SJIF Impact Factor (2023): 8.574| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 12 | December 2023 - Peer Reviewed Journal

MEIOSIS IN PLANT CARRYING 2n = 21 CHROMOSOMESTELO-TRISOMIC (2n + t = 21)

Shrimant Raut[1], Datta Chamle[2]
[1]Pratibha NiketanMahavidyalaya, Nanded - 431605 (M.S.) India
[2]Sharda Mahavidyalaya (Art's & Science), Parbhani - 431401, (M.S.), India

ABSTRACT
Coix L. a genus which is very much known for the chromosomal variations within its species. The aneuploidy to polyploidy and hybridization is common in the genus as it has ill-defined species or cytological forms growing in the same habitats. The meiotic abnormalities have reported many times in the Coix aquatica, C. gigantea and C. lacrymajobi. But the presence of telo-trisomic condition is not so common which has been reported in self-pollinated population of C. gigantea with mosomictelo-trisomy. Morphologically the plant was similar to diploid plants, so investigated for the meiotic behavior of a telo-chromosme during various stages of the meiosis. During the study method of single plant cytology has been followed. Telo-chromosome showed the varied behavior sometimes it behaved like normal chromosomes especially during meiosis I but in considerable number of meiocytes behaved abnormally to give the tetrads with variable number of micronuclei in the tetrads after meiosis II. Telo-chromosme though a fragmented part of the chromosome might be getting included in some the gamete instead of its disintegration and elimination by the nature as a corrective measure.

KEY WORDS: *Coix, Meiosis, aneuplods Telo-trisomic, Trisomy.*

INTRODUCTION

The *Coix* L. is an oriental wild relative of maize. It is a member of tribe Maydeaeina family Poaceae. It is widely distributed all over South-East Asian countries. In India also, its occurrence has been reported from almost all states, showing its adaptation to a variety of climatic and edaphic conditions. *Coix* has been extensively studied and exploited as food, fodder and medicine point of view, in countries like China, Japan, Thailand, Indonesia, Korea and Brazil etc. In India, its commercial value as a food crop has been totally neglected, though it has been studied here widely for its cytology and genetics.

In India the genus *Coix* is represented mainly by three species viz. *Coix aquatica* Roxb with 2n = 10 chromosomes (Mangelsdorf and Reeves 1939; Nirodi 1955; Nirmala 2003; Barve and Sangeetha 2008)., whereas *Coix gigentea* Koen Ex Roxb known to have variable number of chromosomes like 2n = 12, 20, 32, 40 etc. (Nirodi, 1955; Venketshvarlu and Rao, 1956; Koul and Paliwal, 1964; Christhopher and Jacob, 1991). But the *C. lacryma-jobi* L. is having well established diploid chromosome number as 2n = 20 (James 1943; Bor1960). The two species *C. aquatica and C. gigantea* are morphologically ill defined and cross breed freely in nature (Sapre and Barve 1986; Deshpande, 1986) to give rise to hybrids. The aneuploids produced through the hybridization are known to have been established successfully with diploids as well (Barve, 1983). Monosomictrisomic and Telotrisomic in the *Coix gigantea* has been reported (Barve and Sapre, 1986 and Barve 2013) respectively. Here in this communication the monosmic for one chromosome and telo-trisomic for another chromosome with chromosome number 2n - 1 + t = 20 (Monosome + telo-chromosome) has been investigated thoroughly.

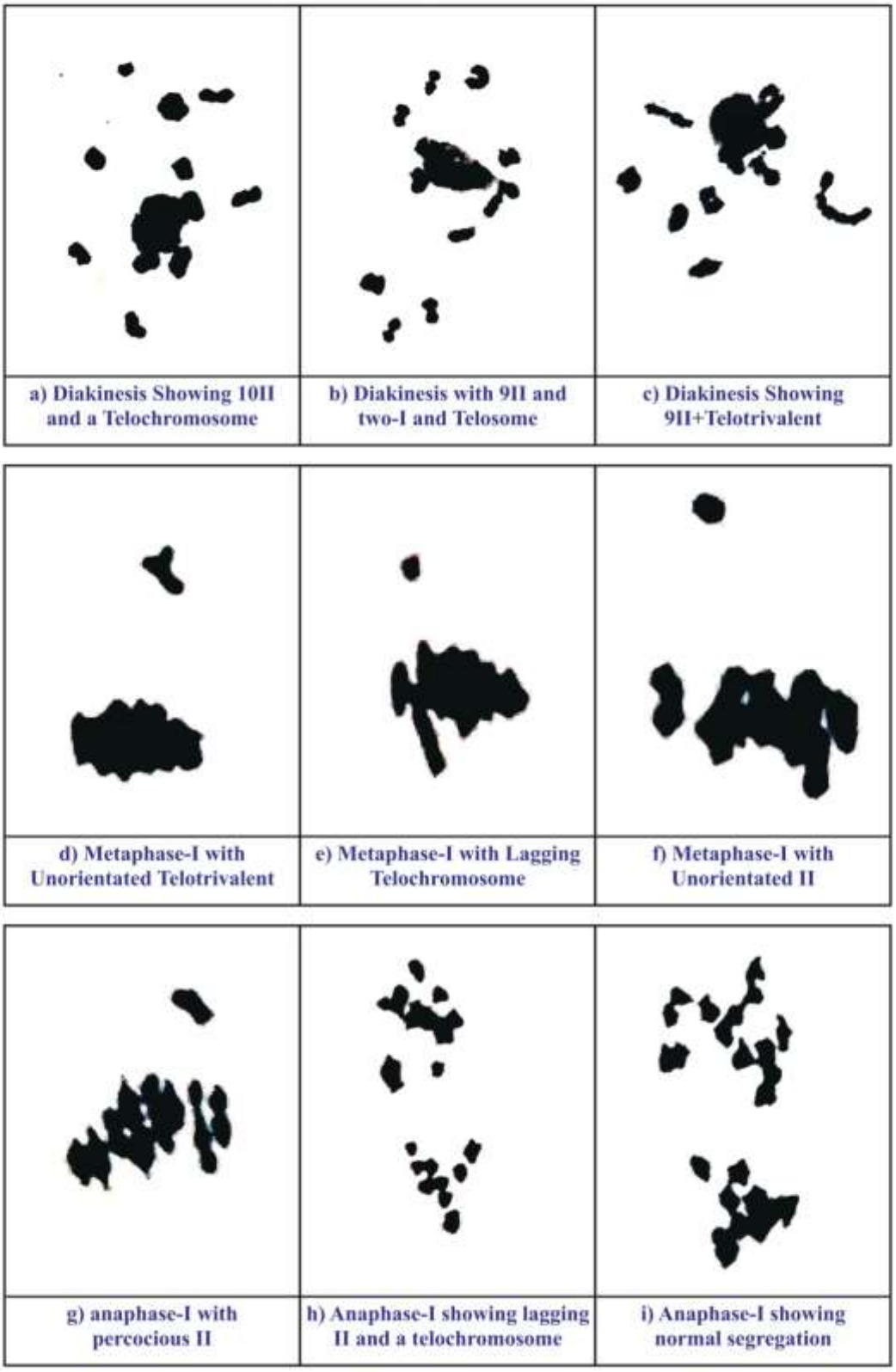
Three monosomictelo-trisomic 2n= 20 plants were isolated from the progeny of diploids the plants were observed to be two in one aneuploids showing monosomic condition of one chromosome and telo-trisomic condition of the other chromosome without any change in diploid chromosome number i.e. 2n - 1 + t = 20.

MATERIALS AND METHODS

The seeds of *Coix gigantea* collected from Uttar Dist. Kolhapur. Their plants were grown in the Botanical Garden of Pratibha Niketen Mahavidyalaya Nanded. All the plants in the field were serially numbered with tags before the flowering starts. When the flowering starts male racemes of appropriate size has been transferred to acetic acid : alcohol (1:3) and kept at room temperature and then stored in the refrigerator until meiotic analysis is performed. Each plant was studied as single plant cytology. 1 % aceto-carmine was used as meiotic stain for this study. From each plant a number of slides were prepared and observed for meiotic analysis and chromosome counts at different stages. Micro photomicrography was done with the temporary slides by using an Olympus Research Microscope at 100X.

SJIF Impact Factor (2023): 8.574| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 12 | December 2023 - Peer Reviewed Journal

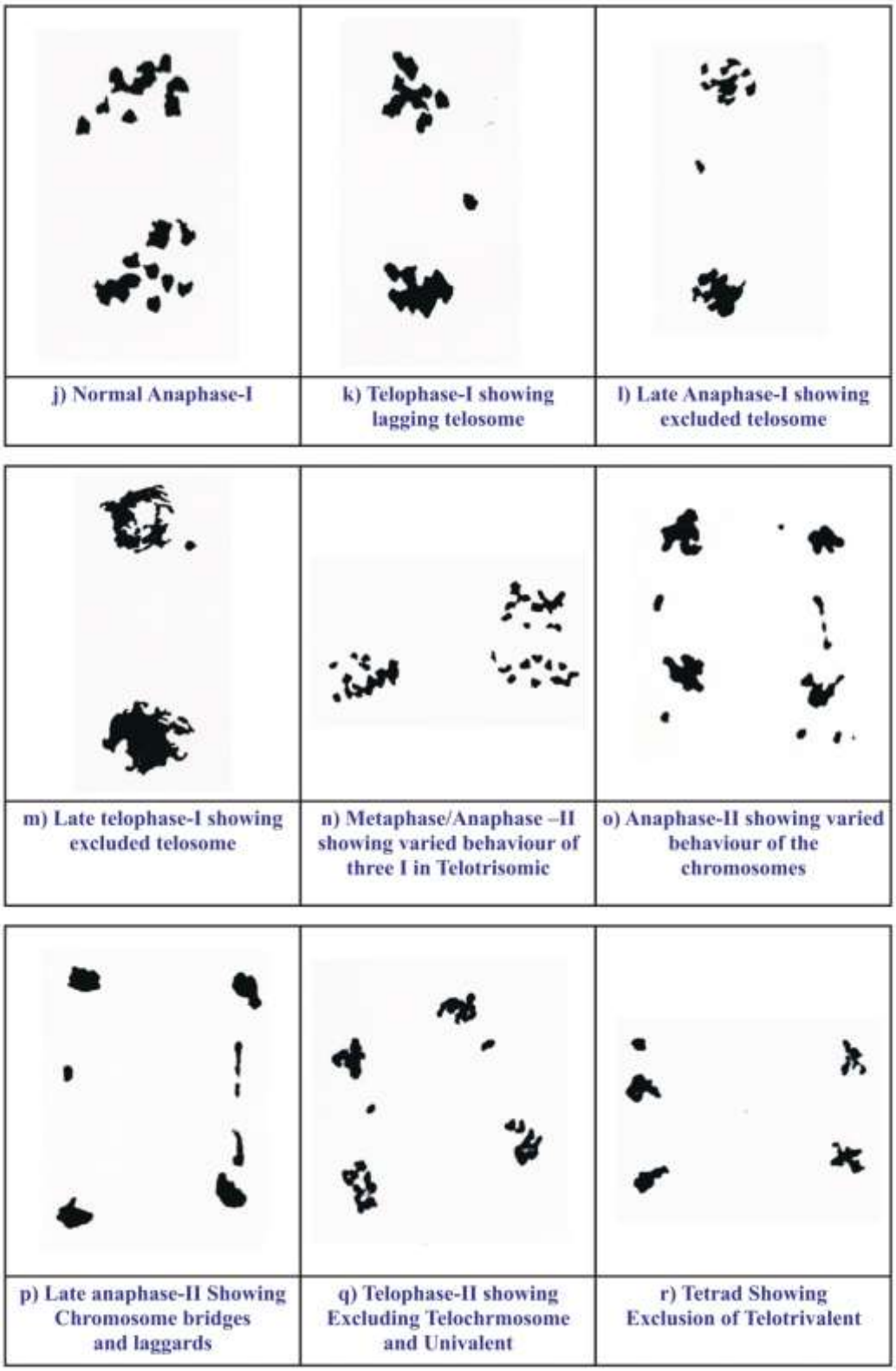
Plate : 1 Meiosis in plant carrying 2n=21 Chromosomes (Telo-trisomic)



a) Diakinesis Showing 10II and a Telochromosome	b) Diakinesis with 9II and two-I and Telosome	c) Diakinesis Showing 9II+Telotrivalent
d) Metaphase-I with Unorientated Telotrivalent	e) Metaphase-I with Lagging Telochromosome	f) Metaphase-I with Unorientated II
g) anaphase-I with percocious II	h) Anaphase-I showing lagging II and a telochromosome	i) Anaphase-I showing normal segregation

SJIF Impact Factor (2023): 8.574| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 12 | December 2023 - Peer Reviewed Journal

Plate 2 : Meiosis in plant carrying 2n=21 Chromosomes (Telo-trisomic)



j) Normal Anaphase-I	k) Telophase-I showing lagging telosome	l) Late Anaphase-I showing excluded telosome
m) Late telophase-I showing excluded telosome	n) Metaphase/Anaphase –II showing varied behaviour of three I in Telotrisomic	o) Anaphase-II showing varied behaviour of the chromosomes
p) Late anaphase-II Showing Chromosome bridges and laggards	q) Telophase-II showing Excluding Telochrmosome and Univalent	r) Tetrad Showing Exclusion of Telotrivalent

SJIF Impact Factor (2023): 8.574| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 12 | December 2023 - Peer Reviewed Journal

RESULTS

At diakinesis, majority of the PMCs showed nine bivalent and telo-trivalent (9II + IIt) configuration which is of typical trisomocs. However the additional chromosome was smaller in size and always paired with one of the two homologous at the end forming a telo-trivalent (Fig. c). In some meiotic cells, ten bivalent and telo-univalent (10II + t) configuration was also observed. (Fig. a). Rarely 9II + 2II + t configuration was observed at diakinesis (Fig. b, Table 1).

Table 1 : Chromosomal configurations at Diakinesis

Total No. of cells scored	9II+IIt	10II+t	9II+2I+t
129	89	37	3

At metaphase-I the trivalent was seen oriented at equatorial plate along with rest of the bivalents. Rarely even the trivalent was seen precociously to one of the poles (Fig. d) or randomly placed in a cell. In few cells ten bivalents were observed to be oriented at equator whereas the tel-trivalent was either seen precociously to one of the poles or randomly placed in the meiocytes (Fig. e). In many microsporocytes the other univalent was seen precociously to one of the poles (Fig. e). Rarely some other bivalents was seen randomly placed in the cell, whereas telo-trivalent was observed on metaphase plate (Fig. g). In many PMCs three univalent of telo trivalent were seen precociously to one of the poles (Fig. h, Table 2).

Table 2: Chromosomal behavior at Mataphase-I

Total No. of cells scored	Normal	Precocious telounivalent	Precocious three univalent (2I+telo)	Un-orientated / randomly placed trivalent (IIt)
248	196	19	27	6

Most of the PMCs showed regular segregation of trivalent as bivalent and telo-univalent giving 10----10 + t distribution (Fig. i) of chromosomes. Due to non-disjunction of trivalent or irregular distribution of univalents, anaphase-I showing unequal distribution of chromosomes like 9----11 + t were recorded (Fig. h) Rarely the trivalent was observed to be late separating or completely lagged. In few cells at anaphase-I / telophase-I lagging univalent (Fig. k) or telo chromosome (Fig. l) were recorded (Table 3). Same configurations continued in meosis-II (Figs. n - r). Most the cells at meiosis-II were observed to be normal leading to 10---10---11---11 distribution of chromosomes (Fig. n), with two microspores (n=11) incorporating telo-chromosome in their complement. In few cells at anaphase-II, segregation were observed to be distributed showing precociously moved univalent to one of the poles getting excluded from the telophase-II group (Figs. o and p) or laggard univalent/chromatids (Figs. q and r). Few cells also showed sticky - trails of chromatin along with lagging univalent / chromatids leading to their elimination in the form of micronuclei in tetrads (Table 4).

Table 3: Chromosome distribution during Anaphase-I / Telophase-I

Total No. of cells scored	Normal 10I+t-------10I	Lagging telosome 10I---t---10I	Late separating trivalent 9I---IIt---9I
189	176	08	05

Table 4: Tetrads showing one or two micronuclei

Total No. of tetrads scored	Normal (cleantetrads)	Tetrads with one micronucleus in one of the cell	Tetrads with one small and one big micronucleus in one cell	Two micronuclei in one Cell
238	187	41	3	7

DISCUSSION

It appeared that n-1+t gamete is functional as monosomictelo-trisomic plants were obtained in the selfed progeny of monosomictelo-trisomic 2n=20 plants. Similarly one telo-somic and one monosomictelo-trisomic plant wereappeared in the selfed progeny of the same plant. It indicates n+t gamete is functional. Its mating with n gamete have resulted in formation of 2n+t =21 i.e. telo-trisomic plant. Univalency of smaller bivalent and inclusion of univalent in to tetrad having n constitution might have resulted in to n+I gamete. This plant also produced n-1 gametes. Chance mating of n=I and n-1 gamete during selfing might have resulted in to the formation of 2n-1=i 20 (monosomic / trisomic for small chromosome). Mostly telochromosome arise from the miss division, sometimes they modified in to iso-chromosomes or get eliminated during cell division. It means that telochromosomes are unstable and get eliminated and cannot survive in nature. (Darlington 1939). But in this case the addition of telo-chromosome had not disturbed the meiosis as much. Though in some meiotic divisions laggards and precocious movements of monosome and telo-chromosome was observed. Ultimately in the tetrad formation large number of clean tetrads observed, which indicates that the

SJIF Impact Factor (2023): 8.574| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 12 | December 2023 - Peer Reviewed Journal

additional telo-chromosome will persist in the next progeny instead of its elimination. This may be because of the unstable nature of the plant genome in *Coix gigantea*.

CONCLUSION

The plant having an additional telochromosome behaves abnormal and tries to eliminate the extra chromosome i.e. telo-chromosome. But it also affects the behavior of other chromosomes especially the complementary II of the telochromosome. The meiosis of the plant leads to the possibility of gametic combinations like n = 9, n = 9+t, n = +I+t and n = 9+I+I+t which may lead to further possible hypo or hyper aneuploids.

REFERENCES

1. *S. S. Barve, Telotrisomics in Coix gigantea koen ex roxb Bioinfolet Volume : 10, Issue : 1b, 2013 : 309 - 310.*
2. *S. S. Barve and J. S. Sangeetha, Cytological studies in 2n=17 Coix gigantea (Maydeae). Journ. Cytol .Genet. 9, 2008, 79 - 83.*
3. *S. S. Barve and A. B. Sapre, Monotrisomic in Coixgigantean (Poaceae). Curr. Sci.,1976, 55: 660 - 661.*
4. *N, L. Bor, Grasses of Burma,Ceylon,India and Pakistan. New York: Pergamon Press,1960.*
5. *Christhopher and Thayasingh, Chromosome number of Coix aquatic Roxb. Current Science December 5, 1986, Vol, 53 PP 23.*
6. *J. Christopher, and B. Jacob, Cytological studies of Coix gigantea Koenex Roxb from South India. Cytologia, 1991, 56: 265 - 268.*
7. *C. D. Darlington, Recent Advances in Cytology; p. 39. London. & mdash.,* 1939, *J. Genet. 37, 341.*
8. *C. D. Darlington and A. P. Wylie, Chromosome atlas of flowering plants. G. Allen and Unwin, London, 1955.*
9. *James W. Cameron, Chromosomes of A Maize Relative, PolytocaMacrophyllaBenth.' American Journal of Botany, 1943, Vol. 30, No. 10, pp. 776 - 778*
10. *P. C. Mangelsdorf and R. G. Reeves, The origin of Indian corn and its relatives. Texas Agri. Exp. Sta. Bull, 1939, 574: 1 - 315.*
11. *Nirmala, Cytomorphological study of Coix gigantea Koen (2n = 8x = 40) and its interracial and interspecific hybrids. Nucleus, 2003, 40: 115 - 119.*
12. *N. Nirodi, Studies in Asiatic relatives of maize. Ann. Missouri Bot. Gard., 1955, 42: 103 - 130.*
13. *Sapre, A. B. and S. S. Barve, Occurrence of pentasomic and hexasomic plants in wild population of Coix gigantea; Current Science, 1983, 52(1): 614 - 615.*
14. *B. Sapre and D. S. Deshpande, A change inchromosome number due to cytomixis in an interspecific hybrid of Coix L. Cytologia, 1987, 52: 167 - 174.*
15. *J. Venkateswarlu and Rao, Rajeswara G., Progress Report on the 1. C. A. R. Scheme on Cytological Studies in Maize and Its Relatives, 1956.*