

ENVIRONMENTAL INFLUENCE ON CYTOMIXIS IN *CORCHORUS FASCICULARIS* LAMK. (TILIACEAE)

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Abstract: Cytomictic behaviour (intensity assessed from the frequency of hypo- and hyperploid meiocytes formed) is noted in a single plant (to avoid any intra plant variations) of *Corchorus fascicularis* Lamk. from the natural population under a unit location (West Bengal plains, Kalyani, Nadia; latitude 22°50' to 24°11' N, longitude 88°09' to 88°48' E, altitude 9.75 m, sandy loamy soil, pH-6.89) from early June to early July 2012. Meiosis has been studied from 6 samples under the assessed period. High temperature has intensified the phenomenon of cytomixis as evidenced from the enhanced frequency of hypo- and hyperploid PMCs formation without affecting pollen fertility. Apart from cytomixis, differential condensation of chromosomes, meiocytes with 2 nucleoli, occurrence of minute fragments, high frequency of univalent formation and irregular anaphase I separation are also observed. Results obtained have been discussed.

Keywords: *Corchorus fascicularis*, Cytomixis, Temperature effect

REFERENCES

- Ajay, K.J. and Sarbhoy, R.K. (1987). Cytogenetical studies on the effect of some chlorinated pesticides. II. Effect on meiotic chromosomes of *Lens* and *Pisum*. *Cytologia*, **52**: 55-61.
- Baptista-Giacomelli, F.R.; Pagliarini, M.S. and Almeida, J.L. de. (2000). Meiotic behavior in several Brazilian oat cultivars (*Avena sativa* L.). *Cytologia*, **65**: 371-378.
- Bellucci, M.; Roscini, C. and Mariani, A. (2003). Cytomixis in pollen mother cells of *Medicago sativa* L. *Journal of Heredity*, **94**: 512-516.
- Bobak, M. and Herich, R. (1978). Cytomixis as a manifestation of pathological changes after the application of trifluraline. *Nucleus*, **21**: 22-26.
- Boldrini, K.R.; Pagliarini, M.S. and do Valle, C.B. (2006). Cell fusion and cytomixis during microsporogenesis in *Brachiaria humidicola* (Poaceae). *South African Journal of Botany*, **72**: 478-481.
- Carlson, J.G. and Handel, M.A. (1988). Intercellular bridges and factors determining their patterns in the grasshopper testis. *Journal of Morphology*, **196**: 173-185.
- Carr, D.J. (1976). Plasmodesmata in growth and development. In: Gunning BES, Robards AW (ed) *Intercellular Communication in Plants: Studies on Plasmodesmata*. Springer, Berlin, pp 243-288.
- Datta, A.K.; Mukherjee, M. and Iqbal, M. (2005). Persistent cytomixis in *Ocimum basilicum* L. (Lamiaceae) and *Withania somnifera* (L.) Dun (Solanaceae). *Cytologia*, **70**: 309-313.
- De, M. and Sharma, A.K. (1983). Cytomixis in pollen mother cells of an apomictic ornamental *Ervatamia divaricata* (Linn.) Alston. *Cytologia*, **48**: 201-207.
- de Souza, A.M. and Pagliarini, M.S. (1997). Cytomixis in *Brassica napus* var. *Oleifera* (Brassicaceae). *Cytologia*, **62**: 25-29.
- Dong, L.Z. and Junying, Y.X. (1988). By isolating single spore for determine genotype of *Pleurotus sapidus* and *Lentinus edodes*. *Journal of Agricultural University of Hebei*, doi: cnki:ISSN:1000-1573.0.1988-03-014
- Dong, W.; Li, W.; Guo, G.Q. and Zheng, G.C. (2004). Ultrastructural aspects of plasmodesmata and cytoplasmic bridges during spermatogenesis in *Funaria hygrometrica*. *Acta Botanica Sinica*, **46**: 988-996.
- Gates, R.R. (1911). Pollen formation in *Oenothera gigas*. *Annals of Botany*, **25**: 909-940.
- Gayen, P. and Sarkar, K.P. (1996). Cytomixis in maize haploids. *Indian Journal of Genetics and Plant Breeding*, **56**: 79-85.
- Ghaffari, S.M. (2006). Occurrence of diploid and polyploidy microspores in *Sorghum bicolor* (Poaceae) is the result of cytomixis. *African Journal of Biotechnology*, **5**: 1450-1453.
- Guo, G.Q. and Zheng, G.C. (2004). Hypotheses for the functions of intercellular bridges in male germ cell development and its cellular mechanisms. *Journal of Theoretical Biology*, **229**: 139-146.
- Guzicka, M. and Wozny, A. (2005). Cytomixis in shoot apex of Norway spruce [*Picea abies* (L.) Karst.]. *Trees*, **18**: 722-724.
- Haroun, S.A.; Al Shehri, A.M. and Al Wadie, H.M. (2004). Cytomixis in the microsporogenesis of *Vicia faba* L. (Fabaceae). *Cytologia*, **69**: 7-11.
- Heng-Chang, W.; Li, J.Q. and He, Z.C. (2007). Irregular meiotic behavior in *Isoetes sinensis* (Isoetaceae), a rare and endangered fern in China. *Caryologia*, **60**: 358-363.
- Himshikha, P.; Kumar, R.; Gupta, C.; Kumari, S. and Singhal, V.K. (2010). Impact of chromatin

- transfer and spindle abnormalities on pollen fertility and pollen size in *Plantago lanceolata* L. *Cytologia*, **75**: 421-426.
- Iqbal, M. and Datta, A.K.** (2007). Cytogenetic studies in *Withania somnifera* (L.) Dun. (Solanaceae). *Cytologia*, **72**: 43-47.
- Kaur, D. and Singhal, V.K.** (2012). Phenomenon of cytomixis and intraspecific polyploidy (2x, 4x) in *Spergularia diandra* (Guss.) Heldr. & Sart. in the cold desert regions of Kinnaur district (Himachal Pradesh). *Cytologia*, **77**: 163-171.
- Kaur, H.; Gupta, A.; Kumari, S. and Gupta, R.C.** (2010). Meiotic studies in *Poa annua* L. from different altitudinal ranges of North India. *Cytologia*, **75**: 313-318.
- Körnicker, M.** (1901). Über ortsveränderung von Zellkarnern S B Niederhein Ges Natur-U Heilkunde Bonn A, pp 14-25.
- Kumar, G. and Tripathi, R.** (2008). Induced cytotoxic variations through abiotic stresses in grasspea (*Lathyrus sativus* L.). *Indian Journal of Genetics and Plant Breeding*, **68**: 58-64.
- Kwiatkowska, M.; Popłońska, K. and Wojtczak, A.** (2003). *Chara tomentosa* antheridial plasmodesmata at various stages of spermatogenesis. *Biologia Plantarum*, **46**: 233-238.
- Li, X.F.; Song, Z.Q.; Feng, D.S. and Wang, H.G.** (2009). Cytomixis in *Thinopyrum intermedium*, *Thinopyrum ponticum* and its hybrids with wheat. *Cereal Research Communications*, **37**: 353-361.
- Mahapatra, A.K. and Saha, A.** (2008). Genetic Resources of Jute and Allied Fibers Crops. Jute and Allied Fibers Updates: Production and Technology, Barrackpore. p 327.
- Maheshwari, P.** (1950). An introduction to the Embryology of Angiosperms. McGraw-Hill, New York.
- Maity, S. and Datta, A.K.** (2008). Cytomorphological studies in F₁ hybrids (*Corchorus capsularis* L. x *Corchorus olitorius* L.) of jute (Tiliaceae). *Comparative Cytogenetics*, **2**: 143-149.
- Maity, S. and Datta, A.K.** (2009). Meiosis in nine species of Jute (*Corchorus*). *Indian Journal of Science and Technology*, **2**: 27-29.
- Malallah, G.A. and Attia, T.A.** (2003). Cytomixis and its possible evolutionary role in a Kuwaiti population of *Diplotaxis harra* (Brassicaceae). *Botanical Journal of the Linnean Society*, **143**: 169-175.
- Mandal, A. and Datta, A.K.** (2011). Secondary chromosome associations and cytomixis in *Corchorus* spp. *Cytologia*, **76**: 337-343.
- Mandal, A. and Datta, A.K.** (2012). Inter- and intra-plant variations in cytotoxic behavior of chromosomes in *Corchorus fascicularis* Lamk. (Tiliaceae). *Cytologia*, **77**: 269-277.
- Mandal, A.; Datta, A.K.; Gupta, S.; Paul, R.; Saha, A.; Ghosh, B.K.; Bhattacharya, A. and Iqbal, M.** (2013). Cytomixis—a unique phenomenon in animal and plant. *Protoplasma*, **493**: in press. DOI 10.1007/s00709-013-0493-z
- Marks, G.E.** (1954). An aceto-carmine glycerol jelly for use in pollen-fertility counts. *Biotechnic & Histochemistry*, **29**: 277-278.
- Miljajev, E.L.** (1967). Cytochimiceskoje I electron – mikroskopi ceskoje izucenje mikosporogeneza *Citrus sinensis*. Autoreferat Kandidaatskej dizertacie.
- Morisset, P.** (1978). Cytomixis in the pollen mother cells of *Ononis* (Leguminosae). *Canadian Journal of Genetics and Cytology*, **20**: 383-388.
- Mukherjee, M. and Datta, A.K.** (2005). Secondary chromosome associations in *Ocimum basilicum* L. and *Ocimum tenuiflorum* L. *Cytologia*, **70**: 149-152.
- Narain, P.** (1979). Cytomixis in the pollen mother cells of *Hemerocallis* Linn. *Current Science*, **48**: 996-998.
- Nirmala, A. and Rao, P.N.** (1996). Genesis of chromosome numerical mosaicism in higher plants. *Nucleus*, **39**: 151-175.
- Paolillo, Jr. D.J. and Cukierski, M.** (1976). Wall developments and coordinated cytoplasmic changes in spermatogenous cells of *Polytrichum* (Musci). *Bryologist*, **79**: 466-479.
- Pécricx, Y.; Rallo, G.; Folzer, H.; Cigna, M.; Gudín, S. and Le Bris, M.** (2011). Polyploidization mechanisms: temperature environment can induce diploid gamete formation in *Rosa* sp. *Journal of Experimental Botany*, **62**: 3587-3597.
- Peng, Z.S.; Yang, J. and Zheng, G.C.** (2003). Cytomixis in pollen mother cells of new synthetic hexaploid amphidiploid (*Aegilops tauschii*×*Triticum turgidum*). *Cytologia*, **68**: 335-340.
- Rani, S.; Kumar, S.; Jeelani, S.M.; Gupta, R.C. and Kumari, S.** (2010). Effect of cytotoxic on male meiosis in populations of *Clematis grata* Wall. from Western Himalayas. *Chromosome Botany*, **5**: 61-64.
- Roosen-Runge, E.C.** (1977). The Process of Spermatogenesis in Animals. Cambridge University Press, London.
- Saggoo, M.I.S.; Gill, A. and Walia, S.** (2011). Cytomixis during microsporogenesis in some populations of *Croton bonplandianum* of north India. *Cytologia*, **76**: 67-72.
- Singhal, V.K. and Kumar, P.** (2008). Impact of cytotoxic on meiosis, pollen viability and pollen size in wild populations of Himalayan poppy (*Meconopsis aculeate* Royle). *Journal of Bioscience*, **33**: 371-380.
- Soman, T.A. and Bhavanandan, K.V.** (1993). Temperature sensitive cytotoxic in *Helicanthes elastica* (Desr) Dans (Loranthaceae). *Cytologia*, **58**: 21-26.
- Song, Z.Q. and Li, X.F.** (2009). Cytotoxic in pollen mother cells of *Salvia miltiorrhiza*. *Caryologia*, **62**: 213-219.
- Soodan, A.S. and Wafai, B.A.** (1987). Spontaneous occurrence of cytotoxic during microsporogenesis in almond (*Prunus amygdalus* Batsch) and peach (*P. persica* Batsch). *Cytologia*, **52**: 361-364.

- Srivastava, P. and Kumar, G.** (2011). EMS-induced cytotoxic variability in safflower (*Carthamus tinctorius* L.). *Cytology and Genetics*, **45**: 240-244.
- Takats, S.T.** (1959). Chromatin extrusion and DNA transfer during microsporogenesis. *Chromosoma*, **10**: 430-453.
- Tarkowska, J.** (1965). Experimental analysis of the mechanism of cytomixis. I. Cytomixis in vegetative tissues. *Acta Societatis Botanicorum Poloniae*, **34**: 27-44.
- Tarkowska, J.** (1966). Experimental analysis of the mechanism of cytomixis. II. Cytomixis in the pollen mother cells of the lily - *Lilium candidum* L. *Acta Societatis Botanicorum Poloniae*, **35**: 25-40.
- Ventela, S.; Toppari, J. and Parvinen, M.** (2003). Intercellular organelle traffic through cytoplasmic bridges in early spermatids of the rat: mechanisms of haploid gene product sharing. *Molecular Biology of the Cell*, **14**: 2768-2780.
- Yun-sheng, W. and Yong-ping, C.** (2006). Study on cytomixis on pollen-mother-cell (PMC) of "Arbo" wheat nullisomic lines. *Journal of Anhui Agricultural Sciences*, **34**: 25-26. doi: cnki:ISSN:0517-6611.0.2006-01-013
- Zheng, G.C.; Yang, Q.L. and Zheng, Y.R.** (1987). The relationship between cytomixis and chromosome mutation and karyotype evolution in lily. *Caryologia*, **40**: 243-259.