Karyology of Two Species of *Lindernia* All.

A. R. P. Sinha

Botany Department, Government College,
Port-Blair-744104, India

Accepted December 7, 1985

The genus *Lindernia* All. belongs to Scrophulariaceae; this is a large genus widely distributed throughout the tropical and sub-tropical regions of India. *Lindernia crustacea* and *L. multiflora* growing as a weed and used as medicinal plants in some regions. Sinha (1984) determined the chromosome number for *Lindernia crustacea* $n=14$ and *Lindernia multiflora* $n=7$ though Raghavan and Srinivasan (1940) and Bhattacharyya (1968) have reported $2n=42$ for *L. crustacea* and Biswas (1975) has reported $n=20$ for the species. Whereas Bhattacharyya (1968) and Biswas (1975) have reported $n=10$ for *L. multiflora*. Keeping in view the diversities in chromosome number of the two species of *Lindernia* a detailed mitosis and karyotype of these species have been done for the first time.

Material and methods

Mitotic studies in *Lindernia crustacea* and *L. multiflora* have been made from young and healthy growing root-tips. The best time of collection of root-tips for somatic metaphase was found to be between 10.20 A.M. to 11.30 A.M.

About 2 cm long healthy root-tips were cut and then thoroughly washed in fresh water. The root-tips were pretreated with saturated solution of para-dichlorobenzene for about two and half hours in freeze. Root-tips were then fixed in Carnoy's solution. A few drops of ferric chloride solution was added as mordant. After 24 hours root-tips were stored in 70 percent ethyl alcohol. Karyological study was made by squashing the root-tips in 2 percent acetocarmine solution. The karyotype study is based on 25 metaphase plates. Classification of chromosomes was made on the basis of their length as below:

Type	Length of the chromosomes
A	above 4.0μ
B	3.1 to 4.0μ
C	2.1 to 3.0μ
D	1.1 to 2.0μ
E	upto 1.0μ

The total form percentage (T.F. %) has been calculated by the formula given by Huziwarra (1962).

Observations

A somatic chromosome number of $2n=28$ in case of *Lindernia crustacea* and $2n=14$ in case of *L. multiflora* was observed in all the root-tip squash preparations (Figs. 1 to 4). In *L. crustacea* chromosome on the whole was small ranging from 1.24μ to 3.74μ in length and in *L. multiflora* it was medium sized and shows only minor differences in size amongst themselves varying from 2.78μ to 4.27μ in length.

On the basis of their length, the chromosomes were categorized into three types in both

the cases. In *L. crustacea* 4 pairs of B type, 8 pairs of C types and only 2 pairs of D type. In *L. multiflora* one pair of A type, 3 pairs of B type and again 3 pairs of C type. The detailed regarding the length of chromosomes, position of centromeres, etc. are given in Table 1 and 2. The karyotype is symmetrical since the chromosomes are with median or submedian region centromeres.

Table 1. Measurement and position of centromere of somatic chromosomes in *Lindernia crustacea*

Chromosome type	Position of constriction		Length of chromosome in μ		Total length of chromosome in μ	No. of chromosome pairs
	Primary	Sec.	Long arm	Short arm		
B	M	—	1.87	1.87	3.74	1
B	Sm	—	1.89	1.56	3.45	1
B	Sm	—	2.18	1.24	3.42	1
B	Sm	—	1.87	1.24	3.11	1
C	Sm	—	1.56	1.24	2.80	2
C	Sm	—	1.87	0.93	2.80	1
C	Sm	—	1.56	1.21	2.77	1
C	Sm	—	1.56	0.93	2.49	1
C	Sm	—	1.26	0.94	2.20	1
C	Sm	—	1.24	0.92	2.16	1
C	Sm	—	1.24	0.90	2.14	1
D	M	—	0.93	0.93	1.86	1
D	M	—	0.62	0.62	1.24	1

T.F. %=42.64

The karyotype formula for this species is $K(2n): 28.1B^m + 3B^{sm} + 8C^{sm} + 2D^m$.

Table 2. Measurement and position of centromere of somatic chromosomes in *Lindernia multiflora*

Chromosome type	Position of constriction		Length of chromosome in μ		Total length of chromosome in μ	No. of chromosome pairs
	Primary	Sec.	Long arm	Short arm		
A	Sm	Sc	2.14	1.42+ 0.71	4.27	1
B	Sm	—	2.14	1.78	3.92	1
B	Sm	—	2.14	1.42	3.56	1
B	Sm	—	2.12	1.40	3.52	1
C	M	—	1.42	1.42	2.84	1
C	Sm	—	1.42	1.40	2.82	1
C	Sm	—	1.40	1.38	2.78	1

T.F. %=46.18.

The karyotype formula for this species is $K(2n): 14 1^{sm(Sc)} + 3B^{sm} + 1C^m + 2C^{cm}$.

Table 3. Percentage of chromosomal irregularities.

Total no. of cells observed	Clumping	Precocious separation	Laggards	Bridges	Total
497	13	18	14	11	56
Percentage	2.615%	3.621%	2.816%	2.213%	11.267%

Mitosis in general was normal. However, some abnormalities like clumping, precocious separation of chromosomes, simple bridges and laggards were noticed at metaphase and anaphase. Details of abnormalities are given in Table 3.

Discussion

On the basis of chromosome length chromosomes have been classified into three groups. In *L. crustacea* out of fourteen pairs of chromosomes three pairs have the median centromeres and eleven pairs have the sub-median centromeres, whereas in *L. multiflora* out of seven pairs of chromosomes only one pair shows median centromere and six pairs shows sub-median centromeres. Moreover, it has been observed that the short arm of the longest chromosome pair

Figs. 1-6. 1, 3, 6: *Lindernia crustacea*. 1, mitotic metaphase showing 28 chromosomes. $\times 750$. 3, camera lucida diagram of the above. $\times 750$. 6, karyotype of the above. $\times 750$. 2, 4, 5: *Lindernia multiflora*. 2, mitotic metaphase showing 14 chromosomes. $\times 750$. 4, camera lucida diagram of the above. $\times 750$. 5, idiogram of the above.

(group A) is provided with secondary constriction. Presence of secondary constriction in the longest chromosome pair has also been reported by Chennaveeriah and Patil (1973) in some species of *Crotalaria*, Nadkarni (1976) in *Crotalaria juncea* and by Singh and Roy (1970) in *Trigonella foenum-graceum*. In the present investigation satellited chromosome could not be seen. However, Bhattacharyya (1968) has reported the presence of such chromosomes in other cytotypes of the same species of *Lindernia*.

Summary

Detailed karyotype of *Lindernia crustacea* and *Lindernia multiflora* have been studied for the first time. It has been found that the *L. crustacea* has a more asymmetrical karyotype than *L. multiflora*. It has been concluded that evolution in these species has been towards diminution in size and increase in number of the chromosomes.

References

- Bhattacharyya, N. M. 1968. Chromosomal diversities in *Lindernia*. Nucleus, International Seminar on Chromosomes—its structure and function: 102–114.
- Biswas, M. 1975. Cytogenetics and evolution of some common weeds of Bihar. Ph. D. Thesis, Magadh University, Bodh-Gaya (unpublished).
- Chennaveeriah, M. S. and Patil, B. C. 1973. Chromosome number and karyotype study in eight species of *Crotalaria*. Cytologia 38: 73–79.
- Huziwara, Y. 1962. Karyotype analysis in some genera of Compositae VIII. Further studies on the chromosomes of *Aster*. Amer. J. Bot. 49: 116–119.
- Nadkarni, R. S. 1976. Cytogenetic studies in the genus *Crotalaria*. Ph. D. Thesis, Nagpur University, Nagpur.
- Raghavan, T. A. and Srinivasan, V. K. 1940. Studies in the Scrophulariaceae: The cytology of *Angelonia grandiflora* C. Merr. and some related genera. Cytologia 11: 37–54.
- Singh, A. and Roy, R. P. 1970. Karyological studies to *Trigonella*, *Indigofera* and *Phaseolus*. Nucleus 13: 41–54.
- Sinha, A. R. P. 1984. New basic chromosome number and cytology for some Scrophulariaceae weeds of Bihar (India). Cytologia 49: 781–787.
- Stebbins, G. L. (Jr.) 1950. Variation and Evolution in Plants. John Wiley and Sons, New York.
-