

An Overview of Poisonous Plants in India

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Abstract -

Indian continent supports a wide diversity of plants and most of them are known for their medicinal value. Different types of bioactive compounds are found in plants, which are directly and indirectly beneficial for plants, animals as well as humans. Apart from this, several plant species contain some toxic compounds that affect the health of many forms of life as well as cause their death. Therefore, it is essential to know in what quantity they should be taken so that it does not harm health. This review on poisonous plants is to explore the current knowledge about poisonous plants in India. The present review will be helpful to different pharmaceutical industries, the scientific community and general public awareness around the world.

Keywords : India, Poisonous plants, Bioactive compounds, Toxicity

The bonding between plants and animals is unbreakable, the relationship between humans and plants is as old as the existence of human beings on earth (Husaini et al., 2020). According to the report published by the World Health Organization (WHO), it is estimated that about 80% of the population from developing countries depend on traditional medicine for their primary health care (Tewari, 2000).

The plants have multiple secondary metabolites, which are to protect them from adverse conditions and these metabolites include alkaloids, phenolics, flavonoids, terpenoids and glycosides (Zlati & Stankovi, 2017). These secondary metabolites and other plant products may have therapeutic properties and are biologically and pharmacologically active. Furthermore, some plants are toxic to both humans and animals due to the presence of harmful by-products, these plants are known as poisonous plants. These plants can be found around the world, and are being used by indigenous people

for various uses such as fishing, hunting, and the treatment of different diseases (H. Bhatia, R. K. Manhas, K. Kumar, & R. Magotra, 2014b).

The poisoning of humans may occur through different means such as from contact with plant parts (skin irritation), ingestion (internal toxicity), absorption, inhalation etc. (Tamilselvan, Thirumalai, Shyamala, & David, 2014). These plant toxins can be divided into several groups based on their effect on humans such as gastrointestinal toxins, cardiovascular toxins, convulsive toxins, anti-cholinergic toxins, nicotine and nicotine-like alkaloids, calcium oxalate crystals and cellular respiration toxins (Achour et al., 2022).

However, local elderly people pass the knowledge of poisonous plants from one generation to the next one, but it is very important to provide general awareness regarding their toxicological profiles (Huai & Xu, 2000). Hence, the focus of this short review is to explore the current knowledge about some poisonous plants, as well as the compounds found in these plants that are responsible for their toxicity to humans and other animals. Some of the major poisonous plants are further described below-

Agave sisalana - *Agave sisalana* is among the important plant used as toothbrush sticks by several people who cannot afford to buy a commercial toothbrush and toothpaste (Kassu, Dagne, Abate, Castro, & Van Wyk, 1999). This plant is also known by different other vernacular names Rambans (Indians) and Garingboom (Africans). Skin contact with the sap from the cut leaves produces burning, redness, tingling and enlarging.

***Abrus precatorius* Linn** - The seeds of *Abrus precatorius* (Indian licorice, Fabaceae) are highly toxic and contain some active compounds, such as abrine, abrasine, abraline, abrin, abricin, abrusgenic acid, etc. (Das, Jain, & Mishra, 2016). Abrin is more toxic than the other active compounds, which is a toxalbumin that inhibits protein synthesis and causes cell death (Narayanan, Surendranath, Bora, Surolia, & Karande, 2005). Even consuming one of its seeds can be fatal for both children and adults. The lethal dose or (LD₅₀) of abrin toxin for humans is 0.1-1 µg/kg body weight (Karthikeyan & Amalnath, 2017).

***Aconitum ferox* (Syn *Aconitum atrox*)** - *Aconitum ferox* (Indian aconite, Ranunculaceae), is an erect and perennial herb whose distribution ranges from temperate

to alpine regions of India, Nepal, Bhutan and China(Agnihotri, Husain, Katiyar, & Husain, 2016; Ghimire, Sapkota, Oli, & Parajuli, 2008; Polunin & Stainton, 1984). It is a rhizomatous poisonous herb with medicinal properties when used after vigorous purification and in the right amounts(Hanuman & Katz, 1993a, 1993b). The plant is used as a poison for arrowheads(Rokaya, Münzbergová, & Timsina, 2010). The lethal dose of aconitine in human is 2 to 6 mg/kg body weight(Regmi, Ravikrishna, Bhat, & Hebbar, 2020).

Aesculus indica - *Aesculus indica* (Indian horse-chestnut or Himalayan horse chestnut, Hippocastanaceae) is widely distributed in low-temperature regions of the world and is commonly found in North Western Himalayas in the Indian context (Kaur, Joseph, & George, 2011). *A. indica* is large sized deciduous and perennial tree species that attains a height of up to 20 m. It is widely used in traditional medicine systems to treat many diseases. *A. indica* is poisonous to humans and other animals due to the presence of a saponin-class toxin called escin or aesculin. After ingestion, aesculin enters the blood and destroys red blood cells. The young leaves and flowers of this plant species are more toxic than mature leaves. The bark and seeds also contain small amounts of aescin(Jamloki, Trivedi, Nautiyal, Semwal, & Cruz-Martins, 2022). *A. indica* poisoning can cause fatigue, paralysis, coma, and even death. The lethal dose or LD50 was observed to be 10.6 mg/g body weight for chicks with a single dose of the seed extract (*A. indica*) and 10.7 mg/g body weight with the hamster. Administration of *A. indica* for two consecutive days showed 6.5 mg/g LD50(Yadav et al., 2022).

Citrullus colocynthis - *Citrullus colocynthis*(Curcubitaceae) is an ancient medicinal plant (Lloyd & Cincinnati, 1898). Its well-known names in English are harsh apple, severe cucumber, colocynth and unpleasant gourd (Rahimi, Amin, & Ardekani, 2012).*Citrullus colocynthis* causes cerebral pain, stomach issues, and sickness in freezing conditions and diarrhoea and irritation in exceptionally hot conditions. Toxic measurements of *C. colocynthis* might cause colic, runs, hematochezia, nephrosis and spewing. Deadly dosages might cause spasms, loss of motion and conceivably passing brought about by circulatory collapse (Duke, Duke, & Ducellier, 2008).The seed of *C. colocynthis* purgative and emetic. Outer utilization of its leaf is utilized for aggravation and bleeding.

The root is a powerful remedy for scorpion and snail bites (Heravi, 1992).

***Cannabis sativa* Linn** - *Cannabis sativa* (Hemp or bhang, Cannabaceae) is one of the most important industrial crops distributed at the global level (Zhang et al., 2018) for its psychoactive resins. The native distribution of the species is in Central Asia, Siberia, China and the Himalayas. *C. sativa* contains more than 400 active compounds, but the major psychoactive toxic constituents are 9-tetrahydrocannabinol (THC) and cannabidiol (CBD). The lethal dose or LD50 of THC is not determined in humans, but in cattle, it was observed to be 40 to 130 mg/kg bodyweight (Breijyeh, Jubeh, Bufo, Karaman, & Scrano, 2021).

Table 1. Some other poisonous plants in India are listed here-

S.No.	Plant Species	Family	Toxic Compound	Symptoms	Reference
1.	<i>Abrus precatorius</i> Linn	Fabaceae	Abrin	In humans, it causes vomiting, nausea, difficulty in swallowing, throat pain, high fever, weakness, irritation in the eyes, severe diarrhoea and even death.	(H. Bhatia, R. Manhas, K. Kumar, & R. Magotra, 2014a)
2.	<i>Aloe vera</i>	Xanthorrhoeaceae	Aloin or barbaloin an anthraquinone glycoside	Excessive consumption may cause nausea, abdominal pain, vomiting and cardiac dysrhythmias.	(Jamloki et al., 2022)
3.	<i>Atropa belladonna</i> Linn.	Solanaceae	Atropine and Scopolamine	Plant ingestion may cause vomiting, nausea and abdominal cramps.	(Jamloki et al., 2022)
4.	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Asclepiadaceae	Uscharin, Calotoxin, Calotropin, Calactin	The milky latex of this plant act as the skin and mucous membranes irritant, which causes blisters in both humans and animals. Both the leaves and the latex cause diarrhoea in livestock and abortion of pregnant animals.	(Bhatia et al., 2014b)
5.	<i>Cannabis sativa</i> Linn.	Cannabaceae	Cannabidiol, 9-tetrahydrocannabinol (THC)	Skin allergy.	(Gupta, Manikyaprabhu, & Dwibedi, 2018)
6.	<i>Commelinab enghalensis</i> Linn	Commelinaceae	n-octacosanol, n triacontanol, n-dotriacontanol	stomach problems	(Bhatia et al., 2014b)

7.	<i>Argemone Mexicana</i> Linn.	Papaveraceae	Sanguinarine and dihydrosanguinarine	Seeds are toxic and cause nausea, intense headaches, vomiting, severe diarrhoea, oedema of the legs and feet.	(Shelar, Bafna, Wahile, & Tupkari, 2011)
8.	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Cuscutin, cuscutatin, beta-sitosterol, luteolin, bergenin and kaempferol	It causes vomiting, stomach ache, anorexia and purgation in animals, and its consumption can cause abortion in pregnant animals.	(Bhatia et al., 2014b)
9.	<i>Datura innoxia</i> Mill.	Solanaceae	Atropine	Contact with the leaves causes several skin problems. Unintentional consumption of these seeds by humans and animals causes dryness and sensation of the mouth and throat, stomach ache.	(Bhatia et al., 2014b)
10.	<i>Digitalis purpurea</i> Linn.	Plantaginaceae	Digitoxin and Digoxin	nausea, vomiting, abdominal pain, excessive urination, abnormal heartbeats and finally death.	(Jamloki et al., 2022)
11.	<i>Lantana camara</i> Linn.	Verbenaceae	Lantadenes	Jaundice, diarrhoea, weakness, lethargy, photosensitivity and hepatotoxicity in grazing animals.	(Negi et al., 2019)
12.	<i>Nerium indicum</i> Mill.	Apocynaceae	Oleandrin	increased blood pressure and heart rate, sweating and vomiting. Its excessive consumption leads to heart attack and sudden death.	(Bhatia et al., 2014b)
13.	<i>Ranunculus arvensis</i> Linn.	Ranunculaceae	Protoanemonin	Skin inflammation and injury of mucous membranes. The fresh leaf juice causes cracks, itching and sores in the skin of humans and animals.	(Sedivy, Piskorski, Müller, & Dorn, 2012)
14.	<i>Solanum xanthocarpum</i>	Solanaceae	Solasoinine and solamargine	Headaches, nausea, vomiting, diarrhoea, stomachache, burning of the throat, itching, eczema, thyroid problems and pain and inflammation in the joints.	(Siddiqui, Siddiqui, & Faizi, 2011)

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10.	<i>Digitalis purpurea</i> Linn.	Plantaginaceae	Digitoxin and Digoxin	nausea, vomiting, abdominal pain, excessive urination, abnormal heartbeats and finally death.	(Jamloki et al., 2022)
11.	<i>Lantana camara</i> Linn.	Verbenaceae	Lantadenes	Jaundice, diarrhoea, weakness, lethargy, photosensitivity and hepatotoxicity in grazing animals.	(Negi et al., 2019)
12.	<i>Nerium indicum</i> Mill.	Apocynaceae	Oleandrin	increased blood pressure and heart rate, sweating and vomiting. Its excessive consumption leads to heart attack and sudden death.	(Bhatia et al., 2014b)
13.	<i>Ranunculus arvensis</i> Linn.	Ranunculaceae	Protoanemonin	Skin inflammation and injury of mucous membranes. The fresh leaf juice causes cracks, itching and sores in the skin of humans and animals.	(Sedivy, Piskorski, Müller, & Dorn, 2012)
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15.	<i>Taxus baccata</i> Linn.	Taxaceae	Taxanes or Taxines, Taxol	Seeds and leaves are highly toxic, causing nausea, vomiting, abdominal pain, bradycardia and respiratory muscle paralysis	(Willaert, Claessens, Vankelecom, & Vanderheyden, 2002)
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In this review, we have described some poisonous plants found in India with their toxicity, toxic compounds and post-ingestion symptoms. This review will be helpful as a guide for researchers, the pharmaceutical industry and toxicological studies, and increase public knowledge and awareness about plant toxicity. We have discussed that the toxicity of a plant depends on the presence of several chemical compounds and their concentration, as well as on other factors, i.e., temperature, rainfall, age of plants, plant dosage, growth stage, time of collection and nutrients in the soil. Some plants are highly toxic, causing cardio- and neurotoxicity, increased heart rate, vomiting, abdominal cramps and diarrhoea, and ultimately death. On the other hand, some poisonous plants can cause mild symptoms, such as fever, skin allergies, headaches and weakness. We believe that further studies are needed towards a better understanding of the detailed mechanism of action of these poisonous plants, as well as their role in curing a variety of diseases.

References -

1. Husaini, D.C., et al. Poisonous plants of Belize: a mini toxicological review. 2020.
2. Zlati?, N.M. and M.S. Stankovi?, Variability of Secondary Metabolites of the Species *Cichorium intybus* L. from Different Habitats. *Plants* (Basel), 2017. 6(3).
3. Bhatia, H., et al., Traditional knowledge on poisonous plants of Udhampur district of Jammu and Kashmir, India. *Journal of Ethnopharmacology*, 2014. 152(1): p. 207-216.
4. Tamilselvan, N., et al., A review on some poisonous plants and their medicinal values. *Journal of Acute Disease*, 2014. 3(2): p. 85-89.
5. Huai, H. and J. Xu, Indigenous knowledge: an inexhaustible "information bank" for toxin research. *Toxicon*, 2000. 38(6): p. 745-6.
6. Kasso, A., et al., Ethnomedical aspects of the commonly used toothbrush sticks in Ethiopia. *East Afr Med J*, 1999. 76(11): p. 651-3.
7. Das, A., V. Jain, and A. Mishra, A brief review on a traditional herb: *Abrus precatorius* (L.). *Int J Forensic Med Toxicol Sci*, 2016. 1(1): p. 1-10.
8. Karthikeyan, A. and S.D. Amalnath, *Abrus precatorius* poisoning: a retrospective study of 112 patients. *Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine*, 2017. 21(4): p. 224.

9. Regmi, P., et al., Ethno-botanical and Toxicological comparison on varieties of *Vatsanabha* (*Aconitum ferox* Wall.) available in Nepal. *International Journal of Ayurveda and Traditional Medicine*, 2020. 2(2): p. 3-9.
10. Kaur, L., L. Joseph, and M. George, Phytochemical analysis of leaf extract of *Aesculus indica*. *International Journal of Pharmacy and Pharmaceutical Sciences*, 2011. 3(5): p. 232-234.
11. Yadav, N., et al., *Aesculus indica*: an updated review on its pharmacognosy, phytochemistry and pharmacological profile. *Egyptian Journal of Basic and Applied Sciences*, 2022. 9(1): p. 125-135.
12. Rahimi, R., G. Amin, and M.R.S. Ardekani, A review on *Citrullus colocynthis* Schrad.: from traditional Iranian medicine to modern phytotherapy. *The journal of alternative and complementary medicine*, 2012. 18(6): p. 551-554.
13. Heravi, M., *Alabnya an al-Haghayegh al-Advia*. Tehran, Iran: Tehran University, 1992.
14. Breijyeh, Z., et al., Cannabis: A toxin-producing plant with potential therapeutic uses. *Toxins*, 2021. 13(2): p. 117.
15. Bha..a, H., et al., Traditional knowledge on poisonous plants of Udhampur district of Jammu and Kashmir, India. *Journal of Ethnopharmacology*, 2014. 152(1): p. 207-216.
16. Jamloki, A., et al., Poisonous plants of the Indian Himalaya: an overview. *Metabolites*, 2022. 12(6): p. 540.
17. Gupta, S.M., K. Manikyaprabhu, and S. Dwibedi, Himalayan toxic plants of defense importance. *Acta Sci Med Sci*, 2018. 2(3): p. 44-48.
18. Shelar, M., et al., Evaluation of edible oils for *Argemone mexicana* seed oil adulteration. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 2011. 2(3): p. 927-936.
19. Negi, G., et al., Ecology and use of *Lantana camara* in India. *The Botanical Review*, 2019. 85(2): p. 109-130.
20. Sedivy, C., et al., Too low to kill: concentration of the secondary metabolite ranunculin in buttercup pollen does not affect bee larval survival. *Journal of chemical ecology*, 2012. 38(8): p. 996-1002.
21. Siddiqui, B., S. Siddiqui, and S. Faizi, Studies in the Chemical Constituents of the Fresh Berries of *Solanum xanthocarpum* Schrad. And Wendle. *Journal of the Chemical Society of Pakistan*, 2011. 5(4): p. 99.