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Research Article

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Mercury induced complementary effects of chromosome stickiness and impairs meiosis

Preeti Rai* and Sangeeta Dayal

Department of Biotechnology, Monad University, NH-24 Delhi-Hapur Road, Kastla, Kasmabad, U.P. India

ABSTRACT

Chromosome stickiness was reported in several plant species and is characterized by sticky clumps of chromatin resulting in sterility. In the present study, sticky behaviour induced by different concentration 10 ppm, 40 ppm, and 80 ppm of mercury on Tritium aestivum. In the meiocytes clumped chromosome masses that did not orient themselves to equatorial plate cause unequal chromosomal distribution were observed. Chromosome form sticky clumps fail to separate at anaphase I and II leads to disturbed cytokinesis. Stickiness found in every stage of meiotic cycle during study following asynchronous division, Chromosome bridges of different thickness were also observed in different stages of meiosis. Regards and precocious movements were also prevalent in the study. Moderate amount of pollen sterility reported in the study. This finding can be helpful in a breeding program.

Keywords: Mercury, Genotoxic, Meiocytes, Stickiness, Parts per million (ppm)

INTRODUCTION

Meiosis is a highly complex process involving a number of stages and different type of chromosomal arrangement, if any, of the stages is disturbed it impairs meiosis and influence reproductive success. Like any other biological process all sequential steps that are involved in meiosis are controlled by a large array of gene [2, 7, 1, 11, 5 and 15]. Mutation in pre or post mitotic event leads to serious anomalies in the process. Heavy metals have the potential to disturb the meiosis cycle. Among the various heavy metal's mercury is a unique metal due to its existence in different forms, e.g., Hgs, Hg2, and Toxic level of Hg2 can induce visible injuries and physiological disorders in plants [17]. Information about the chromosome structure and its behaviour during the meiosis is an important step in genetic breeding programs [3]. Wheat is one of the major crop worlds wide it consumed in various forms throughout the world. Our present aim to study the abnormal and sticky chromosomal behaviour and anomalous meiotic products produced in Tritium aestivum under mercury stress.

EXPERIMENTAL SECTION

Materials and methods

Plants were grown in two sets, one with three different concentrations of mercuric chloride 10 ppm, 40ppm, 80ppm and another set were grown in distilled water. Inflorescence was collected from control and treated plants for meiotic study. Buds were fixed in 1:3 (acetic acid: absolute alcohol) for 24 hrs then transferred into 70% alcohol and stored under the refrigerator. Squash was prepared by using 2% acetocarmine were used for cytological analysis.

RESULTS AND DISCUSSION

Treated plant shows abnormal chromosomal behaviour (Table 1) presenting the aberration percentage of PMC in different phase of cell division. Control plant shows the normal meiotic behaviour. A peculiar type of stickiness had reported during the study stickiness increase with the increase in concentration. In (Fig. 1a) chromosome in the

metaphase II form a very sticky mess completely lose their identity. Peculiar chromosomal stickiness becomes evident at metaphase II, when chromosomes formed a compact mass, completely loses their identity. Chromosome bridge formed due to disturbed chromosomal segregation (Fig 1d) unequal separation and legards were most frequent (Fig 1e,1 b,1 h,1i) The most frequent abnormalities in the two meiotic divisions were those related to chromosome unequal segregation. Fragments, un-orientation, precocious movement and micronuclei are also prominent during meiotic phases (Fig 1). Stickiness affects the pollen sterility and pollen size. In spite of their high meiotic instability, comparatively moderate pollen sterility 3% in control, 10% in 10 ppm 14% in 40ppm, 28% in 80ppm respectively was observed.

Table 1-Percentage of abnormalities induced by mercury treatment

	Metaphase abnormality%					Anaphase abnormality%				
Treatment	Pr	Non	St	Ot	Br	St	Lg	Mic	Ot*	Pollen fertility%
Control	-	-	-	-	-	-	-	-	-	97
Hg10ppm	-	-	-	.11	-	-	-	-	.15	90
Hg40ppm	.019	.17	1.42	.13	-	1.56	.13	.26	.21	86
Hg80ppm	2.0	.69	3.2	.48	1.24	3.9	1.4	.98	.56	72

Pr**-precocious movement; **Non** –Non orientation; **St**-stickiness; **Ot**-scattering, non-synchronous division, fragment; **Ot-unequal separation, multipolarity.

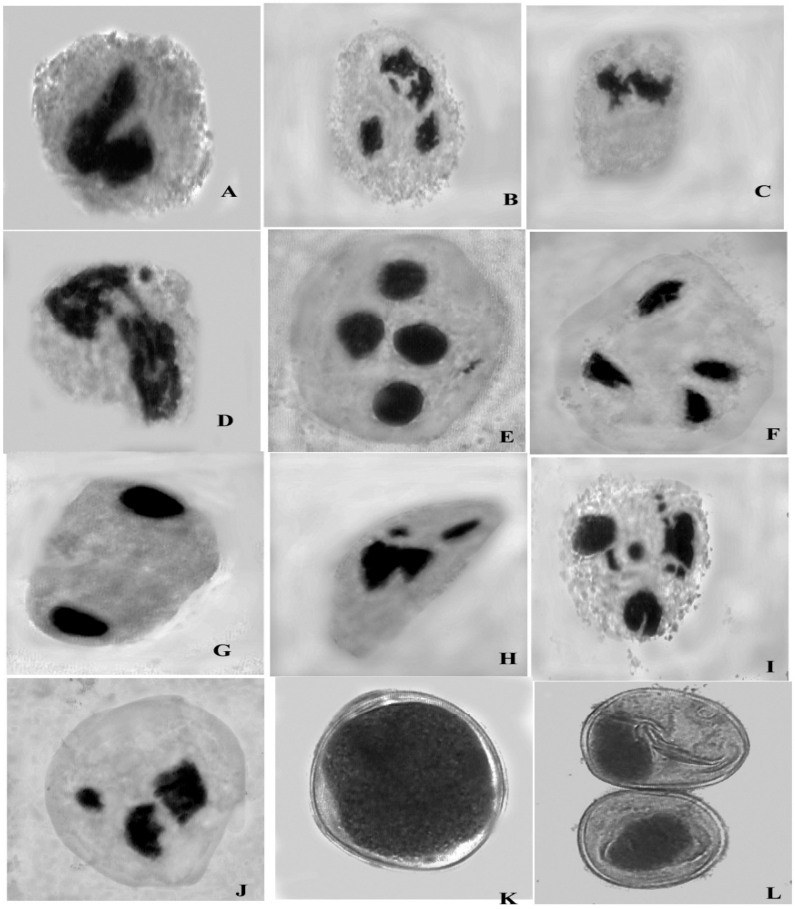

Fig 1-Showing meiotic aberrations ,1(a)- Condense stichiness at metaphase I, 1(b) - Sticky unsynchronous division at anaphase II, 1(c)-Sticky metaphase II , 1(d)- Bridge at anaphase I with legard, 1(e)- Unoriented tellophase with legard , 1(f)-sticky unoriented anaphase II ,1(g)- Sticky anaphase I, 1(h)-Sticky metaphase with legards, 1(i)-Usynchronous anaphase II with precocius movement , legards and micronuclei, 1(j)-Sticky anaphaseI with legard,1(k) and(l)- Fertile and sterile pollen .

Chromosomal stickiness due to the presence of a mutated gene [11]; Or abiotic factor as high temperature and herbicides are reported [4] by same phenomenon reported in present study states that mercury act as abiotic stress for Triticum aestivum plant leads to sticky behaviour of chromosomes.

Stickiness might be due to disturbances in cytochemical balance, reaction [12]. Multivalent associations have been attributed to pairing due to translocations and inversions [13]. Mercury causes gene mutation which disturb coding pattern of some non histone protein which involve in chromosome organization. Disturbances in metaphase II and anaphase II might be due to the disturbance of the spindle apparatus so the chromosome spreads irregularly in the cell. Unequal separation of chromosomes at anaphase I might be responsible for the presence of an unequal chromosome number in the second equatorial plates of metaphors II. Mercury chloride significantly influences aberration at higher extend, clastogenecity of mercury compounds has been lead to the formation of a chelate complex of mercury with DNA [6].

According to [14] anaphase bridge formation may be due to failure of the chiasmata in a bivalent on terminals as a result chromosomes are stretched between poles. Bridge formation at the telophase stage may be due to paracentric inversion. According to [10] laggards at anaphase may be due to a delay in terminalisation or the failure of spindle fibers to bind at the kinetochore. Abnormalities that cause male sterility are important tools in the investigation of anther and pollen development and plant breeding [9, 16]. Pollen fertility was the result of interchanges of segments between non-homologous chromosomes. Pollen fertility is an index of meiotic behaviour. When the chromosomal abnormalities are greater, the level of pollen sterility rises. Pollen sterility was reported in the present study need more evaluation to understand the behaviour of pollens under metal stress.

CONCLUSION

Present Findings show that mercury has mutagenic potential to induce sticky behaviour in chromosome at greater extent, especially at higher concentration, although the sticky chromosome percentage is somewhat related to pollen sterility, it was observed that with the increase in percentage of sickness pollen sterility also increased, so we can conclude that stickiness may induce male sterility. Finding new sources of male sterility is very beneficial for plant breeding and reproduction studies.

REFERENCES

[1] MC. Albertsen and RL. Phillips. *Can. J. Genet. Cytol*., **1981**, 23, 195-208.
[2] B. Baker ,ATC Carpenter ,MS Esposito ,R Esposito et al. *Annu. Rev. Genet*., **1976**, 10, 53-134.
[3] A Bajpai ,AK Singh. Meiotic Behavior of Carica papaya L.; *Cytologia*., **2006**, 71,131-136.
[4] C.M Caetano-Pereria , M.S Pagliarini and E.M. *Brasil.. Maydica*., **1995**, 40, 325-330.
[5] AP Caryl ,GH Jones and FC Franklin . *J. Exp. Bo*., **2003**, 54, 25-38.
[6] Damodara Poojary. M, H. Manohar . *Inorganic chimica acta*., **1985**, 93, 153-160.
[7] IN Golubovskaya. *Int. Rev., Cytol.* **1979**, 58,247-290.
[8] ME Gaulden, *Mutagenesis*, **1989**, 2,357-365.
[9] HT Horner and RG. Palmer . *Crop Sci*., **1995**, 35, 1527-1535.
[10] G. Kumar , Tripathi. *J Indian Bot Soc*., **2004**, 83,136-140.
[11] MLH Kaul , TKG Murthy. *Theoratical Applied Genetic*s., **1985**, 70, 449–466.
[12] PN.Rao ,P. Ranganadham and Nirmala, *Genetica* .,**1990**, 81,221-227.
[13] M.A.Q.Shaikh and M.B.E Godward, *Cytologia*., **1972**, 37, 497–505.
[14] LG Saylor , BN. Smith . *Am J Bot* ., **1996**,53, 453-468.
[15] SP.Sosnikhina , EI. Mikhailova , OA. Tikholiz ,SN. Priyatkina , et al. *Russ. J. Genet*., **2005**, 41: 1310-1321.
[16] C.Shifriss. *Euphytica* .1997, 93, 83-88.
[17] JH. Zou , M. Wang ,W.S Jiang , Liudh. *Pak. J. Bot*., **2006**, 38(3), 673-681.