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Review Article

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A Review on various Biological and Pharmacological properties of *Thevetia peruviana*

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Abstract

Thevetia peruviana are belongs to the Apocynaceae family. *T. peruviana* are commonly found in Asian countries, especially in India, Sri Lanka. This plant contains some toxic parts; cardio active glycosides are present such as Thevetin A, Thevetin B, Nerifolin, oleandrin etc. An adverse effect of *T. peruviana* is numbness, vomiting, diarrhoea, nausea but it used as a mild cardio active agent.

Keywords: Cultivation & Propagation, Toxicity, Uses.

Introduction

Thevetia peruviana belongs to the family Apocynaceae & it commonly known as Yellow oleander & Lucky nut. *T. Peruviana*, called Manjarali in Tamil Nadu, is a small evergreen tree (3-4 m high) cultivated as an ornamental plant in tropical & subtropical regions of the world, including India, Australia and China. Fruit contains 2-4 flat gray seeds, which yields about half a litre of oil from 1 kg of dry kernel. This plant can be cultivated in wastelands. It requires minimum water when it 30 is in growing stage. It starts flowering after 1 & a half year. After that, it blooms thrice every year. It has also been regarded as a rich source of biologically active compounds such as insecticides, fungicides & bactercides, that shows *T. Peruviana* plant extract have also been reported have Anti-microbial properties [(1)].

Description of the Plant [(1,2,3,5,9)]:

A. Taxonomical Classification:

Botanical Name: *Thevetia peruviana*
Family: Apocynaceae
Genus: Thevetia
Kingdom: Plantae
Order: Gentianales
Species: *T. peruviana*
Common Names: Kolke (Bengal), Mexican Oleander, Yellow Oleander, Lucky Nut
B. Macroscopical Character:
Taste: Seed are very bitter, when chewed produce numbness
Colour: Seed are green to greenish black
Odour: Odourless
Shape: Oblong, hard

Figure 1: Flower of *Thevetia peruviana*

Figure 2: Thevetia plant shows Different Parts

Plant distribution: This plant is grown up in Central & South America as well as Asian countries; India, Sri Lanka and tropical region also. It is a small tree, leaves are green, flowers colour is yellow or orange yellow it shows like trumpet structure. Flowers have odourless; fruits are deep green or black colour. Fruit size is largely it contains milky sap substance which is called Thevetin. Thevetin is a glycoside which presents cardiac stimulant property. But it is poisonous material. Leaves are present waxy coating to reduce the water loss of the plant. When plant turned to aged condition stem change colour greenish to gray. [1,2,5,9]

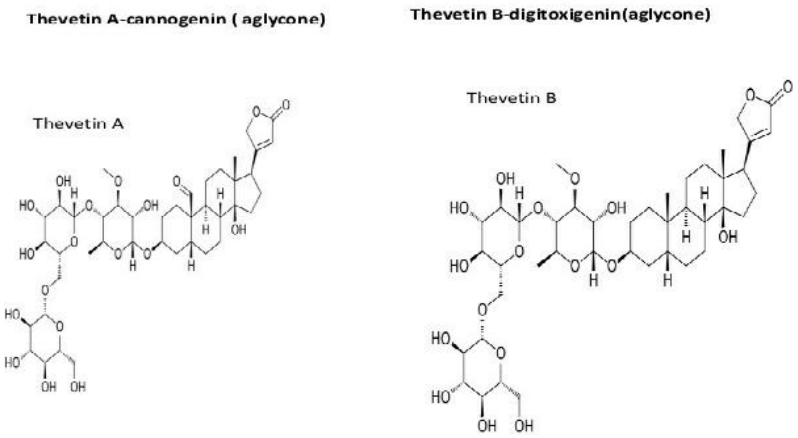
Habitat: A large, evergreen shrub 450-600 cm tall with scented bright yellow flower in terminal cymes bears triangular fleshy drupes, containing 2-4 seeds. Leaves about 10-15 cm in length linear & acute.[1, 5,9]

Cultivation & Propagation:

Cultivation: The cultivation of *T. peruviana* is not much hard. This plant is large flowering shrub; it plants in field, gardens in a normal temperature. It does not need much maintenance. It tolerates all types of soil. Warmer condition is prone to grown of this plant. Green house may be used in winter season. [1,3,5,9]

Propagation: Generally seeds are propagated in spring condition or early summer when spring is just turned off with hard wood cutting. In spring condition (in a glass containing 10% bleach 90% warm water and clean seed coat are taken for 2-3 minutes; after wash seed and soak in warm water for 24 hours).[1,4,5,9]

Chemical constituents: Thevetia kernels are very rich in cardio active glycoside, found to be triosides i.e. aglycone of these glycosides is a combination of three sugar units. Thevetin A is major &active constituent of Thevetia



. **Figure 3:** Structure of Thevetin A & Thevetin B [1,5,9]

Which is a mixture of two triosides i.e. Thevetin A & Thevetin B (cerebroside).

The monoside separated from thevetia seeds are cereberin, neriifolin, peruvoside, theveneriln (ruviside) & peruvosidic acid (Perusitin).[1,2,3,4,5,9]

Table 1: Chemical constituents [1.5,9]

Glycoside	Aglycone	Sugars
Cerebroside	Digitoxigenin	L-thevetose+2mol.D-glucose
Thevetin A	Cannogenin	L-thevetose+2mol.D-glucose
Peruvoside	Cannogenol	L-thevetose
Neriifolin	Digitoxigenin	L-thevetose
Thevenerin	Cannogenol	L-thevetose
Peruvosidic acid	Cannogenic acid	L-thevetose

Toxin: *T. peruviana* have toxic effect for human and other animals also. The toxin glycosides are Thevetin A and Thevetin B (cerebroside) others are Neriifolin, Peruvoside, Ruvoside. This glycoside (cardenolides) does not destroyed by drying, heating and they are similar to Digoxin from Digitalis purpurea. It creates gastric, cardio toxic effect. In case of digoxin poison Ovine polyclonal anti-digitoxin Fab fragment antibody is used. [1,5,8,9]

Toxicity studies: According to toxicity study it showed that the Lethal or death causative glycosides are Thevetin A and Thevetin B and toxins affect other multisystem organ. Raw thevetia seed cake at low 5% replacement of soyabean meal is very toxic. If carefully removed toxic substance and other anti nutritive agents it may be allow to used as a protein supplement in rabbits and other animals. [1,5,9]

Biological pest control: This plant used for biological pest control. *T. peruviana* seeds oil used as an anti-fungal, anti-bacterial, anti-termite purposes. It inhibited spermatogenesis in rat and chances to developing herbal male contraceptive. [1,5,6,7,9]

Medicinal uses: *T. peruviana* contain heart stimulant compound Thevetin which is milky sap nature, naturally it is poisonous. Thevetin is two types Thevetin A & Thevetin B (cerebroside), others are neriifolin, thevetoxin, ruvoside. It does not destroyed by drying and heating process, similar to digoxin from *Digitalis purpurea.* It produces gastric and cardio toxic effect. It treatment as a antibodies of Digoxin and atropin may include oral route administration of activate charcoal. Tincture is used as a cathartic emetic, abortifacient, purgative, rheumatism and dropsy. Widely used as a pest control and heart strengthening. Therapeutic effect is high compared to digoxin. [1,5,8,9]

The plant have been use to treat heart failure in China & Russia for decades, but scientific evidence supporting use limited to small, poorly designed studies. Human research began in the 1930s, but was largely abandoned due to serious gastrointestinal & heart toxicity. It should be noted that the drug may improve symptoms of congestive heart failure, but does not improve mortality. [1,5,9]

Pharmacological activity:

Anti-microbial activity: The greater anti-microbial activity shows against *Escherichia coli* and ethanol extract obtained from *T. peruviana* was worked against bacterial species of *E. coli, Streptococcus lactis, Enterobacter aerogens, Alternaria helianthii, Curvularia lunata, Aspergillus niger* & *Penicillium spp*. [1,5,9,10]

Anti-fungal properties: By help of thin layer chromatography or column chromatography *T. peruviana* seed extracts obtained with n-hexane or dichloromethane. Seed extracts inhibit of the fungus *Cladosporium cucumerinum* because extracts has anti-fungal photo activity. Fractions and crude extracts both condition light dependent activity observed. Photo active fraction was analysed by capillary gas chromatography with mass spectrometry. [1,5,11]

Piscicidal activity: *T. peruviana* leaf and bark was applied on *Catla catla* (Hamilton) for 24 hours. In two condition a laboratory condition and b. cemented pond condition to evaluate the piscicidal activity. For both cases different solvents are used (i.e., acetone, diethyl ether, ethyl alcohol, chloroform, carbon tetrachloride) The LC50 values are different for acetone leaf extract and acetone bark extract of *T. peruviana*. In case of laboratory condition acetone leaf extract value is 88.80 mg/L(24 hours) and cemented pond condition

value is 529.38 mg/L (24 hours); acetone bark 9943 mg/L (24 hours) in laboratory condition and 591.78 mg/L (24 hours) in cemented pond condition in opposition to freshwater fish *Catla catla*. Similarly the whole process was observed in different types of solvent but the acetone leaf and bark extract is much more effective than other solvent. [1,5,9,12]

Anti-spermatogenic activity: By the help of anti-fertility property of *T. peruviana* it shows that the male albino rats spermatogenesis is inhibit. α-amyrin acetate, lupeol acetate, α-amyrin, β-amyrin, thevetigenin, lupeol are active constituents which are responsible for anti-spermatogenic activity. *T. peruviana* stem bark methanol extract (TPMtE) administered orally to male albino rats at 100 mg/rat/day. The level of protein and sialic acid is decreased in reproductive organs (i.e., testes, epididymides, seminal vesicle and ventral prostate) but cholesterol level was increased. Reduces the nuclear diameter of Leydig cell, seminiferous tubular diameter, sertoli area ($p<0.001$). After study it may concluded that *T. peruviana* inhibit spermatogenesis in rat and also used as a herbal contraceptive. [1,5,9,13]

The Effects of *T. peruviana* seeds extracts on *in vitro* growth of four strains of *Phytophthora megakarya*:

A study was carried out in Yaounde (Cameroon) to test the anti-fungal activity of extracts of *T. peruviana* seeds. Crude extracts were obtained after successive maceration with hexane, ethyl acetate & methanol. Seed extracts were tested for inhibition of *P. megakarya*, a causal agent of black pod disease of Theobroma cacao. Four strains of *P. magakarya* were used. Anti-fungal tests were performed by using three concentrations (12.5, 25 & 50 µl.ml-1 concentrations of the extract respectively. These results suggest that crude extract from *T. peruviana* seeds are efficient biocide substance with anti-fungal activity. [1,5,9,14]

Anti-inflammatory: After distillation *T. peruviana* seed oil anti-bacterial activity was found. Seed contain glucoside of neriifolin, acetylneriifolin and therein. After studied it shows that flowers contain quercetin, kaempferol and quercetin-7-o-galactoside. Isolated compound was tested by in vitro method and isolated compound characterized by UV, ^{1}H NMR, ^{13}C NMR spectra. Isolated compound showed biphasic property.[1,5,9,15]

Anti-termite: *T. peruviana* (pers.) seed oil has anti-fungal, anti-bacterial & anti-termite properties. The paint demonstrated inhibitory activity against *Escherichia coli, Staphylococcus aureus, Bacillus subtillis* & *Candida albicansin* a concentration dependent manner. The antibacterial activities were statistically signified ($p= 0.05$). The repellent action of paint against subterranean termites (Microtermes app.) was signified ($p= 0.03$). The seed oil protects wood material against subterranean termite attack. [1,5,9,16]

Properties &constituents: Seed contains a toxic glucoside, thevetin. Seeds yield a fixed oil containing triloein 63%, tripalmitin & stearin 37%. Thevetin has been classified with the digitalin group so activity on heart muscle, blood muscle elevation, heart irregularities. It also causes increased intestinal peristalsis, increased salivation& pupil contraction. [1,5,9,16]

Rodenticide potential of *T. peruviana*: An albino strains of non-fasted &female Norway rats, *Rattus norveqicus*, weighing 120-125 gm were treated with *T. peruviana* by being fed a bait containing ground kernels from the plant or administered a crude, aqueous extract (fresh or aged) of the kernels by intra peritoneal injection. A control group of rats received non poisoned bait or distilled water by intra peritoneal injection. No mortality or abnormal behavioural or physiological changes were observed among the control group or those treated with aged crude aqueous extract. Rats that consumed bait containing lethal doses of *T. Peruviana* exhibited poisoning symptoms with 30 minutes & later died between 2-30 hours after treatment. Poisoning symptom included pilomotor & tail erection, ataxia, limb paralysis &paroxysmal tachycardia. Diarrhoea & diuresis were evident. Poisoned rats were easily startled, became aggressive on touch. [1,5,9,16]

Conclusion

Thevetia peruviana is a plant which contains so many phytochemical properties, medicinal uses for various therapeutic purposes. Not only therapeutic effect but are also others properties are included which may have application to normal life such as anti-fungal, anti-microbial & anti-termite effect also. Glycosides are present in this plant which have play a major role in human health, entire plants parts are useful but it contain a toxic effect.

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