Innovations

Ethnomedicininal Profile and Bioactive Compounds of "Loranthus" Species

Subhashini Kuramana[1], Gaddeyya Gandipilli[2], and P. K. Ratna Kumar[3]

[1,2,3] Centre for Advanced Study, Department of Botany,
Andhra University, Visakhapatnam-530003, Andhra Pradesh, India

Corresponding author*:* Subhashini Kuramana

Abstract:

Climate change, the loss of biodiversity, the depletion of plant resources and deforestation due to anthropological activities threaten human life in the areas of food security, health and sustainability. The overpopulation of developing countries and natural and manmade disasters demand the need for medicinal resources from plants for human health. Mistletoes are a specialised group of plants commonly known as parasitic flowering plants. Apart from their parasitic nature, they are considered tremendous medicinal herbs worldwide due to the health benefits of their ingredients or phytochemical constituents. The present study attempted to review ethnomidicinal aspects of a total of five mistletoes, such as Loranthusparasiticus*Mirr*, Loranthuslongiflorus *Desr (Dendrophthoefalcata),* Loranthusferruginus*(*Scurrulaferruginea*Danser),*Lonathusmicranthus*Linn, and* LoranthuseuropaeusJac., *that belong to the family Loranthaceae. The phytochemical constituents of Loranthus species and their activity as folk remedies or traditional usage are also systematically represented.The study enlightens the distribution, traditional uses, and important bioactive compounds of selected mistletoes for further research.*

Keywords:*1.Mistletoes, 2.Loranthaceae, 3.phytochemical constituents,*4.Loranthus longiflorus

Introduction:

The Republic of India is the 7th largest country in the world as well as the second largest in Asia. There is a beautiful diversity of plants in India represented with various forest types such as tropical rain forests, tropical moist and dry deciduous forests, wet tropical evergreen forests, mangrove forests, and desert and thorn forests. Ethnomedicinal practice or traditional medicine is unique and well established in the era of 2500 to 500 B.C in India. The traditional medicinal practice of India flourished as Ayurveda, Siddha, Unani and homeopathy and spread to other neighbouring countries. India was recognised as one of the twelve mega biodiversity centres of the world because of various agro-climatic conditions and rich species diversity. India also represented two major hot spots of endemic species; among them 15,000 to 20,000 plant species have medicinal importance. However, 30% of species are endemic medicinal plants that reflect the demand of cultivation, conservation and sustainable use of ethnomedicinal plants. Moreover, 70% of Indian medicinal plants are found in tropical areas mostly in Western Ghats and Eastern Ghats (ICS-UNIDO, 2016).

Natural products are widely used as folk medicine or phytoremedial practice by indigenous people for long ago. Many wild plants are the pool of bioactive compounds that used for human healthcare. Loranthaceae, a unique family in plant kingdom, comprises mostly epiphytes and hemiparasites also produce many phytoremidial compounds. The members of loranthaceae are parasitic flowering plants that widely distributed in tropical

regions including India (Calvin and Wilson, 2006). There are a total of 75 genera that represented Loranthaceae and are globally known as mistletoes (Barlow, 1991; Calvin and Wilson, 2006). This group of plants show diverse characteristics and adhere to host species by means of haustoria are known as mistletoe (Loranzei, 2000). Species of Loranthaceae are very important plants in various ecosystems, such as forests, deserts, mangroves and manmade ecosystem. They maintain ecological balances and beautiful interactions with insects, birds and mammals for their pollination and seed dispersion (Watson, 2001). Arial mistletoe, *Loranthus*is a medicinal herb that widely used by ethnic people (tribal/indigenous) to cure a variety of human ailments in India. Experimental and pharmacological investigations revealed that the decoction of the plant is useful in the treatment of high blood pressure (BP) and gastrointestinal complaints (Ameer *et*., 2015).

India is endowed with a plenty of medicinal plants including mistletoe, a specialised group of plants. Nevertheless, scientific data on phytomedicinal knowledge is limited in the area of medicinal mistletoe such as *Loranthus.* Even though,investigation on some species of Loranthaeceae is recently reported, but still some species are under not evolution for phytomedicine. Globally there is a demand of phytomedicine due to various pandemic diseases such as COVID-19 caused by pathogenic virus recently. India is a hub of natural medicine that represented by huge diversity of medicinal plants including mistletoes. Therefore, this study brings back the need of ethnic knowledge on *Loranthus* and its sustainable utilisation.

Ethnomedicinal study

The family Loranthaceae, which includes mistletoes, is a unique family in the order Santalales (Sandalwood family). Mostly, the members of Loranthaceae are hemiparasitic plants with high medicinal values. These are considered medicinal herbs worldwide and are used in traditional and folk medicine for several human alignments **(**Table1**).** Data on the ehthnomidicinal properties of a few mistletoe plant species were gathered from relevant literature and previous studies. Personal observations were made in the case of *Loranthuslongiflorus*Desr (*Dendrophthoefalcata*), which is widely used by ethnic and native people of Andhra Pradesh in India **(**Table 2&3**).**

1. *Loranthuslongiflorus*Desr (honey suckle mistletoe or Indian mistletoe)

Synonym: *Dendrophthoefalcata* (L.f) Ettingshausen

The mistletoe, *L. longiflorus*(Loranthaceae), is a native of the Indian subcontinent and it is used in the world-famous Indian traditional practise of Ayurveda. This mistletoe is popularly known as Vanda in Indian folk medicine, and the whole plant is consumed by ethnic people and other native people of India. The mistletoe has some unique features such as long, curved many flowered recemes (Figure 1). Fruits or berries of the mistletoe are red to saffron in colour at mature stage (Figure 2). The plant is widely spread in tropical and temperate agroclimatic conditions and has been reported from India, Sri Lanka, Bangladesh, Malaysia, Myanmar, Thailand, China and Australia (Subhashini et al., 2019 and 2020). The mistletoe seeds are disseminated by frugivorous birds, and they spread the invasion of the parasite on a variety of host plants, including *Mangiferaindica* (mango), *Annonasquamosa*(Sugar apple), *Psidiumguajava*(guava), *Achraszapota*(sapota) and *Punicagranatum*(pomegranate).

Traditional uses:

This parasitic plant is widely used in Indian folk medicine and the Ayurvedic system of medicine. Tribal and native Indians of south and north states consume a variety of plant parts, including leaves, branches, stems, bark, flowers, and fruits. The mistletoe, as a wonder drug in Indian folk medicine, has many medicinal values including narcotic, diuretic, astringent, antifertility, anticancer, antiulcer, and the decoction of the plant is applied to cure pulmonary tuberculosis, asthma, menstrual disorders, swellings, wounds, and other diseases (Sarvani, *et al.*, 2011).

Bioactive constituents:
Many secondary metabolites or phytoconstituents are reported from the methanolic extract of the plant in India, among which quercetin and quercetrin are commonly identified (AYUSH, 2015).

2. *Loranthusparasiticus* Merr (Chinese mistletoe)
Loranthusparasiticus (Loranthaceae) is widely used in Chinese traditional medicine. It is popularly known as Sang Ji Sheng in China and has spread around China, Japan, and Malaysia. The mistletoe is commonly parasitic on *Osmanthusfragrans*, *Cinnamomumburnanni*, *Coriariasinica*, and *Neriumindicum* (Moghadamtousi et al., 2014)

Traditional uses:
This parasitic plant is widely used in Chinese folk medicine to cure many human ailments. The plant is consumed in the form of either a decoction or a paste by the Chinese. The mistletoe has many medicinal values and health benefits, including neuroprotective, immunomodulatory, tranquilizing, anticancer, antiviral, diuretic, antimutagenic, antioxidant, antinephrotoxic, antihepatotoxic, and hypotensive agent.

Bioactive constituents:
Some important bioactive compounds are isolated from the Chinese mistletoe, *Loranthus*parasiticus for health care. They are Coriaria lactone and sesquiterpene lactones such as Coriamyrtin, Tutin, Corianin, and Coriatin.(Wu and Zhang,1984)

3. Loranthusmicranthus Linn. (African mistletoe)
Loranthusmicranthus, a member of Loranthaceae is commonly known as African mistletoe or Nigerian mistletoe. The parasitic plant is widely distributed in Estren Nigeria and other parts of Africa. The mistletoe is parasitic on diverse plants, including *Baphianitida, Kola acuminate, Persia Americana,Mangiferaindica,* and *Azadirachtaindica*(Osadebe, 2010; Cemaluk, 2012; Moghadomtousi*et a*l., 2013).

Traditional uses:
The mistletoe, *L. micranthus,* is a medicinal herb and is used by various native peoples of Africa. The plant has many medicinal values and is used to cure many health disorders. The plant is used for various human health problems such as antidiabetic, antimicrobial, antihypertensive, antioxidant, anticancer, immunomodulatory, antimicrobial, hypolipidemic activity, menopausal syndrome, rheumatism, infertility, epilepsy, schizophorenia, and cardiovascular diseases.

Bioactive constituents:
The major bioactive constituents of Loranthusmicranthus are Lupeol, Lupinine, Loranthoic acid, Catechin, Quercatin and Rutin.

4. *Loranthusferruginus*Roxb (Rusty –leaf Mistletoe)
Synonym: *Scurrulaferruginea*Danser
*Loranthusferruginus*is commonly known asrusty-leaf mistletoe belongs to family Loranthaceae. The parasitic plant is a medicinal herb and traditionally known as “dedaluapi “and “dalu-dalu” in folk medicine. The common host plants of *L. ferruginus*include *Vitexnegundo* L., *Micromelumminutum*(G.Forst.) Wight&Arn., and *Tecomastans* (L.).Juss ex HBK. The mistletoe is native of India, Malaysia, Sumatra, Singapore, Australia and New Zealand (Ameer, 2015).

Traditional uses:
The mistletoe has some important medicinal properties and used as antiviral, anticancer, cytotoxic, treatment of lower blood pressure, ulcer treatment, high blood pressure, snakebites, wounds, fever, malaria and gerontological effects (enhancement of memory).

Bioactive constituents:
Bioactive compounds such as Quercetin, Quercitrin and 4-O-acetyl quercetrin are identified from the plant extract of *Loranthusferruginus*.

5. *Loranthuseuropaeus*Jacquin(European yellow mistletoe)
*Loranthuseuropaeus*Jaq. is a hemiparasitic plant species that belongs to the family Loranthaceae. The parasitic plant is known as European mistletoe, Yellow-berried mistletoe, and Showy mistletoe and is distributed in Central Europe, South-Eastern Europe, Anatolia, South Russia, and China (Watson and Dallwitz, 1991). The fruit of the mistletoe is yellow, roundish and single seeded that dispersed by birds (Figure 3).The mistletoe is parasitic on European forest plants such as *Quercusrobur* L., *Quercuspetraea* (Matt.) Liebl, and *Castaneasativa* (European Chestnut).

Traditional uses:
Loranthuseuropaeus is a medicinal herb and is widely used in traditional practises in European countries. The plant has tremendous medicinal properties and is used in the treatment of various health disorders such as inflammation(antiinflammatory agent), wound healing, antimutagent, antimicrobial, anticarcinogenic, antioxidant, and immunomodulatory therapy**(Jawad,2006; Khalifa, 2016).**

Bioactive constituents:
Major bioactive compounds such as Quercetin, Rutin, Lueteolin, Sesquiterpene lactones, Kaempferol, (+) - Catichin, 3, 4 - dimethoxycinnamylalcohol and 3, 4, 5- trimethoxycinnamylalcohol are isolated from the plant extracts of*Loranthuseuropaeus*.

Conclusions

Medicinal herbs are the key resources of traditional medicinal practise in India as well as in other ancient cultures of the world. These herbs are relatively cheap and abundantly available in nature at no cost. Mistletoes, the reservoirs of many bioactive compounds, have great medicinal value and are considered for further investigation in the field of phytopharmacology or phytoceuticals. Although some members of the loranthaceae are widely used in traditional medicine, the research up to laboratory level is not well developed due to insufficient data on medicinal constituents. Currently, there are about 75 genera of Loranthaceae that are known as mistletoes, but only a few species are considered for medicinal usage. As a result, more research on mistletoes, which are used in both traditional and modern medicine, is required to ensure their long-term use.

Acknowledgements:
Authors are very thankful to tribal people and native people of costal Andhra Pradesh for their support and information during field survey

Conflict of interest of authors
There are no conflicts of interest

Financial support
There is no financial support to authors for the present research

References

1. *Ameer Omar, Z., Ibrahim, M., Salman, Ko Jin Quek., Mohd Z. Asmawi.(2015) Loranthusferrugineus: A mistletoe from Traditional Uses to Laboratory Bench. Journal of Pharmacopuncture 18(1):007-018.*
2. *AYUSH. (2015).The Ayurvedic Pharmacopoeia of India. Part I, Vol.V. Published by Government of India, Ministry of Health and family welfare, Department of Ayush.*
3. *Barlow B. (1991). Provisional Key to the genera of Loranthaceae and Viscaceae of the flora malesiana region. Flora Malesiana Bull 10: 335-8.*
4. *Calvin, C.L. and Wilson, C.A. (2006).Comparative morphology of epicortical roots in old and new world Loranthaceae with reference to root types, origin, patterns of longitudinal extension and potential for clonal growth. Flora-Morphology, Distribution, Functional Ecology of plants, 201(1): 51-64*
5. *CemalukEgbuonu, AC. and Emeka, NN.2012. Phytochemical properties of some solvent fractions of petroleum ether extract of the African mistletoe (Loranthusmicranthus Linn) leaves and their antimicrobial activity. African Journal of Biotechnology11(62):12595-12599.*
6. *ICS-UNIDO (2006). Compendium of medicinal and aromatic plants. Volume II. Asia. Published by United Nations industrial Development Organisation and the International Centre for Science and High Technology, Italy. pp.295*
7. *Jain SK (1965) Medicinal Plantlore of the tribals of Baster. Econ Bot 19(1965) 236-250*
8. *Jawad, AAH., Al-Rubaee, M.A. and AL-Diab. J.M. (2006). Effects of Loranthuseuropaeus seeds on Pyogenic Inflammation in Rabbits. Journal of Missan Researches 2, 4.*
9. *Subhashini, K., Ratna Kumar, P.K. and Gaddeyya,G.2019. A comprehensive review on Dendrophthoefalcata(L.f.) Ettingsh. (Loranthaceae). Tropical Plant Research 6(3): 514–520*
10. *Khalifa, E.S., Noaimi, A.A. and Banaz, A.S.(2016). Loranthuseuropaeus as an Alternative Medicine in Treatment of Acute Cutaneous Lesihmaniasis: Review Article. Journal of Cosmetics, Dermatological Sciences and Applications, 6:24-33.*
11. *Kulakarni, D.K. and Kumbhojkar, M,S .(2002). Traditional use of family loranthaceae from western Maharashtra, India. Anceient science of life vol.No.XXI(3) January, page.178-181.*
12. *Lorenzi H.(2000).Weeds of Brazil: Terrestrial, Aquatic, Parasitic and Toxic Herbs. 3rd Edn, Plantarum Institute, Nova Odessa, Brazil.*
13. *Moghadamtousi, S.Z., Maryam, H., Kadir, H.A. and Keivan, Z. 2013. LoranthusmicranthusLinn:Biological Activities and Phytochemistry. Hindawi Publishing Corporation, Evidence-Based Complementary and Alternative Medicine.p.9.*
14. *Moghadamtousi, S.Z., AlfarizalKamarudin, M.N., Chan CK., HingGoh, B. and Abdul Kadir H.2014. Phytochemistry and Biology of LoranthusparasiticusMirr, a commonly used herbal Medicine. The American Journal of Chinese Medicine, 42(1):23-35*
15. *Osadebe, P.O, Omeje, E.O, Sylvester, C.N, Esimone, C.O, Philip, F.U., David, E.K. and Uzoma, J.U.2010.Antidiabetic principles of Loranthusmicranthus Linn. parasitic on Persea Americana. Asian Pacific Journal of Tropical Medicine, 619-623.*
16. *Sarvani, M,,Chaitanya, S.K., Manjula, T.(2012).Pharmacognostic, Phtochemical and Pharmacological review of Dendrophthoefalcata. Journal of Phytology 3(3): 18-25*
17. *Shanavaskhan, A.E., Sivadasan, M., Affarhan, A.H. and Thomas, J.(2012). Ethnomedicinal aspects of angiospermic epiphytes and parasites of Kerala, India. Indian J.Tradit. Knowl 11: 250-258.*
18. *Subhashini, K., Gaddeyya, G. and RatnaKumar,P.K.(2020). Studies on Biology, Seed dispersal and Host interaction of Dendrophthoefalcata(L.f.) Etting. - A stem parasite of Mangiferaindica L. (Mango). World Journal of Advanced Research and Reviews 08(03), 097–103.*
19. *Watson, D.M. (2001). Mistletoe –A keystone resource in forests and woodlands, worldwise. Ann. Rev.Ecol.Syst 32:219-249.*
20. *Watson, L. and Dallwitz, M.J.(1991). The families of angiosperms: automated descriptions, with interactive identification and information retrieval. Aust.Syst.Bot 4:681-95.*

21. *Wu, C. and Zhang, G. (1984).Quantitative analysis of sesquiterpene lactone in Loranthusparasiticus (L.)Merr. Parasitizing on Coriariasinica Maxim and seeds of Coriariasinica Maxim. Acts Pharm. Sin.19: 56.*

Tables

S.No	Species	Traditional Name	Distribution
1.	LoranthusparasiticusMirr	Sang Ji Sheng	China, Japan, Malaysia
2.	LoranthuslongiflorusDesr Syn: Dendrophthoefalcata (L.f) Ettingsh.	Vanda	India, Sri Lanka, Thailand, China, Australia, Bangladesh, Malaysia, Myanmar
3.	LoranthusferruginusRoxb Syn: ScurrulaferrugineaDanser	Dalu-Dalu Dedaluapi	Malaysia, Sumatra, India, Singapore, Australia, New Zealand, Malaysia
4.	Lonathusmicranthus Linn.	African mistletoe (nbunnunu)	Nigeria, other parts of Africa
5.	LoranthuseuropaeusJac.	European mistletoe yellow-berries mistletoe	Central Europe, South-Eastern Europe, South Russia, Anatolia

Table 1. Species of *Loranthus* used in traditional medicine worldwide

Parasite	Host	Phytoremedial uses	References
Loranthuslongiflorus Synyme. Dendrophthoefalcata	Mangiferaindica L	Urine trouble Wound healing Antifertility	Kulkarni and Kumbhojkar, 2002
	Annonasquamosa	Narcotic, Diuretic Pulmonary tuberculosis	Sarvani et al., 2011
	Artocarpusheterophyllus Lam.	Inflammation	Shanavaskhan et al. 2012
	Careyaarborea L.	Smallpox and rheumatic condition	Shanavaskhan et al. 2012
	Tamarindusindica L.	Treating impotency	Jain, 1965
	TecotonaGrandis L.	Urine trouble	Kulkarni and Kumbhojkar, 2002
	Ficusracemosa L	Bone fracture	Kulkarni and Kumbhojkar, 2002
	Grecian tillifoliavahl	Bone fracture	Kulkarni and Kumbhojkar, 2002
	Sterculiaurens	Bone fracture	Kulkarni and Kumbhojkar, 2002
	DiosporyosmelanoxylonRoxb.	Bone fracture	Kulkarni and Kumbhojkar, 2002
	Crassiacarandus L	Diarrhoea Wound healing	Kulkarni and Kumbhojkar, 2002

Table 2. Phytoremidial uses of *Loranthuslongiflorus*based on host preference

Plant part	Phytoremedial Composition / Plant material used	Folk remedy/ Ethnic usage
Whole Plant	Decoction	High blood pressure Gastrointestinal complaints
Whole Plant	Decoction	Antifertility agent
Whole Plant	Tonic/ Plant Extract	Leucorrhoea
Whole Plant	Tonic/ Plant Extract	Urine disorder
Leaves	Fresh leaves	Anti diabetic
Fresh leaves	Paste	Wound healing
Leaf	Paste	Easy delivery of Placenta(after birth)
Leaf	Paste	Skin diseases
Fresh stem	Paste	Wound healing
Stem	Paste	Urine disorder
Stem	Paste	Bone fracture
Flower	Powder	Malarial fever, Small pox, Chicken pox
Dryfruit	Poltice	Maturation and Acceleration in the drain of pulse
Bark	Powered/Extract	Menstrual troubles, Tuberculosis, Asthma Astringent Narcotic
Bark	Partial powder	Substitute for betel nut
Flower	Extract	Dye (Nail Polish),
Stem	Dry stem	Witchcraft
Tender Shoots	Extract	Softening leather
Fruits	Fresh Fruits	Edible
Leaves/Branches	Small Twigs	Fodder for cattle

Table 3. Phytoremedial and ethnic usage of *Loranthuslongiflorus*(Syn.*D.falcata*) by indigenous people in India

Figure 1. Inflorescence of Loranthuslongiflorus Desr [**Syn. Dendrophthoefalcata (L.f)]**
(Photo courtesy: Subhashini, Gaddeyya, Ratna Kumar, 2020)

Figure2. Fruits of Loranthuslongiflorus Desr [**Syn. Dendrophthoefalcata (L.f)]**
(Photo courtesy: Subhashini, Gaddeyya, Ratna Kumar, 2020)

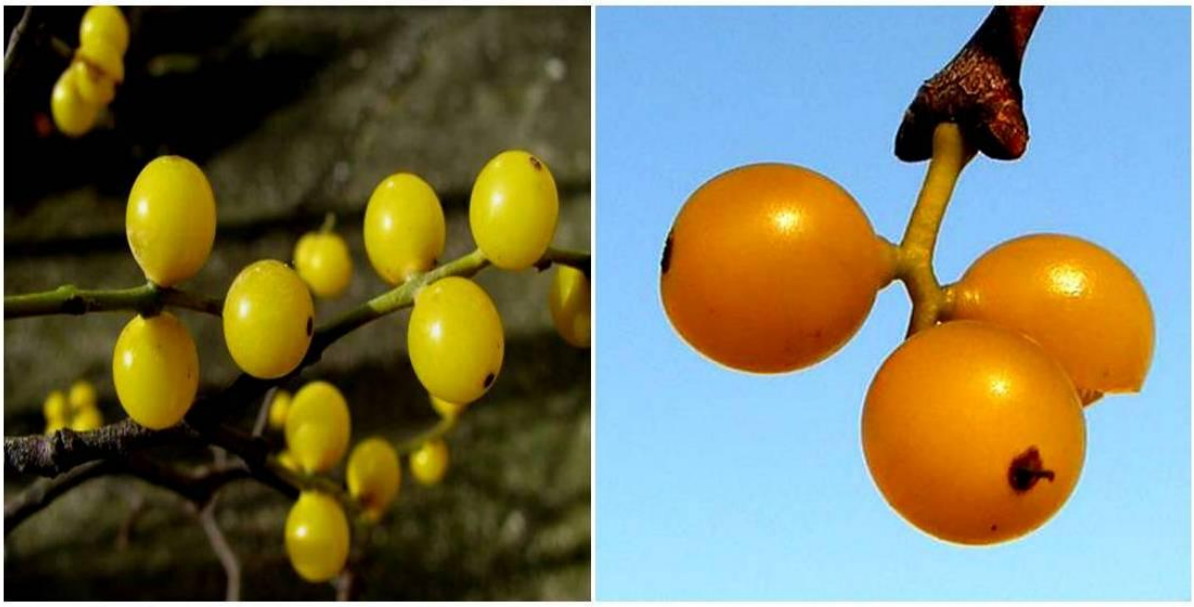

Figure 3. Yellow-coloured fruits of *Loranthuseuropaeus* (European mistletoe) (Photo courtesy: Watson and Dallwitz, 1991)

Corresponding author's e-mail: mycology.au@gmail.com