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Research Article

Beneficial Poisonous Plants and their Therapeutic Values in Coal Capital City of Dhanbad, Jharkhand, India

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Abstract

The main objective of this study is to provide an insight into selective poisonous medicinal plants used in various beneficial treatments for the safety of the human health and culture which are now ignored and vanishing from Dhanbad district. The chemical constituents and phytochemical screening of plant species were done in the laboratory for their suitability in curing various ailments. Standard methods were used for identifying chemical species such as protein, carbohydrates, flavonoids, alkaloids, saponins, tannins, terpenoids, glycosides etc. Screening of these species were done for the various plant parts by established procedures using various media such as aqueous, chloroform, methanol, ethanol etc. Minimum Inhibitory Concentration (MIC) of leaf extracts of *Nerium oleander* (*N. oleander*) in acetone was found to be 30 mg/l while it was 100 mg/l in aqueous extract. No microbial lethality was seen. In *Thevetia peruviana* (*T. peruviana*), the concentration. of secondary metabolites followed methanol>aqueous>chloroform sequence. Presence of saponin and phalobatannin were not reported. Only phenols were seen. The bacterial inhibition rate in *Ricinus communis* (*R. communis*) was found to vary from 60-100% in *Escherichia coli,* 72-100% for *Staphylococcus aureus* (*S. aureus*), fungal inhibition against *Aspergillus niger* (*A. niger*) from 58-100% and antioxidant activity against 2, 2 Diphenyl, 1-picryl-hadrazyl-hydrate (DPHH) only 4%.

In this study therapeutic applications of three poisonous plants have been screened and selected for their use against various diseases once abundant in the coal city of Dhanbad, Jharkhand, India.

Keywords: Poisonous; Medicinal-Plant; Dhanbad; Toxic; Disease; Health

Introduction

In India, curing specific ailments using different medicinal plant parts has been a vogue from ancient period and many ethical tribes still use medicinal plants for their day to day health care requirements. Although indigenous use of medicinal plants has been recorded in ancient literature and many civilizations still profess for treatment of primary health ailments. Plants have developed several mechanisms as they cannot escape from their predators and due to its adaptation habit biologist call it "defence mechanism" [1]. According to a recent estimate by WHO [2] 80% of the populace still depend on plant drug for their major health needs [3,4]. The Indian poisonous plants were studied in detail by Kumar and Sikarwar., *et al.* [5]. Compounds naturally produced by several species of bacteria, fungi, protists, higher plants, animals find beneficial application for the human society. Homeopathy uses effective application of many poisonous plants in pharmacognosy for curing ailments [6].

Categorization of plant with respect to toxicity is very difficult because it varies with stage of plant growth, victim's age and environment. Toxicity varies within a plant or plant family [7]. Toxicity knowledge of plants has always been important but has not been often studied for its reliability. The poisonous effects on existing plant species is commonly referred to as toxicology [8]. Estimation and application for curing diseases, level of toxicity is of highest significance in most parts of world [9]. In India, treatment of common ailments such as ulcers, wounds, piles, diarrhoea, cough,

bronchitis, fever, typhoid, leprosy, syphilis, psoriasis, urinogenital disorders can be successfully treated by natural herbalist. This led to the renewed interest in such study [10].

Nature has endowed India with medicinal plant along with a gargantuan amount of 89 minerals, 4 fuel, 11 metallic, 52 non-metallic and 22 minor minerals. India is prime coal producing country producing 433MT of coal [11] with more than 594 coalmines operating [12,13]. Mining operation destroys existing ecosystem resulting in extreme landscape perturbations with intense ecological damage and health hazards [14-17]. India is leading biodiversity hotspots of the world with wide use of traditional medicine. Knowledge base of many indigenous species world-wide finds application in treatment of common diseases [18]. Several authors have studied the non-poisonous medicinal plants of the Dhanbad district; however there is paucity of literature in the area of poisonous plants. Nature has endowed India with medicinal plant along with a gargantuan amount of 89 minerals, 4 fuel, 11 metallic, 52 non-metallic and 22 minor minerals. India is prime coal producing country producing 433MT of coal [11] with more than 594 coalmines operating [12,13]. Mining operation destroys existing ecosystem resulting in extreme landscape perturbations with intense ecological damage and health hazards [14-17]. India is leading biodiversity hotspots of the world with wide use of traditional medicine. Knowledge base of many indigenous species world-wide finds application in treatment of common diseases [18]. Several authors have studied the non-poisonous medicinal plants of the Dhanbad district; however there is paucity of literature in the area of poisonous plants.

Therefore, the objective of present study explores the use of obnoxious medicinal plants in Dhanbad district.

Materials and Methods

Plant material

Plant extract preparation method

Fresh plant samples from each species for leaves and flowers were randomly collected from CSIR-CIMFR campus located in Dhanbad district of Jharkhand state during December-January and March-April 2018 to carry out the experiment in the laboratory and air dried for seven days and subsequently pulverized crushed into small fraction size (<0.5mm). Three samples of each species were extracted (dry crude) with organic solvents like acetone, chloroform, methanol, ethanol and distilled water (aqueous) following Zibbu., *et al.* [19] for phytochemical analysis. The details of phytoscreening are described in the respective plant species.

Results and Discussion

Nerium oleander

Chemical constituents

Laboratory tests reveal prominent effects due to two elements; glycoside neriin, and an alkaloid, oleandrin possessing cardio-stimulatory action. Gentiobiosyl-oleandrin, gentiobiosyl-nerigoside and gentiobiosyl-beaumontoside are glycosides found in leaf. It is diuretic and has soothing effects on dermatosis and contusion. Lymph possesses minerals [20,21]. α-tocopherol (antioxidant) and Adyregenin (anti-cardiogenic) is also found. Weakly reactive cardenolides (heterosides of uzarigenine) along with inactive cardenolides (heteroside of adynergenine, digitalose) are also found. Chemicals such as triterpenoids, resin, tannins, glucose, paraffin, ursolic acid, vitamin C and an essential oil are agents of reactivity. Glucosides such as rosaginoside, nerioside, corteneroside occurs in bark. Glucosides such as oleandrine, odorosides, adigoside are found in seeds. Steroids prominently occur in roots [19].

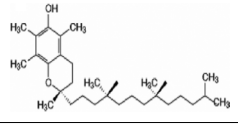
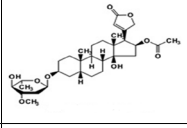
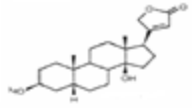
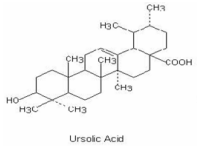
Chemical Name	Chemical activity	Structure
α-tocopherol	Vitamin-E (childbirth), anti-oxidant and stabilizer	
Oleandrin	Water soluble coenzyme and antioxidant	
Digitoxingenin	Toxic, insect repellent and cardiotonic (inhibits Na/K ATPases)	
Ursolic acid	Anti-inflammatory, anti-tumor and anti-microbial	 Ursolic Acid
Quercetin	Anti-inflammatory, anti-cancerous, anti-ulcerous, anti-allergic, anti-viral etc	

Table 1: Chemical constituents of *N. oleander.*

Phytochemical screening

Following procedure were adopted in the laboratory for screening biochemical compounds with Acetone, Methanol and Ethanol from the leaf extracts of *N. oleander* [19].

- **Protein:** Addition of 2 drops of 1% $CuSO_4$ and 1ml of 40% NaOH to 2ml of leaf extract of oleander leading to violet coloration indicating presence of protein peptide.
- **Carbohydrates:** Development of reddish-violet ring to a well shaken solution of Molisch's reagent (2 drops) and *oleander* extract (2ml) with conc. H_2SO_4 (2ml) indicates the presence of carbohydrates.
- **Flavonoids:** Aqueous filtrate (2ml) of oleander leaf extract were mixed with dilute ammonia (5ml) followed by addition of con.H_2SO_4. Development of yellow coloration which vanishes after standing indicates presence of flavonoids
- **Alkaloids:** Mayer's and Dragendroff's reagent (6 drops each) and 1% HCL to was added *oleander* leaf extract (2ml) leading to development of an organic precipitate indicating presence of alkaloids.
- **Saponins:** Sufficient amount of *oleander* leaf extract with distilled water (20 ml) was agitated for 15 minutes, a foam layer (1cm) develops confirming presence of saponins.
- **Tannins:** Development of yellow precipitate when 1% of lead acetate (few drops) was added to leaf extract (5ml) of oleander indicates presence of tannins.
- **Terpenoids:** When chloroform (2ml) and con. H_2SO_4 (3ml) was mixed with oleander leaf extract (5ml), formation of a monolayer (reddish-brown) at the interface indicates presence of terpenoids.
- **Cardiac Glycosides:** Glacial acetic acid (2ml) containing ferric chloride (1 drop) when mixed with Oleander leaf extract (5ml) and conc. H_2SO_4 (1ml) leads to a development of brown ring at the interface indicating cardenolides (glycoside). Violet ring may be seen below the brown with greenish colored ring of acetic acid throughout the thin layer.

The results are indicated in the table 2.

S. No.	Name of the test	Extracts		
		Acetone	Methanol	Ethanol
1	Proteins	-	-	+
2	Carbohydrates	-	+	+
3	Flavonoids	-	-	-
4	Alkaloids	+	-	+
5	Saponins	-	+	-
6	Tannins	+	-	+
7	Terpenoids	-	+	-
8	Cardiac Glycosides	+	+	+

Table 2: Phytochemical Screening of *N. oleander* leaf
+indicates Presence; -indicates Absence

Toxicity

Laboratory tests were performed by micro dilution method in the laboratory for minimum inhibitory concentration (MIC) and minimum bacterial concentration (MBC) of *N. oleander* leaf extracts. The MIC value for acetone and ethanol leaf extract was found to be 30 mg/l and for aqueous extract it was 100 mg/l. No microbial death was seen for MBC tests (Table 3).

Bacterial Strains	Plant extracts	MIC (mg/ml)	MBC
P. aeruginosa	Acetone	30	No lethality observed
	Ethanol	30	
	Aqueous	100	

Table 3: The MIC and MBC of *N. oleander* leaf extracts against *P. aeruginosa.*

Thevetia peruviana

Chemical constituent present in the various parts of *T. peruviana* shown in Table 4.

Glycoside	Aglycone	Sugars
Cereberoside (Thevetin B)	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

Table 4: Chemicals found in *T. peruviana* [22].

Collection of Plant material:

The fresh leaves and flowers of *T. peruviana L.* were collected from CSIR-CIMFR botanic garden, Barwa road., Dhanbad, India in December, 2018. Screening procedure was followed as described for *N. oleander* above with Methanol, Chloroform and Aqueous solvents. The results are given in the table 5.

Toxicity study of *T. peruviana*

Toxicity study was performed on *R. radiobacter, V. subtilis, E. coli* and *B. phaseoli.* The methanol extract showed maximum secondary metabolites followed by aqueous and chloroform extract (Table

Phytochemicals	Tests	Parts of *T. peruviana*					
		Leaf			Flower		
		Methanol	Chloroform	Aqueous	Methanol	Chloroform	Aqueous
Alkaloids	Dragendroff's Test	+	+	+	+	+	+
	Mayer's Test	+	+	+	+	+	+
Flavonoids	H_2SO_4 Test	-	-	-	-	-	-
	Alkaline Reagent Test	-	-	+	-	-	+
Phenols	Lead acetate Test	+	-	+	+	-	+
Saponins	Frothing Test	-	-	-	-	-	-
Tannins	Lead acetate Test	+	-	-	+	-	-
Terpenoids	Copper Acetate Test	+	-	-	+	-	
Glycosides	Keller-Killiani Test	-	-	-	-	-	-

Table 5: Phytochemical Screening of secondary metabolites of *T. peruviana.*

+indicates Presence ; -indicates Absence.

6). Saponin and phalobatannin were found totally absent in all the tested leaf extracts of *T. peruviana*. Only phenols were present in all the extract, phalobatannin was totally absent.

Microorganisms	Zone of inhibition (mm)*		
	Chloroform	Methanol	Aqueous extract
R. radiobacter	26 ± 0.3	31 ± 0.6	Na
V. subtillis	22 ± 1.2	25 ± 0.3	Na
E. coli	22 ± 2.1	27 ± 0.3	Na
B. phaseoli	22 ± 1.7	20 ± 0.3	Na

Table 6: Zone of inhibition (mm) of *T. Peruviana* leaf.

*All the values are mean ± Standard Error of Mean (SEM) of three determinations

Ricinus communis

Chemical constituents

The main chemical elements present in *R. communis* seed oil are listed in table 7.

Phytochemical screening

Phytochemical screening (Table 8) was performed in the laboratory using Chloroform, methanol and aqueous as solvent medium.

Toxicity

The antibacterial (*E. coli* and *S. aureus*), antifungal (*A. niger*) and antioxidant (2, 2 Diphenyl, 1-picryl hadrazyl hydrate) study was

Fatty acid	% Value	India
Linoleic	0.5	0.2
Stearic	1.3	1.0
Palmitic	1.5	-
Dihydrostearic	1.5	-
Oleic	3.5	-
Linolenic	7.5	4.3
Ricinoleic	84.2	94.0
Saturated fatty acid	2.4	1.0
Unsaturated fatty acid	97.6	98.3

Table 7: Free Fatty acid composition of *R. communis* seed oil [23].

Extracts	Terpenoids	Tannins	Flavonoids	Alkaloids	Glycosides	Saponins
Chloroform Extract						
Leaf	+	++	+	+	+	+
Seed	+	--	+	+	++	+
Methanol Extract						
Leaf	++	++	+	+	--	+
Seed	+	+	+	+	+	+
Aqueous Extract						
Leaf	--	+	+	--	+	+
Seed	+	-	+	+	+++	+

Table 8: Phytochemical screening of *R. communis* seed oil.

Plant extract	Bacterial culture	Inhibition zone (mm)	% age Inhibition
Antibacterial activity of *R. communis* seed oil			
Control- *R. communis* (seed oil)	*E. coli*	38 23	100 60
Control- *R. communis* (seed oil)	*S. aureus*	37 27	100 72
Antifungal activity of *R. communis* seed oil			
Control- *R. communis* (seed oil)	*A. niger*	40 23	100 58
Antioxidant activity of *R. communis* seed oil			
Plant extract	DPPH* inhibition	DPPH* % age Inhibition	
R. communis (seed oil)	0.2	4	

Table 9: Antibacterial, antifungal and antioxidant of *R. communis* seed oil.?

*DPPH: 2, 2 Diphenyl, 1-picryl-hadrazyl-hydrate

conducted in the laboratory. The percent inhibition reflected in the inhibition zone is listed in the table 9.

Conclusion

Present study indicated that selected medicinal plants are poisonous in nature and caused several ailments to both man and animals. Consequently they were largely neglected by the people. Screening study indicated presence of such toxic elements and their levels of lethality. In *N. oleander,* the MIC for acetone and ethanol leaf extract was found to be 30 mg/l while it was 100 mg/l for aqueous extract. No microbial death was seen in MBC tests. In *T. Peruviana* the methanol showed maximum secondary metabolites followed by aqueous and chloroform extract. Saponin and phalobatannin were totally absent only phenols were present. The bacterial inhibition rate for *R. communis* ranged from 60-100% for *E. coli* and 72-100% for *S. aureus*, antifungal activity against *A. niger* from 58-100% and antioxidant activity against 2, 2 Diphenyl, 1-picryl-hadrazyl-hydrate (DPHH) only 4%.

Thus, the toxicity study of selected strains on a suitable solvent indicated their potentials in medicinal application.

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