Comparative Study of Different Species of the Genus *Ocimum* L. found around Madinat-ul-Hikmah Hamdard University, Pakistan, with Special Reference to Taxonomical Characteristics.

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Abstract

Ocimum L.is one of the most popular genus that has been prescribed widely over the centuries as the traditional medicine and food, such as essential oils and tea.It is necessary to identify the herbs correctly prior to its use as medicines. The present literature survey focus on the comparative and taxonomical study of three species of *Ocimum* L. reported from Pakistan., These species namely *O. americanum* L., *O. basilicum* L., and *O. tenuiflorum* L. were collected from Madinat-ul-Hikmah Hamdard University. They were identified base on taxonomical parameters.

Keywords:

Ocimum, Tulsi, comparative study, taxonomicalcharacters, Madinat-ul-Hikmah.

1. INTRODUCTION

Madinat-ul-Hikmah is the Main Campus of Hamdard University, Karachi. It is situated in the vicinity of Sindh Baluchistan border on the main highway leading to Bund Murad Khan, which connects it to the Hub Chowki. It is of great historical and geographical significance. The climate is semi-arid, characterized by extreme temperature, severe drought along with high wind velocity and too scanty rainfall (Rahmatullah Qureshi, 2006).

The genus *Ocimum* L. belonged to the family Labiatae which was later called Lamiaceae. This family considered as widely distributed and cosmopolitan. Mostly found in tropical, subtropical, and temperate regions as wild plants (Wu, 1994). The species can be grown inmoderate to extreme temperatures; the species develop best in full sun and well-drained soils(Tropical Plants Database). The name*Ocimum* L. derived from the Greek word 'Ocymum' said by Methiolus which means 'to smell' because of the powerful aromatic and pungent smell. (Grieve, 1998). It has been recognized as a rich source of essential oil and used in the food, pharmaceutical, cosmetics, and aromatherapy industries (Charles, 1990). Furthermore, these species are also widely used

in holy places and gardens, and homes for their fragrance.*Ocimum* L. species are valuable in many aspects, but the most common is for culinary purposes. The herb use in both forms as fresh and dry, basil is used to flavor foods such as vegetables, poultry, fish, tea and oils. The herb is famous for use in French soups and sauces and Italian, European, Egyptian, and Asian dishes(Kintzios, 2008).

Our aim is accurate identification of *Ocimum* L. species, highlight differences between them and standardize their taxonomical names using reference literature. These are important prior to recommending their utilization for culinary and medicinal purposes.

2. MATERIAL AND METHOD

The species were collected from different regions of Madinat-ul-Hikamah, and near faculty of Pharmacy, Hamdard University as mentioned in Appendixand deposited in the Herbarium of Hamdard University for record as (voucher no. H10-H12).

Each taxon is studied under the **Stereoscope (**Nikon SMZ 645) in University of Karachi and the morphological description such as description of stem, leaves, inflorescence, flower, and seeds are given including scientific name, vernacular name, and distribution and comparative morphological studies of these species. (Table 1), (Fig. 1-3).

The literature survey was carried out on morphology and medicinal uses of *Ocimum* L. species are in accordance of (Hedge, 1990)and documented.

Table 1. Appendix for collection of specimen details.

S.No.	Specie Name	Date of Collection	Location	GPS	Herbarium no.
1.	*Ocimum americanum*L.	25.01.2021	Behind of Faculty of Pharmacy	25.089722, 67.014725	H-10
2.	*Ocimum basilicum* L.	21.01.2021	Nearby Tomb of Hakim Said Shaheed	25.084723, 67.008331	H-11
3.	*Ocimum tenuiflorum*L.	21.01.2021	Herbal garden, Behind Faculty of Eastern Medicine	25.085278, 67.010277	H-12

3. RESULTS AND DISCUSSION

In this study, all species of such a valuable genus *Ocimum* L. reported from Pakistan have been demonstrated with the taxonomical differences between the various species grown around Madinat-ul-Hikmah,Hamdard University, Karachi. The species of this genus can also be useful at the commercial bases due to its survival nature in different seasonal and climatic conditions i.e. too cold and too hot weather as it is growing near the junction of Sindh and Baluchistan provinces.

3.1.General Morphology of Genus *Ocimum* L.(Basil).

Annual or perennial herbs or sometimes

undershrubs (woody), strongly aromatic. **Stem** branched, erect, hairy, green to purplish green or woody. **Leaves** petiolate, simple, dark green to light green or purplish green, gland-dotted on both surfaces, ovate to ovate oblong or elliptic, margin sub entire to serrate. **Inflorescence** terminal or axillary spike or raceme, verticillasters 6-10 flowered, small, white, purplish white, or purplish to violet, pedicillate, pedicel spreading or adpressed. Calyx ovoid- campanulate, bilabiate, 5 lobed, (1/4), infundibular to tubular, upper lobe broad, straight, curved upward or rarely bent downword. Corollatubular,bilabiate, 5 lobed (4/1), upper lip 4-lobed sub equally, lower lip entire, flat, spreading. Stamens 4, exserted, didynamous, declined on lower lip corolla, filaments usually free, anther ovoid-reniform, unilocular. Style bifid. Nutletfinely rugulose, sub globose to oblong-ellipsoid, rounded, glabrous.

About 100-150 species found worldwide and 3 species are reported from Pakistan and also found from Madinat-ul-Hikmah Hamdard university, Karachi. Among which only one specie seems to be native while remaining are cultivated for different purpose (Hedge, 1990).

Key to species

1 + Fruiting pedicel spreading, calyx tube glabrous within…….....*O. tenuiflorum*

-Fruiting pedicel adpressed, calyx tube bearded within…….… 2

2 + Verticillasters often condensed and purplish ……...*O. basilicum*

-Verticillasters clearly separated and mostly greenish……. *O. americanum.*

3.2. Ocimum americanum L.,

Herb perennial, stem erect 30-80 cm, retrorse, hairy, light green to woody. Inflorescence long, verticillasters 5-18, clearly separated, 6 flowered. Leaves elliptic to ovate, blade 1-4 cm x 1-2 cm, margin serrate to sub entire. Calyx 4-5 mm in flowering, 6-8 mm in fruiting. Corolla white, 5-7mm, lower lip longer than upper. Nutlet dark brown or black, narrowly oblongto ellipsoid, c. 2x1.3 mm.

Distribution

Tropical Africa, Arabia, Pakistan, Kashmir, Himalayas to Nepal, Sri Lanka, Malaysia.

Vern. Name: Jungli Tulsi.

3.2.1. Chemical constituents

Essential oil, eugenol, ocimene may found in this specie (Pullaiah, 2006). Three types of volatile oils yield from *O. americanum* may be distinguished. One is containing methyl cinnamate as the principal constituents, the second containing d-camphor and the third citral(Sastri, 1966).

3.2.2. Medicinal properties

This specie possesses aromatic, carminative, diaphoretic and stimulant properties (Pullaiah, 2006). Decoctions made from *O. americanum* are used in cases of chest trouble and dysentery; and an essential oil also extracted from the plant (Grieve, 1998)(Sastri, 1966), while also useful in hyperdipsia, malaria, migraine and emaciation (Arya Vaidya Sala, 1995).

3.3. Ocimum basilicum L.

Herb, perennial, 30-80 cm, sometimes up to 1 m tall, retrorse, stem light green or less woody than the previous taxa, glabrous. Inflorescence often condensed and purplish. Leaves ovate to elliptic, blade 2-8 x 1-4 cm, margin sub entire to serrate.

Flowering calyx 4-5 mm and fruiting calyx 7-8 mm, Corolla pinkish or purplish white, 8-9 mm. Nutlet black, ellipsoid, c. 2.5 x 1.5 mm.

DistributionSub tropical and Tropical Asia, Africa, South East Asia.

Vern. Name: Niazbo

3.3.1. Chemical constituents

These include volatile oils, saponins, coumarins, alkaloids, tannins, anthra-quinones, anthocyanins, flavonoids, di-terpenoides, tri-terpenoides, pyridines, pyrrolidines, polyphenols, iridoids, quinones, sugars and insect moulting hormones (Rubab, 2017). Flavonoids, essential oil, and caffeic acid also reported by (Pullaiah, 2006)Some other constituents found in essential oil are also reported such as linalool, methyl chavicol, eugenol, 1, 8-cineole, geranial. neral, methyl cinnamate. (Nurzynska-Wierdak, 2013) i.e. also reported by Koba*et al.*, 2009, Singh*et al.*, 2010.

3.3.2. Medicinal properties

Ocimum basilicum L. is an important medicinal and culinary herb that contains highly antioxidant compounds, antibacterial, antimicrobial, antifungal, antiviral, anticonvulsant, and natural phenolic compounds.It's also shows hypoglycaemic, hypolipidemic, spermicidal, dermatologic, and insecticidal effects (Rubab, 2017). It is also reported that this plant has been used as an anthelmintic, nervine, diuretic, diaphoretic, demulcent, and to treat piles, bronchitis, rheumatism, inflammation, fever, cough, worms, stomach complaints and gout.(Pullaiah, 2006).

3.4. Ocimum tenuiflorum L.,

Herb perennial, stem erect 30-80 cm, sometimes up to 1 m tall, purplish green, spreading, hairy. Leaves dark green to purplish,ovate-oblong to elliptic, 0.8-4 x 0.5-2 cm, margin serrate. Verticillasters 8-12, separated. 3-6 flowered. Pedicels 2-3 mm, spreading in fruit. Calyx in flower 2 mm, in fruit 4-4.5 mm. Nutlet pale brown, globose to ovoid, 1.2 x 0.8 mm.

DistributionAlmost Pantropical, widely cultivated in Tropical Asia,

Vern. Name: Tulsi

3.4.1. Chemical constituents

Terpenes and Eugenol (which is the predominant character of essential oil) have been mainly reported in *Ocimum tenuiflorum*(Pullaiah, 2006). Eugenol is the active constituent largely present in leaves that contributes to therapeutic potential as pain killer and reduces blood glucose levels in type-2 diabetics (Malav, 2015).

3.4.2. Medicinal properties

The herb is useful in the treatment of respiratory system disorders. It also has strengthening effect on the kidney, beneficial effect in cardiac diseases. Act as anti-stress agent and good for headache (Pullaiah, 2006). Also treat genitourinary disorders, ringworm, verminosis and skin diseases (Arya Vaidya Sala, 1995).

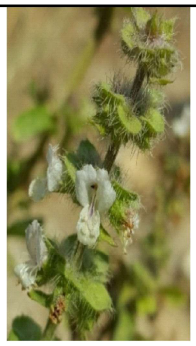
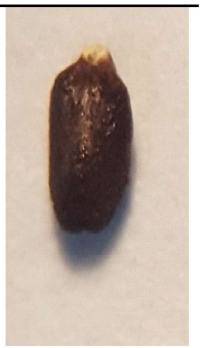
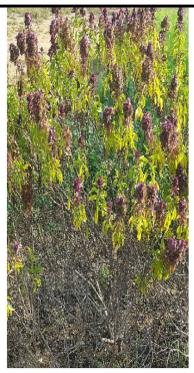
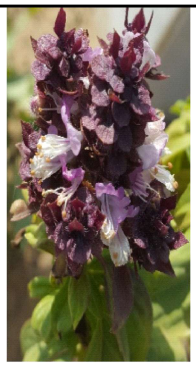
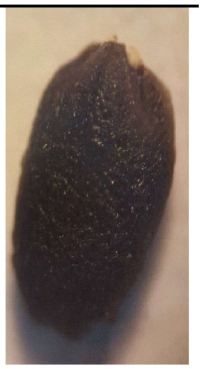
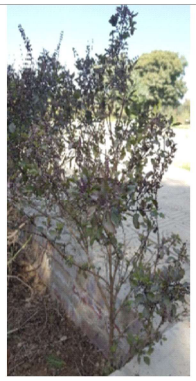
S. No.	Specie Names	Whole Plant	Leaves	Flowers	Seeds
1.	*Ocimum americanum* L.				
2.	*Ocimum basilicum* L.				
3.	*Ocimum tenuiflorum* L.				

Fig 1. Comparitive species of Ocimum L.

Fig.2. Photographs of Leaves of different species of *Ocimum* L. **A**. *Ocimum americanum* L., **B.***Ocimum basilicum* L., **C**. *Ocimum tenuiflorum* L.

Fig.3. Photographs of seeds of different species of *Ocimum* L. **A**. *Ocimum tenuiflorum*L., **B.***Ocimum americanum* L., **C**. *Ocimum basilicum* L.

4. CONCLUSION

We concluded that *Ocimum americanum* (jungle tulsi) resembles with the *Ocimum basilicum*(Niazbo) i.e. cultivated specie, and the morphologicalcharacteristic of *O. americanum* is comparatively smaller than *Ocimum basilicum* L. The main characteristic that have been observed was Inflorescence which is condensed in *O. basilicum* while separated inflorescence found in*O. americanum*. The other specie *O. tenuiflorum* L. (Tulsi) has shown the different characters among all and easily recognizable.

In addition, chemical constituents also differentiated closely related species.It must state that this study will not only be helpful in the identification of these species on the taxonomical growth but also beneficial for agricultural and horticultural aspects too. Moreover, their excellent medicinal potential i.e. antioxidant, antipyretic, and antiviral due to having stronashing chemical components such as polyphenols, anthocyanins, anthraquinous, eugenol, methyl cinnamate, and campheraceus. These compounds mainly found in *Ocimum basilicum* L. and *Ocimum tenuiflorum* L. and might be useful for the certain biological diseases which is currently enhanced due to viral infections.

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