Effect of Household Detergent on Mitotic Root Tip Cells of Vigna unguiculata (Cowpea)

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Abstract: Two household detergent (Chemical washing powder and Herbal washing Powder) were evaluated for possible genotoxic effect in the cowpea root tip cells. Household detergents gained popularity over other cleaning agent as they are free from animal fat and act at low concentration in acidic as well as Alkaline medium in hard water. Plant chromosomal aberration assay was exploited for screening. cowpea seeds were incubated for over night in aqueous solutions of household detergents in three different concentration (low 0.1%, medium 0.3% and high 0.5%). The untreated seeds were used as control (incubated in distilled water). Herbal washing detergent has the maximum inhibitory effect on germination. In Chemical washing detergent seed were germinate in all concentration. Detergent cause fragmentation the most deleterious damage. Cytotoxic and genotoxic effects were evaluated by observing chromosomal aborration observed in cells mostly lethal but some cells with related aberration are viable that can cause genetic effect either somatic or inherited. Therefore daily use of hand washing with detergents may cause skin cancer and due to increase used of detergents the domestic and sewage water get contaminated which are main source of irrigation for kitchen garden and farmland around the cities.

Keywords: Mitosis, Cell Blebbing, Pyknosis

1. Introduction

- Cowpea (Vigna unguiculata) also known as black eye pea and common name are lobia and barbate is a herbaceous annual crop mostly grown in the dry agro-ecology.
- In India context it is a minor pulse cultivation mainly in arid and semi arid tracts of grown in pockets of Punjab, Haryana, Delhi and West UP.
- Cowpea is a diploid with 2n=22 chromosome and a genome size of about 620 million base pairs.
- Cowpea is cultivated mainly for its grains, which are in protein with most improved varieties containing between 20 and 25% on dry weigh basis. Fresh leaves are also used as pot herb especially in east Africa.
- In India, domestic waste water and city sewage are used for irrigating kitchen gardens and croplands and the detergents may affect crops or soils or both.
- This may ultimately cause nutritional imbalance, disorders and toxic effect on growth, metabolism and product composition synthetic detergents contain surfactants, phosphates, bleaching agents, enzymes and other additive to match user requirement.

Classification of cowpea

Rank	Scientific Name and Common Name
Kingdom	Plantae-Plants
Subkingdom	Tracheobionta-Vascular plants
Superdivision	Spermatophyta-Seed plants
Division	Magnoliophyta- Flowering plants
Class	Magnoliopsida- Dicotyledons
Subclass	Rosidae
Order	Fabales
Family	Fabaceae LindlPea family
Genus	Vigna Savi-cowpea
Species	Vigna unguiculata (L.) WalpCowpea

Cowpea nutrition value (raw cowpeas)

Amount per100 grams

une per 100 grums	
Calories 336	% daily value
Total fat 1.3 g	2%
Saturated fat 0.3g	1%
Cholesterol 0mg	0%
Sodium 16 mg	0%
Potassium 112 mg	31%
Total carbohydrate 60g	20%
Dietary fiber 11g	44%
Sugar 7g	
Protein 24g	48%
Vitamin C	2%
Iron	46%
Calcium	0.08-0.11%
Vitamin B6	20%
Magnesium	46%
Vitamin D	0%

2. Material and Method

2.1 Materials

- 1) Cowpea (seed)
- 2) Detergent (Chemical & Herbal washing powder)
- 3) Distilled water
- 4) Aceto-carmine
- 5) Ethanol
- 6) Glacial Acetic acid
- 7) Para di-chloro benzene

2.2 Equipment

- 1) Petri plate
- 2) Forceps
- 3) Cotton
- 4) Filter paper
- 5) Sprit lamp
- 6) Slides
- 7) Watch glass
- 8) Spatula

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9) Tissue paper

- 10) Coverslips
- 11) Measuring cylinder
- 12) Test tube
- 13) Microscope

2.3 Methods

- 1) Selection of seed
- 2) Preparation of stock solution
- 3) Serial dilution
- 4) Soaking of seeds
- 5) Germination





Herbal stock solution Chemical stock solution



Control



Herbal 0.1%



Herbal 0.3%



Herbal 0.5%



Chemical 0.1%



Chemical 0.3%



Chemical 0.5%



Control

Seed Germination



Herbal 0.1%

0.3%

0.5%



Chemical 0.1%

0.3%

0.5%

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Cytological techniques

Cytological techniques are methods used in the study or manipulation of cells. These include methods used in cell biology to culture, track, phenotype, sort and screen cells in populations or tissues, and molecular methods to understand cellular function.

- Paradichlorobenzene preparation •
- Fixation of root tips •
- Preparation of fixative •

- Storage of root tips •
- Preparation of temporary cytological slide by squash • method
- Preparation of acetocarmine
- Preparation of 45% glacial acetic acid •
- Slide preparation •

Slide was ready to be observed.



Sticky in metaphase

3. Observation



Normal cells arrangement

Dividing cells

Vacuolated cells



Binucleate cell

Formation of lesion

Cells digradation



Damaged Cells

Giant cells

Ghost cells

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Elongated cell

Blebbing of cells

Abnormal cell

4. Result and Discussion

- Binucleate cells observed in the study were consequences of cytokinesis inhibition at any checkpoint of the cell cycle.
- Sticky chromosome in metaphase loses their normal appearance and they are less seen with sticky surface causing chromosome assemblage. Formation of sticky chromosomes at metaphase and late telophase and coagulated anaphase are due to the cytotoxic effect of detergents in different concentrations.
- Chromosome breakage indicates clastogenic effect.
- Pulverised prophase were seen. Pulverisation of chromosome in micro nuclei may also be explained as chromothripsis is developmental disorders, where isolated chromosome or chromosome arms undergo massive local DNA breakage and rearrangement.
- Many ghost cells were seen in the study which showed the existance of dead cells or apoptotic cells due to cytogenetic damage.
- Nuclear lesions were seen. According to Akaneme and Lyioke the presence and nuclear lesions indicates cytological evidences for the inhibitory effect on DNA biosynthesis.

5. Conclusion

In our study, the effect of detergents [Chemical Washing Powder and Herbal Washing Powder] on mitotic root tip cells of brown cowpea were evaluated. Different types of chromosome abnormalities were observed. Household detergent are the part of a large groups of chemical compound which are toxic to aquatic flora and fauna even humans. In waste water studies detergents are known causative agents of cytotoxic effects. The differential toxicity observed in the detergents may be due to the ingradients and their concentration types of surfacants used in their preparation chemicals in detergents, causing errors in normal cell-division. [Ozkara et al 2015].

It is concluded that these detergents are capable of causing chromosomal aberrations. They are genotoxic and could be carcinogenic. Detergents should be treated more carefully in their production due to negative effects on the life, development and genetics of living being.

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