

# A Review Article on Pharmacognostic Study of Polyherbal Plant

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**Abstract:** *Pharmacognosy is defined as the scientific study of the structural physical, chemical and biological characters of crude drugs along with their history cultivation, collection, preparation for the market and preservation. Portulaca oleracea is a wild plant pest of orchards and gardens, but is also an edible vegetable rich in beneficial nutrients. Sesame (Sesamum indicum L.), of the Pedaliaceae family, is one of the first oil crops used in humans. Sesame seeds are rich in protein and lipids and have many health benefits. Jasmine essential oils are primarily used in the perfumery industry and have a very high commercial value due to its therapeutic properties. Fenugreek (Trigonella foenum-graecum) is a legume and it has been used as a spice throughout the world to enhance the sensory quality of foods. Neem (Azadirachta indica) is a member of the Meliaceae family and its role as health-promoting effect is attributed because it is rich source of antioxidant. Tulsi, also known as holy basil, is indigenous to the Indian continent and highly revered for its medicinal uses within the Ayurvedic and Siddha medical systems. Curry leaves were originally cultivated in India for its aromatic leaves and for ornament is normally used for natural flavoring in curries and sauces. Henna is a dye obtained from Henna leaves, Lawsonia inermis belonging to the family- Lythraceae. Bhringraj is also known as Kesharaj which means "Ruler of the hair". It is rich in proteins, vitamins and antioxidants which help protect the body against certain infections.*

**Keywords:** Pharmacognosy, legume, spice, sauces

## I. INTRODUCTION

Ever since ancient times, in search for rescue for their disease, the people looked for drugs in nature. The beginnings of the medicinal plants' use were instinctive, as is the case with animals.(1) Now-a-days there is a renewed interest in drugs of natural origin simply because they are considered as green medicine and green medicine is always supposed to be safe. Another factor which emphasizes this attention is the incidences of harmful nature of synthetic drugs which are regarded as harmful to human beings and environment. The advantage of natural drugs is their easy availability, economic and less or no side effects but the disadvantage is that they are the victims of adulteration. The most common error is one common vernacular name is given to two or more entirely different species(2)

Portula oleracea is a wild plant pest of orchards and gardens, but is also an edible vegetable rich in beneficial nutrients. It possesses many antioxidant properties due to the high content of vitamins, minerals, omega-3 essential fatty acids and other healthful compounds; therefore, the intake of purslane and its bioactive compounds could help to improve the health and function of the whole human organism. Sesame (*Sesamum indicum* L.) is one of the earliest human production and consumption oil crops in the family of Pedaliaceae(3) Sesame seeds are rich in protein and lipids and have many health benefits. They have antioxidant, cholesterol reduction, blood lipid regulation, liver and kidney protection, cardiovascular system protection, anti-inflammatory, anti-tumor, and other effects, which have great benefits to human health. Jasmine essential oils are primarily used in the perfumery industry and have a very high commercial value due to its therapeutic properties. Jasmine essential oil has a sweet and floral aroma. Jasmine is sought after for its powerful characteristics that aid the body as an anti-depressant, an aphrodisiac, and its 3 confidence boosting qualities it has on the mind. Seeds of fenugreek spice have medicinal properties such as hypocholesterolemic, lactation aid, antibacterial, gastric stimulant, for anorexia, antidiabetic agent, galactagogue, hepatoprotective effect and anticancer. Azadirachta indica is a tree in the mahogany family Meliaceae. Neem oil extracted from its seeds is used in medicines, pest control and cosmetics etc. and its leaves are used in the treatment of chicken pox. Neem also have anticoccidial effect in broilers and is used as pesticide(4,5) Tulsi (*Ocimum sanctum*) member of family (Lamiaceae) is

the most significant medicinal plants mentioned in Ayurvedic creative writing for its medicinal and religious properties. Tulsi is widely used in home remedy for for treatment of injury, respiratory disorders, hepatic disorders, viral infection, earache, spinal pain, hiccup, inflammation of the conjunctiva in newborns(6,7)*Murrayakoenigii (M. koenigii) (L) Spreng* (Family: Rutaceae) is usually known as “curry leaves”. The tropical and subtropical regions in the world have large distributions of *M. koenigii*(8) *M. koenigii* leaves are slightly bitter in taste, pungent in smell, and weakly acidic. They are used as antihelminthics, analgesics, digestives, and appetizers in Indian cookery (9,10) FAO estimated Henna (*Lawsoniainermis L.*) is a flowering plant, the sole species in the genus *Lawsonia* in the family *Lythraceae* (11) ]. The flowers, seeds, roots, stem and bark of henna plant contain other polyphenols, xanthones, alkaloids and terpenoids. The compounds exhibit a wide variety of biological activities such as, antimicrobial, antiparasitic, antisickling, antipyretic, analgesic, hypoglycemic, anti-inflammatory, immunostimulant and antioxidant effects (12-16)*Ecliptaprostrata (L.) L.* (Syn.: *Eclipta alba (L.) Hassak*, Family: *Asteraceae*) is commonly known as False daisy or Ink plant in English and locally known as *Bhringraj, Bhumiraj, Aalijhar*, and *Nash jhar* in Nepali language.(17-18) Traditionally, it is used to treat different skin problems such as wounds, hair loss prevention, and dermatitis. The leaves are used to treat snakebite in India, China, and Brazil. The mixture of leaf juice and honey is used to cure catarrh in infants(19-20) The juice of *E. prostrata* is taken orally or applied locally to promote hair growth(21)



**Drug Profile :**

**Taxonomic classification:**

1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	Tracheophyta
3)	<b>Order</b>	Caryophyllales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Portulacaceae
6)	<b>Genus</b>	Portulaca
7)	<b>Species</b>	Portulaca oleracea
8)	<b>Binomial Name</b>	Portulaca oleracea

**Use:** It may help maintain hair health as purslane contains omega fatty acids that may help boost hair growth and density

**Sesame oil**



1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	Magnoliophyta
3)	<b>Order</b>	Lamiales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Pedaliaceae
6)	<b>Genus</b>	Sesamum
7)	<b>Species</b>	S.indicum
8)	<b>Binomial Name</b>	Sesamumindicum

Use: Aiding hair growth due to the high level of omega-3 and omega-6 fatty acids

### Jasmine oil



1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	Magnoliophyta
3)	<b>Order</b>	Lamiales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Oleaceae
6)	<b>Genus</b>	Jasmineae
7)	<b>Binomial Name</b>	Jasminum

Use: *It soothes and moisturizes the hair and scalp and promotes hair growth*

### Fenugreek powder



1)	<b>Kindom</b>	Plantae
2)	<b>Division</b>	Magnoliophyta
3)	<b>Order</b>	Fabales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Fabaceae
6)	<b>Genus</b>	Trigonella
7)	<b>Species</b>	T.foenum-graecum
8)	<b>Binomial Name</b>	Trigonella foenum -graecum

**Use:** Fenugreek is a great source of protein and amino acids, which help repair the hair shaft damaged due to dehydration, heat styling, chemicals.

**Neem Powder**



1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	Magnoliophyta
3)	<b>Order</b>	Sapindales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Meliaceae
6)	<b>Genus</b>	Azadirachta
7)	<b>Species</b>	A.indica
8)	<b>Binomial Name</b>	Azadirachta indica

**Use:** It helps make your hair soft and shiny while also removing lice and moisturizing dry and flaky scalp.

**Tulsi leaves powder**



1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	Magnoliophyta
3)	<b>Order</b>	Lamiales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Lamiaceae
6)	<b>Genus</b>	Basil
7)	<b>Species</b>	O.tenuiflorum
8)	<b>Binomial Name</b>	Ocimum tenuiflorum

**Use:** Tulsi benefits hair by rejuvenating the hair follicles and strengthening the roots, which in turn curbs hair loss.

**Curry powder**



1)	<b>Kingdom</b>	Plantae
2)	<b>Divison</b>	Magnoliophyta
3)	<b>Order</b>	Sapindales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Rutaceae
6)	<b>Genus</b>	Murraya
7)	<b>Species</b>	M. koenigii
8)	<b>Binomial Name</b>	Murrayakoenigii

**Use:** curry leaves are rich in antioxidants which help moisturise the scalp, and also remove dead hair follicles.

**Henna powder**



1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	Magnoliophyta
3)	<b>Order</b>	Myrtales
4)	<b>Class</b>	Magnoliopsida
5)	<b>Family</b>	Lythraceae
6)	<b>Genus</b>	Lawsonia
7)	<b>Species</b>	L. inermis
8)	<b>Binomial Name</b>	Lawsoniainermis

**Use:** Henna is extremely nourishing, which helps repair damage in the hair shaft. It also improves hair elasticity and strength.

**Bhringraj powder**



1)	<b>Kingdom</b>	Plantae
2)	<b>Division</b>	<i>Magnoliophyta</i>
3)	<b>Order</b>	Asterales
4)	<b>Class</b>	<i>Magnoliopsida</i>
5)	<b>Family</b>	Asteraceae
6)	<b>Genus</b>	Eclipta
7)	<b>Species</b>	<i>E. prostrata</i>
8)	<b>Binomial Name</b>	<i>Ecliptaprostrata</i>

Use: promote hair growth, strengthen hair, and prevent graying and dandruf

**Morphological and microscopical characteristics:**

**Purslane plant**



**Morphological characteristic:**

The Purslane weed which is an angiospermic plant was collected from sahastradhara region and identified with the help of Garhwal Flora of Babu(22) Purslane has reddish green, herbaceous stem which was aerial, weak and cylindrical, up to 30 cm long, diffusely branched and the internodes are 1.5–3.5 cm in length. Leaves were sessile (stalk less), ovate, smooth, succulent (fleshy and juicy leaf), shiny and vary from 0.5 to 2 inches in length. The leaves were generally arranged in the opposite manner, short petiolated, stipular appendages present were minute or absent and taste sour. Flowers initiation occurs during May to September, originates as single or clusters of 2-5 at the tips of stems. Flowers were bisexual, regular; 2 sepals, ovate, triangular and 3-5 mm long; 5-petals, adnate at base to sepals, broadly obovate, 3-8 mm long, yellow, emarginated; stamens 7-12, half inferior ovary; one celled style with 3-6 arms. Root consists of a long thick taproot as well as many fibrous lateral roots. Seeds were reddish brown to black, oval and tiny. A single plant may produce 240,000 seeds which may germinate even after 5-40 years(23)

**Microscopical characteristic:**

The stem has a cortex, an epidermis, and a pith. The walls of the epidermal cells are thin, polygonal-shaped, tangentially elongated, slightly bulged and surrounded externally by a striated cuticle. The stem is broad and consists of 2-3 layers of outer collenchyma, with the remaining portion composed of thin-walled, less compact parenchymal cells. The leaf is bilaterally symmetrical and contains an epidermis, palisade parenchyma, spongy parenchyma, and ground tissue. The transverse section of the root has a circular outline. It has a periderm, a cortex and a central core of the primary xylem. a. The pollen grains are rounded. The anther has an angular projection on its surface and has two lobes.(24)

**Sesame oil**



**Morphological characteristic:**

Sesame is an erect annual herb that grows 60–150 cm tall. The stem is hollow or has a white pith. The sesame leaves are 3–10 cm long, 2.5–4 cm wide, and rectangular or ovate in shape with a slightly hairy surface. They are borne singly or 2–3 together in the leaf axils. The calyx lobes of sesame are 5–8 mm long and 1.6–3.5 mm wide, lanceolate in shape, and have a pilose appearance. The corolla of sesame is 2.5–3 cm long in a tube shape about 1–1.5 cm in diameter. It is white, often with a purplish-red or yellow halo. The four stamens are hidden inside the flower, the ovary is superior, 4-loculed and pilose outside, and flowering occurs in late summer and early autumn. The sesame capsule is rectangular in shape, 2–3 cm in length, and 6–12 mm in diameter, with longitudinal ribs on the surface and microscopic hairs on the epidermis. Sesame seeds are black or white, the black ones are called black sesame and the white ones are called white sesame (39,40,41)

**Microscopical characteristic:**

Tranverse section of the seed is oval in outline, shows outer epidermis characterized by thin walled palisade cells, where anticlinal walls being more or less wavy, cells contain spherical mass of crystals. The testa consist of collapsed cells with yellowish membrane inside. The endosperm and cotyledons consist of cellulosic, polygonal parenchyma containing fixed oil and small aleurone grains. Starch grains are absent.

### Jasmine oil



#### **Morphological characteristic:**

The flowers are borne in cymose clusters with a minimum of three flowers, though they can also be solitary on the ends of branchlets. Each flower has about four to nine petals, two locules, and one to four ovules. They have two stamens with very short filaments. The bracts are linear or ovate.

#### **Microscopical characteristic:**

In transverse section the leaf appeared dorsiventral in nature showing three layers. It showed the presence of single layered epidermis composed of flat rectangular cells covered by thincuticle while lower epidermis covered by thick cuticle. The uniseriate, unicellular and multicellular covering trichomes were present in the upper and lower epidermis. The glandular trichomes were multicellular with single stalk .Stomata were present only on the lower epidermis. Below the epidermis layer in the lamina the next region was mesophyll which consisted of single layered long elongated palisade cells followed by spongy parenchymatous cells.

### Fenugreek powder



#### **Morphological characteristic:**

Fenugreek is an erect, smooth, herbaceous plant that can grow up to a height of 40-80 cm (Ecocrop, 2017). It is taprooted. Its stems are erect, up to 50 cm high, sometimes branched. The leaves are alternate, compound, trifoliolate, 7-12 cm long, light green in colour. The leaflets are oval, up to 5 cm long, hairy on their lower face. The



flowers are papilionaceous, borne in leaf axils, white, lemon-yellow or purplish blue in colour (Ecocrop, 2017). The fruits occur as straight or sickle-like pods of 2-10 cm, long, thin and pointed, and contain 10-20 seeds. The seeds are 6-8 mm long, oblong or square, green-olive or brownish in colour, with a very strong and spicy odour.

**Microscopical characteristic:**

**Neem**



**Morphological characteristic:**

Neem is a medium-sized tree, reaching 15 to 30 m in height, with a large rounded crown up to 10-20 m in diameter. It is mainly evergreen but sometimes shed its leaves during the dry season (Orwa et al., 2009; Puri, 1999). Neem has a deep taproot and is a mycorrhizal-dependent species. The bark is grey, becomes fissured and flakes in old trees. A sticky foetid sap exudates from old trees in humid climates (Orwa et al., 2009; Puri, 1999). The branches are numerous and spreading. The leaves are alternate, petiolated, clustered at the end of the branches, unequally pinnate, glabrous and dark glossy green at maturity, 20-40 cm in length and bearing 10-20 leaflets (FAO, 2015). The leaflets are 5-10 cm long x 1.2-4 cm broad, sickle-shaped and slightly denticulate (FAO, 2015; Orwa et al., 2009; Puri, 1999). The flowers are numerous, fragrant, white and borne in large clusters (up to 30 cm long). Neem fruits are 1-2 cm long drupes, smooth and green with white milky juice when unripe, turning to yellow to brown when mature. They have a thin epicarp, a mucilagenous fleshy mesocarp and a hard endocarp. They contain a variable number of ovoid (1-2 cm) oil seeds.

**Microscopical characteristic:**

Neem Leaves are imparipinnate, alternate, exstipulate, 3-6 cm long on long slender petioles; leaflets 7-17; alternate or opposite, very shortly stalked, 1-1.5 cm long.

**Tulsi leaves**



**Morphological characteristic:**

Annual herb 30-75 cm high, much branched, stems and branches usually purplish. Leaves are 2.5-5 cm. long and 1.6-3.2 cm broad, elliptical, margin entire or serrate, surface pubescent on sides, minutely gland dotted, base obtuse or acute, petioles 1.3-2.5 cm. long slender, hairy. Inflorescence verticillaster, flowers in racemes 15- 20 cm. Bracts 3 mm. Corolla 4 mm long, purplish, bilabiate upper lip pubescent on the back. Seeds brownish, globose or subglobose. Odour and taste aromatic and sharp. The fruit is a caeruleus.

**Microscopical characteristic:**

Tulsi leaf is dorsiventral. Stomata are of diacytic type, particularly abundant on lower surface. Epidermal cells are wavy walled with thin cuticle. A single layer of elongated palisade cells is present below upper epidermis.

**Curry leaves**



**Morphological characteristic:**

Stems are dark green to brown, with numerous dots. White, funnel-shaped, 5-lobed flowers have a sweet fragrance (1.1 cm wide). Flowers are arranged in clusters (called as cyme) at the terminal. Black, glossy fruits are round to oblong (1.4-1.6 cm long, 1-1.2 cm wide).

**Microscopical characteristic :**

The leaves have the obliquely ovate or fairly rhomboid with acuminate obtuse or acute apex. The petiole is about 20 to 30cm in length and the leaves have reticulate venation and dentate margin with an asymmetrical base.

**Henna**



**Morphological characteristic:**

Henna flowers have four sepals and a 2 mm (0.079 in) calyx tube, with 3 mm (0.12 in) spread lobes. Its petals are ovate, with white or red stamens found in pairs on the rim of the calyx tube. The ovary is four-celled, 5 mm (0.20 in) long, and erect.

### **Microscopical characteristic**

The leaf of *Lawsoniainermis* L. is short and smooth. The midrib is distinct from the lamina. It is broadly shallow on the adaxial side and convex on the abaxial side. It has a single layered polygonal epidermal cells containing cuticle on outer layer only. It also consists of unicellular covering trichome. Diacytic stomata are present on both the surface. The leaf of *Lawsoniainermis* L. is dorsiventral as oblong palisade cells are present below the upper epidermis and absent on lower epidermis. The abaxial epidermis is also very thin and distinct. The ground tissue of the midrib is parenchymatous and homogeneous. The cells are circular or angular and compact.

### **Bhringraj**



### **Morphological characteristic:**

It is an erect or prostrate, branched (occasionally rooting at nodes) annual herb up to 30-40 cm high. Stem is cylindrical or flat, rough due to appressed white hairs, nodes distinct and greenish occasionally brownish.

### **Microscopical characteristic :**

The leaf epidermis is composed of a single layer of parenchyma cells with characteristics of glandular trichomes on both surfaces. In transection, the stem is circular in outline with a ring of collateral ends each vascular bundle of varying size and a central parenchymatous pith. The root has a diarch structure with normal and secondary growth, prominent multicellular secondary xylem rays are seen. The endodermis is distinct. Few layers of cork cells are present.

### **Pharmacological Activity Of:**

**1) Purslane** :It is used as a herbal medicine in many countries, acting as a diuretic, febrifuge, vermifuge, antiseptic, anti-spasmodic and has pharmacological activities including analgesic, anti-bacterial, skeletal muscle-relaxant, wound-healing (31), anti-inflammatory (32), radical scavenger (33) and anti-convulsant (34).

**2) Sesame oil**: Sesame oil produced significant antipyretic effect comparable to paracetamol. In a study, the sesame oil administered as dietary supplement produced analgesic, antipyretic and anti-inflammatory activities in animal models(35).

**3) Jasmine oil**: Jasmine is an ornamental plant that is found throughout Asia and is generally used in aromatherapy. Leaves show pharmacological activities such antiseptic, anti- as spasmodic, and wound healing which is reported from ancient Indian literature (Wealth of India, 2003) Whole plant is traditionally used for chronic ulcer healing, tumor and skin disease. is a remedy for hepatitis and duodenitis. It is also used to treat fever, diabetes, diarrhea, ringworm, ulcers and eruptions in the mouth (Zhao et al 2009).

**4) Fenugreek powder** : Fenugreek is known to have several pharmacological effects such as hypoglycemic, antilipidemic activities(25,26). However, the exact mechanism of action is still unclear. Furthermore, this plant has an antioxidant action(27), gastroprotective activity (28) appetite stimulation (29) , and antirheumatism(30)

**5) Neem powder**: Pharmacological activities of neem compounds have been reported such as antioxidant, anti-inflammatory, antiarthritic, antipyretic, antiviral, spermicidal, hypoglycemic, anthelmintic, antigastric ulcer, and antitumour activities (Gupta et al. 2019).

**6) Tulsi leaves**: The *Ocimum sanctum* L. has also been suggested to possess antifertility, anticancer, antidiabetic, antifungal, antimicrobial, hepatoprotective, cardioprotective, antiemetic, antispasmodic, analgesic, adaptogenic and diaphoretic actions.

**7) Curry leaves**: Curry leaves have a traditional use, either whole or in parts, as antidiarrheal, antifungal, blood purifying, anti-inflammatory, and anti-depressant agents(36,37,38)

**8) Henna powder**: The main pharmacological actions of henna and compounds isolated therefrom include lawsone, coumarine, anti-microbial, anti-tumorigenic, anti-inflammatory, anti-apoptotic, anti-hyperglycemic and anti-lipidemic.

**9) Bhringraj powder**: The plant has been used for its analgesic, antimytotoxic, antihepatotoxic, antibacterial, antioxidant, antihemorrhagic, antihyperglycemic and immunomodulatory properties.

## II. CONCLUSION

Herbal plants are used in the treatment and prevention of diseases. Pharmacognostic studies ensure plant identity, lay down standardization parameters which will help and prevent adulterations. Such studies will help in authentication of the plants and ensure reproducible quality of herbal products which will lead to safety and efficacy of natural products. Therefore, this report describes the various studies of polyherbal plant for beneficial uses.

## REFERENCES

- [1]. Stojanoski N. Development of health culture in Veles and its region from the past to the end of the 20th century. Veles: Society of science and art. 1999:13–34.
- [2]. Dineshkumar C. Pharmacognosy can help minimize accidental misuse of herbal medicine. *Curr Sci* 2007; 3:1356-1358.
- [3]. Zech-Matterne V., Tengberg M., Van Andringa W. *Sesamum indicum* L. (Sesame) in 2nd Century BC Pompeii, Southwest Italy, and a Review of Early Sesame Finds in Asia and Europe. *Veg. Hist. Archaeobotany*. 2015;24:673–681. doi: 10.1007/s00334-015-0521-3.
- [4]. Udedibie ABI, Opara CC. Responses of growing broilers and laying hens to the dietary inclusion of leaf meal from *alchoriacordifolia*. *Anim. Feed Sci. Techno*. 1998; 71:157-164.
- [5]. Esonu BO, Opara MN, Okoli IC, Obikaonu HO, Udedibie C, Iheshiulor OOM. Physiological responses of laying birds to Neem (*Azadirachta indica*) leaf meal based diets, body weight, organ characteristics and hematology. *Online J Health Allied Sci*. 2006, 2(4). <http://www.ojhas.org/issue/18/2006-2-4.htm> 2006.
- [6]. Das S.K., Vasudevan D.M.(2006). *Tulsi: The Indian holy power plant*. *Natural Product Radiance*, 5: 279-83.
- [7]. Prajapati N.D., Purohit S.S., Sharma A.K., Kumar T. (2003). *A Hand Book of Medicinal Plant*, 1st Ed. Agrobios, India, 367.
- [8]. Wojdyło A., Oszmiański J., Czemerys R. Antioxidant activity and phenolic compounds in 32 selected herbs. *Food Chem*. 2007;105:140–149. doi: 10.1016/j.foodchem.2007.04.038.
- [9]. Bhandari P. Curry leaf (*Murrayakoenigii*) or Cure leaf: Review of its curative properties. *J. Med. Nutr. Nutraceuticals*. 2012;2:92–97. doi: 10.4103/2278-019X.101295.
- [10]. Desai S.N., Patel D.K., Devkar R.V., Patel P.V., Ramachandran A.V. Hepatoprotective potential of polyphenol rich extract of *Murrayakoenigii* L.: An in vivo study. *Food Chem. Toxicol*. 2012;50:310–314. doi: 10.1016/j.fct.2011.10.063.
- [11]. Kumar S., Singh Y. & Singh M. (2005) *Henna: Cultivation, improvement and Trade*, Central Arid Zone Research Institute, Jodhpur, India.
- [12]. Singh A. & Singh D. K. (2001) *Indian J Exp Biol.*, 39(3), 263-8

- [13]. Uddin N., Siddiqui B. S., Begum S., Bhatti H. A., Khan A., Parveen S. & Choudhary M. I. (2011) *Phytochemistry Letters*, 4(4), 454-458.
- [14]. Hsouna A. B., Trigui M., Culioli G., Blache Y. & Jaoua S. (2011) *Food Chemistry*, 125(1), 193-200.
- [15]. Chaudhary G. D., Poonia P., Kamboj P. & Kalia A. N. (2012) *Int J Phytopharmacol*, 3, 66-73.
- [16]. Jeyaseelan E.C., Jenothiny S., Pathmanathan M.K. & Jeyadevan J. P. (2012) *Asian Pacific Journal of Tropical Biomedicine*, 2(10), 798-802.
- [17]. Manandhar N.P. *Plants and People of Nepal*. Timber Press; Portland, OR, USA: 2002.
- [18]. Sherchan J., Poudel P., Sapkota B., Jan H.A., Bussmann R.W. *Ecliptaprostrata (L.) L. Asteraceae*. In: Kunwar R.M., Sher H., Bussmann R.W., editors. *Ethnobotany of the Himalayas*. Springer International Publishing; Cham, Switzerland: 2020. pp. 1-19
- [19]. Bakht J., Islam A., Ali H., Tayyab M., Shafi M. Antimicrobial Potentials of *Eclipta alba* by Disc Diffusion Method. *Afr. J. Biotechnol.* 2011;10:7658-7667. doi: 10.4314/ajb.v10i39.
- [20]. Jayathirtha M.G., Mishra S.H. Preliminary Immunomodulatory Activities of Methanol Extracts of *Eclipta alba* and *Centellaasiatica*. *Phytomedicine*. 2004;11:361-365. doi: 10.1078/0944711041495236.
- [21]. Datta K., Singh A.T., Mukherjee A., Bhat B., Ramesh B., Burman A.C. *Eclipta alba* Extract with Potential for Hair Growth Promoting Activity. *J. Ethnopharmacol.* 2009;124:450-456. doi: 10.1016/j.jep.2009.05.023.
- [22]. Babu CR. *Herbaceous Flora of Dehradun*, Publications and Information Directorate. Council of Scientific and Industrial Research, New Delhi, India. 1977
- [23]. . Chowdhary CV, Meruva A, Kumar N, Elumalai RKA. A review on phytochemical and pharmacological profile of (Purslane) *Portulaca oleracea* Linn. *International Journal of Research in Ayurveda Pharmacy*. 2013; 4(1):34-37.
- [24]. . Bown D. *Encyclopaedia of Herbs and Their Uses*. Reader's Digest Association, Canada, 1995, 182.
- [25]. Sharma RD, Raghuram TC, Rao NS. Effect of fenugreek seeds on blood glucose and serum lipid in type 1 diabetes. *Eur J clin nutr.* 1990;44:301-306
- [26]. Ajabnoor MA, Tilmisany AK. Effect of *Trigonella foenum-graecum* on blood glucose levels in normal and alloxan-diabetic mice. *J Ethnopharmacol.* 1998;22:45-49.
- [27]. Belguith-Hadriche O, Bouaziz M, Jamoussi K, El Feki A, Sayadi S et al. Lipid-lowering and antioxidant effects of an ethyl acetate extract of fenugreek seeds in high-cholesterol-fed rats. *J Agric Food Che.* 2010;58(4):2116-2122.
- [28]. Pandian RS, Anuradha CV, Viswanathan P. Gastroprotective effect of fenugreek seeds (*Trigonella foenum graecum*) on experimental gastric ulcer in rats. *J Ethnopharmacol.* 2002;81:393-397.
- [29]. Max B. *This and That: The essential pharmacology of herbs and spices Trends. Pharma Sci.* 1992; 13:15-20.
- [30]. 30.Suresh P, Kavitha ChN, Babu SM, Reddy VP, Latha AK. Effect of ethanol extract of *Trigonella foenum graecum* (Fenugreek) seeds on Freund's adjuvant-induced arthritis in albino rats. *Inflamm.* 2012; 35(4):1314-1321
- [31]. Lee AS, Kim JS, Lee YJ, Kang DG, Lee HS. Anti-TNF-alpha activity of *Portulaca oleracea* in vascular endothelial cells. *Int J Mol Sci.* 2012;13(5):5628-44. doi: 10.3390/ijms13055628.
- [32]. Chan K, Islam M, Kamil M, Radhakrishnan R, Zakaria M, Habibullah M, et al. The analgesic and anti-inflammatory effects of *Portulaca oleracea* L. subsp. *sativa* (Haw.) Celak *J Ethnopharmacol.* 2000;73(3):445-51. doi: 10.1016/S0378-8741(00)00318-4.
- [33]. Askari VR, Rezaee SA, Abnous K, Iranshahi M, Boskabady MH. The influence of hydro-ethanolic extract of *Portulaca oleracea* L. on Th1/Th2 balance in isolated human lymphocytes. *J Ethnopharmacol.* 2016;194:1112-21. doi: 10.1016/j.jep.2016.10.082.
- [34]. Shakeri F, Boskabady MH. A review of the relaxant effect of various medicinal plants on tracheal smooth muscle, their possible mechanism (s) and potency. *J Ethnopharmacol.* 2015;175:528-48. doi: 10.1016/j.jep.2015.10.017.
- [35]. Saleem TS, Basha SD, Mahesh G, Rani PV. Analgesic, anti-pyretic and anti-inflammatory activity of dietary sesame oil in experimental animal models. *Pharmacologia*2011;2:172-7

- [36]. Nalli Y., Khajuria V., Gupta S., Arora P., Riyaz-Ul-Hassan S., Ahmed Z., Ali A. Four new carbazole alkaloids from *Murrayakoenigii* that display anti-inflammatory and anti-microbial activities. *Org. Biomol. Chem.* 2016;14:3322–3332. doi: 10.1039/C6OB00267F.
- [37]. . Joshi T., Jain T., Mahar R., Singh S.K., Srivastava P., Shukla S.K., Mishra D.K., Bhatta R.S., Banerjee D., Kanojiya S. Pyranocarbazoles from *Murrayakoenigii* (L.) Spreng. as antimicrobial agents. *Nat. Prod. Res.* 2018;32:430–434. doi: 10.1080/14786419.2017.1308363.
- [38]. Sharma S., Handu S., Dubey A., Sharma P., Mediratta P., Ahmed Q. Anti-anxiety and anti-depressant like effects of *Murrayakoenigii* in experimental models of anxiety and depression. *Anc. Sci. Life.* 2017;36:215–219.
- [39]. Dar A.A., Kancharla P.K., Chandra K., Sodhi Y.S., Arumugam N. Assessment of Variability in Lignan and Fatty Acid Content in the Germplasm of *Sesamum indicum* L. *J. Food Sci. Technol.* 2019;56:976–986. doi: 10.1007/s13197-018-03564-x
- [40]. Akhila H., SuharaBeevy S. Palynological Characterization of Species of *Sesamum* (Pedaliaceae) from Kerala: A Systematic Approach. *Plant Syst. Evol.* 2015;301:2179–2188. doi: 10.1007/s00606-015-1222-1.
- [41]. Gloaguen R.M., Couch A., Rowland D.L., Bennett J., Hochmuth G., Langham D.R., Brym Z.T. Root Life History of Non-Dehiscent Sesame (*Sesamum indicum* L.) Cultivars and the Relationship with Canopy Development. *Field Crops Res.* 2019;241:107560. doi: 10.1016/j.fcr.2019.107560.