ISSN 2249-3875

International Journal of Pharmaceutical Erudition

Review Article

Scindapsus Officinalis: A Comprehensive Review

Kaushik Dhirender, Kaushik Pawan *, Tuteja Ruby, Choudhary Balram

University Institute of Pharmaceutical Sciences, Kurukshetra University, Kurukshetra, India

The oldest remedies known to mankind are herbal medicines. India is known worldwide for its Ayurvedic treatment. *Scindapsus officinalis* (ROXB.) Schott, Araceae is often used traditionally for erectile disorders, respiratory ailments (cough, bronchitis, pharyngitis, and asthma), worm infestation, dysentery, troubles of the throat, ozoena, rheumatism arthritis and diarrhoea It is also used as carminative, anthelmintic, cardiotonic, diaphoretic, antiprotozoal (fruit), hypoglycaemic (stem and fruit), anti-inflammatory,analgesic, antiasthmatic, cytostatic and antimicrobial steroids, flavonoids and terpenoid are characterized in the ethanolic extract of *Scindapsus officinalis*. This review describes the general information (distribution, and plant description), description (macroscopic and microscopic), chemistry, ethnopharmacology, traditional uses, medicinal uses, and other important information about the plant *Scindapsus officinalis.*

Key-words: *Scindapsus officinalis*, Analgesic, Cytostatic, antiasthmatic, , etnopharmacology.

INTRODUCTION

Traditional medicine based on herbal remedies has played a key role in the health system of many countries. [1] The value and importance of traditional knowledge are now being increasingly all over the world [2]. In India, between 2500 and 500 BC, Ayurvedic concept appeared. The literal meaning of Ayurveda is "science of life," because ancient Indian system of health care focused views of man and his illness [3]. Of the 2,50,000 higher plant species on earth, more than 80,000 are medicinal. India is one of the world's 12 biodiversity centres with the presence of over 45000 different plant species. Of these, about 15000-20000 plants have good medicinal value. However traditional communities are using only, 7,000-7,500 plants for curing different diseases [4]. In the present context, the Ayurvedic system of medicine is widely accepted [5]. According to the all Indian-co-ordinate project sponsored by the Ministry of Environment of Forests, New Delhi, 40% of the 16,000 recorded flowering plants in India have Ethnomedical value, whereas, only 10% of these are used in drug and pharmaceutical industries. The intrinsic importance of these medicinal plants can very well prove as a potential source of new drugs [6]. In 2001, researchers identified 122

***Address for correspondence**
pwn.kaushik1@gmail.com

compounds used in mainstream medicine which were derived from "ethnomedical" plant sources; 80% of these compounds were used in the same or related manner as the traditional ethnomedical use [7]. Detailed research on the chemistry and pharmacology of plant origin are much essential and this may eventually lead to the discovery of medicine that can be used in the treatment of several diseases [8].

Synonyms

Pothas officinalis Roxb.[9,10].

Vernacular names

Bengal: Gajapipal and gajapipul; Gujerati: Mottopiper; Hindi: Braipipli, gajapipal, gajapipli, maidah, pippaljhhanca; Punjabi: Gajapeepal; Tamil: Anaittippili and Urdu: Gajapippali [11].

Distribution

Scindapsus officinalis is a large epiphytic climber, found all along the sub-Himalayan tract between an altitude of 330-1000 m in West Bengal, Orissa, Andhra Pradesh, Burma and the Andaman Islands [12].

Description

Macroscopic:

Fruit – colour of the fruit is brownish-grey. Seed are present in the each fruit. Central core are present in the transverse cut circular pieces of about diameter 2.0-3.0 cm and thickness 2.0-3.5 cm. Odour and taste are not distinct [13].

Leaves – size of the leaves are 12.5-25 by 6.3-15 cm which are dark green. Petiole are present about size 7.5-15 cm. Peduncle are much shorter than the petiole[14].

Seed – colour of the kidney shaped seed is greyish-brown of length about 0.4-0.6 cm and 0.3-0.4 cm wide. Odour and taste are not distinct[15].

Microscopic:

Spadix – spadix has thick straight central axis, 1.5 mm thick. Seed coat and endosperm are present in each seed and seed are present in each fruit. Pericarp are not present in the seed. These microscopic characteristics are seen in the Lateral section (L.S) of the spadix. In the Transverse section of the spadix ,vascular bundles are present which are collateral. Parenchymatous bundle sheath are also present in the outer of vascular bundles[16].

Fruit – shows more or less loosely arranged, thin-walled, parenchymatous cells having more or less isodiametric cells filled with brown content and numerous acicular crystals of calcium oxalate.

Pericarp – Epidermal cells and subepidermal cell are present in the pericarp. Mixture of thin walled parenchyma cells and thick walled tissue. sclereids are also found in the ground

Seed – contains thin walled testa, sclereid like cells (wide lumen), lignified stone cells (very narrow lumen),

parenchymatous cells. Oils globules and aleurone grains are present in the parenchymatous cells [17]. Seed also contains the dense endosperm and seed coat.

Seed-coat – consist of the outer zone of sarcotesta, 20 µm wide, in which the cells are wide, angular and parenchymatous. Seed coat is 100-130 µm thick. Inner seed-coat (three-layered) about 150 µm thick are also present in the inner with parenchyamatous sarcotesta. Sclerotic cells are found in the outer and inner layered of inner seed coat and middle layer consist of parenchymatous cells.

Endosperm – Cellular type endosperm in which dense starch grains are present when viewed under the polarised light microscope [18].

Powder – consist of stone cells (lumen), numerous needle-like acicular crystals of calcium oxalate and oil globules. Colour of the powder of the *Scindapsus officinalis* are dark brown [19] .

Chemistry of *Scindapsus officinalis*

Fruits contain alkaloids, gum and ash [20] . It also contains two glucosidic colouring substances, scindapsin A ($C_{31}H_{28}O_{13}$, m.p.308-09^0 decomp.) and scindapsin B ($C_{26}H_{32}O_{14}$, m.p.289-90^0 decomp.) which on hydrolysis yield the aglucones scindapsinidine A ($C_{25}H_{16}O_7$, m.p.315-10^0 decomp.) and scindapsinidine B ($C_{20}H_{22}O_9$, m.p.309^0 decomp.) respectively. A sterol ($C_{30}H_{50}O_2$, m.p.270^0 decomp.) and three unidentified colourless substances ($C_{20}H_{28}O_3$, m.p.199-200^0; $C_{18}H_{24}O_4$, m.p.231-32^0; and $C_{17}H_{30}O_3$, m.p.140^0) have also been isolated from the fruit extract. A new hydroxy fatty acid characterized as 11-hydroxy-cis, cis-5,8-tetracosadienoic acid along with cyclopropenoid fatty acids are also one chemical compounds present in the oils of *Scindapsus officinalis* which are identified by some spectroscopic techniques such as IR, NMR, MS and chemical degradation [21,22].Aqueous extract or Fruit decoction (1.0 g/ml) administer orally or i.v.(1.0 ml/kg) show significant analgesic and antidiarrhoeal activities in albino rats. The decoction did not show any toxicity up to 10 ml/kg[23,24] .

Steroids, flavonoids and terpenoid are characterized in the ethanolic extract of *Scindapsus officinalis* [25]. Eight metal elements are present in *Scindapsus officinalis* by using the Microwave-digestion procedure. Eight metal elements such as Zn, Cu, Fe, Mn, Cd, Cr, Mg, Ca and six are the essential elements in this. The experimental result showed that the detection limits are all smaller than 0.0072 µg/ml[26] .

ISSN 2249-3875

International Journal of Pharmaceutical Erudition

Ethnopharmacology

Fruits of *Scindapsus officinalis* Schott. are used in the form of powder amount 200 mg-1 g mixed with honey taken per day, or decoction, 5-10 ml twice a day orally for treating asthma[27] . The halwa made from the plant is used in gout and leaves are used in *Bsoun* for cattle. Fruit decoction is given as an expectorant in asthma [28]. Stem of *Scindapsus officinalis* (Roxb.) belonging to family *Araceae* in the form of pound and boil are applied locally along with Acacia catechu for fracture, sprains and /or dislocation of bones, wounds[29] . Shoots of *Scindapsus officinalis* Schott. belonging to family *Araceae* are used by Tribals in Madhya Pradesh as antidiabetic[30]. Inflorescence of *Scindapsus officinalis* from Paderu division of Visakhapatnam district, A.P is used in diarrhoea[31] . Roots paste of *Scindapsus officinalis* along with fruits paste of *Syzygium cumini* belong to family Myrtaceae in dose of 2-3 times in a day is used by the Taungya community in Terai Arc Landscape, externally for the treatment of cancerous sores. Stems and leaves of *Scindapsus officinalis* were used for body nourishment when boiled with water[32]. Trigonelline and caffeine were the isolated phytocompounds of *Scindapsus officinalis* belonging to family Araceae which were active against the 2-aminoanthracene mutagens[33] .

Ayurvedic uses

The root of Aswagandha (*Withania somnifera* Dunal.), the fruit of Gajapimpali (*Scindapsus officinalis* Schott.), the root of Kosta (*Saussurea lappa* Clarke.), and the rhizomes of *Vekhanda* [Vekhanda , English name : Sweet flag.] in powder form are used as breast developers [34]. *Mucuna Prurita*, commonly known as 'Kunch', (Leguminosae). *Kunch Pak* is an Ayurvedic preparation, used from ancient time for its Aphrodisiac activity. *Scindapsus officinalis* is an ingredient of Kunch Pak preparation which is used as carminative, stimulant, tonic and anthelmintic[35] . Powders of Scindapsus officinalis along with patha, patola, nimbabhu, nimbaparpata, jyotishmati, snuhi, vasa, chavya, granthika, shigruka, vacha, katphala, rodhra, chitraka, fruits of two types of brihati, tikta, duralabha, ratri, Karanja, triphala, trikatu, trayamana, paushkara and dhataki mixed with honey to cure throat diseases[36] .

Traditional uses

The leaf of *Scindapsus officinalis*(Roxb.) Schott belonging to family *Araceae* is used in fever, rheumatism, and pain. Powdered leaves are taken for 21 days for fever and pain. Warmed leaves are applied to affected area for rheumatism [37].

ISSN 2249-3875

International Journal of Pharmaceutical Erudition

Medicinal uses

The fruit is cardiotonic, useful in ozoena, bronchitis, troubles of the throat, dysentery. The fruit is applied externally for rheumatism. A decoction of the sliced fruit (1 in 10) in doses of 2 to 6 drachms are used in diarrhoea, asthma and other affection supposed to be caused by Kafa. Sliced and dried fruit is used as carminative, tonic and as an aromatic adjunct to other medicines[38,39] The fruit shows the hypoglycaemic as well as antiprotozoal activity and shoots exhibit only hypoglycaemic activity . Therapeutic actions of fruit of *Scindapsus officinalis* are diaphoretic, stimulant, and anthelmintic[40]. Fruit also possesses the Aphrodisiac activity [41].

Pharmacological activity

Anthelmintic activity

Aqueous, methanol and hexane extract of fruits of *Scindapsus officinalis* showed the anthelmintic activity against *Haemonchus contortus*[42] . Extract of *Scindapsus* officinalis also showed the in-vitro effect on the motility of mature *Haemonchus contortus* of goat origin[43,44].

Antiasthmatic activity

Methanolic extract of fruit of *Scindapsus officinalis* (MESO) showed the antihistaminic (H_1 receptor antagonist) activity. In-vivo and in-vitro models such as Histamine-induced Bronchospasm in Guinea pigs and Isolated Guinea pig ileum preparation respectively were used to evaluate the antiasthmatic activity. In-vitro study, increase in the contractile responses of the tissues significantly at the different doses of 50, 100 and 200 µg/ml. In-vivo study, different doses of 50, 100 and 200 µg/ml of MESO showed the significant increase in preconvulsion time. Alkaloids, tannins, saponins, flavonoids, glycosides, phenolic compounds, terpenoids and steroids were reported in MESO extract [45].

Antibacterial activity

Ethanolic and aqueous extract of *Scindapsus officinalis* (Roxb.) Schott. Showed the antimicrobial activity against *Escherichia coli*, *Salmonellam typhi*, *Klebsiella pneumonia* and *Staphylococcus aureus*. *Salmonella typhi* showed the highest susceptibility. Ethanolic extract possessed the higher degree of antibacterial activities than the aqueous extract [46].

Anti-inflammatory and Analgesic activity

Ethanolic extract of fruits of *Scindapsus officinalis* (50,100 and 200 mg/kg) showed the anti-inflammatory and analgesic activity in the carrageenan-induced rat paw oedema and tail flick method in dose dependent manner. Ethanolic extract of fruits of *Scindapsus officinalis* showed the presence of steroid, flavonoid and terpenoid and flavonoid present in this

extract was responsible for the anti-inflammatory and analgesic activity [47].

Antimicrobial activity

Methanolic extract of *Scindapsus officinalis* (MESO) were assayed for activity against eleven strains of bacteria and four strain of fungi. Fruit of *Scindapsus officinalis* show the antibiotic, and the antiviral potential. No zone of inhibition are shown in *Bacillus subtilise*, *Staphylococcus aureus*-methicilin resistant, *Streptococcus faecalis*, *Pseudomonas aeruginosa*-sensitive, *Pseudomonas aeruginosa*-wild type, *Mycobacterium phlei*, *Saccharomyces cerevisiae*, and *Candida albicans*. MESO are active only one strain of fungi as *Trichophyton mentagrophytes*. MESO are active only when exposed to UV light only one Gram-positive strain of *Staphylococcus aureus*-methicilin sensitive[48].

Antiviral activity

Methanolic extract of fruits were assayed in two in vitro viral systems, influenza virus/MDCK cells and herpes simplex virus/vero cells and IC_{50} value was calculated. These extract showed no cytotoxic effects. The IC_{50} (µg/ml) was 87 using test system Influenza A/MDCK cells and CC_{50} (µg/ml) not measured. The CC_{50} (µg/ml) was 33.3 using test system stimulant [49].

Cytostatic activity

Ethanolic extract of *Scindapsus officinalis* in concentration of 200 µg/ml were tested for cytotoxicity on COLO 320 tumour cells, using the microculture tetrazolium (MTT) assay. The IC_{50} – value, the concentration causing 50% growth inhibition of the tumour cells, was used as a parameter for cytotoxicity. The extracts of *Scindapsus officinalis* did not show a cytotoxic effect up to 100 µg/ml , the highest concentration tested.The value of IC_{50}(µg/ml) of fruit of *Scindapsus officinalis* was found to be 38±1 and Growth inhibition at 100 µg/ml (%) was 93.[50]

In – vitro Antioxidant Activity

Coarse powder of *Scindapsus officinalis* (Roxb.) Schott fruit was extracted successively using hexane, chloroform, ethyl acetate and 50% ethanol. The ethyl acetate and 50% ethanolic extracts were investigated for its antioxidant activity by using nitric oxide and DPPH radical scavenging methods. The IC_{50} Value was also calculated and Ascorbic acid was used as standard. Both the 50% ethanolic and ethyl acetate extract were found to exert concentration dependent free radical scavenging activity but former extract was more effective than the later on. The highest free radical scavenging activity by *Scindapsus officinalis* fruit extracts was

observed at concentration of 1000 µg/ml[51].

CONCLUSION

Literature review of the plant shows that a very little work has been carried out on the Phytochemistry of the plant, although a number of pharmacological activities are attributed to the plant. Moreover this plant has renowned ayurvedic uses; more clinical trials should be conducted to support its therapeutic activities. There is dire need for finding the active principles from the plant so that they can be correlated to its pharmacological activities.

Acknowledgement

Authors are very thankful to Dr. O.P Arora, Director, Institute of Pharmaceutical Sciences, Kurukshetra University, Kurukshetra for providing All the necessary facilities.

REFERENCE

1.Pushpangadan P, Kumar B. Ethnobotany, CBD, WTO and the Biodiversity Act of India. *Ethnobotany*. 2005; 17: 2-12.

2. Posey DA, Dutfield G 1996. Beyond Intellectual Property. Toward Traditional Resource Rights for Indigenous Peoples and Local Communities, Canada: International Development Research Centre 303.

3. Subhose V, Narian A. Basic principles of pharmaceutical science in Ayurveda. *Bull Indian Inst Hist Med Hyderbad*.2005; 35: 83.

4. Joy PP, Thomas J, Mathew S, Skaria PB. Medicinal Plants. Kerala, India. 1998.

5.John D. One hundred useful drugs of the Kani tribes of Trivandum forest divisions, Kerala, India. Inter. *J. crude drug Res*. 1984;22: 17-39.

6. Mehrorta S, Mehrorta BN. Role of traditional and folklore herbals in the development of new drugs. *Ethnobotany*. 2005; 17: 104-111.

7. Lai PK, Roy J. Antimicrobial and chemopreventive properties of herbs and spices. *Curr. Med. Chem*. 2004 11(11): 1451-60.

8. Dev S. Ethnotherapeutic and modern drug development. The potential of Ayurveda. *Current Science*.1997 ;73: 909.

9. Kirtikar KR, Basu BD. Indian medicinal plants with illustration. Oriental Enterprises. Dehradun, India. 2003

10. Nadkarni KM. Indian Materia Medica. Popular Prakashan. Bombay. 1976

11. The *Ayurvedic Pharmacopoeia of India*. Government of India, Ministry of Health and Family Welfare, Department of Indian System of Medicine and Homeopathy, New Delhi. 1999

12. The *Ayurvedic Pharmacopoeia of India*. Government of India, Ministry of Health and Family Welfare, Department of

Indian System of Medicine and Homeopathy, New Delhi. 1999

13. The *Ayurvedic Pharmacopoeia of India*. Government of India, Ministry of Health and Family Welfare, Department of Indian System of Medicine and Homeopathy, New Delhi. 1999

14. Kirtikar KR, Basu BD. Indian medicinal plants with illustration. Oriental Enterprises. Dehradun, India. 2003

15. The *Ayurvedic Pharmacopoeia of India*. Government of India, Ministry of Health and Family Welfare, Department of Indian System of Medicine and Homeopathy, New Delhi. 1999

16. Velraj M, Singh M, Ravichandiran V, Tyagi LK. Anatomical studies on gajapipal fruit: an ayurvedic herb. *Academic Journal of Plant Sciences*. 2010; 3 (1): 37-41.

17. The *Ayurvedic Pharmacopoeia of India*. Government of India, Ministry of Health and Family Welfare, Department of Indian System of Medicine and Homeopathy, New Delhi. 1999

18. Velraj M, Singh M, Ravichandiran V, Tyagi LK. Anatomical studies on gajapipal fruit: an ayurvedic herb. *Academic Journal of Plant Sciences*. 2010; 3 (1): 37-41.

19. The *Ayurvedic Pharmacopoeia of India*. Government of India, Ministry of Health and Family Welfare, Department of Indian System of Medicine and Homeopathy, New Delhi. 1999

20. Nadkarni KM. Indian Materia Medica. Popular Prakashan. Bombay. 1976

21. Daulatabad CD, Mirajkar AM. A new hydroxy fatty acid from *Scindapsus officinalis* seed oil. *International Journal of Food Science & Technology*. 1992; 1(27): 77-79.

22. The Wealth of India. National Institute of Science communication and Information Resources, CSIR, New Delhi. 2004

23. Rastogi RP, Mehrotra BN. Compendium of Indian Medicinal Plants. India: Central Drug Research Institute, Lucknow. 1998

24. Pullaiah T. Encyclopaedia of World Medicinal Plants. Regency publications. New delhi, India. 2006

25. Patel BD, Shekhar R, Sharma P, Singh A, Tyagi S, Singh RK, Shakya YS. Anti-inflammatory and analgesic activity of *Scindapsus officinalis* (Roxb.) Schott. fruit in experimental animal models. *American-Eurasian Journal of Toxicological Sciences*. 2010; 2(3): 158-161.

26. Yan-qing YF. Determination of metal elements in *Scindapsus officinalis* Schott by microwave digestion-atomic absorption and atomic absorption spectrometry. *Journal of Anhui Agricultural Sciences.* 2008 23: 92.

27. Savithramma N, Sulochana Ch, Rao KN. Ethnobotanical survey of plants used

to treat asthma in andhra pradesh, India. *Journal of Ethnopharmacology*. 2007; 113: 54-61.

28. Verma S, Chauhan NS. Indigenous medicinal plants knowledge of kunihar forest division, district Solan. *Indian Journal of Traditional Knowledge*. 2007; 6(3): 494-497.

29. Ghimire K, Bastakoti RR. Ethnomedicinal knowledge and healthcare practices among the Tharus of Nawalparasi district in central Nepal. *Forest Ecology and Management*. 2009; 257: 2066-2072.

30. Shawl HY, Tripathi L, Bhattacharya S. Antidiabetic plants used by tribals in Madhya Pradesh. *Natural Product Radiance*. 2004 3(6): 427-429.

31. Padal SB, Murty PP, Rao DS, Venkaiah M. Ethnomedicinal Plants from paderu division of visakhapatnam district, A.P, India. 2010 2(8): 70-91.

32. Suksri S, Premcharoen S, Thawatphan C, Sangthongprow S. Ethnobotany in Bung Khong Long Non-Hunting Area, Northeast Thailand. *Kasetsart J.(Nat.Sci.)* 2005;39: 519-533.

33. Iqbal A, Aqil F, Owais M. Modern Phytomedicine. WILEY-VCH Verlag Gmbh and Co.KGaA, Weinheim. 2006.

34. Patkar KB. Herbal cosmetic in ancient india. *Indian Journal of Plastic Surgery*. 2008 41: 134-137.

35. Agrawal A, Agrawal M, Rathore. Traditional remedy, kunch pak- a review. *International Journal of Pharma and Bio Sciences*. A 2010; 3(1): 1-6.

36. Sadhale N, Nene YL. On elephants in manasollasa-2. diseases and treatment. *Asian Agri-History Foundation*. 2004 8(2): 115-127.

37. Rahmatullah M, Noman A, Hossan S, Rashid H, Rahman T, Chowdhury MH, Jahan R. A survey of medicinal plants in two areas of dinajpur district, bangladesh including plants which can be used as functional foods. *American-Eurasian Journal of Sustainable Agriculture*. 2009 ;3(4): 862-876.

38. Kirtikar KR, Basu BD. Indian medicinal plants with illustration. Oriental Enterprises. Dehradun, India. 2003

39. Nadkarni KM. Indian Materia Medica. Popular Prakashan. Bombay. 1976

40.Meena AK, Bansal P, Kumar S. Plants-herbal wealth as a potential source of ayurvedic drugs. *Asian Journal of Traditional Medicines*. 2009 4(4): 152-170.

41. Singh B, Gupta V, Bansal P, Singh R, Kumar D. Pharmacological potential of plant used as aphrodisiacs. International *Journal of Pharmaceutical Sciences*. 2010; 1(5): 104-113.

42. Singh M, Velraj M. In-vitro evaluation of Scindapsus officinalis (Roxb.) Schott.

fruit for antioxidant potential. *African Journal of Basic and Applied Sciences*. 2009; 1(3-4): 83-86.

43. Iqbal Z, Jabbar A, Akhtar MS, Muhammad G, Lateef M. Possible role of ethnoveterinary medicine in poverty reduction in pakistan: use of botanical anthelmintics as an example. *Journal of Agriculture and Social Sciences*. 2005;1(2): 187-195.

44. Sharma LD, Bagha HS, Srivastava PS. In vitro anthelmintic screening of indigenous medicinal plants against Haemonchus contortus (Rudolphi, 1803) Cobbold, 1898 of sheep and goats. Indian *J. of Animal Research*. 1971 5: 33-38.

45. Hedaytullah MD, Arya GS, Raghvendra, Singh N, Mishra A, Chaturvedi P. Evaluation of anti-asthmatic activity of methanolic extract of the fruits of *Scindapsus officinalis* (Roxb.) Schott. *Advances in Biological Research*. 2010; 4(6): 305-308.

46. Rakshit, Tyagi S, Pachute AP, Singh A, Baghel A, Patel BD. Antibacterial activity of aqueous and ethanolic extracts of *Scindapsus officinalis* (Roxb.) Schott Advances in Biological Research. 2011. ;5(2): 77-80.

47. Patel BD, Shekhar R, Sharma P, Singh A, Tyagi S, Singh RK, Shakya YS. Anti-inflammatory and analgesic activity of *Scindapsus officinalis* (Roxb.) Schott. fruit in experimental animal models. *American-Eurasian Journal of Toxicological Sciences*. 2010; 2(3): 158-161.

48. Bonjar GHS, Aghighi S, Nik K. Antibcaterial and antifungal survey in plants used in indigenous herbal medicine of south east regions of iran. *Journal of Biological Sciences*. 2004; 4(3): 405-412.

49. Rajbhandari M, Wegner U, Julich M, Schopke T, Mentel R. Screening of nepalese medicinal plants for antiviral activity. *Journal of Ethnopharmacology*. 2001; 74: 251-255.

50. Smit HF, Woerdenbag HJ, Singh RH, Meulenbeld GJ, Labadie RP, Zwaving JH. Ayurvedic herbal drugs with possible cytostatic activity. *Journal of Ethnopharmacology*. 1995;47: 75-84.

51. Singh M, Velraj M. In-vitro evaluation of Scindapsus officinalis (Roxb.) Schott. fruit for antioxidant potential. *African Journal of Basic and Applied Sciences*. 2009; 1(3-4): 83-86.