var. *longum*. Somatic metaphase plate and idiogram respectively.

Figs. 13 & 14. — Var. *grossum*, « Californian Wonder ». Somatic metaphase plate and idiogram respectively.

Figs. 15 & 16. — Var. *grossum*, « Ruby King ». Somatic metaphase plate and idiogram respectively.

Figs. 17 & 18. — Var. *grossum*, « Elephant's Trunk ». Somatic metaphase plate and idiogram respectively.

Figs. 19 & 20. — Var. *grossum*, « Chinese Giant ». Somatic metaphase plate and idiogram respectively.

primary constrictions indicate primitive nature, and increase in number of nucleolar construction is a sign of advancement (SHARMA 1960, STEBBINS 1966). Therefore, among the 24-chromosome varieties, Var. *acuminatum* with the longest chromosomes and mostly median and submedian primary constrictions (Figs. 3 & 4) seems to be the most primitive variety. Var. *grossum* (particularly « Chinese Giant ») highly polyploid and with the highest number of secondary constrictions (Figs. 19 & 20), appears to be most advanced. Var. *longum* for the difference in the general appearance of its chromosomes (Figs. 11 & 12) from those of others, seems to represent a distinct line of evolution.

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SUMMARY

Nine varieties and forms of *Capsicum annum* Linn. have been examined as regard their karyotype. Most of the varieties represent $2n = 24$ chromosomes. Many derived forms of Var. *grossum* and Var. *conoides* show $2n = 36$ and 48 chromosomes. It has been assumed that both polyploidy and structural alteration of chromosomes have played important roles in the evolution of the varieties. From the chromosome morphology and number, it appears that Var. *acuminatum* is the most primitive variety, while Var. *grossum* is most advanced. Var. *longum* represent a distinct line of evolution.