

Full Length Article

Pharmacognostic Study of *Adhatoda vasica* Nees

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ABSTRACT

The Pharmacognostic study of *Adhatoda vasica* leaves was carried out to detect the adulteration. Studied characters are stomata, trichomes and anatomical features etc. The plant was analyzed for its preliminary screening of phytochemicals. The results reveal that the plant shows presence of bioactive constituents comprising alkaloids, reducing sugar, anthraquinones, saponins, flavanoids and tannins. In the present study medicinal uses, Phytochemical analysis and Pharmacognosy of plant have been reviewed.

Key Words: *Adhatoda vasica* Nees, pharmacognostic studies, Phytochemicals, Adulteration and powder analysis.

INTRODUCTION

Adhatoda vasica is used as medicine in the treatment of various diseases because it has ability of the formation of secondary metabolites like tannins, alkaloids, saponins, flavanoids, reducing sugars and anthraquinones substances which are in turn used to restore health and heal many diseases. Medicinal plants constitute important components of flora and are widely distributed in different regions of India (Kaushik, 2009). The *Adhatoda vasica* Nees is large shrub, 1-2 m tall.

Leaves are used to treat cough, Asthma, fever, tuberculosis, piles, jaundice, bleeding gum, as an expectorant and as a bronchodilator (Taydae and Patil, 2005; Mishra and Broker, 2009; Singh *et al.*, 2010; Mahajan, 2007; Dey *et al.* 2009; Venkataswamy *et al.*, 2010; Muhbubur Rahman *et al.* 2013 and Naik, 1998). Decoction of plant is given in cold and in rheumatism. Extract of root, bark, leaves and flower is used for bronchial, asthmatic and Pulmonary affections (Ramaya and Jayakumarara 2009). *Adathoda vasica* is also been used to speed delivery during childbirth (Sampath Kumar, 2010).

MATERIALS AND METHODS

The leaves of *Adhatoda vasica* Nees collected from Medicinal plants Garden of Nutan

Mahavidyalaya, Sailu district Parbhani. The collected plant material was taxonomically identified by using renowned floras (Naik, 1979, Naik *et al.*, 1998; Chetty *et al.*, 2008 and Yadav and Sirdesai, 2002). The voucher specimen of plant was preserved in the Department of Botany, Nutan Mahavidyalaya Sailu. Leaves were shade dried and powdered. The powder was successively extracted with different solvent. The fresh leaves and stem were used for the study of macroscopic and microscopic characters.

Preliminary phytochemical Screening

Phytochemical screening of leaves extracts of *Adhatoda vasica* Nees in different solvents were undertaken by using standard methods for the analysis of secondary phytoconstituents like alkaloids, reducing sugar, anthraquinones, saponins, flavanoids, tannins, glycosides, flavonoids, tannins, terpenoids and cardiac glycosides (Harborne, 1984).

Preparation of extract

Leaves powder was subjected to Soxhlet extraction with petroleum ether (60-80°C), Methanol (64.5-65.5°C) and water for 3-4 h in the order of increasing polarity of solvents (Daniel, 1991).

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The extracted solvent is evaporated to make the final volume one fourth of its original volume. Yield of extracts were 6.3, 12.7 and 14.56 % respectively. The extracts were stored at 4°C in airtight bottles for further study.

Macroscopic study

Morphological studies were done using simple microscope. The shape, apex, base, margin, taste and odour of leaves powder were observed.

Microscopic studies:

The free hand transverse section of leaves and stem were taken and stained by using double stained differential staining technique and the section were mounted in DPX (Johanson, 1940). The cellular and anatomical illustration was prepared by using camera lucida and some photographs were taken with the help of digital camera.

The leaf was peeled off for the study of stomata and the trichomes of upper and lower epidermis. For the study of vessels the stem was macerated by using Jeffery's fluid and stained with aqueous 1% saffranin and mounted in glycerine and made semipermanent by ringing with DPX mountant.

The leaves powder was treated with phloroglucinol and HCl for the detection of lignin. Glycerin and iodine solutions were used to determine calcium oxalate crystal and starch grains respectively. As a part of quantitative microscopy, stomata number, stomatal index, vein islet number and vein termination number were determined by using fresh leaves of the plant (Kokate, 1997).

RESULTS AND DISCUSSION

The present paper deals with the study of T.S. of stem, T.S. of leaf, study of stomata, phytochemical constituents and Powder analysis.

T. S. OF STEM

The transverse section of the stem was wavy in outline. The epidermis was outermost layer of stem made up of compactly arranged barrel shaped cells. The outer cell wall was greatly thickened and heavily cutinized. Beneath the epidermis, multilayered thick walled hypodermis was present. Beneath hypodermis multilayered parenchymatous cortex was present. The cortex with large intercellular spaces. Endodermis and pericycle was not distinct. Inner to cortex a ring of many conjoint, collateral and open vascular bundles were present. Phloem was present toward epidermis. Xylem was endarch and radially

arranged medullary rays are present in between vascular bundles. Multilayered polygonal compactly arranged cells were present at the center forming pith (fig. 1).

T. S. OF LEAF

It was typical dicot leaf. The leaf was covered on both surfaces by a single layered epidermis. The epidermis was single layered and made up of compactly arranged barrel shaped parenchymatous cells. The outer surface of the epidermis was covered with cuticle. Stomata were found in both upper and lower epidermis. The mesophyll tissue was differentiated into palisade tissue towards upper epidermis and it contain double layered columnar cell compactly arranged with chloroplast. Spongy tissue towards lower epidermis, cells were polygonal loosely arranged with numerous intercellular spaces. Each vascular bundle was conjoint, collateral and closed. Xylem present towards upper epidermis and phloem toward lower epidermis. The vascular bundle was enclosed by a parenchymatous bundle sheath.

STOMATA

The leaf was simple smooth, leaf lamina has entire margin with uncostate reticulate pattern of venation. The leaf was amphistomatic. The stomatodes of both the surfaces were paracytic, the guard cells were surrounded by two subsidiaries, which are morphologically correlated with epidermal cells. The subsidiary cells are parallel to the long axis of the pore and guard cell. Stomata were found in most abundance in the lower epidermis while they are very few in the upper epidermis (Fig 2 and 3).

TRICHOME

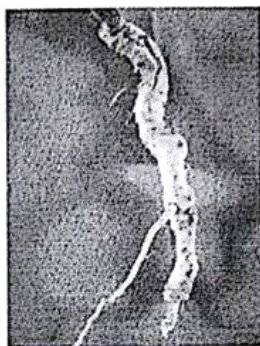
The trichomes were present on both the adaxial and abaxial leaf surfaces. The trichomes of upper surface are unicellular with cytoplasmic content. The foot was embedded into epidermal cell and tip of the trichome is pointed. The trichomes of lower surface were unicellular with cytoplasmic content. Foot was embedded into the epidermal cell. The length of trichome of upper surface was more than the lower surface (fig. 5 and 6).

VESSELS

The vessel elements of the secondary xylem shows variation where, 33% of the vessels were with pitted thickening. Both the end wall plates are oblique and multiperforate having size of 70 μ diameter and 270 μ length (fig. 4).



Flowers and Leaves



Root

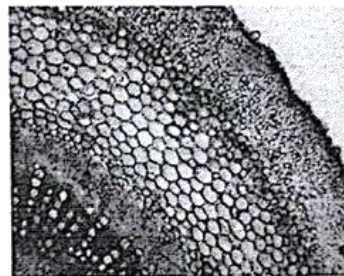


Fig. 1 : T. S. of Stem



Fig 2: Stomata upper epidermis

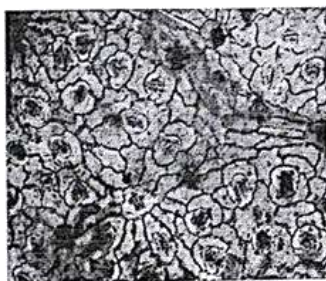


Fig 3 : Stomata Lower epidermis



Fig. 4 : Stem Vessel



Fig- 5 : Trichomes-upper epidermis

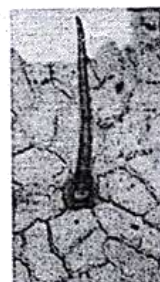


Fig 6: Trichomes-lower epidermis

Fig. 1 Different plant parts of *Adhatoda vasica*

In 33% vessels one end wall plate was transverse with simple perforation plates and other end wall was oblique with simple perforation plate. Lateral wall thickenings were reticulate, the length is 240 μ m and diameter is 40 μ m (fig. 5). In 33% of the vessels the lateral wall thickening was scleriform, one end wall was transverse with simple perforation plate and other end wall is oblique with short tail, length was 280 μ m and diameter was 100 μ m (fig. 6).

Phytochemical constituents

The preliminary phytochemical analysis of leaves powder show the presence of alkaloids, reducing sugars, anthraquinones, saponins, flavanols and tannins. The Glycoside, phlobatannins Terpenoids and Cardiacglycosides are absent (Table. 1).

Powder analysis

The powder was characterized by its morphological features like green colour; presence of specific odour and astringent taste. Microscopic study of powder reveals the presence of Lignified cells of vascular bundle, cells of epidermis are mucilaginous while endodermis contain starch. (Table. 2&3)

Table 1- Preliminary phytochemical screening of leaves powder of *Adhatoda vasica*

Sr.no	Phytochemicals	Test	sr. no	Phytochemicals	Test
1	Alkaloid	+	6	Phlobatannins	-
2	Glycoside	-	7	Saponins	+
3	Flavonoids	+	8	Terpenoids	-
4	Tannins	+	9	Anthraquinones	+
5	Reducing sugar	+	10	Cardiacglycosides	-

Table 2- Preliminary test of *Adhatoda vasica*.

Sr No	Test	Observation	Inference
1	Colour	Green	Leaf drug
2	Odour	Specific	Aromatic crude drug
3	Taste	Astringent	Drug contain tannins

Table 3: Fluorescence analysis of the powdered leaves of *Adhatoda vasica*.

Sr No.	Reagent	Observation	Characteristic
1	Powder +Phloroglucinol+conc. HCl	Red or pink colour	Lignified cells of vascular bundle
2	Powder +Ruthenium red	Pink colour	Mucilagenous cell of epidermis
3	Powder +Sudan red III	Pink colour	Cuticle
4	Powder +Acetic acid	Insoluble	Calcium oxalate crystal
5	Powder +Conc.Sulphuric acid.	Green colour	Stone cell present
6	Powder +Dil. Iodine solution	Blue	Starch in endodermis
7	Powder +Dil. Iodine solution +Conc. Sulphuric acid	Black colour	Hemicellulose absent

The standardization of crude drugs has become very important for identification and authentication of a drug. But due to certain problems the importance was not up to the mark. Thus, the lack of standardization techniques fails to identify the drug from its originality which thereby exploits the usage of drug from its traditional system of medicine (Charkaborthy and Ghorpade, 2009). The medicinal plants which are abundantly found and their authentication and identification could not be a part of standardization but it is thoroughly accepted as per traditional method of as said.

The plant *Adhatoda vasica* Nees is abundantly found and is used to treat many diseases and gives a helping hand to the humans. Thus special technique is designed for its authentication and identification on the basis of microscopy and chemical analysis. The plant

produce various natural active product such as Alkaloid, Glycoside, Flavonoids, Tannins, Reducingsugar, Phlobatannins, Saponins, Terpenoids, Anthraquinones, Cardiacglycosides etc. have received considerable attention in recent years due to their diverse pharmacological properties including antimicrobial haepatoprotective and antioxidant activities (Arokiyaraj et al., 2012). The phytochemical analysis of the plant show presence of alkaloids, reducing sugar, anthraquinones, saponins, flavanods and tannins. Due to presence of these phytochemicals in this plant is used against various diseases. As the global scenario is now changing towards the use of harmless plant products, development of good quality and modern drugs from *Adhatoda* should be emphasized. Clinical trials should be conducted to support its therapeutic use.

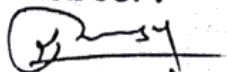
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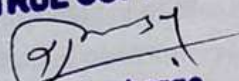
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MEDICO-BOTANICAL TREASURE TROVE OF MAHUR RANGE FOREST OF NANDED DISTRICT, MAHARASHTRA

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ABSTRACT

The survey of medicinal plants was conducted in different villages of Mahur range forest of Nanded district. An attempt has been made to study medicinal properties of plant used by *Andh, Kolam, Gond, Naikede and Pradhan* for the treatment of diseases like abdominal pain, dysentery, fever, malaria, skin diseases, eye diseases, tympanitis, kidney stone, typhoid, headache and teeth diseases. The 43 plant species belonging to 23 families were studied during survey. Of which 9 trees, 8 shrubs, and 26 herbs. The plant species were described taxonomically, with their medicinal properties. It is enumerated alphabetically with local name, scientific name, family, voucher specimen number, part(s) used, formulation and mode of administration with doses.

Key words: Medicinal plants, Tribes, Mahur and Maharashtra.

INTRODUCTION

The Mahur range forest of Nanded district is rich in biodiversity. Mahur taluka is located in northern part of Nanded district. It is bounded North and South by Yavatamal district. East part by Andhra Pradesh and West by Pusad taluka of Vidarbha region. It lies between 19°49' to 19°83' North latitude and 77°91' to 77°55' East longitude. It is inhabited by large rural population and different tribes. *Andh, Kolam, Gond, Naikede and Pradhan* are some of the major tribal community in this area (Pawade *et al.*, 2008). The area is rich in medicinal plants and tribals are depending on medicinal plants for the treatment of various diseases. The valuable knowledge about plants of this area is an important Indian heritage. Tribals are good at knowledge of herbal wealth and related vegetation in the immediate vicinity. According to 2001 census population is 86782, out of this 15.5 percent is inhabited by tribal population of aborigines like *Andh, Kolam, Gond and Pradhan*. They have their own soci-cultural traditional and way of life.

METHODOLOGY

Ethnobotanical survey was conducted in Mahur range forest during 2005-2010 to collect ethno-medicinal importance of plants. The traditional uses of plants were gathered from traditional healers, tribal medicinal practitioners and vended by oral interviews, discussion and even observation during the survey in different area of this region. During survey medicinal uses were collected.

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along with their local name, part(s) used, flowering period, mode of administration, duration of treatment, mode of preparation and doses. In this study 17 knowledgeable elders (between the ages of 45 to 65) choose with the assistance of local administrators and community leaders who served as key informants. During the course of the study we visited to informant three times in order to verify the reliability of the obtained data. If what was said during the first visit concerning the use of a particular medicinal plant by any informant did not agree with what was told during the second or third visit, such information was considered unreliable and it is discarded. Repeated visits also helped to get some additional information that was not mentioned during the earlier interviews. The plants were identified with help of standard floras (Naik, 1979; Naik *et al.*, 1998; Cook, 1958; Yadav and Sirdesai, 2002). The voucher specimens were housed in Department of Botany, Dnyanopask College Parbhani.

Ethnomedicinal Enumeration : The plants were enumerated alphabetical along with their botanical names, local name, family, voucher number, uses, formulation, dosages and mode of administration for treating diseases along with the name of resource person.

1. *Abelmoschus manihot* (L.) Medik.

Family: Malvaceae. **Local Name:** Ran bhendi. **Part(s) used:** seeds.

Morphology: Plant is erect, branched herb. Stem is pubescent, leaves are simple, margin serrate, and petiole is long. Flowers are axillary or in terminal racemes, pedicel is long. Petal is yellow. Capsule ovoid beaked. Seeds are kidney shaped black (PRK 18).

Ethnobotanical Uses: About spoonful powder of seeds is given at night for three days to cure abdominal pain or gastric problem (Ram Cherange and Gangaram).

2. *Acacia farnesiana* (L.) Willd.

Family: Mimosaceae. **Local Name:** Devbabul. **Part(s) used:** Stem bark, fruit.

Morphology: It is an erect branched shrub, bark brown coloured. Leaves are long, rachis slender, leaflets are 10-13 pairs, oblong white. Flowers are sessile, in axillary or terminal globose head, peduncle long, flowers fragrant. Corolla yellow. Pod is cylindrical, long turgid, black or brown. Seed is oval, black or brown (PRK 24).

Ethnobotanical Uses: 1) Paste of bark is applied on foot, hands and abdomen regularly to treat rickets of child (Pawar) 2) A spoonful powder of fruit is given along with butter milk two times in a day for three days as an antidote to rabid dog (Pawar) 3) A spoonful powder of fruit is given along with water two times in a day as an antidote for rat bite (Mantute).

3. *Acacia leucophloea* (Roxb.) Willd.

Family: Mimosaceae. **Local Name:** Hiwar. **Part(s) used:** Stem bark.

Morphology: Plant is much branched tree, bark is white or ash coloured, young part is pubescent. Leaves are compound with pubescent rachis, pinnae 4-15 pairs, sub sessile. Calyx green and corolla dull white. Pod is oblong, flat, brown tomentose thickened on sutures. Seeds are 8- 15 obovoid brown (PRK 134).

Ethnobotanical Uses: 1) About a spoonful juice of stem bark is given twice a day for two days to cure fits (Gangaram) 2) Paste of stem bark is applied on chest to cure fits (Pawar).

4. *Ageratum conyzoides* L.

Family: Asteraceae. **Local Name:** Osadi. **Part(s) used:** Leaves.

Morphology: Plant is annual erect herb. Young stem is clothed with hairs. Leaves are opposite, upper leaves are alternate, ovate with serrate margin, hairs on both surface, petiole long. Head is in dense terminal corymbs. Corolla is tubular, pink. Seeds are black (PRK 39).

Ethnobotanical Uses: About spoonful juice of leaves is taken twice a day for five days to control cough (Gangaram).

5. *Amaranthus tricolor* L.

Family: Amaranthaceae. **Local Name:** Tandulja or Tandulkundera.

Part(s) used: Entire plant.

Morphology: It is an annual erect herb. Stem is angular, glabrous. Leaves are broadly ovate, cuneate and often decurrent at base into a petiole, petiole is long. Flowers born in dense clusters in the lower leaf axil, upper ones in simple or branched thick spikes. Tepals are long awned, green with broad scarious margins. Seed is discoid brown (PRK 169).

Ethnobotanical Uses: 1) About half cup juice of plant is given twice a day for six days to treat urinary complaints (Gangaram) 2) Curries prepared from plant is consumed to treat dysentery (Rathod) 3) About a cup juice of plant is given twice a day to treat fever (Rathod) 4) Half cup juice of stem is given twice a day for fifteen days against obesity (Gangaram).

6. *Azadirachta indica* A. Juss.

Family: Meliaceae. **Local Name:** Kadu limb.

Part(s) used: Leaves, stem bark and flowers.

Morphology: It is a branched tree. Leaves are pinnately compound, leaflets are five to ten opposite, lanceolate, serrate margin, petiole short. Flowers are in axillary panicles, petals are white fragrant. Drupe is ellipsoid, yellow and single seeded (PRK 130).

Ethnobotanical Uses: 1) Half cup bark juice is drunk twice a day for three days to treat burning sensation in fever (Chavan) 2) About half cup decoction of stem bark is drunk twice a day for four days against malaria (Chavan) 3) About 25 g flowers are chewed at night regularly for digestive diseases (Cherange) 4) Powder of stem bark and leaves is locally applied on diseased skin to control skin diseases (Cherange) 5) About a cup juice of leaves is taken orally in early morning for 14 days blood purification (Chavan). 6) Powder of leaves is applied on wound for quick healing (Cherange).

7. *Balanites aegyptica* (L.) Del.

Family: Balanitaceae. **Local Name:** Hinganbet. **Part(s) used:** Seed.

Morphology: Plant grows on waste land, erect branched thorny tree, young parts pubescent. Leaves are bifoliate, petiole is long, leaflets are elliptic acute at base. Flowers are in axillary cyme, greenish. Drupe is ovoid hard yellowish. Seed is ovoid pale yellow (PRK 150).

Ethnobotanical Uses: 1) Seeds are crushed in water and two drops of this mixture dropped in eyes twice a day for two days to treat eye diseases (Pawar) 2) 1 g of seeds consumed thrice a day to treat cough (Pawar) 3) Half spoonful seed extract is consumed thrice a day to cure abdominal pain (Chavan).

8. *Bambusa vulgaris* L.

Family: Poaceae. **Local Name:** Bambu. **Part(s) used:** Tender shoot.

Morphology: It is an erect perennial herb. Clums tufted terete, nodes hardly raised with usually a ring of brown hairs. Leaves linear lanceolate, apex twisted, panicle large with clusters of spikelets (PRK 99).

Ethnobotanical Uses: 1) Tender shoot act as an energetic (Madwae) 2) Paste of tender shoot is applied on piles till cure (Madwae) 3) Ash of tender shoot is applied along with coconut oil on wound for quick healing (Gite).

9. *Barleria prionitis* L.

Family: Acanthaceae. **Local Name:** Pivli kate koranti. **Part(s) used:** Leaves.

Morphology: It is an erect branched, thorny under shrub. Stem glabrous grooved. Leaves simple, opposite, elliptic tapering at base, petiole long. Flowers solitary axillary interterminal spike. Petal yellow. Capsule ovoid. Seeds ovoid, black (PRK 133).

Ethnobotanical Uses: Few drops of mixture of leaf juice and kapur is dropped to treat earache and tympanitis (Kadam).

10. *Bauhinia variegata* L

Family: Caesalpinaceae. **Local Name:** Apta or Kanchan.

Part(s) used: Stem bark, leaves.

Morphology: It is a small branched tree with brown coloured bark. Leaves are alternate, ovate, cordate at base, divided for 1/2 way down into 2 rounded lobes. Flowers are in axillary raceme white or whitish pink, fragrant. Pod is flat, long beaked. Seeds are black (PRK 23).

Ethnobotanical Uses: 1) 50g powder of dried stem bark is mixed in powder of 21 Cardamom. About halfspoonfull mixture is given twice a day for twenty-one days to cure weakness (Gangaram) 2) Powder of two dried leaves, two date palm, dried ginger and black pepper is mixed in one glass water and used to cure malaria (Gangaram).

11. *Biophytum sensitivum* (L.) DC.

Family: Oxalidaceae. **Local Name:** Lajari. **Part(s) used:** Entire plant.

Morphology: Plant is annual herb, grows on wet land. Leaves are pinnate present at tip of stem, leaflets are ten to twelve pairs oblong rounded at base. Flowers are in terminal cymes. Peduncle and pedicel is long. Sepals are green, petals are yellow. Capsule is long. Seeds are globose (PRK 136).

Ethnobotanical Uses: 1) Spoonful juice of plant is taken orally twice a day for two days to stop dysentery (Rathod) 2) Spoonful decoction of root is drunk two times in a day for seven days against kidney stone (Rathod).

12. *Caesalpinia bonduc* (L.) Roxb.

Family: Caesalpinaceae. **Local Name:** Gajaga or sargagota. **Part(s) used:** Seed.

Morphology: Plant is branched, scandent shrub, young stem is green coloured with many small thorns. Leaves are long, compound, leaflets are 6-9 pairs, oblong, obtuse and shining above, pale and pubescent beneath, petiolules is terminal and supra axillary racemes, calyx is fulvous hairy lobes ovate oblong. Corolla is greenish yellow, petals are oblanceolate, Pod is ellipsoid, armed with prickles. Seed is 1-3 globose ash coloured polished (PRK 182).

Ethnobotanical Uses: 1) About 1g seed is given along with betel leaf twice a day for two days to cure abdominal pain (Pawar) 2) About one spoonful seed extract is administered twice a day for two days as an analgesic (Mawdawe) 3) Powder of warmed seed is consumed along with 50 gm ghee in early morning for six days to control rheumatism (Mantue).

13. *Capparis zeylanica* L.

Family: Capparaceae. **Local Name:** Waghata. **Part(s) used:** Root and Fruit.

Morphology: It is an straggling shrub, with hooked stipular spines. Leaves opposite, ovate, rounded at apex petiole .5-2 cm long. Flowers 2.5-3 cm across, 2-3 together in supra axillary row; pedicel 1-2.5 cm long, hairy. Sepals obtuse, concave, densely brown tomentose on the back. Petals greenish white, oblong. Stamens 30-40, filament white turning purple. Gynophore 3-5 cm long, ovary ellipsoid. Fruit subglobose brown. Seeds globose (PRK 111).

Ethnobotanical Uses: 1) A spoonful root extract is drunk twice a day to cure or regularize menstrual cycle (Perchake) 2) About half cup of juice of fruit is taken orally at morning for three days to cure diarrhoea (perchake).

14. *Cassine albens* (Retz.) Kosterm.

Family: Celastraceae. **Local Name:** Bhuta palas or Bhoott keshi.

Part(s) used: Leaves.

Morphology: It is a branched deciduous tree. Leaves are simple, opposite with serrate margin, oblong and acute with short petiole. Flowers are numerous in divaricate axillary cyme. Petals are greenish white. Fruit is fleshy drupe (PRK 142).

Ethnobotanical Uses: 1) Spoonful powder of leaves is filled in leaves of *Diospyros melanoxylon* and smoked after scorpion sting and also used to stop hiccough (Raut) 2) Paste of stem bark is applied on inflammatory area as an antiphlogistic (Perchake).

15. *Cassia fistula* L.

Family: Caesalpinaceae. **Local Name:** Amaltas or Bhava.

Part(s) used: Seeds, flowers, Pod and root.

Morphology: It is a moderate sized, deciduous glabrous tree. Leaves are dark green, rachis pubescent, leaflets are 4-6 pairs, coriaceous, opposite, ovate cuneate at base, petiolules is long. Flowers are in dropping racemes, pedicel is long, slender, calyx is green, and corolla is dark yellow, stamens 10. Pod is cylindrical long straight or slightly curved, black. Seeds are many brown (PRK164).

Ethnobotanical Uses: 1) Powder of pod is used as an antidote on scorpion sting (Kadam) 2) About 10 g flowers are advised orally twice a day for three days to control digestive problem (Kadam) 3) Powder of pod is administered along with curd twice a day for three days to treat dysentery (Marape) 4) Powder of pod is applied on infected skin till cure (Marape) 5) A spoonful powder of pod is taken once a day for three days to cure abdominal pain (Kamble) 6) Powder of seed is used to stop nausea (Kamble) 7) A spoonful powder of pod is advised twice a day for three days to treat typhoid (Chavan).

16. *Celosia argentea* L.

Family: Amaranthaceae. **Local Name:** Kardu or kombada. **Part(s) used:** Seeds.

Morphology: Plant is annual herb grows on waste land. Leaves are simple alternate, lanceolate. Flowers are in fasciated convolute, comb like. The inflorescence is white or pink coloured. Nut let is black (PRK 135).

Ethnobotanical Uses: Half spoonful powder of seed is taken orally with cow milk twice a day for two days to treat kidney stone (Gangaram).

17. *Citrullus colocynthis* (L.) Schrad.

Family: Cucurbitaceae. **Local Name:** Indrayan or Kaduindrayan.

Part(s) used: Seed.

Morphology: Plant is monoecious. Stem is diffused angular, creeping; tendrils slender. Leaves are ovate in outline; pinnately, 5-6 lobed, hirsute on both surface, petiole long densely hirsute. Male flowers solitary. Calyx tube campanulate, hispid outside. Corolla pale yellow. Fruit globose, variegated green and white globose, pulp spongy; bitter. Seeds ovate, oblong and yellow (PRK 58).

Ethnobotanical Uses: 2-3 seeds are given along with betel leaf thrice a day for three days to cure fever (Dulasing Pawar).

18. *Coix gigantea* Roxb.

Family: Poaceae. **Local Name:** Kasaigawat. **Part(s) used:** Root.

Morphology: Plant grows on wet soil. It is an annual erect herb. Leaf sheath is compressed, long, blade flat linear. Flowers are in racemes with long peduncle, raceme consists basal globose female spikelets white. Male spikelets are sessile, lanceolate. Ovary is ellipsoid involucre turbinate (PRK 137).

Ethnobotanical Uses: Spoonful extract of root is drunk twice a day for four days to cure urinary complaints (Gangaram).

19. *Crotalaria hirsuta* Willd.

Family: Fabaceae, **Local Name:** Sonari, **Part(s) used:** Leaves.

Morphology: It is an erect branched herb. Leaves are linear, alternate, pubescent, sessile, entire margin. Flowers are in raceme, corolla yellow. Pod is oblong pointed at tip. Seeds are kidney shaped (PRK 7).

Ethnobotanical Uses: 1) Paste of leaves is applied over inflammatory area two times in a day for three days to cure inflammation (Gangaram) 2) Paste of leaves or juice of leaves is applied over forehead to control headache (Gangaram).

20. *Crotalaria montana* Roth

Family: Fabaceae. **Local Name:** Rapati. **Part(s) used:** Root.

Morphology: The plant is erect branched herb with white hairs. Leaves are oblong, petiole is short. Flowers are terminal. Corolla yellow. Pod is ovoid four seeded. Seeds are kidney shaped (PRK 56).

Ethnobotanical Uses: Powder of root is used to control lice (Ubale).

21. *Curcuma pseudomontana* Grah.

Family: Zingiberaceae. **Local Name:** Ranhalad. **Part(s) used:** Rhizome.

Morphology: Plant is a perennial herb. It bears underground subglobose tubers. Leaves are oblong tapering towards base, petiole is long succulent. Flowers are small yellow (PRK 93).

Ethnobotanical Uses: 1) A spoonful paste of fresh rhizome is mixed in cup of cow milk and is drunk twice a day for three days to cure cough (Ubale) 2) Paste of rhizome is applied on face to remove black lesions (Govind) 3) Paste of rhizome is applied on injury till cure (Ubale) 4) Paste of fresh rhizome is mixed with moist soil and is applied on inflammatory area as a antiphlogistic (Gangaram).

22. *Eranthemum roseum* (Vahl) R. Br.

Family: Acanthaceae. **Local Name:** Jabhal rangi. **Part(s) used:** Root.

Morphology: Plant is an erect branched shrub. Stem is woody. Leaves are oblong lanceolate dark green tapering at base (PRK 96).

Ethnobotanical Uses: Paste of root is applied on feet at night to reduce burning sensation or to cure cracks of feet (Ubale).

23. *Euphorbia thymifolia* L.

Family: Euphorbiaceae. **Local Name:** Kalidudhi. **Part(s) used:** Entire plant.

Morphology: It is a prostrate annual herb. Stem is slender blackish brown spreading. Leaves are small and opposite, red coloured. Cyathia is axillary. Fruit is ovoid globose, three lobed. Seeds are brown (PRK 41).

Ethnobotanical Uses: 1) Small tablets were made from the mixture of plant extract and jaggery. Three tablets are advised at the interval of ten minutes to control high fever (Perchake) 2) Spoonful decoction of plant is drunk twice a day for three days to treat typhoid (Perchake).

24. *Gantelbua urens* (Heyne ex Roth) Bremek.

Family: Acanthaceae. **Local Name:** Matoli. **Part(s) used:** Seeds.

Morphology: The plant is annual prostate herb. Stem is four angled covered with tomentum. The leaves are obovate simple reticulate. Flowers are purple in capituliform dense compound. Capsule is linear, oblong. Seeds are brownish (PRK 83).

Ethnobotanical Uses: A spoonful powder of seed is mixed in a cup of cow milk and drunk in early morning for four days to cure kidney stone (Behare).

25. *Gardenia latifolia* Ait.

Family: Rubiaceae. **Local Name:** Chekati. **Part(s) used:** Fruit.

Morphology: The plant is small branched tree with smooth bark. Leaves are simple and opposite. Flowers are white. Fruit is subglobose with peristant. Calyx three valved. Seeds are numerous pale brown (PRK 78).

Ethnobotanical Uses: 1) About spoonful fruit powder is mixed in spoonful amount of honey. It is advised to consume twice a day for ten days for flatulence (Behare) 2) A spoonful root extract is mixed with spoonful honey and is given at night for five days to treat colic (Behare).

26. *Glossocardia bosvallea* (L. f) DC.

Family: Asteraceae. **Local Name:** Khadak shepu. **Part used:** Entire plant.

Morphology: Plant is annual prostrate-branched herb. Stem is spreading from central root. Leaves are alternate pinnatiset. Heads are axillary. Flowers are yellow. Seeds are black (PRK 102).

Ethnobotanical Uses: 1) About half cup decoction of leaves is taken twice a day for three days to cure chronic fever (Gangaram) 2) Spoonful powder of plant is given orally twice a day for two days to cure typhoid (Ubale) 3) Spoonful powder of plant is given at night for four days to cure gastric trouble (Rathod).

27. *Gnaphalium polycaulon* Pers.

Family: Asteraceae. **Local Name:** Ran pather. **Part(s) used:** Leaves.

Morphology: It is an erect herb, branches arise from base, white woolly. Leaves are alternate, linear, upper leaves are sessile, while lower are petiolate, cottony pubescent on both surface. Head is sessile interterminal racemes. Flowers are yellow. Achenes are oblong brown (PRK 105).

Ethnobotanical Uses: 1) Paste of leaves is applied on swelled part till cure (Rathod) 2) Paste of leaves is applied on breast to control mastitis (Rathod).

28. *Goniocaulon indicum* (Klein ex Willd.) Cl.

Family: Asteraceae. **Local Name:** Karad kusumb. **Part(s) used:** Leaves and Flowers.

Morphology: It is an erect herb. Stem is angular green. Leaves are long sessile, alternate, lanceolate with serrate margin. Head is narrow, corolla tubular pink. Seeds are black (PRK 19).

Ethnobotanical Uses: 1) A spoonful juice of leaves is given two times in a day for three days to cure abdominal pain (Rathod) 2) Juice of leaves and flower is mixed and applied over forehead to control headache (Rathod).

29. *Grangea maderaspatana* (L.) Pior.

Family: Asteraceae. **Local Name:** Machipatra. **Part(s) used:** Entire plant.

Morphology: Plant is prostrate annual herb, grows on wet soil. Stem is green succulent spreading. Leaves are simple with serrate margin, sessile, alternate. Head is globose. Corolla is yellow. Achene is long black (PRK 112).

Ethnobotanical Uses: 1) Few drops of juice of leaves are dropped in ear twice a day against earache (Gangaram) 2) Half cup of plant juice is given orally once a day for three days to stop dysentery (Gangaram).

30. *Hibiscus lobatus* (Murr.) O. Ktze.

Family: Malvaceae. **Local Name:** Lahan jaswand. **Part(s) used:** Entire plant.

Morphology: Plant is erect herb. Leaves are dimorphic, lower leaves are simple, margin serrate, upper leaves are trilobed and pubescent. Flowers are axillary. Corolla white (PRK 55).

Ethnobotanical Uses: Paste of fresh plant is applied on breast to cure mastitis (Ubale).

31. *Hybanthus enneaspermus* (L.) F. Muell

Family: Violaceae. **Local Name:** Ratan puruash. **Part(s) used:** Entire plant.

Morphology: Plant is erect annual herb about 28 cm tall. The leaves are sessile, lanceolate, simple and stipulate. Flowers are deep pink axillary or terminal. Petals are five of which upper two are large. Capsule is ovate. Seeds are white numerous (PRK 86).

Ethnobotanical Uses: 1) About one spoonful plant powder is taken with cow milk twice a day for eight days to increase sperm count (Ubale) 2) About spoonful, powder of root is given twice a day for three days to cure leucorrhoea (Doheli).

32. *Indigofera cordifolia* Heyne ex Roth

Family: Fabaceae. **Local Name:** Bhuigavat. **Part(s) used:** Root.

Morphology: It is a common annual branched herb. The leaves are simple covered with white hairs on both surfaces. Flowers are in dense axillary cluster and red. Pod is oblong (PRK 76).

Ethnobotanical Uses: Paste of root is applied regularly on joints at night for rheumatism (D. D. Kamble).

33. *Iphigenia indica* (L.) A. Gray

Family: Liliaceae. **Local Name:** Jangli lasan or pakli lasan. **Part(s) used:** Seeds.

Morphology: Plant is an erect herb, grows on wet soil. Corm is black coloured. Leaves are sessile linear pointed at tip. Seeds are numerous white (PRK 66).

Ethnobotanical Uses: About spoonful seed powder is mixed in 25 gm jaggery and is given twice a day for three days to increase the lactation of mother (Ubale).

34. *Martynia annua* L.

Family: Martyniaceae. **Local Name:** Waghnakhi or Kutri.

Part(s) used: Leaves & Fruit.

Morphology: Plant is annual branched erect herb. Stem is hollow with glandular hairs. Leaves are large, simple, alternate, broadly ovate, cordate at base and margin dentate. Flowers are in axillary racemes. Calyx is green. Corolla is pink with dark purple patch at base. Fruit is green ovoid with two hooks, hard. Seed is black (PRK 47).

Ethnobotanical Uses: 1) Paste of leaves is applied on pimples (Perchake) 2) About one gm of seed is consumed along with milk thrice a day to cure headache (Perchake).

35. *Maytenus emarginata* (Willd.) Ding Hou

Family: Celastraceae. **Local name:** Hekalni. **Part(s) used:** Leaves.

Morphology: Plant is branched thorny shrub. Branches drooping straight, sharp thorns. Leaves obovate or broadly elliptic, narrowed at base. Flowers in short, axillary cyme, sepals elliptic-oblong, petals white elliptic-oblong. Filaments dilated at base. Disk fleshy. Ovary globes. Fruit black with fleshy pericarp, dehiscent with age. Seed brown (157).

Ethnobotanical Uses: 1) Paste of leaves is applied on inflammatory area (Gangaram) 2) Paste of leaves applied on infected skin till cure (Gangaram)

36. *Mucuna pruriens* (L.) DC.

Family: Fabaceae. **Local Name:** Khajkuir. **Part(s) used:** Root and seeds.

Morphology: It is annual branched herb. Leaves are trifoliate, petiole is long silky, and leaflets are rhomboid ovate, rounded at base, petioles long. Flowers are many in pendulous racemes. Calyx is grey and corolla is dark purple. Pod is long brown, covered with hairs. Seeds are black (PRK 139).

Ethnobotanical Uses: 1) Spoonful extract of root is given with half cup of curd twice a day to stop dysentery (Perchake and Gangaram) 2) Spoonful extract of root is drunk two times in a day for three days to control abdominal pain (Rathod) 3) Spoonful powder of seeds is taken with honey twice a day for 14 days to reduce weakness (Rathod).

37. *Pergularia daemia* (Forsk.) Choiv.

Family: Asclepiadaceae. **Local Name:** Utran. **Part(s) used:** Leaves.

Morphology: It is an annual twiner, much branched with tomentose. Leaves are simple, alternate and deeply cordate at base, petiole is long and pubescent. Flowers are white; pedicel is long. Follicles are long green with spines seeds are ovate (PRK 28).

Ethnobotanical Uses: 1) Three leaves are chewed as an antidote for scorpion bite and latex is applied on stung area (Mantute) 2) About half glass juice of leaves is drunk to reduce poison from body (Mantute) 3) Three leaves are given thrice a day for three days against indigestion (Mantute) 4) A mixture of latex and butter is applied on teeth to cure teeth diseases and mouth diseases (Perchake).

38. *Prosopis cineraria* (L.) Druce

Family: Mimosaceae. **Local Name:** Sondad. **Part(s) used:** Leaves.

Morphology: It is an erect branched spiny tree. Stem is rough black. Leaves are long, leaflets five to nine pairs, oblong, subsessile rounded at base. Flowers are sessile, in short peduncled axillary spike. Seeds are black or brown (PRK 25).

Ethnobotanical Uses: 1) Paste of leaves is applied on inflammatory area to cure inflammation (Gangaram) 2) Powder of stem bark is rubbed on teeth two times in a day for 15 days to cure

bleeding gum (Baliram) 3) Leaves are chewed three to four times in a day for two days to cure mouth ulcer (Gangaram).

39. *Rhynchosia minima* (L.) DC.

Family: Fabaceae. **Local Name:** Pivli pushpin. **Part(s) used:** Leaves.

Morphology: It is an annual herbaceous twiner. Stem is weak, branched. Leaves are trifoliate. Petiole is long. Flowers are in axillary raceme, yellow. Pod is oblong. Seeds are black (PRK 35).

Ethnobotanical Uses: About spoonful juice of plant is taken orally thrice a day for two days to cure chronic fever (Perchake).

40. *Rorippa indica* (L.) Hiern.

Family: Brassicaceae. **Local Name:** Ranmohri. **Part(s) used:** Leaves and seeds.

Morphology: Plant is erect or prostrate annual herb. Leaves are lyrate, dentate and petiolate. Flowers are yellow in terminal or corymbose, pedicelate. Siliqua is long. Seeds are numerous arranged in two rows, black or brown minute (PRK 107).

Ethnobotanical Uses: 1) Paste of leaves is applied on joint against joint pain (Ubale) 2) A spoonful powder of seed is consumed at night to treat indigestion (Ubale).

41. *Soyimida febrifuga* (Roxb.) A. Juss.

Family: Meliaceae. **Local Name:** Rohan. **Part(s) used:** Stem bark.

Morphology: It is a branched tree. Leaves are pinnately compound, leaflets are 3-6 pairs oblong, rounded at base and apex, petiole is short. Flowers are white present in axillary and terminal panicles, pedicel is short. Capsule is ovoid. Seeds are brown (PRK 118).

Ethnobotanical Uses: 1) About a cup of decoction of stem bark is drunk twice a day for two days to cure dysentery (Baliram) 2) Spoonful powder of stem bark is drunk along with cow milk or buttermilk twice a day for three days to control abdominal pain (Gangaram).

42. *Tephrosia hirta* Buch. Ham.

Family: Fabaceae. **Local Name:** Ranlalari. **Part(s) used:** Root.

Morphology: It is an erect branched under shrub. Leaves are pinnate, leaflets are nine to thirteen, oblong, cunate at base rounded at apex, petioles are long. Pedicelate, pink rose coloured. Pod is linear long. Seeds black (PRK 43).

Ethnobotanical Uses: A spoonful extract of root is drunk twice a day for three days to control cough (Ubale).

43. *Triumfetta rotundifolia* Lamk.

Family: Tiliaceae. **Local Name:** Lahan zuzudna. **Part(s) used:** Leaves.

Morphology: It is an erect, branched under shrub, young parts densely tomentose. The leaves are obovate simple, serrate margin, petiole is long, alternate. Flowers are in cluster at node, pedicel is short. Petals are yellow. Fruit is globose with hooked spines. Seeds are trigonous, smooth (PRK 32).

Ethnobotanical Uses: 1) About spoonful extract of root is given two times in a day to stop dysentery (Gangaram) 2) A mixture of one spoonful leaf juice, five spoonful safflower oil and two gm lime is applied over burnt skin till cure (Perchake).

DISCUSSION

The present study 43 plant species were belongs to 23 families are in used in the treatment of various ailments. Among them there are nine trees, eight shrub and twenty six herbs. Some important herbal plants which occur in this region, have exhibited remarkable ethnomedicinal properties. Tribal people use various plant parts such as root, stem, leaves, fruits, flowers and seeds. The different methods of administration of drugs noted during this study are: raw plant part, juice, extract, decoction. Paste, poultice etc. the enumeration has been compared with important published literature (Naik, 1998; Jain, 1991; Khare, 2007; Chopra *et.al.* 1956 and Watt, 1889-1899). During the survey it is noticed that the plant resources of Mahur taluka are still quite rich in raw materials. The local people and tribals are fully depend on medicinal plant for the treatment of various diseases. The number of medicinal plant species were decreasing due to human interference. So the area needs proper protection for conservation and survival of bioresources.

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