

Pesticide induced genotoxicity assessment in mung beans by DNA fragmentation assay.

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ABSTRACT

The purpose of this study was to determine and compare plant DNA breakage in *Vigna radiata* (mung bean). The mung bean was grown with two pesticides, one of which is chloropyrifos and the other is Pepsi. The DNA fragmentation assay was used to evaluate the degree of DNA breakage. Viable counting was estimated for each plant, totally enhanced, and brought up for a statistical measure of which plants had growth issues and how many seeds didn't accept the chemical, and it was taken into account for reasons. Coca-Cola and Pepsi have been used by Indian farmers as a cheaper alternative to insecticides. So I'm giving my plant pepsi to test whether it will cause DNA damage. After completing the DNA fragmentation assay, we discovered that the control plant has a nice set of smear and darker DNA, whereas pesticide has affected other plants.

Keywords : Mung beans, DNA fragmentation assay, chloropyrifos, insecticides and genotoxicity

I. INTRODUCTION

Pesticides are used in agriculture to prevent weeds, insects, fungi, and disease from destroying crops. Chemical agents employed in crop production have been shown to provide a

genotoxic danger to agricultural plants, as well as humans and animals, according to studies. The creation of adducts, or the binding of these compounds to DNA, is heavily implicated. Many pesticides are electrophilic agents, meaning they can react with DNA at various points. Pesticides or their metabolites react with DNA bases, altering the structure of the nucleic acid and preventing correct replication. This breakdown of genetic material results in poor vine, leaf, root, or fruit development, and eventually poor agricultural output quality or yield. This research focuses on the extent and type of the risk that pesticides provide to plant DNA, either directly or indirectly through interactions with pesticide compounds or metabolites. Oxidative stress causes DNA damage. Pesticide treatment of diverse agricultural plants, isolation of plant DNA, and assaying of DNA alterations are all part of the biological experiments. The green gram, maash, or moong is another name for the mung bean (*Vigna radiata*). Mudga (Sanskrit: mudga) is a legume plant species. In India, Pakistan, Bangladesh, Nepal, Sri Lanka, China, Taiwan, Korea, South Asia, and Southeast Asia, the mung bean is mostly grown. It's a versatile component that may be utilised in both savoury and sweet meals.



Figure 1 and 2 : Mung bean seeds and flowers.

The mung bean is a yellow-flowered annual vine with fuzzy brown pods. The English

word mung, which is pronounced correctly as 'Moong,' comes from the Hindi word moong,

which is derived from the Sanskrit (mudga) (Fig 1 and 2). Moong is referred to as "Paasi Payaru" in Tamil. Mung beans are one of a number of species that have recently been shifted from the genus *Phaseolus* to the genus *Vigna*. The species is still called *Phaseolus aureus* or *Phaseolus radiates* erroneously.

Pesticides are chemicals used to manage pests and weeds [1]. Herbicide, insecticide, insect growth regulator, nematicide, termiticide, molluscicide, piscicide, avicide, rodenticide, predacide, bactericide, insect repellent, animal repellent, antimicrobial, fungicide, disinfectant (antimicrobial), and sanitizer are all examples of pesticides. [2] Herbicides are the most frequent of

them, accounting for nearly 80% of all pesticide use. [3] The majority of pesticides are designed to protect plants (also known as plant protection products).

Crop protection products (sometimes known as pesticides) protect plants from weeds, fungus, and insects. Chlorpyrifos is classified as Class II: moderately dangerous by the World Health Organization for acute effects (Figure 3). In experimental animals, the oral LD50 ranges from 32 to 1000 mg/kg. In rats, the dermal LD50 is greater than 2000 mg/kg, but in rabbits, it is 1000 to 2000 mg/kg. Chlorpyrifos has a 4-hour inhalation LC50 of more than 200 mg/m³ in rats.

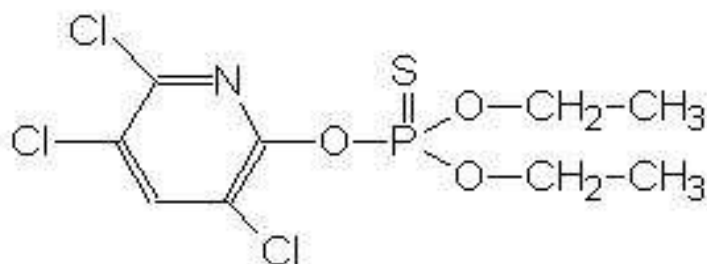


Figure 3 : Chemical structure of chlorpyrifos

Pepsi is a brand of carbonated soft drink made by PepsiCo. Caleb Bradham invented and presented Brad's Drink in 1893, but it was renamed Pepsi-Cola on August 28, 1898 (1,4-6) and then Pepsi in 1961. Carbonated water, high fructose corn syrup, caramel colour, sugar, phosphoric acid, caffeine, citric acid, and natural flavours are used to make Pepsi in the United States. A 12-ounce can of Pepsi contains 41 gms of carbs (all sugars), 30 mgs of salt, 0 gm of fat, 0 gm of protein, 38 mg of caffeine, and 150 calories (7-12). Coca-Cola has 10 more calories, 2 more gm of sugar, and 2 more gm of carbs than Pepsi. Pepsi Caffeine-Free includes the same ingredients as regular Pepsi, but without the caffeine:

Pesticides are widely used in agriculture to increase crop yields, and as a result, they accumulate in the environment. As a result, it's important to figure out what influence they have on organisms in nearby little bodies of water (eg. Creeks, ponds, and drainage ditches). Chlorpyrifos is a pesticide that attracts a lot of study attention, in part because there has already been a lot of research done on the

product, so researchers have a head start (13-18). Chlorpyrifos is also of continued concern since it is widely used on food crops, resulting in widespread human exposure. Human blood has been found to contain trace amounts of chlorpyrifos, and low quantities of its principal metabolite, or breakdown product, TCPy (trichloro-2-pyridinol), have been found in human urine.

II. MATERIAL AND METHODS:

Mung bean seeds were collected from market located at Chennai, South India in 2017. The seeds were soaked in 2ml of insecticide solution for 24 hrs. And some seeds are treated with pepsi and kept for germinating. After treated with insecticides, seeds were placed in cotton at petri plates. The seeds were maintained till its germination of apical root meristems. One set of seeds in a petri plate without treating with any insecticides but with normal water is maintained as control. It took 7 days for the growth of plant (4-6).



Figure 4 : Plant grown after treating with insecticide. Plant grown after treating with pepsin and plant grown after treating with pesticide:

DNA Fragmentation Assay:

When DNA fragments arising from apoptotic DNA fragmentation are detected following separation by gel electrophoresis, a characteristic known as DNA laddering can be seen. Andrew Wyllie of the University of Edinburgh Medical School was the first to describe it in 1980. (19-28). DNA fragments can also be seen in necrosed cells, but when these DNA fragments are separated and run through a gel electrophoresis, no distinct "ladder" pattern emerges.

III. RESULTS :

When DNA fragments arising from apoptotic DNA fragmentation are detected following separation by gel electrophoresis, a characteristic known as DNA laddering can be seen. Andrew Wyllie of the University of Edinburgh Medical School was the first to describe it in 1980. (19-28). DNA fragments can also be seen in necrosed cells, but when these DNA fragments are separated and run through a gel electrophoresis, no distinct "ladder" pattern emerges.



Figure 5 : The first two bands are for control plant and second two are of plant grown in pesticide and The last two are DNA of plant grown in pepsin.



A : normal treated **B.** Pesticide treated

Figure 6 A and B: Viable counting in normal and pesticide treated plant.

Control plant measurement: Plant 1=1.7 cm, Plant 2= 21.2 cm, Plant 3=12.9 cm, Plant 4=10.5cm, Plant 5=10.3cm , Plant 6=5.4cm, Plant 7=3cm, Plant 8=1cm, Plant 9=2 cm , Plant 10=1.5

cm. Pepsin plant measurements: Plant 1=24 cm, Plant 2= 18 cm, Plant 3=15.5 cm, Plant 4=16.5cm, Plant 5=9.3cm , Plant 6=9cm, Plant 7=7.2cm , Plant 8=5.5cm, Plant 9=3 cm, Plant 10=1.5

cm. Pesticide plant measurements: Plant 1=20 cm, Plant 2= 21cm, Plant 3=17.1cm, Plant 4=12.5cm, Plant 5=7.5cm, Plant 6=4.6cm, Plant 7=3.1cm, Plant 8=2cm, Plant 9=2.6 cm, Plant 10=1.4 cm.

IV. SUMMARY AND CONCLUSION:

Coca-Cola and Pepsi have been used by Indian farmers as a cheaper alternative to insecticides. So here I am, also dosing my plant with Pepsi to test whether it will trigger DNA breakdown. The study for assessing DNA damage induced by certain insecticides in green gramme was effectively performed. Insecticides cause DNA damage as concentrations rise, according to the study. DNA fragmentation Assay is the procedure used to assess DNA breakage. After completing the dna fragmentation assay, we discovered that the control plant has a good set of smear and darker dna, whereas the pesticide has a faded smear and dna in other plants. Insecticides are less hazardous to plants at the genetic level at lower concentrations, it can be determined. Because chlorpyrifos does not harm DNA, it can be used on plants at authorised doses. @ 50 parts per million Another type of DNA damage, the double strand break, has been proven to cause cell death (cell death), cell cycle arrest, and other detrimental effects on plants through apoptosis (cell death), and other mechanisms. According to the findings, higher pesticide concentrations in plants result in increased DNA damage and cell apoptosis. Other creatures such as water plants, animals, and even people have been discovered to be harmful to the above-mentioned chemical. Higher organisms are exceedingly harmful to it. The buildup of compounds such as pesticides or other chemicals in an organism is known as bioaccumulation. When an organism absorbs a material at a higher rate than it is eliminated through catabolism and excretion, this is known as bioaccumulation. When plants consume insecticides, bioaccumulation occurs, and the insecticides reach people and other species through consumption of the plant. It could have an impact on the cuisine.

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