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Pharmacognostial Characterization of Some Selected Medicinal Plants of Semi-Arid Regions.

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Pharmacogonasy is mainly concerned with naturally occurring substances having a medicinal action. It also includes the study of other material used in pharmacy such as flavoring and suspending agents, disintegrants, filtering and support media and so on. It is closely related to both botany and plant chemistry. During present investigations studies were conducted on some selected plants of semi-arid regions

Keyword: Phamarcognostical Studies, Rajasthan, Medicinal Plants.

1. Introduction

Several studies have been conducted on medicinal plants of Rajasthan (Kumar and Sopory, 2008). Kumar (2000) studied traditional Indian Ayurvedic Medicines and some potential plants for bioenergy, medicine from India. Sharma, Agrawal and Kumar (2003) characterized Medicinal plants for skin and hair care. Mahlawat and Kumar (2005) studied some traditional medicinal plants used by tribal people of Rajasthan in Human ailments. Sharma and Kumar, (2006, 2007), studied traditional medicinal practices of Rajasthan. Parveen et al., (2007) studied Traditional use of medicinal plants among the rural communities of Churu District in the Thar Desert, India have been reported by Parveen et al., (2007). Plant based veterinary medicine from traditional knowledge of India has been recorded in Bulletin of Botanical Survey of India (Sharma, Dadhich and Kumar, 2005). Ethnobotanical survey of medicinal plants from Baran District (Meena and Kumar, 2012:

The word "Pharmacognosy" derives from the Greek words *pharmakon* (drug), and *gnosis* or knowledge. The term pharmacognosy was used for the first time by the Austrian physician Schmidt in 1811. A "crude drug" means a dried unprepared natural material of plant, animal or mineral origin, which is used for medicine. The term "Pharmakognosie" and it discipline developed in German speaking areas of Europe - where it is a synonym of "Drogenkunde" ("science of the crude drugs").

The different fields within today's pharmacognosy include: (i) Ethnobotany or ethnopharmagocology; study of the traditional use of plants in the society. Ethnobotany refers to any use of the plants, whereas ethnopharmacology refers more specifically to the madical use of the plants. (ii) Phytochemistry, or natural product chemistry; a field closely

related to organic chemistry, studying the chemical composition of living organisms. It is also closely connected to the process of finding new drug candidates from natural sources. (iii) Phytotherapy study of crude drugs, i.e. extracts from natural sources in medical use .

Pharmacognosy includes the study of the proper horticulture, harvesting and uses of the raw medicinals found in nature. Its scope includes the identification or authentication of crude drugs (using macroscopical, microscopical, radiological or chemical methods), and their bio-pharmacological and clinical evaluations. Sharma, and **Kumar,** (2012) carried out pharmacognostical studies on medicinal plants of semi-arid regions. Upadhyay, Singh and **Kumar** (2011) studied Ethno-veterinary uses and informants consensus factor of medicinal plants of Sariska region, Rajasthan. Sharma and **Kumar** (2011) recorded ethnobotanical uses of medicinal plants of Rajasthan. Although today pharmacognosy is still taught in a small number of university pharmacy schools in US and in the UK, this subject is still obligatory within the pharmacy curricula in all universities of continental Europe.

Pharmacogonasy is mainly concerned with naturally occurring substances having a medicinal action. It also includes the study of other material used in pharmacy such as flavouring and suspending agents, disintegrants, filtering and support media and so on. It is closely related to both botany and plant chemistry.

During earlier investigations studies have been conducted on ethnobotanical and pharmacognostical characterization of medicinal plants (Kumar, 2000; **Cordell and Colvard, 2005 ;** Parveen et al., Upadhyay et al, Kumar and Sharma, Sharma et al, Sharma et al., 2012
Pharmacognosy has been generally pursued for utilitarian ends and may thus be called an applied science. It has played an important role in the development of the pure sciences, e.g. in descriptive botany, plant classification (taxonomy) and plant chemistry (phytochemistry). Chemical plant taxonomy, genetical studies, involving secondary metabolites are now attracting the attention of more and more botanist and chemists.

Vegetable drugs are usually arranged for study in one of the following five ways:

1. ***Alphabetical*:** The drugs are arranged in alphabetical order using either Latin or English names.
2. ***Taxonomic**:* The drugs are arranged according to the plant from which they are obtained in phyla, orders, families, genera and species.
3. ***Morphological*** : Drugs are divided into different groups such as organized drugs which include root, wood, bark, flowers, fruits and leaves and unorganized drugs such as oil, fats, extracts and gums.
4. ***Pharmacological or therapeutic:*** Classification of drugs is according to the pharmacological action of their most important constituent.
5. ***Chemical:*** Drugs are classified according to their most important constituent that is alkaloids, volatile oils etc.

Pharmacy starting from medicine, separated and materia medica the science of material medicines describing collection, preparation and compounding emerged.

Even up to the begining of 20^{th} century pharmacognosy was more a descriptive subject mainly of botanical science and consisted of identification of drugs both in entire and powdered condition and their history, commerce, collection, preparation and storage.

1.1 Period 1934-1960:

The development of modern pharmacognosy book place later during the period 1934-1960 by simultaneous application of disciplines like organic chemistry, biochemistry, biosynthesis, pharmacology and modern methods and techniques of analytic chemistry including paper, thin layer and gas chromatography and spectrophotometry.

The substances from the plants were isolated, their structure elucidated and pharmacologically active constituents studied. The development was

mainly due to following four events:

1. Isolation of penicillin in 1928 by Fleming and large scale production in 1941 by Florey and Chain.
2. Isolation of reserpine from Rauwolfia roots and confirming its hypotensive and tranquillising properties.
3. Isolation of Vinca alkaloids especially vincristine and vinblastine. Vincristine was found useful in the treatment of leukeemia. These alkaloids have also anticancer properties.
4. Steroid hormones like progesterone were isolated by partial synthesis from diosgenin and other steroid saponins by Marker's method. From progesterone by microbial reactions, cortisone and hydrocortisone are obtained.

1.2 Progress from 1960 onwards:

During this period only a few active constituents mainly antibiotics, hormones and antitumour drugs were isolated or new possibilities for their production were found. From 6- amino penicillianic acid which has very little antibiotic action of its own but from which important broad spectrum semi-synthetic penicillins like ampicillin and amoxycillin were developed.

From ergocryptine alkaloid of ergot, bromocryptine has been sybnthesised. Bromocryptine is a prolactine inhibitor and also has activity in Parkinson's disease.

By applications of several disciplines pharmacognosy from a descriptive subject has developed into an integral, important discipline of pharmaceutical sciences.

Diseases are born with man and drugs came into existence since a very early period to remove the pain of diseases and to cure them. Thus, the story or history of drugs is as old as mankind.

Drugs used in medicine today are either obtained from nature or are of synthetic origin. Natural drugs are obtained from plants, animals or mineral kingdom. Drugs made from micro-organisms like antibiotics were not known in the early period. Synthetic drugs (or syntheticals) like aspirin, sulpha drugs, some vitamins and some antibiotics are synthesized in laboratories from simple chemical (or chemicals) through various chemical reactions.

Natural drugs obtained from plants and animals are called drugs of biological origin and are produced in the living cells of plants or animals.

Each drug is always obtained from the same plant or animal. The Latin name of the plant or animal is called its botanical or zoological source. The family to which this plant or animal belongs is also mentioned, e.g. Vasaka leaves are obtained from *Adhatoda vasica* plant; family Acanthaceae. Vasaka leaves are included in the Indian pharmacopoeia and are called official leaves. Their botanical source is called official source. Geographical source or habitat gives us information about the country or place where the drug is produced. Ginger is produced in Jamaica and nux vomica and ispaghula in India. In some cases the original native place of a drug is not the same as the present geographical source, e.g. cinchona is a native of South America and is at present cultivated in Indonesia, India and Congo. History of the drugs gives us useful information about how the drug was known, where it was growing originally and how it was introduced into the modern medicine. History of some drugs like cinchona bark, coca leaves, rauwolfia root and opium is very interesting. Politics play its part in the drugs also. Thus there is restriction on the import of buchu leaves growing in South Africa because of our political relations with that country.

Sometimes crude drugs are adulterated. An adulterant is the drug resembling the original or authentic drug but usually quite different or inferior, less effective, containing less percentage of active constituents and sometimes containing more extraneous matter than permitted.. Nature of adulteration can be determined by the study of pharmacognosy.

In organoleptic evaluation macroscopical and sensory characters are mentioned. In microscopical evaluation, microscopic characters of drugs are described. In biological, physical and chemical evaluation quality or activity of the drug is determined.

In chemical classification as the medicinal action

of the drug is due to active chemical constituents, drugs are classified according to the chemical nature of active constituents. Thus alkaloid containing drugs like opium or solanaceous drugs or rauwolfia are arranged under alkaloidal drugs and even according to the chemical nature of alkaloids. Drugs containing anthraquinone glycosides like senna, cascara, rhubarb and those containing cardiac glycosides like digitalis, strophanthus and scilla are grouped together. Similarly, drugs containing volatile oils like clove, cardamom and umbelliferous fruits are put together.

2. Material and Methods

The plant material was collected from Department of Botany, U.O.R. Jaipur. Efforts were made to collect this plant in flowering and fruiting conditions for correct botanical identification. For macroscopical studies free hand sections of the tuberous roots were taken from fresh material. These were further dehydrated, stained in alcoholic safranin and light green and finally mounted in Canada balsam.

3. Pharmacognosy of Some Plants

Some of the commercially available plants based pharmaceuticals are presented below.

3. 1 *ALOE VERA*

3.1.1 History of *Aloe vera*:

There is historical documentation that shows *Aloe vera* being used as far back as 1500 B.C. and *Aloe vera* is often referred to as the "Miracle plant." *Aloe* was also mentioned in the Natural History of Pliny the Elder (23-79A.D) and in the Materia Medica of Dioscorides (first century A.D.) as well as by later Greek and Arabian physicians.

Mahatma Gandhi said that "You ask me what were the secret forces which sustained me during my long fasts. Well it was my unshakeable faith in God, my simple and frugal lifestyle and the *Aloe*, whose benefits I discovered upon my arrival in South Africa at the end of the 19th century."

The word *Aloe* is derived from the Arabic word 'alloeh' which means 'bitter and shiny substance.' *Aloe* describes more than three hundred fifty closely related plants that grow all over the world.

Aloe has been used in folk remedies around the world for over 2,000 years. The ancient Chinese used it to relieve stomach ailments. The South American and Central American Indians use *Aloe* gel to treat kidney and bladder problems, and to increase longevity. In other cultures, *Aloe* is used to treat a variety of skin diseases. In India, *Aloe* medications are used for a variety of conditions, particularly for their cathartic, stomachic, emmernagogic and anthelminthic properties. Whole leaves, the exudate, and the fresh gel are all used.

Evolving historical patterns of the use of plant substances in traumatic conditions and in systemic illnesses have revealed that man may have first observed animals who were injured or ill to be eating or rolling in patches of certain plants. Subsequently, early man found that these plants would aid in healing human illnesses. Initially, *Aloe* substances were mainly used as healing aids for topical skin problems and conditions and this has remained their most wide spread use to the present. However, over the years the use of these and some other plant substances has been extended into scientific experimental treatments for internal upsets and conditions.

Aloe vera is known to contain well over 100 separate ingredients or constituents between those found in the leaf and those found in the mucilaginous gel inside the leaf. It is also known that some of the ingredients found in the leaf such as aloin, or the emodins are recognized as having laxative and anti-microbial properties respectively, which are not present to any significant degree in the gel itself.

There are many other areas of research imvolving *Aloe* that are being conducted around the world. There is a tendency in today's pharmaceutical

and cosmetic markets to move away from synthetic ingredients and return to natural botanicals whenever possible. *Aloe vera* is certainly one of the more complex and widely recognized natural botanicals yet discovered. Much more controlled, scientific research must be conducted by respected research entities on *Aloe* before the many secrets associated with its benefits are unlocked. It is gratifying to see that this unique botanical is finally getting the scientific attention it deserves.

3.1.2 Vernacular names:

Sanskrit :	Kumarirasambhava, Ghritkumari
Gujarati :	Kunwar
Hindi:	Ghikanvar
Malyalam:	Kattavazha
Telgu:	Kalabanda

3.1.3 Distribution:

Aloe are member of the Liliaceae and are mostly succulents with a whorl of elongated, pointed leaves. There are over 360 accepted species. Some species are tree-like with long stems, while others are small, with their leaves at ground level. They occur over most of Africa, Southern Arabia and Madagascar, but not in rain forest regions or dry deserts. A few species have been carried in cultivation around the Mediterranean and from there have reached as far as Japan in the east and America in the west. The plant is distributed throughout India. It has become completely naturalised, especially in the hot dry valley of North-Western Himalayas.

3.1.4 Cultivation and Collection:

For cultivation in West Indies young offsets are planted in the soil after the rainy season in rows situated at distance of 60 cm. (Fig. 5.1, 5.4). In the second year leaves are collected by the natives. Because of the spiny nature of leaves the natives protect their hand and feet, cut the leaves near the take them to a central place for the preparation of aloe.

Juice of aloe is present in parenchymatous cells of pericycle, surrounding which are mucilage cells. On incision of leaves, juice exudes from pericyclic cells and mucilage cells exert pressure on pericyclic cells and by a single incision juice of the entire leaf is drained out. Although it is cultivated and harvested in large areas in Rajasthan but due to lack to factories in Rajasthan it is exported to Haryana where factories make huge profit from this plant.

3.1.5 Nomenclature:

The nomenclature of *Aloe vera* has been very confused and the plant has been known under a variety of names, most notably *Aloe barbadensis* Mill., *Aloe vera* Tourn. ex. Linn., and *Aloe vulgaris* Lam. While *Aloe barbadensis* Mill. was until recently the official name, the plant was still popularly known as *Aloe vera,* and Newton (1979) argued that the scientific name should also be *Aloe vera.*

3.1.6 Botanical source:

Aloe is the dried juice collected by incision from the bases of the leaves of various species of aloe.

3.1.7 Geographical origin:

The geographical origin of *A. vera* is not known for sure, since it has been introduced and naturalised throughout most of the tropics and warmer regions of the world, including the West Indies and Bahamas, Southern U.S.A., Mexico, Central America, Arabia, India and other parts of Asia.

3.1.8 Description:

3.1.8.1 Macroscopic: Leaves large, succulent, subulate 20-50 cm long and 5-10 cm wide. Apex in the form of a sharp and acute spine. Both the surfaces are strongly cuticularized. Dried leaf juice dark chocolate brown to black in colour and of irregular masses. Odour, characteristic; taste very bitter.

3.1.8.2 Microscopic: Thin walled, large pericyclic cells contain yellow fluid. The fluid under microscope shows crystals in the form of innumerable needles, varying in size and shape. The odour of each variety is characteristic, and taste is nauseous and bitter.

3.1.9 Chemical Constituent:

Aloe contains about 30% aloin and is a mixture of three isomers: barbaloin, β-barbaloin and isobarbaloin. Barbaloin present in all the four varieties is slightly yellow-coloured, bitter water-soluble crystalline glycoside. β-barbaloin is amorphous and present in Cape aloe and can be produced from barbaloin on heating. Isobarbaloin is crystalline, present in Curacao aloe and in traces in Cape aloe and absent in Socotrine and Zanzibar aloe. Barbaloin is a cardiac glycoside compared to common glycosides and cannot be hydrolyzed by acid or alkali but only by oxidative hydrolysis with ferric chloride and hydrochloric acid or periodate. Barbaloin on hydrolysis yields aloe-emodin anthrone and arabinose. Besides aloe-emodin anthrone, aloe-emodin anthranol and aloe-emodin are also present. *Aloe* contains a resin which is ester of *p*-coumaric acid or *p*-hydroxy cinnammic acid esterified with aloeresinotannol. According to recent work Cape aloe-resin consists of aloe-resin B is chromone C. glycoside with glucose and aloe-resin A is P. coumaric acid ester of aloe-resin B esterified at one of the OH groups of glucose.

3.1.10 Uses: *Aloe* and aloin are strong purgatives and in higher doses may act as abortificient. If used alone, aloe causes griping and is usually combined with carminatives or antispasmodics like belladonna of hyoscyamus. Recently, a preliminary study suggests that the *Aloe vera* may mimic Zidovudine without toxicity. A substance in *Aloe vera* show signs of boosting the immune systems of AIDS patients and blocking the human immune- deficiency virus spread without the toxic side effects.

3.2 *Acacia nilotica* Linn.

3.2.1 Vernacular Names :

Arabic : Saelam; Bengal : Babur, Babul, Kikar; Bombay : Babhula, Kikar Kalikikar; Central Provinces : Babul; English: Black Babool, Indian Gum Arabic Tree ; Gujrat : Babalia, Bavan; Hindi : Babla, Babul, Babur, Kikar; Punjab : Babla, Babul, Babur, Kikar; Rajasthan : Babul, Bambun, Bawal; Sanskrit: Pitapushpa, Sukshmapatra, Babbula; Tamil : Iramangandan, Karuvelam; Telgu : Barburamu, Nellatuma.

3.2.2 Family: Mimosaceae.

3.2.3 Distribution: It is found in Delhi, Rajasthan, Punjab and Saurashtra.

3.2.4 Morphology: A ever green moderate sized tree with terete, pubescent and slender branches when young. Bark grey or brown. Leaves bi-pinnate, pinnae 4-10 pairs, leaflets 10-25 pairs and subsessile, linear oblong, glabrous and sub-obtuse. Flowers yellow coloured (Fig. 3.16). Calyx campanulate with short teeth. Corolla 3 mm long and lobes triangular. Pods compressed , persistently grey-downy, moniliform and contain 8-12 black-brown, sub orbicular, compressed and smooth seeds (Bhandari, 1978).

3.2.5 Part Used: Bark, Leaf, Fruit, Gum, Pod and Flowers.

3.2.6 Uses: Bark is a powerful astringent, demulcent used for remedy in relaxed condition of mucous membranes, in leucorrhoea used as a poultice for ulcers attended with sanious discharges. Decoction of bark is used as an astringent in diarrhoea, dysentery, in gleet and leucorrhoea, as a wash for haemorrhagic ulcers, also as a gargle in affection of mouth and throat. A decoction of leaves with a piece of tamarind pod is used to cure a disease of eye which causes the lashes to fall out. Leaves are beaten in pulp are given in diarrhoea as an astringent. These leaves mixed with leaves of pomegranate is given in gonorrhoea. Leaves bruised and mixed with human milk are used in inflammation of conjunctiva as a poultice or juice mixed with milk is dropped into eye. Fruit is a powerful astringent and used in cases of fever, diarrhoea, dysentery, ophthalmia. Gum is useful in diabetes mellitus. A strengthening sweet meat is nade by frying the gum with spices and butter, is given to recently delievered women as a tonic. Gum resin is used for troubles of throat and the chest. Gum alone is used for dysentery. An infusion of pod is used in ophthalmia. A decoction of pod is given for fever, venereal disease and leprosy. Fresh pods are sucked as a specific for cough, pulverized and mixed with water and drunk every morning for

cough and chest complaints. The juice of pods and bark or astringent extract is used to arrest bleedings of circumcision wounds and pulverized pods are applied to sores of mouth or to hasten cicatrisation of syphilitic ulcers Tender leaves and bark are burnt to ashes and are sprinkled daily over wounds. Leaves, Bark and Pod are chewed as antiscorbictic and infusion of pod and bark alone is used for dysentery. Juice from flowers is recommended as a wash for sore eyes.

3.3 *Cassia senna* Syn. *Cassia angustifolia*

It is known by different names:

Hindi: Bhuikhakhasa, Hindisana and Sonamukhi; English : Alexandrian, Bombay, or Tinnevelly senna ; Sanskrit : Bhumiari, Pitapushpi, Swarnamukhi, swarnapatrika ; Rajasthan : *Senna*.

The plant is a variable, branching, erect shrub, upto 1.8 m in height (Fig. 5.5). Leaves pinnate pubescent, leaflets pale green to bluish green, 3 to 9 pairs, lanceolate or elliptic, varying on the same plant, 1.5 to 5 cm. X 0.4 to 2 cm. flowers brilliant yellow, in erect, terminal racemes ; pods light green when young to dark brown or black when mature, flat, thin, oblong pubescent, 3.5 to 7 cm. x 0.2 to 2.5 cm. ; seeds dark brown, obovate-oblong, 5 to 7 (Fig. 5.6).

It is highly drought resistant crop and suitable for desert. It is largely cultivated on marginal lands in a 10,000 ha. , both as rain-fed and irrigated crop, mainly in Tamil Nadu, where it is now grown principally as a cash-crop in Tirunelveli, Ramanathapuram, Tiruchchirappalli and Madurai districts and to a lesser extent in Salem district (Gupta *et al.*, 1977). Recently, it has been observed occuring wild in Cuddapah district of Andhra Pradesh, and Bhuj district of Gujarat. At present, it is also being cultivated in Andhra Pradesh, Karnataka and Maharashtra (Pune). About 2,700 ha. is under cultivation in Cuddapah, Mysore and Anand and Mehsana districts of Gujarat. Trials conducted at Jammu, Jhodhpur district of Rajasthan and Delhi have given very encouraging results ; in Jammu, it can be grown at lower altitudes in drier regions. It was successfully introduced into West Bengal, and recommended for Tripura (Gupta *et al.*, 1977).

The plant requires dry and warm climate, bright sunshine, and occasional drizzle for good growth. It can grow in places where the average minimum and maximum temperatures fluctuate between 10 and 42^0 C. A rainfall of 60-70 cm per year is sufficient for a good crop however, 25-40 cm of rainfall was reported to be sufficient in arid areas.
The plant is stripped three times during the season, first picking is in March and others before May ; more picking can be taken later in October and December. Immediately after picking the leaves are dried in sun. Quick drying ensures excellent green colour. The method of drying affects the percentage of sennosides in the leaves. In sun drying-sennosides are 2.78% ; moisture , 70.70% and in oven drying (40^0 to $\pm 2^0$) – sennosides are 3.13% ; moisture 72.90% .

Among different methods of drying, freeze drying was found to be the best method of drying. The *senna* is well known drug in Unani, Ayurvedic and Allopathic systems of medicines and is also a house hold medicine. The drug from India is known as Tinnevelly senna. The dried leaves and pods comprise the drug, the former known as Senna leaf and later Senna fruit as pod. The commercial drug consists of dried green leaves and shells of nearly dried and ripe pods. The flowers are reported to contain considerable quantity of sennoside (2.6%). The commercial samples of pod (shells) contain sennosides 3 to 5% and the foliage 2.5 to 5%.

The Senna leaves and pods contain sennasoides A, B, C, D, G, rhein, aloe-amine, Kaempferein and iso-rhein in the free and compound glycoside forms. The leaves, pods and roots of *Cassia senna* contains rhein, chrysophenol, imodin and aloe-imodin.

The leaves and pods (shells) are usually administered in the Ayurvedic and Unani systems of medicine as infusion, and considered a great tonic. The milk of nursing women acquires purgative properties after the use of senna. The

drug is contra indicated in spastic constipation and colitis. The senna is an efficient purgative either for occasional use or for habitual constipation. It is free from astringent action of rhubarb (*Rheum* sp.) type but has a tendency to cause gripe ; hence it is combined with carminatives, aromatics and other saline laxatives ; the pods, however, cause less gripe. The disagreeable odour is masked by the addition of ginger or cloves. In India several household preparations such as decoction, powder, syrup, infusion and confection are made with senna. It enters into a compound Nilaavarai Churnam used for treating distention of stomach, hiccups, vomiting and biliousness.

Besides being an excellent laxative, the senna is used as a febrifuge, in splenic enlargements, anaemia, typhoid, cholera, biliousness, jaundice, gout, rheumatism, tumours, foul breath and bronchitis and probably in leprosy. It is employed in the treatment of amoebic dysentery, as an anthelmintic and as a mild liver stimulant. The leaf is one of the constituents of a patented drug reported to have protective effects on the liver. The leaves in the form of confection of senna are used in treating haemorrhoids. They are externally used for certain skin diseases and the powdered leaves in the vinegar are applied to wounds and burns, and to remove pimples. However, it has been known to cause a severe and painful dermatitis in sensitized persons. The leaves along with those of hina are used to dye the hair black.

3.4 *Tinospora Cordifolia*

3.4.1 Botanical origin: *Tinospora cordifolia* (Willid.) Miers (Fig. 4.1).

3.4.2 Family: Menispermaceae

3.4.3 Sanskrit synonyms

Amrita, Amritalata, Amritavallari, Amritavalli, Bhishakapriya, Chakralakshna, Chakrangi, Chandrahasa, Dhira, Guduchi, Jivanthika, Madhuparni, Pittaghni.

3.4.4 Regional names

Bengali: Gadancha, Giloe, Gulancha, Guluncho, Nimgilo.
Bombay: Ambarvel, Gharol, Giroli, Guloe, Gulwel.
Gujarati: Gado, Galo, Gulo, Gulvel.
Hindi: Giloe, Gulancha, Gulbel, Gurach, Ambarvel.
English: Gulancha, Tinospora
Marathi: Ambervel, Gharol, Giroli.

3.4.5 Parts used: Root, stem and leaves.

3.4.6 Properties and Uses:

Tinospora cordifolia is mentioned in Ayurvedic literature as a constituent of several compound preparations used in general debility, dyspepsia, fever and urinary diseases. The plant attracted the early notice of European physicians in India. Fleming remarked on its use as a febrifuge and as a drug in gout. Ainslie described the root as a powerful emetic.

The drug Guduchi has been in use in the indigenous system of medicine since remote past. The leaves of Guduchi are mentioned under Tikta-saka varga which is claimed to be salutary and useful in treating kushta, meha jwara, svasa, kasa and aruchi (Susruta). It has been indicated in Ayurvedic treatises in various ailments like kamala (Jaundice), Jvara(fever), vatarakta and so on. The fresh plant is said to be more efficacious than the dry and the stem is the part which is mostly used, from which a kind of starch is prepared known as Giloe-Ke-Sat or Guduchi-Satva.

Guduchi is considered as bitter, tonic astringent, diuretic and a potent aphrodisiac and curative against skin infections, jaundice, diabetes and chronic diarrohea and dysentery. Dhanvantari Nighantu mentions other properties and uses such as cure for bleeding piles, promoting longevity, curing itching and erysipelas. Its use has been indicated in heart diseases, hypertension, leprosy, helminthiasis and rheumatoid arthritis.

It has been in extensive use in India as a valuable tonic, alterative and antipyretic. It caught the notice of European physicians in India as a specific tonic, antiperiodic and diuretic. The drug itself as well as a tincture prepared from it are now official in the Indian Pharmacopoeia.

Gulancha was included in the Bengal Pharmacopoeia of

1844 and the Indian Pharmacopoeia of 1868. Gulancha which grow on Neem trees is considered to be most efficacious for remedial purpose.

3.4.7 Botanical description:

This is a glabrous, succulent, climbing shrub, often attaining a great height and sending down long thread like aerial roots. The plant seems to be particularly found climbing up the trunks of large Neem trees. The aerial roots that arise from the mature branches or cut bits of stems grow downward and by continuously lengthening sometimes reach the ground. They thicken gradually and resemble the stems, except for the absence of nodal swellings. The fresh or tender stems are greenish, longitudinally striated ribbed. The bark is grey of creamy-white in colour, deeply cleft with spiral and longitudinal clefts, the space between the clefts being usually dotted with large rosette like lenticels. The branches bear smooth heart shaped leaves.

3.4.8 Distribution:

Indigenous and found distributed throughout most parts of tropical India from Kumaon to Assam, in north extending through Bengal, Bihar, Deccan, Konkan, Karnataka and Kerala. It is a fairly common wild plant of the deciduous and dry forests of most districts growing over hedges and small trees.

3.4.9 Cultivation:

The plant is sometimes cultivated for ornament and is propagated by cuttings. It is perfectly suited to and grows well in almost any type of soil and under varying climatic conditions. It is specially trained to grow on Neem and mango trees, thereby it is supposed to possess increase in its medicinal virtue.

a. **Stem:** The drug occurs as long, cylindrical, glabrous, soft wooded pieces which show characteristic nodal swelling. The fresh stems are greenish with a smooth surface but the older stems have a warty surface due to the presence of circular lenticels. Fracture is fibrous, taste bitter and odourless.

b. **Leaves:** Simple, alternate, ex-stipulate, fairly long petiolate and are articulated to short tumid nodal projections on the stem, petiole slender, rounded, basal part pulvinate for a short length and this thickened portion is slightly twisted. Lamina broadly ovate to roundish cordate, thin, entire, glabrous on both surfaces, tip acute or shortly acuminate and base with a broad sinus and five to seven –nerved.

c. **Inflorescence:** The plants are dioecious, male and female developing on separate plants. Racemose, simple or panicled. Staminate inflorescences are usually dropping, longer than the leaves and bear the flowers in fascicles of two to six. The pistillate inflorescence is often shorter with flowers borne singly but densely packed on the rachis.

d. **Flower:** Small, numerous, very early deciduous, greenish-yellow with short slender pedicels. Bract lanceolate, subulate, the lower ones occasionally somewhat leafy.

e. **Sepals:** Six , free, deciduous in two series of which the outer are small, ovate, oblong, acute and the inner three larger and membraneous.

f. **Petals:** Six, in one whorl free, smaller than the sepals being about half the length of the calyx. In staminate flowers each petal loosely embraces or encloses a stamen and its limb finally gets reflexed. In pistillate flowers, petals are cuneate, oblong with the limb entire and not getting reflexed.

g. **Staminate flowers:** Stamens six, filaments free, spreading, slightly longer than and wrapped in petals, anther cells oblong.

h. **Pistillate flower:** Have six clavate staminodes in addition to the gynoecium. Gynoecium superior of three free carpels. Styles very short, simple, stigma dilated and forked.

i. **Fruit:** An aggregate of one to three sessile drupelets. Seed, solitary in each drupelets.

Aerial root:
In commerce the aerial roots are usually seen associated with the pieces of stem. The young roots are thread like, whereas the mature ones resemble the young stem except for the presence of nodal swellings. The surface is light grey, fracture short, taste bitter, odourless.

3.5 *Ricinus Communis*

3.5.1 Botanical origin : *Ricinus communis*

3.5.2 Family : Euphorbiaceae

3.5.3 Sanskrit synonyms:
Erandah, Rubukah, Urubukah,Tribijah,Gandharva hasta.

3.5.4 Regional names:

Assamese	:	Eri
Bengali	:	Bherenda
Gujarati	:	Diveligo,Diveli
Hindi	:	Arand, Arend, Erend, Rendi
Rajasthani	:	Edia, Arend
English	:	Castor oil plant
Trade name	:	Castor oil plant

3.5.5 Parts used:
Root, Root bark, leaves and flower, fruit.

3.5.6 Botanical description
It is a tall glabrous glaucous branched shrub of almost a small tree, 2-4 m high, the stem and branches green when young but turning grey and getting covered with thin greyish brown bark, when mature (Fig. 5.7). A similar plant *Jatropha curcas* also has great medicinal potential.

3.5.7 Distribution:
Ricinus communis is believed to be a native of tropical Africa. Its occurrence in the scrubby jungles of the outer Himalayas in what would appear to be a truly wild state, together with the undoubted antiquity of the knowledge of its use as a drug, as revealed by Sanskrit literature are held to point to its being a native of India as well as of Africa. It is said to be under cultivation from ancient times in both these areas.
It is indigenous to India and Africa but is diffused now over all tropical and sub-tropical countries. In India, the plant is found throughout the hotter parts of the country, cultivated in the fields and gardens, also frequently found wild near habitations, roadsides and on waste lands.

3.5.8 Macroscopical characters:

a. **Root:** The tap root gives off profuse branches. Branches are straight, tortuous at the end greyish brown in colour and become lighter on drying. Dry root breaks with a granular fracture. Entire root surface bears longitudinal corrugations which unite at their ends. The corrugations are long and appear running parallel in the case of young roots but are quite separate and convergant on old roots. Well-developed lenticels occur irregularly on old roots. They are globular on younger parts geeting elongated on older regions. Secondary thickening results in the formation of annual growth rings. The colour of the cut end is light cream and hence is easily distinguished from the external surface of the root.

b. **Root bark:** The drug occurs generally in thin curved pieces, 4 to 7mm thick, while a few pieces from upper portion of the root are much thicker. Outer surface is light dirty yellowish brown with five longitudinal wrinkles. Scars are present due to the removal of rootlets. At some place the cork exfoliates leaving lighter patches. Inner surface is light yellowish brown and somewhat smooth. Fracture is soft and fracture is slightly fibrous. Odour is not characteristic and taste is slightly astringent.

c. **Fruits and seeds:** The fruit is dry three-celled three-seeded, ovoid and thorny capsules about 3.4 cm long. The seeds are about 8 to 15 mm long, 6 to 9 mm. wide and 4 to 8 mm thick. The testa is hard, glossy and smooth, grey to red brown and marbled with reddish brown or black

spots and strips. They are oval and slightly flattened, the flattened ventral surface being slightly ridged, along the rounded ridge, the rapture extends from the caruncle at the hilar end of the seed to the chalaza at the other extremity. Within the testa is a delicate colourless membrane surrounding the kernel, this membrane is the remains of nucellus. The kernel consists of an abundant oily endosperm having a wide, oval disc shaped central cavity in which lie the two colourless leafy cotyledons of the embryo, the radicle of which pierces the layer of endosperm and points towards the micropyle immediately beneath the caruncle. The seeds have a slight odour and a weakly acrid taste.

3.5.9 Cultivation and collection:

India occupies the second place among castor seed producing countries in the world, being Brazil the leading country. Russia, Thailand, USA and Rumania are some of the other countries which produce sizable quantities of castor seed. Castor is one of the five major oilseed crops cultivated in India and a major part of the production is exported in the form of oil. Though it is grown in almost all states Andhra Pradesh, Gujarat and Mysore are the three major areas which include about 64.12 and 7.5 per cent respectively of the total area under the crop in the country.

The plant is essentially a crop of the tropics and it can withstand dry arid climates as well as also heavy rains and floods. It is generally grown on sandy or clayey deep red loams and on good alluvial loams. It is frequently grown as a mixed crop, the time of sowing is June-July or September-October.

The method of cultivation appears to be almost the same everywhere. The best soil for the cultivation of castor oil plant is red loam. It also grows well on alluvial earths. The land is ploughed in May and in July or August and after the first showers, the seeds are sown. The seeds are first soaked in water and then sown in well and deeply tilled soil, in holes about 15 cm. apart three or four seeds being put in each hole. The plants are finely thinned out so as to leave only the strongest which are spaded about 1.5 to 2 meters apart.

The plants begin to bear when four to six months old and the number of spikes of flowers on each plant is increased by tipping back the main stem. When the capsules begin to turn brown the spikes of fruits are collected and exposed to the sun or concrete floors in layer about 15 cm. deep.

The harvested spikes are stacked in heaps till the capsules blacken and they are then spread out in the sun or dry. Once or twice daily they are turned over with a rake and after three or four days the capsules burst suddenly and the seeds are flung out violently. The husks are removed by winnowing. The average yield of castor seed for all India is about 200-290 kg/ha.

3.5.10 Properties and uses:

The root of *Ricinus communis* and the oil obtained from the seeds have been used in medicine by the Hindus from a very remote period. They are mentioned by Susruta. In Ayurveda, root bark is very much reputed for its anti-inflammatory activity. Root and root bark are used as carminative, alternative in asthma, bronchitis and skin diseases. It is also recommended as a febrifuge, purgative, in eye diseases, jaundice, nervous disease, rheumatic affections such as lumbago, pleurodynia and sciatica. Eranda is sweet, bitter, light and hot. It is purgative, cures dysponea, hydrocele flatulance, piles, cough, lumbago, headache, leprosy, arthritis, calculus and dysuria.

3.5.11 Economic uses:

Castor oil is frequently employed by the Indian dyers as an auxillary in certain dye preparations. The oil is used for lubricating all kinds of machinary, clocks and also considered as the best lamp oil in India. The dried stems and husks after the extraction of the seeds constitute a highly combustible fuel, which is largely used in boiling sugar-cane juice.

a. **Leaves:** Large, alternate, long petiolate, stipulate, peltate, palmately veined, broad,

nearly orbicular 7-10 or more lobed. Lobes membraneous, oblong to linear acute of acuminate, gland serrated. The petioles vary from 4 to 20 cm. in length and 2.5 to 7.5 cm in breadth. A number of saucer shaped glands 1 to 2 mm in diameter are present on the petiole, two prominent glands occur close together at the top of the petiole.

b. **Inflorescence:** Stout, erect, sub-panicled racemes that terminate the main axis and branches. Flowers very large, monoecious. The staminate flowers are usually located in the distal or upper leaf of the inflorescence in a crowded manner and the pistillate at the basal part. Stamens apparently many, anther cells distinct, sub-globose and divergent on the rather large connective. Pistillate flowers large, perianth spathaceous, ovary superior, three chambered with one ovule in each chamber. Styles three, short or long spreading often very large and brightly or lightly coloured, entire, two fid or two partite. Stigmas feathery or papillose.

c. **Fruit:** A globose or globular-oblong, explosively dehiscent three seeded capsule 1.2 to 2 cm. long, septicidally dehiscent or splitting into three two-valved cocci. The fruit when young is green and usually covered with fleshy prickles.

d. **Seeds:** Carunculate, oblong, 1-1.5 cm, long with smooth hard mottled crustaceous testa and oily or fleshy endosperm. Embryo thin with flat broad cotyledons. *Ricinus communis* said to be a very variable species. It has been divided into a number of varieties and forms based on the characteristics of capsule, seed and inflorescence.

3.5.12 Preliminary phytochemical studies

The root powder shows presence of phenolic constituents. Anthraquinone derivatives are absent in the water extract of the root powder. Powder mixed with water, shaken at left to stand for sometimes, yields a mucilaginous substance. This substance is light yellow in colour and turn dark on heating. The powder does not froth when mixed with water indicating the absence of saponins.

3.5.13 Diagnostic characters:

The roots are greyish brown in colour, rough due to the presence of irregular lenticels. Fracture is granular. The root bark occurs in thin curved pieces, outer surface dirty yellowish brown with fine longitudinal wrinkles. Taste is slightly astringent. The root comprises of periderm, cortex and stele. Highly branched latex canals are present in the cortex. Xylem is pentarch. Root bark shows lignified cork cells, groups of fibres in the phelloderm and cork and a broad zone of phloem. Resin and tannin are present in the cortex and phloem.

3.5.14 Chemistry:

Castor seeds contain about 50% of the fixed oil and about 26% of proteins. The cake leaf after the expression of the oil contains about 0.2% of ricinine, a crystalline principle (m.p. 201.5°) ricin, a toxin similar in nature to the bacterial toxins, a very active lipase, and other enzymes.
Castor oil consists of the glycerides of ricinolecis, isoricinoleic, stearic and dihydroxy- stearic acids. Root bark shows the presence of steroid having m.p. 159°. It also contains considerable amount of gallotannins along with many inorganic ions. Ricinine is a water soluble alkaloid present in the seed coat, leaves and stems.

4. Conclusion

Rajasthan is rich in vegetation and pharmcognostical studies provide valuable insight into identification and characterization of some of the plants of semi-arid and arid regions.

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