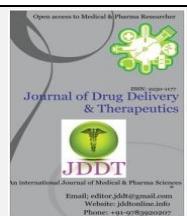


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Review Article

Therapeutic and medicinal properties of Neem (*Azadirachta indica*) in context of Unani System of Medicine: A Review Study

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ABSTRACT

Neem is very important medicinal plant which is used to treat different diseases in Unani System of Medicine as well as traditional system of medicine (Ayurveda, Homeopathic Chines and European "Materia Medica"). The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed. In the last century, approximately 130 pharmaceutical products have been discovered based on the information obtained from the traditional scientist and physician. The importance of the Neem tree has been recognized by the US National Academy of Sciences, which publish a report in 1992 entitled 'Neem- a tree for solving global problems'. The scientific name of Neem, *Azadirachta indica*, is derived from the Persian, Azad means "Free" dirakht means "tree" I-Hindi means "of Indian Origin" .Hence it literally means "the free tree of India". The Chemical principles from natural sources have become much simpler and have contributed significantly to the development of new drugs from medicinal plants and because of these facts the domain market for plant derived chemicals, pharmaceuticals, fragrances, flavor's, and color ingredients, alone exceeds several billion dollars per year. The present review highlights a Unani medicine literature as well as scientific on taxonomical, botanical, and pharmacological discussion on *Neem*.

Keywords: Neem, *Azadirachta indica*, Unani Medicine, Nim.

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INTRODUCTION

Neem is a large found wild and often cultivated in India [1]. The height of the tree is about 12 meters to 15 meters. All the part of the tree is bitter in taste. Its stem is erect and having a girth of 1.75 meters to 2.75 meters with spreading branches. Bark is dark grey and rough [1].

Leaves are green in color, bluntly serrate and alternate. The flowers are white, having a scented odor especially at night. Its fruit is smooth, oblong and small in size and is called, *Niboli*. Unripe fruit is color and bitter in taste while the ripe fruit is yellow colored and somewhat sweetish in taste. [1, 5-8]. Its four varieties viz. Ban, Bakain (Maha neem), Bhoi neem

and Meetha neem (Kiryapak) have been mentioned in classical literature [1].

Neem Gum

The bark exudes, a clear, bright, amber colored gum, known as the East Indian gum which blackens with age. It forms into small tears or vermiciform pieces, and the surface is cracked or fissured. The tears are soluble in cold water and are non-bitter. The tears in the drier areas produce the gum very freely. In wet climate, the gum is liable to be washed away or spoiled before collection [9].

Table 1: Scientific Classification [9]

Order	Rutales
Suborder	Rutinae
Family	Meliaceae
Subfamily	Melioideae
Tribe	Melieae
Genus	Azadirachta
Species	indica

VERNACULARS [9]

Baluchistan	Nim
Bengali	Nim, Nim gachh
Bombay	Bakayan, Balnimbi, Nim
Burma	Bawtamaka, Kamaka
Cambodia	Sdoa
Canarese	Bemu, Bevina
Central provinces	Limbo
Cohine-China	Chado
Deccan	Nim
English	Indian Lilac, Margosa Tree
French	Agem lilas, Azedarac alie
German	Grossblaettiger, Zedrach
Gujarat	Danujhada, Kohumba, Libado, Limba
Hindi	Balnimbi, Nim, Nimb
Indo China	Sau dau, Sdao, Xoan dau
Kolami	Nim
Konkani	Nim
Kumaon	Betain, Nim
Lambadi	Lemalo
Malayalam	Atikta, Nimban
Marathi	Balantanimba, Kadukhajur
Palamow	Agas
Persian	Neeb, Nib
Portuguese	Amargoseira, Margosa, Nimbo
Punjab	Bakam, Bakhain
Sanskrit	Arishta, Arkapadapa
Sind	Nimuri
Sinhalese	Kohumba, Nimbunimbagaha
Tamil	Arulundi, Kaduppagai
Telugu	Nimbamu, Taruka, Vemu
Tulu	Bevu, Kaybevu
Urdu	Neem
Uriya	Kakopholo, Limbo, Nimbu, Nimo.

DISTRIBUTION

The tree is found apparently wild on Swalik hills. It grows Wild in the dry forests of Andhra Pradesh, Tamil Nadu and Karnataka. It is also found in dry regions of the Irawali Valley, cultivated and naturalized in the Punjab to the Jhelum and west of the Sutlej [10,11].

BOTANICAL DESCRIPTION

A. indica commonly known as neem, is a large, evergreen tree, 12-18m in height and 1.8-2.4m in girth, with a straight and long, spreading branches forming a board crown, commonly found throughout the greater part of India.

Stem and Bark

Stem has a girth 1.8-2.4m and the bark is rough, hard, grey or dark grey, reddish brown inside with numerous oblique furrows and scattered tubercles.

Leaves

The leaves are alternate, impair pinnate and 20-38 cm long. The leaflets are 8-19 cm alternate or opposite. Leaves are ovate-lanceolate, oblique or sub foliate, glossy and bluntly serrate.

Flowers

The flowers are hermaphrodite. White or pale yellow, small, scented and numerous. Flowers are very lax and in axillary panicles.

Calyx

The calyx is five lobed. The sepals are small in size.

Petals

The petals are five in number, polypetalous. Stamina tube is a little shorter than the petals. There are 9-10 lobes at the apex; the lobes are truncate, again slightly toothed. The anthers are within the tube opposite to and shorter than the lobes.

Ovary

The ovary is called, style elongate, slender and stigma shortly cylindrical. There are two collateral ovules in each cell.

Fruit

The fruit is one seeded, drupe and endocarp is woody.

Seeds

The seeds are ellipsoid, cotyledons thick, fleshy cordate at base and radical superior [10,11].

MIZAJ (Temperament)

The Unani authors described its *Mizaj* as follows:

Har¹ Yabis² [1, 6]

Har¹ Yabis² [3]

Barid¹ Yabis² [2, 5, 7]

Barid¹ Yabis² [8]

Har² Rataab² [4, 12]

AFAAL (Pharmacological Actions)

Various Pharmacological action described in Unani Classical literature are as follows,

Dafe humma (Antipyretic) [1,7]

Dafe yarqaan (Useful in Jaundice [1]

Dafe taffun (Antiseptic) [1-7]

Hazim (Digestive) [1, 3]

Habise ishaal (Antidiarrheal) [1, 2, 5]

Kasire riyah (Anti flatulent) [1, 2, 4-6]

Munzij (Concoctive) [1, 8]

Musakkine alam (Analgesic) [1, 2, 5, 6]

Nafe amrazz jild (Skin Diseases) [1-7]

Mundamile Qurooh (Cicatrizing) [1, 2, 5-7]

Musakkine atash (Thirst quenching) [1, 2, 5]

Muqavvi snan wa lissa (Teeth and gum tonic) [1-8, 12]

Muqavvi basar (Eye tonic) [1, 2, 4]

Musakkine suaal (Antitussive) [1,2,5]

Mudire Haiz (Emmanagogue) [1, 2, 5]

Musakkine Suda (Headache Reliever) [1-8, 12]

Mane nazool (Anti hydrotic) [1, 2, 5, 6]

Nafe ziabetus (Anti Diabetic) [1]

Nafe zeequnafas (Useful in asthma) [1, 2]

Nafe jarooh wa qurooh (Useful in burns and wounds) [1-3, 5, 7]

Nafe falij and laqwa (Useful in paralysis and hemiplegia) [1, 2, 5, 6]

Nafe istisqa (Useful in Dropsy) [1, 2, 5]

Nafe wajaul mufasil (Anti rheumatic) [1-3, 5, 6, 8, 12]

Nafe darde gosh (Useful in ear ache) [1-8, 12]

Rade (Repellent) [3, 8]

AFAAL OF NEEM GUM

Neem gum is mentioned as *Muqavvi* (Tonic), *Muharrrik* (Stimulant), *Muzliq* (Demulcent) and *Mana-e-Nazla* (Anti catarrhal) [11].

ETHNO BOTANY SURVEY**Medicinal Uses**

Almost every part of the tree has long been used in folklore and traditional systems of medicine for the treatment of a variety of human ailments, particularly against diseases of bacterial and fungal origin [10,11,13,14]. Nimbidin is anti-arthritis and anti-inflammatory [15] in its action and possesses significant antiulcer potential [16] whereas various other fraction have antipyretic and anti-inflammatory [17] and antitumor [18] properties. The extracts and various factors derived from neem also possess diverse biological effects on insects such as repellency, phagodeterrence, reduced growth, abnormal development and reduced oviposition. [19]. An antineoplastic drug has also been obtained from the bark of bark plant [20, 21].

ETHNO BOTANY SURVEY OF NEEM GUM

Neem gum is mentioned as a tonic [22-24], Stimulant [22], demulcent [23, 24], blood purifier [22], Anti-catarrhal [23-25], remedy for splenic enlargement [14] and antipyretic [24].

Table 2: Phytochemical Studies

Compounds	Source	Ref
7-Alpha-acetoxy-4,4,8-trimethyl-1-5-alpha-(13-alpha-Me)-androsta-1,14-dien-3,16-dione	Ripe fruit coat	[26]
7-alpha-acetoxy-4,4,8-trimethyl-5-alpha-(13-alpha-Me)-oxandrosta-1,14-dien-3,16-dione	Ripe fruit coat	[26]
7-alpha-acetoxy-4,4,8-trimethyl-5-alpha-17-oxandrosta-1,14-dien-3, 16dione	Ripe fruit coat	[26]
Azadiracht	Fresh whole fruit	[26]
Azadirachtin	Neem seed	[27]
Azadiradione	Neem oil	[28,29]
Azadirinine	Root bark	[30]
Azadirol	Ripe fruit	[37]
Azadirone	Neem oil	[28]
Deacetylnimbin	Neem oil	[31,32]
Cis and trans-3,5-Diethyl-1,2,4-trithiolanes	Neem oil	[33]
6,8- Dihydroxy-3-methyl-1-3,4-hydro iso coumarin	Uncrushed twigs	[33]
7,8-Dihydroxy-3-methyl-3,4-dihydro iso coumarin (Margocetin)	Uncrushed twigs	[26]
6,8-Dimethoxy-7-hydroxy coumarin	Uncrushed twigs	[26]
Dimethylnimbionol	Stem bark	[34]
Di-tri and tetrasulphide with di-n-propyl disulphide	Seed oil	[35]
Docosane	Leaves and fruit coat	[26,33]
Docosene	Fruit coat	[36]
Dotriaccontane	Leaves	[33]
17-Epinimbocinol	Neem oil	[38]
Gedunin	Neem oil	[28]
Hentriaccontane	Leaves	[33]
Heptacosane	Leaves	[26]
17, Hdroxyazadiradione	Neem oil	[29]
Icosane	Fruit coat	[31]
Kulactone	Ripe fruit	[37]
Limocin A	Ripe fruit coating	[37]
Limocin B	Ripe fruit coating	[26]

Limocinin	Ripe fruit coating	[26]
Limocinol	Ripe fruit coating	[26]
Limocinone	Ripe fruit coating	[26]
Mahmoodin	Neem oil	[36]
Margocilin	Root bark	[39]
Margocin	Root bark	[26]
Margocinin	Root bark	[26]
Margolone	Stem bark	[40]
Margolonone	Stem bark	[26]
Margosinlone	Stem bark	[41]
Margosolone	Stem bark	[40]
Margosone	Stem bark	[26]
Meliantriol	Neem seed	[42]
6Methoxymellin	Uncrushed twigs	[33]
24-Methylendophenol	Heart wood	[43]
Methyl grevillate	Stem bark	[44]
Methyl nimbol	Stem bark	[45]
Methyl nimbionone	Stem bark	[26]
2-Methyl tricosane	Fruit coat	[36]
Naheedin	Fresh whole fruit	[26]
Nimbanal	Seed extract	[46]
Nimbidin	Neem oil	[36]
Nimbidiol	Root Bark	[47]
Nimbin	Neem oil	[31,36]
Nimbisonol	Neem oil	[36]
Nimbocinol	Stem bark	[39]
Nimbocinolide	Green leave	[47]
Nimbolicin	Root bark	[46]
Nimbolin	Trunk Wood	[44]
Nimbolone	Stem bark	[44]
Nimbonone	Stem bark	[26]
Nimbosodione	Stem bark	[34]
Nimbosone	Stem bark	[45]
Nimosone	Stem bark	[26]
Nonacosane	Leaves	[33]
Octacosane	Leaves	[26]
Pentacosane	Leaves	[26]
Salanin	Neem seed	[48]
Salannol-3-acetate	Seed extract	[46]
Scopoletin	Uncrushed twigs	[34,49]
Triaccontane	Leaves	[26]

CHEMISTRY OF NEEM GUM

Analysis of gum gave moisture 13.8%, and ash 3.0%. Purification of gum with alcohol gave a non-reducing gum having $[\alpha]_D^{21.5}$ -70.6 0 . On hydrolysis it yielded L-Arabinose, L-fructose, D-galactose and D-glucouronic acid. The aldouronic acid component of the gum, obtained by graded hydrolysis, was found to be 4-O- (D-glucopyranosyl uronic acid) -D-galactopranose [50]. The presence of D-glucosamine is also reported in the gum [51].

SCIENTIFIC REPORT

Hypoglycemic

The seed oil possesses active constituents capable of lowering blood glucose in both norm and hyperglycemic animals [52]. The aqueous extract of the leaves produced some hypoglycemia in normal and diabetic rats, [53]. Effect of water soluble alcoholic extract of *A. Indica* leaves on isolated tissue preparation were studied with a view to find out the possible mechanism of its reported anti-hyperglycemic effect [54]. Neem oil produced a significant blood glucose lowering activity in normal as well as alloxan induced diabetic rats

after 3h and 6h. The decrease in blood glucose level was more pronounced in hyperglycemic rats.

Abortive effect: Seed and leaf extract [55]

Analgesic effect: Leaves [56,57].

Anti-dermatophytic effect: Leaves [57,58]

Antifertility effect: Neem oil [59-69]

Anti-inflammatory effect: Leaves [70,71]

Gastric antiulcer effect: Leaves [72]

Hypotensive effect: Leaves [73]

Immuno modulatory effect: Stem bark [74]

Larvicidal effect: Isolated hydrocarbon fraction from dried leaves (Okpanyi and Ezeukwu, 1981)

Metabolic effect: Seed [75]

Neuropsycho pharmacological effect: Leaves [76]

Toxic effect: Neem oil [77]

MIQDARE KHORAK (Dose)

The doses described for Neem's different parts by various Unani physicians are as follows:

3-6 gm (leaves decoction) [1]

2-4 Tola (Arq of root) [1]

8-10 gm (Arq of bark) [1]

9-6 gm. (Leaves Decoction) [5]

1 Misqal (Fruit) [5]

2-4 Tola (Whole plant Arq) [2, 6]

MUZIR (Adverse Effect)

Neem has adverse effect on the dry *Mizaj* (temperament) people. [1, 5-8]

MUSLEH (Corrective)

Shahad (Honey), *Filfil Siyah* (*Piper nigrum*) and *Roghaniyat* are the drugs recommended as corrective (*Musleh*) for Possible side effects caused by Neem [1, 2, 5]

METHODOLOGY

The databases used to get information from journals and articles are Google, PubMed, Science Direct, Scopus and Google Scholar. For the search of primordial and current *Unani Classical* literature author visited Library of Regional Research Institute of Unani Medicine (RRIUM), Srinagar, J & K, India.

CONCLUSION

The parts (Green Leaves, Ripe fruits and its coat, Neem seed, Root, Bark, Uncrushed twigs, Stem bark, Root bark, Fresh whole fruit and Dry leaves) of *Azadirachta indica* (*Neem*) have been in use since times immemorial to treat the wide range of disease. It has been subjected to somewhat extensive phytochemical, experimental and clinical investigations. Experimental studies have demonstrated its anti-fungal, anti-aging, antibacterial, Anti-diabetic, Abortive effect, antihypertensive, anti-inflammatory, antioxidant, antispasmodic, antitussive, reflux esophagitis, Anti-dermatophytic effect, Cardiac stimulant, hypnotic, Larvicidal and respiratory system. It has no toxic effect on vital organs. The scientific studies have proved most of the claims of traditional medicines. However, further, detailed clinical research appears valuable to explore the full therapeutic potential of this plant in order to establish it as a standard drug. Looking upon wide prospects and potential of *Neem* for various purposes, it is worthwhile to cultivate the plant at large scale. This will help in financial upliftment of poor and landless farmers.

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REFERENCES

1. Ghani NH, "Khazainul *Advia*". Idara Kitabul Shifa; New Delhi: YNM; 988-996.
2. Sheerazi A, *Tohgalat Monineen wa Makhzam-ul-Advia* (Persian), Idara Kitabul Shifa; New Delhi: 1917; 780-781.
3. Sharif M, *Riyazul Advia*, Matba Mustafa Musrafa Mohd. Hussain Khan, Idara Kitabul Shifa, New Delhi: YNM; 413- 414.
4. Kabeeruddin M. "Makhzen ul Mufredat". Ejaz Publishing House; New Delhi: YNM; 219.
5. Hakeem MA, *Bustanul Mufradat*, (Reprinted recently) Idara-e-Tarraqqi Urdu Publication, Lucknow: 1311; 341.
6. Kareem, Noor, *Mukhzanul Advia*, Ejaz Publishing House; New Delhi: 1888; 1: 186.
7. Ghulam, HS, *Ganjeena-e Tib Mumtazia*, Matba Mumtazia, Agra: 1888; 365-366.
8. Ali, MS, *Aneesul Atibba*, Shame Jahan Raunaq Fiza Gulshan, Lahore: 1875; 251-252.
9. Anonymous, *Wealth of India*, C.S.I.R., New Delhi: 1985; I: 506.
10. Manjunath BL, *The wealth of India*, CSIR, New Delhi: 1948; I:140.
11. Chopra RN., Chopra, I. C, Handa, K. L. and Kapur, L. D. (eds), *Indigenous Drugs of India*, U.N. Dhur and Sons, Kolkata: 1958; 51-595.
12. Haider AK, *Majmaul Behrin*, Tibbi publishing House, Nawal Kishore, Lucknow: 1905;174.
13. Dymock W., Warden, C.J.H. and Hooper, D, *Pharmacographia Indica*, The Institute of Health and Tibbi Research (Republished under the auspices of Hamdard National Foundation), Pakistan: 1890; 1: 322.
14. Nadkarni AK, "Indian *Materia Medica with Ayurvedic, Unani Tibbi,Siddha, Allopathic, Homeopathic, Naturopathic and Home remedies*".Vol.1st .Bombay: Popular Parkashan Private Ltd. 2009; 776.
15. Rojanapo W, Suwanno S, Somaree R, Glinsukon T, Thebtaranon Y, Screening of Antioxidants from some Thia vegetables and herbs. *J Sci Thailand* 1985; 11: 177- 188.
16. Pillai NR. and Santhakumari G, *Planta Medica*, 1984; 50,143,146.
17. Okpanyi SN. and Ezeukwu, G.C, *Plata Medica*, 1981; 34.
18. Kurokawa Y., Tekeda, T., Ogihara, Y., Shimazu, M., and Takai, M, *Chem Pharma Bull*, 1988; 36, 2654.
19. Schmutterer H, *The Neem Tree: Source of Unique Natural Products for Integrated Pest Management, Medicine, Industry and Other Purposes*, VCH, Weinheim, Germany: 1995; 1- 696.
20. Shimazu M., Sudo, T. and Nomura, T., *Parentschrift*, J.P. Chem., 1985; 103: 650,404.
21. Vander JM., Vander Sluis, W.G., De Silva, K. T. D. and Labadei, R.P, *J. Ethnopharmacology*, 1991; 35, 41.
22. Singh D, *Unani Dravya Gun Vigyan*, Nirnay Sagar Press, Mumbai: 1949; 304.
23. Kirtikar, K. R. and Basu, B. D., in *Medicinal Plants* (eds Blatter, E., Cains, J. F., Mhaskar, K. S.), Vivek Vihar, New Delhi: 1975; 536.
24. Perry LM. and Metzger, J, *Medicinal Plants of East and South East Asia*, M.I.T. Press, London. 1895; 260-261.
25. Watt G, A *Dictionary of the Economic Products of India* vol 5, Cosmopolitan, Delhi: 1972; 241.
26. Iffat A, Siddiqui BS, Faizi S, Siddiqui S, Structurally novel diterpenoid constituent from the stem bark of *Azadirachta indica* (meliaceae). *J Chem Soc Perkin Tran*. 1989; 2: 343-345.
27. Jones I, Ley SV, Denholm AA, Lovell H, Wood A, Sinden RE, Sexual development of malaria parasites is inhibited in-vitro by the neem extract azadirachtin, and its semisynthetic analogs. *FEMS Microbiol Lett*. 1994; 120: 267-273.
28. Lavie D., Levy, E.C. and Jain, M.K, *J Tetrahedron*, 1971; 27: 3927.
29. Kraus, W., in *The Neem Tree: Source of Unique Natural Products for Integrated Pest Management, Medicine, Industry and Purposes* (ed. Schmutterer, H.), 1995; 35-88.
30. Ara I., Siddiqui, B. S., Faizi, A. and Siddiqui, S, *J Fitoterapia*, 1992; 63: 118.
31. Siddiqui, S.Siddiqui, B. S., Mahmood, T. and Faizi, S, *J. Nat. Prod.*, *Journal of Phytochemistry* 1991; 30: 1615.
32. Narayana CR. and Lyer, K.N, *Indian Journal of Chemistry*, 1967; 5: 460.
33. Rochanakij S, Thebtaranon Y, Yenjal CH, Yuthavong Y., Nimbotide, a constituent of *Azadirachta indica* inhibits

Plasmodium falciparum in culture. *Southeast Asian J Trop Med Public Health*, 1985; 16: 66-72.

34. Ara I, Siddiqui, B.S., Faizi, S., and Siddiqui, S. *J. Nat Prod.*, 1990; 53: 816.

35. Balandirin MF., Lee, S. M. and Klocke, J. A. *J. Agric. Food. Chem.*, 1988; 36: 1048.

36. Sharma VN, Sakseña KP, Sodium nimbidinate in vitro study of its spermicidal action, *Indian J. Med Res*, 1959; 13: 1038.

37. Siddiqui S., Siddiqui, B.S. and Ghiasuddin and Faizi, S. *J. Nat. Prod.*, 1991; 54: 408.

38. Gaikwad, B.R., Mayelvagnan, T., Vyas, B.A. and Bhat, S.V. *J Phytochemistry*, 1990; 29:3963.

39. Ara I, Z. siddiqui, B.S., and Siddiqui, S. *J Phytochemistry*, 1990; 29:911.

40. Ara I, Siddiqui BS, Faizi S, Siddiqui S, Structurally novel diterpenoid constituents from the stem bark of *Azadirachta indica*(meliaceae). *J Chem Soc Perkin Trans*, 1989; 2: 343-345.

41. Ara I, Siddiqui, B.S., Faizi, A. and Siddiqui, S. *J Fitoterapia*, 1989; 60: 519.

42. Lavie D., Jain, M.K. and Shpan Gavrieliyah, S.R., *J Chem. Commun*, 1967; 910.

43. Banerji R., Misra, G. and Nigam, S.K, *J Phytochemistry*, 1987; 26:2644.

44. Ara I, Siddiqui, B.S., Faizi, S., and Siddiqui, S. *J Phytochemistry*, 1989; 28:1177.

45. Ara I, Siddiqui, B.S., Faizi, S. and Siddiqui, S. *J. Nat. Prod.*, 1988; 51:1054.

46. Rojatkar SR., Bhat, V.S., Kulkarni, M.M., Joshi, V.S. and Nagasampagi, B.A, *Phytochemistry*, 1989; 28,203.

47. Majumdar PL, Maiti, D. C., Kraus, W., and Bokel, M. *J Phytochemistry*, 1987; 26: 3021.

48. Henderson R., Mc Crindle, R., Overton, K. H., Mebra, A, *Tetrahedron Lett*, 1964; 3969.

49. Siddiqui S., Siddiqui, S.B., Faizi, S. and Mahmood, T.J *Hetercycles*, 1986; 24: 3163.

50. Mukherjee S, Garg S, Talwar GP. Early post implantation contraceptive effects of a purified fraction of neem (*Azadirachta indica*) seeds, given orally in rats: possible mechanisms involved. *J Ethnopharmacol*. 1999; 67(3):287-96.

51. Lakshmi SU. and Pattabiraman, T. N, *Ind. J. of Biochem.*, 1967; 4: 181.

52. Dixit VP., Sinha, R. and Tank, R. *J. Ethnopharmacology*, 1986; 17-95.

53. Hawary EI, Z.M. and Kholief, T.S, *Archives J Pharmacol. Res*, 1990; 13(1):108-3963.

54. Chattopadhyay RN, Mita, S. K. and Chattopadhyay, R.R, *Fitoterapia*, 64(4), *J Pharmacology*,1993; 25(2): 99-100.

55. Mukherjee S, Lohiya NK, Pal R, Sharma MG, Talwar GP, Purified neem (*Azadirachta indica*) seed extracts (Praneem) abrogate pregnancy in primates. *Contraception*, 1996; 53(6): 375-8.

56. Tandon SK, Chandra, S., Gupta, S., Trioathi, H. C. and Lal, J. *J Fitoterapia*, 1990; 61, 75.

57. Khanna, N., Goswami, M., Sen, P. and Ray, A, *Indian J. Exp. Biol.*, 1995; Nov., 33(11): 848-850.

58. Vanugopal PV and Venugopal, T.V, *Indian J. of Pharmacology*, 1993; 26 (2): 141-143.

59. Lal R, Ghandhi, M., Shankaranarayanan, A., Mathur, V.S. Sharma, P.L, *J Fitoterapia*, 1988; 23, 53.

60. Prakash AO, Tewari RK, Mathur R, Nonhormonal post-coital contraceptive action of neem oil in rats. *J Ethnopharmacol*, 1988; 23(1):53-9.

61. Prakash AO, Tewari RK, Mathur R, Nonhormonal post-coital contraceptive action of neem oil in rats. *J Ethnopharmacol*, 1991; 28, 163.

62. Sinha KC, Riar SS, Tiwary RS, Dhawan AK, Bardhan J, Thomas P, Kain AK, Jain RK, Neem oil as a vaginal contraceptive. *Indian J Med Res*, 1984; 79:131-6.

63. Tewari RK, Mathur, R. and Prakash, A. O, *International Research Communication System of Medical Science*, 1986; 14: 1005.

64. Brar SS., Devakumar, C., Sawhney, R.C., Ilavazhagan, G., Bardhan, J., Kain, A.K.Thomas, P., Singh, R., Singh. B. and Rajinder parshad, *J Contraception*, 1990; 42-470.

65. Brar SS, Devakumar, C., Sawhney, R.C., Ilavazhagan, G., Brdhan, G., Bardhan, J., Kain, A.K., Thomas, P., Singh, R., Singh.B. and Rajinder Pajinder Parshad, *J Contraception*, 1991; 44-319.

66. Upadhyay SN, Kaushic, C. and Talwar, G.P, *Proc. R. Soc. London and Biol. Sci. England*, 1990; 175-9.

67. Upadhyay SN, Dhawan S, Talwar GP, Antifertility effects of neem (*Azadirachta indica*) oil in male rats by single intra-vas administration: an alternate approach to vasectomy. *J Androl*, 1993; 14(4):275-81.

68. Bardhan J, Riar SS, Sawhney RC, Kain AK, Thomas P, Ilavazhagan G. Neem oil--a fertility controlling agent in rhesus monkey. *Indian J Physiol Pharmacol*. 1991; 35(4):278-80.

69. Garg S, Taluja V, Upadhyay SN, Talwar GP, Studies on the contraceptive efficacy of Praneem poly herbal cream. *Contraception*, 1993; 48(6): 591-6.

70. Koley KM. Lal J. and Tandan, S.K, *J Fitoterapia*, 1994; 6-66, 524-528.

71. Chattopadhyay, R.R., Chattopadhyay, R.N. and Maitra, S.K, *Indian Journal of Pharmacology*, 1992; 25 (2): 99-100.

72. Garg GP., Nigam, S.K. and Ogle, C.W, *Planta Medica*, 1993; 59 (3): 215-217.

73. Koley KM. and Lal, J, *Indian J. Physiol. Pharmacol.*, 1994; Jul., 38(3):323-325.

74. Vandernat, J.M., kierz, J.P.A.M., Vann Dijkm H., Desilva, K.T.D. and Labadie, R.P.J, *Ethnopharmacology*, 1987;19: 125.

75. Prakash, AO, Mishra, A, Mehta, H. and Mathur, R, Nonhormonal post-coital contraceptive action of neem oil in rats. *J Ethnopharmacol*,1991; 62, 99.

76. Singh, P. P., Jinnarkr A.K. Reddi, G.S., and Singh, K.V, *Fitoterapia*, 1987; 58: 235.

77. Gandhi, M., Lal, R., Sankaranarayanan, A., Banerje, C.K. and Sharma, P.L, *J. Ethnopharmacology*, 1989; 23-39.