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2.1. MEDICINAL PLANTS

The use of plants as source of therapeutic drug for the treatment of many diseases previous fashioned and people have this old tradition. The search for agents to cure infections diseases began long before people were aware of the existence of microbes. These early attempts used natural substances, usually native plants or their extracts and many of these herbal therapeutic drugs proved successful (Sofowora, 1982). Plants usually create numerous secondary metabolites which represent an imperative source of microbicides, pesticides in addition to many pharmaceutical drugs. Plant foodstuffs still hang about the principal source of pharmaceutical agents use in traditional medicine (Ibrahim, 1997; Ogundipe et al., 1998).

The advantageous therapeutic effects of plant materials characteristically result from the combination of secondary products present in the plant. The therapeutic actions of plants are exceptional to particular plant species or groups and are dependable with this concept as the combination of secondary products in a particular plant which is taxonomically distinct (Wink, 1999).

At present days, medicinal plants receive attention to research centres because of their special importance for the safety of communities. The curative properties of medicinal plants are mainly due to the presence of various complex chemical substances of different composition which occur as secondary metabolites (Karthikeyan et al., 2009; Lozoya and Lozoya, 1989). These are grouped as alkaloids, glycosides, flavonoids, saponins, tannins, carbohydrate and essential oils. Plant based natural constituent can be derivative from some part of the plant in the vein of bark, leaves, flowers, roots, fruits, seeds etc (Gordon and David, 2001).

2.2. ANTIOXIDANTS

The Phenylpropanoids (PPs) which belongs to the major assembly of secondary metabolites formed by plants, mostly, in rejoin to biotic and abiotic stresses. The metabolic pathways of these Phenylpropanoids biosynthesis in plants and the molecular basis in favour of the defensive act of phenylpropanoids in plants is their antioxidant and free radical scavenging properties. The natural as well as synthetic phenylpropanoids are used as antioxidant for medicinal purposes. The plants, free radical-driven, molecular and cellular processes modulate by phenylpropanoids in human cell cultures in vitro and in the in vivo animal models of tumors, inflammation, and cellular damage are furthermore reported. (Korkina, 2007).
The medicinal plants which are used generally having methanolic crude extracts were screened in support of their free radical scavenging property using 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical and ascorbic acid as standard antioxidant. It was found that the on the whole antioxidant activity of green tea (C. sinensis Linn.) be the strongest out of all the methanolic extracts which exhibit antioxidant activity appreciably The methanolic extracts having IC50 range between 6.7 ± 0.1 and 681.5 ± 8.4 μg/ml and so as to of ascorbic acid was 8.9 ± 0.1 μg/ml. It was concluded that the utilization of these type of spices would apply numerous advantageous effects by asset of their antioxidant activity (Nooman et al., 2008).

Medicinal and aromatic plants form a large group of economically important plants that provide the basic raw materials for indigenous pharmaceuticals, perfumery, flavor and cosmetic industries. Medicinal plants represent a rich source of antimicrobial agents (Mahesh & Satish, 2008). Many of the plant material used in traditional medicine are readily available in rural areas at relatively cheaper than modern medicine (Mann et al., 2008).

2.3. **E. campestris**

The plant has been reported to possess mucilage (Khory and Materia, 1982). Upreti and Shrestha, 2006, evaluated the plant for dry matter, organic matter, total ash, crude protein, crude fibre, calcium content, phosphorus and nitrogen free extract. Gum mucilage was extracted from the plant by multiple maceration technique using water and precipitation by acetone (Bhandari et al., 2010; Ghule et al., 2006; Baveja et al., 1988).

Shankar et al., 2009, studied the extract of rhizome of the plant against 7,12-dimethylbenz(a) anthracene induced carcinogenesis in rats and observed significant activity.
2.4. *P. retrofractum*

Banerji et al., 2002, isolated an amide from the plant characterized as retrofractamide-D. Two new unsaturated amides, retrofractamides A and C, were isolated from the total above-ground parts of the plant. Retrofractamide A was identified as \(N\)-isobutyl-9(3',4’-methylenedioxyphenyl)2E,4E,8E-nonatrienamide. Besides, the presence of sesamin and 3,4,5-trimethoxydihydrocinnamic acid as well as two higher homologues of retrofractamide A, viz. pipericide (retrofractamide B) and retrofractamide D was also demonstrated (Banerji et al., 1985).

The fruit of the plant revealed the presence of six compounds from the neutral fraction and piperic acid from a strongly acidic fraction (Nakatani et al., 1986). Sharma et al., 2012, isolated piperine from the plant. Saeda et al., 2005 and Kametani et al., 2005, studied various extracts of the plant for the presence of various secondary metabolites.

The phytochemical analysis of the plant have revealed the presence of 1-undecylenyl-3,4-methylenedioxybenzene, \(\alpha\)-amyrin, \(\beta\)-sitosterol, chavicine, cineol terpinan-4,1-\(\beta\)-caryophylene, fructose, glucose, guineesine, \(N\)-isobutyl-decatrans-2-trans-4-dienamide, palmitic acid, pellitorine, peperidine, pipereicosalidine, piperine, piperlonguminirine, pipernonaline, piperoctadecalidine, pipilandine, retrofractamide-D, sesamin, tetrahydropiperic acid, veneol (Ahn et al., 1992; Ahn et al., 1992; Syamsul, 2009; Khare, 2007; Hardi, 2009). Kikuzaki et al., 1993, isolated novel amides from the plant and determined its structure with LC-MS analysis. Two amides, cubebin and hinokinin, were isolated from the hexane and methanol extract of the plant (Singh et al., 2007).

The principle active constituents of the fruit of the plant are the alkaloidal pieprine and volatile oils (THP, 2000). Kim et al., 2011 isolated piperidine alkaloid including pipeline, pipernonaline and dehydropipernonaline from the fruit of the plant. Subcharoen, macerated the plant with and extracted in boiling water to deduce the chemical composition of the extract and observed the highest concentration of phenolics on the extract. The fruit of the plant has been shown to contain alkaloids (Selvendiran et al., 2003; Pradeep and Kuttan, 2004). From the ethyl acetate fraction of the plant extract, several polyphenols including flavonoid glycosides were isolated (Kikuzaki et al., 2004).

Piperic acid and some of the neutral components isolated from the plant showed slight antioxidative activity, but they were less active than \(\alpha\)-tocopherol (Nakatani et al., 1986).
Saeda et al., 2005, evaluated various extracts of the plant for its antioxidant potential and observed significant activity. Subcharoen (public health ministry) evaluated a number of plants for their antioxidant potential after macerating with ethanol and extracting in boiling water. He observed the highest antioxidant activity of the plant *P. retrofractum*. The fruit extract of the plant has shown significant antioxidant activity (Jagdale et al., 2009; Wakade et al., 2008).

Mahfudz et al., 2011, studied a number of plants for deducing their antioxidant activity including *P. retrofractum* and suggested that the lignin content of *P. retrofractum* might be responsible for its high antioxidant potential. Chenwitheesuk and Rakariyatham, 2000, extracted the plant by powdering and soaking it in methanol overnight and then boiling in water for 45 seconds. He observed a strong antioxidant activity of the extract. Jang, 2010, showed that the plant possess a strong antioxidant activity *in vitro*. The ethyl acetate extract of the plant showed string antioxidant activity evaluated by OSI method and the DPPH radical scavenging test (Kikuzaki et al., 2004).

2.5. *P. nubicola*

Devkota et al., 2000 studied antibacterial activities of a number of herbal plants used in traditional medicine in Nepal. Cold extraction technique was used. The ethanolic extracts of 9 medicinal plants viz., *G. glabra*, *A. indica*, *S. chirayitia*, *A. calamus*, *W. somnifera*, *T. chebula*, *B. aristate*, *P. nubicola* and *C. angustifolia* were tested against *P. autegiinosa* which showed the antimicrobial activities. The antimicrobial activities of *G. glabra*, at different dilution against *P. aureginosa*, *S. aureus*, *E. coli*, *Methicilin resistant S. aureus*, *V. cholera*, *S. typhi* and *Sh. dysenteriae* were also studied. The antimicrobial activities were found to be decreasing on increasing dilution of extract.
V. wallichii

Qualitative phytochemical analysis revealed that the aqueous-ethanolic extract of the plant possess terpenoids (Subhan et al., 2009). Novel flavonoids such as 6-methylapigenin and 2S(-)-hesperidin have been isolated from the plant (Marder et al., 2003).

The plant is reported to contain maalioxide, 2-acetyl-pyrrole, 7-epideacetylisovaltrate, 8-eipikessanol, acetoxy-valepotriatum, α-curcumene, α-kessyk-alcohol, α-methyl-2-pyrrole ketone, β-carotene, caffeeic acid, capronic acid, catalase, dihydrovalepotriatum, eremophilene, γ-linolenic acid, kaempferol, kanokosides, kessane, kessene, kessyl glycol, kongol, linoleic acid, myrtenyl acetate, myrte isovalerianate, oleic acid, oxydase, p-coumaric acid, aplmitic acid, peroxidase, quercetin, saccharose, valepotriatum, valerenal, valerenol, valerenolic acid (Bruneton, 1995; Schultz et al., 1982). Also the plant has exhibited the presence of calcium, camphene, carbohydrates, caryophyllene, chatinene, chlorogenic acid, choline, chromium, cobalt, deacetylisovaltrate, δ-cadinene, didrovaltrate, eugenyl-isovalerate, fat, faurinol, faurinone, fiber, formic acid, fructose, γ-terpinene, γ-valene, glucose, gum, homodivaltrate, homovaltrate, hydroxyvalerinic acid, iron, isoeugenyl isovalerate, isovalerianic acid, isovaleroxy-hydroxy-didrovaltrate, ledol, limonene, maaliol, magnesium, manganese (Morazzoni and Bambardelli, 1995; Bruneton, 1995; Schultz et al., 1982).

The roots of the plant is reported to contain actinidine, acetic acid, acevaltrate, allo-aromadendrene, α-fenchene, α-kerzyalcohol, α-valene, aluminium, ascorbic acid, azulene, baldrianicacid, baldriatannic acid, β-bisabolene, β-elemene, β-ionone, β-phellandrene, β-pinene, β-sitosterole, β-sitosterole stearate, β-valene, borneol, bornyl-acetate, bornyl-butyrate, bornyl-formate, bornyl-isovalerianate. Also, the roots were shown to be positive for the presence of myrcene, mytrenol, N-(β-(p-hydroxyphyenyl)-ethyl)-actinidine, niacin, p-cymol patcholyl alcohol, phosphorus, potassium, protein, raffinose, resin, riboflavin, selenium, silicon, sodium, terpinolene, thiamine, tin, tridecen-(1)-pentain, valechlorine, valenol, valepotriates, valerenic acid, valeroside-A, valerenone, valeriniane, valerianol, valerianolic acid, valeric acid, valerosidatum, zinc valtrate-isovaler oxyhydrin (Morazzoni and Bambardelli, 1995; Bruneton, 1995; Schultz et al., 1982).

Indian system of traditional medicine, Ayurveda have described CNS-activity beneath diverse categories. A quantity of medicinal plants commencing India has been revealed to have activity by the customary methods of psychopharmacology, V. wallichii is one of them. (Vaidya, 1997). Indian medicinal plant, V. wallichii (VW), a accepted source of the sedative
in addition to tranquilizing valepotriates, is well predictable (Violon et al., 1983). Valepotriates are conscientious for the sedative action of the plant (Mishra, 2004). Diverse in vitro cultures of valerianaceae were analyze for valepotriate substance. By means of TLC and HPLC, twelve valepotriates has been isolated along with identified by Proton Mass Resonance (PMR), Citron Mass Resonance (CMR) and Mass Resonance (MS). The rhizomes enclosed appreciably higher levels of valepotriates than the roots (Konovalova and Ryalko, 1983; Becker et al., 1984; Mathur, 1992) Valeriana belong to the most important remedies in insomnia especially owing to nervous exhaustion and mental overwork.

Chattopadhyay et al., 2010, studied a number of plants including V. wallichii to determine in vitro scavenging of DPPH, ABTS, NO, OH, O₂ and ONOO⁻ and capacity to prevent oxidative DNA damage, and observed only a moderate activity of the plant methanolic extract.

2.7. Z. sativa

The phytochemical analysis of the plant have revealed the presence of mucronine-D, nummularine-B (Shah et al., 1979), satiavnine-H (Shah et al., 1986), cyclopeptide type Ia1 (Cassels et al., 1974), Ia2 (Park et al., 1996; Auvin et al., 1996) Ib (Leung et al., 1986: Morita et al., 2000; Wele et al., 2004; Li et al., 1998; Li et al., 1999; Li et al., 1998; Li et al., 1997, Morita et al., 1999) frangulanine (Shah et al., 1979). Pandey et al., 2006, isolated sativanine-N and sativanine-O from the methanolic extract of the stem of the plant by preparative TLC. Three terpenoid acids were isolated from ethyl acetate extract of the fruit of the plant identified as betulinic acid, oleanolic acid and maslinic acid by meas of MS, NMR spectroscopic reported data (Anh et al., 2007). Shah et al., 1979, isolated sativanine-a and sativanine-b from the bark of the plant. Shah et al., 1989, isolated mauritine-C and sativanine-C from the bark of the plant in benzene-ethanol-ammonia (100:5:1) solvent extraction.

Two alkaloids were isolated from the fruit of the plant besides butane-2,3-diol and glycerol, those were identified as stepharine and 1,2-dimethoxy-5,6,6a,7-tetrahydro-4H-dibenzo-quinoline (Anh et al., 2007). From the bark of the plant a new type of 13-membered alkaloid, sativanine-D was isolated (Shah et al., 1985). From the bark of the plant, a novel 13-membered N-formyl cyclopeptide alkaloid, identified as sativanine-F (Shah et al., 1985), sativanine-K (Shah et al., 1987), sativanine-G (Shah et al., 1984) has been isolated. The 14-
membered cyclopeptide alkaloid mauritineC and 13-membered cyclopeptide alkalid sativanine-C were isolated from the plant (Shah et al., 1989). The ripe edible fruit of the plant was phytochemically investigated for its quail-quantitative flavonoid profile. Twelve compounds from the methanol extract has been recognized as quercetin, kaempferol and phloretin derivatives (Pawlowska et al., 2009). A new cyclopeptide alkaloid, sativanine-M, together with known alkaloid nummularine-P was isolated from the stem bark of the plant and identified by spectral analysis (Pandey et al., 2008).

2.8. R. hypocrateriformis

The two new bergenin derivatives were isolated from the stem of Rivea hypocrateriformis (Desr.) Choisy, namely rivebergenin A and B (1 and 2), along with the two known compounds, bergenin (3) and norbergenin (4). The structures of these new compounds have been assigned from 1H and 13C NMR spectra, DEPT, and by 2D COSY, HMQC, and HMBC experiments. Compounds 1–4 showed the strong antioxidant activity (Zamarrud et al., 2011). Saboo et al., 2011 reported the Successive Ethanolic Extracts (SEE) of R. hypocrateriformis (RH) which record the maximum polyphenolic contents was subjected to fractionation by column chromatography. All fractions were tested for in vitro antioxidant activity. Further this fraction was tested for in vivo antioxidant and hepatotoxicity in rat liver using carbon tetrachloride (CCl₄), which shows significant activity. Further, it was confirmed by pretreatment of mice and it was observed that it shortened the duration of pentobarbitone induced necrosis. The HPLC was performed for same fraction evidence the attendance of gallic acid and lupeol along with other polyphenol while compared with markers.
It was reported by Brahmbhatt et al., 2010 that the ethanolic extract of the leaves of *R. hypocrateriformis* which was obtained by soxhlet extraction method was further evaluated for deadening action by Radiant Heat Tail Flick method as well as further tested for anti-inflammatory action by carrageenan induced paw edema. The ethanolic extract in doses of 200 and 400 mg/kg of Body weight showed 64.83 and 100% inhibition of paw edema, respectively at the end of three hours compared to that of standard Ibuprofen (87.04%). In this method, the ethanolic extract at high dose 400 mg/kg of Body weight augmented the pain threshold appreciably after 30 min, 1, 2 and 4 h of administration. The ethanolic extract showed dose-dependent action in all the investigational models. The results were analyzed for numerical significance using two-way ANOVA follow by Dunnel’s test. A P value < 0.05 is considered significant.

The use of diverse plants for curing a variety of ailments like wound healing, cold, heaviness of head, diarrhoea, snake-bite, jaundice, to condense body heat etc. An evaluation was made with bordering study area in Kerala (Nair, & Jayakumar, 2003) and it was found that the species like *B. diffusa, C. gigantean, C. swietenia, P. amarus and T. procumbens* were used by equally of these communities. The medicinal uses *S. potatorum, T. pilosa, S. calva* and *R. hypocrateriformis* were seem to be new-fangled.

Shivalingappa et al., 2002 also reported that the ethanolic extract of *R. hypocrateriformis* was administered orally at the dose levels of 200 and 400 mg/kg body weight to adult rats and resulted in an irregular oestrous cycle with shortened estrus and metestrus, and with lengthened proestrus in non-dose dependent manner. Considerable decrease in number of graffian follicles along with corpora lutea as well as significant increases in number of atretic follicles in treated rats during investigational period indicates the antiovulatory outcome of the extract. Increases in the weight of the uterus, its thickness and diameter indicated the uterotrophic result of the extract. The momentous increase in the level of cholesterol in the tissues of treat rats indicates the inhibition of steroidogenesis of cholesterol by ovarian endocrine tissues. Restoration of normal estrous cycles after withdrawal of treatment indicates the reversible effect of ethanol extract in rats.

### 2.9. *B. retusa*
Kripa et al., 2011 reported the study which was based on the folklore claim and on the scarcity of methodical substantiation form the narrative for the medicinal uses of *B. retusa*. The aim of the current swot up was to scrutinize the phytochemical constituents of the leaves of *B. retusa*. The fraction which was obtained by successive fractionation with solvents of altering polarity were deliberate for the occurrence of primary as well as secondary metabolites and the total phenolic content of the dissimilar fractions were resolute by HPLC. The results of the study support the conventional acclaim of the therapeutic uses of *B. retusa*. The prospective of *B. retusa* to inhibit α-amylase, a prime enzyme involved in carbohydrate metabolism was analysed and it was pragmatic that the ethyl acetate and methanolic extract of the leaves of *B. retusa* possessed *in vitro* amylase inhibitory activity.

2.10. *W. fruticosa*

*W. fruticosa* is being used as a source of medicinal agents for anthelmentic, astringent, emetic, febrifuge, sedative and stimulant. The decoction of the flower is used for biliousness, burns, diabetes, haemorrhage, leprosy and skin diseases (Parekh and Chanda, 2007).

Dried flowers of *W. fruticosa* are used in diversity of diseases in conventional Indian system of medicine including hepatic ailments (Chandan et al., 2008). Baravalia and Chanda, 2011 reported that the flowers of *W. fruticosa* Kurz. (Lythraceae) are commonly used for the treatment of several ailments which includes rheumatism, leucorrhea, menorrhagia, asthma, liver disorder, and inflammatory conditions.

The methanol, ethanol and distilled water extracts of leaves, bark and flowers of the plant were studied for their phytochemistry by Chaturvedi et al., 2012. The bark of the plant showed highest total phenolic content of all the extacts. The methanol extracts of leaves, bark and flowers showed high tannic acid content. Shahwar et al., 2012, tested the crude methanolic extract of the plant fractioned with n-hexane, chloroform and n-butanol, for the presence of total phenolic compounds. The methanolic extract of the dried flowers of the plant reveled the presence of carbohydrates, phenols, flavonoids, tannins, glycosides and anthraquinones, while alkaloids and amino acids were found absent (Finose and Devaki, 2011). A wide range of chemical compounds including tanninds, flavonoids, anthraquinone alycosides amd polyphenols have been isolated from the plant (Das et al., 2007). Yoshida et al., 1991, isolated woodfordins A, B, C, D, E, F, G, H and I from the flowers of the plant. Phytochemical constituents in leaf samples of the plant were analysed and compared during between various seasons. The results revealed that photosynthetic pigments, reducing and
total sugars, starch and other constituents like alkaloids, steroids, saponins, glycosides and flavonoids varied with the season (Chougale and Dhumal, 2010).

Chandan et al., 2008, studied the petroleum ether extract, chloroform extract, ethyl alcohol extract and aqueous extract of the flowers of the plant on carbontetrachloride induced hepatotoxicity and observed restoration of lipid peroxidation and glutathione contents which suggests the antioxidant property of the aqueous extract of the plant. Baek and Bhatt in the year 2005 evaluated the antioxidant activity of the crude ethanolic extract and different solvent fraction of the plant with DPPH assay. Crude extract and most of the polar fractions showed higher activity than that of reference antioxidants. Among all the fractions obtained, the aqueous/methanol fraction showed the highest activity. The methanol, ethanol and distilled water extracts of leaves, bark and flowers of the plant were studied for their radical scavenging potential.

The methanol extract of bark showed the highest activity followed by water and ethanol extracts (Chaturvedi et al., 2012). The crude methanolic extract of a number of plants including W.fruticosa were partitioned with n-hexane, chloroform and n-butanol and their anti-radical activity was against DPPH radical scavenging, total antioxidant capacity assay and ferric reducing antioxidant power. The ethyl acetate extract of the plant exhibited the highest activity (Shahwar et al., 2012). The methanolic extract of the dried flowers of the plant were tested against DPPH free radicals for deducing the antioxidant potential of the extract and an strong activity was observed (Finose and Devaki, 2011).

Choi et al., 2010 studied that the Human rhinoviruses (HRVs) are a chief basis of the widespread cold with anticipation of at present readily available is no registered clinically effectual antiviral chemotherapeutic agent for treatment of disease caused by HRVs. It was showed that gallic acid from W. fruticosa flowers possessed antioxidant activity and also it was reported that antioxidants possess antiviral activities against various viruses.

Consequently, they examined antiviral activity of gallic acid against HRVs and mode of its actions by observing the effect of gallic acid on HRV-induced cytopathic effect (CPE) plus the infectivity of HRV particles. Gallic acid aggressively inhibited HRV2 and -3 replications with antiviral activity more than 55% without cytotoxicity in human epitheloid carcinoma cervix (HeLa) cells at a concentration of 100 µg/ml.
Lal et al., 2009 found an important Ayurvedic formulation i.e. *Arjunarishta* (*Parthadyarishta*) is used for cardiovascular disorders as well as organized by fermenting the decoction of specific plant materials via flowers of *W. fruticosa*. In present study, an HPLC-PDA method was prepared for the standardization of *Arjunarishta* by quantitative estimation of major antioxidant compounds, ellagic acid, gallic acid, ethyl gallate, quercetin and kaempferol as markers. This analysis showed an increase in amount of ellagic acid and gallic acid during preparation, i.e. decoction vs. formulation. A similar increase in free radical scavenging activity of formulation vs. decoction was also observed.

### 2.11. *S. surattense*

*S. surattense* Linn is initiate in the ethnic area of Koraput district and also it is broadly used traditionally by the clannish people as anthelmintic, diuretic, antiarrhythmic, hypotensive, expectorant and carminative. Nayak et al., 2009 made an attempt to investigate the anthelmintic activity of aqueous and ethanolic extract of fruits of plant *S. surattense* in a relative study and observed that all the extracts of both the solvent were able to show anthelmintic activity at 10 mg/ml concentration. These activities are well analogous with the standard drugs, Piperazine citrate and Albendazole. All the doses of aqueous as well as ethanolic extract of *S. surattense* shows enhanced anthelmintic activity than the standard drugs. Also there is a gradual increase in anthelmintic activity, when the dose of the extract is increased. The Aqueous extract showed better anthelmintic activity in comparison to the ethanolic extract of *S. surattense*.

Joseph et al., 2011, investigated the acetone and methanol extracts of the leaves, stem and roots of the plant for total phenolics and tannins and observed their higher levels in the acetone extract of roots. The aqueous, ethanol and methanol extracts of the shade dried plant exhibited the presence of alkaloids, phenolic compounds, flavonoids, dteroids, proteins, carbohydrate and tannins (David et al., 2010). Abirami and Rajendran, 2011, investigated the bioactives present in the methanol extract of the plant and reported the presence of n-hexadecanoic acid and olic acid. A rare 16β-H steroidal alkaloid saponin, an avenacoside-type saponin, two steroidal saponins, one revised-structure steroidal saponin and six known compounds were isolated from the aerial parts of the plant (Kong et al., 2011).

Joseph et al., 2011, investigated the antioxidant potential of acetone and methanol extracts of the plant leaves, stem, fruits and roots. Results indicated that acetone extract of the roots exhibited higher activity against DPPH, ABTS, OH radical scavenging and
phopshomolybdenum reduction. Methanol extract of the roots contained relatively higher level of ferric reducing/antioxidant power, whereas methanol extract of stem showed higher metal chelation. Both the acetone and methanol extracts of roots were found to have recognizable peroxidation inhibition and antihemolytic activity. The antioxidant activity of alcoholic leaf-extract of the plant was evaluated using hydroxyl radical and hydrogen peroxide, inhibition of superoxide anion radical and 2,2-diphenyl-1-picryl hydrazyl (DPPH) radical, total antioxidant activity and reducing ability. The extract effectively scavenged free radicals which showed its potent antioxidant activity (Sridevi et al., 2011). Treatment with β-sitosterol, isolated from the plant, increased the pancreatic antioxidant level with a concomitant decrease in thiobarbituric acis-relative substances, in an experimental model for diabetes-induced oxidative damage (Gupta et al., 2011).

2.12. *C. intybus*

Lavelli, 2008, reported the presence of polyphenols in the minimally processed red chicory products. Furthermore he reported a decrease of less than 20% in the polyphenol content during storage at 4°C. Papetti et al., 2002, obtained the water soluble components present in the plant by centrifugation of the vegetable and assessed it by sequential dialysis, SPE, GFC and RP-HPLC techniques showing the presence of several highly antioxidant components with different molecular weight and polar features. Aqil et al., 2006, examined the crude methanolic extract of the plant for the presence of different phytochemicals and reported the presence of phenolics, alkaloids, glycosides, flavonoids and tannins. Gazzani et al., 2000, obtained a complex mixture of highly active brown components from the water soluble fraction of the plant obtained by centrifugation of the plant. The methanolic and ethanolic extracts of the plant showed the presence of tannins, flavonoids (Satta et al., 2009). Du et al., 1998, isolated seven compounds form the roots of the plant. Four of them were identified as α-amyrin, taraxerone, baurenyl acetate and β-sitosterol.

Phytochemical onvestigation of aerial parts of the plant resulted in the isolation and characterization of two new metabolites, 2,6-di[but-3(E)-en-2-onyl]naphthalene and 3,3′,4,4′-tetrhydroxychalcone. The other nine known compounds were scopeoletin, 4-hydroxyphenyl acetic acid, 3-hydroxy-4-methoxybenzoic acid, 4,4′-dihydrochalcone, 6,7-dihydroxycoumarine, 1-triacnotanol, lupeol, β-sitosterol and β-sitosterol-3-O-β-glucopyranoside (Saied et al., 2011).
Minimally processed red chicory products were studied for their antioxidant activity evaluated by using the synthetic 2,2-diphenyl-1-(2,4,6-trinitrophenyl) hydrazyl radical and three model reactions catalyzed by relevant enzymatic sources of reactive oxygen species, namely, xanthine oxidase, myeloperoxidase and diaphorase. On a molar basis, red chicory was as efficient as the reference compound Trolox in scavenging the synthetic radical. Furthermore, the antioxidant activity decreased by less than 20% during storage of the plant extract (Lavelli, 2008). Papetti et al., 2002, investigated the anti- and pro-oxidant activity of the water soluble components present in the plant. The vegetable juice obtained by centrifugation of the vegetable were assessed using the micellar model system linoleic acid-β-carotene. The boiled juice showed only strong antioxidant activity, proving that the vegetable pro-oxidant components were thermally instable. Aqil et al., 2006, examined the crude methanolic extracts of several different plants including C.intybus for their antioxidant and free radical scavenging properties by ferric thiocyanate assay and DPPH scavenging assay using α-tocopherol and butylated toluene as standard antioxidants.

The overall antioxidant activity of the plant extract showed significant potential. Gazzani et al., 2000, investigated the water soluble compounds of the plant for their antioxidant potential and observed a strong but variable antioxidant activity against rat liver cell microsome lipid peroxidation. The efficacy of leaf extract to prevent lipid peroxidation was assayed in vitro using goat liver mitochondria as the model system via catalase test, superoxide dismutase test, glutathione peroxidase test, peroxidase, polyphenol oxidase, ascorbate oxidase, glutathione-S-transferase and glutathione reductase test. The study revealed that the plant possess high quantities of antioxidants (Smitha and Sudha, 2012). The hydroalcoholic extract of roots of the plant was studied by Saxena et al., 2011, via ABTS radical cation decolorisation assay and reported a strong activity of the plant. The methanolic and ethanolic extracts of the plant showed high free radical scavenging activity (Satta et al., 2009).

2.13. *M. sylvestris*

Della et al., 2009, isolated 4-hydroxybenzoic acid, 4-methoxybenzoic acid, 4-hydroxy-3-methoxybenzoic acid, 4-hydroxycinnamic acid, ferulic acid, methyl 2-hydroxydihydrocinnamate, scopoletin, N-trans-feruloyl tyramine, a sesquiterpene, (3R,7E)-3-hydroxy-5,7-megastigmadien-9-one, and (10E,15Z)-9,12,13-trihydroxy-octadeca-10,15-dienoic acid from the aqueous extract of the plant. Shelbaya et al., 2011, studied the pet ether and hydroalcoholic extracts of the leaves of the plant and reported pyrogallol as the most
abundant phenolic acid present. Also reported were chrisin, synergic, gallic and vanillic acids.

Cinnamic acid was present in the least amount. Barros et al., 2010, reported the mallow leaves of the plant to be the richest source of nutraceuticals such as phenols, flavonoids, carotenoids and tocopherols, unsaturated fatty acids, e.g. α-linolenic acid, and minerals. Conforti et al., 2008, reported the presence of sterols in the hydroalcoholic extract of the plant. Ozkan et al., 2011, reported the presence of phenolics and flavonoids in the methanolic extract of the plant. Tesevic et al., 2012, determined the oil content, fatty acids and unsaponifiable composition of the seed oil obtained from the plant. The main fatty acids of the seed oil were linoleic acid, oleic acid and palmitic acid. A small amount of cyclopropenoid acids was also reported. The predominant sterol in was β-sitosterol.

Della et al., 2009, reported the antioxidant capacity of the aqueous extract of the plant measured by its ability to scavenge the DPPH and superoxide anion radical and to induce the formation of a phosphomolybdenum complex and observed significant activity of the plant extract. Marouane et al., 2011, studied the effect of decoction of the plant on metavanadate intoxicated rats for 80 days. When treated with the plants decoction, the animals showed significantly reduced lipid peroxidation levels and antioxidant enzyme activities. Shelbaya et al., 2011 studied the antioxidant potential of the petroleum ether and hydroalcoholic extracts of the leaves of the plant by determination of acid, peroxide, P-anisidine values, TBA, DPPH and determination of phenolic compounds in the extracts and observed a strong antioxidant potential of the extract.

The effect of the plant on free radicals were investigated by Zhen, 2005, on albino rats by scavenging of free radicals and capability of anti-lipid peroxidation by orthophenanthroline Fe^{+2} oxidation-reduction method. The results indicated that the clearance of free radicals and the inhibition of lipid peroxidation reached a significant value with an amount of the extract comparable with the standard. The leaves of the plant have been reported to possess antioxidant activity (Gasparetto et al., 2012). The mallow leaves of the plant revealed very strong antioxidant properties including radical scavenging activity, reducing power and lipid peroxidation inhibition in liposomes and brain cells homogenates (Barros et al., 2010). Conforti et al., 2008, evaluated the antioxidant potential of the plant by inhibition of linoleic acid oxidation and bovine brain liposomes peroxidation and DPPH radical scavenging and reported that the hydroalcoholic extract of the plant exhibited strong
antioxidant potential. The methanolic extract of the plant was examined for its antioxidant potential by DPPH free anion radical and ABTS free cation radical scavenging, power reducing and metal chelating assays. The plant extract showed a significant activity in all the assays (Ozkan et al., 2011). Tesevic et al., 2012, examined the seed oil obtained from the plant and observed a strong antioxidant potential determined via radical scavenging activity using DPPH assay. Nehir and Sibel, 2004, studied the antioxidant potential of several plants including *M. sylvestris* via radical scavenging effects on hydrogen peroxide and Fe$^{2+}$-chelating activity and observed a marked antioxidant potential of the plant among several different plants.

2.14. *O. bracteatum*

The phytochemical analysis of the plant revealed the presence of tannins, glycosides, resins and alkaloids (Arya and Gupta, 2011). Ata and Farooq, 2011, reported the presence of Na, Li and Mg in various parts of the plant.

Ashraf et al., 2011, studied the NADH oxidase inhibitory activity of the plant extract and observed a moderate activity.

2.15. *C. colocynthis*

The seeds are rich in fatty acids such as myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid and linolenic acid (Khatri et al., 1993). Tumba seed oil is edible; its composition is similar to that of soybean oil. Refining and washing with citric acid removes its bitter taste (Ramakrishna et al., 1993). Akhtar et al., 1999, reported that during germination of seeds in the dark at 30°C, the relative amounts of triacylglycerol decreased, while the free fatty acids increased continuously in significant amounts. However, it was mentioned that saturated fatty acids are increased and unsaturated fatty acids decreased gradually during germination.

The protein content of seeds of the plant was found to be 8.25% and rich in lysine, leucine and sulfo-amino acids viz., methionine (Shaheen and Hamed, 2003). The kernels of the plant contains oil (52%), protein (28.4%), fiber (2.7%), ash (3.6%) and carbohydrate (8.2%). These are good source of essential amino acids, such as arginine, tryptophan and methionine, and vitamins, B1, B2, Niacin and minerals, Ca, Mg, Mn, K, P, Fe and Zn (Simmons et al., 1982). Flavonoid quercetin was isolated from *in vivo* (leaf, stem, fruit and root) and *in vitro* callus of the species (Meena and Patni, 2008). Estimation of protein and
amino acids composition of defatted seed meal showed high protein content (40.5%) and it was reported that the amino acid tryptophan is absent. Flavones c-glycosides were identified from the fruits and aerial parts of the plant. Fruit contains iso-vitexin, iso-orientin and iso-orientin-3'-ethylether, while the aerial parts contain three C-p-hydroxy benzyl derivatives viz., 8-C-p-hydroxybenzylisovitexin, 6-C-hydroxybenzylvitexin and 8-C-p-hydroxybenzylvitexin 4'-glucoside (Maatooq et al., 1997).

The activity of lipase extracted from germinated seeds increases with the stage of development. However, the activity of phospholipase decreases with increase in size of the seeds (Akhtar et al., 1999). Fruits of the plant contains seventeen compounds which were broadly identified and divided into five classes viz., alcohols, ketones, epoxy compounds, hydrocarbons and acids. The alcohols identified were 4-(1-methyl)-ethoxy, 1-butanol, 5-methoxy, 2-methyl, 2-[entanol, 1-cyclopentyl, 2-prpene-1-ol and 2-furanmethanol, tetrahydro-5-methyl-cis and trans isomers. The ketones characterized were 3,4-dimethyl, 2-hexanone, 2-methyl, 4-heptanone and 3-methyl, 2-heptanine (Gurudeeban, 2007).

The antioxidant and free radical scavenging potential of the methanolic fruit extract has been evaluated by various methods (Kumar et al., 2008). The seedless pulp of the plant significantly decreased superoxide dismutase (SOD) and catalase (CAT) in the RBC’s hemolysate and exhibited a potent antioxidant property against oxidative stress in the RBS’s of alloxan induced diabetic rats (Dallak and Bin-Jaliah, 2010). Gill et al., 2011, studied various extracts of the plant for their DPPH free radical and hydrogen peroxide free radical scavenging activity and observed the methanolic extract of the seed to exhibit the maximum activity. Shekhawat et al., 2010, evaluated the ethanolic extract of the plant against DPPH free radical scavenging activity and found them to be exceptionally advantageous for human health. Gurudeeban et al., 2010, studied the DPPH free radical scavenging activity of the leaves and stem extracts of the plant and observed significant activity. Aqueous and diluted acetone extracts from different parts of the plants have been investigated for their scavenging activity on DPPH free radical and ABTS cation [2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)]. All the extracts showed a significant dose-dependent activity (Marzouk et al., 2010).

2.16. *D. inoxia*

Phytochemical screening of leaf, seed, stem, pod and roots of the plant revealed the presence of atropine, scopolamine, essential oils, saponins, flavonoids, phenols, as well as
cardiac glycosides, while tannins, coumarins, carboxylic acids and valepotriates were absent in all the plant parts examined (Ayuba et al., 2011). Rudiger et al., 1993, purified a haemagglutinin from the seeds of the plant. Berkov and Zayed, 2003, compared the tropane alkaloids between D.inoxia grown in Egypt and Bulgaria and observed a marked influence of the environment.

Cyril et al., 2010, compared the chemical profile of plant co-cultivated with A.rhizogenes and that of the sterile plant. The levels of 3-acetoxy-6-hydroxytropane and 3-hydroxylittorine were found higher in plants inoculated with the bacterium. Also, hyoscyamine and scopolamine total contents were found much higher in the whole plant co-cultivated with the bacterium. Furthermore, the leaves and roots of axenic plants contained more alkaloids than non-sterile ones. Selim and Ali, 1994, studied the effects of nitrogen fertilization on growth and chemical composition of the plant. Patel et al., 2010, studied the effect of various purification procedures (Shodhana) on the hyoscyamine and scopolamine content of the seeds of the plant and observed that the procedure resulted in 70-90% reduction in hyoscyamine content, whereas scopolamine content reduced almost to zero.

The effect of cytokinins especially benzyl adenine on plant growth and chemical constituents have been mentioned by Mazrou, 1992. Nahu and Ghani, 2002, isolated tropine, tigloidine and meteloidine besides hyoscyamine and hyoscine form leaves of the plant. Two new steroidal lactones of the withanolide group named as withametelinol and withametelinone have been isolated from the aerial parts of the plant alongwith withametelin (Siddiqui et al., 1999). Gadzikowska et al., 2005, separated the tropane alkaloids present in the plant by thin layer chromatography and characterized the fractions obtained. Triadimefon treatment (TDM), when compared to control plants, induced an increase in α-tocopherol, ascorbic acid, reduced glutathione, superoxide dismutase, ascorbate peroxidase, catalase and indole alkaloid content in the plant (Sivakumar and Panneerselvam, 2011).

Mahmood and Mahmood, 2012, studied the methanolic crude plant extract against DPPH radical scavenging activity and observed significant activity of the plant. Ramadan et al., 2007, studied different extracts of the seeds of the plant for their radical scavenging activity (RSA) towards the stable DPPH radical, and observed a strong RSA exhibited. Karimi and Khataee, 2012, studied the effect of aluminium on the antioxidant potential of the
plant, and observed that Al had significant positive effects on hyoscyamine and scopolamine contents especially in roots of the plantlets and AlCl$_3$ caused ROS production in shoots.

2.17. *R. communis*

Kadri *et al.*, 2011, analyzed the essential oil from the aerial parts of the plant by GC-MS yielding seven constituents. The main constituents were found to be $\alpha$-thujone, 1,8-cineole, $\alpha$-pinene, camphor and camphene. The plant produced an oil rich in ricinoleic acid, which confers unique properties to the oil (Velasco *et al.*, 2005; Rojas *et al.*, 2004; Zhang *et al.*, 2005). Five types of castor bean seed oil triacylglycerols were identified as triricinoleni, diricinoleoylstearoylglycerol, diricinoleoylloleoylglycerol, diricinoleoyllinoleoylglycerol and diricinoleoylpalmitoyl -glycerol (Salimon *et al.*, 2010). Phytochemical studies of the plant have revealed the presence of tannins, saponins, alkaloids, carbohydrates, phenols, flavonoids, sterols and resins (Sundarasiyaraao *et al.*, 1977; Rao *et al.*, 1986; Biswas *et al.*, 2002).

The plant contains a number of aromatic compounds which are responsible for various activities (Lutterodt *et al.*, 1999; Marjorie, 1999). Kensa and Yasmin, 2011, studied acetone, ethanol and hexane extracts of leaf, stem and root of the plant and observed the presence of steroids, phenols, tannins, steroids, saponins, flavonoids, carbohydrates, alkaloids and resins. Salimon *et al.*, 2010, extracted crude oil from the seeds of the plant by soxhlet method using hexane, containing ricinoleic acid, linoleic, oleic, palmitic, stearic, linolenic acid. Castor bean seeds yield viscous, pale yellow non-volatile and non-drying oil (Ogunniyi, 2006; Ramos *et al.*, 1984). Castor oil is one of the few naturally occurring glycerides with high purity, since the fat acid portion is nearly 90% of ricinoleic (Akpan *et al.*, 2006). Ricinoleic acid is a major component of castor oil ranging as 89.2-94.9% (Gupta *et al.*, 1951), about 70-90% (Foglia *et al.*, 2000), 87-90% (Puthli *et al.*, 2006), over 89% (Ogunniyi, 2006) and 90.2% (Conceicao *et al.*, 2007). Mansour *et al.*, 1984, isolated alkali lignins from the plant and its bagasse. Allen and Smith, 1986, studied the effects of increased ammonium concentration on the chemical composition of the plant and observed that at increased ammonium concentration the amount of secondary metabolites in the plants decreased accompanied by a decrease in growth of the plant. Phytochemical study of the roots of the plant revealed the presence of steroids, saponins, alkaloids, flavonoids and glycoside (Taur and Patil, 2011).
Kadri et al., 2011, tested the essential oil from the aerial parts of the plant by DPPH assay, β-carotene bleaching test and reducing power assay and observed a strong activity as compared to positive control. The free radical scavenging activity of the plant is well demonstrated (Ilavarasan et al., 2006). Dry leaves of the plant were extracted with different solvents for deducing their antioxidant potential against DPPH. It was observed that MeOH:water extract showed the highest activity (Chauhan et al., 2008). Singh et al., 2010, evaluated six extracts of the stem against DPPH for evaluating the antioxidant potential and observed benzene and 50% methanol extract to show the maximum activity. Machado et al., 2010, studied the effects of methyl jasmonate (JAME) treatment on the reactive oxygen species (ROS) and on the activities of H$_2$O$_2$ scavenging enzymes, such as superoxide dismutase, catalase, ascorbate peroxidase and guaiacol peroxidase in the leaves of the plant, and reported an increase in all parameters after the treatment with JAME. Islam et al., 2011, studied three chromatographically purified fractions of the aqueous extract of the plant against DPPH assay and nitric oxide radical inhibition assay and observed significant activity.

2.18. Q. infectoria

Q. infectoria Olivier (Fagaceae) is a diminutive tree originate in Greece, Asia Minor and Iran. The galls come up on young branches of this tree as a consequence of attack by the gall-wasp Adleria gallae-tinctoria (Samuelsson, 1992). In Asian countries, the galls of Q. infectoria encompass for centuries in oriental conventional medicines for treatment of inflammatory diseases (CSIR, 1995). Majuphal, a far and wide known plant in Indian traditional medicine have been worn as dental powder and in the dealing of toothache and gingivitis (Chopra et al., 1956; Hwang et al., 2000).

The galls of Q. infectoria comprise pharmacologically predictable to acquire astringent, anti-diabetic, (Dar and Ikram, 1979) antitremorine, local anesthetic, (Hussein et al., 2000) antiviral, (Fatima et al., 2001) antibacterial, (Digraki et al., 1999) antifungal, (Redwane et al., 2002) larvicidal (Kaur et al., 2008) and anti-inflammatory (Ikram and Nowshad, 1977) activities. The foremost constituent originate in the galls of Q. infectoria are tannin (50-70%) and miniature amounts of free Gallic acid and ellagic acid (Dar and Ikram, 1979; Wiart and Kumar, 2001).
Two compounds were isolated from the ethanolic extract of the plant, identified as ellagic acid-4-O-[β-D-glucopyranosyl]-10-O-[β-D-glucopyranosyl]-β-D-rhamnopyranoside and 2-methyl-3-hydroxymethylene-4,5,6,7,8-pentahydroxy-naphthalene (Hamid et al., 2005). The phytochemical studies carried out so far have revealed the presence of tannic acid (gallotannic acid), gallic acid, syringic acid, ellagic acid, β-sitosterole, amentoflavone hexamethyl ether, iso-creatomerin, starch, essential oils, anthocyanins, methyl-betulinate, methylloleananate, hexagalloylglucose, polygalloyl-glucose (Ikram and Nowshad, 1977; Dar and Ikram, 1979; Hwang et al., 2000), monoterpenes, p-coumarins, vanillic acid, toluene and kaempferol (Scherbath, 2002) in the plant. The preliminary chemical detection for the composition in acorn, pericarp and capsules of the plant showed the presence of flavonoids, alkaloids, glycosides, tannins, phenolic compounds, resins, saponins, terpenes and steroid while the detection gave a negative result for alkaloids and saponins in acorn of the plant (Ghafour et al., 2010). The main constituents found in the galls of the plant are tannins and small amounts of free gallic acid and ellagic acid (Wiart and Kumar, 2001; Kokate, 1994). The galls extract of the plant contained tannic acid and gallic acid (Pin et al., 2006). Phyisochemical analysis of ash of the plant showed a high concentration of potassium (Vermani et al., 2010). Elahi, 2010, quantitatively estimated the concentration of organic matter, crude protein, neutral detergent fiber, acid detergent fiber, lignin, total phenols, total tannins, condensed tannins and hydrolysable tannins in the leaves and branches of the plant.

Elemental analysis result showed that the plant has useful minerals of carbon, oxygen, silica, magnesium, aluminium, potassium and calcium (Soon et al., 2007). Nishizawa et al., 1983, isolated two structural isomers of pentagalloyl glucose and four isomers of hexagalloylglucose from the galls of the plant in addition to 1,2,3,6-tetra-O-galloyl-B-D-glucose. Khare, 2004, reported the presence of phytochemicals such as amentoflavone, iso-creatomerin and β-sitosterol. The alcoholic and aqueous extracts of the plant showed the presence of alkaloids, tannins, saponins, resins and phenols, while glycosides and flavonoids were found absent (Al-Sorchee et al., 2010).

The ethanolic extract of the plant exhibited nitric oxide (NO) and superoxide (O₂⁻) inhibiting activity (Hamid et al., 2005). The plant showed a significant increase in the level of the antioxidant enzymes, superoxide dismutase and catalase in the granuloma tissue (Umachigi et al., 2008). Rohana et al., 2004, reported that the aqueous extract of the galls of the plant showed high potential in antioxidant properties as the extract inhibited the
superoxide and DPPH radical scavenging activities and tyrosine activities. The ethanolic extract of the plant showed a mechanism of antioxidant action by hydrogen donation and terminating the oxidation process by converting the free radicals into more stable products (Kaur et al., 2008). Umachigi et al., 2008, showed the plant extract to strongly scavenge the DPPH radical in a dose-dependent manner. The antioxidants such as flavanols (Goncalves et al., 2008) from this plant may contribute to its anti-carcinogenic effect (Shahrzard et al., 2001), contributing to inhibition of cell proliferation (Scalbert et al., 2005). Phytochemical work reveals that ethanolic extract of galls of the plant contains high amount of tannins which may be responsible for its antioxidant activity. Also, studies on the estimation of antioxidant enzyme reveal that the extract significantly increased the level of superoxide dismutase and catalase, known to quench superoxide radicals. Also, investigation indicated its manifestation in wound healing (Umachigi et al., 2008; Haidari et al., 2005; Malekinejade, 1996). Chantana et al., 2010, studied four medicinal plants for their antioxidant activity including Q. infectoria and observed significant antioxidant activity.

2.19. *L. usitatissimum*

Sun et al., 2009, isolated 10 compounds, vanillic acid, syringic acid, xanthine, vitexin, isovanillin, (E)-3,3′-dimethoxy-4,4′-dihydroxystilbene, tachioside, β-sitosterole and stigmasterol mixture, berberine from the roots of the plant. Five trace compounds were isolated from the roots of the plant, namely, 3-methyl -2,5-pyrrolidione-5-oxime, hypoxanthine, nonanedioic acid-1,9 and the mixture of isoleucine and leucine (Sun et al., 2011). Peiretti and Meineri, 2008, concluded that the chemical composition and fatty acid profile of the plant is closely connected to the developmental stage of the plant with 4 characteristic dominant fatty acids, palmitic acid, stearic acid, linoleic acid and α-linoleic acid.

The plant was fractioned via pH control to obtain five linseed meal fractions rich in protein and fibre, especially, secoisolariciresinol diglucoside (Mueller et al., 2010). Khan et al., 2009, reported the presence of linamarin in the plant. The seed is rich in two essential fatty acids α-linolenic acid and linoleic acid (De Lorgeril et al., 1999; Foulk et al., 2002; Bloedon and Szapary, 2004). Oil extracted from flaxseed contained 51.86% of linolenic, 16.34% linoleic and 20.98% of oleic acid. Fractioning of defatted flaxseed cake produced a polyphenol content of 0.73mg GAEg⁻¹ (Gutierrez et al., 2010). The changes in the nitrogenous compounds of flaxseed during germination was studied. During this period, a
decrease in total nitrogen content, increase in free amino acids concentration, and increase in water-soluble protein and a decrease in salt-soluble protein fraction was observed (Shahidi et al., 1999). *L. usitatissimum* of Blinka variety was extracted using water. The mucilage was precipitated from the extract with 80% ethanol in water. The extraction yielded 3-5% mucilage at 25°C, while 8% with boiling water (Barbary et al., 2010).

Bhatia et al., 2006, tested the linseed oil against cyclophosphamide-induced oxidative stress in mouse and observed that the oil significantly prevented the decline in the leaves of reduced glutathione, glutathione peroxidase and alkaline phophatase activity. Antioxidant property of flaxseed “chutney” was evident by decreasing lipid peroxidation and predictor enzyme γ-glutamyl transpeptidase profile and micronuclei formation in azoxymethane treated rats. A significant reduction in both γ-glutamyl transpeptidase level and micronuclei formation was observed (Shakir and Madhusudhan, 2007). Rizea et al., 2010, studied different plants for their antioxidant activity and concluded that *L. usitatissimum* possess strong antioxidant activity. Herbacetin 3,7-O-dimethyl ether and herbacetin were shown to mediate antioxidant activity (Qiu et al., 1999). The different extracts of the leaves (methanol, butanol, acetate and water) of the plant were found efficient in the inhibition of DPPH radical, with butanol and acetate fractions showing the highest activity (Ana-Carolina et al., 2010). Zanwar et al., 2010, studied the ethanolic extract of the plant via DPPH radical scavenging, reducing power, superoxide anion radical scavenging, hydroxyl radical scavenging, hydrogen peroxide scavenging and metal chelating assay to deduce the antioxidant potential of the extract and observed a dose-dependent activity. Different parts of the plant were extracted with pet ether, dichloromethane and methanol which a significant activity against DPPH scavenging (Pratibha et al., 2012).

Oral administration of linseed oil prior to an acute dose of cyclophosphamide significantly inhibited the augmented level of malondialdehyde, conjugated dienes and hydroperoxides in the mouse brains. The cyclohexamide induced decline in the levels of reduced glutathione, glutathione peroxidase and alkaline peroxidase was also significantly prevented in mouse blood. The increased activity of acid phophatase and oxidized glutathione was significantly inhibited (Bhatia et al., 2006).

2.20. *S. nigrum*

*S. nigrum* Linn. (Family solanaceae) is usually worn in the long-established medicine as a medication for treatment of an assortment of diseases. The berries possesses diverse
medicinal properties such as sedative, diaphoretic, diuretic, hydragogue, expectorant along with are valuable in the disease of liver, heart and eyes and is furthermore effective adjacent to piles, fever and dysentery (Rastogi and Mehrotra, 1991). The leaves are worn to heal open wounds and are recognized to possess hypotensive effect (Ye, 1984). The berries has been used in the healing of stomach ulcers in the folk medicine in South Africa, European, China and all the way through India (Ikram and Hussain, 1918). The fruits of S. nigrum encompass play an adjuvant function in the hepatoprotective possessions. Inhibition of lipid peroxidation and free radical scavenging activity have been recommended as a promising mechanism of action (Sarwat et al., 1995).

Sun et al., 2006, isolated acetic acid, tartaric acid, malic acid and citric acid from the plant. High concentration of solanine is found in most parts of the plant but highest in unripe berries (Cooper and Johnson, 1984). Merck and Budavari, 1962, separated solanine obtained from the plant into six components by chromatography namely, α-, β-, γ- chaconines and α-, β-, γ-solanines.

Bhat et al., 2008, reported the presence of solasodine in the plant, while Eltayeb et al., 1997, isolated the same from the leaves of the plant. Cooper and Johnson, 1984, showed the presence of alkaloids in the whole plants extracts. Hu et al., 1999, isolated three antineoplastic steroidal glycosides, β-2-solamargine, solamargine and degalactotigonin from the plant. Studies on the plant through spectroscopic analysis, chemical degradation and derivitisation led to the identification of six new steroidal saponins collectively known as solanigrosides and a one known saponin degalctotigonin (Zhou et al., 2006). Wang et al., 2007, observed the presence of various chemical constituents i.e. 6-methoxyhydroxycoumarin, syringaresinol-4-O-β-D glucopyranoside, pinoresinol-4-O-β-D glucopyranoside, 3,4-dihydroxybenzoic acid and 3-methoxy-4-hydroxyienzoic acid from the whole plant extracts. Dhellot et al., 2006, isolated linoleic acid, palmitic acid, stearic acid and oleic acid from the seeds of the plant. One spirostanol glycoside and two furostanol glycosides have been isolated from methanol extract of the stem and roots of the plant (Sharma et al., 1983). Nawwar et al., 1989, reported the presence of quercetin-3-O-(2Gal-α rhamnosyl)-β-glucosyl (1->6)-β-galactoside and quercetin-3-O-α-rhamnosyl(1-2)-β-galactose.

Chen et al., 2009, isolated two novel disaccharides, ethyl-β-D-thevetopyranosyl-(1-4)-β-D-oleandropyranoside and ethyl β-D-thevetopyranosyl-(1-4)-α-D-oleandropyranoside by
chemical and spectroscopic methods. The berries of the plant have been found to contain steroidal genin, identified as tigogenin (Varshney and Sharma, 1965).

Adebooye et al., 2008, showed a dose dependent radical scavenging activity on radicals including 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals, hydroxyl radicals (OH) and superoxide anion (O$_2^-$). The glycoproteins present in the plant may induce apoptosis through the inhibition of NF-κB activation, induced by oxidative stress in HT-29 cells (Heo et al., 2004). A 50% ethanol extract of the whole plant possess hydroxyl radical scavenging potential (Kumar et al., 2001; Mohamed et al., 2007). Arulmozhi et al., 2010, studied the antioxidant activity of the ethanolic extract of the fruit of the plant and observed significant activity. The antioxidant activity of the ethanol and aqueous extract of the plant was evaluated against DPPH radical and the ethanolic extract was observed to exhibit a greater antioxidant activity comparable to the standard (Aboul-Enein et al., 2012).

Methanol extracts of the plant have shown significant antioxidant activity in various assays, including DPPH radical scavenging activity, estimation of total phenolic compounds in the plant extracts and determination of the 5-lipoxygenase activity (Akula and Odhav, 2008). The plant glycoproteins effectively inhibited hydroxyl radicals in a dose dependent manner (Lee and Lim, 2003). The methanolic extract was screened for antioxidant activity using silica gel thin-layer chromatography followed by spraying with DPPH; the result showed positive antioxidant activity (Patnibul et al., 2008). In the qualitative antioxidant assay using DPPH, the plant extract showed free radical scavenging properties (Karmakar et al., 2010). The ethanol extract of the ripe fruit of the plant revealed to be a potential scavenger of hydroxyl radicals and DPPH radicals rather than superoxide anions (Lee and Lim, 2003).

2.2.1. C. longa

The plant is used in ethnomedicine for the treatment of jaundice, gastric ulcer, skin diseases, joint inflammation, diabetics, cold and flu symptoms (Anonymous, 1950).

Khuarana and Ho, 1988, evaluated the curcuminoids and their photooxidative decomposition compounds in the plant with High performance liquid chromatographic analysis and obtained different compounds. The phytochemical investigation of the plant revealed the presence of curcumin, demethoxy curcumin, bis-demethoxy curcumin...
(Udolmlert et al., 2000). Hydro distillation of rhizomes and leaves of the plant resulted in the isolation of 0.36% and 0.53% oils respectively, of which the major ones were, ar-turmerone, α-turmerone, β-turmerone, β-ocimene (Awasthi and Dixit, 2009). Pulverized rhizome of the plant yielded monoterpenes, β-bisabolene, trans-ocimene, myrcene, 1,8-cineole, α-thujene and thymol (Usman et al., 2009). Tumerone and carvacol have been reported as the most abundant constituents of rhizome essential oil of yellow and red varieties of Bangladesh (Chowdhury et al., 2008). Oguntimehin et al., 1990, have identified α-phellandrene and terpinolene as the predominant constituents of the leaf oil. Hu et al., 1998, extracted the volatile oil from the plant by steam distillation and separated fifteen components. The major components were α-curcumene, α-zingiberene, 1,8-cineole, zerumbone, 1-(3-cyclopentylpropyl)-2,4-dimethylibenzene, β-sesquiphellandrene and germacrene. Babu et al., 2007, evaluated and compared different water distillation techniques for their chemical composition extractives. Khalique and Amin, 1967, evaluated the rhizome for its chemical constituents. Bioassay-directed fractionation of ethyl acetate extract from the plant rhizome yielded three curcumoids namely, Curcumin I, II and III (Geoffrey et al., 1998). Gounder and Lingamallu, 2012, isolated ar-, α- and β-turmerone from the rhizome of the plant.

Leela et al., 2002, analysed the essential oils of leaves, flowers, rhizome and roots of the plant by GC-MS and observed the major constituent of flower oil as p-cymene-8-ol, of leaf oil as α-phellandrene and of rhizome and root as ar-turmerone. Braga et al., 2003, obtained different extracts of the plant by hydrodistillation, low pressure solvent extraction, soxhlet and supercritical extraction using CO₂ and co solvents and observed maximum amount of curcumoids in the soxhlet extract.

Fresh, dried and cured rhizome oil showed antioxidant capacity quenching DPPH radical (Gounder and Lingamallu, 2012). Unnikrishnan and Rao, 1995, studied the antioxidative properties of curcumin and its three derivatives (demethoxy curcumin, bisdemethoxy curcumin and diacetyl curcumin). The isolate demonstrated the protection of hemoglobin from oxidation. Curcumin is a good antioxidant and inhibits lipid peroxidation in rat liver microsomes, erythrocyte membranes and brain homogenates (Reddy and Lokesh, 1994). The plant lowers the activities of superoxide dismutase, catalase and glutathione peroxidase, hence, lowering lipid peroxidation (Reddy and Lokesh, 1992). Reddy and Lokesh, 1992, observed that curcumin is capable of scavenging oxygen free radicals. Rao,
1994, showed that curcuminoids inhibit lipid peroxidation in rat brain homogenates and rat liver microsomes. Selvam et al., 1995, isolated turmeric anti-oxidant protein (TAP) from the aqueous extract of the plant and observed a concentration dependent inhibitory effect on lipid peroxidation. Braga et al., 2003, obtained different extracts of the plant by hydrodistillation, low pressure solvent extraction, soxhlet and supercritical extraction using CO\textsubscript{2} and co-solvents and observed strongest antioxidant activities in the soxhlet and low pressure extract of the plant.

Chatterjee, 1999, studied the effect of γ-radiations on the hexane, benzene, aqueous and methanolic extracts of the plant and found that the γ-radiations did not affect the antioxidant potential of the extracts. The antioxidant activity of 50% methanolic extract of leaves of the plant were tested by Fenton’s reaction to deduce their antioxidant potential. A strong and concentration-dependent activity of the extracts was observed (Bhardwaj et al., 2011). Cikrikci et al., 2008, evaluated the antioxidant activity of the plant by CUPRAC method and observed a significant activity.
2.22. **A. calamus**

*A. calamus* Linn. (Family Araceae) usually acknowledged as “sweet flag” or Waan-Nam, is a renowned medicinal plant. The rhizomes be utilized expansively by the Chinese, Indians and American Indians as well as by supplementary cultures, and loads of of these uses prolong to this day (Motley, 1994) together with in Thai traditional medicine (Anonymous, 2000). The rhizomes are well thought-out to possess anti-spasmodic, carminative and anthelmintic properties along with also used for healing of epilepsy, mental ailments, chronic diarrhea, dysentery, bronchial catarrh, intermittent fevers and tumors. It is planned as an insecticide, an antifungal agent, an antibacterial agent and a fish toxin (Anonymous, 1975).

The phytochemical investigation of the plant revealed the presence of asarone, acoradin (Patra and Mitra, 1979; Patra and Mitra, 1981), calamuseone (Keller and Stahl, 1983), β-sitosterole in the plant. Three new sesquiterpenes, 1-β, 7-α(H)-cadinane-4α, 6-α, 10α-triol, 1-α, 5-β-guaiane-10α-ethyl-4β, 6β-diol and 6β, 7β(H)-cadinane-1α, 4α, 10α-triol, together with 25 known ones, were isolated from the rhizome of the plant (Dong et al., 2010; 21). Isocalamendiol was isolated by steam distillation of the ethereal extract of the plant (Iguchi and Nishiyama, 1969). Acrogermacrone and preisocalamendiol were separated by repeated preparative TLC (Iguchi et al., 1973). Galangin, a dihydroxy flavonol was isolated from the ethanolic extract residue (Stahl and Keller, 1981).

The aromatic compounds asarylaldehyde and asarone were isolated from the roots and leaves of the plant respectively (Venakutonis and Dagilyte, 2003). Three monocyclic sesquiterpenes were isolated from the rhizome of the plant namely, shyobunone, epishyobunine and 2,6-diepishyobunone (Iguchi and Nishiyama, 1968). Raina et al., 2002, studied the rhizome and leaf oils of the plant by GC and GC-MS and obtained 29 constituents form them. The major constituents were β-asarone, α-asarone and linalool. The various extracts of the rhizome contains alkaloids, flavonoids, gums, lectins, mucilage, phenols, quinines, saponins, sugars, tannins and triterpenes (steroids) (Ahmad and Aqil, 2006; Aqil et al., 2006; Bains et al., 2005; Chit et al., 2001; Parab and Mengi, 2002). Calamenone, as well as calamendiol and isocalamendiol also occur in roots (Wu et al., 1994). The oil constituents include acoramone and phenylpropane derivatives and methyl ether (Patra and Mitra, 1981; Tamas et al., 1996). As a product of super critical extraction from the rhizome, the oil
contained as major constituents acorenone, iso-acorone, Z-sesquilavandulol, dehydroxy isocalamendiol and β-asarone (Marongiu et al., 2005).

Antioxidant action occurred with an extract of the rhizome (Acuna et al., 2002). In a study that screened various plants alcoholic extracts as possible antioxidants, the plant extract scavenged hydroxyl radicals, as well as radicals in the 2,2-diphenyl-1-picryl hydrazine reduction assay, and the extract inhibited polyphenol oxidase (Gacche and Dhole, 2006). In rats, after 30 days of exposure to white noise for four hours a day, there were decreases in lipid peroxidation and activity of superoxide dismutase in various parts of the brain (cerebral cortex, cerebellum, midbrain, pons and medulla oblongata, hippocampus, hypothalamus) in the rats that had daily prior intraperitoneal injection with either an extract (ethyl acetate or methanol) of the rhizome or commercially available α-asarone, a constituent of calamus; concurrent increases occurred in the respective activities of catalase and glutathione peroxidase as well as in the respective concentrations of glutathione, protein thiol, vitamin C, and vitamin E. Through such actions against the effects from the stress of noise, calamus speculatively has the potential for production of an increase in the capacity for the action of antioxidants in the brain so that this herb substantially lessens changes that the given stress induces in the brains of rats (Manikandan et al., 2005; Manikandan and Devi, 2005).

This effect may relate to α-asarone, which apparently has action as an antioxidant. Besides such effects in biochemistry, histologic analysis showed normal features in the tissues of cerebral cortex from rats with daily intraperitoneal injection of a certain dose of α-asarone before exposure to white noise for four hours a day over 30 days whereas in the cerebral cortex of rats that only had this exposure to noise, there was reduction in the size of nerve cells, as well as histological disturbance of the cortical layers (Manikandan and Devi, 2005). In the model of middle cerebral artery occlusion in rats, lipid peroxidation decreased in the cerebral cortex, the concentration of glutathione increased in the cerebral cortex and striate body, and there were increases in the activity of superoxide dismutase in the cerebral cortex and striate body at 72 hours after occlusion in those rats that ingested an extract (alcohol and water in the proportion of 1:1) of the rhizomes for five days prior to, and for three days following the technique of middle cerebral artery occlusion (Shukla et al., 2006). With the extract in combination with acrylamide, there were increases in the content of glutathione and the activity of glutathione-S-transferase in the striate body, whereas these decreased with acrylamide by itself (Shukla et al., 2002). A. gramineus (not calamus), as the
essential oil from the dry rhizomes, inhibited lipid peroxidation in mice that inhaled the essential oil before induction of convulsions with pentylenetetrazole (Koo et al., 2001).