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Role of *Thevetia neriifolia* A. Juss. in Biodiversity as Medicinal and Poisonous Plant

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Abstract: ***The medicinal and poisonous plants are used in Ayurvedic preparation.*** **Thevetia neriifolia** ***A. Juss. Ex Steud.*** **Cascabela thevetia** ***(L.) Lippold(Apocynaceae), used and act directly on the muscular system, especially upon the heart and blood vessels causing great constriction of the latter and distention of the longer arteries. Plant is deadly poisonous and can be used as suicidal purpose and poison for livestock. Present study includes macroscopy, microscopy, Histopathology, phytochemical study and qualitative analysis has been carried out. It has more importance in biodiversity conservation as a poisonous plant.***

Keywords: Biodiversity, Forensic science, Poisonous plants, Thevetia neriifolia.

I. INTRODUCTION

Since antiquity, vegetation of India is famous for diversity in wealth of medicinal and Poisonous plants. Plants are used in the different ancient systems of medicine throughout the world. *Thevetia neriifolia* A. Juss. Ex Steud. *Cascabela thevetia* (L.) Lippold (Apocynaceae), Yellow oleander, is popularly known in Marathi *'Pivalakaner'* is occurring throughout tropical and subtropical regions of both hemispheres. It is very common in plains of India [3].

All part of this plants are used as purgative, an effective cure for intermittent fevers and emetic in small doses in larger doses it act as powerful poison [5]. Seeds are deadly poisonous and can be used as suicidal purpose and poison for livestock, as well as they are used as abortificient by tribal women. Despite being most important Ayurvedic drug, they have not been investigated so far [10]-[11]. Hence, it is essential to standardize it for utilization. Despite being most important in Ayurvedic medicines, it has more importance in biodiversity conservation as a poisonous plant [6]-[7].

Forensic science is the study and application of the science to law in the search of truth in civil, criminal and social matters to any member of the society. It is an interdisciplinary field covers biological, physical, chemical, mathematical and behavioral science. Poisonous properties of plants are due to presence of certain toxic constituents, those are responsible for the specific physiological action on living organism. Generally crude plant powder or extract of plant are used as a poison [4].

The present study includes macroscopy, microscopy, Histopathology, phytochemical study and qualitative analysis for starch, protein alkaloids etc.

II. MATERIAL AND METHODS

Plant material of *Thevetia neriifolia*, A. Juss. (Apocyanaceae) was collected along with root, leaves, flowers, fruits and seeds for correct botanical identification from various places of Maharashtra. Thin transverse sections were taken from root and leaves. Macro and microscopic characters were studied [12]-[13]. Root and leaves were separated and dried in shade, so as to prevent the decomposition of active principles. The powder was sieved by using 70 mm mesh and stored, used for feeding orally to Swiss Albino mice. Some of the powder of root and leaves were further used for phytochemical screening [1]-[2].

Forty Swiss Albino male mice previously reared weighing about 20 -25gm and at the age of three to four weeks divided into four group. Each consists of 10 animals were fasten for 24 hours, prior to experiment. First group of mice was feed orally for one week. 1ml suspension containing 2gm, 4gm and 6gm root powder and leaves powder respectively in100 ml sterile water per day.

Similarly second and third group was given suspension; fourth group was kept as a control. Different groups of animals were kept in separate cage and provided with normal food 5gm per mouse every day. Those mice which died due to poisoning (which was usually between 1 -7 days). These were dissected and observed change in the internal organ. The visceral fluid collected was preserved in 10% formalin for further quantitative microscopic studies [8]-[9].

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III. OBSERVATIONS

There are more than four thousand species of medicinal plants found to be growing as herbs, shrubs and trees in India. Many of these medicinal plants are poisonous when administered in large doses in human and animal system. Some of the well known medicinal plants are ipecac (*Cephaelis ipecacuanha,* L.), foxglove (*Digitalis purpurea,* L.), Cocaine (*Erythroxylon coca,* L.), Aralia (*Aralia pseudogineng,* Benth), kuchala (Strychnous *nux-vomica,* L.), aconite (*Aconitum napellus,* L.), atropa, (*Atropa belladonna*, L.), Opium (*Papaver somniferum,* L.), Bhang (*Cannabis sativa* L.) etc.

A. Experimental Analysis

1) Macroscopic Characters of Root

Thevetia neriifolia, A. Juss. belongs in the family Apocynaceae. Milky juice of the plant is highly poisonous. Bark of the plant is bitter cathartic, febrifuge, useful in different kinds of intermittent fevers. Seeds are poisonous. Kernel is narcotic poison. Contains glucoside thevetin and thevetoxin. Fatty oil consisting more than 62% of the kernel and four crystalline substances viz. phytosterolin, ahouain, kokilphin and thevetin. Nuts gave anew heteroside neriifolin. Seeds contain glycosides neriifolin, acetyl nerifolin and thevetin.

Thevetia neriifolia A. Juss. All part of this plant used as purgative and emetic in small doses in larger doses it act as powerful poison [5]. Seeds are deadly poisonous and can be used as suicidal purpose and poison for livestock, as well as they are used as abortificient by tribal women.

2) Morphology of Thevetia neriifolia A. Juss.

a) *Habit:* The plant is perennial tree, reaching up to 5 m in height and forming spherical crown by its green colored branches and green leaves. Stem surface is measuring 1 – 10 cm in diameter. Externally it is green in color while inner color is white.

b) *Leaf:* Leaves are simple, opposite, sub-petiolate and are 5 – 15 cm long and 1 – 3 cm broad, lanceolate, acuminate, entire, smooth and finely reticulate veins with 1 -3 prominent nerves. Petioles are 0.4 –1 cm long.

C) *Flower:* Dark yellow flowers are borne in axils, 4 – 8 cm across. Pedicels are longer than the petioles. Calyx is persistent, green colored, corolla 6 –10 cm long, and 4 – 8 cm across. Stamens are five and showing epipetalous condition. Filaments are bearing bithecous anthers. Gynoecium is bicarpellary, united to form two chambered ovary with one ovule in each locule. Fruit is a drupe, sub globose, about 1.5 – 2 cm long and across Seeds are pubescent, 0.4 – 0.7 cm long and ovoid and brownish black in color.

d) *Root:* Plant bears tap root system. The lateral rootlets run parallel to earth or it goes little down. Root system is about 1 – 2 m long and 0.2 – 1 cm in diameter. Outer surface of the root is yellowish brown, while inner surface is white in color. It has long fibrous fracture, odour is characteristic and taste is bitterish.

3) Anatomical Characters of Thevetia neriifolia A. Juss.

a) *T. S. of Stem:* This is circular in outline with waxy cuticle on the epidermal region. Which is single layered. 6- 8 layers of cortex present with large parenchymatous cells. These cells are filled with starch grains and milky latex. It is followed by single layered barrel shaped cells of endodermis. Phloem periderm is present. Bast fibres are also present in the periderm it is followed by undifferentiated thin walled cells and cambial strip in the centre wood is formed by xylem tracheids and vessels it consists unicellular medullary rays. Primary xylem is in endarch condition scanty pith is also noted in the centre with some laticiferous cells.

b) *T. S. of Leaf:* mesophyll, ground tissue contains calcium oxalate crystals. In T. S. the leaf is showing dorsiventral structure. The thick cuticle is observed on both the epidermis. Both epidermis are made up of tabular compactly arranged cells and both are interrupted by anomocytic stomata. Mesophyll is well differentiated in to palisade and spongy tissue. Palisade cells consist of single layer of elongated compactly arranged chlorenchymatous cells. The spongy tissue is formed of thin walled irregularly arranged 2 - 3 layered chlorenchymatous cells. It lies towards the lower surface. The midrib is swollen towards the lower epidermis and contains crescent shaped vascular strand. Protoxylem is pointing towards the upper epidermis and metaxylem is facing towards lower epidermis. Phloem lies below the metaxylem. Vascular bundle is closed and is surrounded by thin walled parenchymatous bundle sheath. Outside the vascular strand towards the lower surface 6 – 7 layered collenchyma tissue is present and towards upper epidermis 2 – 3 layered collenchyma is present. In parenchymatous ground tissue calcium oxalate crystals (10 – 12 μ) are present.

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B. Quantitative Microscopic Characters of Leaf

1) Stomatal number of upper epidermis: 2,
2) Stomatal number of lower epidermis: 21,
3) Stomatal index of upper epidermis: 2.98,
4) Stomatal index of lower epidermis: 26.92,
5) Vein-islets number: 50,
6) Veinlet termination number: 13,
7) Palisade ratio: 2.06.

C. Experimental Behavior

In mice feeding the following symptoms were observed stepwise:

1) Drowsiness.
2) Dilated pupil.
3) Paralysis of limbs in some.
4) Tetanic convulsion in some.
5) Ultimately death of the animals.

In postmortem investigation lungs of mice were found to be congested, small intestine showed black or sometimes yellowish patches and was perforated and hemorrhaged. Liver changed to black on edges and slightly congested.

D. Observation of Histopathology

1) *Liver:* Observed congestion in the sinusoid cells those are binucleate cells with numerous glycogen globules and fatty vacuolation around the nucleus.
2) *Intestine:* Mucosa and villi are damaged; goblet cells and columnar epithelium are also damaged. Basement membrane is normal. Mucosa is irregularly arranged.
3) *Kidney:* Congestion of vessels occurred, convoluted tubules, glomerules and medullary rays are normal.

Table 1: Histochemical studies

Tests	Chemical / reagent	*Thevetia neriifolia* Stem	*Thevetia neriifolia* leaf	*Thevetia neriifolia* Fruit
Starch	Iodine	Cortex	Ground tissue, palisade	Mesocarp
Protein	$NaOH + CuSO_4$	Cortex	Ground tissue, palisade	Mesocarp
Saponin		Cortex	Ground tissue, palisade	Mesocarp
Tannin	$10\%FeCl_3$	Cortex	Ground tissue,	Mesocarp
Fat	Sudan III	Cortex	Ground tissue, palisade	Epicarp, Mesocarp, endocarp
Sugar	Benedict's reagent	Hypodermis, Cortex	Ground tissue, palisade	Epicarp
Sugar	20 % NaOH + Cu. Acetate	Cortex, phloem	palisade	Embryo
Glycoside	KOH + Alcohol $+FeCl_3$	Cortex, phloem	Palisade	Embryo
Alkaloid	Mayer`s	Cortex	Ground tissue, palisade	Epicarp
	Wagner`s	Cortex	Ground tissue, palisade	Epicarp, Mesocarp
	D`droff`s	Cortex	Ground tissue, palisade	Epicarp, Mesocarp
	Hager's	Cortex	Ground tissue, palisade	Epicarp, Mesocarp
		Cortex	Ground tissue, palisade	Epicarp, Mesocarp

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Table 2: Morphological changes of internal organ in mice treated with *Thevetia neriifolia A. Juss. Fruit*

Sr. No.	Name of organ	Control	Gr I 2%	Gr.II 4%	Gr. III 6%
1	Lung	Normal	Slightly congested	Slightly congested	Slightly congested
2	Heart	Normal	Slightly congested	Slightly congested	Slightly congested
3	Liver	Normal	black	black	Black
4	Stomach	Normal	Filled with blackish yellow fluid	Filled with blackish yellow fluid	Filled with blackish yellow fluid
5	Small intestine	Normal	Filled with blackish yellow fluid	Filled with blackish yellow fluid	Filled with blackish yellow fluid
6	Large intestine	Normal	Filled with blackish yellow fluid	Filled with blackish yellow fluid	Filled with blackish yellow fluid
7	Kidney	Normal	Black	Black	Black

IV. DISCUSSION

The present investigation of plant poisoning on albino mice revealed the change in behavior such as drowsiness, dilation of pupils, convulsion of limbs and ultimately leading to death. In Post mortem it was observed organ s like live, small intestine and kidney get affected. Liver turn black and slightly congested. Small intestine showed black or some times yellowish patches and was further perforated and color of kidney changed to black

In histopathological observation it was observed that congestion of the sinusoid cells and many glycogen globules, fatty vacuolation around the nucleus of some of the cells in intestine, mucosa and villi were damaged. Goblet and columnar epithelium cells were also damaged. Mucosa was irregularly arranged. Congestion of vessels occurred in kidney.

Quantitative microscopic studies supported that the half digested remnants of plant material which were collected from the alimentary canal closely resemble to the macerated fragments of root, stem and leaves of *Thevetia neriifolia,* A. Juss. (Apocyanaceae). These fragmented materials may remain in half digestion condition because of toxicity present in them.

Phytochemical investigations were carried out on root, stem and leaves. It confirmed the presence of calcium oxalate crystals, and alkaloid in the organs.

Both these chemical are toxic in nature.

Hence from the foregoing account it was proved that the death of albino mice occurred due to toxic principles of root, stem and leaves.

This plant *Thevetia neriifolia,* A. Juss. (Apocyanaceae) is not grazed because of poisonous chemicals. Common tiger (*Danaua genutra,* Draner. Nymphalidae) named butterfly feed on this plant successfully. Because of its occurrence in marshy places animals do not come near to this plant, hence number of marshy plant also get protected from grazing animals and that locality becomes the home for many microorganisms. A few bird species are however known to feed on them without any negative effects. These include the sunbirds, myna and grey hornbill.

V. RESULTS

From the above observations and discussion it is clear that *Thevetia neriifolia,* A. Juss. (Apocyanaceae) is important medicinal and poisonous plant for increasing biodiversity of organisms.

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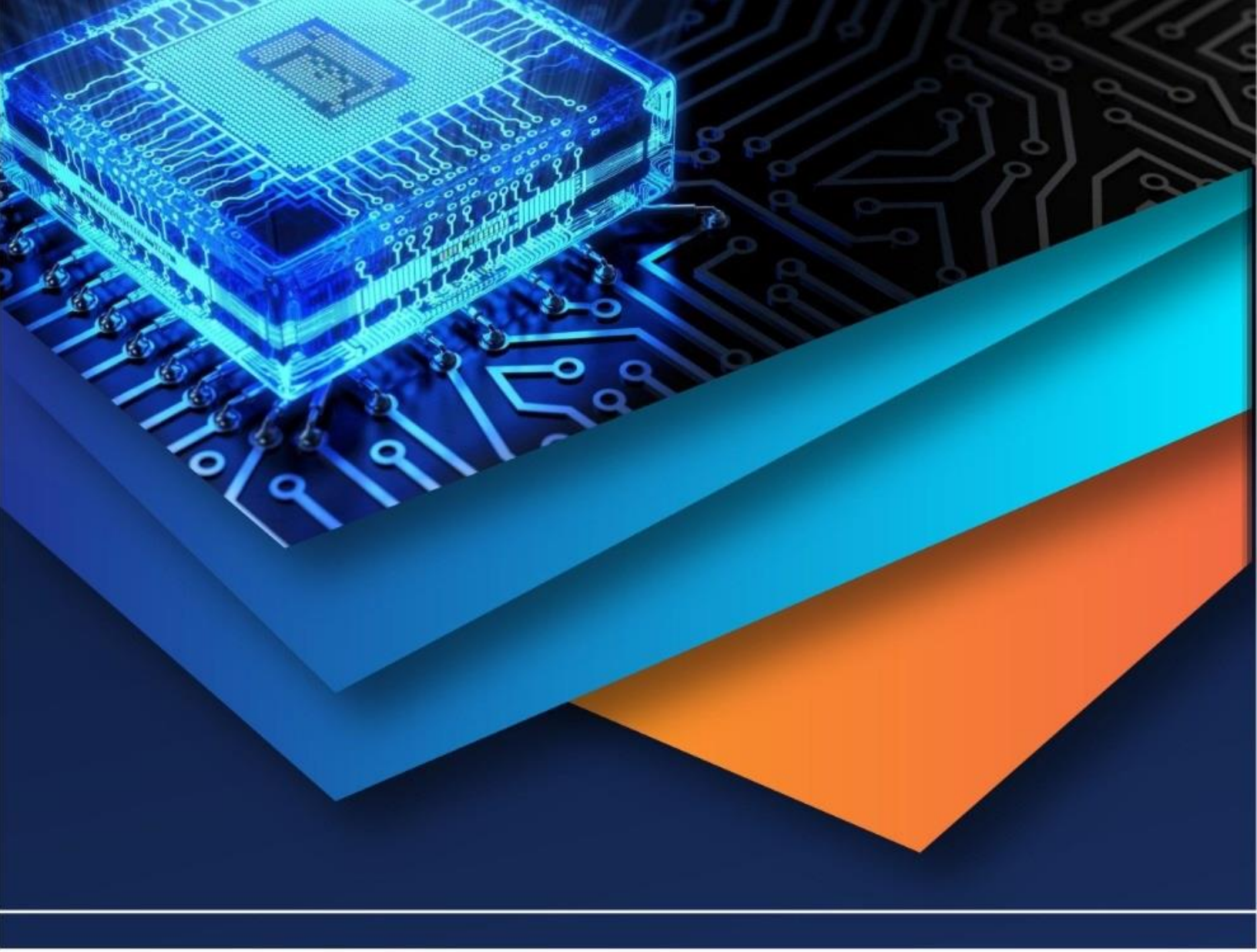

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