Quantity: a parameter deciding various health hazards

Sankalpa N. Navathar1, Pritam P. Pandit2

1Department of NALSAR University of Law, Telangana 500101, India. 2Department of Forensic Science, Vivekananda Global University, Jaipur 303012, India.

*Corresponding to: Pritam P. Pandit. Department of Forensic Science, Vivekananda Global University, Sector 36, NRI Road, Jaipur 303012, India. E-mail: panditpritam086@gmail.com.

Author contributions
SN contributed in study conception, design and data collection. PP dealt with interpretation and validation of the data. Both the authors contributed equally in revising the manuscript.

Competing interests
The authors declare no conflicts of interest.

Acknowledgments
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Peer review information
Toxicology Advances thanks all anonymous reviewers for their contribution to the peer review of this paper.

Abbreviations
TRPV1, transient receptor potential vanilloid 1; COX, cyclooxygenase; LOX, lipoxygenase; WHO, World Health Organisation; PAs, pyrrolizidine alkaloids; RBC, red blood cell; LD, lethal dose; ATP, adenosine tri phosphatase; PA, pyrrolizidine alkaloids; mg/kg, milligram/kilogram; gm, gram; cm, centimeter; Na+/K+, anions of sodium/potassium.

Citation

Abstract
Plants are vital to the survival of life on earth and have enormous implications for both the environment and human well-being. Plants carry both medicinal and toxic properties. The plants were used by people traditionally for medicinal purposes. But people were not aware of the concentration of the doses. So, excessive quantity of doses may lead to severe toxic effects on the human body. This topic discusses the potential hazards of toxic plants on human health. There are many plants around the world that can cause adverse effects, ranging from mild irritation to severe organ damage or death. This review focuses on the plants which are available locally used as medicines carrying toxic properties too. It is essential to learn to recognize them and avoid touching or ingesting them. If exposure does occur, prompt medical attention is necessary. Understanding the risks associated with toxic plants can help individuals take the necessary precautions to protect their health.

Keywords: toxic plants; poison; hazardous effects; fatal period; dosage

Executive editor: Jing-Fang Han.
Received: 26 April 2023; Accepted: 27 May 2023; Available online: 05 June 2023.
© 2023 By Author(s). Published by TMR Publishing Group Limited. This is an open access article under the CC BY license. (https://creativecommons.org/licenses/by/4.0/)
Introduction

Men have used plants for many different kinds of reasons since the dawn of time. He felt the necessity to classify plants into categories like food plants, hazardous plants, and medicinal plants due to his need for them. This eventually resulted in the creation of plant taxonomy [1–3]. The use of alternative and integrative medical approaches to health has grown exponentially among Americans, according to recent trends. In 1997, 42% of Americans said they used alternative medicines, 40% for the management of persistent illnesses, and 60% for avoidance of illness. Despite this tremendous expansion, there is little research on the toxicity and efficacy of alternative medicine. To build an empirical foundation for herbal, botanical, and nutritional supplements, much more work has to be done. Plants have been used as a source of medicine since antiquity, yet scientific medicine frequently overlooks the value of herbal therapy [4]. In 1997, the WHO recommended using potent, easily accessible plants as alternatives to medications. The study of medicinal plants has advanced, and knowledge about them has been shared [5].

A poison is a chemical that can have negative effects on a person’s body when ingested, breathed, or swallowed. The sole defining criteria are dosage/quantity, hence there are truly no distinctions between a medicine and a poison in a huge amount is still a poison and a medicine in a relatively small dose may still be a poison. The only legal analogy between a medication and a toxic substance is the intent behind its administration. When a drug is taken with the intention of extending life, it is taken as medicine; when it is taken with the intention of harming the body, it is taken as poison [6–9]. As stated by Paracelsus (1,493–1,541), the pioneer of toxicology, "Everything is poison, there is poison in everything, only the dose makes a thing not a poison," practically every substance can be dangerous at elevated concentrations [10, 11]. Poisons are chemicals that can upset organisms in the context of biology. The deliberate administration of poison has been employed throughout human history by means of a form of killing, suicide, and execution. Mutually, naturally occurring substances and elements created by humans can be considered poison. Naturally occurring bacteria, fungi, protists, plants, and animal species all create poisons. Poisonous plants are ones that can be fatal if even a tiny amount of their stems, leaves, seeds, fruits, or roots are consumed [12–14]. Other plants can turn hazardous if their preparations are consumed in excess, in high dosages, or over an extended period of time [15–17]. Poisonous plants are defined as those that, in full or in portion, under all or certain conditions, in a way, and in an amount that is most likely to be guled by or placed into contact with a living entity, will have detrimental impacts or cause demise either right away or by reason of the harmful property’s overall action due to the containment of known or unknown chemical substances in it and not by mechanical action. A plant’s poisonous nature may result from the creation of toxic substances such as alkaloids, glucosides, amines, tocalbamins, toxins, resins, saponins, tannins, essential oils, and others, many of which are harmful to humans and other animals, at least in some situations [18, 19].

Several species that are harmful or dangerous to humans can be observed in gardens or nurtured as wayside trees by the forest service, regardless of the understanding of their impact on human body systems. A person can become poisoned by interaction, swallowing, absorbing through the skin, breathing through the respiratory system, or absorption via the skin. Some plants that are regarded as being harmless are actually not. In medicine, several plants are utilized in various ways, particularly in homeopathic pharmacotherapy [11, 20]. Plants have been employed for curative illness treatment in several indigenous medical systems from time immemorial. Presently, this herbal medicine is gaining popularity all over the world, particularly in underdeveloped nations where medicinal herbs are readily accessible and affordable. Additionally, people feel that natural medicines have fewer negative consequences than those made from chemicals. The widespread belief that herbal medications are remarkably secure and free of side effects, however, is both false and deceptive. In reality, several studies demonstrate that therapeutic herbs can cause a variety of unfavorable and severe effects, including teratogenicity, cancer, diseases that are potentially fatal, and even death [21, 22].

Traditionally, people used plants for medicinal purposes as they have high potential value for disease curation. Different parts of plants carry variable amounts of medicinal value. But the people were unaware of the toxicity of such plants, the amount of dosage that is needed to cure diseases. Therefore this review focuses on such plants which are easily available at local places carrying medicinal values but their excessive amount of consumption can cause hazardous effects on humans.

Some toxic plants and their general properties (Table 1)

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Name of Plant/Family</th>
<th>Toxic Parts</th>
<th>Toxic Constituents</th>
<th>Fatal Dose</th>
<th>Fatal period</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Abrus Precatorius</td>
<td>Roots, seeds and leaves</td>
<td>Abrin, Abrine and Abrasine</td>
<td>1–2 seed or mg/kg (Abrin)</td>
<td>3–5 days</td>
<td>[23]</td>
</tr>
<tr>
<td>2.</td>
<td>Capsicum annum L.</td>
<td>Fruit</td>
<td>Capsaicin and Capsicin</td>
<td>High dose</td>
<td>-</td>
<td>[24]</td>
</tr>
<tr>
<td>3.</td>
<td>Calotropis gigantea</td>
<td>Juice and roots</td>
<td>Uscharin, Calotoxin, Calactin and Calotropin</td>
<td>0.12 mg/kg calotropin</td>
<td>12–24 h</td>
<td>[23]</td>
</tr>
<tr>
<td>4.</td>
<td>Aegle marmelos</td>
<td>seeds and the immature or unripe fruits</td>
<td>Marmelosin, Psoralen</td>
<td>Lethal Dose LD (50)</td>
<td>14 days</td>
<td>[25]</td>
</tr>
<tr>
<td>5.</td>
<td>Semecarpus</td>
<td>Juice</td>
<td>Semecarpol and Bilawanol</td>
<td>5–10 gm</td>
<td>12–24 h</td>
<td>[23]</td>
</tr>
</tbody>
</table>
**Abrus Precatorius** (Figure 1)

A woody twining plant known as *Abrus precatorius* has distinctive deadly crimson seeds with a black mark at the base [26, 27]. The leaves have 20–40 leaflets and resemble tamarind leaves. It was once only found in India at elevations of 1,200 meters considering the outer Himalayas, but today it may be found in all humid nations [28]. It is a stunning, numerous-branched, thin, woody, thorny twining or climbing plant, spirally arranged, wrinkled, smooth-textured, and with brown bark on the stem. Leaflets are 7–24 pairs, 0.6–2.5 cm, 0.4–1.2 cm, turgid, cylindrical, obscure, truncate at each end, and appressed hairy; leaves are pointedly intricate and stipulate. Pink or pinkish-white flowers in auxiliary racemes that are shorter than the leaves. Pods are turgid, oblong, appressed hairy, sharply deflexed, silky-textured, and contain three to five seeds. They are 1.5–5.0 cm, 0.8–1.5 cm [29].

**Mechanism.** The principal harmful mechanism in *Abrus precatorius* is caused by the presence of the poisonous protein abrin. Abrin functions as a powerful cytoxicin, capable of harming and killing cells. Abrin’s approach entails impeding protein synthesis in cells by causing ribosome disruptions, which are the biological components in charge of the formation of protein. The result of this blockage is the destruction of cells. A and B are the two subunits that makeup abrin. In order for the A subunit to enter the cell and exercise its harmful effects, the B subunit must attach to certain receptors on the surface of cells. When the A subunit enters the cell, it messes with the ribosome system, inhibiting the production of vital proteins and ultimately causing cell death. Moreover, it is the need of an hour to understand and make people aware of the fact that, abrin is a highly toxic agent which causes stomach pain, dehydration, convulsions, difficulty in breathing, etc [32, 33].

**Capsicum annum L.** (Figure 2)

The Capsicum genus is a member of the Solanaceae family, Solanocleae subfamily, and Solaneae tribe. The chili (Capsicum), along with corn, beans and squash, was one of the earliest plants planted in America [4]. A total of around 25 wild and semi-grown species of chili, including five that are commercially cultivated (C. Chinense, C. annum, C. pubescens, C. baccatum, and C. frutescens) [5]. Peppers (C. annum L.) can be either fiery or sweet, and they are produced worldwide in subtropical climatic zones.

**Mechanism.** The chemical termed capsicin, which gives chili peppers their distinctive pungency and heat, plays a key role in the mechanism of action of *Capsicum annum l.* Transient receptor potential vanilloid 1 (TRPV1) receptor is the particular receptor that capsicain activates. Onafferent nerve fibers throughout the body, notably in regions like the skin, mucous membranes, and gastrointestinal tract, TRPV1 receptors are found. Capsicain attaches to and activates TRPV1 receptors whenever it enters into touch with them. The triggering event triggers a number of biological responses. Heat and Pain Sensation: Capsaicin activates TRPV1 and causes a heat and pain sensation. The experience of warmth results from the stimulation of sensory nerve fibers, which send information to the brain. Emit of Substance P: Capsicain causes sensory nerve terminations to emit a neuropeptide known as substance P. Signals for pain are modulated and sent by substance P. The pain that capsicain causes is a result of substance P is released. Vasodilatation: Capsaicin widens blood vessels, resulting in more blood flowing through the treated region. This action is helpful in topical applications of capsicain for ailments like arthritis and muscular discomfort since it might enhance circulation and reduce pain. Capsaicain has been proven to have metabolic benefits, such as boosting fat oxidation and elevating energy expenditure. May momentarily boost fat burning and metabolism, which is why it’s frequently seen in weight reduction products [34–36].

**Calotropis gigantea** (Figure 3)

Six species make up the genus Calotropis (family Apocynaceae, subfamily Asclepiadaceae). Common names for *C. gigantea*, a non-cultivable plant that is widely distributed in Africa and Asia, include “crown flower”, “giant milkweed” and “shallow wart”. Its popular name in India is “Madar” in the local Hindi language. It may be identified by its dense, oblong leaves, odorless purple blossoms, and habitats in a wasteland where it thrives. A milky, bitter substance exudes from the plant’s cut or damaged leaves or stalks. Numerous glycosides, alkaloids, flavonoids, tannins, etc. are among the phytoconstituents of *C. gigantea* that are generated from different portions of the plant, including canatoxin, usharin, picaridin, and procero side.

Numerous cardenoloids, flavonoids, terpenes, pregnanes, and amino acid that is not a protein have also been identified. The majority of plant substances that have been thoroughly investigated and isolated from sap, root bark, and/or leaves are cytotoxic.

**Mechanism.** Calotropis gigantea’s many sections, including the leaves, stems, and roots, contain a variety of bioactive substances that are thought to be responsible for the plant’s various action processes. Traditionally, Calotropis gigantea has been utilized for its cardiotoxic properties. Heart muscle is affected by cardiac glycosides found in the plant, such as calotropin and calotocin, which block the Na’/K’ ATPase pump. This blockade raises intracellular sodium and calcium levels, which facilitates heart contractility and may have advantageous antiinotropic effects. The anti-inflammatory activities of Calotropis gigantea are well known. It has flavonoids, triterpenoids, and alkaloids that have inhibitory effects on cytokines and inflammatory enzymes like cyclooxygenase (COX) and lipooxygenase (LOX), as well as other inflammatory mediators. These substances can be helpful in treating illnesses like arthritis and skin inflammation by reducing irritation. Potential anticancer action has been noted in certain investigations with Calotropis gigantea extracts. Apoptosis (programmed cell death), reduction of cell growth, and anti-angiogenic actions are only a few of the chemicals the plant contains that have cytotoxic effects against cancer cells. [37–39].

**Aegle marmelos** (Figure 4)

Due to its numerous therapeutic characteristics, *Aegle marmelos* (L.) Correa (A. marmelos), also known as Bael and a member of the Rutaceae family, has been utilized extensively in traditional systems of Indian medicine. Native to Northern India, *A. marmelos* is also widely spread in Ceylon, Burma, Bangladesh, Thailand, and Indo-China. It is also found in Burma, Bangladesh, Bangladesh, and Thailand. It is a medium- to large-sized, armed, deciduous tree with alternate trifoliate leaves that are 2.5 cm long. Its fruits are globular and its blooms are fleeting.

**Mechanism.** Aegle marmelos are rich in bioactive substances, including phenolics, flavonoids, and tannins, which have antioxidant qualities. These substances aid in the removal of free radicals from the body and lessen oxidative stress. Aegle marmelos antioxidant activity may help explain why it has potential health benefits against a number of conditions, including cancer and cardiovascular disease [40].

**Antihyperlipidemic activity:** High blood levels of triglycerides, fatty acids, and cholesterol cause atherosclerosis, which damages blood vessels and can result in ischemic heart disease, myocardial infarction, and brain vascular accidents. The blood and tissue lipid profiles of streptozotocin-induced diabetic rats were dramatically reduced after oral administration of an aqueous extract of bael fruits and seeds at a dosage of 250 mg/kg [41–43].

**Semecarpus Anacardium L.** (Figure 5)

It is an average-sized deciduous tree that may reach heights of 10 to 15 meters. The plant naturally develops in a tropical, arid environment. Grey in appearance, the bark releases an irritating fluid when cut. Simple alternating leaves are 30–60 cm in length and 12–30 cm in width. They are pubescent below and glabrous above. In panicles, the blooms have a greenish-white color. Fruits are 2–3 cm

Submit a manuscript: https://www.tmrjournals.com/air
wide, ovoid, smooth, and have a shiny black color when they are mature, which is between December and March. In June, the plant blooms, and from that point on, it produces fruits. Large leaves and the crimson blaze of oozing resin, which becomes black when exposed, make it easy to identify. It has no particular soil affinity.

**Mechanism.** Effects on Immunomodulation: Semecarpus anacardium has been investigated for its ability to modulate immunity. Through their effects on immune cell proliferation, cytokine generation, and immune response pathways, plant extracts have demonstrated the capacity to influence the immune system. In the circumstances like autoimmune illnesses where immunological dysregulation is a factor, these effects could be advantageous. Semecarpus anacardium demonstrates anti-inflammatory characteristics. It has bioactive substances, including flavonoids, tannins, and phenolic compounds that can stop inflammatory enzymes like cyclooxygenase (COX) and lipoxygenase (LOX) from doing their jobs. By regulating the synthesis of inflammatory mediators, including prostaglandins and leukotrienes, these substances contribute to the reduction of inflammation [44].
Poisoning by medicinal plants

Traditional medicine is a category of medicinal therapies recognized by the World Health Organisation (WHO) as having traditionally been utilized in many countries. Texts from China, Rome, Greece, Egypt, India, and Syria are among those that show that medicinal treatments have been utilized for nearly 5,000 years [45, 46]. Due to a lack of resources and inadequate access to healthcare, the majority of the world’s population, particularly rural populations, still relies on herbal remedies to treat their common illnesses [47].

Hepatotoxicity of medicinal plants (Figure 6)

Humans have always relied on medicinal plants to treat illnesses. A greater understanding of medicinal plants is now possible thanks to advancements in analytical technology and knowledge of the active substances contained in plants. Hepatotoxicity is caused by hepatotoxins used in medications, chemicals, foods, or herbs [48]. Over fifty million people worldwide are impacted by the global burden of hepatotoxicity [49]. The liver is an important organ in the process of breaking down food and drugs via oxidation, reduction, and hydrolysis processes, converting lipophilic substances into water-soluble molecules that may be expelled from the body [50]. Some therapeutic plants employ the seeds of Cassia occidentalis, and in two cases, four brothers were poisoned by ingesting the plant’s seeds, resulting in acute hepatic failure as well as muscular and encephalopathic damage [51, 52]. Xanthium strumarium is used to treat a number of conditions, most of which are skin-related [53]. Four siblings experienced weariness, nausea, and vomiting after eating X. strumarium seeds. The severity of the symptoms was correlated with the number of eaten seeds, and in one case, liver transplantation was required due to severe liver failure and hepatic necrosis following X. strumarium consumption. The plant includes carboxy attractylo side, a very poisonous glycoside that is known to be powerful [54]. According to reports, Sedum aizoon was erroneously substituted with Gynura segetum when making a traditional Chinese medication, which led to a patient’s liver becoming injured. Traditional Chinese medicine’s hepatotoxicity was caused by the pyrrolizidine alkaloids (PAs) present in G. segetum, and the absence of PAs in S. aizoon coupled with further evidence of plants having PAs suggests a link between plant PAs content and liver failure [55].

Despite the fact that the liver metabolizes medicines, interference with these systems might cause hepatotoxicity. Hepatotoxicity can be a result of the number of different processes, including hepatocyte apoptosis, bile duct damage, mitochondrial inhibition, and cytolitic T-cell activation. Case series and case reports include information on herbal hepatotoxicity. Loss of weight, fatigue, jaundice, dyspepsia, coagulation of blood, edema, and pruritus are signs of hepatotoxicity [56-58]. Cirrhosis is characterized by the development of liver nodules that are encircled by fibrous glands, which results in increased portal blood pressure and, eventually, hepatic disease because of hepatic vasculature malformation. Two types of liver damage brought on by hepatotoxins: reactive metabolite production and immune system activation, lead to idiosyncratic injuries. It is predictable and dosage independent. Injury to the liver is intrinsic, dose-dependent, and reversible [59-61].
**Gastrointestinal poisoning**

Due to the fact that ingesting medicinal plants is a highly typical way to consume them, gastrointestinal symptoms are quite prevalent in a range of toxicities. They could happen separately or at the same time as toxicities in other organs. Gastrointestinal poisoning is characterized by diarrhea, vomiting, and abdominal discomfort. In a case of abuse toxicity, the patient was described as being febrile and comatose, with depressed reflexes and down-going planters, bloody diarrhea, mild proteinuria, and sporadic RBC in urine. The patient had consumed *Abrus precatorius* seeds, which are known as an aphrodisiac in Indian folk medicine. The plant’s seeds have a tough outer shell that is safe and resists digestion. Before eating seeds, chewing them releases arbon. Important gastrointestinal poisons including botulinum, tetanus, cholera, diphtheria, and insulin share structural similarities with arbin. Two polypeptide chains, A and B, are present in arbin; chain B aids in the compound’s penetration of cells whereas chain A kills cells by inhibiting protein synthesis via interfering with ribosomes [62, 63]. Colchicine poisoning may cause vomiting, diarrhea, thirst, hematuria, a drop in body temperature, various organ failure, and even death. The capacity of colchicine to bind to tubulin and stop cells in metaphase, which results in a halt of cell activities, is the basis for the drug’s harmful effects [64]. In West African traditional medicine, the purgative oil of *Jatropha multifida* was used to cure rheumatic disease, and parasite infestation, and as an abortifacient. However, *J. multifida* fruit consumption has been linked to the poisoning of four siblings in West Asia. This plant is grown as a garden plant in several parts of the world. *J. multifida* has the same gastrointestinal symptoms as *J. curcas* and includes toxicants that are comparable to those of *J. curcas* [65]. The primary toxin of *R. simsi*, grayanotoxin I, binds to sodium channels in cell membranes, prevents their deactivation, and depolarizes cells. This scenario accelerates calcium entrance into the cells, which may have negative consequences on the cardiovascular system [66].

**Nephrotoxicity**

Among the hazardous side effects of traditionally used herbal extracts, nephrotoxicity is prevalent [40, 41]. The following factors might contribute to nephrotoxicity: consumption of a herb with an unknown level of toxicity; inappropriate documentation of a herb with a poisonous nature; intentional adulteration of a herbal product with chemicals or non-herbal preparations that are nephrotoxic; the interface of a herbal drug with any other drug that causes negative side effects. The kidney’s functional unit, or nephron, is where urine is made by filtering blood. They are engaged in the body’s elimination of harmful and waste materials. Reabsorption is the process by which tiny ions, water molecules, and other small molecules are returned to the peritubular capillaries. The urine is used to get rid of any leftover waste ions and molecules [67, 68].

*Pithecellobium lehmannii*, often known as Jering trees, produces the edible fruit known as the djenkol bean. In Java and Sumatra, Jering (djenkol) beans are a popular meal that can be consumed raw, fried, roasted, or in the sprouting stage. Acute renal failure is linked to the consumption of jerking beans, however the pathophysiology of acute renal failure after jerking bean consumption is yet unknown. Urinary, urethral, and renal tubule blockage may be caused by djenkol acid crystals [69]. In both diabetic and non-diabetic individuals, fenugreek
(Trigonella foenum-graecum) seeds are frequently used to lower blood cholesterol and blood sugar levels. A 62-year-old diabetic patient with acute interstitial nephritis who had no history of renal disease was reported to have it by Zononi et al. According to a previous study, flavonoid-induced nephropathy has also been seen in other cases. This implies that the occurrence of different flavonoids in fenugreek seeds may be the cause of the onset of autoimmune hemolytic anemia and acute interstitial nephritis [70]. In addition to being used as an expectorant and an abortifacient, the root of Securidaca long epedunculata, commonly known as the violet tree or wild wisteria, is said to be beneficial in treating dysmenorrhea and venerable infections.

A well-known intravaginal suicide toxin is the root. This plant’s root contains methyl salicylate, a nephrotoxin that can lead to abrupt renal failure [71].

**Conclusion**

Plant toxicity is among the age-old consequences due to exceeding the threshold quantity of the specific plant component. The toxicity level of a particular plant depends entirely on the quantity that is being consumed, which may arise from mild superficial skin irritation to organ failure or even death of an individual person or animal. Thus, it is very crucial to recognize poisonous plants along with their potent parts in order to avoid consumption or tactile irritability as considered in accidental poisoning. In addition to this, many parts of plants seem to be attractive or pleasing to the eye due to their vibrant colours and shapes thus, children fall prey and result in accidental poisoning. Therefore, they must be educated regarding the same at an early age in life. Depending upon parts of plants such as leaves, flowers, seeds, extract, roots, fruit, they hold different potency levels. Various signs and symptoms can be seen that are particularly associated with each type of plant. Some of them are severe allergic reactions, respiratory distress, gastrointestinal problems, renal failure, pale body, internal hemorrhage, convulsions, cardiac failure, and other serious health problems. Prevention in every possible way is the ultimate goal in order to stay away from its toxicity. Moreover, as stated earlier it is the quantity (dosage) that makes it toxic. Considering research studies, while handling such plants, gloves, masks shall be worn appropriately so as to avoid any kind of exposure. If exposure occurs at a high level, prompt medical attention is needed. Treatment may include washing the affected area, administering antidotes, antihistamines or other medications depending upon the signs and symptoms and the type of toxic plant involved if it is known. In conclusion, educating people with proper knowledge of such plants including their hazardous effects on the body and the estimated amount of toxic active principles in each part of a plant plays a pivotal role in preventing accidental consumption and its adverse effect.

**References**

12. Grevol, S. Lyon’s Medical Jurisprudence and Toxicology. DI. H; 1953
http://doi.org/10.1016/j.phymed.2006.05.004


27. Gogate VM. Ayurvedic pharmacology and therapeutic uses of medicinal plants (Dravyaguna-griya). Bharatiya Vidya Bhavan; 2000


