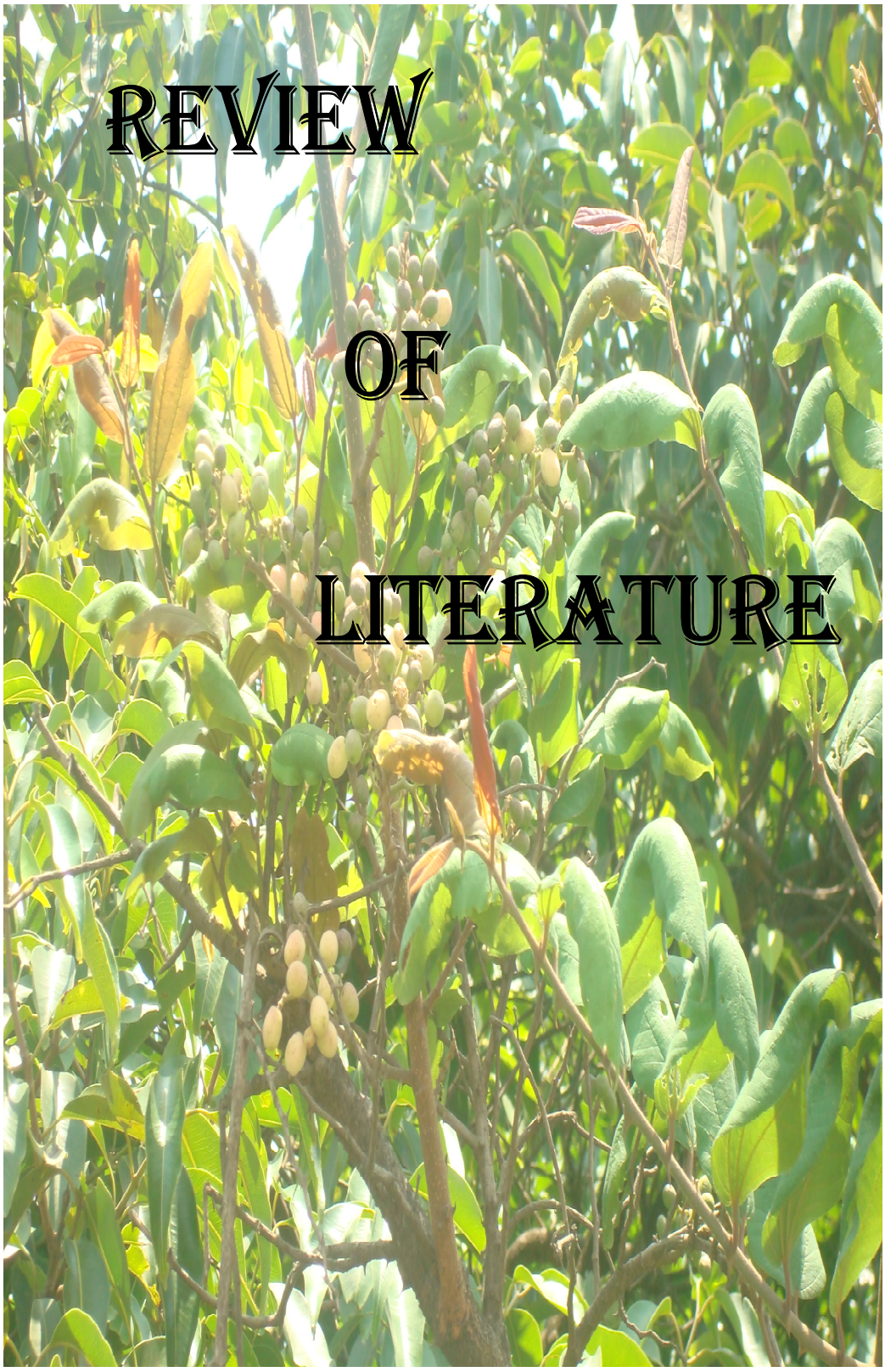
REVIEW
OF
LITERATURE

Local people in different parts of the country have learnt to live on many wild fruits available around their localities. It is possible that the extensive use of these plants as foods and other purposes have resulted in rapid decreases in their population and some of them might be already on the verge of extinction. Hence the responsibility comes to the exports dealing with natural resources to find out way to conserve and utilize them in proper way. At the same time these plants need to be checked for their nutritive value and thereby some best fruits can be selected for further development and bring them into horticulture practices. There is no doubt that the edible wild fruits influence on the living of the tribal people of different parts where they live near the forests. These fruits can also be good additional nutritive material for the people living far from these forests. It will help to combat nutritive deficiency diseases and food scarcity problems in the villages (Bajaracharya, 1984, Bhandari, 1978).

Earlier works on the exploration of wild fruits has more or less been centralized in western and central Nepal. Some of the wild edible fruits of East Nepal have been reported by Banerjee (1955), Shrestha (1978, 1983). Charkoshe Jhadi, the forest belt extending East to West in the Tarai plain, has been found very rich in tropical wild fruits. Present work includes a few wild fruits viz.*Cordia dichotoma* Linn. *Ficus racemosa* Roxb., *Grewia tiliifolia* Vahl., *Meyna laxiflora* Robyns, *Ziziphus rugosa* Lmk., *Flacourtia indica* Roxb., *Glycosmis pentaphyllla* Corr., *Antidesma ghasembilla* Gaertn., *Schleichera oleosa* Merr., *Elaeagnus conferta* Roxb. from this district which were not been reported as edible and studied for its nutritional and medicinal values.

The genus *Cordia dichotoma* L. belongs to family Boraginaceae, distributed in tropical and subtropical regions of India. It is a medium sized tree with short crooked trunk, leaves simple, entire and slightly dentate, elliptical-lanceolate to broad ovate with round and cordate base, flower white, fruit drupe, yellowish brown, pink or nearly black when ripe with viscid sweetish transparent pulp surrounding a central stony part. It occurs in sub-Himalayan tract and outer ranges, ascending to 1500 m elevation and it is used as antidiabetic, anthelminitic, diuretic and hepatoprotective in folklore medicine. The seed of *Cordia dichotoma* contains α-amyrins, betulin, octacosanol, lupeol-3- rhamnoside, β-sitosterol, β-sitosterol-3-glucoside, hentricontanol, hentricontane, taxifolin-3, 5-dirhmnoside and hesperitin-7-rhamnoside. The α-amyrin and toxifolin 3, 5,

dirhamnoside, which showed significant anti-inflammatory activity. The seeds of this plant reported to contain fatty acids and flavonoids (Srivastava *et al.,* 1979) also. *Cordia dichotoma* Forst. Fruits are 1.3- 2.5 cm long globose or ovoid glossy, yellowish brown, pinkish or nearly black when ripe, usually single seed surrounded by a transparent, sticky, sweet edible pulp. The edible pulp used as a anticapping agent in most of the pharma industry. Flacourtiaceae is a family of 93 genera and over 1000 species (Trease and Evans, 1985). *Flacourtia indica* is the moderate size tree and produces fruit that is eaten fresh and has a pleasant but rather sour taste. The fruits make a good jelly with the seeds and skin being discarded (Ndhlala *et al.,* 2007). *Glycosmis* is a genus of forty species of small trees and shrubs from the family Rutaceae, found mostly in South-East Asia and South of China. Fourteen species are reported to occur in Peninsular Malaysia (Whitmore, 1983). Other *Glycosmis* species are *G. elmeri* Merr., *G. gracilis* Tanaka, *G. greenei* Elmer, *G. macrantha* Merr., *G. pentaphylla* (Retz.) and *G. triphylla* Wight. In Malaysia, *Glycosmis* species can be found in Langkawi, Perak, Selangor and Kelantan, which normally grow on limestone rocks and limestone hills. Members of the genus are aromatic and used medicinally, chiefly the roots (Burkill, 1966). *Glycosmis pentaphylla* Retz. DC. (Rutaceae-Aurantioideae) is a small wild shrub that has been used in India as a folk medicine in the treatment of fever, liver complaints, and certain other diseases. In Hindu medicines, *Glycosmis pentaphylla* has been used traditionally in bilious complaints, cough, worms, jaundice and fever. This drug has been proved by CCRH, monograph of which has also been published. This medicine has been found clinically useful in amoebiasis, dyspepsia, migraine and irritable bowel syndrome. This drug is proved to be effective in bilious complaints like nausea, vomiting, bitter taste in the mouth, heart burn with desire for lime juice, which ameliorates and gastric symptoms are aggaravated by eating, Migraine-pain in temples, throbbing type with bilious vomiting followed by weakness. Juice of leaves is used in fever, liver complaints and as a vermifuge, while leaves are considered good antidote for eczema and other skin troubles.

1. Ethnobotanical survey:

Jain (1963) carried out the survey of wild plants used by the tribals of Bastar. He recorded eighty eight plants; *Schleichera oleosa* is one of them. He mentioned their uses,

Schleichera oleosa fruits were eaten as a raw. Ramachandran *et al.* (2009) carried out the ethnobotanical studies in the Amaravathy Range of Indira Gandhi Wildlife Sanctuary, Anamalais, Western Ghats, Tamilnadu. They collected the information of ninety four plant species; out of which, 73 are wild and the rest are cultivated; within the wild plants 24 are used as edible fruits; 12 species as a leafy vegetable; 23 species are having medicinal value and 18 species utilized for miscellaneous uses; *Schleichera oleosa* is one of them. The fruits are eaten as a raw. Maden and Dakhal (1998) were carried out the survey of the wild edible fruits from the khoshi zone region of the eastern Nepal. They mentioned various wild fruits eaten by local people, with flowering and fruiting period, local name and family; *Schleichera oleosa* is one of them. Jain *et al.* (2005) carried out field survey of the Sitamata wildlife sanctuary of Chittorgarh and Udaipur district. They surveyed two hundred fourty-three genera belonging to 76 families which were reported by the tribals of about 50 villages around the sanctuary as means of primary health care to cure various ailments. This study revealed the new ethnobotanical uses of 24 plant species. *Cordia dichotoma* is one them. The decoction of stem bark was taken for indigestion. Rai and Nath (2005) described the significant role of ethnic people in conserving the biodiversity in and around localities of their natural habitat. Plants are conserved by these ethnic and indigenous people that serve as a source of wild edible food in the form of roots, tubers, rhizomes, seeds, fruits and as agricultural and horticultural plants. Many of the plants conserved by ethnic people are used as antidotes for snake bites and scorpion stings, for setting bone fractures by traditional healers, for curing wounds or arthritis, or as abortifacients and as cures for menstrual problems, etc. *Cordia dichotoma* also conserved by these people for eating and medicinal purpose.

Anis *et al.* (2000) carried out the herbal ethnomedicinal study of the Gwalior forest division in Madhya Pradesh. They have given therapeutic applications of 102 plant species. They collected information on medicinal claims from the tribal people called 'Sahariya' and the traditional healers. They described details of botanical identity, local name, parts of the plants used, mode of preparation, administration of the drug, and diseases for which the given plants are used. Among plants studied by them *Ficus* species was common. Fentahun and Hager (2009) studied the composition of wild fruits, their exploitation and their potential contribution to improved food and nutritional security in

three districts of the Amhara region of Ethiopia. They studied total forty four wild fruit species; *Ficus* is one of them. They observed *Ficus* as richest source of nutrient followed by other species like *Grewia and Ziziphus*. They observed that these fruits were rich in valuable nutrients and are accessible year-round with significant overlap at times of acute food and nutrient scarcity. Sasi *et al.* (2011) documented indigenous knowledge on wild edible plant resources from the tribe Irulas of Kotagiri at Nilgiri Hills. These tribes were partially or fully dependent on the wild resources for their nutritional requirements. They identified total fifty plants belonging to thirty one families under forty three genera. The *Ficus racemosa* is one of them and its fruits were eaten as a raw or cooked as vegetable. Rahmatullah *et al.,* (2010, b) carried out an ethnomedicinal survey at Station Purbo Para village of Jamalpur Sadar sub-district in Jamalpur district of Bangladesh. They obtained information of one hundred twenty one medicinal plants. They screened all plants in the scientific databases and scientific journals for pharmacological activities or presence of phytochemicals, which could be relevant to their folk medicinal uses. Sixty one plants of the total were found to have relevant pharmacological activities consistent with their uses. *Ficus racemosa* is one of them. They mentioned all its medicinal uses that are Hypoglycemic activity demonstrated for stem bark of the plant, hypoglycemic and anti-oxidant activity reported in fruits; potent anti-oxidant activity observed in ethanol extract of stem bark. Their results suggested that the medicinal plants used by the folk medicinal practitioners of Bangladesh cannot be dismissed as irrelevant. Rahmatullah *et al.* (2009) carried out the ethnobotanical survey and pharmacological evaluation of medicinal plants used by the Garo tribal community living in Netrakona district, Bangladesh. Among the plants studied by them, *F. racemosa* is one of them. Fruit is consumed as treatment for diabetes.

Tiwari *et al.* (2010) surveyed the ethnobotanical exploration, identification, concerns and future potentialities of the wild edible plants of Srinagar and Alaknanda valley of Garhwal Himalaya. They recorded total 55 plant species belonging to 35 families. They reported that herbs had highest proportion of the edible species (18) followed by trees (17), shrubs (13) and climbers (7). Among the plants, *Grewia* species is one of them. They mentioned that *Grewia* fruits are edible. Yashodharan and Sujana (2007) studied the ethnomedicinal plants in the Parambikulam Wild Life Sanctuary

Kerala. Among the plants studied by them, *Grewia tiliifolia* was one of them. The crushed bark of *Grewia tiliifolia* is used for washing the hairs to prevent the hair fall. Patil and Bhaskar (2006) described the uses of plants used by the tribal people of the Nandurbar district; *Grewia tiliifolia* is one of them. They mentioned that powder of roots of *Grewia tiliifolia* is mixed with equal water and this preparation is used at night for curing the sprain. Bandopadhyay and Mukharjee (2009) were focused their studies on the Koch Bihar district. They surveyed total 125 plants species belonging to 102 genera and 54 families. Among the plants surveyed by them; *Grewia tiliifolia* is one of them. They mentioned that ripen fruits of *Grewia tiliifolia* are eaten. Deshmukh and Shinde (2010) documented 29 wild edible fruit plants consumed by tribal communities from Kalsubai-Harishchandragad wild-life; *Meyna laxiflora* is one of them. They mentioned that fruits of *Meyna laxiflora* are used as vegetable and also sold in market. Kanade *et al.* (2008) studied the woody plant species diversity at Chandoli National Park, an under-explored area from Northern Western Ghats. A total of 4200 stems were sampled which represented 107 species belonging to 86 genera and 44 families were studied by them; *Meyna laxiflora* is one of them. They are concluded that it categorized under evergreen forest. The ethnobotanical survey of wild edible fruits from Kolhapur district was carried out by Valvi *et al.* (2011); *Meyna laxiflora* is one of them. They mentioned that ripen fruits of *Meyna laxiflora* are eaten.

Ramchandran *et al.* (2007) in his paper entitled survey of the wild edible plants of Annamalais Coimbator district. They published a list of studied total 74 plant species including 25 leafy vegetables, 4 fruit yielding 45 seed fruit yielding varieties; *Ziziphus rugosa* is one of them. They mentioned that ripen fruits were eaten as a raw. The ethnobotanical exploration, identification, concerns and future potentialities of the wild edible plants of Srinagar and Alaknanda valley of Garhwal Himalaya, were studied by Tiwari *et al.* (2010). They recorded total of 55 plant species belonging to 35 families. They reported that herbs have highest proportion of the edible species (18) followed by trees (17), shrubs (13) and climbers (7). Among the plants studied by them; *Cordia dichotoma, Ziziphus and Grewia* species are three of them. They mentioned that *Cordia dichotoma* fruits are edible and made into pickle and young leaves are cooked as vegetable. Incase of *Ziziphus* and *Grewia* fruits are edible. Motlhanka *et al.* (2008)

surveyed the wild edible fruits from the eastern Botswana. Among the plants studied by them; *Ziziphus mucronata, Grewia flava, Grewia flavescens* are three of them. Crushed roasted seeds of Ziziphus *mucronata* are used as coffee substitute. The *Grewia flavescence* fruits are used in making alcoholic beverages. The fruits can be sundried and preserved to be eaten during times of food scarcity. The fruits of *Grewia flava* are edible and are used in making traditional beer (*khadi or mogwana).* The fruits are harvested when fully ripe and can be sun dried and eaten during times of food scarcity.

Jin *et al.* (1999) carried out the ethnobotanical studies on wild edible fruits in southern Yunnan. They presented total 123 different fruits with folk names and evaluated the uses and the nutritional contents of fifty two different species with edible part percentage, moisture, total sugar, titratable acid, vitamin C, crude fat, crude fibre, starch, and soluble tannin; *Flacourtia indica* is one of them. Jain (1963) carried out the survey of wild plants used by the tribals of Bastar. They have recorded eighty eight plants; *Flacourtia indica* is one of them. They mentioned their uses. The ripen fruits of *F. indica* are eaten as a raw. Mali and Borges (2003) determined the phenolics, fibre, alkaloids, saponins, and cyanogenic glycosides from the forest tree species. *Flacourtia indica* is one of them. They mentioned that there is absence of alkaloids, and other values like acid detergent fibres, neutral detergent fibre and acid detergent lignin. Cyanogenic glycosides were absent in *Flacourtia indica.* The minor and less-known fruits of Assam have been documented by Neog and Mohan (1994). The total ten minor fruit crops that grown in Assam and adjoining states of North East India and which have medicinal, therapeutic or commercial value (these include: sapida (*Baccaurea ramiflora* Lour.); governor's plum (*Flacourtia ramontchi* L'Herit); nagatenga (*Rhus chinensis* Mill.); bonthereju (*Prunus jenkinsii* Hook. f); star gooseberry (Phyllanthus acidus Skeels); carambola (*Averrhoa carambola* Linn.); ber (*Ziziphus mauritiana* Lam); mikirtengalata (*Parameria polyneura* Hook); kajithekeva (*Garcinia cowa* Roxb.); and dillenia (*Dillenia indica* Linn. etc.); the fruit of *F. indica* is one of them and its fresh fruits are eaten.

Rahmatullah *et al.* (2010, d) have done ethnobotanical survey of Bihar Village, Bogra District. They have studied 53 plant species belonging to 31 families for treatment of various ailments; 11 plants were used for treatment of gastrointestinal disorders, in which *Glycosmis pentaphylla* is one of them. They mentioned that *Glycosmis pentaphylla*

leaf juice is orally administered for gastritis; branches are used as toothbrush. Narayanan and Kumar (2007) have worked on the changing trends in utilization of wild greens in Western Ghats. They have taken interviews of 366 people and twenty key informants were selected by each community to examine multiple use, marketing, preferences and local availability. *Antidesma acidum syn. ghasembilla* was used as a green vegetable by these communities. Acharya *et al.* (2009) focused their studies on Indigenous Knowledge on Miscellaneous Uses of Plants by the People of Parroha VDC, Rupandehi District, Central Nepal. Altogether 33 different species of plants belonging to 19 families were found used for miscellaneous purposes. The Leaves of *Antidesma acuminatum* are sour in taste and used to prepare pickle. Acharya and Acharya (2010) collected the information of the 67 plant species belonging to 41 families and 57 genera from Rupandehi district, central Nepal, which were used as a source of fruit, vegetables, pickle (achaar) or nectar of which, 51 species have single use, whereas 16 species have two or more uses. The leaves of *Antidesma montana* were sour in a taste and made into pickle. Binu (2010) worked on wild edible plants by the tribles in Pathanamthitta district, Kerala; *Antidesma menusa* is one of them. The fleshy pericarp is saperated from the seeds and consumed. It is sour in taste. Arora (2010) had studied on the management of tropical forest through indigenous knowledge by shompens community. These communities have the management practices in simple way and it was their daily routine. Among plants studied by them; *Antidesma* spp i. e. tetradum is one of them, whose branches are used for the posts, beames, thatching of roades or sticks etc. The author suggested that in order to conserve the biodiversity, save the knowledge of ethnic community. Bandopadhyay and Mukherjee (2009) worked on the wild edible plants of the Koch Bihar district, West Bengal. They surveyed the plants used by the Koch, Kheria, Oraon, Rabha and Santhal. Total 125 plants belonging to 102 genera under 54 families were recorded by them; *Antidesma ghasembilla* is one of them. They reported that ripen fruits are eaten as a raw. Yamada (1999) carried out ethnobotanical study on wild plants among the Nyindu, in the eastern part of the former Zaire. They collected data on 412 plants including scientific names, vernacular names, observations, uses, and name etymology were obtained and listed in the Appendices; *Antidesma laciniatum* Mull. is one of them. They mentioned

that the trunk is used for a house post and it is good for firewood; the wood can be made into charcoals.

Ramchandran (2007) have carried out the ethnobotanical survey of the wild edible plants of Annamalais, Coimbatore district. Total seventy four plant species were studied by them, which include 14 leafy vegetable and 4 fruit yielding and 45 fruit and seed yielding species; *Schleichera oleosa* is one of them. They pointed out that kernels of *Schleichera oleosa* were eaten by local people in studied area. Chhetri (2006) had worked on the ethnodomestication in some wild plants in Meghalaya. He had studied total 62 plants species belonging to 59 genera and 44 families; *Elaeagnus conferta* is one of them. He mentioned the fruits of *Elaeagnus conferta* were eaten as a raw and also sold in a market. Sundriyal and Sundriyal (2003) determined to study the underutilized edible plants of the Sikkim Himalaya. They were focused on six most prominently used fruit species i.e. *Baccaurea sapida, Diploknema butyracea, Eriolobus indica*, *Spondias axillaris, Machilus edulis* and *Elaeagnus latifolia*. They were analyzed the the fruit yield per tree and predict that they could easily compete with commercial fruit-yielding species. Among the fruit studied by *them Elaeagnus latifolia* syn *E. conferta* is one of them. The average fruit yield is 9–155kg per tree. The ethnobotanical studies on wild edible fruits in Southern Yunnan were carried out by Jin *et al.* (1999). They listed total 123 different fruits with folk names along with the uses and the nutritional contents. Out of them fifty two different species have moisture, total sugar, titratable acid, vitamin C, crude fat, crude fibre, starch, and soluble tannin. Among the fruits studied by them *Elaeagnus conferta* and *Flacourtia indica* are two of them. Tiwari *et al.* (2010) surveyed the ethnobotanical exploration, identification, concerns and future potentialities of the wild edible plants of Srinagar and Alaknanda valley of Garhwal Himalaya. They recorded total 55 plant species belonging to 35 families. They reported that herbs had highest proportion of the edible species (18) followed by trees (17), shrubs (13) and climbers (7). Among the plants studied by them, *Cordia dichotoma* is one of them. They mentioned that *Cordia dichotoma* fruits are edible and made into pickle and young leaves are cooked as vegetable. Kapoor *et al.* (2010) have recorded traditional recipes of district Kangra of Himachal Pradesh. They were mentioned its recipes, as follows. The fruits are cut into two pieces and stones are removed and fruits are boiled for five to ten minutes,

while boiling slices of raw mango are also added to reduce the sticky effect. Fry the boiled fruits along with spices till it softens. Add raw mango or powder of tamarind and cook again few minutes more and serve hot. Dixit and Geevan (2000) have conducted the quantitative analysis of plants in Central india. *Grewia tiliifolia* is one of them. They have mentioned that *Grewia tiliifolia* was used as agricultural implements and also as a food.

Patil and Patil (2005) carried out the ethnomedicinal practices of Nasik district. *Cordia dichotoma* is one of them. They mentioned that ripen fruits were boiled in a water and drunk for 10-15 days to treat kidney stone. Ahmad and Beg (2001) studied the 45 Indian medicinal plants for their antimicrobial activity against certain drug-resistant bacteria and a yeast *Candida albicans* of clinical origin. *Cordia dichotoma* is one of them. They mentioned that *Cordia dichotoma* leaves are used for headaches and ulcers. Decoction is used for soar throat. Their phytochemical investigation showed the presence of glycosides, phenolics and tannin and absence of alkaloid and flavonoides. Tayade and Patil (2006) worked on the ethnomedicinal wisdom of tribals of Nandurbar district. They recorded 73 angiospermic species belonging to 66 genera and 39 families. *Cordia dichotoma* is one of them. The decoction of inner bark is used for the excessive menstruation and fruits eaten for gonorrhoea. Rajasab and Isaq (2004) documented fifty one genera of wild edible plants of north Karnataka. They recorded twenty four species whose fruits were eaten as raw or cooked. *Cordia dichotoma* is one of them. Fruits of *Cordia dichotoma* were used as an expectorant and useful in lung diseases. Fruit juice was taken orally as a blood purifier. Singh and Mall (2008) carried out their work on *Cordia dichotoma*. They mentioned its traditional uses. The inhabitants of the area have inherited a rich traditional knowledge on the use of Lasora tree in the management of their various ailments viz. chronic orthopaedic fever, dropsy, dysentery, dyspepsia, cholera, catarrh, headache and skin diseases. Phytochemical investigation of the plant is desirable for more useful information. Husain *et al.* (2008) recorded the ethonobotanical properties and uses of medicinal plants of Morgah biodiversity park. They studied total 40 species belonging to 39 genera and 32 families. They collected ethonobotanical data through questioners by interviewing local communities, local Tabib and Hakims. Among plants studied *Cordia dichotoma* is one of them. They mentioned its uses that ripe fruit is eaten raw; green fruit is eaten as vegetable, used in curry and pickled. Demulcent,

expectorant, tonic and refrigerant. It is used to reduce the irritation of the urinary passages, alleviation of thirst and dry cough. Anis and Iqbal (1994) have described the folk healing uses of 25 plants common to rural areas of Aligarh. They have documented the botanical and local names of the plants, therapeutic use, mode of administration, precautions and side effects, the plants which were described by them were used for treating arthritis, bronchial and pulmonary problems, diabetes, fevers, fractures and injuries, hydrophobia, jaundice, piles, pain, skin infections, tooth and tonsil problems, and urinary, gastric and intestinal diseases; Among these *Cordia dichotoma* is one of them. They mentioned that Fruits of *Cordia dichotoma*, *Psidium guajava, Solanurn surdtense, Syzygium cumini* and *Calotropis procera* taken in equal quantities, are roasted in an earthen pot. The roasted material is crushed and mixed with an equal quantity of honey. Gram size pills are made of this and given three times a day to cure cough and asthma. Anis *et al.* (2000) have done the ethnobotanical survey of Gwalior forest division in Madhya Pradesh. They have given therapeutic applications of 102 plants. They collected information on medicinal claims from the tribal people called 'Sahariya' and the traditional healers. They described details of botanical identity, local name, parts of the plants used, mode of preparation, administration of the drug, and diseases for which the given plants are used. Among plants studied by them *Cordia, Grewia* and *Ficus* species were common.

Vijeesh and Velumani (2011) studied the use of ethno medicinal plants among Mullu Kuruma tribe of Wayanad district, Western Ghats, Kerala. Sixty two medicinal plants belonging to different families were recorded by them; *Ficus racemosa* is one of them. They reported that bark is pasted for skin diseases and poison. Fruit juice is taken internally for urine complaint. Paarakh (2009) has given the review on *Ficus racemosa*. In this review she mentioned the various plant parts like bark, leaves, fruit and latex are used in dysentry, diarrhoea, diabetic, bilious affection stomachache, menorrhage, haemoptysis, piles carminative and astringent. She also mentioned the detailed survey of the literature of its pharmacognosy, phytochemistry, traditional and pharmacological uses. In traditional uses, she mentioned that root of the tree is used in dysentry, piles and diabetics. The fruits are astringent, stomachic, refrigerant, dry cough, loss of voice, disease of kidney and spleen, astringent to bowel, styptic, tonic, useful in the treatment of

leucorrhoea, blood disorder, burning sensation, fatigue, urinary discharges, leprosy, menorrhagic, epitasis and intestinal worms.

Rahmatullah *et al.* (2010, a) carried out the information on 107 plant species belonging to 53 families. They reported medicinal uses of most of the plants, which were used to treat common ailments. They were given the plants which were used to treat more complicated ailments like cardiovascular disorders, hepatic disorders, epilepsy and cancer or tumors. In the majority of cases, a single plant part was used for treatment of any given ailment; *Ficus racemosa* is one of them. The leaves of *F. racemosa* are used against the cough, blood dysentery. Rahmatullah *et al.* (2010, c) surveyed the Medicinal Plants used by Folk Medicinal Practitioners in Balidha village of Jessore District, Bangladesh. Nineteen plants were used for treatment of gastrointestinal disorders and seventeen plants for treatment of sexual disorders. Nine plants were used to treat pain and seven plants for treatment of respiratory tract infections. Three plants were used to treat diabetes; *F. racemosa* is one of them. Its bark and sap were used to reduce obesity, nose bleed, sexual weakness and stomach ache. Hasan *et al.* (2010) surveyed medicinal plant usage by folk medicinal practitioners in seven villages of Ishwardi Upazilla, Pabna District, Bangladesh. A total of 80 plants distributed into 45 families were observed to be used by the Kavirajes. The Kavirajes used both whole plant as well as plant parts for treatment of ailments. Leaves constituted 35.1% of the total uses, followed by roots at 17.5%, and barks and fruits at 11.4% each. Twenty one plants were used for treatment of gastrointestinal disorders like constipation, dysentery, loss of appetite, and acidity. Thirteen plants were used to treat skin disorders like eczema, pimples, and itches, while twelve plants were used for treatment of respiratory tract disorders like asthma, coughs, and colds. The Kavirajes also treated hepatic disorders (e.g. jaundice), sexual disorders, pain, fever, bleeding from cuts and wounds, bone fractures, eye disorders, ear problems, toothache, loss of hair, hemorrhoids, gonorrhea, infections, physical weakness, helminthiasis, leprosy, vomiting, snake bite, gall bladder stones, burns, chicken pox, malaria, rheumatic fever, diphtheria, anemia, rheumatism, menstrual problems, urinary problems, and physical weakness. Leaf, root, bark and fruit of *F. racemosa* were used by them for treatment of Pimples, eczema, bleeding due to external cuts or wounds, burning sensations during urination. Joseph and Raj (2010) evaluated phytopharmacological

properties of *Ficcus racemosa.* They have given the detailed survey of the literature on its pharmacological properties. They have mentioned that various plant parts such as bark, root, leaves, fruits and latex were used in dysentry, diarrohoea, diabeties, stomachache, piles and as carminative and astringent and also as antioxidant and anticancer agent. Methanol extracts of *Ficus racemosa* contained relatively higher levels of total phenolics than the other extract. Antioxidants from figs can protect lipoproteins in plasma from oxidation and produce a significant increase in plasma antioxidant capacity.

Adhikari *et al.* (2010) examined the status and distribution pattern of medicinal plants in Wildlife Institute of Dehradun, Uttarakhand. They recorded 605 plants; 63 trees, 55 shrubs, 208 herbs, 34 climbers, 3 ferns and 10 grasses belonging to 94 families. Among plant, *Grewia tiliifolia* is one of them. They reported that its flowers fruits, bark and leaves are used for the Syphilis. Owuor and Kisangau (2006) worked on the Kenyan medicinal plants which were used as antivenin. They documented thirty two plants used for snakebite treatment. The majority of the antidotes are prepared from freshly collected plant material frequently leaves. Among the plants studied by them *Grewia* spp. are one of them. They mentioned that the leaves of *Grewia* spp. are snake bite antidote. Leaves are used in cooking to prevent secondary poisoning. Livestock bitten by snakes are drenched with a leaf, bark decoction, infusion and the mucilaginous crushed leaves are used to wipe the bitten area. Reddy *et al.* (2006) carried out an ethnopharmacological survey of the Eastern Ghats region of Andhra Pradesh, comprising Chittoor, Cuddapah, East Godavari, Guntur, Khammam, Krishna, Kurnool, Srikakulam, Visakhapatnam, Vijayanagaram and the West Godavari districts. They surveyed eighty-four species of folk drug plants belonging to 72 genera and 41 families. They have taken information from forest ethnic people like Chenchus, Erukulas, Lambadas, Koyas, Kondareddies, Nukadoras, Yanadis; *Grewia tiliaefolia* is one of them. Four to five teaspoons of a decoction made from the stem bark of this species are administered once daily for 2-3 days for curing the cough. Sravanthi *et al.* (2010) have written the reviews of the wound healing herbs. Exploring the herbs for their potential wound healing activity is essential. They revealed the wound healing natural products usually localized in root (27%), leaves (20%), stem, seed, whole plant, fruit, flower, rhizome, tuber, shoot, stamen, grain, gall, filament and plant product like latex (46%), oil (40%), gum and resin

(7%); *Grewia tiliaefolia*, is one of them. They have mentioned that methanolic extract of the stem bark has supportive scientific evidence for the medicinal use of *G. tiliaefolia* for healing of cutaneous wound. Karnick and hocking (1975) worked on the ethnobotanical records of medicinal plants described in Valmiki-Ramayana. They have listed fifty drug plants with their uses as described in the Avurvedic (or native Indian) system of medicine. In this, *Grewia tiliifolia* is one of them.

The nutritional composition of *Grewia* Species was determined by Elhassan and Yagi (2010). They observed that *Grewia* fruits were rich source of iron. This finding supports the traditional use of *Grewia* spp in the treatment of anaemia. Their results provide evidence that these local traditional fruits could be important contributors in improving the nutritional status of rural and urban people. Silja *et al.* (2008) worked on the ethnomedicinal plant knowledge of the Mullu Kuruma Tribe of Wayand district, Kerala. They have reported 136 plants for traditional medicinal purpose, fourteen plants for the skin treatments, ten for inflammation, three as abortificient, nine for drandruff, eleven for dysentry, six for piles, seven for epilepsy and nineteen for asthma and like wise they have given the uses of remaining plants. *Grewia tiliifolia* is one of them. The bark fibre of it was used for hair cleaning and also used for the promoting hair growth. The wound healing plants of Jalgaon district reported by Chopda and Mahajan (2009). The total 283 wound healing plants have been described; out of these 224 plants are native of Maharashtra, a 131 plants among them occurred in Jalgaon District, which are in practice by local herbalist, Vaidyas and nonregistered medical practitioners and Mukhiya (Head) of tribal community. *Grewia tiliifolia* is one of them; its stem was used for curing the wounds. Okeke *et al.* (2008) worked on Igbo traditional food system. They have taken interviews, focus group discussions and questionnaires for documentation and ascertain use of local foods by households. Total 294 species and over 400 varieties of foods were documented by them. *Grewia* spp. is one of them; the whole plant of *Grewia* is used in treating worms and dysentery.

Tiwari *et al.* (2010) have documented medicinal uses of plants and their status of availability in Alaknanda valley around Srinagar. They studied total 102 species belonging to 92 genera and 54 families including 32 herbs, 27 shrubs, 30 trees and the rest 13 were climbers. They have given a list of plant species along with their local

names, plant part(s) used and mode of administration in different ailments. *Ziziphus* and *Grewia* were two of them. They mentioned that decoction of root and stem bark powder of *Ziziphus marutiana* is given in fever, diarrhea and to improve digestion. Fruits of *Grewia optiva* are used in digestive disorders and bark juice is given to women to facilitate delivery. It is also used as wash for sores. Singhi and Joshi (2010) have compiled the information on medicinal and nutritive supplementation by the desert inhabitants. They studied the plants like *Cenchrus biflorous, Prosopis cineraria, Calligonum polygonoids, Tribulus terrestris* and *Acacia nilotica* etc which were used as famine foods whereas, *Salvadora oleoides* and *Citrullus colocynthis* are used for the medicinal purpose. Among the plnats studied by them; *Zizyphus nummularia* is one of them. The fruits of *Zizyphus nummularia* were stored, ground and eaten during scarcity. The local people use to distill the spirituous liquor from fruits, flowers, bark, roots etc. In winters fruits are dried, grounded and sieved and powder is eaten as such or mixed with jaggery. Fruits are known for cooling effect. The ethnobotanical study of medicinal plants in Alamata district, of northern Ethiopia was carried out by Yirga (2010). He documented twenty-five medicinal plants. *Ziziphus spinacristi* is one of them. He reported that *Ziziphus* is used against the tenea capitis. Hossan *et al.* (2010) evaluated the traditional use of medicinal plants in Bangladesh to treat urinary tract infections and sexually transmitted diseases. Among the plants studied by them, *Glycosmis pentaphylla*, *Grewia* and *Ziziphus* species were three of them. The whole plant of *Glycosmis pentaphylla* is used against Leucorrhoea. They mentioned that other uses like rheumatoid arthritis, migraine, gastritis, jaundice, stimulant, toothache, toothbrush, Anemia, cough, fever, jaundice, rheumatism, vermifuge. *Ziziphus oenophylla* was used against burning sensations in urinary tract, less urination, frequent urination. *Grewia asiatica* was used against Gonorrhea and other uses like acidity, giddiness, diarrhea, hypertension, stimulant, anorexia. Gonorrhea, astringent, demulcent, rheumatism, stomachic etc. Kaou *et al.* (2010) isolated three compounds from the decoction of this plant material, Pyrocatechol, Homaloside D and Poliothrysoside. They mentioned that, the aerial parts of *Flacourtia indica* are used in traditional medicine to treat malaria.

Hossan *et al.* (2010) have evaluated the traditional use of medicinal plants in Bangladesh to treat urinary tract infections and sexually transmitted diseases. Among the

plants studied by them; *Glycosmis pentaphylla,* is one of them. The whole plant of *Glycosmis pentaphylla* is used against Leucorrhoea. They mentioned the other uses like rheumatoid arthritis, migraine, gastritis, jaundice, stimulant, toothache, toothbrush, Anemia, cough, fever, jaundice, rheumatism, vermifuge. Thyagarajan *et al.* (2002) worked on the Herbal medicine for liver diseases. They have given the list of the Indian medicinal plants having liver protection properties against chemical-induced liver damage in experimental animals; *Glycosmis pentaphylla* is one of them, which had liver protection properties. *Glycosmis pentaphylla* is used as a folk medicine in the treatment of fever, liver complaints and certain other diseases (Sastri, 1956). Phytochemical study of this species was done and he has focused on hydrophobic alkaloids, including those of the quinolone (Bhattacharyya and Chowdhury, 1985), quinazoline (Muthukrishnan *et al.,* 1999; Sarkar and Chakraborty, 1969), acridone (Quadera *et al.,* 1999) and carbazole (Jash *et al.,* 1992; Chowdhury *et al.,* 1987) types, of leaves, root and stem bark. Fusun (2005) in the proceedings of the fourth international congress of ethnobotany, reported about the nyatang (resin) prepared from the *Antidesma ghasembilla*. He mentioned that a "resin (nyatang) is burned, and its smooth black soot is collected from the bottom of a cooking pot. Red inner bast is scraped thinly from the Selaman tree, mixed with a little water, and pressed between both hands to collect sap. This sap which acts as a mordant and the nyatang soot are then mixed together, and the mixture is rubbed on the whole surface of the hat". Kulip (2003) presented the results of ethnobotanical studies on medicinal and other useful plants used traditionally by the Muruts in Sabah. A total of 91 species of plants were noted and collected and reported by him. Among them are 68 species of medicinal plants and 64 species of other useful plants. Among the surveyed plants, *Antidesma montanum* is also reported. Its leaves and roots are used for curing various ailments. Root is boiled in water to make a tea. Leaves are pounded into paste and applied on chest.

Jothi *et al.* (2008) reported the tribal knowledge of Tirunelveli Hills, Western Ghats. They studied 46 plant species of angiosperms belonging to 19 genera of Euphorbiaceae that occur naturally in the Tirunelveli Hills. It was found that the uses of Euphorbiaceous plants by the inhabitants of this region cover a number of broad categories including food, various kinds of poisons, medicines, sundry types of oils,

waxes, rubbers, varnishes, compounds for paints and other industrial products. Among them, *Antidesma ghasembilla* is one of them. The leaves of *Antidesma ghasembilla* is cooked as vegetables. Other species of *Antidesma* also reported by them. *Antidesma bunius* leaves were used for ulcers and indigestion and *Antidesma alexiteria* leaves used for treating snake bites. Aryal (2009) carried out ethnobotanical study of Tharu; *Antidesma ghasembilla* is one of them. He mentioned that the fruit of *A. ghasembilla* is used against appetite. Jothi *et al.* (2008) surveyed the 46 plant species of angiosperms belonging to 19 genera of Euphorbiaceae that occur naturally in the Tirunelveli Hills of Western Ghats, India. It was found that the uses of Euphorbiaceous plants by the inhabitants of this region cover a number of broad categories including food, various kinds of poisons, medicines, sundry types of oils, waxes, rubbers, varnishes, compounds for paints and other industrial products. *Antidesma acidum* Retz, *Antidesma alexiteria* L. and *Antidesma bunius* (L.) Sprengel were reported by them. They mentioned that leaves of *Antidesma acidum* syn. *ghasembilla* were coocked as a vegetable. The leaves of *Antidesma alexiteria* were used in snake bite while the leaves of the *Antidesma bunius* were used against ulcers and indigestion. Suksri *et al.* (2005) focused ethnobotanical knowledge of the villagers comprising list of useful plants and method of use. Data and plant specimens were collected by interviews with practitioners from 121 households (25%) and plant collecting trips during field studies, respectively. A total of 203 species, 128 genera, and 67 families were considered as ethnobotanical plants by the villagers; *Antidesma ghasembilla* is one of them. Young leaves were boiled with water for blood nourishment and ripe fruits were eaten.

Kar and Borthakur (2008) discussed the wild vegetables of Karbi, Anglong district, Assam. They have studied total 57 plants which were used as vegetables; *Antidesma acidum syn. ghasembilla* is one of them. The tender shoots are eaten, boiled with chilli and salt. As a medicine it is used against appetizer. Two boiled tender shoots are taken with rice, once daily for five days. Chinsembu and Hedimbi (2010) carried out an ethnobotanical survey of plants used to manage HIV/AIDS opportunistic infections in Katima Mulilo, Caprivi region, Namibia. Total of seventy one plant species from 28 families, mostly the Combretaceae (14%), Anacardiaceae (8%), Mimosaceae (8%), and Ebanaceae (7%), were used to treat conditions such as herpes zoster, diarrhoea, coughing,

malaria, meningitis, and tuberculosis. The studied plant parts were leaves (33%), bark (32%), and roots (28%) etc. while the least used plant parts were fruits/seeds (4%). *Antidesma venosum* is one of them. Its bark is used against appetite, diarrhea and anaemia and roots are used against tuberculosis, chronic diarrhoea and oral candidiasis. Khan and Yadava (2010) worked on the antidiabetic plants used in thoubal district of Manipur. They mentioned fifty four species which were used for treating diabetes by different ethnic communities; *Antidesma acidum* syn. *ghasembilla* is one of them. The Lois community used the boiled extract of the leaves for treating diabetes. Kisangau *et al.* (2007) focused their studies on use of traditional medicines in the management of HIV/AIDS opportunistic infections in Tanzania. They reported 75 plant species belonging to 66 genera and 41 families which were used to treat one or more HIV/AIDS related infections in the district; *Antidesma venosum* is one of them. Its roots were used. It was used against tuberculosis, chronic diarrhoea and in Oral candidiasis.

Ibrahim *et al.* (2007) carried out the ethnobotanical survey to identify and document methods traditionally utilized for treatment of mental illness and to expand the quality and quantity of information for research and development especially in the area of new drug discovery and development. About sixty seven traditional medicine practitioners were interviewed orally by them with use of questionnaire; *Antidesma venosum* is one of them. The stem bark and whole plant are dried and burn to fumigate the patient. It also contains the Antidesome, saponins, steroids and terpenes. From their survey, various methods were found to be used by the traditional medicine practitioners to treat mental illness and associated disorders. These include music, incantations and medicinal plants in various formulations decoction, powder, infusion which are administered in various ways like fumigation, inhalation, bathing, steaming and drinking. Reddy and Reddy (2008) worked on medicinal plants from Khammam District, Andhra Pradesh. *Schleichera oleosa* is one of them. They mentioned its uses; the bark paste supported by bamboo sticks is applied to cure fractured bones. For early relief, this treatment should also be accompanied by oral use of bark juice twice a day. Bark is also used for skin diseases, ulcers etc. Adhikari *et al.* (2010) carried out the status and distribution pattern of medicinal plants in Wildlife Institute of Dehradun, Uttarakhand. They surveyed 605 plants out of which 63% are medicinal plants. These medicinal plants

comprise of 63 trees, 55 shrubs, 208 herbs, 34 climbers, 3 ferns and 10 grasses belonging to 94 families. Among plant, *Schleichera oleosa* is one of them. They reported that its seed, bark and fruits were used as hair tonic, pleurisy, fever, itching, rhematism, skin diseases, wounds, ulcer, paralysis cool, cholera and syphilis. Kunwar *et al.* (2010) have compiled the information on traditional herbal medicine in Far west Nepal. *Schleichera oleosa* is one of them. They mentioned that fruits are eaten as an anthelmintic, Fruits are used for heat stroke, and valued as appetite stimulant, anthelmintic and tonic and Seed oil is used for skin diseases. They also mentioned the chemical compound in it. These chemical compounds are Behemin, campesterol, gadoleic acid, oleic acid, oxalate, palmitic acid, stearic acid, tartaric acid. Further they mentioned that fruit juices were also used to stimulate the hair growth. Pattanaik *et al.* (2006) reported 30 plant species belonging to 23 families, mostly used by the tribal people of Rayagada district, Orissa. They enumerated with binomial, family, habit, local name, parts used and ethnomedicinal uses; *Schleichera oleosa* is one of them. They have mentioned that the oil obtained from seed is applied in eczema area. Mohanta *et al.* (2006) have documented information on ethnomedicinal plant resources of Simplipal biosphere reserve; *Schleichera oleosa* is one of them. They mentioned its uses that the powdered bark of *Pterocarpus marsupium* is mixed with *Schleichera oleosa* and taken with cold water to treat dysentery. Vijeesh and Velumani (2011) studied the use of ethno medicinal plants among Mullu Kuruma tribe of Wayanad district, Western Ghats, Kerala. Sixty two medicinal plants belonging to different families were recorded by them. *F. racemosa* is one of them. They were reported that bark is pasted for skin diseases and poison. Fruit juice is taken internally for urine complaint. Yashodharan and Sujana (2007) studied the ethnomedicinal plants in the Parambikulam Wild Life Sanctuary Kerala. Among the plants studied by them, *Ficus racemosa* is one of them. From the young fruits of *Ficus racemosa* they prepared the thoran to treat constipation. The crushed bark of *Grewia tiliifolia* is used for washing the hairs to prevent the hair fall.

2. Nutraceutical analysis

i. Proximate analysis:

Mandal (1997) carried out the nutritive values of the tree leaves of the tropical species; *Cordia dichotoma* is one of them. They obtained the 12.4-15.1% crude protein, 16.4-26.8% crude fibre, 12.6-17.4% total ash, 2.4-4.2 calcium, 0.2-0.3 phosphorus, 0.8% tannin from the fresh leaves. He further analyzed dry matter content as 67% neutral detergent fibre, 58.20% acid detergent fibre, 8.80% hemicellulose, 21.70% lignin, 31.20% cellulose, 5.30% silica. Aberoumand and Deokule (2009) worked on the food analytical evaluation of fruits and vegetables used diets in relation to human carbohydrates. They studied the *Alocacia indica* Sch*., Asparagus officinalis* DC. *Chlorophytum comosum* Linn*., Cordia Myxa* Roxb*., Eulophia Ochreata Lindl., Momordica dioicia* Roxb*., Portulaca oleracia* Linn. and *Solanum indicum* Linn. Their results showed that fructose, glucose, sucrose contents were high in *Cordia myxa* (9.38%, 12.75% and 29.09%) respectively. They also observed the highest content of total dietary fibres (27.7 g %) and low in starch 5.86% in *Cordia dichotoma* fruits. They also mentioned that *Cordia dichotoma* was the sweetest fruits because it contains the maximum amounts of sucrose, glucose and fructose. Aberoumand (2009) studied the balance between nutrients and anti-nutrients in some plant food. They analyzed eight edible plants in order to detect differences in nutritional quality, considering the balance between nutrients and antinutrient compounds present in each. The most important nutrients studied by them were; water, starch and free sugars, such as glucose, fructose and sucrose. Among eight plants, *Cordia myxa* was one of them. They observed 6.21 % water, 12.75% glucose, 9.38% fructose, 29.09% sucrose, 5.86% starch. They further observed the 248.0% mg/100g phytic acid in it.

Rajyalakshmi *et al.* (2003) studied the three vegetables, 5 roots and tubers, 23 fruits and 3 stored products collected and consumed by tribals of Andhra Pradesh; Cordia *dichotoma* is one of them. They obtained 62.71% moisture, 0.02 ± 0.0007 Total carotenoid, 0.01 ± 0.002 Beta carotene, 50.00 % Beta carotenoid in total carotenoid. Aberoumand (2008) worked on the comparative studies of the protein values of the seven edible plants from Iran. They studied *Arum maculatum, Portulaca oleracia, Semicarpus anacardium, Carissa karandus, Cordia myxa, Solanum indicum and Chlorophytum*

comosum. They estimated the protein values. These are: *A. maculatum,* (57.0), *Portulaca oleracia* (44.8), *C. comosum* (28.4), *C. karandus* (22.6), *C. myxa* (20.2), *S. indicum* (17.5) and *Semicarpus anacardium* (7.93). Among all the plants, *C. myxa* syn. *dichotoma* is one of them. Aberoumand and Deokule (2010) evaluated nutritional value of plant-based diets in relation to human carbohydrates. They determined the sugars through HPLC. Their results showed that fructose, glucose, sucrose contents were high in *Cordia myxa* (9.38, 12.75, 29.09%) respectively and the starch content was high in *Alocacia indica* (60.41%). They observed *Cordia* as the sweetest fruit because it contains the maximum amounts of sucrose, glucose and fructose. Further they observed the total dietary fibre was low in *Portulaca oleracia* (dried) (8g %) and was high in *Cordia myxa* (27.7g %). Chen *et al.* (2008) were analyzed the oil composition from woody oil plants. Among the plants studied *Cordia dichotoma* is one of them. They extracted 51.8% oil from the seeds of *Cordia dichotoma*. Borges (1993) studied the role of *Ficus* as a source of nutrient in two tropical forests in India. He evaluated the total fat 0.82%, 0.11% nitrogen, 1.02% total nonstructural diatery fibres, 7.45% are the acid detergent fibres from the *Ficus racemosa* fruits. Agarwal and Chauhan (1988) worked on the composition of dietary fibre from some plant foods. They studied *Prsopsis cinceria, Ficus religiosa, Ficus bengalensis, Ficus glomerata* and *Capparis deciduas.* The diatery fibre varied from 38.5% to 55.7°/0. They mentioned that cellulose and lignin were predominating constituents in *Ficus glomerata.* Ahmed *et al.* (2010) reported the nutrient composition, physicochemical properties and utilization potential of *Ficus racemosa* stem bark as an ingredient in tea, a popular non alcoholic beverage. The bark was found to be a good source of dietary fibre, minerals, sugars and phenolic compounds. They obtained 20.5% total dietary fibre content of which major portion was contributed by insoluble dietary fibre (13.6%). Potassium was the most abundant mineral (11975 ppm) followed by chloride (7475 ppm) and calcium (1729 ppm). They also mentioned that the bark was good source of other minerals and trace elements such as phosphorus and iron, zinc, magnesium, respectively. Further, they used the bark powder as an ingredient in the preparation of tea and they found significantly higher amounts of phenolic compounds in bark incorporated tea (nutra tea) as compared to control tea ($p < 0.05$). Their results

suggested that the bark could be effectively used in the preparation of tea to derive its beneficial effects particularly attributable to those of phenolics.

Semwal *et al.* (2003) studied the chemical characteristics of six multipurpose tree species, viz., *Alnus nepalensis, Albizzia lebbek, Boehmeria rugulosa, Dalbergia sissoo, Ficus glomerata and F. roxburghii*. Significant effects of species, incubation time and species × incubation time interaction on monthly mass, N, P and K release rates were observed by them. Incase of *Ficus glomerata*, the parameters studied by them were moisture 7:71 ± 0:37, lignin 13:82 ± 2:45, cellulose 25:92 ± 1:00, calcium 39:16 ± 0:76, nitrogen 1:97 ± 0:07, phosphorus 0:17 ± 0:01, potassium 1:10 ± 0:07 and polyphenol 7:10 ± 1:06. Ramachandran *et al.* (2009) carried out the ethnobotanical studies in the Amaravathy Range of Indira Gandhi Wildlife Sanctuary, Anamalais. They collected information on ninety four plant species; out of which, 73 are wild and the rest are cultivated; within the wild plants 24 are used as edible fruits; 12 species as a leafy vegetable; 23 species are having medicinal value and 18 species utilized for miscellaneous uses. *Ficus racemosa* is one of them. The fruits of *F. racemosa* are edible. Proximate analysis of the wild edible plants had been done by Becker (1983). He has studied several plants such as *Adansonia digitata, Balanites aegyptiaca* and *Ziziphus mauritiana*, as well as *Boscia senegalensis* and *Cassia obtusifolia*. He has mentioned that these plants supplies vitamins A, B_2 and C. They evaluated nutrient values such as energy, dry matter, protein, fat, cellulose, carbohydtrate, and minerals like Phosphorus, Calcium and Iron. Among the plants studied by him, *Ziziphus marutiana* is one of them. Evans *et al*., (1991) stated that calcium acts as a transducer of hormonal and environmental signals to the responsive elements in cell metabolism. Mengel and Kirkby (1982) reported the role of calcium in regulation of membrane permeability for various ions and various metabolic processes. Flavedo tissue of Marsh grape fruit showed 0.876 mg/100g calcium (Ezz and Awad, 2009). The *Opuntia elator* showed 12.8 $\pm$ 59 g/100g of calcium content (Feugang *et al.,* 2006). The Endopleura uchi fruits contained 96mg/100g of calcium (Marx *et al.,* 2002). The calcium content in some fruits i.e. *Physalis peruviana* 28mg; *Physalis minima* 25 mg; *Carissa edulis* 10mg (Musinguzi *et al.,* 2007). Ekholm et al. (2007) were studied the changes in the mineral and trace element contents of cereals, fruits and vegetables in Finland. The calcium content in the fruits were *Strawberry*, 200

mg/100g; *Blackcurrant,* 220 mg/100g*; Redcurrant*, 290 mg/100g *Raspberry*, 160mg/100g; *Bilberry*, 140 mg/100g ; *Lingonberry*, 100 mg/100g; *Cranberry*, 110 mg/100g.

Boyoma *et al.* (2003) studied the composition of essential oils from some Cameroonian medicinal plants. *Antidesma laciniatum* is one of them. They obtained 0.18 % oil. Through GCMS and MS they obtained compound like terpenoids, among which a-copaene, g-cadinene, d-cadinene, a-cadinol, spathulenol and caryophyllene oxide were most commonly found. The fifth oil obtained was active against *Plasmodium falciparum* in culture. They further obtained 23.8% oxygenated sesquterpen 27.3% aromatic compound. Nergiz *et al.* (2009) have determined the contents of oil, sugar and organic acids of olive fruit samples (Domat, Memecik and Uslu) by using HPLC at different maturation stages. Olive fruit samples presented a common organic acid profile, composed of four constituents: oxalic, citric, malic and succunic acids. During the month of January they found total organic acid content of Domat variety. It was 4787.1 $\pm$ 4.53 mg/100g. They observed that Memecik variety had the highest value at the beginning of the ripening period (6385.08 $\pm$ 4.90 mg/100 g). The amount of organic acid in Uslu variety reached up to the value of 10942.5 $\pm$ 30.41 mg/100 g. By statistically they evaluated their results to determine relationship between the oil, sugar and organic acid content in three olive varieties during maturation. They found the positive correlation between the total sugar and organic acid ($r = 0.54$, $p < 0.01$) whereas a low positive correlation was observed between the contents of oil and total organic acids ($r = 0.46$, $p < 0.05$) in olive varieties. Elemental composition of some Ayurvedic medicinal plants used for healing urinary tract disorders has been studied by Rajurkar and Damane (1998). They have mentioned the botanical names and plant parts used in urinary disorder. *Ficus racemosa* is one of them. They reported that bark of *F. racemosa* is used against the swelling of urinary tract. They also analyzed the total 14 elements from the plants; among these Cu, Cr, Co and Cd are found to be present at the trace level; Mn, Pb, Zn, Ni, Na, Fe and Hg at minor level and K, Ca and C1 at major level.

Mineral analyses of some wild edible fruits of Kolhapur district have been carried out by Valvi and Rathod (2011). *Meyna laxiflora* and *Ziziphus rugosa* are two of them. They have analyzed mineral concentration from ripened fruits. Among the fruits studied

by them, the highest values of nitrogen , phosphorus and magnesium was observed in a *Grewia tiliifolia* fruits, calcium, sodium and potassium in *Ficus racemosa* fruits respectively and microelement found like iron, which is higher in *Meyna laxiflora* fruits, Zinc in *Elaeagnus conferta* fruits, while Copper and manganese are present abundant in *Flacourtia indica* fruits. The mineral content observed in mature and ripened fruits of *Meyna laxiflora* are Nitrogen content in mature fruits is 2 $\pm$ 0.02 mg/100g DW and in ripened 0.44 $\pm$ 0.049 mg/100g DW; Phosphorus in mature fruit is 1.36 $\pm$ 0.025 mg/100g DW and in ripened fruit 0.15$\pm$ 0.043 mg/100g DW; Pottassium is 1563.3 $\pm$ 0.35 mg/100g DW(M), 1278.4 $\pm$ 0.51 mg/100g DW(R); Ca is 219.6 $\pm$ 0.57 mg/100g DW(M), 325.1 $\pm$ 0.6 mg/100g DW(R); Mg is138.7$\pm$ 0.2 mg/100g DW(M), 99.5 $\pm$ 0.90 mg/100g DW(R); Sodium is 220.3 $\pm$ 0.57 mg/100g DW(M), 222.1 $\pm$ 0.28 mg/100g DW(M), Iron is 35.5 $\pm$ 0.4 mg/100g DW(M), 27.5 $\pm$ 0.11 mg/100g DW(M); Zinc is 5.34 $\pm$ 0.33 mg/100gDW(M) and 5.21 $\pm$ 0.09 mg/100g DW(R); Copper is 0.84 $\pm$ 0.032 mg/100g DW(M), 0.54 $\pm$ 0.040mg/100g DW(R). Manganese is 1.15 $\pm$ 0.015 mg/100g DW (M) and 0.94 $\pm$ 0.045 mg/100g DW(R). Among all minerals, in mature fruits potassium is higher and copper is lower. In ripened fruits, potassium is higher and nitrogen is lower. *Ziziphus rugosa* is also one of them. They analyzed mineral concentration from ripened fruits. The nitrogen content of *Ziziphus rugosa* fruits was 0.42 ± 0.041mg/100g, phosphorus 0.45 ± 0.03 mg/100g, potassium 1502.3 ± 4.9 mg/100g, Calcium 256.2 ± 0.15 mg/100g, magnesium 156.4 ± 0.41 mg/100g, sodium 181.6 ± 2.08 mg/100g, iron 23.87 ± 0.01mg/100g, Zinc 3.68 ± 0.02 mg/100g, copper 2.06 ± 0.03 mg/100g, manganese 4.26 ± 0.20 mg/100g. Among the fruits studied by them, the highest values of nitrogen, phosphorus and magnesium were observed in a *Grewia tiliifolia* fruits, calcium, sodium and potassium in *Ficus racemosa* fruits respectively and microelement found like iron, which is higher in *Meyna laxiflora* fruits, Zinc in *Elaeagnus conferta* fruits, while Copper and manganese are present abundant in *Flacourtia indica* fruits. Leterme *et al.* (2006) worked on the mineral content of tropical fruits and unconventional foods of the Andes and the rain forest of Colombia. Total 68 species of starchy foods, tropical fruits, leaves and tubers have taken for analysis. *Flacourtia indica* is one of them. The dry matter content was found 22.7%, ash 745, calcium 47 mg/100g, phosphorus 4 mg/100g, potassium 167 mg/100g, 15 mg/100g magnesium, 2 mg/100g sodium, 6 mg/100g chloride and 11

mg/100g sulphur, 0.43 mg/100g manganese, 0.45 mg/100g zinc, 0.45 mg/100g iron, 0.14 mg/100g copper respectively as well as selenium was not detected.

Madejon *et al.* (2006) detrmined the trace elements (As, Cd, Cu, Fe, Mn, Ni, Pb, Tl and Zn) in wild olive and holm oak. They concluded that Zn, As, Pb and Cu were main trace elements polluting the soil while the fruits (pulp) were more polluted than the oak seeds (protected inside a hard pericarp), reaching toxic values for Cd and Pb. The concentration of trace elements in the leaves and fruits decreased with time and, in consequence, the toxicity risk to the food web diminished. San *et al.* (2009) studied the mineral composition of leaves and fruits of some promising jujube *(Ziziphus jujube* Miller) genotype. They analysed nitrogen, potassium, calcium and magnesium for leaves and nitrogen, potassium and calcium for fruit were major macroelements in promising jujube genotypes and represented about 98 and 93 % of the total mineral content, respectively. They also found other minerals in appreciable amount in leaves and fruits. They further found significant differences for each individual mineral between genotypes except for the sodium content in leaves and manganese content in fruits.

ii. Mineral analysis:

Aberoumand (2009) assessed the nutritional data for traditional vegetables and fruits including their content of mineral elements (calcium, potassium, sodium, zinc, and iron) along with antioxidant phenolic compounds levels. Among the fruits and vegetable studied by them, *Cordia dichotoma* is one of them. Their results indicated that 50% of the fruits and vegetable have significant energy values ranging from 281.4 to 303.9 kcal/100 g. Aberoumand and Deokule (2009) carried out nutritional studies on some wild edible plants. *Cordia dichotoma* is one of them. They observed that *Cordia dichotoma* Roxb have the lowest nutritional values because they have minimum ash values. Also it had lowest zinc values. Duhan *et al.* (1992) analysed nutritional values of thirteen non-conventional foods including fruits, leaves and grains. From the fruits studied *Cordia dichotoma* is one of them. They found medium level of calcium and zinc. Aberoumand (2009) studied the nutrient and antinutrients in eight wild edible fruits. *Alocacia indica* Sch. *Asparagus officinalis* DC, *Chlorophytum comosum* Linn, *Chlorophytum comosum* Linn., *Cordia myxa* Roxb., *Eulophia ochreata* Lindl., *Momordica dioicia* Roxb.,

Portulaca oleracia Linn., *Solanum indicum* Linn. etc. *Cordia dichotoma* is one of them. The most important nutrients studied by Aberoumand were water, starch and free sugars, such as glucose, fructose and sucrose. The antinutrients measured included phytic acid and trypsin inhibitors. Rathore (2009) worked on nutrient content of some important fruit trees from arid zone of Rajasthan. They observed that most of these fruits are rich sources of protein and energy. *C. dichotoma* is one of them. They suggested that these fruits from forests are rich sources of protein and energy and can be very useful in treating malnutrition viz. protein energy deficiencies so prevalent in these areas particularly during famines and floods.

Dhyania and Khalib (1993) studied the Fruit yield and economics of jelly and jam production from fruits of some promising *Ficus* tree crops. *F. racemosa* is one of them. Nagendran (1999) had studied some minerals (Cr, Fe, Cu and Zn) of 35 plants for the presence and levels of minerals like Cr, Fe, Cu and Zn. Of them only seven plants had detectable levels of Cr. *F. racemosa* also contained the detectable levels of Cr. They mentioned that it was used as vegetable. They determined the one fourth of the chromium as Cr (III) in *F. racemosa.* Trivalent Cr has a very large safety range upto 1 mg per day. Ohiokpehai *et al.* (2003) have done the preliminary survey of traditional food products. *Grewia tiliifolia* is one of them. *Grewia tiliifolia* contain 82.1% sugar content and 67.5% CHO. Further they suggested that women indigenous knowledge of these traditional foods should be harnessed to improve nutrition security sustainable especially in the light of increased prevalence of HIV/AIDS.

Hassena *et al.* (2010) have determined the nutritive value of *Ziziphus mucronata* during different seasons. They observed the higher amount of crude protein 123-262 g kg/DM in spring than in the other seasons. The acid detergent fibre ranged between 175-312 g/kg DM which was higher in autumn than in either spring or summer. The concentrations of calcium (Ca), sodium, zinc and manganese (Mn) appear to be higher in autumn while the concentrations of phosphorus (P), magnesium (Mg), and potassium and copper (Cu) tended to be lower at this time compared to other seasons. Fentahun and Hager (2009) studied the composition from the wild fruits, their exploitation and their potential contribution to improve food and nutritional security in three districts of the Amhara region of Ethiopia. They studied total forty four wild fruit species; *Ziziphus* spp.

is one of them. They examine, *Ficus* as the richest source of nutrient followed by *Grewia* and *Ziziphus*. They concluded that these fruits were rich in valuable nutrients and are accessible year round with significant overlap at times of acute food and nutrient scarcity. Rathore *et al.* (2009) have examined the nutrient content of important fruit trees from arid zone of Rajasthan. They studied seven plant species; *Ziziphus* species were two of them. *Capparis decidua* (Ker), *Cordia dichotoma* (lasora), *Ziziphus mauritiana* (ber), *Ziziphus nummularia* (Bordi), *Salvadora oleoides* (Jal), *Balanites aegyptiaca* (Hingota), *Prosopis cineraria* (Khejri) etc. They mentioned that most of these fruits are rich sources of protein and energy. *Capparis deciduas* was rich source of fibre, vitamin A and vitamin C. *Ziziphus mauritiana* is richer than apple in protein, phosphorous, calcium, carotene and vitamin C. *Salvadora oleoides* fruits are rich source of carbohydrates. They suggested that these fruits from forests are rich sources of protein and energy and can be very useful in treating malnutrition viz. protein energy deficiencies so prevalent in these areas particularly during famines and floods.

Saka and Msonthi (2003) studied the nutritional value of edible fruits of indigenous wild trees in Malawi. They analyzed moisture, protein, fat, crude fibre, ash and minerals (Ca, Mg, Fe, P, K, and Na), from *Trichilia emetica, Strychnos spinosa, Ximenia caffra*, *Azanza garckeana, Parinari curatellifolia*, *Adansonia digitata, Syzigium guineense* and *Flacourtia indica.* In *Flacourtia indica* highest level of sodium (589 μg g−1).is found in fruits. Nahar *et al.* (1990) analysed the carbohydrate from in seven edible fruits of Bangladesh; *Flacourtia indica* is one of them. They have mentioned that except *Flacourtia indica* all the fruits were low in carbohydrate with low molecular weight. They further mentioned that these fruits contained substantial amounts of glucose and fructose and glucose was the main constituent of polysaccharides. Their values of dietary fibre ranged from 29 to 79%. They further stated that *Flacourtia indica* had far the best combination of low free sugars and high dietary fibre. The nutrient content of the *Flacourtia* from Western Maharashtra were carried out by Kulkarni et al. (1991). They studied two fruits that is *Flacourtia Montana* and *Flacourtia latifolia*. The nutrient values for *Flacourtia Montana* were 1.08 g/100g proteins, 17.21 g/100g carbohydrates, 1.59 g/100g fats, 232 mg/100g Ca, 10.6 mg P and 38 mg tannic acid. Corresponding values for *F. latifolia* were 2.13 g/100g, 22.86 g/100g, 2.98 g/100g, 19.7 mg/100g and 31 g/100g

respectively. They further stated that unripe fruits showed marked differences in the contents of Ca and P and vitamin C and presence of Fe in very low quantities

Nazarudeen (2010) carried out the Nutritional composition of some lesser known fruits used by ethnic communities and local folk of Kerala. *Antidesma ghasembilla* is one of them. He mentioned that Kanikkar, Malampandarangal, Paniyar tribes eat the ripe fruits and sour, unripe fruits are pickled. 10.79% reducing sugar was obtained by him which was higher among studied fruits. The reported nutritional values are 82.83% moisture, 1.81protein, 0.95 fat, 1.21 non reducing sugar, 12.21 total sugar, 1.5% fibres, 0.49 mineral matter, 111.2 mg/100g vit.c, 0.76 iron, 9.26 sodium, 303.9 potassium, 64.63 energy, respectively. Mercader *et al.* (2009) worked on the phytoliths in woody plants from the Miombo woodlands of Mozambique. They studied *Antidesma* species. They obtained 1.900g of moisture, 14.47% ash and 1.526% dry weight from the leaves of the *Antidesma* species while 4.867% ash, 4.5% moisture, 0.022% dry weight from stem of the *Antidesma* species. Their research contribute to filling the current information gap in woody phytoliths and explore their taxonomic value in paleoecological reconstruction through phytolith analysis. They have presented evidence that Miombo woody species are hyper variable silica producers and their phytolith morphotypes are many and highly polymorphic. Msangi and Hardesty (1993) determined the nutritional value of *Antidesma venosum, Margaritaria discoides Phyllanthus reticulatus* and *Leucaena leucocephala* from the western Tanzania. They determined the nutritional values during every month. During June, the crude protein content was 9.38%, ash was 7.44%, dry matter 21.09. Incase of July, the crude protein content was 9.92%, 7.71% ash, 20.43dry matter. The nutritional values somewhat decreased during August and September, while it was increased during month of October, 14.04 crude protein, 7.59% ash, 28.37% dry matter. Their research showed variation in the nutritional values in every month.

Rai *et al.* (2005) evaluated the food value of common edible wild plants of Sikkim. They selected total fifteen common edible wild plants viz., *Nasturtium officina/e, Phlogacanthus thyrsiflorus, Urlica dioiea, Ficus benjamina, Aconogonummolle, Dipazium eseulentum, Tupistra nutans, Castanopsis hystrix, Choerospondias axillaris, Docynia indica, Machilus fruetifera, Fragaria nubicola, Ficus hookeriana and Elaeagnus conferta.* Among the studied plants *Elaeagnus conferta* is one of them. They

analysed 91.7 ± 2.0% moisture, 0.7 ± 0.1%ash, 0.8 ± 0.2 ash, 0.8 ± 0.2% Fat, 1.4 ± 0.5% protein, 5.3 ± 0.5% carbohydtrate, 6.7 ± 0.3 mg/100g sodium, 233.5 ± 2.3 mg/100g Potassium, 5.8 ± 0.3 mg/100g and 34.0 ± 2.5 Kcal/100g nutritive values in *E. conferta*. Weiye *et al.* (1986) have done the trial planting of *Elaeagnus conferta* tree. They mentioned that when plant was introduced for trial planting, as its roots have nodule bacteria, the plant grew rapidly with good adaptability and gave early and higher production. Fruits are quite nourishing with the contents of protein, amino acids, minerals and the major vitamins higher than those in some commercial fruits produced in the Tropics and Subtropics. The fruit also contains protease. Therefore they suggested that, this plant can be recommended for large-scale planting as a new fruit tree in South China to help solve the problem of fruit shortage in the off seasons and provide a new source of protease production.

iii. Antioxidant Analysis:

Antioxidants are considered important nutraceuticals on account of their many health benefits and they are widely used in the food industry as inhibitors of lipid peroxidation (Scherer and Godoy, 2009). Antioxidant parameteters covered in this literature is polyphenol (Williamson and Manach, 2005; Scalbert *et al*., 2003; Lambert *et al*., 2005, Melo *et al.,* 2006), ascorbic acid, antioxidant enzymes like catalase, peroxidase, superoxide dismutase (Tolbert, 1971; Willekens et al., 1997; Lopez- Nicolas *et al.,* 2002; Dat *et al.,* 2000; Khali and Selselet Attou, 2007; Robinson, 1991; Vamos Vigyazo, 1981; Kurepa *et al.,* 1997). The free radical scavemgimg activities like DPPH, FRAP, reducing power, ferrous ion chelating activity and total antioxidant activity (Shyur *et al.,* 2005; Yen, 1995). The evaluation of the Total Antioxidant Capacity (TAC) of fruit extracts has been introduced in the past decade for determining the cumulative action and the synergistic interaction of all the antioxidants present in fruits giving the cumulative capacity of fruits to scavenge free radicals (Scalzo *et al.,* 2005b, Bompadre *et al.,* 2004, Pellegrini *et al.,* 1999, 2003; Halvorsen *et al.,* 2002; Giorgi *et al.,* 2005) and these properties account for the recent successes that such an approach has actually obtained both in basic research and in applied investigations.

Singh *et al.* (2010) studied role of *Cordia dichotoma* seeds and leaves extract in degenerative disorders. They analysed the free radical scavenging potential of methanolic extract of seeds and leaves of *Cordia dichotoma* using in vitro models viz. DPPH and hydrogen peroxide model. These models demonstrate positive antioxidant activity in a concentration dependent manner and demonstrate that highest concentration exhibits highest (100µg/ml) antioxidant activity. Their study suggested that methanolic extract of *Cordia dichotoma* seeds and leaves possess powerful antioxidant activity, the leaves are more potent than seeds. Therefore it is suggested that *Cordia dichotoma* could be a potential source of natural antioxidants that could have great importance as therapeutic agent in preventing or slowing down the progress of ageing and age associated oxidative stress related degenerative diseases. Salar and Dhall (2010) carried out the antioxidant potency of aqueous and organic solvent extracts of five Indian medicinal plants *(Prosopis cineraria, Capparis decidua, Tinospora cordifolia, Carissa carandas and Cordia dichotoma)*. Acetone extracts showed inhibitory zones ranging from 11.2 - 19.8 mm whereas no inhibitory effect was observed for aqueous extracts. *C. dichotoma* fuits showed 131.0% NBT radical scavenging activity in acetone extract and 149.0 % activity in methanol extract. Their results indicated that the solvents and extraction procedure may modify the final results to get maximum antioxidant activity. Aberoumand and Deokule (2010) studied the comparative analysis of polyphenol content in some food plants. *Cordia dichotoma* is one of them. They mentioned that *Cordia dichotoma* contained the 4.02 ± 2.1% polyphenols.

Preliminary assessment of antioxidant activity of young edible leaves of seven Ficus species were carried out by Shi *et al.* (2011). For the first time, they evaluated the antioxidant effects of the edible young leaves of *F. virens var. sublanceolata, F. auriculata, F. vasculosa, F. callosa, F. virens var. verins, F. racemosa* and *F. oligodon* along with their total phenolic and flavonoid contents. The results showed that the edible young leaves of the seven Ficus species possess abundant antioxidants at various concentrations, and the ethanol extracts of *F. virens var. sublanceolata and F. auriculata* showed considerable high antioxidant potential compared with other species tested. Recently, seven different antioxidant compounds, including protocatechuic acid, chlorogenic acid, catechin, epicatechin etc., have been reported in methanolic extracts of

the stem bark of *F. microcarpa* L. fil. All the reported compounds showed strong antioxidant activity. Joseph and Raj (2010) overviewed the phytopharmacological properties of *F. racemosa* and reported much evidence on its considerable antioxidant ability. Meanwhile there has been no previous study of antioxidant effects of the other six species examined here. Some examples, such as young leaves of *F. virens var. sublanceolata* and *F. auriculata* have however been found to be more potent than *F. racemosa*. Hence, further research is essential to establish the antioxidant potential of some underexploited *Ficus* species, especially those being used traditionally for pharmacological or dietetic purposes. Poongothai *et al.* (2011) focused their studies on preliminary phytochemicals screening of bark of *Ficus racemosa* linn Bark. They extracted bark with benzene, chloroform, ethanol, ethyl acetate, methanol and petroleum ether. Sugar, protein, alkaloids, flavonoids, sterols and glycoside were found to be present in the extracts. They found that most of the biologically active phytochemicals were present in the ethanolic extract of *Ficus racemosa* bark. Flavonoide, glycosides, phenols and triterpenoides are present in all extracts of the bark of *F. racemosa.*

Veerapur *et al.* (2009) carried out the antioxidant studies of the *Ficus racemosa* stem bark. They were subjected ethanol extract and water extract to free radical scavenging both by steady state and time resolved methods such as nanosecond pulse radiolysis and stopped flow spectrophotometric analyses. They observed that ethanol extract exhibited significantly higher steady state antioxidant activity than water extract. ethanol extract exhibited concentration dependent DPPH, ABTS, hydroxyl radical and superoxide radical scavenging and inhibition of lipid peroxidation with IC_{50} comparable with tested standard compounds. They also observed the pretreatment with different doses of ethanol extract 1h prior to 2Gy g radiation resulted in a significant ($P<0.001$) decrease in the percentage of micronucleated binuclear V79 cells. They further observed maximum radioprotection at 20 mg/ml of ethanol extract. From their result they concluded that the ethanol extract of *F. racemosa* acts as a potent antioxidant and a probable radioprotector. Murti *et al.* (2011) carried out phytochemical studies of roots of *Ficus racemosa*. Their Phytochemical investigation of root shows, total ash (7.0 % w/w), acid insoluble ash (3.0 % w/w), and water soluble ash (4.0 % w/w). Loss on drying is 1.584 % w/w. Alcohol soluble extractive value (3.2% w/w), water soluble extractive

value (10.4 % w/w), chloroform soluble extractive value (1.06 % w/w) and ether soluble extractive value (4.8% w/w). Alcoholic and aqueous extracts obtained from the plant are 10.6% w/w and 9.2% w/w. They found saponin and tannin in alcoholic extract and aqueous extract. They also found other constituents like carbohydrate, glycosides, phenolic compounds, gums and mucilage. Manian *et al.* (2008) carried out the antioxidant activity of the stem bark and fruits of *Ficus bengalensis* L*., Ficus racemosa* L. and *Camellia sinensis*. They observed that methanol extracts of green tea and *F. bengalensis* and 70% acetone extract of *F. racemosa* contained relatively higher levels of total phenolics than the other extracts. All extract exhibited dose dependent reducing power activity. Methanol extract of all the samples shows the more hydrogen donating activity. They further observed that all the extracts exhibited antioxidant activity against the linoleic acid emulsion system (34–38%). They evident that potential of multiple antioxidant activity is present as it possessed antihemolytic activity and metal ion chelating potency.

Joseph and Raj (2010) have given the detailed survey of the literature on its pharmacological properties of various bioactive compounds present in the plant. The stem bark and fruits are used in India for the treatment of various diseases. Methanol extracts of *Ficus racemosa* contained relatively higher levels of total phenolics than the other extract. Antioxidants from *Ficus* can protect lipoproteins in plasma from oxidation and produce a significant increase in plasma antioxidant capacity. The antioxidant potential of the extracts can be assessed by employing different in vitro assays. The ethanolic extract showed a greater effect against pathogens, worms and renal carcinoma in rat compared with the standard drugs. From their studies they showed that *Ficus racemosa* possesses various phytochemical and pharmacological properties. Selvam *et al.* (2010) have evaluated the free radical scavenging activity of methanolic extract of *Grewia tiliaefolia* bark in In-vitro model systems. They analyzed the IC_{50} (Concentration required for 50 % inhibition) for the test drug against each radicals. The results showed that the *G. tiliaefolia* extract had potential radical scavenging activity against different radical system. The highest activity was observed against DPPH radicals (85.44 ± 1.13) and then followed by hydroxyl radical, superoxide radical, ABTS, lipid peroxidation system and nitric oxide radical. They suggested that the activity may be due to the

presence of phytomolecules like lignans, flavanoids, phenols and alkaloids in the crude extract. Yadav *et al.* (2008) studied the antioxidant properties of the methanolic extract from *Grewia tiliifolia*. They extracted whole, fresh barks of *Grewia tiliifolia*. The minimum inhibitory concentration values at 125 µg/ml against B. Sterarothermophilus, 31.25 µg/ml against *L. licjmani* and 62.5 µg/ml against *P. cepacia.* The antioxidant activities of 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radicals (13.65 µg/ml IC_{50} value) and superoxide anion radicals (44.0 µg/ml IC_{50} value) and reducing power. The results showed that *Grewia tiliifolia* extract had great potential as antioxidant and very good anticancer agent. Ganesh *et al.* (2010) carried out the antioxidant activity of *Meyna laxiflora* seeds. They have taken methanol extract of the seeds of the *Meyna laxiflora*. The methanol extract is found to possess free radical scavenging property in concentration dependent manner. They determined IC_{50} values and are found to be 84.2 ± 2.1, 91.0 ± 3.0, and 104.5 ± 3.4 µg/ml for DPPH, H_2O_2, and NO radical scavenging method respectively. Their observation indicates the presence of free radical scavenging potential by the methanol extract of *Meyna laxiflora* seeds. The methanolic extracts of twenty wild edible fruits grown in Manipur were done by Haripyaree *et al.* (2011); *Meyna laxiflora* is one of them. Result has shown that thirteen fruits were most effective, five fruit extracts were moderate antioxidant activities and remaining two fruit extracts were remarkable lower amount of radical scavenging compounds. The *Meyna laxiflora* fruit showed 118.87% DPPH activity and from total fruits studied by them, *Aphanamixis Polystachya* fruits showed highest DPPH activity. The antioxidant enzymes like catalase, peroxidase and superoxide dismutase is carried out in eight wild edible fruits (Valvi *et al.*, 2011) from Kolhapur district. *Meyna laxiflora* is one of them. The highest activity was found incase of superoxide dismutase, followed by peroxidase and catalase. Peroxidase activity is found to be higher in ripened fruits, while Catalase and Superoxide dismutase is higher in mature fruits and then activity decreased during ripening of the fruit. Azam *et al.* (2005) were evaluated the prospectus and potential of fatty acid methyl esters of some non-traditional seed oils for use as biodiesel. Total 75 plant species having 30% or more fixed oil in their seed/kernel were examined by them. Saponification number (SN), iodine value (IV) and cetane number (CN) of fatty acid methyl esters of oils were empirically determined and they varied from 169.2 to 312.5, 4.8 to 212 and

20.56 to 67.47, respectively. Among seventy plant species *Meyna laxiflora* is one of them. They analyzed 38.5% oil, 202.8 saponification numbers, 101.3 iodine values and 50.42 cetane number from the seeds of the *Meyna laxiflora.*

Valvi *et al.* (2011) isolated the antioxidant enzymes from the mature and ripened wild edible fruits. Catalase, peroxidase and Superoxide dismutase were studied from eight fruits. The highest catalase activity was shown by mature (0.116 + 0.001) and ripened (0.076333 $\pm$ 0.003786) fruits of *Ziziphus rugosa*, whereas least activity was shown by mature *Cordia dichotoma* fruits (0.002667 $\pm$ 0.000321) and ripened fruits of *Elaeagnus conferta* (0.000667 $\pm$ 0.000252). The highest SOD activity was shown by mature (0.007533 $\pm$ 0.000252) and ripened (0.004767 $\pm$ 0.000115) fruits of *Meyna laxiflora*, where as least activity was shown by mature (0.0008 $\pm$ 0.0001) and ripened fruits(0.0006 $\pm$ 0.000265) of *Antidesma ghasembilla.* The highest peroxidase activity was found in ripened fruits *Meyna laxiflora* (0.006333 $\pm$ 0.004619) and less in *Antidesma ghasembillae* ripened fruits (0.000467 $\pm$ 0.000208). In mature fruits, again the highest peroxidase activity was found in *Meyna laxiflora* (0.0096 $\pm$ 0.000265) and less in *Antidesma ghasembillae* (0.000633 $\pm$ 0.000306). They have concluded that antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well being. They find out the levels of antioxidant enzymes, from mature and ripened wild edible fruits. Ndhlala *et al.* (2008, a) studied the antioxidant activities of four wild fruits, *Diospyros mespiliformis, Flacourtia indica, Uapaca kirkiana* and *Ziziphus mauritiana.* These were extracted with methanol and analysed for radical-scavenging effect of 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical, reducing power and anion radical effect on superoxide anion using colorimetric method. They observed an increase in the radical-scavenging effect, reducing power and superoxide anion radical-scavenging effect as the concentration of sample was increased. Their results showed that the peels of *F. indica* had higher DPPH radical-scavenging effects (41.45 ± 3.61%), reducing power and superoxide-scavenging effects (18.75 ± 0.92) compared with the pulp of *Z. mauritiana* had high DPPH radical-scavenging effects, reducing power and superoxide scavenging effects compared with the peel.

Bhatia *et al.* (2011) investigated the antioxidant effect of the ethanolic extracts of the leaves of *Glycosmis pentaphylla* and *Bauhinia variegata*. The antioxidant activity

was evaluated by various antioxidant assays, including 1, 1-diphenyl-2-picrylhydrazyl (DPPH), 2, 2'-azino-bis (3-ethylbenzthiazoline-6-sulfonic acid) (ABTS), nitric oxide and hydrogen peroxide (H_2O_2) scavenging method. *Glycosmis pentaphylla* leaves showed the 28.5% DPPH activity, 26.2 ABTs activity, 31.0% NO radical scavenging activity, 26.2% hydroxyl radical scavenging activity. From their studies they concluded that antioxidant activity of these extracts might be attributed to its flavonoids, phenolic and other phytochemical constituents. Gupta *et al.* (2011) carried out their studies on antioxidant effect of the different crude extracts (Petroleum ether, ethanolic and aqueous) of the plant *Glycosmis pentaphylla* correa. The antioxidant activity was evaluated by various antioxidant assays with different extracts that is petroleum ether, ethanol and aqueous extract. Aqueous extract showed the better DPPH activity (38.5%), 33.6 % ABTS activity, 41.5% NO radical scavenging activity and 48.5% hydroxyl radical scavenging activity. Their findings suggested that *Glycosmis pentaphylla* could be a potential natural source of antioxidants and could have greater importance as therapeutic agent in preventing or slowing oxidative stress related degenerative diseases. Butkhup and Samappito (2008) carried out the analysis on flavoinoides content in mao luang fruits of fifteen cultivars (*Antidesma bunius*), Grown in Northeast Thailand. Their result shows that fruits of fiteen mao luang cultivers contained three different kind of flavonoides, i.e. catechin, procynidin B1 and procynidin B2. They found out that these three chemical compounds were major flavonoides in all analyzed fruits. The highest amount of procyanidine B1 was found in *Antidesma bunius* with values 4122.75 and 3993.88 mg/100g FW and procyanidine B2 was found in sangkrow2 followed by fapratan with values 5006.39 and 3689.42 mg/100g FW. Catechin varied from 73.39 to 316.22mg/100g. Maisuthisakul *et al.* (2007) anayzed phenolic constituents and free radical scavenging capacity of ethanolic extracts from various parts of 26 Thai indigenous plants. *Antidesma velutinum* tulas is one of them. They analyzed its seeds which contain 38.4 ± 0.0% moisture. 123.3 ± 0.3 mg GAE/g dw total phenolic, 50.3 ± 0.0 mg RE/g dw total flavonoid, 0.07 ± 0.01 ug/ug DPPH activity. Their results showed that total phenolic compounds and flavonoid content were higher in seed extracts of berries used in wine production. They suggested that ethanolic extracts of some Thai indigenous plants exhibit a potential for use as natural antioxidants. Nuengchamnong and

Ingkaninan (2010) have screened multiple antioxidant compounds in *Antidesma thwaitesianum* Muell. fruit wine through HPLC-MS-DPPH. They separated antioxidant compounds and identified them as gallic acid, cyanidin-3-sophoroside, monogalloyl glucoside, delphinidin-3-sambubioside, catechin, caffeic acid, and pelargonidin-3-malonyl glucoside. This result showed that on-line HPLC–MS–DPPH assay can be a powerful technique for the rapid characterization of antioxidant compounds in plant extracts.

Puangpronpitag *et al.* (2008) analyzed polyphenolic content in both *Antidesma* seeds and *Antidesma* marcs and investigated the radical scavenging activities of these polyphenolics against 1,1-diphenyl-2-picryl-hydrazyl (DPPH) and 2,2-Azinobis (3- ethylbenzothiazoline 6-sulphonate) (ABTS) radicals and thiobarbituric acid reactive products (TBARP). Results showed *Antidesma* seeds and *Antidesma marcs* to be an abundant source of polyphenols (97.32 to 130 mg gallic acid equivalents GAE/g) and proanthocyanidins. The radical scavenging activities of *Antidesma* seeds and *Antidesma marcs* against DPPH and ABTS radicals (IC_{50} of 0.85 to 1.21 μg/mL) were significantly higher ($P < 0.05$) than that of standard trolox (IC_{50} of 5.05 μg/mL). Activity of *Antidesma* seeds and *Antidesma* marcs extracts were 3.74 and 3.80 μg/mL trolox eq/g f.w. for the DPPH and ABTS assays, respectively. The oxidation of erythrocyte membranes using 2-thiobarbituric acid demonstrated that the protective effect of *Antidesma* seeds and *Antidesma marcs* on lipid peroxidation is as strong as grape seed proanthocyanidin extract. Their findings suggest that polyphenolic compounds and proanthocyanidins isolated from these mao extracts had much higher antioxidant activities than those of standard trolox and exhibited similar antioxidant potential to grape seed proanthocyanidin extract. Samappito and Butkhup (2010) studied methanolic extracts from ten fruits for their anthocyanin, flavonoids and phenolic acid constituents, and antioxidant capacity. The fruits included: mao luang (*Antidesma bunius* Linn.), mao khipla (*Antidesma ghaesembilla* Gaertn.), mulberry (*Morus alba* Linn.), wild grape (*Tetrastigma quadrangulatum*), red grape (*Vitis vinifera*), blueberry (*Vaccinium myrtilus*), strawberry (*Fragaria ananassa*), red raspberry (*Rubus idaeus*), cherry (*Prunus avium*), and black currant (*Ribes nigrum*). The RP-HPLC-DAD method was used for the simultaneous analysis of flavonoids and phenolic acids in fruits. Their results showed that the highest

anthocyanin and total phenolic contents were found in *Antidesma ghaesembilla* Gaertn, *Morus alba* Linn and *Antidesma bunius* Linn. The antioxidant activity was measured from EC_{50}-1 by the DPPH method. *Antidesma ghaesembilla* Gaertn and *Antidesma bunius* Linn. have the highest radical scavenging activity. The correlation coefficients exhibited a high positive relationship between total phenolic and anthocyanin contents in the berry extracts and scavenging activity. Santiago *et al.* (2008) carried out antioxidant activities, flavonol and flavanol content of selected Southeast Asian indigenous fruits. *Antidesma bunius* is one of them. They found 75.8% the percent inhibition of linoleic acid peroxidation, it also determined to have both catechin and epicatechin with 20.40 and 1.47micro g/g fresh samples, 0.22 micro g quercetin/g fresh samples and 0.42 micro g myricetin/g fresh samples, respectively. Thind *et al.* (2011) evaluated the free radical scavenging activity of methanol extract and fractions from the bark of *Schleichera oleosa* (Lour.). They observed that the residue fraction, left after the precipitation, was more effective in scavenging the free radicals than the aqueous extract and precipitation. 942.4 mg/g GAE phenolic compound was analyzed from methanolic extract. The highest DPPH activity (119.5ug/ml), reducing power (137ug/ml), chelating power (100 ug /ml) was observed in precipitate extract.

Jia-hong (2005) studied the effect of several inhibitors on the activities of polyphenoloxidase and peroxidase in Chinese white olive fruit. Their results indicated that polyphenoloxidase activity was highest at 27^0 and peroxidase was at 45^0. The inhibition of polyphenoloxidase activity was more significant than that of peroxidase during low temperature. They further mentioned that ascorbic acid and sodium sulfite could significantly inhibit the activity of polyphenoloxidase and ascorbic acid and magnesium chloride had significant inhibition on the activity of peroxidase. Sundriyal and Sundriyal, R.C.(2005) were studied the seedling growth and survival of selected wild edible fruit species of the Sikkim Himalaya. They have taken studied the *Baccaurea sapida, Diploknema butyracea, Elaeagnus latifolia, Eriolobus indica, Machilus edulis and Spondias axillaris*. Out of them, *Spondias axillaris* and *Machilus edulis* had the maximum absolute growth rate, relative growth rate, leaf area ratio and stem weight ratio among all species. Leaf area ratio was highest for *B. sapida.* Relative growth rate, leaf area ratio and leaf area ratio declined with the age of seedlings. They suggested that these

species should be multiplied at large scale and distributed to the local inhabitants to reduce pressure on them in natural stands as well as provide economic benefit to the subsistence farmers.

iv. Antinutritional analysis:

Llelaboye and Pikuda (2009) determined the minerals and antinutritional factors of some lesser known crop seeds. The calcium content of *Trichosanthe cucumerina* and *Citirllus vulgaris* were 1643.00mg/kg and 1826.00 mg/kg dry weight. The antinutritional activities of the mature and ripened fruits were carried out by Rathod and Valvi (2011). The saponin content was found to be more in both mature and ripened fruits. Except, *Ziziphus rugosa* and *Glycosmis pentaphylla* all other fruits were low in saponin. Phytic acid is 0.46 $\pm$ 0.01 % (M) and 0.26 $\pm$ 0.011 % (R); Oxalate 1.41 $\pm$ 0.011(M) and 0.86 $\pm$ 0.0025 % (R) and tannin content is 2.82 $\pm$ 0.01 % (M), 1.06 $\pm$ 0.02 % (R) respectively. Nutritional value of some non-conventional plant foods of India were analysed by Duhan *et al.* (1992). They studied total thirteen plants. *Cordia dichotoma* is one of them. They were carried out the proximate parameters like moisture, ash, crude fibre, protein and fat, mineral analysis like calcium, phosphorus, zinc, iron, manganese and antinutrient like phytic acid and oxalate. The phytic acid content in *Cordia dichotoma* was 355 $\pm$ 30 mg/100g and the oxalate was 250 $\pm$ 19 mg/100g. Aberoumand and Deokule (2009) carried out the nutritional values of some wild edible plants from Iran and India. The *Cordia myxa* Roxb is one of them. They analysed nutrients such as carbohydrates (free sugars and starch), oil, proteins, minerals, ascorbic acid and antioxidant phenols and phytic acid. They obtained 2.5 mg/100g phytic acid in this fruit. Umaru *et al.* (2007) studied the 16 wild edible fruits for their antinutritional factors from the Northern Nigeria. They were studied the fruits like *Adansonia digitata, Balanites aegyptica, Borassus aethiopum, Nuclea latifolia, Detarium macrocarpum, Diospyros mespiliformis, Haematostaphis barteri, Hyphaena thebaica, Parkia biglobosa, Vitex doniana, Vittaleria paradoxum, Ziziphus marutiana, Borassus aethiopum, Phoenix dactylifera, Sclerocarya birrea, Ziziphus spinachristi. Ziziphus* species are two of them. They were studied *Ziziphus mauritiana* and *Z. spinachrist*. They evaluated the antinutritional factors like phytic acids, oxalate, saponin and tannin. The *Ziziphus mauritiana* fruit contained 15.50

± 1.50 % oxalate; 1.57 ± 0.33 % phytate; 7.13 ± 0.21 % saponin and 2.42 ± 0.04 % tannin. Biochemical evaluation of *Cassipourea congoensis* and *Nuclea latifolia* was carried out by Nkafamiya *et al.* (2006). The fruits of *Cassipourea congoensis* and *Nuclea latifolia* were assessed chemically for the presence of mineral, vitamins and antinutritional factors. Among these fruits the *Cassipourea congoensis* fruit was rich in oxalate saponin and phytate. The phytate content in *Cassipourea congoensis* fruit was (2.57 ± 0.41%). Ojoyako and Igwe in 2008 worked on the nutritive, antinutritive, and hepatoxic properties of *Trichosanthes anguina* fruits from Nigeria. They analysed oxalate (0.58 ± 0.12), phytate (0.11 ± 0.02) and tannin (0.02 ± 0.05), from tomato fruit. These results are lower than antinutritional values obtained in present study viz. oxalate (1.64 ± 0.052), phytic acid (0.7 ± 0.2), and tannin (1.956 ± 0.030). Bello *et al.* (2008) studied the chemical compositions and antinutrients of some lesser known Nigerian fruits, viz. *Cola millenii, Strychnos innocua, Bombax glabra, Artocarpus heterophyllus, Parkia biglobosa and Gardenia erubescens.* The tannin content from these fruits were 1.08 ± 0.03 mg/100g (*Artocarpus heterophyllus*); 1.20 ± 0.01 mg/100g (*Bombax glabra*); 1.27 ± 0.06 mg/100g (*Cola millenii* seed); 1.33 ± 0.06 mg/100g (*Cola millenii* mesocarp); 7.5 ± 0.71 mg/100g (*Gardenia erubescens*); 1.08 ± 0.20 mg/100g (*Parkia biglobosa*); 1.01 ± 0.10 mg/100g (*Strychnos innocua*).

The nutritional and antinutritional potentials of number of wild tropical seeds and fruits have assessed by several researchers (Osabor *et al.,* 2009; Feugang *et al.,* 2006; Musinguzi *et al.,* 2007; Desai *et al.,* 2010; Li *et al.,* 2007). Nkafamiya *et al.* (2010) carried out the nutritional status of non-conventional leafy vegetables, viz. *Ficus asperifolia* and *Ficus sycomorous.* They studied the antinutritional factors like oxalate, tannin, saponin, phytic acid etc. Aberoumand (2009) studied the balance between the nutrient and antinutrients in some plant food, in which *Cordia dichotoma* is one of them. He analysed the phytic acid conent in this fruit, which is 248 mg/100g and Trypsin inhibitor content is 1.39 mg/100g. Five different species of *Ficus* from Nigeria were evaluated for their nutritive and antinutritient factors by Bamikole *et al.* (2004). The phytic acid content from the five species viz *F. mucosa* 0.17g/100g, *F. thonnengii* 0.13g/100g, *F. benjamina* 0.39g/100g, *F. religiosa* 0.27g/100g and *F. polita* 0.29g/100g. Odoemelam and Osu (2009) evaluated the phytochemical content of some edible grains

marketed in Nigeria viz Groundnut, millete, wheat, guinea corn and bread fruit. They studied the antinutrient factors like saponin, phytic acid and tannin. They reported values as 0.05 ± 0.03% saponin; 0.17 ± 0.0% phytic acid; 0.55 ± 0.05% tannin from the bread fruit. The seeds of the fruits of some wild plants, *Cassipourea congoensis* (Tunti), *Nuclea latifolia* (Luzzi), *Deterium microcarpum* (Tallow), *Balanites aegytiaca* (Betu), and *Gemlin arborea* (Melina) were analysed to establish their proximate compositions and the physico chemical characteristics of the oils by Nkafamiya *et al.* (2007). The oxalate content in these seeds were 10.21 ± 1.11% in *Cassipourea congoensis*; 9.5 ± 0.16% in *Deterium microcarpum*; 10.15 ± 0.13 *Nuclea latifolia*; 10.01 ± 0.12% in *Balanites aegyptiaca,* 9.16 ± 0.13% in *Gemlina arborea.* Osabor *et al.* (2009) worked on the profile of African bread fruit (*Treculia africana*), they studied the antnutritional factors like oxalate and phytic acid, the values of oxalate obtained by them were 3.01 ± 0.11%. Bello *et al.* (2008) studied the chemical compositions and antinutrients of some lesser known Nigerian fruits, viz. *Cola millenii, Strychnos innocua, Bombax glabra, Artocarpus heterophyllus, Parkia biglobosa* and *Gardenia erubescens*. The oxalate content from these fruits were 0.23 ± 0.01 g/100g (*Artocarpus heterophyllus*); 0.46 ± 0.01 g/100g (*Bombax glabra*); 0.56 ± 0.14 g/100g (*Cola millenii* seed); 0.25 ± 0.10 g/100g (*Cola millenii* mesocarp); 1.10 ± 0.10 g/100g (*Gardenia erubescens*); 0.93 ± 0.10 g/100g (*Parkia biglobosa*); 1.17 ± 0.10 g/100g (*Strychnos innocua*). Akwaowo *et al.* (2000) carried out the biochemical composition of fluted pumpkin (*Telfairia occidentalis* Hook f.) at different stages of growth. They analyzed the antinutrient factors such as oxalate (2.42 ± 0.16), cynide (0.10 ± 0.02), phytate (1.48 ± 0.10) and tannin (1.30 ± 0.08). Adepaju (2009) worked on the proximate composition and micronutrient potentials of three locally available wild fruits in Nigeria, these are *Spondias mombin, Dialium guineense* and *Mordii whytii*. Highest level of oxalate (1.88 ± 0.06) was found in *S. mombin* fruits. Proximate composition and micronutrient potentials of three locally available wild fruits in Nigeria were carried out by Adepaju (2009). Oxalate content of *Spondias mombin* was 1.88 ± 0.06 mg/100g; *Dialium guineense* 0.90 ± 0.04 mg/100g; *Mordii whytii* 1.44 ± 0.05 mg/100g. Miyasea *et al.* (2009) isolated and characterized three oleanane type triterpenoid saponins Gleditsia saponins C' and E', and Gleditsioside I from the methanol extract of fruits of *Gleditsia caspica* Desf. Further they determine

their structures by 1D and 2D (H1 H1 COSY, HMQC, HMBC) NMR analysis and by acid and alkaline hydrolysis. Hess *et al.* (2003) determined the saponin rich tropical fruits and its effect on fermentation and methanogenesis in faunated and defaunated rumen fluid. They studied three fruit species *Sapindus saponaria, Enterolobium cyclocarpum* and *Pithecellobium saman.* They observed 120 mg/g DM saponin from *Sapindus saponaria* fruit; 19 mg/g DM saponin from *Sapindus Enterolobium cyclocarpum* fruit; 17 mg/g DM saponin from *Pithecellobium saman* fruit.

v. Secondary metabolites:

Secondary metabolites are the pharmacologically active 'basic principles' of predominantly, although not exclusively, flowering plants. Since the identification of the first alkaloid, morphine from the opium poppy, Papaver somniferum in 1806, about 15000 alkaloids have been isolated from 20% of vascular plants and their structures elucidated (Taiz and Zeiger, 2006, Bureau *et al.,* 2000; Nie *et al.,* 2004; Cheistophe and Celine 2007; Bu *et al.,* 1998). Free sugars, organic acids and amino acids (free and in proteins) are natural components of many fruits and vegetables and they play important roles in maintaining fruit quality and determining nutrititive value (Ashoor and Knox, 1982). The nature and the concentration of these constituents in fruits have been of interest because of their important influence on the organoleptic properties.(Glew *et al.,* 2003). Numerous studies have been reported on the metabolism and physiology of many fruits, including free sugar, organic acid, and amino acid compositions. The relationships between these compounds and fruit ripening have been extensively studied in different fruits such as peach (Chapman and Horvat, 1990), mayhaw (Chapman and Horvath, 1993; Chapman *et al.,* 1991), persimmon (Ayaz and Kadioglu, 1998; Senter *et al.,* 1991), apples (Ackerman *et al.,* 1992), strawberry (Perez *et al.,* 1992), blueberry (Ayaz *et al.,* 2001).

Crude protein contents are known for hundreds of wild fleshy fruits (Jordano, 1992). However, positive nitrogen balance is not solely a function of crude protein content. Most crude protein values are derived byKjeldahl analysis. Since there is a large nonprotein nitrogen component in manyforages (Holt and Sosulski, 1981; Sedinger, 1984), including ripe fleshy fruits (Izhaki, 1993), the true protein contents of many fruits

as calculated by the Kjeldahl method are probably overestimated (Milton and Dintzis, 1981; Izhaki, 1993). Moreover, many of the nonprotein nitrogen components of fruits are secondary compounds that may interfere with protein metabolism (Izhaki and Safriel, 1989). Finally, the quality of dietary protein is a function of amino acid profile, a character not measured by Kjeldahl analysis (Milton and Dintzis, 1981; Izhaki, 1993). Little information is available about the amino acid composition of wild fleshy fruits (Herbst, 1986; Pannell and Koziol, 1987; Izhaki, 1993).

Zhao *et al.* (2007, a) determined the betulin and betulinic acid in white birch bark using RP-HPLC. It was found 95% ethanol was a good extraction solvent that allowed extraction of triterpenoid with a highest content. Using this method, the bioactive triterpenoid in white birch bark were simultaneously determined. Significant variations in the content of betulin and betulinic acid in white birch bark growing in different locations of China were also observed. Babu et al. (2010) worked on comparative pharmacognostic studies on the barks of four *Ficus* species Viz. *F. racemosa, F. virens, F. religiosa* and *F. benghalensis*. Their studies include the phytochemical analysis, preliminary phytochemical screening and HPTLC analysis. The result of HPTLC analysis showed that in UV 366 nm, all the barks showed 1 similar common band at Rf. 0.24. In visible light all the barks shows two similar common bands of violet colour at Rf. 0.28. Phenolic acids are potentially involved in beneficial effects like degenerative diseases, cardiovascular diseases or cancer. Phenolic acid potentially involved in these beneficial effects include mainly hydrocinnamic acid and also hybroxybenzoic acid (Mullen *et al.,* 2003). The health effects of polyphenols depend on the amount consumed and their bioavailability. (Manach *et al.,* 2004). Phenolic compounds are ubiquitous in plants which collectively synthesize several thousand different chemical structures characterized by hydroxylated aromatic ring (s). These compounds play several important functions in plants. They represent a striking example of metabolic plasticity enabling plants to adapt to changing biotic and abiotic environments and provide to plant products colour, taste, technological properties and putative health promoting benefits. Phenolic compounds represent the most studied phytochemicals and have been widely exploited as model systems in different areas of plant research. Initial studies in the field concerned the

analytical characterization of a wide range of structures and of relevant enzymes with PAL being one of the most studied plant enzymes (Boudet, 2007).

In fact, some of the antioxidative phenolics, such as glycosides (rutin and asperulosidic acid) and trisaccharide fatty acid ester (2,6-di-0-(b-D-glucopyranosy1)-1-0-octanoyl b-D-glucopyranose) as well as neolignan and americanin have been isolated from the n-BuOH extracts obtained from the ethanol extracts of the fruits of Noni (Su *et al.,* 2005; Zhou *et al.,* 2007). However, the antioxidant mechanisms of each phenolic compound may be different, and the synergistic effect of many compounds cannot be excluded in the hot juice of Xisha Noni, because most natural antioxidative compounds often work synergistically with each other against the free radical attack. Quercetin, one of the most abundant flavonoids in human diets such as red wine, green tea, onions, apples, and vegetables, has been known to have various bioactivities, such as anti-ulcer, anti-allergy, anti-viral, immunomodulating activities and inhibition of lipid peroxidation. The mechanism of quercetin as an antioxitant against lipid peroxidation has been proved by scavenging reactive oxygen species and cheating metal ions responsible for the generation of ROS (Wang *et al.,* 1998).

Aberoumand (2011) had evaluated the total phenolic contents in eight plant foods which were used as traditional vegetables and fruits. Their phenolic contents ranged from 0.87 to 7.02 mg gallic acid/g. *Cordia myxa* Roxb contained 402 mg/100g of phenolics. Their result suggested that the plant foods possess valuable antioxidant properties for culinary and possible nutritive use. Labay (2002) worked on the ethnobotanical and phytochemical studies on beneficial flora of marinduque, among the plants studied by them, *Cordia dichotoma* forst. is one of them. They mentioned the ethnomedicinal properties such as antidysentery, diuretic, liver tonic. They evaluated phytochemicals in the plant extract like alkaloid, flavonoid, unsatutaed sterol and triterpene, steroid glycoside, cyanogenic glycoside, saponin, tannin and phenol. Aberoumond and deokule (2008) analyzed the Phenolic compounds, from some edible plants of Iran and India. The plant included in their study were *Alocacia indica* sch., *Asparagus officinalis* DC., *Chlorophytum comosum* Linn., *Cordia Myxa* Roxb., *Eulophia Ochreata* Lindl., *Momordica dioicia* Roxb., *Portulaca oleracia* Linn. and *Solanum indicum* Linn. The antioxidant activity of phenolic compounds depends on the structure, in particular the

number and positions of the hydroxyl groups and the nature of substitutions on the aromatic rings. Soluble phenolic acids were extracted with methanol. The result showed that total phenolic amounts of *Cordia myxa* Roxb (402 mg/100g) were comparable lower than total phenolic amount of Black berry (417-555%). Among the plants studied by them, *Cordia myxa* Roxb is one of them. Basu *et al.* (1984) isolated the neutral polysaccharide from the fruits of *Cordia dichotoma.* They analysed two fraction I and II and observed that fraction, II, contain glucose and arabinose in the molar ratio of 21:4. The results of complete hydrolysis with acid, permethylation studies, periodate oxidation, and Smith degradation suggested it to be an arabinoglucan, and the backbone of the polysaccharide to be composed of (1→6)-linked-gluco-pyranosyl and (1→2)-linked - arabinofuranosyl residues.

Mai *et al.* (2007) worked on the α- glycosidase activity and antioxidant activities of Vietnamese edible plants and their relationship with polyphenol content. Among the plant studied by them, *Ficus racemosa* is one of them. They reported 41.2% and 87.2 mg/g polyphenol content in aqueous and methanol. 0.72% alpha glycosidase activity in aqueous extract and 0.64% in methanol. Babu *et al.* (2010) were carried out the pharmacognostic studies on the barks of 4 *Ficus* species, namely *F. racemosa, F. virens, F. religiosa and F. benghalensis.* The barks are considered to be very effective in various treatments, such as diabetes, skin diseases, ulcers, and nervous disorders. Their phytochemical studies shows the 16.31 ± 1.45 total ash, 1.35 ± 0.21 acid insoluble ash, 8.48 ± 0.30 alcohol soluble extractive, 11.27 ± 0.47 water soluble extractive. Their phytochemical screening shows that absence of alkaloid and presence of tannin, saponin, flavonoides, steroids, terpenoides and cardic glycosides. Rajwaidhya (2006) had worked on the separation of phytoconstituents from *Ficus racemosa* Linn and evaluation of the same for antiashmatic activity. Their result shows that it contains the carbohydtrate, glycosides, phytosterol, tannins and flavonoides and absence of alkaloids and volatile oils. He had isolated compound F-1 which had antiashmatic activity. From his research he predicted that that compound might be flavonoide, which is responsible for antiashmatic activity. Mahajan and Bad-Gujar (2008) carried out the phytochemical investigation of laticiferous plants belonging to Khandesh region of Maharashtra. *F. racemosa* is one of them. Their phytochemical analyses showed the presence of phenolics

and tannins. They also carried out the moisture and total solids content that were 68.42% and 31.58%. Their results suggest that, the laticiferous plants would be exploited in the management of various diseases as they have diverse group of secondary metabolites. Veberic *et al.* (2008) studied phenolic acids and flavonoids of fig fruit (*Ficus carica* L.) in the Northern Mediterranean region. They identified the phenolics, that is gallic acid, chlorogenic acid, syringic acid, (+)-catechin, (-)-epicatechin and rutin. The analysed phenolics present at the highest content were rutin (up to 28.7 mg per 100 g FW), followed by (+)-catechin (up to 4.03 mg per 100 g FW), chlorogenic acid (up to 1.71 mg per 100 g FW), (-)-epicatechin (up to 0.97 mg per 100 g FW), gallic acid (up to 0.38 mg per 100 g FW) and, finally, syringic acid (up to 0.10 mg per 100 g FW). They observed higher total level of phenolics in dark fruit, in comparison to the white fruit cultivar `Skofjotka'. The amounts measured are comparable to those of other fruits grown in this region. Mali and Borges (2003) determined the phenolics, fibre, alkaloids, saponins, and cyanogenic glycosides from the forest tree species. *Ficus racemosa* is one of them.

Badami *et al.* (2004) determined the betulin in *Grewia tiliaefolia* by HPTLC. They used the chloroform extracts of bark from five different sources for HPTLC on silica gel with toluene-ethyl acetate, 90 + 10 v/v as mobile phase. The mean assay of betulin was 2.596 l 0.594 mg g– 1 of bark. The method permits reliable quantification of betulin and good resolution and separation of betulin from other constituents of *Grewia tiliaefolia*. They obtained the recovery values from 96.09 to 98.87%. They concluded that the HPTLC method for quantitative monitoring of betulin in *Grewia tiliaefolia* was rapid, simple, and accurate and can be used for routine quality testing. Ndhlala *et al.* (2007) worked on the phenolic acid composition of the peel and pulp of the fruits of *Flacourtia indica* (Burm. f.) Merr., *Opuntia megacantha* (L.) Mill and *Sclerocarya birrea* (A. Rich.) Hochst., from Zimbabwe. *Flacourtia indica* pulp contained the least total phenolics, flavanoids and condensed tannins 334 µg GAE/g, 41.l g catechin/g and 1.4%, respectively. They mentioned that there were no significant differences in the total phenolics between the peels and the pulps of the individual fruits. They found that ferulic acid, caffeic acid and vanillic acid were the dominant phenolic acids in the three fruits.

Bhaumik *et al.* (1987) isolated Flacourtin (3-hydroxy-4-hydroxymethylphenyl-6-O-benzoyl-b-D-glucopyranoside) from *Flacourtia indica*. They mentioned that

flacourtin, was a phenolic glucoside ester isolated from from *Flacourtia indica.* Dehmlow *et al.* (2000) isolated sitosterol (60-O-fattyacyl)- b-D-glucopyranosides from the bark and leaves of *Flacourtia indica.* Bhattacharyya and Chowdhury (1985) isolated the Glycozolidol, an antibacterial carbazole alkaloid from *Glycosmis pentaphylla*. They isolated this compound from the roots. They established its structure as 6-hydroxy-2-methoxy-3-methylcarbazole on the basis of physical and chemical evidence. They further observed that this compound was active at some Gram-positive and Gram-negative bacteria. Mukherjee *et al.* (1983) undertook the examination of the seeds of the plant in which they reported the isolation and elucidation structure of glycozolinine (2) $C_{I3}H_{11}NO$, m.p. 231 - 232^{0}C. From physical and chemical evidence, its structure was identified as 6-methoxy-3-methylcarbazole. One of the plants from the genus that had been exhaustively investigated was *Glycosmis pentaphylla* and it furnishes a number of acridone, carbazole and quinolone bases. Chakraborty (1969) isolated a known compound, glycozoline (1), $C_{I4}H_{I3}NO$, m.p. 181-182^{0}c. Bhattacharyya and Chowdhury (1985) on the roots of G. pentaphylla, a reputed Indian medicinal plant has revealed the presence of carbazole alkaloid, glycozolidal (4), $C_{1s}H_{13}N_3$, m.p. 185^{0}C.In an investigation of root bark of G. pentaphylla, Jash *et al.* (1992) isolated three carbazole alkaloids, glycozolicine (5), $C_{14}H_{13}NO$, m.p. 135^{0}DC, glycosinine (6), , m.p. 185^{0}DC and 3-formyl carbazole (7), C_3H_9NO, m.p. 158^{0}DC. Chakraborty *et al.,* (1974) reported the structural studies of carbazole alkaloids also from the root bark of *Glycosmis pentaphylla*, glycozolidine (8), m.p. 160 - 162^{0}DC. Patra *et al.* (2010) have given the reviews of the traditional approaches towards the standardization of herbal medicines. Their paper reviewed the traditional methods in the quality control of herbal medicines, including, the traditional chromatographic methods and comprehensive methods, such as fingerprint and multi-component quantification are emphasized; hyphenated techniques, like HPLC-MS, GC-MS. They have mentioned that γ-Fagarine a phytochemical isolated from the *Glycosmis pentaphylla* used for the preparation of the crude drug. Chowdhury *et al.* (1987) isolated three natural compounds 1-methyl-9H-carbazole (cas: 6510- 65-2), 3-methyl-9H-carbazole (cas: 4630-20-0) and 2, 4- dimethyl-1H-indole (cas: 10299-61-3) are alkaloids from *Glycosmis pentaphylla.*

Ito *et al.* (2004) isolated the quinolone alkaloids, orixalone thei is 4,8-dimethoxy-3-(3-methylbut-2- enyl)-N-methyl-2-quinolone,14 which had previously been isolated from *Glycosmis arborea.* Ito *et al.* (1999) identified the novel naphthoquinone and A New Acridone Alkaloid From the *Glycosmis pentaphylla.* They were isolated a new acridone alkaloid called glycoquinone (1) and glycocitrine-III (2), respectively, were isolated along with twelve known compounds like Known acridone alkaloids, noracronycine,6) des-N-methylnoracronycine, 6) des-N-methylacronycine,6) citracridone-I,7) arborinine, 8-10) 5-hydroxyarborinine, 11, 12) and acrifoline, 13) furoquinoline alkaloids, skimmianine14) and kokusaginine,14) and naphthoquinone analogues, avicenol-B, 15) avicequinone- C, 15) and avicenone15) were also isolated and characterized by them. This is the first isolation of a naphthoquinone derivative from the genus *Glycosmis*. Mckekzie and Price (1952) were discovered the 0.01% each of the two anthroquinoline bases kokusaginine, 4, 6, 7-trimethoxyfuro-(2',3'-2,3)-quinoline , and skimmianine, S,8-trimethoxyfuro-(2',3'-2.3)-quinoline from the leaves and twigs of the *Glycosmis pentaphylla.*

Doktorgrades (2004) had derived some alkaloids from the *Glycosmis pentaphylla*. Quanoline alkaloids, 4 methoxy, 1 methyl 2(1H) quinolinone and quinazoline isolated from *Glycosmis pentaphylla.* Govindachari *et al.* (1966) isolated the skimmianine and three new acridone alkaloids from the root bark of *Glycosmis pentaphylla* (Retz.). Based on the spectral evidence and chemical correlations, these are shown to be hitherto naturally unknown noracronycine (IIb), des-N-methyl-acrocynine (IXa) and des-N-methylnoracronycine (IXb). They confirmed the two possible structures, 1-methoxy-2', 2', 10-trimethylpyrano (5', 6' -2, 3 or 3, 4) acridone (Ia or IIa) for acronycine. Bhattacharyya and Chowdhury (1985) isolated the Glycolone, a quinolone alkaloid the leaves of *Glycosmis pentaphylla*. They established the structure of the compound as 4,8-dimethoxy-3-(3-methyl but-2-enyl)-2-quinolone from physical and chemical evidences. The well-known alkaloids arborine, skimmianine, and arborinine (Mester, 1983; Greger *et al.,* 1992) in *G. pentaphylla*, both species additionally produced a series of carbazoles. Intekhab and Aslam (2011) isolated the flavon glucoside from *Glycosmis mauritiana* (syn. *Limonia pentaphylla* Auct; *Glycosmis pentaphylla* Auct. pl.; *Limonia mauritiana* Lam.). From the ethyl acetate extract of the roots of *Glycosmis mauritiana* they isolated

a flavone glucoside, luteolin 8-C-b-D-glucopyranoside. The structure was further supported by its 13C NMR spectrum which demonstrated a downfield signal at d 182.03 clearly assigned to carbonyl carbonC-4. The anomeric carbon signaled at d 73.50 in its 13C NMR spectrum indicating the 8-C-b-D-glucopyranoside structure of the compound. Wang *et al.* (2006) derived four hydroquinone diglycoside acyl esters, glypentosides A–C (1–3) and seguinoside F (4), were isolated from the stems of *Glycosmis pentaphylla*. Glypentosides A–B (1–2) were identified as compounds and designated as methoxyquinol 4-O-[(5-O-trans-p-coumaroyl)-b- D-apiofuranosyl-(1 !2)-b-D-glucopyranoside] (1) and 4-demethylantiarol 4-O-[(3-methoxy-4-hydroxy-benzoyl)-b-D-apiofuranosyl- (1)-b-D-glucopyranoside] (2). Glypentoside C (3) is a hydroquinone diglycoside acyl ester with a neolignan moiety in the acyl unit. Their structures were elucidated by the combination of one- and two-dimensional NMR analysis, mass spectrometry and chemical evidences. Sharma *et al.* (2010) isolated and characterized the flavone C-glucoside form ethanolic extract of leaves part of *Glycosmis arborea*. They have extracted leaves of *G. arborea* (1.8 kg) with 90% ethanol and extract was partitioned with H_20 and n- BuOH. The concentrated n-BuOH crude extract was again fractionated with CH_3OH and C_6H_6. They subjected the CH_3OH extract to silica gel chromatography (60–120 mesh) using binary mixture of CHC_{l3}:MeOH (85:15) and investigated a new C-glycosyl flavone 7, 40-dihydroxy-5-methoxyflavone-6-C-b-D-glucopyranoside. Chakravarty *et al.* (1996) isolated tetracyclic triterpenoids from *Glycosmis arborea*. Two new tetracyclic triterpene alcohols, along with (24S)-24-methyl-5a-lanosta-9(11), 25-dien-3/3-ol and 24, 24-dimethyl-5 a-lanosta-9(l1),25-dien-3/3-ol, were isolated from the petrol extract of the overground part of *Glycosmis arborea* and they were elucidated their structures as (24S)-24-methyl-5a-lanosta-9(1 l),25-dien-3aol and 24, 24 - dimethyl- 5 a - lanosta - 9(11), 25- dien- 3 a- ol on the basis of 2D NMR and mass spectral analyses. Chakraborty *et al.* (1974) reported the structural studies of carbazole alkaloids also from the root bark of *G. pentaphylla*, glycozolidine (8), m.p.
160 - 162 DC. It indicates that a variety of chemical constituents found in root, bark, stem, leaves and fruits of the *G. pentaphylla.* Along with the fruits are rich in mineral, vitamins, antioxidant components so that this said plant indicates medicinal and

nutritional relationship. Along with the ethnobotanical uses, it proved that the *Glycosmis pentaphylla* play an important role in human life.

Buske *et al.* (2001) described the isolation and structural elucidation of the Alkaloidal, Megastigmane and Lignan Glucosides from *Antidesma membranaceum*. They were isolated alkaloidal glucosides (17RS)-17- (D-glucopyranosyloxy) antidesmone (2) and (17RS)-8-deoxo-17-(Dglucopyranosyloxy) antidesmone (3), the megastigmane glucosides blumenyl C-D-glucopyranoside (4), 3-oxo-a- ionyl-D-glucopyranoside (5), blumenyl B-D-glucopyranoside (6) and blumenyl A-D-glucopyranoside (roseoside, 7) and the lignan glucosides (1)-lyoniresin-4-yl glucopyranoside (8), (1)-49-methoxylyoniresin-4-yl glucopyranoside (9) and secoisolariciresin-4-yl glucopyranoside (10). The presence of the antidesmone glucosides 2 and 3 suggests a biological function for antidesmone, possibly acting in glucosylic storage or as a transportation form. Butkhup and Samappito (2008) analysed Anthocyanin, Flavonoids, and Phenolic Acids in Tropical Bignay Berries (*Antidesma bunius)*. 'Maeloogdog' showed the highest content of total phenolics, followed by 'Kumlhai' (13.37 mg GAE/g DW) and 'Phuchong' (13.21 mg GAE/g DW). The antioxidant activity was measured from $1/EC_{50}$ using the DPPH method. 'Sangkrow no. 2' had the highest radical scavenging (83.26%) and antioxidant activity (0.32 μg/μg DPPH). Their results suggested that methanolic extracts of bignay berries exhibit a potential for use as natural antioxidants. Llusia *et al.* (2010) carried out their work on measurement of volatile terpene emissions in 70 dominant vascular plant species in Hawaii. The emission rates of total terpenes ranged from 0 mg g-1 h-1 to 55 mg g-1 h-1, and altogether 15 different terpenes were emitted in detectable amounts by the overall set of species. Among the plants studied by them, *Antidesma platyphyllum* is also studied for its volatile terpenes. They found 2.72 + 1.29 ug g-1 h-1monoterpenes and 0.28 +0.13 ug g-1 h-1 sesquiterpenes in it. Buske *et al*. (1999) isolated Antidesmone (isoquinoline alkaloid) from *Antidesma membranaceum* Mill. The structure was determined to be (5S)-l-hydroxy-4-methoxy- 3- methyl - 5-octyl- 5,6,7,8-tetrahydro isoquinolin-8-one by spectroscopic methods (MS, 1H, 13C 2D NMR, CD) and chemical derivatisation. Bringmann *et al.* (2000) were detected the revised structure of antidesmone. The structure of antidesmone, an alkaloid from *Antidesma membranaceum* Mull. Arg. and *A. venosum*

E. Mey. (Euphorbiaceae), was revised to be (S)-4, 8-dioxo-3-methoxy-2-methyl-5-n-octyl-1,4,5,6,7,8-hexahydroquinoline [(S)-2], not the isoquinoline derivative 1, as assumed previously. The revision was initiated by biosynthetic feeding experiments of one of our groups. Antidesmone [(S)-2] is structurally closely related to hyeronimone,8 a similar quinoline alkaloid from the roots of *Hyeronima alchorneoides* (likewise Euphorbiaceae), which is a dihydro form of 2. From *H. oblonga*, by contrast, two related compounds, hyeronines A and B, were reported to be isoquinoline derivatives. Of these, hyeronine A, although considered as an alkaloid related to structure 1, yet with an n-octanoyl side chain at C-6, might likewise be a quinoline, not an isoquinoline alkaloid.

Butkhup and Samappito (2008) analysed flavonoids contents in Mao Luang fruits of fifteen cultivars (*Antidesma bunius*), grown in North East Thailand. The fifteen cultivars were used as treatments. Their results showed that fruits of the fifteen Mao Luang cultivars contained three different kinds of flavonoids, i.e., catechin, procyanidin B_1 and procyanidin B_2. These three chemical compounds were the major flavonoids in all analyzed fruit samples of the fifteen cultivars. The highest amount of procyanidin B_1 was found with Lompat followed by Maeloogdog with values of 4122.75 and 3993.88 mg/100g of fresh weight, respectively and the highest amount of procyanidin B_2 was found in Sangkrow 2 followed by Fapratan with values of 5,006.39 and 3,689.42 mg 100 g(-1) of fresh weight, respectively. Catechin contents in fruits of the fifteen cultivars varied from 73.39 to 316.22 mg 100 g(-1) of fresh weight for Sangkrow 5 and Fapratan, respectively where Fapratan was the highest among the fifteen cultivars followed by Sangkrow 2 with values of 316.22 and 175.40 mg 100 g(-1) of fresh weight, respectively. In terms of grand total amounts of flavonoids, Sangkrow 2 was the best followed by Fapratan, Sangkrow 1 and Maeloogdog, whilst the rest were of secondary importance. Arbain and Taylora (1993) identified cyclopeptide alkaloids from *Antidesma Montana*. They isolated two cyclopeptide alkaloids, AM-1 and AM-2 from the leaves and terminal branches of *Antidesma montana*. By spectroscopic methods AM-1 was shown to be 2-dimethylamino-3-phenyl-N-[3-(1-methylethyl)-7-(2-methylpropyl)-5,8-dioxo-2-oxa-6,9-diazobicyclo[2.2] hexadeca-10,12,14,15-tetraene-4-l] propanamide and AM-2 to be 2-dimethylamino-3-phenyl-N-[3-(1-methylethyl)-7-(2-methylpropyl)-5, 8-dioxo-2-oxa-6, 9-diazobicyclo[2.2] hexadeca-12,14,15-triene-4-yl] propanamide. These structures have

previously been proposed for myrianthine B and aralionine B, respectively, but the reported physical properties differ markedly from those of AM-1 and AM-2. However, direct comparison of AM-1 with an authentic sample of myrianthine B confirmed their identity. They were used a GC method to establish the chirality of the isoleucine in AM-1, AM-2 and myrianthine B as l. The chirality of N, N-dimethylphenylalanine in AM-1 and myrianthine B and of N-methylphenylalanine in AM-2 was also found to be one.

Pettit *et al.* (2000) isolated the seven cancer cell growth inhibitory hydroxylated sterols from bark and stem of the Sri Lankan tree *Schleichera oleosa*. These sterols were designated as schleicherastatins 1-7 and two related sterols, schleicheols 1 and 2. They elucided the structure of schleicherastatin 1 (1) by X-ray crystal structure determination. Makkar *et al.* (1990) determined the tannin in 15 agro-industrial by-products. *Schleichera oleosa* is one of them. They observed that total phenols and condensed tannins were low in *Schleichera oleosa.* The chemical studies on seeds of forest origin have done by Jain *et al.* (1988). They mentioned that fatty oil extracted from the seeds of the *Schleichera oleosa* was used on commercial level. Venkata *et al.* (2010) were studied 84 methanolic extracts prepared from the 54 Indian plants belonging to 33 different families from Eastern Ghats of India. Preliminary phytochemical screenings was conducted for the presence of alkaloids, flavonoids, steroids and terpenoids from methanolic extract and the result shown the presence of flavonoides and terpenoides in bark of *Schleichera oleosa.*

Mali and Borges (2003) determined the phenolics, fibre, alkaloids, saponins, and cyanogenic glycosides from the forest tree species. *Ficus racemosa, Flacourtia indica* and *Elaeagnus conferta* are three of them. Five triterpene alcohols and four 4-monomethylsterols were identified by GC-MS during the ripening of Picholine olive, by Sakouhi et al. (2009). The quantitative characterisation of these compounds was performed using GC-FID. Their results showed that the maximum level of total triterpene alcohols (263.68 mg/100 g oil) was reached at 26th week after the flowering date of olive; while the highest level of total 4-monomethylsterols (234 mg/100 g oil) was attained at 24th week after the flowering date of fruit. The percentage of these two classes represented 20-33% of total phytosterols during olive maturity. 24-Methylene cycloartenol (12-207 mg/100 g oil) and cycloartenol (27-198 mg/100 g oil) were the predominant triterpene alcohols during the ripening of Picholine olive; whereas

citrostadienol (30- 161 mg/100 g oil) and cycloeucalenol (11-74 mg/100 g oil) were the main 4-monomethylsterol compounds followed by obtusifoliol and gramisterol. They identified that, [beta] - Amyrin, [delta]- amyrin and traroxerol were less present in Picholine olive and they accounted for 14% of total triterpene alcohols at complete maturity of fruit. The level of these methylsterols was overwhelmed by the amount of 4-desmethylsterols at each stage of Picholine olive maturity.