Therapeutic Properties and Nutritive Values of Some Fruit Bearing Medicinal Plants of Rajasthan State in India

Gupta GK¹, Tejas Joshi¹, Keshu Madhudiya¹, Arijit Chaudhuri²*

Department of Agriculture, Madhav University, Sirohi- 307 026, Rajasthan, India
Department of Pharmacy, Manav Bharti University, Solan-173229, Himachal Pradesh, India

Article Information
Received 10 August 2017
Received in revised form 16 Oct 2017
Accepted 18 Oct 2017

Keywords: Medicinal Plant, Rajasthan, Therapeutic Properties, Nutritive

Corresponding Author:
E-mail : armanchaudhuri92@gmail.com
Mob.: +919459481842

Abstract
The medicinal plants impart a chief role in protecting our health from various diseases. It is nature’s gift to human beings to live healthy life. Medicinal plants are believed to be much safer and proved as elixir in the treatment of various ailments. Medicinal plants used in Indian system of medicine from Rajasthan state have been surveyed and categorized systematically. The manuscript incorporated the therapeutic properties and nutritive values of medicinal plants of Rajasthan. The paper deals with 11 medicinal plants, thoroughly indexed along with their important traditional application for the cure of various ailments. This study also incorporates the ethno-botany and biological activities of these important plants.

1 Introduction
Folk medicines today play a key role in the developing countries due to a lack of or limited modern health service. From ancient times, plants have been a rich source of effective and safe medicines. Due to their safe, effective and inexpensive nature, indigenous remedies are popular among the people of both urban and rural areas in China and India. Information from ethnic groups about indigenous traditional medicines has played a vital role in the discovery of novel products from plants for use as chemotherapeutic agents. Herbal medicines have been the main source of primary health care in many nations. About 80% of the world’s populations are still dependent on traditional medicines¹².

Traditions are dynamic entities of unchanging knowledge. Traditional medicine is in an evolutionary process as communities and individuals continue to discover new techniques that can transform practices. Ethnopharmacology and drug discovery using natural products remain important issues in the current target-rich, lead-poor scenario. Many modern drugs have their origin in ethnopharmacology. However, despite technologic advances, the drug discovery process is facing a major innovation deficit that is adversely affecting the pharmaceutic industry¹⁴. Rajasthan is the largest state in the Northeastern part of India, geographically it lies between 23º3' to 30º12'N longitude and 69º30' to 78º17'S latitude and is rich in diversity of medicinal plants¹. Medicinal uses of different plants have been recorded in numerous literatures standing from the age of Vedas. In Rajasthan also a lot of work has been done on ethnomedicinal plants used for various ailments by different tribal communities and researchers. The present paper represents the data of the therapeutic properties and nutritive values of fruit-bearing medicinal plants occurring in the Rajasthan state which may be used in future as plant resources for modern system of medicine.

2 Therapeutic properties and nutritive values of medicinal plants of Rajasthan

*Balanites aegyptiaca

*Balanites aegyptiaca is a member of Zygophyllaceae family, is also known as ‘Desert date’ in English, one of the most common but neglected wild plant species of the dry land areas of Africa and South Asia⁷. It is a slow growing, small, not very spreading, multibranched, evergreen, spiny and medium size tree up to 10 m tall, or shrub⁸. This tree is native to Africa and parts of the Middle East. In India, it is particularly found in Rajasthan, Gujarat, Madhya Pradesh, and Deccan⁹. It can be found in...
many kinds of habitat, tolerating a wide variety of soil types, from sand to heavy clay, and climatic moisture levels. This plant has been reported to have anemophilic, insecticidal, antidiabetic, antimicrobial, antibacterial, antifungal, hepatoprotective, anticancerous, antiparasitic, anti-inflammatory, molluscicidal and antioxidant properties\textsuperscript{15-12}.

*Balanites aegyptiaca* is traditionally used in treatment of various ailments i.e. jaundice, intestinal worm infection, wounds, malaria, syphilis, epilepsy, dysentery, constipation, diarrhea, hemorrhoid, stomach aches, skin boils, leucoderma, malaria, wounds, colds, syphilis, liver and spleen disorders, asthma, snake bite\textsuperscript{13} and fever. The bark of the plant is useful in curing mental diseases, yellow fever, jaundice and syphilis and can also act as a fumigant to heal circumcision wounds. Fruit kernel has been found as a mild laxative, an antidote to arrow poison, and also acts as a vermifuge. Kernel oil helps in curing skin disease. The seeds are useful as ointments, to cure cough, colic pain and also have magicoreligious properties\textsuperscript{14,15}.

*Balanites aegyptiaca* contains saponin, furanocoumarin, and flavonoid namely quercetin 3-glucoside, quercetin-3-rutinoside; 3-glucoside, 3-rutinoside, 7, 8-diglucoside and 3-rhamnoglactoside of isorhamnetin\textsuperscript{16}. Fruit contains protein, sugars, organic acids, other constituents like 3-rutinoside and 3-rhamnoglactoside, Diosgenin. kernel contains a xylopyranosyl derivative of above saponin present in mesocarp. Balanitoside (furostanol glycoside) and 6-methyldiosgenin, balanitin-3 (spirostanol glycoside) have been reported from fruits (mesocarp) of *B. aegyptiaca*. The kernels also contained oil and protein, oil contains mainly palmitic, stearic, oleic, and linoleic acids which were the main fatty acids. The leaves and fruit kernels of *B. aegyptiaca* L. were found to contain six diosgenin glucosides including di-, tri, and tetraglucosides\textsuperscript{16, 17}.

Roots is reported to contain steroidal saponin about 1% glucosides and major sapogenin is yamogenin other glycosides. Bark is reported to contain furanocoumarin bergapten and dihydrofuranocumarin D- marmesin, two alkaloid namely, N-trans-feruloyltyramine and N-cis-feruloyltyramine, and three common metabolites, vanillic acid, syringic acid; and 3-hydroxy-1-(4-hydroxy-3-methoxyphenyl)-1-propanone\textsuperscript{18, 19}.

*Calligonum polygonoides*

*Calligonum polygonoides* is a member of family Polygonaceae. It is a small leafless shrub, which has a reputation in folklore medicine as a stimulant and astringent\textsuperscript{20}. *Calligonum polygonoides* is locally known as Phog, Phogala or Phogaro\textsuperscript{21}. Usually it is seen as a small glabrous, winter shedding, perennial shrub 3-4 feet high with whitish and fragile branches. Sometimes a small tree with 12-15 feet in height and a trunk with 2-3 feet in girth\textsuperscript{22}. It is found from arid and semi-arid areas of Thar desert in India. It grows on sand dunes as a psammophytic vegetation of Barmer, Bikaner, Churu, Jaisalmer, Jhunjhunu, Nagaur, Sikar and Shri Ganganagar.

Leaves and stems are chewed to wash teeth and to treat gummosis while young shoots infusion is used as tonic\textsuperscript{23}. Paste of Root is applied on the affected areas for the treatment of Prickly heat and scabies. Decoction is used for the treatment of sore gums, typhoid. Flowers buds are effective in sun stroke. Flowers are also used for the treatment of asthma, eczema, cough and cold. It is reported that juice of the plant is applied in eyes to remove poisonous effect of *Calotropsis procera*\textsuperscript{24}.

*Calligonum polygonoides* possesses hypoglycemic, cytotoxic, antioxidant, antimicrobial, anti-cancer, antiulcer, anti-inflammatory, antifungal, and mosquitocidal activities\textsuperscript{25-27}.

Findings show that flavonoids, alkaloids, tannins, steroids, phenols, carbohydrates and terpenoids are present in different parts of *C. polygonoides*\textsuperscript{28}. Chemical analysis of *Calligonum polygonoides* revealed the presence of catechin, dehydroadicatechin A, kaempferol-3-O-rhamnopyranoside, quercitin, β-sitosterol-3-O-glucoside, isoquercitrin, kaempferol-3-O-glucuronide, and mequilianin. Campesterol, stigmasterol, (3 β, 5 α, 24 S)-stigmastan-3-ol, and stigmast-4-en-3-one were isolated from the roots of the plant, whereas β-sitosterol, kaempferol, quercitin, taxifolin, gallic acid, and astragalin were isolated from leaves\textsuperscript{29, 30}.

*Citrullus colocynthis*

*Citrullus colocynthis* is perennial herbs usually trailing belongs to family Cucurbitaceae, commonly known as Chitrapala or Bitter apple. It is found wild in the sandy lands of North West, the Punjab, Sind, and Central and southern India, and coromandal coast. Also found indigenous in Arabia, West Asia, and Tropical Africa and in the Mediterranean region. *Citrullus colocynthis* is tender climbing monoeconomous plant with 2-3 tendrils. Leaves are deeply 3-5 lobate and both, the male & female flowers are yellow. Fruits are globular, variegated, dark green with yellowish blotches. When ripe, it is filled with a dry spongy very bitter pulp\textsuperscript{31, 32}.

*Citrullus colocynthis* shows mild stomachic, bitter tonic, anthelminthic, anti-cancer, antioxidant, antimicrobial, antidiabetic, analgesic, antipyretic, anti-inflammatory, carminative, diuretic and anthelmintic property\textsuperscript{33, 34}.

*Citrullus colocynthis* is used generally in the cure of various diseases such as leprosy, gut disorders, diabetes, constipation, asthma, indigestion, colic, rheumatism, hypertension, gastroenteritis, dysentery, bronchitis, jaundice, joint pain, cancer and mastitis\textsuperscript{35, 36}.

*Citrullus colocynthis* contain various bioactive compounds such as alkaloids, flavonoids, carbohydrates, glycosides, fatty acids and essential oils. Cucurbitacin (Cucurbitane type triterpen glycoside viz colocolysonside A & B) have been documented as
the major constituent of Citrullus colocynthis fruits\textsuperscript{37}. Seeds contain Fatty acid like Stearic, Myristic, Palmitic, oleic, Linoleic, Linolenic acid, Protein 8.25 \% and rich content rich in lysine, leucin and sulfo amino acid like methionine, Vitamin B1, B2 and Niacin, Mineral like Ca, Mg, K, Mn, Fe, P and Zn. Aerial part and fruit contain flavonoid glycoside quercetin, Flavone- 3-glucoside viz iso-vitexin, iso-orenentine and isorenentine -3-methyl ether\textsuperscript{38}.

**Commiphora wightii**

Guggulu consists of oleo-gum resin obtained as an exudate from the tapping of stem and branches of **Commiphora wightii** (Arnott) Bhandari; Family, Burseraceae. The plant is commonly known as guggal, gugar, and Indian bdellium tree and is found in arid areas of India, Bangladesh, and Pakistan. In India, it is found in Rajasthan, Gujarat, Assam, Madhya Pradesh, and Karnataka. It is a small, bushy tree with thorny branches and produces a yellowish gum resin (guggulu) in small ducts located throughout its bark. The trees are tapped by making an incision on the bark. The resin, which flows out, is allowed to harden before it is collected. The tree is tapped from November to January and the resin is collected throughout its bark. The preliminary phytochemical screening carried out on **Cordia myxa** fruit extract revealed the presence of oil, glycosides, flavonoids, sterols, saponins, terpenoids, alkaloids, phenolic acids, coumarins, tannins, resins, gums and mucilage. The seeds of **Cordia myxa** was consisted of palmitic acid, stearic acid, oleic acid and linolenic acid. The flavonoids and phenolic derivative content of the five species of genus Cordia leaves (C. francisci, C. martينicensis, C. myxa, C. serratifolia and C. ulmifolia). Four flavonoid glycosides, robinin, rutin, datiscoside and hesperidin, one flavonoid aglycone, dihydrorobinetin, two phenolic derivatives, chlorogenic and caffeic acid\textsuperscript{49}.

**Gymnema Sylvestre**

**Gymnema sylvestre** belongs to family Asclepiadaceae, is also known as ‘gurmar’ or ‘sugar destroyer’ (If the leaves of the plant are chewed, the sense of taste for sweet and bitter substances is suppressed)\textsuperscript{50}. It is a woody, climbing traditional medicinal herb which has many therapeutic applications in Ayurvedic system of medicine. **Gymnema sylvestre** is a slow growing, perennial, medicinal woody climber found in southern part of China, Tropical Africa, Vietnam, Malaysia, and Srilanka and is widely available in Japan, Germany, USA, central and peninsular India (mostly in Rajasthan, Bihar, West Bengal)\textsuperscript{51}. The bioactive compounds of plant have antidiabetic, atherosclerotic, antimicrobial, antiarthritic, antioxidant, hypolipidaemic, immunostimulatory, hepatoprotective, anti-hyperglycemic, antipyretic, diuretic, anti-inflammatory, wound healing and anticancer properties\textsuperscript{52,54}.

**Gymnema sylvestre** is a traditional medicinal plant, with reported use as a remedy for diabetes mellitus, stomachic and diuretic problems. Its use has been indicated in adenopathy, cough\textsuperscript{50}, asthma, alexipharmic, anthelmintic, astringent, biliousness, bronchosis, cardiopathy, conjunctivosis, cornea,
dysuria, digestive, emetic, expectorant, fever, furunculosis, glycosuria, hemorrhoid, hepatospplenomegaly, inflammation, jaundice, leukoderma, rheumatismopacities, ophthalmia, and worm. The roots of Gymnema sylvestre have also been used in snake bite, boil, constipation, and water retention, epilepsy, pain, high cholesterol, IDDM, NIDDM and obesity.

The plant is a good source of a large number of bioactive substances. Its constituents include two resins, gymnemic acids, saponins, stigmasterol, querctol; the amino acid derivative of betaine, choline and trim ethylamine and Gymnemagenin and gymnemogenin. Gymnemic acids, a group of triterpenoid saponins belonging to oleanane and dammarene classes. Oleanane saponins are gymnemic acids and gymenmasaponins, while dammamrene saponins are gymnemasides. Gymnemic acids I-VI and gymnemic acids XV-XVIII were also isolated. Gymnemic acids VIII-XII have been elucidated as glucosideuronic acid derivatives of gymnemagenin.

Jatropha curcas

Jatropha curcas a multipurpose, shrub or tree, drought resistant, perennial plant belongs to family ‘Euphorbiaceae’, is widely distributed in the wild or semicultivated areas in Central and South America, Africa, India and South East Asia. Jatropha grows almost anywhere except waterlogged lands, even on gravelly, sandy and saline soils. The tree has a straight trunk and grey or reddish bark, masked by large white patches. Various parts of the plant are of medicinal value, its bark contains tannin, the flowers attract bees and thus the plant has a honey production potential. Its wood and fruit can be used for numerous purposes including fuel. It is easy to establish and grows relatively quickly.

The bioactive compounds of Jatropha curcas have antioxidant, anti-diabetic, atherosclerotic, antimicrobial, antiarthritic, antibiotic, hypolipidaemic, immunostimulatory, hepatoprotective, anti-hyperglycemic, antipyretic, antifungal, diuretic, anti-inflammatory, wound healing, Nickel toxicity, and anticancer properties.

It is traditionally used in arthritis, gout, jaundice & as contraceptives, fish poison, toothache, gum inflammation, gum bleeding, pyorrhea, dermatomusosal diseases, allergies, burns, cuts and wounds, inflammation, leprosy, leucoderma, scabies and small pox, HIV, tumor and wound healing.

Jatropha curcas have shown the presence of various bioactive constituents such as Amyrin, sitosterol, taraxerol, cyclic triterpenes (stigmasterol, stigmast-5-en-3, 7 diol, stigmast-5-en-3, 7, 3, 7 diol, cholest-5-en-3, 7, 3, 7 diol, campesterol, sitosterol, 7-keto- sitosterol as well as the d-glucoside of sitosterol), Flavonoids (apigenin, vitexin, isovitexin). Leaves contain the dimer of a triterpene alcohol and two flavonoidal glycosides. Latex contain curcacycline A, a cyclic octapeptide curcain. Seeds contain curcin, a lectin Phorbolesters Esterases and Lipase, saponins and a trypsin inhibitor. Roots contain sitosterol and its d-glucoside, marmesin, propacin, the curculathyranes A and B and the curcursones A–D, diterpenoids jatrohol and jatroholone A and B, the coumarin tomentin, the coumarinolignan jatrophin as well as taraxerol.

Leptadenia pyrotechnica

Leptadania pyrotechnica is a typical desert plant belongs to the Asclepiadaceae family, commonly known as Khimp, Kheep or Khip. It is leafless, erect, ascending, shrub up to 0.5 meter to 2.6 meter high with green stem and pale green alternating bushy branches with watery sap erect and evergreen shrub. Leptadenia pyrotechnica occurs throughout the state of Rajasthan and found in dry habitats particularly in desert zones. In India it is commonly found in Punjab, Banswara, Palod, Dungarpur, Kota and Western Uttar Pradesh. It is native to Mediterranean regions, semi-arid deserts of African and Asian countries.

Leptadenia pyrotechnica possess significant antioxidant, anti-inflammatory, antibacterial, anthelmintic, antilipooxygenase, cytotoxic, antifungal, anticancer, wound healing, anti diabetic, hepatoprotective, antitumour, hypolipidemic and anti atherosclerotic activity. The fiber of Leptadenia pyrotechnica is used as antihistaminic and expectorant.

It is traditionally used in fever, cough, kidney disorders, stones, urinary disease. Fresh juice of the plant is used for abortion. Plant sap is applied to eczema and other skin diseases and is also given in diabetes. The latex or the leaf paste is applied over the thorn injury for thorn removal. Whole plant infusion is mixed with buttermilk and given for uterine prolapsed and stomach disorders in sanska region of Rajasthan. It is used to cure constipation and is considered good for health in Bikaner region of Rajasthan.

Leptadenia pyrotechnica have shown the presence of bioactive constituents such as steroidal glycoside, cardiac glycosides, cardenolides, alkaloids, flavonoids, triterpenes tannins, saponins and polyoxypregnane derivatives.

Salvadora oleoides

Salvadora oleoides is a small, multipurpose tree commonly known as jhal, badaplu, pilu, vridhplu and khakon, belongs to family Salvadoreaceae. The tree is primarily sourced for its fruits known as desert grapes. This species is decreasing very rapidly due to over exploitation, indiscriminate collection, low rate of seed set, poor viability and inefficiency of propagation by vegetative means. Salvadora oleoides grows on dry, saline and desert areas of Rajasthan, Haryana, Andhra Pradesh, West Bengal, Karnataka, Tamil Nadu, Punjab, Gujarat, and Madhya Pradesh. The tree species is known to tolerate a very dry environment with mean rainfall of less than 200 mm in Barmer,
Jalore, Jodhpur and Pali districts of Rajasthan. It grows well in the sand dunes of deserts to heavy soils, non-saline to highly saline soils and dry regions to marshy semi-arid and waterlogged areas.\textsuperscript{73,74}

\textit{Salvadora oleoides} possesses anti-oxidant, anti-inflammatory, analgesic, anti-ulcer, anthelmintic, diuretic, hypoglycemic, hypolipidemic, antimicrobial, larvicidal, cytotoxicity activities.

The leaves were used as a cooling agent, blood purifier, low fever, laxative, piles, chest disease, relief of abdominal pain, expectorant;. Leaf juice can also be used for anemic patients. Fruits are sweet with cooling effect and employed in the treatment of rheumatism, low fever, piles, tumor, bronchitis, child birth and snake bites.\textsuperscript{75} Seed oil is widely used in commercial production of cosmetics, paints, varnish, lubricants and as an ointment base for the treatments of rheumatism (Goodman, 1992). The whole plant is used as cooling herb, wound healing herb and nerve tonic, in the treatment of various uterine and skin disorders by the local people of Kachchh region.\textsuperscript{76}

Various qualitative chemical tests revealed the presence of carbohydrates, alkaloids, steroids, glycosides, saponins, tannins, triterpenes, mucilage, fats and oils in the leaf and stem extracts.\textsuperscript{77} Fruits contain glucose, fructose, sucrose and are eaten in other forms, such as dried, candied, pickled, as aromatics. The fruit’s skin is smooth, glossy, thin but tight. Fruits are rich in vitamin C, 20% sugar, up to 2.5% protein and 12.8% carbohydrates.\textsuperscript{78}

\textit{Ziziphus mauritiana} having tremendous medicinal properties, attributed by a diverse group of secondary metabolites such as alkaloids, flavonoids, terpenoids, saponin, pectin, triterpenoic acids and lipids.

It is a rich source of cyclopeptide alkaloids lupane and triterpenes. It have 14-membered ring cyclopeptides to be the largest subgroup of alkaloid obtained, whereas only one 13-membered macrocyclic alkaloid isolated from this plant. It also contain protein ,carotene and vitamin C. Ripe fruits contains 20 to 30% sugar, up to 2.5% protein and 12.8% carbohydrates.\textsuperscript{80}

3 Conclusion

In Rajasthan, several plants were used for maintaining the health and treatment of several ailments. These plants possess anticancer, nephroprotective, hepatoprotective, antimicrobial, antioxidant, anti-diabetic, radio-protective, anti-HIV, anti-hepatoprotective, contraceptive etc. The medicinal plants displayed in this article required immediate steps to be taken for their conservation and sustainable utilization. Thus, there is a great need for manufacturing newer herbal drugs from these medicinal plants.

4 Conflict of interests

The authors have no current conflict of interests in this work.

5 Author’s contributions

GKG, TJ, KM and AC carried out literature review and draft the manuscript. All authors read and approved the final manuscript.

6 References


43. USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network- (GRIN). National Germplasm Resources Laboratory, Beltsville, Maryland. 2015.


54. Thakur G, Sharma R, Sanodiya BS, Pandey M, Prasad GBKS, Bisen PS. Gymnema sylvestre: An Alternative Therapeutic Agent for Management of


78. Mahmood T, Ahmed E and Malik A. Structure determination of Salvadorin, a novel dimeric


