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Studies on cytological changes induced by moth balls in root meristem cells of V*icia Faba* l.

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Abstract

The cytotoxic effects of napthalene (Moth Balls) were analysed for clastogenesis and teratogenesis in the root meristems of *Vicia faba*, Napthalene ($C_{10}H_8$) or tar camphor or white tar is an aromatic polycyclic hydrocarbon, used as moth repellents and in the production of dyes, perfumes, pharmaceuticals and carbaryl disinfectants. The napthalene has mitodepressive and mitostatic effects on somatic cell division which is directly proportional to concentration and duration. The clastogenic effects induced by naphthalene are stickiness, condensation, breakage, disturbed metaphase, bridges, laggards, micronuclei etc. The present investigation clearly revealed that moth balls showed clastogenic and mitostatic action. Hence, precautions should be taken in order to avoid hazardous effects on non-targeted organisms.

Key words :

Napthalene, Cytotoxic Effects, *Vicia faba*, Chromosomal aberrations

Inroduction

Chromosomal aberrations in plants serve as an excellent monitoring system for the detection of toxic effects of environmental chemicals that may pose a genetic hazard[10]. Napthalene ($C_{10}H_8$) is an aromatic polycyclic hydrocarbon having two fused benzene ring structure. John Kidd (1821) described the properties, means of its production and proposed the name '**Napthaline'** as it had been derived from a kind of naptha (a broad term encompassing any volatile, flammable, liquid hydrocarbon mixture, including coal tar). Napthalene is the most abundant single component of coal tar. It may be obtained from petroleum fractions and synthetically from phenyl-butylene. It also occurs naturally in the essential oils of the roots of *Radix* and *Herba ononoidis* and clove buds (*Syzygium aromaticum*).

Napthalene's most familiar use is as household fumigant in the form of moth balls or cakes (odonil). In a sealed container naphthalene fumigation forms a toxic level to both adult and larval forms of many moths that are destructive to textiles and its vapors can also slow the onset of rust. Larger volumes of naphthalene are used as a chemical intermediate to produce other chemicals like phthalic anhydride and anthranilic acids (used in dye manufacturing viz. Indigo, indanthrene and triphenyl methane dyes), alkyl naphthalene sulfonate surfactants, insecticide carbaryl, tetralin and decalin (used as low volatility solvents). Napthalene is also used in the forms of dusting powders, synthetic resins, lubricant,

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celluloid, lampblack, smokeless powders, lavatory, deodorant disks, wood preservatives, fungicides, insecticide, vermicide, intestinal antiseptic and in the treatment of pediculosis and scabies[4]. Napthalene absorbs ultraviolet rays[6]. Napthalene induces mutations in insects, but not in bacteria or cultured human lymphoblastoid cells (immature white blood cells)[2,5] . In newt larvae, naphthalene induced micronucleus formation (an indicator of chromosome damage or loss). In cultured mammalian cells, it produced chromosomal aberration, sister chromatid exchange (CHO cells only), and formation of kinetochore-negative micronuclei (which indicate chromosome loss), or cell transformation (a step in tumor formation), No reports were available in the literature about the potential cytogenetic effects of naphthalene in plants. Present paper includes the clastogenic or teratogenic effects of naphthalene using root meristem cells of *Vicia faba* as test system.

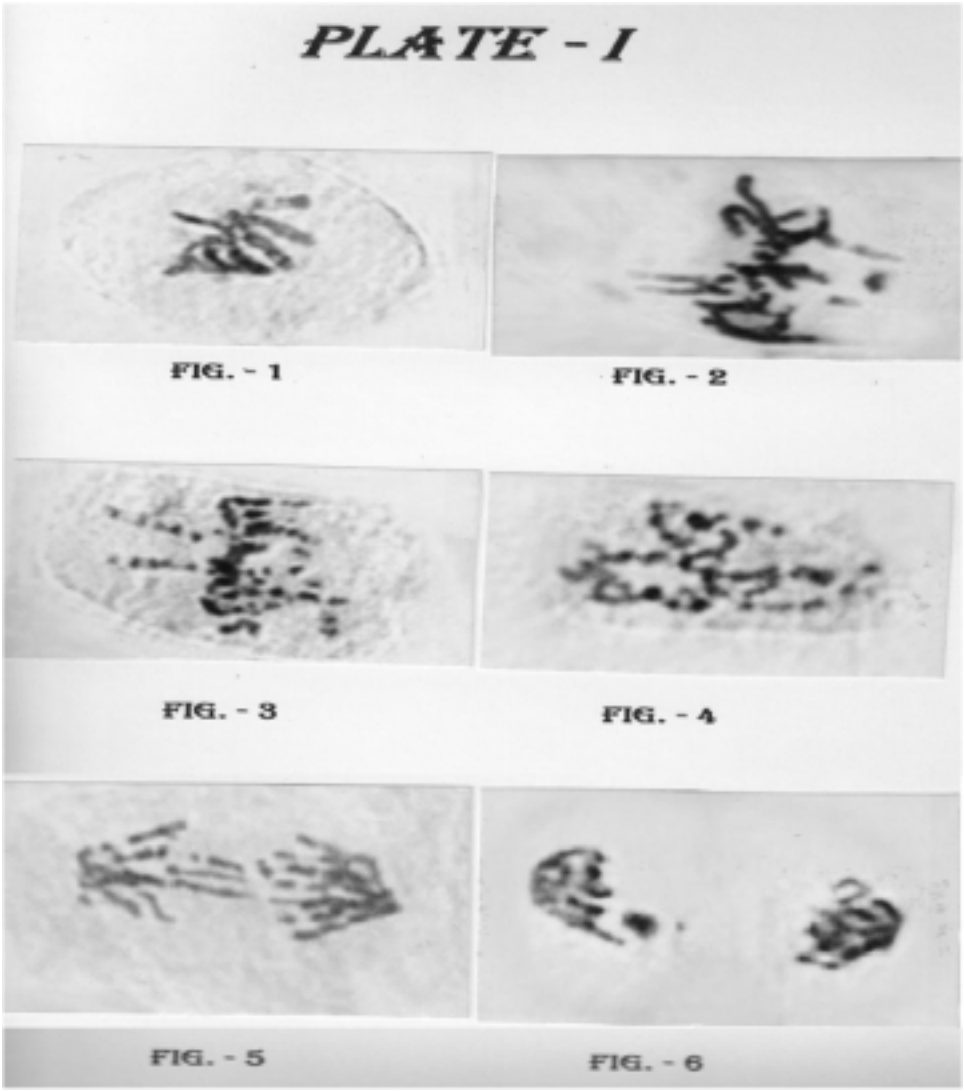
Materials and Methods

Healthy and uniform size seeds of *Vicia faba* were germinated on moist filter paper in petridishes. The root tips when 1 to 2mm. long were subjected to the treatment of different concentrations (10, 20, 30 and 50%) of naphthalene prepared in distilled water for varying durations (3-9hrs.) of time. The treated root tips were washed and then fixed in Carnoy's fixative for 6 hrs. and finally transferred to 70% alcohol for longer storage. The fixed root tips were squashed in 1% acetocarmine. The slides were observed in high power and some important stages were photographed at magnification of 600x.

Results and Discussion

The Results showed that napthalene induced different mitotic changes in the root meristem cells of *Vicia faba.* These includes reduction of mitotic index of the meristematic cells and a number of chromosomal aberrations like chromatin fragments, stickiness, bridges and laggards etc. A decrease in the mitotic index in root meristems of *Vicia faba* was observed after root tip treatment with 10, 20, 30 and 50% of naphthalene for 3-9 hrs. The concentration dependent decrease of mitotic index suggested a mitodepressive action of this compound comparable to that of other pesticides in *Vicia faba*[1] and of food dyes in *Allium cepa*[8]. Naphthalene has an effective role to induce a number of abnormalities involving all the stages of mitosis. The increment of frequencies was concentration related. In this study bridges and fragments were induced in all concentrations (Fig. 3 and 4). Chromosome stickiness was the most common type of abnormalities (Fig.1). Stickiness has been attributed to an action on the proteins of chromosomes. Stickiness may be due to degradation or depolymerization of chromosome DNA[3]. Other types of abnormalities were observed such as disturbed metaphase (Fig.2) which is the result of an action on the spindle apparatus. This effect is similar to that of mitotic poisons or C-mitotic compounds[9,10]. A low percentage of lagging chromosomes (Fig.5) and micronuclei formation (Fig.6) was observed. Lagging chromosomes can be attributed to the delayed termination or because of the failure of the chromosome movement[7].

Fig. 1. Disturbed metaphase showing clumping of chromosomes.
Fig. 2. Sticky metaphase showing unoriented chromosomes.
Fig. 3. Metaphase showing fragmentation of chromosomes.
Fig. 4. Disturbed anaphase showing unequal separation.
Fig. 5. Anaphase showing bridges with fragments.
Fig. 6. Telophase showing a laggard.



Conclusion :

It is concluded from the foregoing that naphthalene (moth balls) induced mitostatic and turbagenic leading to clastogenis effects in the root meristem cells of *Vicia faba*. Chromosome stickiness and fragmentation are the most common and predominant type of chromosomal anomalies besides inactivation of spindle and non-orientation or non-disjunction of chromosomes. The chemical acted as mitotic poison and produce c-mitotic effects on the mitotic cycle. The clastogenic effects clearly revealed the toxic nature of moth balls and its mutagenic potential.

Hence, precaution should be taken in the use of moth balls due to hazardous effects on targeted and non-targeted biota.

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