



MIMUSOPS ELENGI LINN:A REVIEW

Anuradha.S.N¹, Arunkumar.S²

¹Unit of Pharmaceutical Technology, Faculty of Pharmacy, Asian Institute of Medicine, Science and Technology (AIMST) University, Bedong 08100, Kedah, Malaysia

²Scientist, IPDO, Dr.reddys lab, Hyderabad, India.

ABSTRACT

Malaysia has diverse population combined by three races with their traditional system of medications. Large fraction of this population still depends mainly on traditional medicine. Use of herbal products is getting familiar in the growing generation as awareness on personnel healthcare has become a way of life. The naturally available plant products proved to be a no side effect medication foe a numerous diseases conditions. One of the traditional Indian system of medicine, Siddha uses the bark, fruit and seeds of *Mimusops Elengi*, which has several medicinal properties. Various plant parts(root, bark, leaves, flowers, fruit & seeds) have been found to be useful as cardio tonic, alexipharmic, stomachic, hypotensive, antibacterial, anthelmintic, antiulcer, teeth strengtheners and renewable source of energy.

Keywords: *Mimusops Elengi* Linn, Phytoconstituents, Pharmacological Activites

INTRODUCTION

Traditional medicines are being practiced from the early human civilizations. Based on hundreds of years of belief, observations, and analysis the pharmacological action of these medicines were established. Different parts of the plant have different pharmacological actions, which are evaluated and used in development of modern medicine. Interest on use of herbal drugs is widely growing nowadays. This interest is basically upon the belief that herbal medicines are safe, comparatively less expensive and have less adverse side effects. Even today, nearly 80 percent of people depend mainly on traditional medicines as reported by the World Health Organization. Natural products are known to play an important role in Ayurveda and Allopath. Plants are an important source of medicine from thousands of years. In fact, many of the current synthetic drugs either they have mimic naturally occurring molecules or similar structures that are fully or in part derived from natural motifs [1]. Plants are considered as chemical factories which biosynthesize a variety of chemical compounds such as alkaloids, glycosides, saponins, resins, lactones and oils which act on human body in different ways. Due to the presence of specific phytochemicals synthesized in different parts of the medicinal plants, they exhibit the biological property. These phytochemicals can be invaluable to health of

researches on the medicinal plants about their medicinal values have forced scientists to search for plant-derived drugs for treatment of illness. Therefore, there has been growing interest among scientists to isolate and study the pharmacological properties of the phytochemicals. Herbal medicines are widely used to cure a wide variety of health-related problems ranging from treatment of common colds to treatment of cancer.

Mimusops elengi Linn. (*M. elengi*) is an evergreen ornamental tree of the family *Sapotaceae* with pleasant fragrant flowers. It carries a variety of names such as Bakul (Hindi and Bengali), Spanish cherry, West Indian Medlar or Bullet wood tree (English), Bakula (Sanskrit) etc. in different languages [2,3,4].

Mimusops elengi is considered as a sacred plant with fragrant flowers which is considered as symbol of love and beauty [5,6]. *Mimusops elengi* Linn. (*M. elengi*) is a large glabrous evergreen tree 12-15 m high, with a compact leafy head and short erect trunk, bark smooth, scaly, and gray, Leaves 6.3-10 by 3.2-5 cm, elliptic shortly acuminate, glabrous, base acute or rounded, petioles 1.3-2.5 cm long, flower white, fragrant, nearly 2.5 cm across solitary, buds ovoid, acute; pedicels 6.20 mm long. Calyx 1 cm long, stamens 8, opposite to the inner circle of lobes. Ovary appressedly silky-pubescent, fruit berry about 2.5 cm long, ovoid, yellow when ripe, seed solitary, ovoid, compressed, brown, shining [7]. It has made important contribution to the field of science from ancient times as also to modern research due to its large number of medicinal properties [8,9,10]. *Mimusops elengi* contains a

Address for correspondence:

Anuradha.S.N,
Lecturer, Faculty of pharmacy,
AIMST University, Semeling, Bedong, Malaysia.
Email: anuharisiva@gmail.com

variety of active components possess various kinds of biological and pharmacological activities. It has some biological and pharmacological activities such as antibacterial, antifungal, anti-carcinogenic, anti-hyperglycemic, antiviral, anti-hemorrhoidal and cytotoxic activities. It is also reported as antiulcer, anti-inflammatory, antianxiety, anti-hyperlipidemic, anticonvulsant, analgesic, antipyretic, antioxidant, cytotoxic, anti-diabetic, diuretic and hypotensive activity (Table 1) [11, 12] Some of the traditional and modern uses of the different parts of the plant *mimusops elengi* linn is listed in Table 1.

TAXONOMY AND NOMENCLATURE:

Kingdom: Plantae,
 Order: Ericales,
 Family: Sapotaceae,
 Genus: *Mimusops*,
 Species: *M. elengi* L.,
 Binomial name: *Mimusopselengi* (L).

It is distributed throughout South India and Andaman Islands in evergreen forests and grown as avenue tree[7]

PLANT MORPHOLOGY[40, 41,42,43]

Mimusops elengi Linn tree has origin of western peninsula. The tree also found in South India in dry evergreen forests, hills up to 20 meter height,

Table-1: Uses of *Mimusopselengi* Linn

Root	Stem	Bark	Leaf	Flower	Fruit (unripe)	Ripe fruit	seed
Aphrodisiac	Antiprotozoal ¹³	Tonic	Anthelmintic ^{19,20}	Wound healing	Protect loose teeth	Aphrodisiac	Constipation
Diuretic	Anti diabetic ²⁴	Strengthen teeth	Anti pyretic ²¹	Brain tonic	Antioxidant ²⁵	Diuretic	Fix loose teeth
Astringent for bowel	Wound healing ³⁵	Odontopathy	Anti inflammatory ^{21,22}	Cephalalgia		Astringent for bowel	burning
Strengthen gums		Urethrorrhoea	Antioxidant ²⁵	Expectorant		Strengthen gums	Mollucidal ^{37, 38}
Gonorrhoea		Cystorrhoea	Antihypertensive ¹⁴	Liver problems		Gonorrhoea	
Gargle for teeth and gums		Diarrhea	Anti diabetic ²⁸	Nose problems		Chronic Dysentery	
antipyretic		Dysentery	Analgesic ²⁹			Facilitate delivery	
		Analgesic	Cytotoxic ³²			Anti pyretic	
		Antipyretic	Mollucidal ^{37,38}			Source of food	
		Geneto urinary diseases					
		Anti microbial ^{14,15}					
		Antiviral ^{16,17}					
		Antiulcer ¹⁸					
		Anti inflammatory ²²					
		Anti hyperlipidemic ²³					
		Anti hyperglycemic ²⁴					
		Antioxidant ²⁶					
		Antiurolimiatic ²⁷					
		Antianxiety ²⁴					
		Anticonvulsant ²⁴					
		Cytotoxic ^{30,31}					
		Diuretic ^{33,34}					
		Wound healing ³⁵					
		Larvicidal ³⁶					
		Mollucidal ^{37,38}					

Table -2:Macroscopy & Microscopy of *Mimusopselengi* Linn

western coast and in evergreen forests. It is seen in Andaman, Martaban, Tenasserim, Burma and the Western Ghats and in dry areas of Eastern Ghats.

The *Mimusops Elengi* widely spread in India. It is planted for its flower and decorative appearance in the garden. It gives good shade in front of house. Cultivation could be done by germination of seeds. The seeds are soaked in the warm water for at least one day before pretreatment to increase the germination capacity. Pre-treatment of seeds involves soaked into 0.5 - 1.0% solution of thio-urea and the efficiency of total germination increased to 75%.After pre-treatment, seeds take 12 – 15 days for germination it is left into polythene bags for one month. The growth of the plant is very slow which take nearly 18 months in the initial stage before field plantation.

MACROSCOPY AND MICROSCOPY

Macroscopical and microscopical characteristics of *mimusops elengi* linn are presented in Table 2.

PHYTOCHEMICAL SUBSTANCES PRESENT IN MIMUSOPS ELENGI LINN

Different parts of plant has different phytoconstituents are listed in Table 3.

Anuradha.,: *Mimusops Elengi* Linn: A Review

Part of plant	Macroscopy	Microscopy	figures
Stem bark	<p>The fresh bark is grayish black, channelled, occurs in pieces of 15- 25 cm long and 10 -15 cm broad. Externally rough due to the presence of vertical lenticels, cracks and longitudinal fissures. The dried bark is black, curved, thin, fibrous and longitudinally striated fracture along⁴⁰</p> 	<p>Transverse section of bark shows 5-6 layers of cork cells, 2-3 layers of phellogen, 2-3 layers of phelloderm followed by cortex. The cork originates in the sub epidermis or second layer of cortex. Pericycle is represented by a discontinuous ring consisting of thick walled fibers and parenchyma. The secondary phloem is a wide zone of tissue composed of sieve tubes, companion cells, phloem parenchyma, alternating with strands of phloem fibers transverse by phloem rays which are filled with latex. Secretory cells are present, they are elliptical in shape and lined by epithelial cells^{5,40, 44}</p>	<p>T.S of Bark⁶⁵</p> 
Fruit and Seed	<p>Berry ovoid, 2.5 cm long with. It turns yellow and it tastes astringent and sweet. Fruits occur in rainy season, when ripe containing 1, rarely 2 seeds. Seeds are grayish brown, solitary, ovoid, compressed, shining^{6,9}</p> 	<p>Transverse section of seed shows pericarp which is composed of exocarp, mesocarp and a hard endocarp; presence of secretory canals lined with 5-7 epithelial cells is a characteristics. The mesocarp consist of a broad parenchymatous zone, most of the cells of which are filled with masses of rubber like substances. Numerous vascular bundles are scattered in the mesocarp region. The endocarp cells are thick walled. The seed lies enclosed within the endocarp. The testa is 1-1.5 mm thick and is distinguished into five distinct concentric regions. Thin perisperm separates the testa from endosperm. The endosperm and cotyledonous cells are thin walled^{5, 40, 45}</p>	<p>T.S of seed⁶⁵</p> 
Leaves	<p>The leaves are glossy and are dark green when old with 6.3 - 10 cm in long and 3.2 - 5 cm in wide. The new leaves mostly appear in February when the trees often appear bright vivid green. Leaves are variable, elliptic, oblong or oblanceolae, short or long acuminate, margin undulate, closely but faintly veined. Petioles 1.2 - 2.5 cmlong, whereas the dried leaves are Blackish green in color.⁴⁰</p>	<p>Transverse section of leaf shows a dorsiventral structure, heavily thickened and strongly striated with ridged cuticle on both surfaces. The stomata, present on the lower surface, are ranunculaceous or rubiaceous and striations emanate from the sides of stomata. The glands are present only on upper surface. Trichomes are always two armed, each arm being pointed. Mesophylls consist of 2-3 layers of palisade tissues and 5-6 layers of spongy parenchyma. The hypodermal cells are thick walled. Vascular bundle is capped by sclerenchymatous fibers. Laticiferous cells containing latex, solitary crystals of calcium oxalate, tannin and brownish contents are present. Stomatal index- 10.36, palisade ratio- 5, vein islet number- 11, vein termination number-12.^{9,46}</p>	<p>T.S of leaf⁶⁵</p> 

Table -3:Different Phytoconstituents

	Bark [47-51,64]	Seeds [52-60]	Root [61,63]	Flowers	Leaves [62,12]	Fruit [60]
Tannins	X				X	X
Saponins	X	X	X		X	X
Triterpenoids	X	X		X	X	
Phytosterols	X	X	X		X	
Fattyacid esters	X		X			
Saturatered fatty acid		X				
Glycoside	X	X	X	X	X	
Amino acid	X				X	X
Sugar				X	X	X
Alcohol	X			X		
Volatile organic matter	X			X		

X – indicates presence of chemicals

REPORTED RESEARCH WORKS IN MIMUSOPS ELENGI LINN

Till the date more than 20 pharmacological activities are reported in *Mimusops elengi* linn are listed in Table 4.

Table -4: Pharmacological Activities

S.No	Pharmacological activity	Part of plant	Type of extract
1	Anthelmintic	Leaves bark	Ethyl acetate fraction of methanolic extract[20] Methanolic extract[66] Aqueous & Ethanolic extract[67]
2	Anti anxiety	Bark	Methanolic, Aqueous & n-butanol[68]
3	Anti hyperlipidemic	Bark	Methanolic[23,69]
4	Anti ulcer	Bark	Alcoholic & pet.ether[18] Ethyl acetate fraction of n-butanol & methanolic extract[70]
5	Anti convulsant	Bark	Methanolic, Aqueous & n-butanol extract[71]
6	Anti inflammatory, analgesic & anti pyretic	Leaves bark	Methanolic extract[32] Ethanolic extract[72] Ethanolic extract[22]
7	Anti oxidant	Bark leaves Unripe fruit	pet.ether, chloroform & alcoholic extract[27] methanolic extract[73] chloroform extract[26] methanolic extract[74] crude methanolic[75] extracts[76,32] crude extracts[77]
8	Anti urolithiatic	Bark	pet.ether, chloroform & alcoholic extract[27]
9	Anti arthrosclerotic	Leaves	Methanolic extract[78]
10	Anti microbial	Bark Leaves Fruit	Methanolic & Aqueous extract[79] Pet.ether & acetone[80] Ethanolic extract[81]
11	Antibacterial	Seed Leaves Bark	Ethyl acetate fraction of aqueous & pet.ether[82] Toluene, methanol, ethanol & chloroform[83] Ethyl acetate & methanol[84] Aqueous & acetone[85] Acetone –water, ethanol-water, methanol – water[15] Ethanolic extract[86] Chloroform extract[87] Aqueous & Ethanolic extract[88]
12	Antifungal	Leaf & bark	Sterile & nonsterile extracts[89] Aqueous extract[84]
13	Cognitive enhancing activity	Flower	Alcoholic extract[90,91]
14	Cyto toxic activity	Bark Leaf Flower	Methanolic extract[30] Ethanolic extract[31] Methanolic extract[32] Ethanolic extract[92]

15	Anti diabetic	Leaves Bark	Alcoholic & Aqueous extracts[28] Methanolic extract[73] Aqueous extract[93]
		Flowers & leaf	Methanolic extract[94]
16	Anti tyrosinase	Bark, flower, fruit & leaves	Methanolic extract[95]
17	Immuno-stimulatory	Bark	Methanolic extract[96]
18	Larvicidal activity	Bark	Hexane & ethyl acetate extracts[36]
19	Spermicidal activity	Seeds	Crude extract[97]
20	Diuretic	Bark	pet.ether, chloroform & alcoholic extract[34] Ethyl acetate fraction of ethanol & water extract[33]
21	Wound healing effect	Bark	Methanolic extract[35]
22	Anti viral		Aqueous & methanolic extracts[17]

CONCLUSION

In spite of our great dependence on modern medicines and tremendous advances in synthetic drugs, a large portion of humankind still prefers the drugs of plant origin. The plant products prove to be safer and healthier. Since 200 BC from the Sushrut Samhita Period, *Mimusops elengi* linn has been used therapeutically. Most of the parts of this plant such as leaf, fruit, seed, bark and flowers have medicinal properties and used to cure a variety of diseases. Many pharmacologically active compounds with different chemical structures are present in this plant making it a unique source. This reported information's gathered in this review will be useful for further identification, isolation and evaluation of the active moiety and to standardize the use. The identified active moieties structural similarities can be a research topic in evaluation of the disease conditions and the pharmacological actions. Nowadays, development of modern drugs from natural origin is encouraged hence a deeper and thoughtful research study on *Mimusops Elengi* Linn can be emphasized to study the biological and pharmacological actions to cure various diseases conditions.

REFERENCES

- [1] B Joseph, SJ Raj. Pharmacognostic and Phytochem. Properties of *Aloe veralinn* an overview. *Int J PharmaceutSci Rev Res*;4(2):106-110(2010).
- [2] KR Kirtikar, BD Basu. *Indian Medicinal Plants*. 2nd edVol- II, Popular Publications Dehradun, India, 1224-1227 (1999).

- [3] RN Chopra, SL Nayar, IC Chopra. *Glossary of Indian Medicinal Plants*. National Institute of Science Communication and Information Resources (CSIR), New Delhi, 2000, 167.
- [4] PK Warriar, VPK Nambiar, C Ramankutty. *Indian Medicinal Plants*. Vol. 1-5. Orient Longman Ltd., Madras, (1993-1995).
- [5] R Mitra. Bakula- A reputed drugs of Ayurveda, its Historical uses in Indian medicine. *Ind J HistSci* 16(2):169-180 (1981).
- [6] Anonymous. The Wealth of India. New Delhi, India: *Publications and information Directorate, CSIR*, 276-77 (1956).
- [7] KR Kirtikar, BD Basu. Uttaranchal, India: Oriental Enterprises; *Indian medicinal plants with illustrations*(2001).
- [8] KM Nadkarni. *Indian MateriaMedica*. 3rd Ed, Popular Prakashan, Mumbai, 596-599 (1996).
- [9] PC Sharma, MB Yelne, TJ Dennis. Database on Medicinal Plants Used in Ayurveda. Vol. I, .Government of India; *Central council for Research in Ayurveda and siddha*, 65-72 (2000).
- [10] http://en.wikipedia.org/wiki/Mimusops_elengi
- [11] B Gami, S Pathak, M Porabia. Ethnobotanical phytochemical and pharmacological review of *Mimusopselengi*Linn. *Asian Pacific J Tropical Biomed*. 2(9): 743-748 (2012).
- [12] SB Manjeshwar, JP Ramakrishna, PB Harshit, LP Princy, B Rekha. Chemistry and medicinal properties of Bakul (*Mimusopselengi*Linn). *Rev Food Res Int*. 44: 1823-1829 (2011).
- [13] BS Aswal, DS Bhakuni, AK Goel, K Kar, BN Mehrotra. Screening of Indian plants for biologicalactivity. *Indian J Exp Biol*. 22: 487-491 (1984).
- [14] B Gami. Evolution of pharmacognosticantihaemorrhoidal properties

Anuradha.,: *Mimusops Elengi* Linn: A Review

- of *Mimusopselengi*Linn, Ph. D. thesis Veer Narmad South Gujrat University, India (2007).
- [15] D Shahwar, MA Raza. *In vitro* antibacterial activity of extracts of *Mimusopselengi* against gram positive and gram negative bacteria. *Afr J Microbiol Res.* 3(8): 458-462 (2009).
- [16] M Hattori, T Nakabayashi, YA Lim, H Miyashiro, MKurokawa, K Shiraki. Inhibitory effect of various Ayurvedic and Panamanian medicinal plant on the infection of *Herpes simplex virus-1 in vitro* and *in vivo*. *Phytother Res.* 9: 270-276 (1995).
- [17] IT Kusumoto, T Nakabayashi, H Kida, H Miyashiro, M Hattori, T Namba. Screening of various plant extracts used in Ayurveda medicine for inhibitory effects on human immunodeficiency virus type 1(HIV-1) protease. *Phytother Res.* 9: 180-184 (1995).
- [18] D Prakash, BC Koti, T Vijay, Chandrakala, MS Katagi. Antiulcer activity of *Mimusopselengi* bark extracts against serotonin induced ulcer in rats. *Int Res J Pharm.* 2(8): 173-176 (2011).
- [19] LD Kapoor. Handbook of Ayurvedic medicinal plants. CRC Press, pp. 232-233(2000).
- [20] GK Jana, M Dhanamjayarao, M Vani. Evaluation of anthelmintic potential of *Mimusopselengi*Linn. (Sapotaceae) leaf. *J Pharm Res.* 3(10): 2514-2515 (2010).
- [21] B Kar, RBS Kumar, I Karmakar. Antioxidant and *in vitro* antiinflammatory activities *Mimusopselengi* leaves. *Asian Pacific J Trop Biomed.* 2(2): 976-980 (2012).
- [22] S Rajkumara, APandisalvi, G Sandhiya. Isolation of chemical constituents from *Mimusopselengi* bark and evaluation of anti-inflammatory activity. *Int J Phytopharm Res.* 3(1): 9-15 (2012).
- [23] MM Ghaisas, AH Kadam, BD Kshirsagar, VV Dhote, AD Deshpande. Evaluation of antihyperlipidemic activity of *Mimusopselengi*Linn. in triton WR-1339 induced hyperlipidaemia in rats. *J Nat Remedies.* 8(2): 132-137 (2008).
- [24] GP Ganu, SS Jadhav, AD Deshpande. Antioxidant and antihyperglycemic potential of methanolic extract of bark of *Mimusopselengi*Linn in mice. *Res J Pharmaceut Biol Chem.* 1(3): 67-77 (2010).
- [25] B Chaiyan, W Sunanta, S Oranart, C Rasamee. Antioxidant capacity and phenolic content of *Mimusopselengi* fruit extract. *Kasetsart J Nat Sci.* 43: 21-27 (2009).
- [26] KS Rao, PR Munjuluri, NK Keshar. *In vitro* antioxidant activity and total phenolic content of *Mimusopselengi* bark. *Ind J Pharm Edu Res.* 45(4): 317-323 (2011).
- [27] P Ashok, BC Koti, AH Vishwanathswamy. Antiuro lithiatic and antioxidant activity of *Mimusopselengi* ethylene glycol-induced urolithiasis in rats. *Ind J Pharmacol.* 42(6): 380-383 (2010).
- [28] MK Mamatha, T Thomas, HS Yogesh, HJ Pramod. Antidiabetic activity of *Mimusopselengi* leaves on alloxan induced diabetic rats. *Int J Ph Sci.* 3(2): 1358-1362 (2011).
- [29] S Sakshi, G Vineet, G Rajiv, AS Shubhini. Analgesic and antipyretic activity of *Mimusopselengi*L. (bakul) leaves. *Pharmacogonyonline.* 3: 1-6 (2011).
- [30] M Nasrin, PR Dash, MR Saha. *In vitro* anthelmintic and cytotoxic activities of methanolic bark extract of *Mimusopselengi*Linn. *Stamford J Pharmaceut Sci.* 3(2): 20-24 (2010).
- [31] SS Bhujbal, RP Deshmukh, JS Bidkar, VA Thatte, SS Awasare, PP Garg. Evaluation of cytotoxic activity of barks of *Mimusopselengi*. *Eurasia J Biosci.* 5: 73-79 (2011).
- [32] UK Karmakar, R Sultana, NN Biswas. Antioxidant analgesic and cytotoxic activities of *Mimusopselengi*Linn. Leaves. *Ind J Pharm Sci Res.* 2(11): 2791-2797 (2011).
- [33] RG Katedeshmukh, RV Shete, KV Otari, MY Bagade, APattewar. Acute toxicity and diuretic activity of *Mimusopselengi* extracts. *Int J Pharma Bio Sci.* 1(3): 1-3 (2010).
- [34] BC Koti, P Ashok. Diuretic activity of extracts of *Mimusopselengi*Linn Bark. *Int J Green Pharm.* 4(2): 90-92 (2010).
- [35] N Gupta, UK Jain. Investigation of wound healing activity of methanolic extract of stem bark of *Mimusopselengi*Linn. *Afr J Trad Compl Altern Med.* 8(2): 98-103 (2011).
- [36] TR Ruikar, ATambe, V Puranik, N Deshpande. GC-MS study of a steam volatile matter from *Mimusopselengi*. *Int J Chem Tech Res Coden.* 1(2): 158-161 (2012).
- [37] KL Singh, DK Singh, VK Singh. Characterization of the molluscicidal activity of *Bauhinia variegata* and *Mimusopselengi* plant extract against the *Fasciolavector Lymnaeaacuminata*. *Rev Inst Med Trap Sao Paulo.* 54(3): 135-140 (2012).
- [38] KL Singh, DK Singh, VK Singh. Molluscicidal activity of *Mimusopselengi* and *Bauhinia variegata* against the fresh water snail *Indoplanorbissexustus*. *Ecoscan Special Issue.* 4: 89-95 (2013).
- [39] KL Singh, DK Singh, VK Singh. Binary combinations of *Mimusopselengi* and *Bauhinia variegata* with other plant derived molluscicides against *Indoplanorbissexustus*. *Int J Tradit Nat Med.* 4(1): 6-13 (2014).

Anuradha.,: *Mimusops Elengi* Linn: A Review

- [40] K Raghunathan, R Mitra. Pharmacognosy of Indigenous Drugs. *Government of India, Central Council for Research in Ayurveda and Siddha*, Vol. I: 158-183 (2000).
- [41] KR Kirthikar, BD Basu. Indian Medicinal Plants, 2nd Ed, Vol. II, Popular Publications, Dehradun, 1224- 1227 (1999).
- [42] http://www.biodiversityofindia.org/index.php?title=Mimusops_elengi
- [43] UV Singh, SP Ahlawat, NS Blsht. Nursery Technique of Local Tree Species-II. Department of Environment & Forests, Arunachal Pradesh, 12 (2003).
- [44] JN Govil, VK Singh. Pharmacognostic study on stem bark of bakul. *Medicinal Plants. New Vistas of Res* 165-174 (1993).
- [45] B Gopalkrishnan, SN Shimpi. Seeds of *Mimusopselengilinn* pharmacognosy and phytochemistry studies. *Int J PharmacogPhytochem Res* 3(1):13-17 (2010).
- [46] R Mitra, KC Yadav. Pharmacognostic study of bakul: *Mimusopselengilinn* Leaf. *Ind J for* 3:15-23 (1980).
- [47] G Mishra, CR Mitra. Constituents of bark of *Mimusopselengilinn*. *Phytochem.* 6:1909 (1967).
- [48] N Akhtar, M Ali, M Alam. Pentacyclitriterpenes from the stem bark of *Mimusopselengilinn*. *Acta Pol Pharm* 66(5):549-552 (2009).
- [49] N Jahan, W Ahmed, AMalik. A lupene-type triterpene from *Mimusopselengi*. *Phytochem* 39(1): 255-257 (1995).
- [50] Ruikar, R Torane, ATambe, V Puranik, N Deshpande. GC-MS study of a steam volatile matter from *Mimusopselengi*. *Int J Chemtech Res Coden* 1(2):158-161 (2009).
- [51] N Akhtar, M Ali, M Alam. Gallic acid esters from the stem bark of *Mimusopselengilinn*. *Nat Prod Res* 24(10):962-972 (2010).
- [52] G Mishra, CR Mitra. Constituents of fruit and seed of *Mimusopselengi*. *Phytochem* 6:453 (1967).
- [53] S Sen, NP Sahu, SB Mahato. Novel migrated oleananetriterpenoidsapogenins from *Mimusopselengi*. *Tetrahedron* 49(40):9031-9038 (1993).
- [54] S Sen, NP Sahu, SB Mahato. Pentacyclitriterpenoids from *Mimusopselengi*. *Phytochem* 38(1):205-207 (1967).
- [55] N Jahann, A Malik, G Mustafa, Z Ahmad, S Ahmad, E Aniset *al*. Triterpenes From *Mimusopselengi*. *Nat Prod Lett* 15(3):177-185 (2001).
- [56] NP Sahu, K Koike, Z Jia, T Nikaido. Novel triterpenoidsaponins from *Mimusopselengi*. *Tetrahedron* 51(48):13435-13446 (1995).
- [57] NP Sahu, K Koike, Z Jia, T Nikaido. Triterpenoidsaponins from *Mimusopselengi*. *Phytochem* 44(6):1145-1149 (1997).
- [58] NP Sahu. Triterpenoidsaponins of *Mimusopselengi*. *Phytochem* 41(3):883-886 (1996).
- [59] C Lavaud, G Massiot, M Becchi, G Misra, SK Nigam. Saponins from three species of *Mimusops*. *Phytochem* 41(3):887-93 (1996).
- [60] A Nazarudeen. Nutritional composition of some lesser- known fruits used by the ethnic communities and local folks of kerala. *Ind J Traditional Knowledge* 9(2):398-402 (2010).
- [61] VK Saxena, K Shrivastava. New steroidal saponins from the roots of *Mimusopselengi*. *Fitoterapia* 59(5):418 (1988).
- [62] G Mishra, CR Mitra. Constituents of leaves, heartwood and root of *Mimusopselengilinn*. *Phytochem* 7:501-502 (1968).
- [63] VK Saxena, K Shrivastava. New steroidal saponins from the roots of *Mimusopselengi*. *Fitoterapia*. 59(5): 418 (1988).
- [64] M Padhi, S Mahapatra, J Panda, BM Sahoo. Phytochemical and pharmacological review of *Mimusopselengi*Linn. *American Journal of Pharm Tech Research* 2(6):213-230 (2012).
- [65] S RakeshShivatara et al., Pharmacognostic Standards for *Mimusopselengi*Linn - A Review, *Journal of Pharmacognosy and Phytochemistry* 2 (3): 12-18 (2013).
- [66] M Nasrin, PR Dash, MR Saha. *In vitro* anthelmintic and cytotoxic activities of methanolic bark extract of *Mimusopselengilinn*. *Stamford J PharmaceutSci* 3(2):20- 24 (2010).
- [67] HD Dhamija, D Gupta, B Parashar, S Kumar, Shashipal, *In vitro* anthelmintic activity on aqueous ad ethaol extracts of *Mimusopselengi*Linn. *Bark, Pharmacologyonline* 3, 740-746 (2011).
- [68] G Ganu, AGarud, V Agarwal, U Suralkar, S Jadhav, A Kshirsagar. Anti- anxiety activity of *Mimusopselengibarks* extract in experimental animals. *Res J PharmaceutBiolChem Sci.* 2(3):405 (2011).
- [69] H Zahid, GH Rizwani, H Shareef, S Mahmud, T Ali, Hypoglycemic and hypolipidemic effects of *Mimusopselengi*Linn, extracts on normoglycaemic and alloxan-induced diabetic rats, *International Journal of Pharmaceutical and Biological Archives* 3(1), 56-62 (2012).
- [70] PJ Shah, MS Gandhi, SS Goswami, D Santani, Study of *Mimusopselengibark* in experimental gastric ulcers, *J Ethanopharmacol* 89(2-3), 305-311 (2003).
- [71] G Ganu, AGarud, V Agarwal, S Talele, S Jadhav, A Kshirsagar. Anticonvulsant activity

- of a *Mimusopselengi* experimental animals. *J Pharm Res* 4(9):2938- 2940 (2011).
- [72] BC Purnima, AH Koti, MS Thippeswamy, AH Jaji, YV Swamy, AJ Kurheet *al.* Antiinflammatory, analgesic and antipyretic activities of *Mimusopselengilinn.* *Ind j pharm sci* 72(4):480- 485 (2010).
- [73] GP Ganu, SS Jadhav, AD Deshpande, Antioxidant and antihyperglycemic potential of methanolic extract of bark of *Mimusopselengi*Linn in mice, *Res J PharmaceutBiolChem* 1(3), 67-77 (2010).
- [74] MR Saha, SMR Hasana, R Aktera, MM Hossaina, MS Alamb, MA Alam, *et al.*, *In vitro* free radical scavenging activity of methanol extract of the leaves of *Mimusopselengi*Linn. *Bangl J Vet Med* 6(2), 197–202 (2008).
- [75] J Shaik, SM Khasim, PB Naidu, Protective activity of ethanolic leaf extract of *Mimusopselengi*Linn. On lipid peroxidation and antioxidant enzymes in experimental diabetic rats, *Int J Advances PharmaceutSci*2(2), 264-275 (2011).
- [76] C Boonyuen, S Wangkarn, O Suntornwat, R Chaisuksant. Antioxidant capacity and phenolic content of *Mimusopselengifruit* extract. *kasetsart j nat Sci.* 43: 21- 27 (2009).
- [77] Satishchandra, M Sumithra. Synergistic effect of *Mimusopselengi*and *moringaoleifera*on high fat diet induced atheroma in rats. *Int J AdvPharmaceut Res* 2(6):293–300 (2011).
- [78] Prabhat, Ajaybhan, Navneet, A Chauhan. Evaluation of Antimicrobial Activity of Six Medicinal Plants against Dental Pathogens. *Report Opinion* 2(6):37- 42 (2010).
- [79] RR Deshpande, A Ruikar, PS Panvalkar, AA Kulkarni, E Khatiwora, V Adasulet *al.* Comparative evaluation of different concentrations of *Mimusopselengi*(L) extract as an antimicrobial agent against salivary micro flora. *J Biomed Sci and Res* 2(3):151- 154 (2010).
- [80] BNLD Rangama, CL Abayasekara, GJ Panagoda, MRDM Senanayake. Antimicrobial activity of *tephrosiapurpurea*(linn.) pers. and *Mimusopselengi*(linn.) against some clinical bacterial isolates. *J NatnSci Foundation Sri Lanka* 37(2):139- 145 (2009).
- [81] KM Hazra, RN Roy, SK Sen, S Laskar. Isolation of antibacterial pentahydroxy flavones from the seeds of *Mimusopselengi*Linn. *Afr J Biotechnol* 6(12):1446- 1449 (2007).
- [82] V Lalitha, B Kiran, KA Raveesha. *In vitro* evaluation of *Mimusopselengi*Plant extract for antibacterial activity and phytochemical analysis. *Pharmacophore* 2(1):78- 85 (2011).
- [83] MA Ali, MA Mozid, S Yeasmin, AM Khan, MA Sayeed. An Evaluation of Antimicrobial Activities of *Mimusopselengi*Linn. *Res J Agriculture and Biological Sci* 4(6):871- 874 (2008).
- [84] AA Kulkarni, RR Deshpande, P Panvalkar, P Mahajan, A Kale, A Ruikaret *al.* Comparative evaluation of antibacterial properties of different extracts of *Mimusopselengi*(bakul) & *juglansregia*(walnut) against salivary microflora. *Res J PharmaceutBiolChemSci* 2(3):635 (2011).
- [85] BNLD Rangama, CL Abayasekara, GJ Panagoda. Antibiotic activity of *tephrosiapurpurea*(fabaceae) and *Mimusopselengi*(sapotaceae) against some clinical bacterial isolates. *Proceedings of the Peradeniya University Res Sessions* 12(1):55- 56 (2007).
- [86] SS Murudkar, PA Mundhada. Tatke. Antibacterial activity of *Mimusopselengilinn* bark against dental pathogens. *Ind J Pharm Educ Res* 41 (2):114- 120 (2007).
- [87] R Nair, SV Chanda. Antibacterial activities of some medicinal plants of the western region of india. *Turk J Biol* 31:231- 236 (2007).
- [88] K Niranjana, RK Singh, MN Adaji, RB Singh. Effect of aqueous leaf and bark extracts of *Mimusopselengi*(linn.) on radial growth and sclerotial formation of *sclerotiniasclerotiorum*(lib.) de bary, a polyphagous fungus. *Production AgricTechnol* 5(2):288- 300 (2009).
- [89] RV Hadaginhale, VP Tikare, KS Patil, MS Bhanushali, NS Desai, A Karigar, Evaluation of cognitive enhancing activity of *Mimusopselengi*Linn. On albino rats. *Int J Res in Aur and Pharm*1(2):484-492 (2010).
- [90] H Joshi, M Parle, Evaluation of the memory and learning improving effects of *Mimusopselengi*in mice. *Int J Drug Disc Herbal Res*1(4):185- 192 (2011).
- [91] W Mahavorasirikul, V Viyanant, W Chaijaroenkul, Altharat, K Na- Bangchang. Cytotoxic activity of Thai medicinal plants against human. *BMC Complementary and Alternative Med* 1- 8 (2010).
- [92] MK Mamatha, T Thomas, HS Yogesh, HJ Pramod. Antidiabetic activity of *mimosupselengileaves* on alloxan induced diabetic rats. *Int J PhSci* 3(2):1358- 1362 (2011).
- [93] H Zahid, GH Rizwani, H Shareef, S Mahmud, T Ali, Hypoglycemic and hypolipidemic effects of *Mimusopselengi*Linn, extracts on normoglycaemic and alloxan-induced diabetic rats, *International Journal of Pharmaceutical and Biological Archives* 3(1): 56-62 (2012).

Anuradha.,: Mimusops Elengi Linn: A Review

- [94] N Narayanaswamy, S Rohini, A Duraisamy and KP Balakrishnan, Antityrosinase and antioxidant activities of various parts of *Mimusopselengi*: a comparative study, *Int J Res CosmSci*(1): 17-22 (2011).
- [95] PV Kadam, KN Yadav, RS Shivatare, AS Pande, NS Narappanawar, MJ Patil, Immunostimulatory effect of *Mimusopselengi*Linn. stem bark in mice, *Asian Pac J Trop Biomed* 1-5 (2012).
- [96] CP Khare, Indian Herbal Remedies,*Encyclopedia of Indian Medicinal Plant, Springer*, (2004).