2.1 INTRODUCTION
Plants materials having property to cure various disorders in human beings or in animals with lower or no adverse effects can be termed as medicinal plants. Collection of complete data of the plants such as their abundance, identification of specified parts, extraction of active constituents, identification of active constituents, confinement of their use based on pharmacological activities are very much important as plant genes can act as preloaded chips and are capable of producing required chemical constituents.

The World Health Organization also recognized the importance of traditional medicine and has been active in creating strategies, guidelines and standards for botanical medicines. The literature pertaining to the present work only cover medicinal plants, their chemical constituents, pharmacological screening and microbial activities are reported. The information on literature had been compiled from various sources available in the library of this university as well as from other accessible to the author. All the source of information were indicated appropriately in the body of the text on literature and compiled under bibliography session at the end of this chapter.

*Scoparia dulcis* Linn. herbal formulation, *Achyranthes aspera* Linn. herbal formulation and poly herbal formulation (*Adhathoda vasaka* Linn., *Glycyrrhiza glabra* Linn., *Gingiber officinalis* Roscoe. and *Terminalia belerica* Roxb.) were targeted for development and standardization of new analytical methods. So the literature is classified in accordance with the particular herb, their chemical constituents and uses.

2.2 LITERATURE REVIEW:
2.2.1. *Scoparia dulcis* Linn.:  
Scoparia dulcis Linn. contains a compound called ‘Scopadulcic acid B’ have antiviral activity. The activity was determined by the single-cycle replication experiments in which the compound interfered with considerably early events of virus growth. The influence of scopadulcic acid B on the course of the primary corneal herpes simplex virus infection was investigated by means of a hamster test model, with the dose of 100 and 200 mg/kg per day. When the treatment was initiated immediately after virus inoculation, scopadulcic acid B when applied orally or intraperitoneally found to posses’s antiviral activity (Hayashi et al, 1988).

Scoparia dulcis Linn. plant contain Scopadulcic acid B (SDB) which belongs to tetracyclic diterpenoid, Scoparia dulcis Linn. inhibited the effects of tumor promoter 12-O-tetradecanoylphorbol-13-acetate in vitro and in vivo; Scopadulcic acid B inhibited TPA-enhanced phosphor lipid synthesis in cultured cells, and also suppressed the promoting effect of TPA on skin tumor formation in mice initiated with 7,12-dimethylbenz[a]anthracene. The potency of Scopadulcic acid B proved to be stronger than that of other natural antitumor-promoting terpenoids, such as glycyrrhetinic acid (Nishino et al, 1993).

Scoparinol which is a chemical constituent isolated from plant Scoparia dulcis Linn., is a diterpene having significant analgesic and anti-inflammatory activity in animals. Scoparinol was also demonstrated for sedative action by a marked potentiation of pentobarbital-induced sedation with a significant effect on both onset and duration of sleep. Measurement of urine volume after administration of scoparinol indicated its significant diuretic action (Ahmed et al, 2001).

Labdane-derived diterpenes, iso-dulcinol, 4-epi-scopadulcic acid B, dulcidiol and scopanolal together with two known diterpenes, dulcinol/scopadulciol and scopadiol which were isolated from the aerial parts of Scoparia dulcis Linn. Cytotoxicity against a panel of six human stomach cancer cell lines were proved in the crude extracts of Scoparia dulcis Linn.(Ahsan et al, 2003).

Scoparia dulcis Linn. plant extracts were tested (aqueous, ethanolic and chloroform) on streptozotocin diabetic rats and found significant increases in the activities of insulin, superoxide dismutase, catalase, glutathione peroxidase, glutathione-S-transferase, reduced glutathione, vitamin C and vitamin E in liver,
kidney and brain. *Scoparia dulcis* Linn. plant ethanol extract treated groups also showed significant decreases in blood glucose (Latha & Pari, 2003).

*Scoparia dulcis* Linn. aqueous extract (200 mg/kg) showed hyperglycemia on streptozotocin when induced into adult diabetic male albino wistar rats. It is also reported *Scoparia dulcis* Linn. ethanol extract was effective in attenuating hyperglycemia in rats and their susceptibility to oxygen free radicals (Pari & Latha, 2004).

Scopadulcic acid A (SDA), scopadulcic acid B (SDB) and semi synthetic diterpenes are screened and proved these analogues are pharmacologically active compounds in *Scoparia dulcis* Linn. Pure scopadulcic acid A found in vitro posses activity against *P. falciparum*, compounds with antiviral, antifungal and antitumor activity often show activity against *Plasmodium falciparum* (Riel et al, 2002).

Strong scavenging and antioxidant capabilities for *Scoparia dulcis* Linn. extract were reported for 1-diphenyl-2-picrylhydrazyl and measured hemoglobin-catalyzed linoleic acid peroxidation with an oxygen electrode and demonstrated the same corresponding to mitigation of the generation of hydroxyl radicals (Babincova & Sourivong, 2001).

*Scoparia dulcis* Linn. commonly known as ‘Sweet Broomweed’ is widely used in Indian folk medicine for the treatment of diabetes mellitus. Oral administration of 0.15, 0.30 and 0.45 g/kg body weight of the aqueous extract of the *Scoparia dulcis* Linn. leaves for 45 days resulted in a significant reduction in blood glucose, glycosylated haemoglobin and an increase in total haemoglobin but in the case of 0.45 g/kg body weight the effect was highly significant. It is also reported aqueous extract prevented a decrease in the body weight. An oral glucose tolerance test was conducted in experimental diabetic rats, in which there was a significant improvement in glucose tolerance in animals treated with aqueous extract of the *Scoparia dulcis* Linn. leaves and the effect was comparable to that of glibenclamide (Pari & Venkateswaran, 2002).

A diterpenoid, Scopadulcic acid B (SA-B) is a main ingredient of the *Scoparia dulcis* Linn. SA-B and its debenzoyl derivative, diacetyl scopadol (DAS), specifically
inhibit ATP hydrolysis of gastric H+,K(+)-ATPase, the inhibition mechanisms of SA-B and DAS were different from those of omeprazole (Asano et al, 1990).

Tetracyclic diterpenoid, scopadulciol together with 6-methoxybenzoxazolinone, glutinol and acacetin was isolated from the 70% Ethanol extract of Scoparia dulcis Linn. It mildly inhibited gastric H+, K(+)-ATPase. A methyl ester of scopadulcic acid B showed the most potent activity (Hayashi et al, 1991).

2.2.2. Achyranthes aspera Linn.: Literature survey reveals that Achyranthes aspera Linn. is one of the most important herbs used in the herbal medicine and Ayurveda in India. It is a common constituent of many formulations Achyranthes aspera Linn. has been used for many ailments like diabetes, liver disorders, CNS depressant etc.

Achyranthes aspera Linn. (Family Amaranthaceae) is a common plant of the study area abundantly found in wastelands. It is known as “Prickly chaff flower” in English and “Chirchita”, “Onga”, “Latjeera” or “Apamarga” in local language and dialects. The plant is highly esteemed by traditional healers and used in treatment of asthma, bleeding, in facilitating delivery, boils, bronchitis, cold, cough, colic, debility, dropsy, dog bite, dysentery, ear complications, headache, leucoderma, pneumonia, renal complications, scorpion bite, snake bite, skin diseases, etc. Medico botanical uses of Achyranthes aspera Linn. in treatment of gynecological disorders, is part of an extensive study conducted in five districts of western Uttar Pradesh viz., Aligarh, Badaun, Bulandshahar, Farrukhabad and Hatharas (Khan and Khan, 2003; Khan and Khan, 2004).

Khan & Khan published on ethno medicinal analysis. The claims presented here revealed that thirteen claims made use of plant leaves, eight claims utilized roots, two claims used inflorescence and only one claim reported the use of stem. It is important to note that the extract and decoction of the same organ were used to treat different diseases or conditions. An extract is prepared by straining well-pounded fresh plant material, while a decoction is prepared by brewing the plant material (Khan and Khan, 2004).

Achyranthes aspera Linn. plant parts solvent extracts were reported for antimicrobial activity. The successive extracts of Achyranthes aspera Linn. herb
parts had been investigated for invitro antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and *Salmonella typhi* by disc diffusion method. Different solvents such as methanol, acetonitrile, chloroform and hexane were selected for extraction. *Achyranthes aspera* Linn. powder inhibited the growth of *Staphylococcus aureus*, *salmonella typhi* and *Bacillus subtilis* with inhibition zone diameter of 9mm, 7mm and 9mm respectively. Chloroform extract of *Achyranthes aspera* Linn. plant parts was found to inhibit *S. aureus*, *S. typhi* with zone diameter of 6mm (leaves) and 6mm (Inflorescence) respectively. n-Hexane extract showed the growth inhibition against *S. aureus*, *E. coli* and *B. subtilis* with 6mm (stem), 8mm (inflorescence) and 6mm (whole plant) respectively (Naidu et al, 2006).

Acetone, chloroform, ethyl acetate, n-hexane and methanol leaf extracts of *Acalypha indica*, *Achyranthes aspera* Linn., *Leucas aspera*, *Morinda tinctoria* and *Ocimum sanctum* were studied against the early fourth-instar larvae of *Aedes aegypti* L and *Culex quinquefasciatus*. All extracts proved for moderate larvicidal effects; however, the highest larval mortality was found in the ethyl acetate extract of *Achyranthes aspera* Linn.. Bioassay-guided fractionation of *Achyranthes aspera* Linn. led to the separation and identification of a saponin as a potential mosquito larvicidal compound (Bagavan et al, 2008).

*Achyranthes aspera* Linn. and *Neem* used in treatment of post partial fever which may be explained on the basis of antipyretic properties of these two plant species. *Neem*, being a potent antiseptic may also take care of possible infections. Recent studies suggest that chemical constituents present in *Achyranthes aspera* Linn. may act as anti-inflammatory agent (Gokhale et al, 2002; Vetrichelvan & Jegadeesan, 2003).

Oleanolic acid is one of pharmacologically active component present in the plant of *Achyranthes aspera* Linn. Oleanolic acid is a naturally occurring triterpenoid, widely distributed in food and medicinal plants, related to betulinic acid. It is relatively non-toxic, antitumor and hepatoprotective, as well as exhibits antiviral properties. The triterpenoids are effective in protecting against chemically induced liver injury in laboratory animals. The mechanism of hepatoprotection of these two compounds may involve the inhibition of toxicant activation and the enhancement of
the body defense systems. Oleanolic acid and ursolic acid have also been long-recognized to have anti-inflammatory and anti hyperlipidemic properties in laboratory animals (Liu, 1995).

Pharmacological research and toxicity studies were conducted for oleanolic acid and ursolic acid, ubiquitous triterpenoids in medicinal herbs for understanding of these triterpenoids. It is proved beneficial effects and the clinical use of these triterpenoids in various diseases including anticancer chemotherapies (Jie Liu, 2005).

Ursolic acid, its isomer and oleanolic acid had been recommended for skin cancer therapy in Japan (Muto Y, et al 1990).

Ishida registered a patent on topical cosmetic preparations containing ursolic acid/oleanolic acid in Japan for the prevention of topical skin cancer (Ishida M, 1990).

2.2.3. Adhathoda vasaka Linn. :
Vasicine, oxyvasicine and vasicinone are the alkaloids present in Adhatoda vasaka Linn. Vasicine is the active ingredient for expelling sputum from the respiratory system.

Vasaka is a well-known herb in indigenous systems of medicine, particularly in bronchitis. Vasaka leaves, bark, the root bark, the fruit and flowers are useful in the removal of intestinal parasites. Vasaka herb is used for treating cold, cough, chronic bronchitis and asthma. The decoction of its root and bark in doses of 30 grams twice or thrice a day for 3 days can be given for this purpose. A decoction of the leaves can be used as an herbal treatment for cough and other symptoms of colds. In Ayurveda, a preparation made from vasaka flowers, known as gulkand is used to treat tuberculosis, for relief from asthma, the dried leaves should be smoked (Sampath Kumar et al, 2010).

Vasaka leaves contain quinazoline derivatives such as Vasicine, vasicinone and 6-hydroxy Vasicine. Biochemically, Vasicine is oxidized to its ketonic derivative vasicinone and the latter asserts main activity as bronchodilator. The drug also contains volatile oil, betain and vasakin. It is also reported vasaka contains adhatodic acid. Vasaka is used as an expectorant and bronchodilator. The large doses are irritant and cause vomitng and diarrhea (Kokate, 1999).
Vasicine shows abortifient action and this action is due to release of prostaglandins. Bromhexine HCl is a synthetic derivative of Vasicine which changes the structure of bronchial secretions and reduces viscosity of sputum (Atal, 1980).

2.2.4. Glycyrrhiza glabra Linn.:

*Glycyrrhiza glabra* Linn. reported to contain number of components, including a water-soluble, biologically active complex that accounts for 40-50 percent of total dry material weight. This complex is composed of triterpenes, saponins, flavonoids, polysaccharides, pectins, simple sugars, amino acids, mineral salts and various other substances. Glycyrrhizin is one of the triterpenoid compound that accounts for the sweet taste of licorice roots; this compound represents a mixture of potassium-calcium-magnesium salts of glycyrrhizic acid that varies within a 2-25 percent range. Among the natural saponins, glycyrrhizic acid is a molecule composed of a hydrophilic part, two molecules of glucuronic acid, and a hydrophobic fragment, glycyrrhetic acid (Obolentseva et al, 1999).

Glycyrrhizin and its metabolites inhibit hepatic metabolism of aldosterone and suppress 5-ßreductase, properties responsible for the well-documented pseudoaldosterone syndrome. The similarity in structure of glycyrrhetic acid to the structure of hormones secreted by the adrenal cortex accounts for the mineralocorticoid and glucocorticoid activity of glycyrrhizic acid (Armanini D, 1983).

Licorice reported to contain liquiritin, isoliquiritin and other compounds, presence of flavonoids content will give yellow in color to the plant (Yamamura et al, 1992).

Antioxidant activity and estrogen-like activity reported for *Glycyrrhiza glabra* Linn. due to the presence of isoflavones glabridin and hispaglabridins A and B (Vaya J et al, 1997; Tamir S et al, 2001).

After oral administration of licorice in humans, the main constituent, glycyrrhizic acid, is hydrolyzed to glycyrrhetic acid by intestinal bacteria possessing a specialized ß-glucuronidase (Hattori et al, 1985).
Many studies reported that the licorice contain antiviral activity attributed to a number of mechanisms. Antiviral activity reported on herpes zoster. (Su et al, 1984) Antiviral activity reported against HIV (Baba et al, 1987) Antiviral activity reported on Herpes simplex (Hattori et al, 1989; Ito et al, 1988) Antiviral activity reported against CMV (Partridge et al, 1984; Numazaki et al, 1994) Glycyrrhiza glabra Linn. reported to posses hepato protective activity, Glycyrrhizin and glycyrrhizic acid inhibit the growth and cytopathology of numerous RNA and DNA viruses (Tsubota et al, 1999).

Traditionally liquorice had been used as an expectorant and demulcent, it is used in cough mixtures and as a flavoring agent in formulations with naseous drugs like ammonium chloride, alkali iodides, quinine, cascara, etc. Due to flavonoid content with antigastric effects, it is used in peptic ulcer, as antispasmodic and in rheumatoid arthritis, inflammations and addision’s disease (Kokate, 1999).

2.2.5. *Gingiber officinalis* Roscoe.
Ginger consists of volatile oil (1-4%), starch (40-60%), fat (10%), protein (10%), fibre (5%), inorganic material (6%), residual moisture (10%) and acid resinous matter (5-8%). Ginger oil is constituted of monoterpenic hydrocarbons, oxygenated mono and sesquiterpenes and phenyl propanoids. Alcohol gives maximum yield of oleoresin. The yield of gingerin may vary from 3.5 to 9.0%. An average yield of oleo-resin is 6.5% fresh samples of gingerin contain 30% of gingerol (Kokate, 1999).
Dietary polyphenols was having the property to destroy cells, *Zingiber officinale* having poly phenols and can be used for cancer cell treatment. Gemcitabine and ginger extract infusion may improve the efficiency of cervical cancer treatment (Chhavi Sharma et al, 2009).

Ginger is used as a stomachic, an aromatic, a carminative, stimulant and flavoring agent. Ginger oil is used in mouth washes, ginger beverages and liquors. Ginger powder has been reported to be effective in motion sickness. It has been suggested that adsorbent, aromatic and carminative properties of ginger on G.I tract cause adsorption of toxins and acids, enhance gastric motility. These may have probably blocking effects of G.I. reactions and nausea. *Zingiber officinale* Roscoe. (Methanolic extract) has molluscicidal effects, possessing efficacy to control the
gastric infection Viz. schistosomiasis. U.S. food and Drug administration has included ginger as product that is generally regarded safe (Kokate, 1999).

Ginger extracts containing (6) -gingerol reported to posses dose dependent inhibition on the proliferation of HepG2 cell with a corresponding induction of apoptosis. The percentage of apoptotic cells have increased in a dose- dependent manner (Yoo et al, 2002; Hanif et al, 2007).

Ginger reported to contains pungent ingredients including gingerol, shoagol and zingerone that are found to possess pharmacological and physiological activities (Surh et al, 1998).

Several workers reported that Ginger root and its main poly-phenolic constituents (gingerols and zerumbone) exhibit anti-inflammatory and anti-neoplastic activity (Yang et al, 2001; Chang et al, 2003; Kim et al, 2005; Kundu et al, 2009). In several cell types through inhibition of the transcription factor NF-B, involved in cell proliferation, sustained angiogenesis and evasion of apoptosis. [6]- gingerol is capable of killing cancer cells, expressing mutant p53, overcoming the phenotypic resistance to chemotherapy- and irradiation-induced cell death (Yon et al, 2006).

2.2.6. Terminalia belerica Roxb.: 
Chemical substances present in Terminalia belerica Roxb. are of β-sitosterol, gallic acid, ethyle gallate, galloyl, glucose, a new triterpene, the belleric acid and chebulagic acid isolated from fruits of T.bellerica. Fruit extract of T. bellerica caused fall in blood pressure of rats at a concentration of 70 mg/kg body weight (Rastogi, 1999).

Methanol extract of Terminalia bellerica Roxb. dry fruit found to exhibit antimicrobial activity on S. aureus, S. pneumoniae, S. typhi, E. coli, P. aeruginosa, Y. enterocolitica and C. albicans. The minimal inhibitory concentrations (MICs) of crude and methanol extracts were determined on broth dilution technique which ranged from 300 to 2400 µg/ml and 250 µg to 2000 µg/ml respectively indicating that Terminalia bellerica Roxb.was highly effective against S. aureus with lower MIC values. The fruits contain 20-30% of tannins and 40-45% water soluble extractives. Fruits also contain coloring mater. It contains gallic acid, ellagic acid, phyllemblin, ethyl gallate and galloyl glucose. The seeds contain non edible oil. The plant produces
a gum. It also contains most of the sugars. It is used as an astringent and in the treatment of dyspepsia (Elizabeth, 2005).


Integration of literature: *Scoparia dulcis* Linn. is selected for study as it exhibits antiviral activity due to the presence of scopadulcic acid B, scoparinol also exhibit analgesic and anti-inflammatory activity. The extracts of *Scoparia dulcis* Linn. reported to increase insulin activity; hence the developed formulation can be used for antidiabetic and antiviral properties.

*Achyranthes aspera* Linn. is selected for study as it exhibits hepatoprotective activity due to the presence of oleanolic acid. The extracts of *Achyranthes aspera* Linn. reported to contain antimicrobial activity; hence the developed formulation can be used for hepatoprotective properties.

*Adhatoda vasaka* Linn. reported to contain Vasicine, oxyvascicine and vasicinone. Vasicine is the active ingredient for expelling sputum from the respiratory system. Vasaka herb is used for treating cold, cough, chronic bronchitis and asthma. *Glycyrrhiza glabra* Linn. reported to contain Glycyrrhizin and glycyrrhizic acid which inhibit the growth and cytopathology of numerous RNA and DNA viruses thus resulting in Antiviral activity. It also exhibits antioxidant activity, hence can be used in cough suppressant syrups.

*Terminalia. bellirica* Roxb. has demonstrated antimicrobial activity. *Gingiber officinalis* is used as a stomachic, an aromatic, a carminative, stimulant and flavoring agent.

Based on the above reported properties, the plant extracts *Adhatoda vasaka* Linn., *Glycyrrhiza glabra* Linn., *Terminalia. bellirica* Roxb. and *Gingiber officinalis* Roscoe. were selected for developing herbal formulation that can be used in cough and cold treatment.
2.3 REFERENCES:


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