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Floristic diversity of an urban environment: poisonous plants of Bhubaneswar smart city, India

Sanjeeb Kumar Das, Mahendra Kumar Satapathy* and Sidhanta Sekhar Bisoi
Department of Life Science, Regional Institute of Education (NCERT), Bhubaneswar-751022, India
mksatapathy@rediffmail.com

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Abstract

Bhubaneswar, the modern capital of Odisha (an eastern Indian State) is widely known as the temple city of the East. Recently, it has been declared as the smart city by government of India under its smart city mission 2015. From a survey of waste lands, road sides, degraded forests and institutional areas of the city, a total of 52 species has been identified as poisonous plants showing toxicity towards human being and other animals. Argemone Mexicana, Calotropis gigantean, Colocassia esculenta, Datura stramonium, Euphorbia antiquorum, Thevetia nerifolia and Parthenium hysterophorus were the widely distributed toxic plants in the city ecosystem. Euphorbiaceae is the dominant family with the largest number of genera followed by Solanaceae (06) and Fabaceae (05). As far as toxic effect of plant parts is concerned, seeds and plant saps from 12 plant species; fruits, leaves, spines and stem from 11, 10, 07 and 6 species respectively show toxic effects. Looking into the phytochemicals responsible for toxicity, it has been noted that alkaloids were the dominant groups of chemicals as observed in 17 plant species followed by phenolic compounds such as glycoside, terpenoids, and esters. Besides toxicity, certain poisonous plants are also economically valuable because of their medicinal and food value. Apart from creating awareness and eradication of poisonous plants and their selective conservation has been discussed.

Keywords: Smart city, Poisonous plants, Toxic effect, Trichomes, Alkaloids, Medicinal value.

Introduction

Globalization and industrialization has brought rapid urbanization and fast growth of cities[1] that are considered as engines of economic growth. Cities provide ample opportunities to its citizens economic development, better living standards and jobs leading to migration of people from villages to cities. This continuous migration over the years has made cities densely populated, as almost 54% population of the world is confined in about 4% of the terrestrial surface[2].

Global urban population is expected[3] to rise to 70% by 2050. This urbanization is a cause of concern as cities consumption reaches about 75% of the total natural resources and generates about similar amount of waste and pollutants[4].

Urbanization in India is no way different from the world scenario United Nations[5] (UN) has predicted that the number of people in Indian towns will almost double to 814 million by 2050[3]. It is said that urban population presently almost contributes 60% of India's GDP and it likely to reach at 70% in coming 15-20 years. Realizing the need for transformation of urban life, Government of India has lunched the smart cities mission in June 2015 for comprehensive development of physical, institutional, social and economic infrastructure and the quality of life of people in 100 selected cities in the country[6]. Bhubaneswar ranks number one in this smart city pilot project.

Bhubaneswar, the modern capital of Odisha (an eastern Indian state) is rich with hundreds of temples and is widely known as the "Temple City" or the "Cathedral City". It is said that the city had about 7000 temples of which 500 do exist currently.

The capital city that came into existence in 1948 with a total area of about 956 ha has increased tremendously in recent times because of rapid growth of infrastructure, housing complexes, educational institutions, public sectors units, small manufacturing industries, IT hubs, etc. The original master plan of 1946 that was based on the neighborhood concept of living is being replaced by comprehensive development plan to address diverse issues in order to turn Bhubaneswar into a moden city[7]. The population of Bhubaneswar was about 16.5 thousand in1951, reached 4.11 lakhs in 1991 and stands at more than 10 lakhs presently.

Not longtime age, before the construction of new capital in 1948, Bhubaneswar and its surrounding areas supported a thick vegetation cover which was popularly known Rampur-Bharatpur jungle- a part of Chandaka-Damapara forest complex. The forest was mostly deciduous type and the biodiversity was remarkably rich[8].

However, since the new capital comes into being, the rich flora of Bhubaneswar has largely been replaced mostly by thorny species. The tree canopy is altogether absent as the tree species has been reduced to stunted size under the influence of heavy

biotic factors such as repeated cutting, grazing etc. besides other developmental works[8].

Though some studies have been made[9,10] relating to the vegetation and the flora of Bhubaneswar and medicinal plant[11] as well there is no specific study pertaining to the poisonous or toxic plants seen in Bhubaneswar, the proposed smart city. There is very little efforts[12] from Government as well as any other non-government organization and to create awareness among people about the poisonous as well as non-poisonous, but injurious plants around them As people from diverse background do stay and likely migrate to the proposed smart city in the near future, it is pertinent to know the harmful/ toxic plants growing in the city areas.

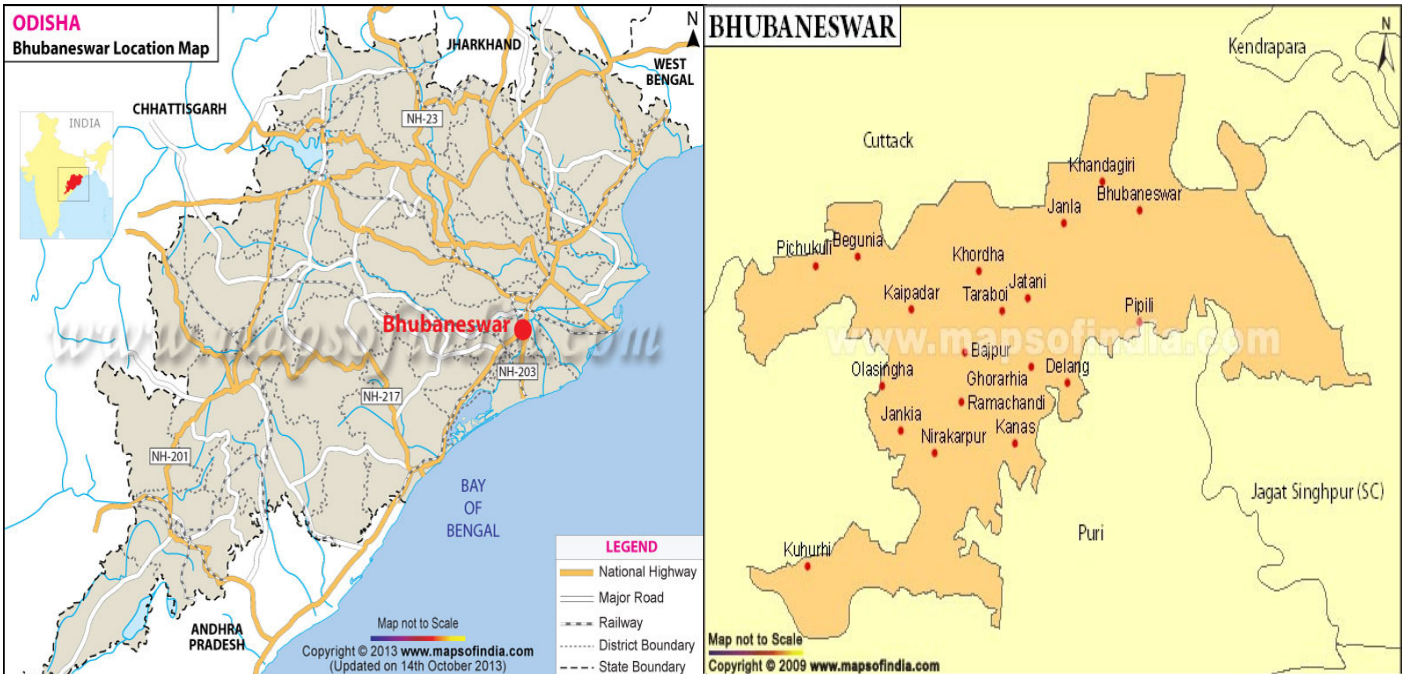
Under this background, the present study was conceptualized to study the poisonous/toxic plants in the proposed Bhubaneswar smart city area and the specific objectives were: i. to identify and document the toxic plants growing in Bhubaneswar city, ii. to know the plant part(s) and the chemical(s) responsible for their toxicity and iii. to find out medicinal/economical value if any, these toxic plants do have.

Materials and methods

Bhubaneswar is geographically located in Khurda district of Odisha state between 20^0 12'N to 20^0 25'N latitude and 85^0 44' E to 85^0 55'E longitude on the western fringes of the coastal plain across the main axis of the Eastern ghats. The city (Figure-1) stands at the western side of the Mahanadi delta on the bank of river Kuakhai, a distributor of Mahanadi river 30 km south-west of Cuttack city. The National Highway No. 5 connecting Kolkata and Chennai passes through Bhubaneswar that stands at a distance of about 435 km south of Kolkata. Topographically, Bhubaneswar forms an undulating hilly terrain. The average height of the town is about 45.3 m above mean sea level. Its annual rain fall is about 120 cm receiving mostly during the south west monsoon. Though the Bhubaneswar Developmental Area covers more than 950 sq Km. the proposed smart city has an area of about 165 sq km.

The present study was carried out following survey method based on primary and secondary data. The study was initiated with a questionnaire submitted to different categories of people inhabiting in the city such as workers, slum dwellers, senior citizens, public servants, teachers etc. On the basis of the information received, the plants were collected from waste lands, road sides, gardens, degraded forests, institutional areas etc. The plants were identified in the Botany section and documented following the book "Flora of Orissa" by Saxena and Brahmam[13]. The plant part responsible for the toxicity was noted. The botanical name of the plant with its local name, family, plant part having toxicity etc. has been reflected in Table-1. The herbarium of collected poisonous/toxic plants is available in the Botany section (Department of Education in Science and Mathematics) of Regional Institute of Education (NCERT), Bhubaneswar.

To find out the chemical nature of the toxic compound (phytochemical compound), present in the plant part, a thorough search of secondary sources (literature and websites) was made.



Source: www.maps of India.com

Figure-1: Map of Study Site (Bhubaneswar City), Odisha, India

Table-1: List of the poisonous plant with its family, plant part having toxicity, nature of phyto-chemicals and Economic value

Name of the Plant	Family	Common English Name	Habit	Plant Part having toxicity	Nature of Phytochemicals present	Target Animals if any	Economic use, if any
1	2	3	4	5	6	7	8
Argemone mexicana L.	Papaveraceae	Mexican Poppy	Herb	Seeds	Alkaloid berberine and protopine	Humans	Used against skin itching
Aloe vera / Aloe barbadensis Mill.	Liliaceae	Indian Aloe	Herb	Juice	Alkaloid-aloin, barbaloin and Nataloin	Humans, dogs, cats and rabbits	Medicinal value(high Blood pressure, headache and skin rash.)
Anacardium occidentale L.	Anacardiaceae	Cashew Nut	Tree	Raw Kernel Plant sap	Phenolic compound cardol, anacardiac acid and cantharidin	Humans and ants	Edible fruits
Abrus precatorius L.	Fabaceae	Indian liquorice	Herb	Seeds	Lectin (Toxalbumin) calledarbin, Abraline.	Cattle (horses, goats and dogs)	Handicrafts
Amorphophallus campanulatus Roxb.	Araceae	Elephant foot yam	Herb	Corm	Calcium oxalate	Humans	vegetable
Bambusa vulgaris Schrad.	Poaceae	Golden bamboo	Shrub	Shoot	Taxiphyllin (cyanogenic glycoside)	Humans, Rats, Horses.	Construction purpose
Bambusa arundinacea Willd.	Poaceae	Throny bamboo	Tree	Shoot Spine	Taxiphyllin (cyanogenic glycoside)	Humans, Rats, Horses.	Hedges
Cascabela thervetia L. / Thevetia nerifolia (Jess.)	Apocyanaceae	Yellow oleander	Shrub	All parts (Seed, latex)	Cardiac glycosides	Humans, lambs, cattle poultry animals.	Flowers used in social festivals
Cestrum nocturum L.	Solanaceae	Queen of night	Shrub	Flowers, Fruits		Human	Perfume
Catharanthus roseus L. / *Vinca rosea* L.	Apocynaceae	Periwinkle	Herb	All parts	Alkaloid indole type	Humans	Medicinal
Calamus tenuis Roxb./ *Calamus rotang* L.	Arecaceae	Climbing plant	Shrub	Spines		Humans	Furniture

Name of the Plant	Family	Common English Name	Habit	Plant Part having toxicity	Nature of Phytochemicals present	Target Animals if any	Economic use, if any
1	2	3	4	5	6	7	8
Capsicum fruitsecene L.	Solanaceae	Bird's eye	Shrub	Fruits, Seeds	Alkaloid Capsaicin	Humans	Food value
Calotropis gigazntea R.Br.	Asclepiadaceae	Crown flower	Shrub	Milky sap	Resinol, cardiac poison, calcium oxalate, proteolytic enzymes.	Humans, Dogs, frogs	Medicinal
Calophyllum inophyllum L.	Gutiferea	Alexandria n laurel	Tree	Every parts Milky juice, frit unrefined oil	Innophyllus A-E, alophyllolide, calophynic acid	Humans, Rat Fish, Cats	Paint preparation
Colocasia esculenta L.	Araceae	Elephant ear taro	Herb	Roots,leaves	Calcium oxalate, Raphides	Humans	Vegetables
Datura stramonium L.	Solanaceae	Thorn apple	Shrub	All parts, seeds, fruits, Nectar	Tropane alkaloid (Scopolamine, hyposcyamine) atropine.)	Humans (Children) chicks, horses, cows and sheep	Flowers in religious function
Duranta repens L.	Verbenaceae	Golden dewdrop	Shrub	Leaves, Berries	Alkolid Saponin	Children, dogs, cats.	Hegdes
Duranta plumieri Jacq.	Verbenaceae	Golden dewdrop	Shrub	Fruits leaves spine	Alkaloid	Humans, dogs, cats	
Digitalis purpurea L.	Plantaginaceae	Fox glove	Herb	Leaves, flowers, seeds	Cardiac glycoside digitoxin	Humans, domesticated animals.	
Diffenbachia seguine Schutt & Schutt / *D. maculata*	Araceae	Dumb cane	Herb	Leaves, Stem sap	Calcium oxalates	Humans, dogs, cats	
Euphorbia nivulia Ham.	Euphorbiaceae	Indian spurge tree	Shrub	Milky sap, spine	Diterpenes Triterpenes	Humans, pets animal	Hedges
Euphorbia antiquorum L.	Euphorbiaceae	Indian spurge tree	Shrub	Milky, Sap, spine	3- triterpenes (Euphol-3-0-cinnamate, antiquol A & antiquol B	Humans	Hedges
Euphorbia pulcherrima Willd.	Euphorbiaceae	Christmas	Shrub	Milkysap, Leaves	Alkaloid Euphorbine	Humans, children	Hedges

Name of the Plant	Family	Common English Name	Habit	Plant Part having toxicity	Nature of Phytochemicals present	Target Animals if any	Economic use, if any
1	2	3	4	5	6	7	8
Euphorbia hirta L.	Euphorbiaceae	Asthma plant	Herb	Plant sap, plant body		Human being	
Fleurya interrupta (L.) Gaud.	Urticaceae	Hen's nettle	Herb	Leaves, hairs, fruits		Human being, Horse	
Flacourita sepiaria Roxb./ *Flacourita indica* burm.f	Flacouritiaceae	Governor's plum	Shrub	Thorns		Human being, children	
Ipomoea carnea Jacq.	Convolvulaceae	Pink morning glory	Shrub	Leaves, plant sap	Polyhydroxy alkaloid	Children, Human beings, Cattle	Fire wood
Jatropha curcas L.	Euphorbiaceae	Purging nut	Shrub	Seeds, Yellow sap	Alkaloid Jatropine	Humans, goats, Guinea pigs all animals	Used as biodiesel
Jatropha gossypifolia L.	Euphorbiaceae	Bellyache bush	Shrub	Seeds	Alkaloid Jatrophine	Humans	Biodiesel
Lantana camara L.	Verbenaceae	Wild sage	Shrub	(Fruit) berry Leaves	Triterpenoid compound Lantanin	Humans, Sheeps, cattles, horses, children	Fire wood
Lycopersicon esculentum L. / *Solanum lycopersium* L.	Solanaceae	Tomato	Herb	Leaves, Stems, unripe fruits	Solanine, Tomatine	Humans, dogs, cats	Food value
Manihot utilissima Pohl.	Euphorbiaceae	Cassava	Shrub	Leaves, Root	Cyanogenic glycoside, linamarin	Human being	
Melia azedarach L.	Meliaceae	Chinaberry	Tree	Fruits, Bark, flowers	Alkaloid chloroxylonine, Flindersine	Insects/lower animals	Leaves and fruits are taken for skin infection and stomach worming
Martynia diandra Glax.	Pedaliaceae	Devil's claw	Herb	Fruits		Humans, Cattles	
Mucuna pruriens L.	Fabaceae Subfamily: Papilionaceae	Buffalo bean	Shrub	Hairs, Spicules, pod	5-hydroxy tryptamine, (Serotonin), Mucunain	Humans	Antidote for insect attack

Name of the Plant	Family	Common English Name	Habit	Plant Part having toxicity	Nature of Phytochemicals present	Target Animals if any	Economic use, if any
1	2	3	4	5	6	7	8
Mirabilis jalapa L.	Nyctaginaceae	Four 'o' clock	Herb	Seeds, Root		Humans	Ornamental
Nerium oleander L.	Apocynaceae	Oleander	Shrub	All parts	Glycosides - oleandrosides & nerioside	Human, cattle, horse, goat, foul, duck, gees	Ornamental
Opuntia elater Mill.	Cactaceae	Cactus pear	Shrub	Thorns		Human	Hedges
Parthenium hysterophorus L.	Asteraceae	Bitter weed	Herb	Pollen, Leaves	Alkaloid Parthenin	Humans, Cattle	Food value
Phaseolus vulgaris L.	Fabaceae	French bean	Herb	Fruits	Phytohaemagglutinin	Humans	Food value
Pedilanthus tithymaloides L.	Euphorbiaceae	Slipper plant	Shrub	Milkysap Roots, Stem, leaves	Diterpenesters, Euphorbol, β-sitosterol, cycloartemone, Octacosamol Oxime	Humans, Snake	
Pandanus tectorius Soland ex Parkinson.	Pandanaceae	Screw pine	Shrub	Spines		Humans	Hedges
Ricinus communis L.	Euphorbiaceae	Castor bean	Shrub	Seeds, Buds	Toxalbumin Ricin	Humans, pig, Rabbits, dog, Sheep etc.	Oil
Solanum nigrum L.	Solanaceae	Black night shade	Herb	Berries	Glycoalkaloid solanine	Humans, All animals, horses etc.	
Semecarpus anacardium Linn.f	Anacardiaceae	Marking-nut-tree	Tree	Nut and Bark	Biflvonoids Phenolic compounds (bhilawanols)	Humans	
Strychnous nux-vomica L.	Loganiaceae	Strychine tree	Tree	Seeds, bark	Alkaloids strychnine brucine	Human beings, cats, dogs, horses	Medicinal
Sida cordifolia L.	Malvaceae	Heart-leaf-side	Herb	Seeds	Alkaloid Ephedrine	Humans	
Solamun tuberosum L.	Solanaceae	Patato	Herb	Tuber	Glycoalkaloid (Solanine) Amylalcohol	Humans	Food value

Name of the Plant	Family	Common English Name	Habit	Plant Part having toxicity	Nature of Phytochemicals present	Target Animals if any	Economic use, if any
1	2	3	4	5	6	7	8
Trapa natans / Trapa bispinosa L.	Trapaceae	Water chest nut	Herb	Sharp Fruit		Humans	
Tephrosia Purpurea L	Fabaceae	Wild indigo	Herb	Leaves, Seeds	Tephrosin, Deguelin, Rotenone Isotephrosin	Fish	
Tribulus terrestris L.	Zygophyllacae	Puncture vine	Herb	Fruits spine		Humans , Cow	Food for cattle
Urtica diocia L.	Urtiaceaue	Stinging nettle	Herb	Stinging hair	Acetykholine, Histamine, 5-hydroxy tryptamine	Human beings, dogs.	Bee attack

Results and discussion

The Bhubaneswar city has not developed as per the plan originally conceived of. The forests consisting of ever green and semi-ever green trees and wet lands in and around Bhubaneswar have vanished over time. The weather condition in the city has been detoriating for the last 20 years. The pleasant and evening breeze for which Bhubaneswar was once famous is no more realized and the summer temperature is rising. This could be due to rise in population, urbanization, development of infrastructure, concrete roads and buildings, increasing number of automobiles, depletion of forest and green cover and natural wetlands[8]. The poisonous plants are said[12] cause allergies skin irritations, swellings and contact dermatitis. In human beings, some other plants described attribute their toxicity due to presence of latex that could be toxic either externally and/or internally to human or other animals. Many plants armed with thrones and spines are also hazardous.

Other plant species having external stinging hairs and trichomes inject sap containing irritable substances and bring skin irritation, swellings etc. A total of sum 52 plants species has been identified and described in Table-1. Of these 52 species 6, 24, and 22 do belong to trees, shrub and herb categories respectively (Figure-2).

Out of these 52 plant species, 45 and 7 species belonged to dicotyledons and monocotyledons respectively. Family wise these belonged to a total of 26 families (22 families of dicots and 04 families to monocots). Euphorbiaceae was the dominant family with the largest number (09) of genera followed by Solanaceae (06) and Fabaceae (05). Papaveraceae and Asclepiadaceae were described by a single genus of toxic plant each.

Regarding plant parts showing toxicity, seeds and plant saps from 12 plant species, fruits, leave, spine and stem from 11, 10, 07, and 06 plant species respectively show toxic effect. There was four plants where the entire body shows toxic effect against animals and human beings (Figure-4). As far as, the phytochemicals present in different parts responsible for toxicity, it was noted that alkaloids were the dominant groups of chemicals as observed in 17 plant species followed by phenolic compounds, glycosides, terpenoids, esters etc. (Figure-5).

Among the target animals, human beings especially children are more often affected followed by cattles and poultry animals. Often consumption of some plant fruits/ seeds such as yellow olerender (*Cascabela thevetia*) and Thorn apple (*Datura stramonium*) causes death in humans. Young buds and inflorescences in caster plant (*Ricinus communis*) are very toxic to cattles, often consumption leads to death. Some of the selected widely distributed toxic plants with their toxicity are described below (Figure-6 a-f).

Argemone mexicana: The plant is an annual, herb about 1-4 ft high seen growing in wild as such waste lands and roadsides belong to family Papaveraceae. The leaves are sessile, spinuate-pinnatifid, light green latex, flowers yellow and fruits long elliptic or oblong. Seeds blackish-brown round in shape. The plants do flower during Sept- October. The plant sap and the seeds are toxic due to presence of two important alkaloids such as berberine and protopine. These alkaloids besides acting as depressant do paralyze sensory nerves, muscles and peripheral nerves. Contamination of oils from the seed with mustard oil very often causes swelling of body parts. Further the seeds mixed with mustard oil often applied externally to treat skin itching.

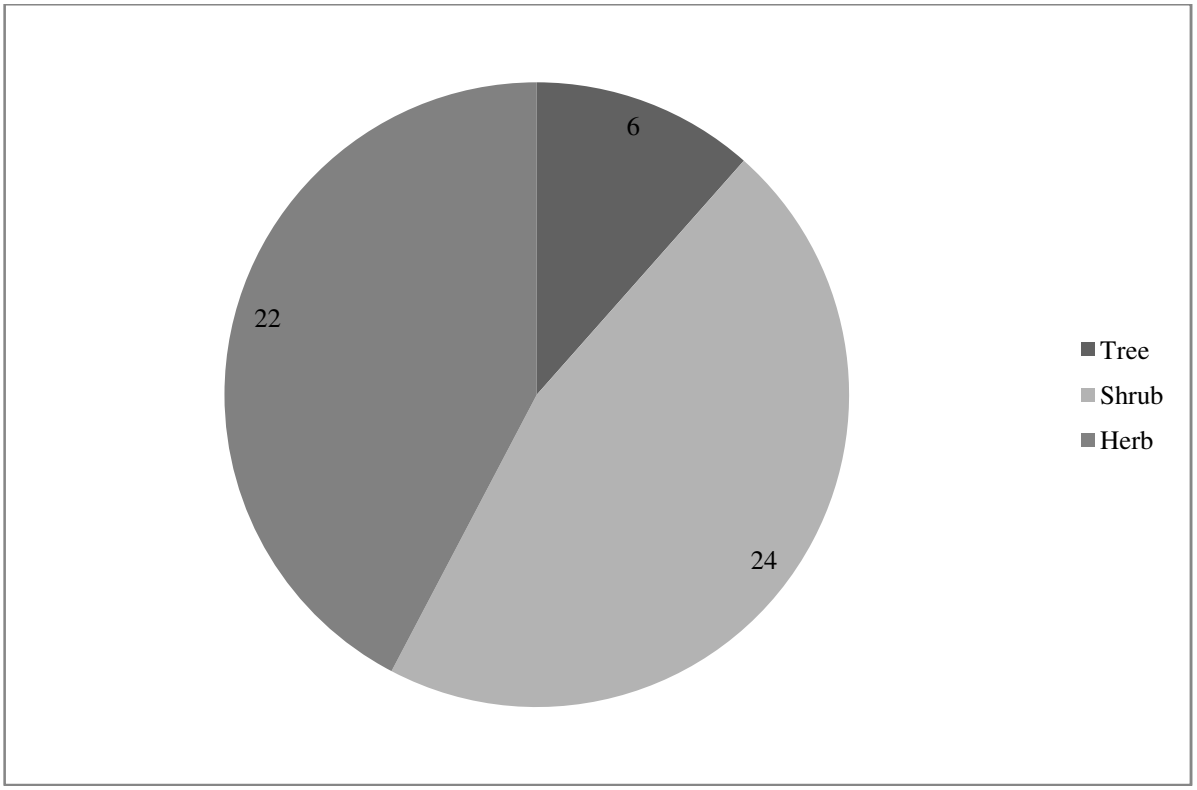


Figure-2: Diversity of Poisonous Plants (in number) according to Habit

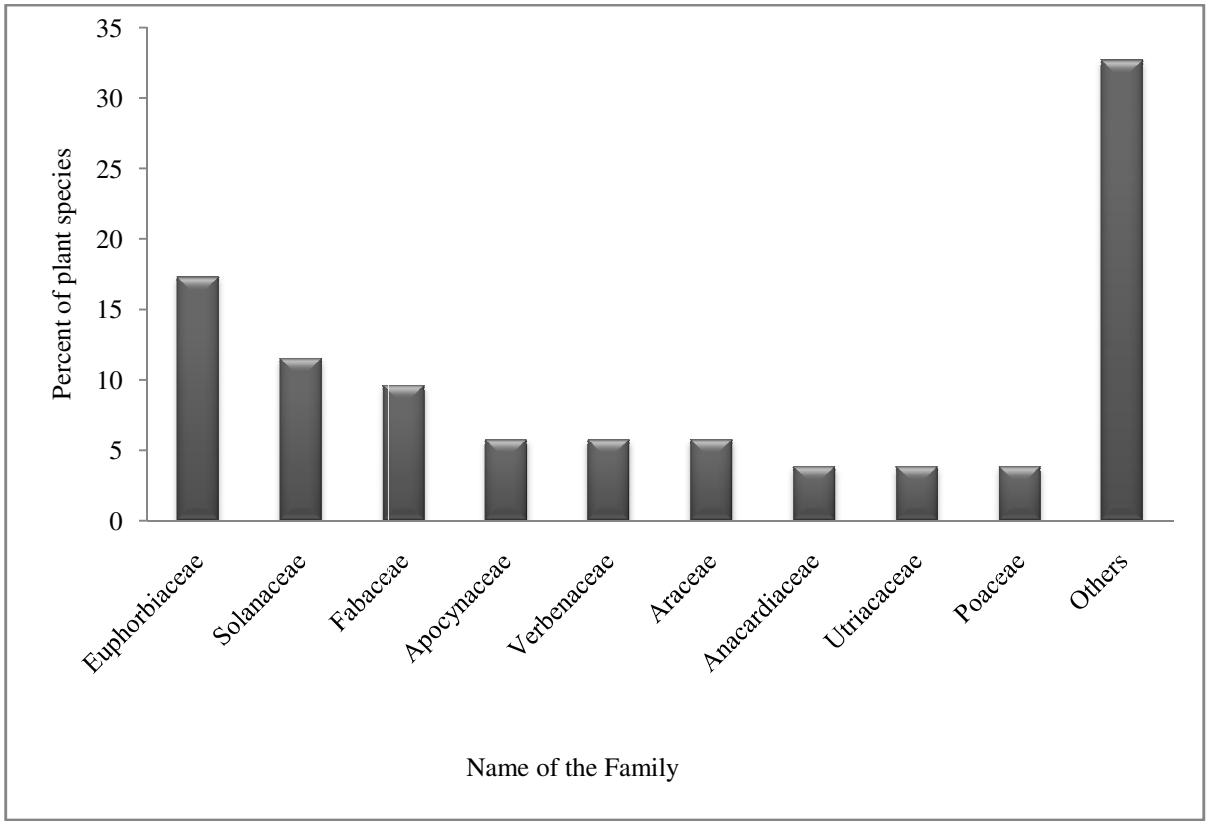


Figure-3(a): Percent of plant species belonging to different families showing toxic effect

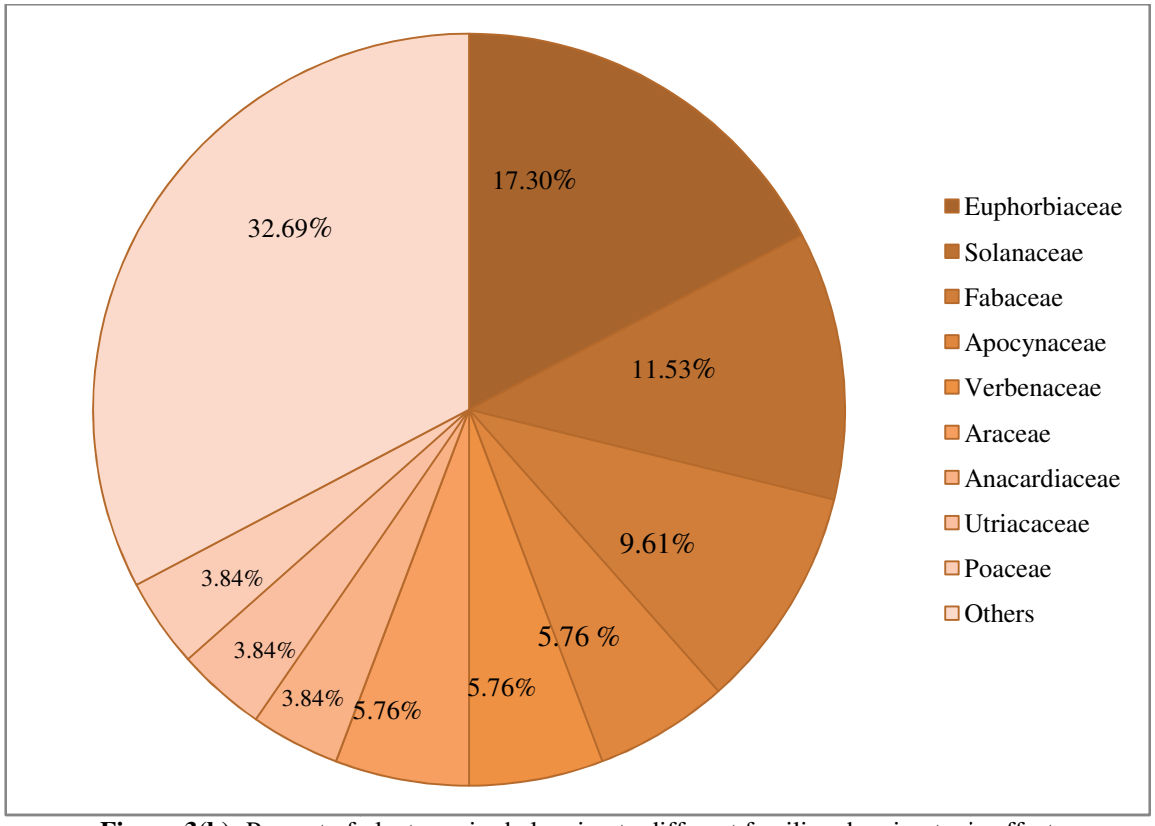


Figure-3(b): Percent of plant species belonging to different families showing toxic effect

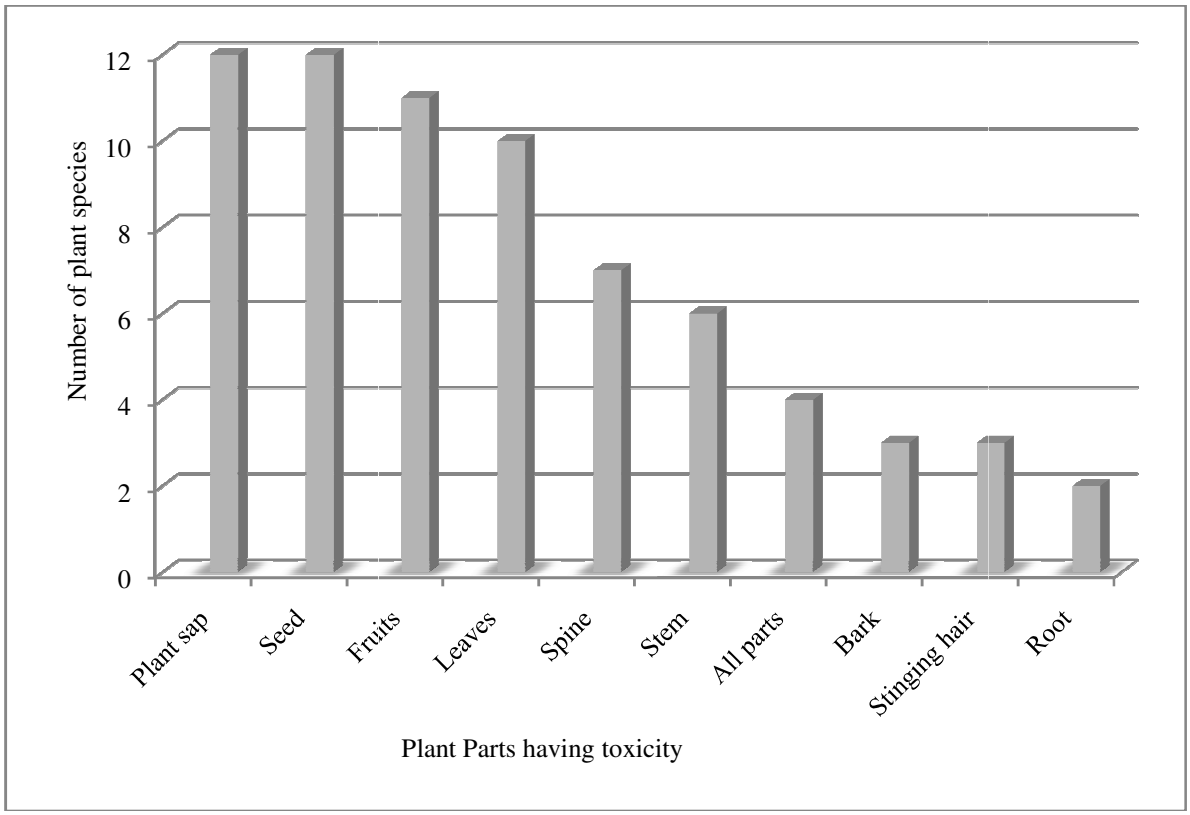


Figure-4: Dominant plant parts having toxicity among plant species studied

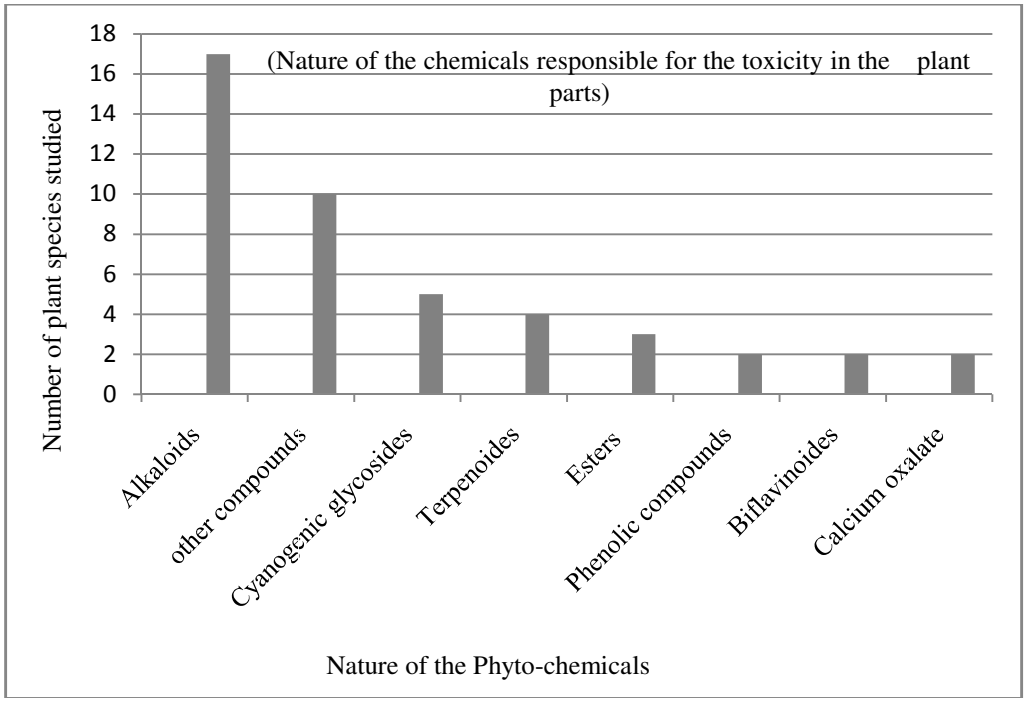


Figure-5: Number of plant species of different families carrying chemical(s) responsible for toxicity

(a) ***Aregmone mexicana*** **L.**

(b). ***Cascabela thevetia*** **L.**

(c). ***Calotropis gigantea*** **R.Br.**

(d). Colocasia ***esculenta*** **L.**

(e). ***Datura stramonium*** **L.**

(f). ***Euphorbia antiquorum*** **L.**

Figure-6: Some of the major toxic plants

Thevetia nerifolia: Popularly known as yellow oleander is seen growing on the road sides and often in gardens and temples. The plant produces white latex. Flowers yellow. Plant flowers throughout the year. Fruits are drupe. All parts of the plant contain deadly cardiac glycosides. The latex may cause eye burning and reddishness. Eating of the fruits causes vomiting, cold cammy skin and heart poisoning and sometimes heart failure.

Calotropis gigantea: Popularly known as crown flower seen growing in waste and fallow lands. The perennial plant is almost 8 ft high with purplish or white flowers and follicular fruits. The plant sap is milky in colour contains resinols as esters of volatile fatty acids (acetic acid and isovaleric). The milky sap can damage the eye sight. It causes heart poisoning and acute gasteroenteritis. It has medicinal value. Latex is used in scratches and cut places to stop bleeding.

Colocassia esculenta: Known as elephant ear found growing in moist, shady land and wet places and sides of water canals. The plant is a tuberous herb, stolen compact and leaves ovate, bears flowers during September-November. Roots and leaves of this plant are poisoinous and cause itching and irritation. Toxic nature of the plant is due to presence of calcium oxalate and needle shape raphides.

Datura stramonium: Known as thorn apple, it is a 4-5 ft high perennial herb bearing white or purple funnel shaped flowers. Fruits are ellipsoid or globose, spinescent- 4 celled capsules. Seeds are numerous black, compressed or dotted. Though most plant parts toxic, seeds are mostly poisoinous. The toxicity is due to alkaloids such as scopolamine, hyposcyamine and atropine in their seeds and flowers. The toxicity symptoms are hallucination, hyperthermia, and tachycardia bizarre and violent behaviour. Consumption of seeds often leads to death of human being.

Euphorbia antiquorum: Known as Indian spurge tree seen in waste lands and often planted in hedges. Plant is a branched, armed fleshy herb flexy with thick green stem and sharp spines. Flowers are yellowish-green or pinkish in axillary cymes. The milky sap of this plant is toxic because of chemicals 3-triterpenes, euphol-3-0-cinnamate, antiquol A and antoquol B. The sap causes irritation when comes in contact with eyes and skin and causes painful inflammation.

Fruits and seeds of *Thevetia* and *Datura* are very toxic to human beings and often suicidal cases are attributed to their consumption. Even mild does of seed extracts of *Datura* are used in drugs (Cannabis) to enhance its stimulatiory effects. *Parthenium* is an exotic weed and it is spreading at a fast rate covering agricultural fields, waste lands etc. The plant itself and its pollen grains are highly allergic and often causes asthma and skin problems. There is an urgent need for the biological control of such obnoxious weeds.

Some of the poisonous plants besides toxicity do have medicinal and economic value. The seed of *Argemone maxicana* is highly toxic and often adultered with mustard seeds. However, the oil of the plant is used against skin itching. *Strychnous nux-vomica* though has a mild poisonous effect; the alkaloids are strongly medicinal and have sedative effect. The inflorescence of *Ricinus* and *Jatropha* are toxic to cattles but the seeds of both plants produce oils. The oils af *Ricinus* is used for industrial purposes and that of *Jatropha* used as biodisel. The latex from *Calotropis*, *Ipomea* are toxic but the plants are grown in hedges and the dried stems are used as fire wood for cooking purpose by slum dwellers in the city. Often the latex causes eye irritation. Stalks when used as firewood are also toxic for the respiratory system.

Mucuna and *Utrica* have stinging hairs and have strong irritating action on human body parts but the paste form such plants is used against insect and bee attack[14]. Some poisonous plants such as *Amorphophallus and Colocasia esculenta* have food value. The rhizome and stems are used as food by poor people and slum dweller, though the saps of these plants do cause irritation in mouth foregut and also cause vomiting. The milky latex from *Euphorbia nivulia* and *Euphorbia antiquorum* are highly toxic and often damages the eyes of children. These plants are used in hedges to keep away the animals. Plants such as *Mirabilis jalapa*, *Nerium oleander* are used as ornamentals even after their toxic effects (Table-1).

As a whole poisonous plant are fatal and often cause allergy, skin irritation, swellings, vomiting, eye burning, chest problems etc. Besides urban dwellers and school going children, visitors and tourists, coming to Bhubaneswar often become prey to the poisonous plants due to lack of awareness. In road sides and gardens both at home and in schools with useful plants, poisonous plants do grow. Children often fail to distinguish between useful and harmful plants due to lack of awareness. Even cactus plant which are kept for ornamental purpose also carry poisonous spine.

Conclusion

From the study, in the Smat city area of Bhubaneswar, a total of 52 plant species has been identified as poisonous/ toxic to human beings and other animals. There is a need to keep such plants away from children, senior citizens and tourists. Further poisonous plants growing on road sides and open spaces are to be removed wherever possible by local administration such as Municipal Authorities in the smart city. Further poisonous plants should be kept away from indoor decorations. Through media, people should be made aware of poisonous plants and their hazardous impacts and the possible first aid. It has been observed[11], plants that are used as traditional medicines in other places are still found in Bhubaneswar and are harvested and used by the localities. Besides toxicity, as certain poisonous plants have medicinal importance and other economic values, those need to be conserved and used sustainably.

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