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Phyto phamacological importance of *Thevetia peruviana*: A literature based review

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Abstract
Nature is the best combinatorial chemist and possibly has answers to all diseases of humankind. Till now, natural product compounds discovered from medicinal plants have provided numerous clinically useful drugs. Plant based therapeutics play an important role in the public health care system of any nation. Natural products with medicinal value are gradually gaining importance in clinical research due to their well-known property of no side effects as compared to drugs. In recent years, the growing demand for herbal product has led to a quantum jump in volume of plant metabolite previously with unknown pharmacological activities have been extensively investigated as a source of medicinal agents. *Thevetia peruviana* Pers. commonly named as "Kaneir or Kaner" is known for its immense application in the treatment of various diseases in the traditional Ayurvedic literature. Plant based therapeutics play an important role in the public health care system of any nation. The plant *Thevetia peruviana* belongs to the family Apocynaceae. The plants have a significant place in traditional system of medicine of Central and South America and tropical Asia. A number of different classes of secondary metabolites are present in *Thevetia peruviana* including alkaloids, flavonoids, steroids, cardiac glycosides, terpenoids, tannins, saponins etc. Several researchers had identified various pharmacological activities in different parts of the plant *viz*. seeds, flowers, bark, fruits, leaves. This review covers detailed ethno pharmacology, toxicology and bioactivities of *Thevetia peruvian*.

Keywords: *Thevetia peruviana*, ayurveda, herbal medicine, terpenoids, flavonoids

Introduction
Herbal formulations are medicinal preparation of one or more herbs present in specified quantities to give the benefits meant for cosmetic, diagnose and to mitigate diseases of human beings or animals. It is also known as botanical medicine or phytomedicine. Earlier in the twentieth century, herbal medicine was the prime medication system as antibiotics or analgesics were not available. Increasing use of an allopathic system of medicine due to its fast therapeutic action and herbal medicine gradually lost their popularity among the people. For example, Curcuma is used in Traditional Chinese Medicine for more than two thousand years to treat anti-inflammatory and robust anti-oxidant. About 70 to 80% of people are still using herbal medicine for their primary health because of the less side effect and better compatibility with the human body. Herbal medicine has gained momentum and is more effective as compared to synthetic drugs [1, 2].

Cascabela thevetia (syn: *Thevetia peruviana*) is a poisonous plant native throughout Mexico and in Central America, and cultivated widely as an ornamental. It is a relative of Nerium oleander, giving it a common name yellow oleander, and is also called lucky nut in the West Indies [3].

Table 1: Vernacular names

Common name (English)	Be-still tree, suicide tree, lucky nut
Telugu	Ganneru, pacha-ganneru, suvarna
Hindi	Peeli kaner, Kulkephul
Tamil	Thiruvachipoo, Ponnarali
Bengali	Kolkaphul
Manipuri	Utonglei
Sanskrit	Karavirah, ashvaghna, ashvaha
Marathi	Bitti
Malayalam	Kanaviram, paccayarali
Kannada	Gowri pushpa, kadakaasi kanigalu
Tibetan	Ka ra bi ra dmar po

Table 2: Taxonomical classification

Kingdom	Plantae - Plants
Subkingdom	Tracheobionta - Vascular plants
Superdivision	Spermatophyta - Seed plants
Division	Magnoliophyta - Flowering plants

Class	Magnoliopsida - Dicotyledons
Order	Gentianales
Family	Apocynaceae – Dogbane family
Genus	*Thevetia*
Species	*T. peruviana*
Binomial name	*Thevetia peruviana* Pers.

Fig 1: *Thevetia peruviana* plant

Fig 2: *Thevetia peruviana* leaves

Fig 3: *Thevetia peruviana* flowers

Fig 4: *Thevetia peruviana* seeds

All parts of the C. thevetia plant are toxic to most vertebrates as they contain cardiac glycosides. Many cases of intentional and accidental poisoning of humans are known [3].

There are two varieties of the plant, one with yellow flowers, yellow oleander and the other with purple flowers, nerium oleander. Both varieties of flower and fruit provide a steady supply of seeds all-round the year. Depending on the rainfall pattern and plant age, they can produce 400-800 fruits per annum when grown in hedges. The fruits are globular, usually green in colour but become black on ripening. When divided longitudinally and transversely, each fruit contains a nut and can have one to four seeds in its kernel. These plants bears milky juice in all organs, and because of the presence of cardiac glycosides such as nerrifolin and peruvoside, they become toxic [4].

Cultivation and distribution

Thevetia peruviana Pers. is cultivated as an ornamental plant and is generally planted as large flowering shrub or small ornamental tree standard in garden and park in temperate climates. *T. peruviana* has been grown for over many decades as an ornamental plant in temple, homes, schools, gardens, churches and road sides by missionaries and explorers. *T. peruviana* is frequently grown in throughout the tropical and sub-tropical regions of the world but is probably native to Central and South America [5]. *Thevetia peruviana* cultivation is not much hard. The plant succeeds in full sun or light shade, prefers a fertile, well-drained loam with additional leaf mould, though plants can succeed as well in poor and dry soils. The plant is also tolerant of moderately saline soils. Established plants are drought tolerant. The plants are shallow-rooted and should be sited in positions protected from strong winds. Stem tips of young plants are

pinched out to encourage a bushy habit, and established specimens are pruned after flowering or shortly before the growing season to shape and restrict size. The plant can flower and fruit all year round in equatorial climates. The ripe fruits remain on the plant for a long time. The plant responds well to coppicing. Propagated by seed - it has a short viability and is best sown within 3 months of harvesting. Up to 80% germination rates can be expected.

Pharmacognostic Description

Macroscopic characters

Leaves of *T. peruviana* are simple, linear lanceolate, 13-15cm X 1-2cm, glaucous, glabrous, having subacute apex, short petioleand entire margin with few notches. The upper surface is dark green and the lower surface is light green in colour [6, 7].

Table 3: Morphological properties of leaves

Parameter	Leaves observation
Colour	Dark green, light green
Odour	Characteristic, pleasant smell
Taste	Bitter
Size	13-15 X 2-3 cm
Shape	Linear

Flowers

The flowers of *T. peruviana* are usually narrow funnel shaped structure, petals spirally twisted with dark green sepals generally 5-7 X 2-3 cm in size, and changes from yellowish green to dark yellow colour with pleasant smell, sweetish taste, and soft smooth touch [7, 8].

Table 4: Morphological properties of flowers

Parameter	Flower observation
Colour	Dark yellow, yellowish, yellowish green
Odour	Characteristic, pleasant
Taste	Sweetish, agreeable
Size	6-7 X 2-3 cm
Shape	Narrow funnel shaped with sword petals
Touch	Smooth

Fruits

The fruit is a drupe with mericarps that are united into a deltoid shape, laterally compressed, measures about 3-4 cm in diameter, yellowish-green turning red, with ripening black, fleshy exocarp and stony mesocarp while the endocarps are free from each other. The fruits, which are green in colour, become black on ripening. Each fruit contains a nut, which is longitudinally and transversely divided. All parts of the plant contain the milky juice [9].

Seeds

The seed is flattened with a small wing where there is one seed per mericarp. Seedling is with epigeal germination.

Parts used

T. Peruviana is an ornamental plant and mostly all parts of plants are medicinal use. These are flowers, leaves, seeds and roots [9, 10].

Phytochemistry

Literature survey of phytochemical analysis of plant reveals the presence of wide variety of phytoconstituents.

Thevetia peruviana seed kernels are very rich in cardioactive glycosides, triosides i.e. the aglycone of these glycosides consists of three sugar units. The major constitutional glycoside is thevetin. Thevetin is a mixture of two triosides namely Thevetin A and Thevetin B (cereberoside). Seed kernel also contains neriifolin, acetylneriifolin, thevefolin, theveneriin and peruvoside which are monoside in nature. Fatty oils constitute more than 62% of the seed kernel. Seed also contains small quantity of theveside, viridoside and perusitin. Apigenin-5 methyl ether has been isolated from seed shells. A number of flavonol glycosides of kaempferol and quercetin have been isolated from the leaves. Leaves also contain polyhydroxy-dinormonoterpenoids and their apiosylglucosides. Epiperuviol acetate, hesperitin-7-glucoside, α-and β-amyrin, kaempferol and quercetin have been isolated from fruit pericarp and flowers [11, 12].

Table 5: Chemical constituents [13-15]

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

Toxicity

All parts of the plant produce latex that is highly poisonous; the kernels are the most toxic. The active principles are cardiac glycosides of the cardenolide type; symptoms of poisoning mainly involve the cardiovascular system (including various types of arrhythmia, e.g. sinus bradycardia) and the gastro-intestinal tract. Vomiting is the common symptom in poisoning in about 30% of all cases. Ischemic changes occur in about 40% of the cases, as well as palpitations in about 10%. The most serious and immediate cause leading to death is peripheral vascular failure. The seeds have been used for committing suicide, homicide, as an ordeal poison. The absorption of the equivalent of two *Thevetia peruviana* leaves may be sufficient to kill a 12.5kg child [11].

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 anti-body is used [15].

Pharmacological activities

Different pharmacological activities of *Thevetia peruviana* Pers. has been reported by the researcher, which has been specified in the following Table [11, 16, 17, 18].

Table 6: Pharmacological uses of *Thevetia peruviana* Pers.

S. No.	Tissue	Activity
1	Leaves	Anti-oxidant activity, anti-bacterial activity, larvicidal activity, anti-lipidemic activity, anti-diarrheal activity
2	Seeds	Anti-bacterial activity, anti-fungal activity
3	Flower	Anti-inflammatory activity
4	Bark	Cytotoxic activity, anthelmintic activity, anti-diabetic activity, anti-fertility activity
5	Fruit	Anti-fertility activity, anti-bacterial activity, anti-oxidant activity, anti-cancer activity

Conclusion

Thevetia peruviana is cultivated as a small ornamental plant, India and Central America, Africa etc. It contains a large number of phyto constituents. This paper reports the uses of various parts of the plant in human being as anti-bacterial, inflammation, anti-fungal, cytotoxicity. The plant was found to be fully poisonous but also shows number of pharmacological effect useful in various diseases. This effect is due to the presence of various chemical constituents present in leaves and flowers of this plant. In the present study, *Thevetia peruviana* belonging to the family of Apocynaceae, having several bioactive constituents is reviewed with special emphasis on the biological activities. In the traditional medicine, various plant parts such as leaves, bark, seeds, and fruit are used for different types of disorders. The plant possess many secondary metabolites especially glycosides and have various pharmacological activities as discussed in the present paper. In contrast to the traditional claims, very few scientific works of medicinal interest have so far been carried out in this plant. However, it is imperative that more clinical and more pharmacological studies should be conducted to explore the potential of this plant. Further, this investigation will be helpful to identify the plant and also provide valuable information to the researchers to establish the pharmacological activities supported with possible mode of action.

Declarations

Author contribution statement

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Additional information

No additional information is available for this paper.

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