



Journal of Medicinal Plants Studies

Ethnobotanical studies of *Citrullus colocynthis* (Linn.) Schrad. An important threatened medicinal herb

Mahesh Chand Meena, Rishi Kesh Meena and Vidya Patni

1. Lecturer in Botany, Rajesh Pilot Govt. PG College, Lalsot (Dausa) Rajasthan
[E-mail: meenamc@rediffmail.com; Tel: 09413090517]
2. Associate Professor, University of Rajasthan, Jaipur (Raj.)
[E-mail: patni-vidya@uniraj.ernet.in; Tel: +91-982905989]
3. Assistant Professor, University of Rajasthan, Jaipur (Raj.)
[E-mail: rishi_1180@yahoo.com; Tel: +91-9828175740]

Ethnobotanical survey based on utilization of plants by the tribals has gained much importance in the recent past all over the world. In India, lot of work has been done, both at national and regional levels. Rajasthan, the largest state of the country is rich in floristic as well as ethnic diversity, which makes it the ideal place to work on 'Ethnobotany'. In the present study *Citrullus colocynthis* is a very important medicinal plant which is used by various tribes for treatment of many diseases. Seventeen recipes are based on root, twelve on fruits, five on seeds, two on whole plant, three on leaf and in two recipes both roots and fruits are used.

Keyword: Ethnobotany, Medicinal Plant, *Citrullus colocynthis*, tribes.

1. Introduction

Medicinal plants have traditionally occupied an important position in the socio-cultural and spiritual arena of rural and tribal lives. Medicinal plants are potential renewable natural resources. It has been estimated that around 8000 species, accounting for around 50 percent flowering plant species of India are used for production of different medicines. There are about 25,000 effective plant based formulations used in folk medicine in rural communities all over India and about 10,000 designed formulations are available in medicinal texts. All medicinal preparations were designed from plants either in the simple form or the most complex form of crude extracts mixtures. A large proportion of the active ingredients and chemical compounds of particular medicinal plants, i.e. drugs has been discovered with the aid of the ethnobotanical knowledge and traditional uses of the plants. The source of the ethnobotanical knowledge is generally creditable

for the product inventors and the financial rewards to the pharmaceutical company. Increasing number of plants, routinely and commonly used in India for medicinal purpose, are being patented. India is currently considering the laws on the Plant Varieties and Farmer's Rights Bill (PVFRB) and Biological Diversity Act (BDA) [1].

Medicinal plants provide an efficient local aid for disease free life. The importance of ethnomedicine has been realized by various sections of the society and the need to use herbal medicines in health care programmes is being stressed upon [2]. Traditional ethnomedicinal studies have in recent years, received much attention due to their wide local acceptability and clues for new or lesser-known medicinal plants [3].

Since pre-historic times man has used plants to cure bodily disorders and hereby kept his health in perfect state of fitness and lived a long life.

Due to after-effects of synthetic drugs, people are increasingly becoming inclined towards the traditional medicines. Ethnobotanical explorations play a vital role in bringing to light information about such plant species of our rich flora that can be sources of safer and cheaper potent drugs for the benefit of mankind. In a country like India, according to recent estimates, 70 percent of inhabitants still rely on herbs. Our Nation witnesses 2,500 species of plants from about 1000 genera which are used by traditional healers [4].

India has great phytogeographical and ethnic diversity. There are over 400 different tribes and other ethnic groups in India. The tribals constitute about 7.5 percent of India's population. The Indian region, therefore, is very rich in ethnobotanical heritage. The Indian tribes are unique, quite knowledgeable about the availability of a wide diversity of plants and animals present in their local environment. They fully depend on the plant resources which provide them healthy and diverse food, fodder, fuel, fibre, shelter and medicine. They have their own prescriptions to cure/alleviate various diseases and ailments. The knowledge and use of plants is an integrated aspect of many ethnic rural communities in India.

Rajasthan is the largest state of India occupying an area of 3,42,274 square kilometers. It covers nearly 11 percent of the area of India lying between 23⁰³ and 30⁰² North latitudes and 69⁰³ and 78⁰⁷ East longitudes. In shape it is almost rhomboidal. It is surrounded by Pakistan in the

West and the States of Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Gujarat in the north, east and south. The presence of the Great Indian Thar desert portion makes Rajasthan a unique state of India.

The state of Rajasthan is inhabited by several tribes namely, Bhil, Bhil-Meena, Damor, Dhanaka, Garasia, Kathodia, Koli, Mina, Nayaka, Patelia and Sahariya. Besides these, there are some nomadic, semi-nomadic tribes and denotified communities also. Nomadic tribes are Banjara, Gadia-Lohar and Kalbelia, whereas semi-nomadic tribes are Rebari, Jogi and Manasi. Among denotified communities, Bori, Kanjer, Sansi, Bagri, Jat and Bhat are included. From the population density view, Meena, Bhil, Damor, Garasia and Sahariya are significant.

In Rajasthan, the first person to record the wild plants which are used as famine food and vegetable products used as food in the desert zones of the state [5]. The plants used in magico-religious beliefs, in rites and rituals including those in diseases, divination and worship by different tribal societies of National and International have been discussed by many scientists [6, 7, 8, 9].

Ethnobotanical studies of *Citrullus colocynthis* has been carried out by many workers as given in Table 1. However, much information on the use of 'Tumba' as traditional medicines has not been documented from many rural areas of Karauli Dausa and Jaipur districts.

Table 1: Medicinal uses of different parts of *Citrullus colocynthis*

| Plant part | How to use | Use |
|-----------------------|--|--|
| Seed | Seed oil | Bowel complaints [10] |
| Seed | Seed oil | Epilepsy [11] |
| Fruits | Small fruits are collected during rainy season, stuffed with salt and ajwain | Acute stomach ache [12] |
| Seeds | (a) Seed oil (b) Seed powder | Cooking purpose Soup thickener and flavouring agent [13] |
| Fruit | Extract of pulp | Anti-bacterial [14] |
| (a) Fruit (b) Root | (a) Juice of fruit mixed with sugar (b) A poultice of root | (a) Dropsy (b) Inflammation of the breasts [15] |
| (a) Root (b) Seed | (a) Powder of roots mixed with ginger and jaggery (b) Oil from seeds | (a) Inflammation of joints. (b) Useful in hair growth and maintaining them black [16] |

Continue Table no. 1

| | | |
|--|---|--|
| (a) Fruit and root (b) Root (c) Root | (a) Fruit and root paste with water. (b) Equal parts of the root with long pepper are given as pill. (c) A paste of root applied to the enlarged abdomen of children. | (a) Boils and pimples (b) Rheumatism (c) Enlarged abdomen ^[17] |
| Fruit | Juice of the fresh fruit is made. Cotton dipped in juice is placed over the mouth of uterus. | Timely and easy delivery ^[18] |
| Fruit | Decoction is drunk | Hepatitis ^[19] |
| (a) Root (b) Fruit and root | (a) Root paste (b) Fruit and root-antidote | (a) Ascites, jaundice, urinary disease and rheumatism. (b) Snake poison ^[20] |
| Fruits | Fruits in low doses | Urticaria, constipation and toxemia ^[21] |
| Seed | Seed oil apply on hair | Blackness grey hair ^[22] |
| Seed | Pulp of seeds | Malaria ^[23] |
| Fruit | Fruit pulp dried and powdered and taken orally | Cause abortion ^[24] |
| Fruit and seed | Jam prepared from pulp of fruits and seeds | Effective in curing biliousness in animals ^[25] |
| Root | Root base mixed with cow milk is applied on hypogastrum | Easy delivery ^[26] |
| Whole plant | Glycosidic extract (50 mg/kg) | Lowering glucose level ^[27] |

2. Methodology

Rajasthan is the largest state of India occupying an area of 3,42,274 square kilometers. It covers nearly 11 percent of the area of India lying between 23⁰³ and 30⁰² North latitudes and 69⁰³ and 78⁰⁷ East longitudes. In shape it is almost rhomboidal. It is surrounded by Pakistan in the West and the States of Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Gujarat in the north, east and south. The presence of the Great Indian Thar desert portion makes Rajasthan a unique state of India.

The state of Rajasthan is inhabited by several tribes namely, Bhil, Bhil-Meena, Damor, Dhanaka, Garasia, Kathodia, Koli, Mina, Nayaka, Patelia and Sahariya. Besides these, there are some nomadic, semi-nomadic tribes and denotified communities also. Nomadic tribes are Banjara, Gadia-Lohar and Kalbelia, whereas semi-nomadic tribes are Rebari, Jogi and Manasi. Among denotified communities, Bori, Kanjer, Sansi, Bagri, Jat and Bhat are included. From the

population density view, Meena, Bhil, Damor, Garasia and Sahariya are significant. Ethno botanical data will be collected according to the methodology suggested by scientist ^[28]. The ethno botanical data were collected using questionnaire, interviews and discussions in their local tribal people.

Present study was conducted in selected rural areas of Karauli district (26.3° and 26.49° North Latitude and 76.35° and 77.26° East Longitude), Dausa district (26.55° North Latitude and 76.21° East Longitude) and Jaipur district (26.55° North Latitude and 75.52° East Longitude). Karauli, Dausa and Jaipur occupy an area of about 5,530 Km², 3404.78 Km² and 11,117.8 Km² respectively. These districts are well known for huge diurnal and seasonal temperature variations from 2-5 °C in winter to 40-45 °C in summers. The sandy soil and bright sunlight are the two important natural resources abundantly available in this region which are responsible for the development of the desert vegetation having

variable medicinal properties. In order to document the traditional uses of *Citrullus colocynthis* survey was carried out during the year 2012-13 in the rural areas of Karauli, Dausa and Jaipur district. The information on medicinal uses of the plant has been described after gathering information from local people, experienced aged rural folk, traditional herbal medicine practitioners, local herbal drug sellers and by consulting literature. In the rural areas of Karauli, Dausa and Jaipur district a total of 400 inhabitants were interviewed. Informants were requested to furnish information on (a) disease treated by the plant species (b) symptoms of the disease (c) whether whole plant is used or some part of it (d) ingredients of a compound recipe (e) preparation of medicine (f) mode of administration (g) duration of treatment and (h) food restriction, if any. The plant collected during the survey was identified and deposited in the Herbarium, Department of Botany, University of Rajasthan, Jaipur, India.

3. Results

An extensive ethnobotanical survey of the rural areas of Karauli, Dausa and Jaipur districts provided first hand information on traditional uses of 'Tumba'. According to survey the plant was used for curing or alleviating a total of 39 different diseases and ill conditions ranging from simple stomach ache to highly complicated female urinogenital disorders. The study has brought to light some 40 folk recipes, used currently by the traditional healers of various cultures in Karauli, Dausa and Jaipur districts of Rajasthan for curing and alleviating different disease conditions by *Citrullus colocynthis*. In most of the cases roots were used followed by fruits, seeds, whole plant and leaves.

During the survey it was observed that the rural population was entirely dependent on herbal medicines for their primary health care and the Vaidyas/Pujaris/Medicine Men/Old women who knew and practiced herbal therapies generally went to the rescue of the villagers when they are in need. Especially in the fringe areas, where

there was no communication facility, the people had access only to their age-old medication.

The tribes believe in superstition and supernatural elements and they attribute the bodily disorders to them. The different ailments of the body are treated using herbal medicines and magico-religious and tentric practices to cure the ailments. The useful methods of applications are as decoction, paste and powder. These are administered orally or applied externally. Most of the recipes include only one plant part however, many preparations are the combination of several herbs.

The information on the diseases cured by the plant, plant parts used, preparation of medicine, mode of administration, dose and duration of treatment are as follows.

- 1. Abdominal pain:** Equal quantities of fresh "Colocynth" roots and black pepper (*Piper nigrum* L., Family-Piperaceae) are ground with a little water to make a fine paste. One g paste is given three times a day for three days.
- 2. Amenorrhoea:** Fresh "Colocynth" roots boiled in cow's milk in the ratio of 1:8. Five ml milk is administered orally twice a day for forty-one days.
- 3. Boils and Carbuncles:** Fresh root and raw fruits of "Colocynth" are pound to make a paste. This paste is applied externally twice a day, till the ailment is cured completely.
- 4. Chronic open wounds:** Fresh root paste of "Colocynth", obtained by grinding fresh roots with a little water, is applied to wounds thrice a day till it heals up completely.
- 5. Constipation:** Decoction of fresh fruits of "Colocynth" is prepared in water in ratio of 1:6. Five ml decoction is administered orally at bed time for three days.
- 6. Deafness:** Ripe whole fruits or pericarp of "Colocynth" is boiled in Sarson/Mustard Oil (*Brassica campestris* L., Family-Brassicaceae) in ratio of 1:7. Three to four

drops of this oil are dropped in affected ear twice a day till ailment is cured completely.

7. **Dental Caries:** A decoction obtained by boiling chopped ripe fruits of “Colocynth” in water in the ratio of 1:6 is used as mouth wash twice a day for seven days.
8. **Dyspepsia:** Ajawain (*Trachyspermum ammi* (L.) Spr. Family-Apiaceae) and common salt (Sodium Chloride, NaCl) are mixed in equal quantities and are stuffed in ripe fruits of “Colocynth” through a hole made in pericarp. These fruits are dried to crispness in sun and ground to a fine powder. Quarter to half gm powder is given after each meal for forty days.
9. **Dysurea (Painful micturition):** (a) Fresh roots of “Colocynth” are boiled in water in ratio of 1:5. Five ml decoction is given twice a day for seven days. (b) Fine fresh root paste of “Colocynth” is applied externally on lower abdomen, twice or thrice a day. Treatment lasts till complete cure is achieved.
10. **Flatulence:** Ripe “Colocynth” fruits are stuffed with black-pepper (*Piper nigrum* L., Family-Piperaceae) through a hole made in pericarp. Each fruit is covered with mud and baked in cow-dung fire till it becomes red. The ash of “Colocynth” fruit and black-pepper are collected and stored. Half gm ash is given after each meal for 15 days.
11. **Hydrocele:** One part fresh root of “Colocynth” is boiled in six parts of “Arandi ka tel” (seed oil, *Ricinus communis* L., Family-Euphorbiaceae). Two ml oil so obtained is mixed with 250 ml cow’s milk and given twice a day for 15 days.
12. **Infertility:** Fresh chopped roots of “Colocynth” and pulp of ripe “bel” fruit (*Aegle marmelos* (L) Corr., Family-Rutaceae) are mixed in equal quantities and boiled in cow’s milk in the ratio of 1:6. Two ml milk is given twice a day for

three months or till the menses becomes regular.

13. **Inflamed Mammary glands/Sore nipples:** A fine fresh root paste, obtained by grinding the roots with a little water, is applied twice daily on inflamed mammary glands or sore nipples till complete cure is obtained.
14. **Leucoderma:** Fresh leaf extract, obtained by squeezing pounded leaves in a muslin cloth, is applied to affected areas of skin twice or thrice a day. Seed oil is applied to depigmented areas every third day. The therapy is continued till the pigments reappear and become stable. This is a reputed therapy for leucoderma in the study area.
15. **Paronychia or witlow:** Fresh root paste of “Colocynth” is applied externally twice a day. Therapy lasts for eight days in acute cases, while in chronic cases it is recommended till complete cure is achieved.
16. **Premature greying of hairs:** Mature “Colocynth” seeds are compressed to extract the oil. Regular application of this oil is claimed to impart natural black colour to the grey hair.
17. **Rheumatism:** Fresh root of “Colocynth” and “Aswagandha” (*Withania somnifera* (L.) Dunal, Family- Solanaceae) is taken in equal quantities and ground to a fine paste. Two g paste mixed with 5 g honey is administered orally twice a day till complete cure is achieved. This therapy is considered to be very effective and it is claimed that the patient begins to improve in two days of therapy.
18. **Snake bite:** Fresh roots of “Colocynth” are ground to a fine paste. Two g paste is applied to a “Pan”/betle leaf (*Piper betle* L., Family-Piperaceae) and is given orally within two hours of snake bite.
19. **Syphilis:** About 150 g chopped whole plant is boiled in two litre water till the volume is reduced to one fourth. Half litre

“Arandi ka tel”, seed oil of (*Ricinus communis* L., Family-Euphorbiaceae) is added to this decoction and boiled again to evaporate the water completely. The oil so obtained is stored in a dark glass bottle. Two ml oil mixed with 250 ml cow’s milk is given orally twice a day till complete cure is achieved.

20. **To induce Labour:** Fresh root paste is applied to genitalia to induce labour.
21. **To promote Lactation:** Decoction of fresh fruit of “Colocynth” is prepared in water in ratio of 1:6. Two ml decoction is administered orally twice daily for seven days.
22. **Termination of Pregnancy (Abortifacient):** Fresh roots of “Colocynth” are ground to a fine paste and applied over the vagina. Two gm paste is given orally once a day.
23. **Vaginal Pain:** (a) Fresh “Colocynth” roots are boiled in cow milk in the ratio of 1:6. Two ml is given orally twice a day. (b) Fresh “Colocynth” roots are ground to a thin paste and are applied to the affected part.
24. **Pimples:** The fruit and roots with or without nux-vomica, is rubbed into a paste with water. The paste is applied externally on pimples, till complete cure is achieved.
25. **Enlarged abdomen of children:** Fresh roots of ‘Tumba’ are ground into a paste.
26. **Indurations of the liver:** A decoction of the whole plant is made in juice of fennel. 2ml juice is taken orally twice a day for 3 days.
27. **Dropsy:** The juice of the fruit is mixed with sugar. The juice is taken orally twice a day for 3 days.
28. **Bowel complaints:** Mature ‘Tumba’ seeds are compressed to extract the oil.
29. **Malaria:** Pulp of seeds eaten twice a day for 2 days.
30. **Cough:** Roots of ‘Tumba’ together with those of *Tylophora indica* and the leaves of *Securinega leucopyrus* are crushed.

One teaspoon of this extract is administered twice a day for 5 days.

31. **Stomach ache:** Small fruits of ‘Tumba’ are collected and stuffed with salt and ‘ajwain’. The fruits are dried and ground to make powder. Two g powder is given orally twice a day for 2 days.
32. **Jaundice:** Fresh fruit pulp of ‘Tumba’ is mixed with ‘ajwain’ seeds and this mixture is kept for seven days and then dried in shade, grind to powder. Two g powder is given orally twice a day for 3 days.
33. **Diabetes:** Pulp of ripe ‘Tumba’ fruits is trampled by naked feet till feeling of bitter taste appears in the mouth for 15 days.
34. **Piles:** Dry fruit pulp is kept in water overnight in the earthen pots. Regular washing of anal part after nature’s call in the morning.
35. **Scarcity:** Seeds of ‘Tumba’ are beneficial in scarcity. Bitter seeds buried in common salt to wash-off their bitter principles, dried and mixed with bajra seeds and the mixed flour is taken.
36. **Healing of wounds:** Leaf juice is applied on body for quick healing.
37. **Skin lice infection:** Leaf juice, boiled with pure mustard oil, filtered and massaged all over the body before bath.
38. **Gastric problem:** Fruits are taken orally in gastric problem.
39. **Haemorrhoids:** Shade dried root paste is given in haemorrhoids.

Besides these fresh roots are used as tooth brush and roasted seeds are used as protein diet. In these district fruits are used as pickles and are eaten by diabetic and cancer patient (Figure 1).

Contra indication: It is a vegetable irritant poison,so beware of it’s over dose. Do not use to pregnant women, children and week patient. The drug and its preparatiions cause drastic irritation of the gastyro-intestinal mucosa and hemorrhage. The toxic dose of fruit pulp is 0.5-1g, while fatal dose is 4g.



Fig. 1 A: Fruits of *Citrullus colocynthis* for sale in gunny bag at the market.
B&C: Pickles of fruit of *Citrullus colocynthis*.

4. Acknowledgement

The senior author (Mahesh Chand Meena) is grateful to University Grant Commission, CRO-Bhopal for financial support and our sincere thanks go to the inhabitants of the study area to provide valuable knowledge about medicinal plant.

5. References

1. Fulekar MH, Jadia C. Ethnobotany, a science of medicinal plants-intellectual property rights. Nature Envir. Pollut. Technol. 2006; 5(1):119-121.
2. Singh VK. Relevance of folk medicines in the context of primary health care programmes in North India. Proc. Herbal Medicines in primary health Care. Lome (West Africa), MC, Geneva 1998;14-19.
3. Tripathi YC. Ethnomedicinal Treasure of Tribal Rajasthan. J. Non-Timber for Products 2000; 7(2):77-84.
4. Chandal KPS, Shukla G, Sharma N. "Biodiversity in medicinal and Aromatic plants in India". Conservation and utilization 1996; 239.
5. King G. 'Notes on vegetable products used as food during late famine in Rajasthan'. Trans. Bot. Soc. Edinb 1870; 10:198.
6. Jain A, Jain AK. Ethnobotanical studies in Rajasthan, India – An overview. Ethnobotany 2012; 24(1&2):59-74.
7. Meena KL, Yadav BL. Some ethnomedicinal plants of Rajasthan. In : Ethnomedicinal Plants of India, (Ed. Trivedi, P.C.), Aaviskar, Publisher, Jaipur 2007; 33-44.
8. Mesfin K, Tekle G, Tesfay T. Ethnobotanical study of traditional medicinal plants used by indigenous people of Gemad District, Northern Ethiopia. Journal of Medicinal Plants Studies 2013; 1(4):32-37.
9. Mahmoud T, Gairola S. Traditional knowledge and use of medicinal plants in the Eastern Desert of Egypt: a case study from Wadi El-Gemal National park. Journal of Medicinal Plants Studies 2013; 1(6):10-17.

10. Nadkarni KM. Indian Materia Medica, Bombay 1954.
11. Dey AC. Indian medicinal plants used in Ayurvedic preparations. Bishen Singh, Mahendra Pal Singh, Deharadun 1980; 202.
12. Singh V, Pandey RP. Economic and medicinal plants of Indian desert. In: Desert resources and technology. (Ed.) Singh, Alam. Vol.I. Jodhpur: Scientific publishers 1983; 307-368.
13. Badifu GIO, Ogunsua AO. Chemical composition of kernels from some species of cucurbitaceae grown in Nigeria. Plant Foods and Human Nutrition 1991; 41:35-44.
14. Singh U, Wadhvani AM, Joshi BM. Dictionary of Economic Plants in India. ICAR 1996; 1-918.
15. Nadkarni KM. Indian Plants and Drugs with their medicinal properties and uses. Asiatic Publishing house, New Delhi 1998; 450.
16. Joshi SG. Medicinal plants. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi 2000; 491.
17. Kirtikar KR, Basu BD. Indian medicinal plants with illustration, Oriental enterprises, Uttranchal 2001; 7:1594-1598.
18. Sharma SC. Indigenous phytotherapy among rural women of Shahjahanpur District, Uttar Pradesh In: Ethnobotany (Eds. P.C. Trivedi). Aavishkar publishers, Jaipur 2002; 313.
19. Dafni A, Lev E. The doctrine of signatures in present-day Israel. Economic Botany 2002; 56(4):328-334.
20. Tiwari G, Shrivastava DK, Gangrade SK. Status of medicinal plants diversity of Kymore Plateau and Satpura Hill Region of Madhya Pradesh and their utilization In: Recent progress in medicinal plants volume 7 Ethnomedicine and pharmacognosy (II) (Eds. V.K., Singh, J.N., Govil, Hashmi Shamima and Singh Gurdip). Studium press LLC, USA 2003; 53.
21. Mitaliya KD, Bhatt DC. Rare and endangered medicinal plants of Gujarat In: Ethnobotany and Medicinal plants of India and Nepal. volume:2 (Eds. V., Singh and A.P., Jain), Scientific publishers, Jodhpur 2003; 847
22. Pawan K, Kasera SM, Shukla JK. Plants of medicinal value from Thar desert, India. In: Medicinal Plants utilization and conservation (Eds. P.C. Trivedi). Aavishkar publishers, Jaipur 2004; 431.
23. Ali AAN, Al-rahwi K, Lindequist U. Some medicinal plants used in Yemeni herbal medicinal to treat Malaria. Afr. J. Trad. CAM. 2004; 1:72-76.
24. Nargas J, Trivedi PC. Plant abortifacients used by tribals of Rajasthan state, India. In: Herbal drugs and Biotechnology (Eds. P.C. Trivedi), Pointer publishers, Jaipur 2004; 240-249.
25. Shah MAU. Ethnomedicinal plants of Bhakkar Tehsil in Punjabm Pakistan. Ethnobotany 2005; 17:171-175.
26. Yadav JP, Kumar S, Siwach P. Folk medicine used in gynecological and other related problems by rural population of Haryana. Indian journal of Traditional Knowledge 2006; 5(3):323-326.
27. Bharate SB, Olier G. Antidiabetic Medicinal Plants. In: Medicinal Plants: Ethnobotanical Approach (Eds. P.C. Trivedi), Agrobios Publisher, Jodhpur 2006; 85-106.
28. Jain SK. 'Ethnobotanical research unfolds new vistas of traditional medicine'. In: Glimpses of Indian Ethnobotany. (Eds. S.K. Jain) New Delhi: Oxford and IBH publishing Co. 1981; 13-36.