

Preliminary Phytochemical Screening and Toxicological Assessment of Locally Available Poisonous Plants

¹Harpreet Kaur, ² Vaishali Sinha

Master of Forensic Science(4th semester),Kalinga university, Raipur, Chhattisgarh

Assistant professor, department of Forensic Science, Kalinga university

Abstract

In this study we observed the presence of toxic compounds in ten common local species including Nerium oleander and Calotropis gigantea, of forensic relevance, posing a danger to humans and livestock. We confirmed the occurrence of different types of secondary metabolites, including but not limited to alkaloids and glycosides, demonstrated by commonly available inexpensive preliminary phytochemical testing methods, (e.g. Baljet test, Ferric chloride test, Vanillin test, and Copper Sulfate test) on water extracts of various parts of each plant. The findings illustrate the importance of understanding plant toxicity for traditional medicinal use and offer these preliminary tests as a swift, convenient and inexpensive means of screening for toxic substances, enhancing safety.

Introduction

There are a variety of plant species that are poisonous to humans. Plants develop toxins as metabolites to defend themselves from peril. The majority of the compounds in plants that are poisonous or toxic are organic compounds, metabolites, derived from

plants and the human environment; these include the following: alkaloids, diterpenes, flavonoids, tannins, cardiac and cyanogenic glycosides, nitrogen compounds, resins, oxalates, or specific proteins or amino acids. Many of these harmful secondary metabolites show variable characteristics based on their evolutionary origin and the environment. Plants can be toxic to humans; however, poisonous plants have also resulted in livestock deaths, health issues, reduced productivity, malformation of offspring, and a shorter life span, resulting in economic losses to producers. Poisonous plants are also important in forensic science because they can be relevant evidence for criminal cases, suicide, burglary, and other criminal acts.

Poisonous plants

Calotrope gigantia

C. gigantea, also known as giant milkweed. Is a common weed wildflower. *C. gigantea* has a native range in Bangladesh, Burma, China, India, Indonesia, Malaysia, Pakistan, Philippines, Thailand, and Sri Lanka. *C. gigantea* is another composed species with wide distribution in India. *C. gigantea* contains Cardiac glycosides, flavonoids, terpenoids, alkaloids, tannins, and resins.

Nerium Oleander

The *Nerium oleander* shrub is an evergreen. Widely referred to as oleander, and is generally recommended for use, it is widely cultivated and is believed to have originally been from Southwest Asia. Oleander is most prominent, and its alluring flowers offer a special danger of unintended consumption. The plant has also been associated with accidental poisonings, violence, and suicides when used with traditional medicine. Cardiac glycosides are found in the Oleander plant.

Lantana camara

Lantana Camara Is a flowering plant with the common names Lantana, Wild Sage, Surinam Tea Plant, Spanish flag, and West Indian lantana. *L. camara* has been shown to contain flavonoids, carbohydrates, proteins, alkaloids, glycosides, quinine, saponins, steroids, and tannins.

Ricinus communis

Ricinus communis, commonly known as the castor plant, is a flowering plant. It is presumed to have been named that way because of the pattern of the seed, as well as a drop at the end that resembles a certain type of tick. *Ricinus communis* contains ricin.

Thespesia populnea

Thespesia populnea (L.) Soland ex Correa is a small evergreen plant commonly referred to as the Portia tree. The name *Thespesia* is derived from the Greek word "thespesios", which means "divine or sacred". *Thespesia populnea* contains thespone and thespesone.

Coleus barbatus

Coleus barbatus is a fragrant succulent shrub that grows as a perennial. Makandi is also known as Patharchur in Hindi and Pashan bhedi in Sanskrit. This herb is found in various countries such as India, China, Africa, Pakistan, and Sri Lanka. It contains forskolin.

Sonchus oleraceus

The seed crop *Sonchus oleraceus* has a wide distribution. Examples of places where it can grow include: roadside, cultivated land, gardens, construction sites, sand dunes, logged or burned areas, walls, mountain slopes, and other areas near water. It contains phenols, seponins.

Dhatura

Datura species are known to be hazardous, but *Datura fastuosa* may be the most toxic of the group. There are active chemicals in the plant, but the seeds and leaves of this plant are the part used in medicines and other treatments. Active alkaloids include hyoscyamine, atropine, and scopolamine which are also found in other plants in this genus.

Brugmausia suaveolens

Brugmansia suaveolens popularly known as “Angel’s trumpet, Brazil’s white angel trumpet, also known as angel’s tears and snowy angel’s trumpet” is a flowering shrub, indigenous to South Africa. It is cultivated widely in Central America, Europe, Asia, Australia and New Zealand. It contains *atropine* and *scopolamine*.

Solaman surattense

Solanum surattense, a member of the Solanaceae family, is called kateli (Hindi), yellow berries or nightshade (English), kantakari (Sanskrit), kandangati (Tamil), nelamulaka (Telugu), bhejibaugana (Oriya).

The plant *Solanum surattense* has bioactive phytochemicals like saponins, alkaloid, glycosides, flavonoid, glycoalkaloid.

Literature review

1, Oleander, a bush found in tropical and subtropical environments, initiates positive inotropic effects in animals and humans and contains cardenolides (i.e., cardiac glycosides). Cardenolides derived from oleander have been used for restorative purposes and as a means of suicide. Although cardenolides would have similar adverse effects and extracardiac effects, they would have different toxic qualities. Humans are regularly exposed to oleander cardenolide, which is associated with high rates of human mortality, especially when exposed to oleander cardioglycoside for suicidal purposes.

Experimental animal models are used to determine treatment regimens.

2, The survey delivered a report on harmful therapeutic plants used for medicinal purposes for different medicines including antidiabetic, anticancer, antibacterial, antifungal and cytogenetic. It lists several phytochemical compounds with diuretic, laxative, purgative, and anti-allergy effects, which are vital to the pharmaceutical industry.

3, The castor plant (*Ricinus communis* L.) is utilized in many medicinal products for its anti-inflammatory, anti-helminthic, anti-bacterial, purgative and abortifacient characteristics. However, its toxic biological features, particularly its most toxic component ricin, are routinely misapplied. Ricin is the most researched protein in this

category of plant; for bioterror purposes it has been used. We will discuss its enzymatic action, structure, and cytotoxicity. Ricin has been designed into immunotoxins for treatment of cancer, promising in vitro or animal study results that have limited clinical trials.

4, The research investigated phytochemicals in Moringa plant extracts, which demonstrated presence of alkaloids, flavonoids, terpenoids, glycosides, steroids, and phenols. These compounds exhibited several pharmacological properties, including anti-cancer, anti-fungal, anti-bacterial, anti-inflammatory, anti-ulcer, and diuretic properties.

5, 40 poisonous plants linked to human deaths have been identified by researchers, and they have also established an approach for poisons in blood, which combines high-performance liquid chromatography with mass spectrometry. For the toxins oleandrine, taxol, and alkaloids, a liquid-liquid extraction was implemented and separated in two groups based on chemical properties. A filtration step was completed for cyanogenic compounds and atractyloside. The drugs were separated using C18 column technology with reversed-phase conditions in two portable stages, where elution mode using either acetonitrile or acetonitrile-methanol was employed.

Methodology

Sample Collection:- The plant samples were collected from different local areas.

Sample preparation:- plant samples were extracted with the help of distilled water.

Test

1, Baljet test

First make a solution with the help of picric acid, sodium hydroxide and distilled water.

Then take a test tube with a sample in it and pour few drops of the Solution.

Result:- Color- yellow, orange and reddish color indicates positive result

2, Ferric chloride test

Make a solution of ferric chloride and distilled water.

After that take a test tube with sample in it and pour few drops of the solution.

Result:- Color- blue and purple color indicates the positive result.

3, venilin test

Make a venicilin and hydro chloride solution.

Then take a test tube with a sample and pour few drops of solution in it.

Result:- Color- pink or red color indicate the positive result.

4, Copper sulphate test

Make a copper sulphate and distilled water solution.

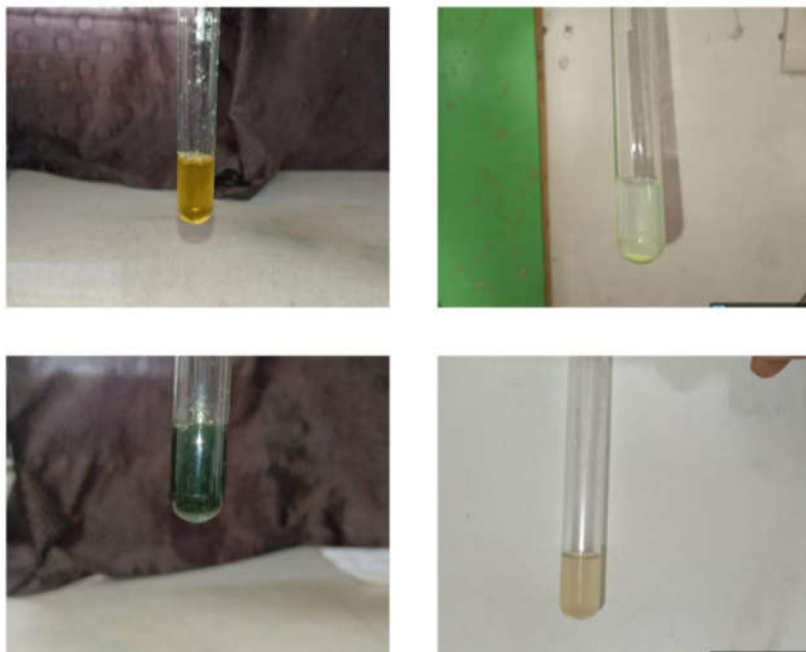
And take a test tube with sample and pour few drops of solution on it.

Result:- Color- color change or precipitation indicates the positive result.

Result:-

S.no.	Plant name	Plants part	Baljet test	Ferric chloride test	Venilin test	Copper sulfate test
1.	Thespesia populnea	Fruits leaf	Poitive Positive	Positive Positive	Positive Positive	Positive Positive
2.	Caltrope Gigantia	Flower Leaf	Positive Positive	Negative Positive	Positive Positive	Positive Positive
3.	Nerium oleander	Flower Leave	Negative Negative	Positive Positive	Positive Positive	Negative Negative
4.	Ricinus communis	Leaf Stem	Positive Positive	Positive Positive	Positive Positive	Negative Negative
5.	Lantana camara	Stem Leaf	Positive Positive	Positive Positive	Positive Positive	Negative Negative
6.	Coleus barbatius	Leaf Stem	Negative Positive	Positive Negative	Positive Positive	Negative Positive
7.	Sonchus oleraceus	Flower Leaf	Positive Positive	Positive Positive	Positive Positive	Negative Negative
8.	Dhatura	Fruits Leaf	Negative Positive	Negative Positive	Positive Positive	Positive Positive
9.	Brugmausia suaveolens	Flower Leaf	Positive Positive	Negative Positive	Positive Positive	Negative Negative
10.	Solaman surattense	Flower Leaf	Positive Positive	Positive Positive	Positive Positive	Negative Negative

result of baljet test, ferric chloride test, copper sulphate test and vennilin test



Discussion

The presence of diverse toxic secondary metabolites across a wide array of plant species, as highlighted by this overview, underscores the pervasive evolutionary strategy of chemical defense in the plant kingdom. The discussed plants, ranging from the common weed *Calotropis gigantea*, *thespesia populnea*, *ricinus communis*, *lantana camara*, *coleus barbatus*, *sonchus oleraceus*, *datura*, *brugmausia suaveolens*, *solaman surattense* to the cultivated ornamental *Nerium oleander*, exemplify how different plant families have converged upon or diversified unique biochemical pathways to produce compounds detrimental to herbivores and, inadvertently, to humans and livestock. This chemical arms race has resulted in a fascinating array of organic compounds, including alkaloids, diterpenes, flavonoids, tannins, and cardiac and cyanogenic glycosides, each with distinct mechanisms of action.

Conclusion

Local plants used in traditional practices may pose health risk due to insufficient scientific research on their toxicity, environment, variation and preparation methods, highlighting the need for thorough testing. More studies are needed to understand their effects and assess long-term exposure risk. These preliminary phytochemical screening can play a major role as we don't have these kind of preliminary tests because we mainly focus on instrumental tests, which is costly, time consuming and difficult. So these kind of tests are easy to perform and can help to quickly detect harmful substances, ensuring safety.

Reference

Dubey, N. Dwivedy, A. Chaudhary, A. Das, S(2018, 23 February) Common Toxic Plants and Their Forensic Significance.

<https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/poisonous-plant>

Pradeep, S. A, B. Sanap, G (2023, 3 march) article on caltropes gigantia.

https://www.researchgate.net/publication/369791518_Review_Article_on_Calotropis_Gigantea

Farooqui, S. Tyagi, T(2018, 22 january)NERIUM_OLEANDER_IT'S_APPLICATION_IN_BASIC_AND_APPLIED_SCIENCE_A_REVIEW

https://www.researchgate.net/publication/323803305_NERIUM_OLEANDER_IT'S_APPLICATION_IN_BASIC_AND_APPLIED_SCIENCE_A_REVIEW

Kalita. S. Kumar, G. Karthik, L. Rao, k.(June, 2012) A Review on Medicinal Properties of Latana Camara Linn

https://www.researchgate.net/publication/229150310_A_Review_on_Medicinal_Properties_of_Lantana_camara_Linn

Bolaji, K. Gana, k, A. Bensen, A(2012) Castor oil plant Ricinus Communis L. Botany ecology and uses

https://www.researchgate.net/publication/292716749_Castor_oil_plant_Ricinus_communis_L_Botany_ecology_and_uses

Warrier, K. S, M. (2023, August) Thespesia populnea a multipurpose tree species

[https://www.researchgate.net/publication/373521614_Thespesia_populnea -
A multipurpose tree species](https://www.researchgate.net/publication/373521614_Thespesia_populnea_-_A_multipurpose_tree_species)

Kanyal, J. Prakash, O. Kumar, R. Rawat, D. Srivastava, R. Singh, R. Pant, A.(2021, August) Study on Comparative Chemical Composition and Biological Activities in the Essential Oils from different Parts of *Coleus barbatus* (Andrews) Benth.

https://www.researchgate.net/profile/Ravendra-Kumar/publication/354272647_Study_on_Comparative_Chemical_Composition_and_Biological_Activities_in_the_Essential_Oils_from_Different_Parts_of_Coleus_barbatus_Andrews_Benth_ex_G_Don/links/615be99b49da3d5b113a12ae/Study-on-Comparative-Chemical-Composition-and-Biological-Activities-in-the-Essential-Oils-from-Different-Parts-of-Coleus-barbatus-Andrews-Benth-ex-G-Don.pdf

Sandoval, J. Rodriguez, P. Popay, A.(2014, 10 January) *Sonchus oleraceus* (common sowthistle)

<https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.50584>

Naseem, A. Yang, B.(2023) An insight into indigenous ethnobotanical and pharmacological potential of Solanaceae family in Pakistan: a review

<https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/datura>

Petricovich, V. Sánchez, S. Montes, D. Levya, C. Vargas, R.(2020, 8 September) Chemical Compounds, Pharmacological and Toxicological Activity of *Brugmansia suaveolens*: A Review Vera L. Petricevich

https://www.researchgate.net/publication/344166342_Chemical_Compounds_Pharmacological_and_Toxicological_Activity_of_Brugmansia_suaveolens_A_Review

Kumar, P. (2021, June) A review on the pharmaceutical activity of *Solanum surattense*

https://www.researchgate.net/publication/352850486_A_review_on_the_pharmaceutical_activity_of_Solanum_surattense