



EFFECTS OF SOLVENTS EXTRACT OF *DATURA METEL* L. (ZAKAMI) STEM ON *ALLIUM CEPA* ROOTS

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Abstract

The effects of solvents extract of *Datura metel* L. stem was carried out in chemistry and biology laboratories of College of Agriculture, Science and Technology Lafia and Plant and Soil laboratories of Faculty of Agriculture Shabu, Nasarawa State University. To determine the effects of solvents extract on growth of *Allium cepa* roots. The results showed that the extract had an inhibitory effects on cell division of *Allium cepa* root tip as the concentration of the extract increase growth of root length decreases. Microscopic examination showed chromosomal aberration like stickiness of chromosomes, spindle dysfunction, fragmentation and condensed chromosome.

Introduction

Datura metel L., with local name “Zakami”, is an erect perennial herbaceous plant with spreading branches, belonging to the *Solanaceae* family with a height of 1.5m. Leaves are simple, alternate, dark green, broadly ovate, shallowly lobed and glabrous. *Datura*, a genus of medicinal herb is credited with toxic as well as medicinal properties. The different plant of *Datura spp.*, mainly *D. stramonium* L., commonly known as Datura or Jimson weed, *D. stramonium* is potentially used to treat numerous human diseases. It also contains toxic tropane alkaloids, including atropine, scopolamine, and hyoscamine. Although some studies on *D. stramonium* have reported potential pharmacological effects, Moreover, the frequent abuse of *D. stramonium* for recreational purposes has led to toxic syndromes. Therefore, it becomes necessary to be aware of the toxic aspects and the potential risks accompanying its use. (Sayyed *et al.*, 2014). Primarily used as an intoxicant and hallucinogen (Alabri, *et al.*, 2014). It is widely cultivated in Europe, Asia,

America, South Africa, and other tropical and subtropical regions (Gaire *et al.*, 2013). In Northern Nigeria they are found growing along road and waste dump and surrounding compound, they are not cultivate as medicinal herb (Aliyu, 2022). *Datura* can be well-grown in average soils, but it prefers nutrient-rich and moist loamy soil or alkaline soil (Monira *et al.*, 2012). Although the plant acts as a narcotic, it has distinct effects on human health, rendering it incredibly beneficial as medicine plant (Nasir *et al.*, 2020). This may be attributed to the fact that it possesses antimicrobial, anti-diabetic, anti-asthmatic, anti-inflammatory, antioxidant, analgesic, insecticidal, cytotoxic, wound healing, and neurological activities (Al-Snafi *et al.*, 2020). The *Datura* plant is also known for its larvicidal effects against red flour beetle (*Tribolium castaneum*) and mosquito repellent activities (Devi *et al.*, 2011). In addition, *Datura spp.* has also been used against animal bites such as snake bites.

Several incidences of accidental or intentional *Datura* species poisoning have been

reported from different part of the world, when eaten directly or through decoction made from herbal prescriptions, owing to its mind-affecting properties (Boumba, *et.al.*, 2004). There had been reported cases of substance abuse of *Datura metel* seeds, aqueous extract of the leaves and roots. It has been erroneously used by unscrupulous people to drug alcoholic drinkers, or added to soft drinks and beverages to cause memory loss, disorientation or unconsciousness of victims as its aqueous extract had no smell or taste. Its fruits aqueous extracts is also used by subsistence farmers as anti-bacterial and antiviral in treatment of chickens against Newcastle disease (Aliyu, 2023).

In addition to a number of beneficial health outcomes, the presence of anticholinergic alkaloids such as tropane renders the *Datura* species toxic to the nervous system (Shah *et.al.*, 2013), and the symptoms of toxicity include fever, dry skin, dry mouth, headache, hallucinations, convulsions, rapid and weak pulse, acute confusion, delirium, tachycardia, coma, and death (Monira and Al-snafi *et.al.*, 2017). Moreover, due to its toxicity, *Datura spp* should not be used in case of glaucoma, pyloric stenosis, tachycardia arrhythmias, enlarged prostate, and acute pulmonary edema (Al-snafi *et.al.*, 2017). The seed extracts at a concentration greater than 0.5% induced adverse physiological modifications. In fact, all the parts of *Datura* have severe anticholinergic effects due to suppression of central and peripheral cholinergic neurotransmission, ultimately leading to death in humans. It was recently reported in the news that five youths died in Kano state after consuming a beverage made of *Datura metel* seeds (BBC, 2023). Intoxication with *Datura* extracts leads to adverse impact on the central nervous system, disorientation, memory loss, inability to process information, impaired vision due to mydriasis, myoclonic jerking, hyperpyrexia, and respiratory and cardiovascular problems (Krenzelok *et. al.*, 2010). The study also suggested that the seed extracts were comparatively safer to induce sleep with better anesthetic indices.

Datura, in general, constitutes significant amounts of carbohydrates, fats, protein, moisture, ash content, and crude fiber besides, major phytochemicals found in *Datura* include alkaloids, phenolic compounds, tannins, flavonoids, and cardiac glycosides (Bagewadi *et. al.*, 2019). In addition, many amino acids

such as alanine, phenylalanine, glutamate, and tyrosine have also been isolated from the seeds (Al-sanfi *et. al.*, 2017). *Datura* species are particularly rich in tropane alkaloids. information about the toxicity of the seed are well reported but for stem remains almost uncertain it was for the reason that the research was carried out to investigate the effects of solvents extract of *Datura metel* L. stem on *Allium cepa* roots.

Materials and Methods

The experimental work was carried out at the College of Agriculture Science and Technology Biology and Chemistry Laboratories and Nasarawa State University Keffi Faculty of Agriculture, Lafia. Soil and Plant Laboratory Shabu Campus, Lafia, Nasarawa State. Lafia is located on latitude 08. 22° N degrees and longitude 08.32° E at an altitude of 181.33 meters above sea level. (NIMET, 2017)

The plant *Datura metel* were identify at the neighboring Village (Ombi 2) opposite College of Agriculture, Science and Technology Lafia. The plant were fully dug when the plant were with ripe fruits. The stem were subjected to very good washing with water thoroughly to remove all attached soil or dirt. The leaves and stem were rinsed in running water. The stem were sliced to expose a greater surface area to facilitated drying. The sliced specimen were oven-dried at temperature between 40°-60°C. The dry material were crushed in a mortar and pestle to powder form. 50g of the crushed specimen divided into three transferred into thimble of a soxhlet extractor. Reflux extraction was carryout in fume chamber. The first solvent was petroleum ether 250mls poured into 250mls conical flask, heating was performed with Bunsen burner at temperature of 60°-80°C for 1 hour 30minutes for each part. The second extraction was by use of chloroform. The distilled off extract of leaves was 150ml and that of stem 200mls respectively were kept in refrigerator at cold temperature of -4°C. The stem extract was diluted with water as test solution of varied concentration as follows: 0mls, 20mls, 30mls, 40mls, 50mls and 100mls, in 100mls beakers. Six randomly selected freshly harvested onions with their roots intact were wash carefully without causing injury to its delicate roots. The roots were counted and marked. The bulb were dip in each beaker with varied concentration as stated above as

treatments and time for root growth after 24hrs, 48hrs and 72 hours noted. Root length of *Allium cepa* and of varied test solution were measured and their mean taken. Few sample of root tip of *Allium cepa* (1-2cm) from apex severed off and sectioned to produce thinner longitudinal sections for cytological treatment.

Hydrolysis of the fixed roots in 8% or 0.8MHCL for about 5 minutes was performed. About 2mm opaque end of the root tip section off with a sharp razor blade and use for slide preparation. This treatment preceded their stabilization before squashing was done with bold end of a pen. For control purposes, another group of randomly selected roots was taken and treated with tap water instead of test solutions after they were cut, and fixation carry out as previously described for each period of collection.

Data collection

Root length were measure on randomly selected *Allium cepa* using micro-gauge in centimeter there mean and standard error computed Observation of the mitotic dividing cells were performed using high resolution microscope at 400 magnification respectively. Data were subjected to analysis of variance to determine the level of significant ($P < 0.05$). Ducan multi-range test was used to separate means using SPSS Statistic version 20.

Results

There was a decline in mean root length relative to control was observed (Table 1). The highest growth inhibition occurred at 100% concentration. Root decay was first observed at 100% concentration at 72 hours after treatment. Further decay was observed with time at 40% and 50% concentration between 46-72hours. The least root decay was observed at 30% concentration.

Microscopic examination of untreated (control) *Allium cepa* roots tip cells at high

magnification showed regular stages of mitosis including prophase, metaphase, anaphase and telophase with chromosomes showing normal behaviors expected at each mitotic stage. Chromosomal photograph not shown aberration induced by treatment with concentration of solvent extract of *Datura metel* stem as from 0.50M showed stickiness of chromosomes, c-mitosis metaphase plate distortion, spindle dysfunction, fragmentation with deeply condensed chromosomes. Table 2 a time dependent rapid increase in mitotic depression was observed for all treatment (Figure 1). The mitotic index (M.I) i.e. the ratio of dividing cells to the total number of cells examined for each treatment decrease with increase in concentration and time of treatments.

Conclusion

Root growth inhibitory effects of *Datura metel* stem solvent extract especially at high concentration is an indication of the cytotoxicity and genotoxicity effect of the extracts. The reduction in mitotic index as concentration increase showed that the extract have an inhibitory effect on cell division of *Allium cepa*. Also showed that there was no significant difference in the effect of time across the various concentrations used in the study. Thus the effect of solvents extract of *Datura metel* on mitotic index of *Allium cepa* root tip cells is concentration dependent. Similar concentration dependent effect has been reported for aqueous extract of *Momordica charantia*, *Pogostemon*, *Spondias mombin* and *auricularius* on *Allium cepa* root tip cells (Salaam, *et al*, 2016). Thus the disruption of mitosis and inhibitory effect on cell division of *Allium cepa* root tips means that the *Datura* solvents product are cytotoxic and genotoxic at certain concentration gradient respectively. Therefore, the therapeutic applications require extensive research and analysis of the plant from every aspects, especially its toxicity.

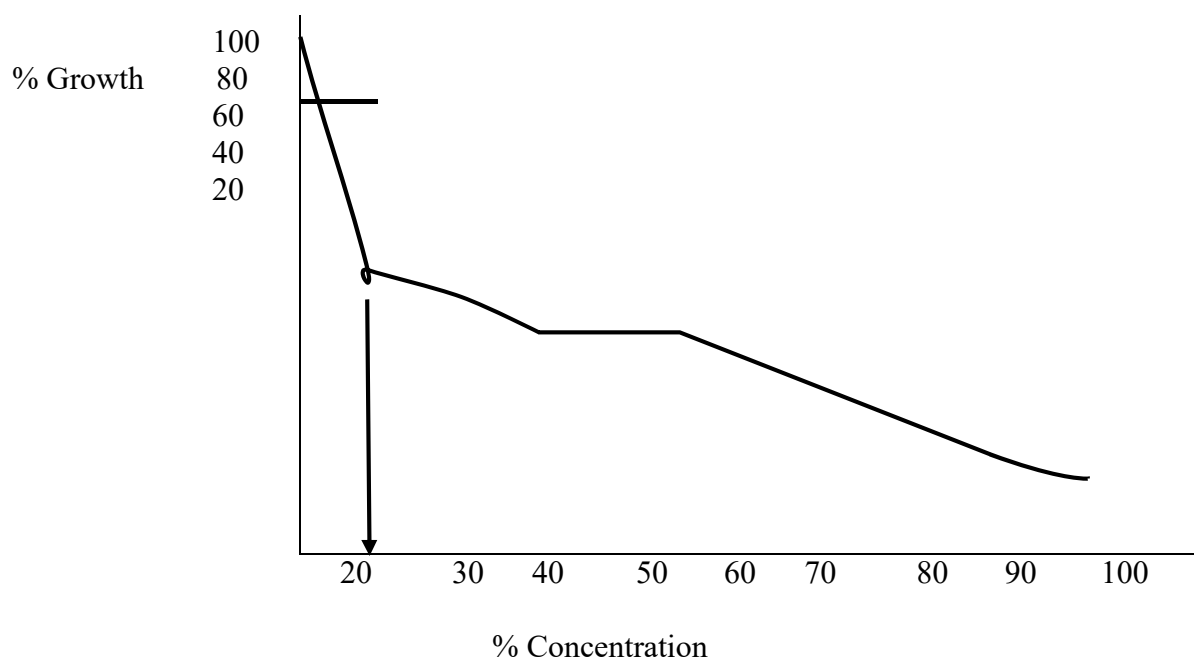


Figure1: Root Growth Curve

Percentage Growth of treated *Allium Cepa* Root.

% Concentration	Mean root Growths (mm)		% Growth	
	24hr	48hr	72hr	(T/C%)
0.00 control	4.64 \pm 0.36	3.3 \pm 0.32	3.24 \pm 0.34	100
0.50	1.08 \pm 0.37	1.57 \pm 0.35	0.67 \pm 0.35	34.72
0.60	2.64 \pm 0.35	2.23 \pm 0.31	1.44 \pm 0.30	39.74
0.70	2.87 \pm 0.37	2.44 \pm 0.36	1.85 \pm 0.27	42.60
0.80	2.88 \pm 0.42	2.68 \pm 0.36	2.17 \pm 0.32	56.40
0.100	0.41 \pm 0.32	0.01 \pm 0.31	0.00 \pm 0.01	23.84

Table1: T= Mean root length of treatment, C= Mean root length of control

Chromosome aberration *Allium Cepa* root tips Cells Treated with different concentrations of *Datura metel* extract

concentration	No. of Cell Count	Total dividing cells	Stickiness	C-mitosis	Vagrations	Bridge/fragments	Anaphase Lag
0.00	374	46	0	0	0	0	0
0.80	331	21	2	2	2	0	0
0.70	310	15	3	3	1	1	1
0.60	301	12	5	4	3	2	2
0.50	290	9	9	7	5	4	3
0.100	282	7	12	9	4	8	5

Table 2: *Allium Cepa* root tips Cells Treated with different concentrations of *Datura metel* extract

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