CHAPTER- 2

LITERATURE REVIEW

Kapoor and Singh (1966) reported betaine (C₅H₁₁NO₂) (m.p. 292°C) from the whole plant of *Achyranthes aspera*.

Hariharan and Rangaswami (1970) reported the isolation, identification and elucidated the structure of saponins A and B from the seeds of *Achyranthes aspera*.

Neogi *et al.* (1970) isolated and reported Achyranthine a water soluble organic compound having pharmacological actions including relaxation of blood vessels, reduction of the vital sign, and depression of the guts.

Ikan *et al.* (1971) isolated ecdysterone from *Achyranthes aspera* root extracts by chromatography on silica gel column, followed by elution with CHCl₃-MeOH (4:1).

Gupta *et al.* (1972) isolated a saponin from the seeds of *Achyranthes aspera* which shows significant diuretic effect in adult male albino rats.

Seshadri *et al.* (1981) isolated two constituents from the fruits of *Achyranthes aspera* L. and identified as Saponins C and D.

Gariballa *et al.* (1983) isolated an aliphatic alcohol, 17-pentatriacontanol from the shoots of *Achyranthes aspera*.

Akhtar and Iqbal (1991) studied the aqueous and methanolic extracts of the whole plant of *Achyranthes aspera* L. shows hypoglycaemic action of Alloxan induced diabetes in rabbits.

Mohammed Shoaib (1991) evaluated the hypoglycemic effect on *Achyranthes aspera* in normal rats and alloxan – diabetic rabbits and acute toxicity study for 7days.

Pawar *et al.* (1991) studied the leaf optical characteristics of *Achyranthus aspera* L. growing along Agra-Bombay road, Indore (MP), Reduction in light reflectance and transmittance of visible light from adaxial and abaxial surfaces of dusted and undusted leaves of *Achyranthus aspera* due to deposit of pollutants was observed. Abaxial surface reflected more light than adaxial. Variation in reflectance & transmittance was found to be related to the amount of surface deposition of pollutants.

Rameshwar *et al.* (1993) revealed three oleonolic acid glycosides from the seeds of *Achyranthes aspera* L.
Misra Sing et al. (1993) have reported certain long chain compounds from the shoots like 27-cyclohexylheptacosan-7-ol and 16-hydroxy-26-methylheptacosan-2-one.

Ali (1993) isolated & identified Saponins A and B from Achyranthes aspera. Saponin A& B was identified as D-Glucuronic Acid (D-GA) and its derivatives.

Misra et al. (1993) reported certain long chain compounds from the shoots like (27-C-7-ol-16HO-26MH-2one)27-cyclohexylheptacosan-7-oland 16-hydroxy-26-methylhepta cosan-2-one.

Misra et al. (1996) isolated various compounds like tetracontanol-2 (C_{40}H_{82}O, melting point 76-77ºC), 4-methoxyheptatriacont-1-en-10-ol (C_{38}H_{76}O) and β-sitosterol.

Talakal et al. (1996) carried in vitro study of aqueous extract and its 9 indigenous plant materials including Achyranthes aspera L against Trypanosoma evansi. The extracts of Cassia occidentalis leaves, Cyperus rotundus rhizome Azadirachta indica leaves, Achyranthes aspera leaves, Streblus asper leaves, and Hydrocotyle asiatica leaves and exhibited moderate trypanocidal action at different concentrations tested.

Nathet al. (1997) surveyed on indigenous medicinal plants used for abortion in some districts of Uttar Pradesh. In that Achyranthus aspera was reported as a good abortifacient drug.

Kunertet et al. (2000) reported three bisdesmosidic saponins (1-3), 20-hydroxyecdymes, and quercetin-3-O-β-D-galactosides isolated from the methanolic extract of the aerial parts of Achyranthes aspera L.

Schmid and Haslinger (2000) reported two new bisdesmosidic triterpenoid saponins and their structures were elucidated from the methanolic extract of the aerial parts of Achyranthes aspera.

Nasare Lal and Sharma (2001) studied the therapeutic efficacy of a native drug formulation in hepatopathy and nephropathy in goats by taking oxytetracycline-induced toxicity model. It consisted of Achyranthes aspera, Onosma bracteanum, Tinospora cardifolia Terminalia arjuna, Andrographis paniculata, Eclipta erecta, Trianthema decandra, Piper chaba, Saxifruga lingulata. The selected drug was observed to be an effective adjuvant therapy for OTC-induced hepatopathy and nephropathy.
Gokhale et al. (2002) reported the ethanolic extract of the Achyranthes aspera at different doses and screened for acute and chronic inflammation induced in mice and rats using adjuvants induced model. Achyranthes asperainhibited these inflammatory responses at doses of 100-200 mg/kg.

Srivastava et al. (2002) isolated the new oleanolic acid saponin from Achyranthus aspera. Butanol extract of Achyranthus aspera inflorescence afforded a new compound which was characterized as beta-D-fucopyranosyl-(1,4)-(beta-D-glucopyranosyluronic acid)-(1,3)-oleanolic acid.

Gokhale et al. (2002) screened the ethanolic extracts of the Achyranthes aspera at the doses of 50, 100 and 200 mg/kg for their effect on acute and chronic inflammation induced in mice and rats using Carrageenan and Freund's complete adjuvant model. Achyranthes asperainhibited these inflammatory responses at doses of 100-200 mg/kg.

Vetrichelvan and Jegadeesan (2003) reported the aqueous extract of Achyranthes aspera tested on Carrageenan-induced paw oedema and cotton pellet comparing with diclofenac sodium as a standard drug. The drug showed the maximum inhibition of oedema.

Khan et al. (2003) reported that the ethanol and chloroform extracts of seeds of Achyranthes aspera showed mild to moderate antibiotic action against B. subtilis, E. coli and P. aeruginosa.

Suresh Kumar et al. (2003) screened comparatively the antimicrobiological activities of ethanolic extracts of roots and aerial parts of Achyranthes aspera Linn.

Bafna and Mishra (2004) reported that the methanolic extract of the aerial parts of Achyranthes aspera shows hepatoprotective action on Rifampicin induced hepatotoxicity in albino rats. Methanolic extract showed dose dependent decrease in the levels of several enzymes and total bilirubin.

Thilagavathi et al. (2005) studied on the expansion of eco sociable antimicrobial textile finishes using herbs, an assortment of herbal species were screened for their antimicrobial activities. Methanolic extract was prepared from herbs like rind of Punica granatum, leaves of Achyranthes aspera, leaves of Ocimum basilicum and Azadirachta indica flower were found to show antimicrobial action against the strains of Staphylococcus aureus and E. coli. The treated fabric samples which are exhibited resistance to degradability as tested by digging soil test.
Ladha et al. (2005) carried out extraction, isolation and purification of 20-hydroxyecdysone from Achyranthes aspera and its characterization and quantification by HPLC, MS, DSC, UV, IR, CD, 1H and 13C NMR.

Sharma et al. (2006) studied on the aqueous extract of Achyranthes aspera, which had shown the occurrence of the triterpenoid saponin with dose change inhibitory action against Staphylococcus aureus, a bacteria causing various skin disease in human beings.

Chakrabarti and Vasudeva (2000) reported that Achyranthes aspera had shown immuno-stimulant action in Catla catla.

Naveed et al. (2007) studied on the effect of parasitoids could be enhanced by planting L. camara, B. pupurea and A. lebbek.

Rameshwar (2007) isolated chemical compounds of the volatile oil from Achyranthes aspera leaves, growing in Dehra Dun were analyzed by GC-MS method and also identified as hydroquinone (57.7%) which is the chief constituent.

Goyal et al. (2007) reported ethanolic extract of Achyranthes aspera against broncho protective effect in Toluene Di Isocyanate (TDI) induced occupational asthma in wistar rats.

Edwin et al. (2008) reported free radical scavenging action of the ethanolic and aqueous extracts of Achyranthes aspera. Both extracts were evaluated using two methods, DPPH radical scavenging action, and superoxide scavenging action. The plant exhibited good antioxidant effect by inhibiting formation of free radicals in the two models studied.

Sutar et al. (2008) reported methanolic extract of leaves for analgesic and antipyretic activities of the plant Achyranthes aspera by using hot plate and brewer’s yeast induced methods using aspirin as a standard drug.

Edwin et al. (2008) investigated the ethanolic extract and aqueous extracts of leaves of Achyranthes aspera for wound healing action by two wound models, cutting out wound healing model and notch wound healing model.

Sharma et al. (2009) isolated a new aliphatic acid and identified as n-hexacos-14-enolic acid (n-H-14-A) from the ethanolic extracts of the roots of Achyranthes aspera.

Malarvili and Gomathi (2009) reported antioxidant action on seeds of the plant Achyranthes aspera. Diminution in rate of lipid peroxidation and enhancement in free radical scavenging action of the herbal seed powder was observed due to presence of phytoactive constituent.
Datir et al. (2009) reported that the petroleum ether extract (200 mg/kg, i.p.) of the plant Achyranthes aspera shows good antiallergic action and the steroids present in the plant may be responsible for the anti-allergic action.


Jayakumar et al. (2009) reported the methanolic extract of the whole plant of Achyranthes aspera shows nephroprotective action and nephrotoxicity in male albino rats.

Zahir et al. (2009) screened the ethyl acetate extracts and aqueous extract of Achyranthes aspera for antiparasitic action.

Prabhu et al. (2009) have indicated efficacy of plants-based holy stick fumigation against infectious bacteria. The results revealed that the organisms like Streptococcus pyogenes, Pseudomonas aeruginosa, Klebsiella pneumonia and Staphylococcus aureus were prominently inhibited. Fumes of Achyranthus aspera forced the inhibition of Streptococcus pyogenes.

Jayakumar et al. (2009) reported the methanolic extract of the whole plant of Achyranthes aspera shows nephroprotective action and nephrotoxicity in male albino rats.

Mehta et al. (2009) studied the leaves and seeds of Achyranthes aspera which shows analgesic action. Both leaves and seeds show analgesic action in mice using chemical and thermal induced methods.

Manjula et al. (2009) studied the extracts of Achyranthes aspera for antibacterial activity against various pathogenic strains such as Escherichia coli, Pseudomonas aeruginosa, Citrobacter species, Bacillus subtilis and Micrococcus species using disc diffusion and well plate method.

Paul et al. (2010) studied effects of various extracts from the roots of Achyranthes aspera and reported spermicidal action in human and rat sperm. The aqueous and chloroform extracts were found to be most efficient for sperm functions due to acrosome status, 5’-nucleotidase action and nuclear chromatin decondensation.

Vasudeva et al. (2012) reported safest approach for obese, fitness risks and amplified mortality activity on plants such as Terminalia arjuna, Emblica officinalis, Garcinia cambogia, Camellia sinensis and Achyranthus aspera, which are being used traditionally in Chinese, Ayurvedic, Unani and Siddha systems of medicine.
reported phytochemicals such as escins, dioscin, perennisosides and gracillin, present in the extracts of the plants identified for the treatment of obesity.

Eilert et al. (1981) reported the isolation of 4(alpha-L-Rhamnosyloxy) benzyl isothiocyanate from seeds of Moringa oleifera.

Prakash(1988) studied the pre and post-implantation changes in the uterus of rats by the response to Moringa oleifera Lam. extract.

Mahajan et al. (2009) evaluated anti-inflammatory activity from the n-butanol extract of the seeds of Moringa oleifera against ovalbumin-induced airway inflammation in guinea pigs.

Caceres et al. (1992) studied pharmacological properties of Moringa oleifera and screened for antispasmodic anti-inflammatory and diuretic action.

Guevara et al. (1996) screened the anti-inflammatory and antitumor activities of seed extract of malunggay, Moringa oleifera L. Moringaceae family.

Gupta and Mazumder et al. (1997) studied anti-epileptic and anti-cancer action of Moringa oleifera. Antioxidant action against antitubercular drugs induced lipid peroxidation in rats. They also explained the CNS activities of methanolic extract of Moringa oleifera root.

Faizi and Siddiqui (1988) reported isolation and structural elucidation of novel hypotensive A plus B from Moringa oleifera. The first naturally occurring thiocarbamates and in 1998, explained and isolated the Hypotensive constituents from the pods of Moringa oleifera.

Anselme Ndabigengeserre and Subba Narasiah (1998) studied the superiority of water treated by coagulation by means of Moringa oleifera seeds and studied the role of muddy water sedimentation and coagulation-flocculation with Moringa oleifera seeds. The Moringa oleifera seeds be used as a coagulant in water and waste water treatment, only after a sufficient cleansing of the lively proteins.

Murakami et al. (1998) reported antitumor activity from the leaves of Moringa oleifera. The antitumor potential was due the presence of three known thiocarbamate (TC) and isothiocyanate (ITC)-related compounds which are acting as inhibitors of tumor promoter teleocidin B-4-induced Epstein-Barr virus (EBV) activation in Raji cells.

Malaya Gupta et al. (1999) expressed on methanolic extract of roots of Moringa oleifera tested for the sleeping time induced by meprobamate, pentobarbitone sodium
and diazepam shown analgesic properties and also potentiated analgesia induced by pethedine and morphine. It also showed CNS depressant effects.

**Ndiaye et al. (2002)** tested anti-inflammatory action of an aqueous extract of root of *Moringa oleifera* in rats using indomethacin (10 mg/kg) as standard drug and oedema was induced in the rat-paw by subcutaneous injection of carrageenan. At a dose of 750 mg/kg the *Moringa oleifera* treatment significantly inhibited the development of oedema at 1, 3 and 5 hours.

**Siddhuraju and Becke (2003)** reported quercetin and kaempferol from the ethanolic extracts of freeze-dried leaves of *Moringa oleifera*.

**Nikkon et al. (2003)** isolated aglycone of deoxy-niazimicine which is characterized as N-benzyl; S-ethyl thioformate from the chloroform extract of *Moringa oleifera* roots barks.

**Latha and Kapoor (2004)** studied chemical composition and post prandial glycemic effects of some plant gums including (drumstick) *Moringa oleifera*, acacia gums and were analyzed for various chemical constituents. Analysis revealed moderate levels of phosphorus, other were high levels of iron total ash, crude fibre, calcium, low levels of protein and lipid contents. The addition of gums significantly lowered the post prandial rise in plasma glucose levels during two hours of study period in non-insulin dependent diabetic subjects.

**Bineesh et al. (2005)** studied on degradation kinetics of ascorbic acid in *Moringa oleifera* leaves during cooking. The kinetics of ascorbic acid degradation in drumstick (*Moringa oleifera*) leaves as well as in pure ascorbic acid solutions at the initial concentrations present in drumstick *Moringa oleifera* leaves over a temperature variety of 150°- 120°C were studied.

**Nambiar et al. (2005)** elucidated polyphenol profile of three Indian green leafy vegetables, Polyphenols in drumstick *Moringa oleifera* leaves, fenugreek and spinach leaves were characterized using paper chromatography. Maximum polyphenols were recognized in drumstick leaves, followed by spinach and fenugreek leaves. Results indicated that these sea green leafy vegetables are a repository of several antioxidants necessary for human health.

**Ravindra et al. (2006)** studied on the effect of *Moringa oleifera* Lam. root-wood on ethylene glycol induced urolithiasis in rats.

Anwar and Rashid (2007) reported various sterols, tocopherols and fatty acids present in the seeds and seed oil from the n-hexane extract. Among the sterols, stigmasterol has the highest percentage (18.8%), whereas among the tocopherols, α-tocopherol was present in high amount (140.5% mg/kg).

Shanker et al. (2007) isolated nitrile glycosides (niaziridin & niazirin) from the leaves, pods and bark of *Moringa oleifera* by Reverse Phase HPLC method.

Renugadevi et al. (2008) reported efficacy of botanicals in improving the seeds and seedling quality characteristics of cluster bean and *Moringa oleifera*.

Naznin Ara et al. (2008) carried out comparison of *Moringa oleifera* leaf extracts with atenolol on body weight in adrenalin induced rat serum cholesterol, serum triglycerides and blood glucose and heart weight.

Edwin et al. (2008) reported free radical scavenging action of the aqueous and methanolic extracts of *Moringa oleifera*. Both extracts were assessed by means of two methods, DPPH radical scavenging action and superoxide scavenging action. The plant exhibited high-quality antioxidant result by preventing the configuration of free radicals.

Koneni et al. (2009) studied on the isolation of bioactive compounds like aurantiamide-4-acetate and 1,3-dibenzyl urea from *Moringa oleifera*. These isolated compounds showed significant analgesic activities in dose dependent manner. It helps in understanding the mechanism of action of this plant leading to control the activated mast cell on inflammatory condition in arthritis.

Ghasi and Nwobodo (2009) screened the leaves of *Moringa oleifera* used as hypocholesterolemic agent and found to suppress cholesterol on obese patients. High fatty diets were administered and serum, kidney and liver cholesterol level were estimated and the result showed to decrease the elevated cholesterol.

Dolly Jaiswal et al. (2009) reported that the plant *Moringa oleifera* is commonly used as a healing herb to treat diabetes. The aqueous extract of *Moringa* leaves were evaluated for antidiabetic and hypoglycemic effects on streptozotocin induced rats.

Andrea et al. (2009) studied the haemagglutinating action using extracts of *Moringa oleifera*. A new lectin was isolated and characterised from seeds which is evaluated for coagulating activities.
Rastogi et al. (2009) reported anthelmintic activity of *Moringa oleifera*. Ethanolic extracts of *Moringa oleifera* were taken for anthelmintic activity against Indian earthworm *Pheritimaposthuma*. Various concentrations of extract were tested and results were expressed in terms of time for paralysis and time for death of worms. Piperazine citrate (10 mg/ml) was used as a reference standard.

Arti et al. (2009) studied the *in vitro* and *in vivo* models for its antioxidant action. It revealed that the *Moringa oleifera* leaves possess high phenolic content and potent antioxidant property.

Melesse et al. (2009) evaluated the nutritive values and *in vitro* degradability description of leaves, seeds and seed pods from *Moringa oleifera* and *Moringa stenopetala* are versatile tree, which has several agricultural, industrial and medicinal uses.

Sharma et al. (2009) indicated antioxidant actions and phenolic stuffing of the aqueous extract of a number of Indian medicinal plants, including *Moringa oleifera* and found antioxidants defended the body against oxidative stress by neutralizing free radicals.

Mohanka and Azad (2009) investigated antifungal activity using the constituents of *Moringa oleifera* Lam. root bark extract against *Aspergillusniger* and *Neurospora crassa*. Percent mycelial inhibition of aqueous extract and methanolic extract were determined.

Trapti Rastogi et al. (2009) performed comparative study on anthelmintic action of *Moringa oleifera* and *Vitex negundo*.

Koneni et al. (2009) isolated bioactive compounds like aurantiamide acetate 4 and 1, 3-dibenzyl urea. These isolated compounds showed significant analgesic activities in dose dependent manner.

Ghasi and Nwobodo (2009) screened the leaves of *Moringa oleifera* used as hypocholesterolemic agent, suppress cholesterol on obese patients. It is shown to decrease the elevated cholesterol.


Hamza (2010) evaluated the effect of *Moringa oleifera* seed extract on liver fibrosis. Liver fibrosis was induced by the oral administration of 20% carbon tetrachloride (CCL₄). Simultaneously, *Moringa oleifera* seed extract (1g/kg) was orally administered daily. The administration of *Moringa* seed extract decreased the CCL₄-
induced elevation of serum amino transferase activities and globulin level. The elevations of hepatic hydroxyl proline content and myeloperoxidase activity were also reduced by *Moringa* treatment

**Newton et al. (2010)** determined the types and levels of major phytochemicals and nutrients present in tissues from vegetative and flowering parts of *Moringa oleifera* are rhamnose and acetyl-rhamnose- substituted glucosinolases. And also consisting of glucosidase, rutinoside, malonylglucosidase and trace quantity of acetylglucosides of kaempferol and quercetin whereas in seeds oleic acid, whereas in stem and twigs predominantly palmitic acid, potassium, magnesium and calcium were present.

**Khalafalla et al. (2011)** studied leaf explants and antileukemia action of an extract of cell cultures of *Moringa oleifera*. These results give an in vitro proof and sustain the traditional use of *Moringa oleifera* leaf as a strong basis of anticancer.

**Banji et al. (2012)** studied immunomodulatory effects of aqueous extract and hydro aqueous extract of *Moringa oleifera* Lam. Aqueous extract and hydro alcoholic extract of leaves of *Moringa oleifera* leaves, at doses of 50, 100 and 200 mg/kg body weight were studied on immune paradigms similar to late type hypersensitivity reaction using SRBC as an antigen. Determination of antibody titre was well-organized in recuperating immune response.

**Sunanda et al. (2013)** studied the cardio protective potential of N,α-l-rhamnopyranosyl vincosamide, an indole alkaloid, which was isolated from the leaves of *Moringa oleifera*. A reduction in myocardial necrosis was further evidenced by the tri-phenyltetrazolium chloride stain in isolated test in drug pre-treated rats.

**Ajani et al. (2014)** studied about the expression of calcium ATPase in different tissues of protein deficient rats supplemented with *Moringa oleifera* leaves.

**Vasanth et al. (2014)** studied anticancer action of *Moringa oleifera* mediated silver nanoparticles on human cervical carcinoma cells by apoptosis initiation, silver nanomaterial acting a vital role in the rising field of nanotechnology. The effect of synthesized AgNPs was tested against human cervical carcinoma cells (HeLa) and was shown to induce apoptosis through reactive oxygen species generation in HeLa cells.

**Hayashi et al. (1987)** isolated and elucidated skeleton of Scopadulcic acid-A and -B, from *Scoparia dulcis* a Paraguayan crude drug "Typycha kuratu"
Kawasaki et al. (1988) isolated 8-Hydroxytricetin 7-glucuronide, a beta-glucuronidase inhibitor from *Scoparia dulcis* and 6-methoxybenzoxazolinone and triterpenoids from roots of *Scoparia dulcis*.

Hayashi (1991) worked on *Scopario dulcis* and explained the compoundScopadulciol is an inhibitor of gastric H⁺, K⁺ATPase which was isolated from*Scoparia dulcis*, and its structure-activity relationships.

Freire et al. (1993) screened about the analgesic and antiinflammatory properties of *Scoparia dulcis* L. extracts and glutinol in rodents.

Hayashi (1996) carried out the in-vitro culture and production of diterpenoids and other secondary metabolites from the plant *Scoparia dulcis* a medicinal and aromatic plant.

Hayashi (1999) explained the biogenetic pathway related to Mevalonate-independent biosynthesis of bicyclic and tetracyclic diterpenes of *Scoparia dulcis* L.

Pari et al. (2002) screened for hypoglycaemic action of *Scoparia dulcis* L. inextract by alloxan induced hyperglycaemic rats. In 2004, they have explained the antihyperglycaemic effect of *Scoparia dulcis* on key metabolic enzymes of carbohydrate metabolism in streptozotocin-induced diabetes.

Latha et al. (2004) reported Insulin-secretagogue action and cytoprotective role of the traditional antidiabetic plant *Scoparia dulcis*(Sweet Broom weed). In 2003, they explained the modulatory effect of *Scoparia dulcis* in oxidative stress induced lipid peroxidation in streptozotocin diabetic rats. In 2005, studied on antihyperlipidemic effect of aqueousextract of *Scoparia dulcis* in albino rats treated with streptozotocin. In 2006, they also studied the phytochemical and antimicrobial studies of *Scoparia dulcis*.

Li Y et al. (2004) studied in acetylated flavonoid glycosides which is potentiating NGF action from *Scoparia dulcis*.

Mesia Vela et al.(2007) studied about the in vivo inhibition of gastric acid secretion by the aqueous extract of *Scoparia dulcis* L. in rodents.

Edwin et al. (2008) reported free radical scavenging activity of *Scoparia dulcis* in the ethanolic and aqueous extracts. Both extracts were assessed using DPPH radical scavenging and superoxide scavenging actions. The plant exhibited good antioxidant effect by preventing the formation of free radicals in the two models studied.
Zulfiker et al. (2010) screened for analgesic activity of the fruits and whole herb of two medicinal plants, *Ficus racemosa* Linn (Moraceae) and *Scoparia dulcis* L. (Scrophulariaceae). They were extracted in 95% ethanol to evaluate for centrally acting analgesic potential using hot plate and peripheral pharmacological actions using acetic acid induced writhing test in mice. The fruits of *F. racemosa* and whole herb of *S. dulcis* in painful conditions act both centrally and peripherally.

Ordaz et al. (2011) indicated chemical composition of necessary oils from leaves of *Scoparia dulcis*, *Solanum subinerme*, *Helicteres guazumifolia* and *Piper tuberculatum* from Sucre, Venezuela. Chemical composition of essential oils from leaves of *Helicteres guazumifolia*, *Piper tuberculatum*, *Scoparia dulcis* and *Solanum subinerme* were identified.

Mitamura et al. (2011) reported modification and translocation of Rac/Rop(G-5BP)guanosine 5’-triphosphate binding proteins of *Scoparia dulcis*.

Yamamura et al. (2011) identified methyl jasmonate inducible cytochrome P450 s and diterpene cyclase involved in cyclic diterpene biosynthesis in plant *Scoparia dulcis*.

Hayashi (2011) investigated on traditional medicines of Germany, India and studies on different species of diterpenes from *Scoparia dulcis*. HPLC examination of diterpenes in the personality of plants of Paraguayan and Asian *S. dulcis* revealed the presence of three chemotypes. The presence of SDc and SDb were shown the properties such as inhibitory property on gastric acid flow, bone resorption, replication of *Herpes simplex* (HSV-1).

Coulibaly et al. (2011) performed antioxidant and anti-inflammatory effects of *Scoparia dulcis* L, different extracts were obtained from *Scoparia dulcis* L. (Scrophulariaceae) by consecutive extraction of hexane, chloroform, and methanol. These extracts exhibit important antioxidant capacity in antioxidant models mediated xanthine oxidase and lipoxygenase by enzymatic activity.

Bieski et al. (2012) expressed ethnopharmacology of medicinal plants of Mato Grosso, Brazil. Ethnobotanical survey of Medicinal Plants were conducted in *Nossa* species with the better relative significance were found in *Scoparia dulcis* L, *and Luehea divaricata*, *Himatanthus obovatus*, *Hibiscus sabdariffa*, *Solidago microglossa*, *Strychnos pseudoquina* and *Dorstenia brasiliensis* and with the highest concordance for prenatal, mental, respiratory and behavioural problems.
*Costa et al. (2012)* studied the molluscicidal and larvicidal action of eight plants that are used in the traditional medicine of the Pankarare indigenous people in Bahia state, Brazil. The experienced plants were selected based on the results of preceding studies, including *Scopario dulcis*. Crude extracts of these plants were experienced for their larvicidal action (against *Aedes aegypti* larvae in the fourth instar) and molluscicidal action (against the snail BG).

*Dos Santos et al. (2012)* studied the bioactivity evaluation of indigenous medicine plant extracts against the Snail, *Biomphalaria glabrata*, and the larvae of *Aedes aegypti*. Crude extracts of these plants were tested for their larvicidal activity against *Aedes aegypti* larvae and molluscicidal activity. The plant species *Scoparia dulcis* and *Helicteres velutina* exhibited the best larvicidal activities.

*Ahsan et al. (2012)* reported new labdane diterpenes from the aerial parts of *Scoparia dulcis*, three new labdane-derived diterpenes, dulcinodal dulcinodiol and scopadiol decanoate were isolated from the aerial parts of *Scoparia dulcis*. The structures were determined by wide NMR studies and contrast of their spectral data with connected compounds.

*Chen et al. (2012)* isolated Benzoxazinoids from *Scoparia dulcis*(Sweet broomweed) with antiproliferative action against the DU-145 human prostate (HP) cancer cell line, Antiproliferative activities of the six benzoxazinoid compounds against the DU-145 HP cancer cell line were tested.

*Mishra et al. (2013)* reported antidiabetic and antioxidant action of *Scoparia dulcis*Linn. The hypoglycaemic action of ethanolic extracts of *Scoparia dulcis*were performed on together in *vitro* and in *vivo* models down with strength of total polyphenols.

*Kenmotsu et al. (2013)* studied cloning and expression of putative Rac/Rop involved in methyl jasmonate-induced transcriptional activation in cell cultures of *Aquilaria microcarpa*, and *Scoparia dulcis* homology-based clone plan yield two cDNA clones most probably encoding Rac/Rop GTPases. These results informing that *Rac/Rop GTPase* proteins play significant role in jasmonate-induced improvement of terpenoid metabolism.

*Yamamura et al. (2013)* performed molecular cloning and functional description of aNADPH cytochrome P450 reductase from a hot medicinal plant *Scoparia dulcis* L.
Singh et al. (2013) studied management of diabetic complications for chemical constituents based approach. A range of medicinal plants and plant extracts contain phytosterol, phenolic compounds, flavonoids, alkaloids, terpenoids and saponins in the organization of diabetic complications including the plant *Scopario dulcis*.

Beh et al. (2013) examined the effect of the SDF7, which is flavonoid compound isolated from *Scoparia dulcis* Linn. on stimulating the insulin signalling and the adipocytokines expression on different cellular fractions of 3T3-F442a adipocytes.

Asano et al. (2013) studied leaf tissues of *Atropa belladonna* were transformed by Sdrac2, a Rac GTPase gene, that is isolated from *Scoparia dulcis* and the change in atropine concentration of the transformants was examined. This study suggested that Rac GTPases play an important role in the regulation of secondary metabolism in plant cells and that over expression of the gene(s) may be capable of enhancing the production of natural products accumulated in higher plant cells.

Nambiar et al. (2014) studied inhibition of LDL oxidation and oxidized LDL-induced foam cell configuration in RAW 264.7 cells show anti-atherogenic properties of a foliar methanol extracts of *Scoparia dulcis*. The methanolic extract inhibited lipid peroxidation and oxidation of low density lipoproteins, thus preventing foam cell configuration in refined RAW 264.7 cells. The phytochemical screening of the extracts showed presence of flavonoids. The methanolic extract of *Scoparia dulcis* has a strong anti-atherogenic potential and this property could be attributed due to presence of flavonoids.

Liu et al. (2014) isolated bioactive diterpenoids and flavonoids from aerial parts of *Scoparia dulcis* L. Six new DT, 4-epi-seven alpha-O-acetylscoparic acid A, 7-alpha-hydroxy scopadiol, 7-alpha-O-acetyl-8,17 beta-epoxyscoparic acid A, neo-dulcinol, dulcinodal-13-one, and 4-epi-7α-hydroxydulcinodal-13-1, and a new flavonoid, dillenetin 3-O-(6"-O-p-coumaroyl)-beta-d-glucopyranoside along with twelve known compounds are isolated from the aerial parts of *Scoparia dulcis*.

Yamamura et al. (2014) studied the transcriptional commencements of a geranyl geranyl diphosphate synthase gene, GGPPS2, isolated from *Scoparia dulcis* by organization with methyl jasmonate and yeast extracts. A cDNA clone, designated SdGGPPS2, was secluded from young seedlings of *Scoparia dulcis* L.
**Fuentes et al., (2015)** isolated scopadulciol, isolated from *Scoparia dulcis* and found to induce β-catenin degradation and overcome tumor necrosis factor-related apoptosis ligand resistance in AGS human Gastric adenocarcinoma cells, scopadulciol, a scopadulan-type diterpenoid, were separated from *Scoparia dulcis* along with three other compounds by an action-guided approach using the TCF reporter luciferase-based assay system.

**Wankhar et al. (2015)** performed HPTLC analysis of *Scoparia dulcis* Linn. and its larvicidal potential next to dengue vector *Aedes aegypti*. This study showed that *Scoparia dulcis* extracts contain many compounds so as to known to have larvicidal property which validate its efficacy on *A. aegypti* larvae.

**Attanayake et al. (2015)** studied acute hypoglycemic and antihyperglycemic property of 10 Sri Lankan medicinal plant extracts in fit and Streptozotocin induced rats, the effectiveness and dose response of oral hypoglycemic and antihyperglycemic activites in normal and streptozotocin induced rats. The plant *Scoparia dulcis* extracts depicted dose dependent relation development on glucose tolerance at and on top of the best effectual dose in Streptozotocin induced rats.

**Sharma et al. (2015)** studied insulin secretagogue action in *Scoparia dulcis* Linn. of Nepalese source and isolated 6 compounds, coixol, glutinol, glutinone, friedelin, betulinic acid and tetratriacontan-one-ol from the plant *Scoparia dulcis* Linn.

**De Freitas et al. (2015)** studied antimutagenic action of the triterpene (DT) betulinic acid isolated from *Scoparia dulcis*. The mutagenic and antimutagenic activities of triterpene betulinic acid (three beta-three-hydroxy-lup-(29)-en-two zero-two eight-oic) which is isolated from the roots of *Scoparia dulcis* were analyzed by means of the somatic mutation and recombination test in the wings of *Drosophila melanogaster*.

**Moniruzzaman et al., (2015)** screened sedative and hypnotic effects of ethanolic extract of *Scoparia dulcis* Linn., a recurrent herb that has been healthy deliberate for its hepatoprotective, antioxidant, anti-inflammatory and antidiabetic.

**Aileni et al. (2015)** studied about highly efficient production of transgenic *Scoparia dulcis* L. mediated by *Agrobacterium tumefaciens* and the plant regeneration via shoot organogenesis.