REVIEW OF LITERATURE

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In India, the use of different parts of several medicinal plants to cure specific ailments has been in vogue from ancient times. Amidst a world population of 7 billion people, around 60% are tribal population and they depend on traditional medicines as their principal source of treating illness. In India, 80 to 90% traditional medicines are based on plant materials. Ethnobotanical investigation has led to the documentation of a large number of wild plants used by tribals for meeting their multifarious requirements.

Studies on ethnobotany were initiated by Janaki Ammal as an official programme in the Economic Botany Section of Botanical Survey of India (Howrah) in 1954. From 1960, Jain started intensive field studies among the tribal areas of Central India (Jain, 1963a–d, 1968, 1981 and 1991). These publications, in the early sixties, triggered ethnobotanical activities in many botanists, anthropologists and medical practitioners. The All India Co-ordinated Research Project (AICRP) on Ethnobiology came into operation since 1982 at National Botanical Research Institute (NBRI) , Lucknow, and four centres (Shillong, Howrah, Coimbatore and Port Blair) of Botanical Survey of India (Jain and Mitra, 1997). Mudgal (1987) provided a synoptic account of ethnobotanical works in India. Binu *et al.* (1992) compiled the ethnobotanical work carried out in India. Later, Lalramnghinglova and Jha (1999) reviewed work on ethnobotany of the World, with special reference to India.

An important prerequisite for proper utilisation of raw materials of the country is the survey of its natural resources and the preparation of an inventory. It is necessary that we should have full knowledge regarding the occurrence, frequency, distribution and phenology of various plants for their proper utilisation. The forests of Gujarat and Tamil Nadu have great potentiality, both from the economic and botanical points of view.

Ethnobotanical Investigations

Ethnobotany of Gujarat

Ethnobotanical explorations in Gujarat dates back to early fifties. The important ethnobotanical contributions are those of Bedi (1969), Bhatt (1975), Bhatt (1987), Bhatt and Mitaliya (1999), (1987), Chavan *et al.*, (1963), Chavda (2006), Chohan and Shah (1969), Gopal (1983), Gopal and Shah (1989), Hamir (2001), Inamdar (1968), Jadeja (2006), Joshi *et al.*, (1980), Joshi (1988), Karatela (1974), Mitaliya (1998), More (1972), Murthy (1957), Nagar (2000), Oza (1961), Oza (1991), Padte (1973), Patel (1971), Patel (2001), Patel (2002), Prajapati (2002), Punjani (1997), Rao (1970), Shah & Vyas (1973), Shah and Yadav (1979), Suryanarayana (1968), Umadevi (1988).

In 2001, Gujarat Ecological Education and Research (GEER) Foundation launched a state level coordinated project on the status of medicinal plants in Gujarat. The sole purpose was to survey the identification, distribution and relative abundance of medicinal plants in Gujarat. The project culminated in the publication of a document viz. Medicinal Plants of Gujarat (Pandey *et al*., 2005). Shah (2006) reported that 318 plant species were used for 223 disorders in Valsad district, Gujarat.

Ethnoveterinary practices associated with animal healthcare in Dang district of South Gujarat were documented by Kathiriya *et al*., (2012). This investigation revealed 34 plant species ,which are used to treat 10 different diseases and disorders in animals. It also includes freshly collected whole plants or plant parts such as leaves, young twigs, bark powder, roots, fruits and seeds.

The tribals of the Jhalod taluk of Dhahod district in Gujarat used 30 plants to cure disease like fever cough, headache, hepatitis, constipation, scorpion bite, muscular pain, asthma, snake bite, etc (Maru and Patel, 2012). Patel and Patel (2013) enumerated the ethnobotanical plants used by the tribes of Poshina Forest Range of Sabarkantha district in North Gujarat, India. About 35 plant species belonging to 24 families were observed during this study. Plant species of these forest areas are documented with their botanical

names, local names, family and their ethnobotanical uses. Besides the above mentioned works, the following ethnobotanical informations are available in various parts of Gujarat.

Joshi *et al*., (1980) provided information on folk medicines of Dangs. They have described the ethnobotanical uses of about 200 plants in the forest of Dang. Joshi and Audichya (1981) enumerated 288 medicinal plants available in the forest of Rajpipla. Shah *et al*., (1981) gave an account of ethnobotany for 133 species available in the forest of Saurashtra. Shah and Gopal (1982) provided ethnobotanical profile of the Dangi community of Dang region, involving 145 medicinal species.

Shah and Gopal (1985) provided the information on the plant species used by the Bhils, Rabaries, Dubias and Garashias tribes of Gujarat. 'Ethnobotany of Khedbrahma' (Bhatt and Sabnis, 1987) reported 41 species used as medicine by Bhil, Dhank, Mayaka and Dubaba tribes. Nurani (1997) worked on ethnobotanical aspect of Barda Hill and he found that total 62 plants belonging to 42 families were used by Rabaries in their daily life. 38 species belonging to 38 genera and 28 families were used by Rabaries of Barda Hills in their traditional modes of treatment (Jadeja 1999); Ismail Master (2000) has documented 113 species from Kala Dunger in Pachcham area of Bhuj Taluka in northern Kutch with their medicinal uses. Punjani (1997) carried out ethnobotanical study of tribal areas of Sabarkantha District.

Silori and Rana (2000) have documented the traditional knowledge on 34 medicinal plants in Narayan Sarovar Sanctury, Kutch. 750 medicinal plants were used by traditional animal healers throughout India.(Anjaria *et al*., 2002)

Bhatt *et al*., (2004) provides information of 83 wild food plant of Barda Hill in Porbandar. Pandey *et al*. (2005) carried out an exhaustive survey of the medicinal flora of Gujarat and documented 1315 plant species with their medicinal uses. Chavda (2006) worked on ethnobotanical aspect of Keshod, Mendarda and Vanthali Talukas of Junagadh district and provided the medicinal information on the 459 angiospermic plant species.

Jadeja *et al*. (2006a) gave a brief account of ethnoveterinary practices in Porbandar and reported 74 plant species that are used for treating ailments in the animals. Jadeja (2006b) has documented 380 angiosperm plant species belonging to 290 genera of 99 families, which have been identified and recorded for ethnobotanical use in Barda hills. Jadeja *et al*. (2007) carried out a research on fodder resources during famines in Gujarat and reported 106 plant species of wild plants used as fodder during droughts.

Ethnobotany of Tamil Nadu

The state of Tamil Nadu has been ethnobotanically well explored for the medicinal uses of indigenous plants. Since the early eighties in Tamil Nadu, several research articles have been published on ethnobotanical aspects of different tribal communities. (Apparanantham and Chelladurai, 1986; Ezekial, 1991; Dwarakan and Ansari, 1992; 1996; Balasubramanian and Narendra Prasad, 1996; Hosagouder and Henry, 1996; Rajendren *et al.,* 1997; 1999; Subramani, 2000, etc).

Ramachandran and Nair (1981a) carried out ethnobotanical study among the people living in Kannanore district located at Kerala. Ramachandran and Nair (1981b) made another ethnobotanical observation on Irulars tribes inhabiting various localities of Tamil Nadu. Ramachandran and Manian (1991) reported the ethnobotanical uses, which were followed by Irulars, Koravas and Puliyas of Coimbatore district in Tamil Nadu.

Ethnomedicinal aspects of 45 species distributed among 42 genera of 26 families of plants used by the Paliyan and Pulayan tribes of lower Palni hills in Tamil Nadu have been enumerated by Ganesan *et al.,* (2004). The enumerated plants distributed among Acanthaceae (4 species), Liliaceae, Cucurbitaceae, Solanaceae (3 species), Sapindaceae, Amaryllidaceae, Euphorbiaceae (2 species each), and one pteridophytic plant, *Nephrolopis auriclata*, and remaining 16 families (one species each) were found to be used by the tribals for the treatment of various ailments like stomach disorders, eczema, fever, cuts, wound, toothache, headache, urinary disorders, rheumatism, menstrual disorders, etc.

Ayyanar and Ignacimuthu (2005) carried out a survey on the medicinal plants used by the Kani tribals of Tirunelveli hills in Tamil Nadu, to treat poisonous bites and skin diseases. They have described the traditional uses of 28 plant species belonging to 21 families. Among the 28 species, the Kani tribals use 14 plants to cure skin diseases and 15 plants to treat poisonous bites. They are using the paste of leaf and root bark of *Albizia amara* and used to cure both skin disease and snake bite.

Ethnobotanical investigation among the tribes in Madurai district of Tamil Nadu was done by Ignacimuthu *et al*. (2006). Information was gathered from the Paliyar tribes using an integrated approach of botanical collections, group discussions and interviews with questionnaires. 12 informants were interviewed, among whom 4 were tribal practitioners. In this study, 60 plant species belonging to 32 families distributed in 53 genera have been recorded. These contributed to 81 remedies. Many species of the family Acanthaceae and Asclepiadaceae are frequently used (21 remedies from 12 species); the Euphorbiaceae and Solanaceae contribute to 9 remedies from 8 species.

Medicinal plants used by Paniyan tribes of Sirumalai hills in Dindigul district of Tamil Nadu were reported by Karuppusamy (2007). During this investigation, 90 plant species used for curing 17 ailments were gathered. Out of the plants recorded, 42 were herbs, 23 were shrubs, 13 were trees and 12 climbers.

A survey on medicinal plants used for oral care was conducted in different districts like Madurai, Sivagangai, Dindigul, Theni and Virudhunagar of Tamil Nadu by Ganesan (2008). A total of 114 plant species distributed among 97 genera belonging to 51 families were recorded during this study and most of these plants were belonging to the family Asteraceae and Lamiaceae (7 species each), followed by Euphorbiaceae, Caesalpiniaceae, Fabaceae, and Arecaceae (6 species each). 29 families were represented by single species each. Most of the plants are used to relieve toothache (29.82%) as tooth brush (25.43%), mouth wash (16.66%), against common dental diseases (14.03%), mouth related ulcer/gingivitis (12.28%) and gum bleeding/disorders (10.53%).

An ethnobotanical survey was carried out in Karandamalai, a village inhabited by Valaiyans in Southern Eastern Ghats of Tamil Nadu. 63 plant species are enumerated in this report (Kottaimuthu, 2008). Mohan *et al*. (2008) carried out an ethnobotanical study in many areas of Tirunelveli district, Tamil Nadu, India, and this is a region where the tribals called Kanikkars reside. For experimenting this, about 80 medicinal plants, which belonged to 72 genera and 46 families were collected and documented. The study showed that one species belongs to the Pteridophytes and one to Gymnosperm. The rest of the 78 species fall within 44 families of Angiosperms. The dominant families were Euphorbiaceae and Liliaceae contributing 5 species each. Dioscoreaceae, Rubiaceae and Verbenaceae are next in line with four plant species each. There are 67 dicots and 11 monocots. As far as plant parts are concerned, the Kanikkars use a wide variety of parts structures in ethnomedicine. The listed 80 plants have been used to cure about 41 different types of human diseases. Around five plants are used for the treatment of common cold and cough; four plants are used for the treatment of fever, stomachache, headache, wounds, bruises, boils and/or ear problems; whereas , three plants are used for rheumatic pain/joint pain, bowel complaints and snake bites.

Ragupathy *et al*., (2008) carried out a research on Consensus of the Malasars traditional aboriginal knowledge of medicinal plants in the Velliangiri holy hills of Tamil Nadu. A total of 95 species distributed in 85 genera belonging to 50 families were identified for medicinal and general health care purposes during this study. The most common families found in this study were Euphorbiaceae (6 species), Fabaceae (6 species) and Acanthaceae (5 species). Herbs (43 species) were the most common functional group of plants followed by climbers (18 species), trees (18 species) and shrubs (16 species).

Ethnobotanical survey of the villagers from Dharapuram taluk in Tamil Nadu was carried out by Balakrishnan *et al*., (2009) and 31 species belonging to 21 families used by these people to cure different ailments like leucoderma, insect bite, constipation, diabetes, earache, hydrocele, jaundice, epilepsy, bone fracture, breast ulcer, dysentery, eye sight improvement, stomach pain, fever, cough, cold, toothache, eye infection, diarrhoea and laxative.

An ethnobotanical study was carried out by Ramachandran *et al*., (2009) in the Amaravathy Range of Indira Gandhi Wildlife Sanctuary in Anamalais of Western Ghats. He reported 94 plants; out of which 73 are wild and rest are cultivated. This study revealed that within the wild plants, 24 are used as edible fruits, 12 species as leafy vegetables, 23 species have medicinal value and 18 species are utilised for miscellaneous uses.

Chendurpandy *et al*., (2010) carried out an ethnobotanical survey among the ethnic community of Kanikkar in Kanyakumari district of Western Ghats in Tamil Nadu. This study revealed that a total of 88 plants belonging to 52 families have been documented for their therapeutic use against skin diseases. Among them 36 were herbs, 21 were shrubs, 16 were climbers and 15 were trees. The most commonly represented families are Ceasalpiniaceae (9 species), Asteraceae (4 species) Euphorbiaceae (4 species) and Fabaceae (4 species).

An ethnobotanical study was done in order to gather information about medicinal plants which were used by Malayali tribes residing in villages located in the forest area of Chitteri hills, Dharmapuri district ,Tamil Nadu, by Kadhirvel *et al*., (2010). Twelve informants in the age group of 30 to 68 were interviewed, and two amongst them were tribal practitioners. In this study, around 65 ethnomedicinal plant species were distributed and across 38 families have been documented. The informations revealed that Malayali tribes have used ethnomedicinal plants for treating various ailments like cold, cough, fever, headache, stomachache, diarrhoea, dysentery, skin diseases, poisonous bites, cut/wounds, diabetes and sexual disorders.

Revathi and Parimelazhagan (2010) enumerated the medicinal uses of 70 wild valuable plant species belonging to 42 families among the ethnic group, Irular tribes of Hasanur hills area situated in Sathyamangalam forest sanctuary of Erode district in Tamil Nadu. Asthma, digestive problems, paralysis, skin diseases and diabetes were the diseases cured.

Ethnobotanical study of medicinal plants used by the traditional users in Villupuram district of Tamil Nadu, India was carried out by Sankaranarayanan *et al*., (2010). This study

revealed that the local people of Villupuram district use 46 species of medicinally important plants belonging to 20 families. These medicinally important plants were categorised into five types: 14 herbs, 9 shrubs, 7 climbers, 1 small tree and 3 large trees. The most medicinally important plant species belong to Malvaceae (4 species), Fabaceae (4 species) and Acanthaceae (4 species). These are commonly occurring medicinally important plants used to treat various diseases like cold, fever, cough, diarrhea, dysentery, skin diseases, toothache, indigestion, worm infestations, jaundice, liver diseases and as an antidote for poison and in wound healing.

An ethnobotanical survey was carried out among the Malasar tribals in various tribal villages like Ayyasamy hills, Ayyanpathy, Muruganpathy, Ettimadai and Chinnampathy of Coimbatore district, Tamil Nadu, India by Venkataswamy *et al*., (2010). They reported that a total of 75 species of ethnomedicinal plants belonging to 71 genera and 40 families and the medicinal uses were gathered with the help of standardised questionnaires from 15 tribal informants between the ages of 48 to 74.

An extensive floristic survey was conducted in the wetland ecosystem of Vembanur in Kanyakumari district of Tamil Nadu by Kensa Mary (2011). During this field survey, ethnobotanical data of 42 species of plants belonging to 30 families have been collected. Among the documented useful species, the family Asteraceae is most frequently represented with a total of 5 species, followed by Cyperaceae and Polygonaceae (4 species each), Amaranthaceae (3 species) and other with less than 3 species. The data also indicate that 27 species were used to treat various diseases;16 species for human food, 12 for fodder, 7 for manure, 6 for animal foods, 3 as pesticidal agents, 3 as insecticides and 1 for mat making. Plants were used to treat gastrointestinal disorders, fever, cough, headache, respiratory ailments, dermatological illnesses, uro-genital complaints, skeletomuscular disorders, cuts and wounds, cardiovascular complaints, hematological disorders etc.

An ethnobotanical survey was conducted to document the ethnomedicinal plants which are used by the Kani tribal people in Pechiparai forest range (Southern Western

Ghats) in Kanyakumari district of Tamil Nadu. The information on plants was collected by interviewing the local Kani traditional practitioners. This documentation revealed that the plants used in traditional systems are mostly collected from the wild resources. There were 58 species of medicinal plants belonging to 27 families which were used to cure skin diseases, stomach ailments, diabetes, urinary tract infections, fever, cough, cold, snake bites, earache, hair growth, headache, indigestion, itches, swellings, wounds and dental problems (Subitha *et al*., 2011).

An attempt has been made to identify medically important plants frequently used by rural communities of Pudukkottai district in Tamil Nadu by Nandagopalan *et al*., (2011). They have enumerated the medicinal uses of 200 plant species from 166 genera belong to 61 families. The most dominant families found in the study were Fabaceae (12 species), Euphorbiaceae (11 species) and Rubiaceae (13 species).

Pandiarajan *et al*., (2011) reported that the plants used for the treatment of rheumatism by the rural people inhabiting in and around Kovilpatti region of Thoothukudi district in Tamil Nadu. This study revealed that the medicinal uses of 8 plant species (*Asparagus racemosus, Cardiospermum helicacabum, Cynodon dactylon, Dodonea viscosa, Enicostemma littorale, Gloriosa superba, Strychnos nux-vomica and Vitex negundo*) belonging to 7 families to cure rheumatism.

Parthiban *et al.,* (2011) conducted a survey on the medicinal plants of Yercaud hill ranges in Eastern Ghats of Tamil Nadu. About 48 plant species belonging to 45 genera and 25 families of medicinal plants related to folk medicine were used by the local people. Among the plants recorded, the most common plants *Asparagus racemosus, Cissus quadrangularis, Gymnema sylvestre, Hemidesmus indicus, Justicia adhatoda, Ocimum sanctum, Phyllanthus amarus, Piper nigrum, Solanum nigrum, Tinospora cordifolia, Tridax procumbens* and *Zingiber officinale*, are used in their daily life to cure various ailments.

Ethnomedicinal plants used to cure diarrhoea and dysentery in Pachalur hills of Dindigul district in Tamil Nadu was documented by Shanmugam *et al*., (2011a). This documentation deals with 54 ethnomedicinal plants of 52 genera belonging to 31 families. Totally 35 plants are used in the treatment of dysentery. 13 plants are used to cure diarrhoea as well as dysentery. Among the 35 plants used to treat dysentery the following 7 plants are used for blood dysentery: *Euphorbia hirta, Hamelia patens, Murraya paniculata, Punica granatum, Sesbania grandifolia, Streblus asper* and *Trichodesma indicum.*

It has been documented by Shanmugam *et al*., (2011b) that the ethnomedicinal plants which are used to cure diarrhoea and dysentery in Sivagangai district of Tamil Nadu and includes 34 plant species belonging to 32 genera of 27 families. Out of 34 modes of remedies from 34 different plants, 11 herbal remedies from *Bauhinia purpurea, Borassus flabellifer, Ficus glomerata, Hibiscus vitifolius, Moringa oleifera, Pedalium murex, Psidium guajava, Sesbania aegyptiaca, Solanum torvum, Tamarindus indica* and *Vernonia cinerea* and 14 remedies from *Carica papaya, Cissus quadrangularis, Cynodon dactylon, Desmodium triflorum, Euphorbia hirta, Fimbristylis cymosa, Melochia corchorifolia, Mollugo cerviana, Morinda tinctoria, Pavonia odorata, Punica granatum, Sida cardifolia, Myristica fragrans* and *Typhonium trilobatum* and 9 different plant species *Asparagus racemosus, Desmodium gangeticum, Ficus benghalensis, Mimusops elengi, Murraya koenigii, Nelumbium speciosum, Papver somniferum, Phyllanthus niruri* and *Stachytarpheta indica* were used to cure both diarrhoea and dysentery. Out of 14 modes of remedies used for dysentery, 4 from 4 plants (*Carica papaya, Cynodon dactylon, Myristica fragrans* and *Typhonium trilobatum*) were used to cure blood dysentery.

An ethnobotanical survey was carried out among the Malayali tribals living in various villages of Kolli hills in Namakkal district of Tamil Nadu, India (Suresh *et al*., 2011). A total of 108 species of ethnomedicinal plants belonging to 102 genera and 59 families were reported with the help of standardised questionnaires among 50 tribal informants between the ages of 20-85. Among the plants reported, 31 were herbs, 17 were shrubs,

3 were small trees, 26 were big trees and 31 were climbers. The most commonly represented families were Euphorbiaceae (8 species) and Asclepiadaceae (5 species). The Malayali tribes were using these plants to cure diseases like fever, cough, leukemia, asthma, disorders of tooth, diabetes, etc.

Vijayalakshmi and Ranganathan (2011) undertook an ethnobotanical investigation to obtain information from traditional healers, on the use of medicinal plants in Cuddalore district of Tamil Nadu. For this purpose, the local traditional healers were interviewed in 20 villages, and native plants used for medicinal purposes were collected through questionnaires and personal interviews, during their field trips. Based on this, they have documented the medicinal uses of 30 plant species, which belonged to 10 families. These documented medicinal plants were used to cure various skin disorders, poisonous bites, stomachache , nervous disorders, cough, fever, body pain, jaundice, rheumatism, dysentery and headache. The important plants used by the rural people of the study area are *Adhatoda vasica, Achyranthes aspera, Phyllanthus niruri, Aegle marmelos, Aloe barbadensis, Hemidesmus indicus, Andrographis paniculata* and *Pongamia pinnata*.

Alagesaboopathi (2012) made an attempt to collect the information on the therapeutic uses of ethnomedicinal plants in Sirumalai hills of Eastern Ghats in Dindigul district of Tamil Nadu. The indigenous information of medicinal plants obtained from the villagers, tribals, herbalists, herbal practitioners and other traditional healers were collected through personal interviews and questionnaires during the field trips. He discussed the information on family, vernacular name (Tamil) and the parts used. The traditional practice of 44 species, 40 genera and 28 families of angiosperms for the treatment of various illnesses viz., asthma, snake bite, anthelmintic, cooling effect, antipyretic, jaundice, diarrhoea, dysentery, leprosy, diuretic, diabetes, stomach problems, paralysis and skin diseases. Among the medicinal plants recorded, this study exposed that the dicotyledons are represented by 41 species of 37 genera which belong to 25 families, whereas monocotyledons are represented by 3 species of 3 genera which belong to 3 families, and the plant parts are used in the form of juice, extract, powder and paste.

Totally, 16 species of plants belonging to 14 families were known to be effectively used for treating diabetes by the tribal peoples of Kolli hills (Elavarasi and Saravanan 2012).

Francisca and Rajendran (2012) highlighted the ethnomedicinal uses of Irular tribes in the Red hills of Tamil Nadu. They have documented the medicinal uses for a total of 35 species affiliated to 27 families. The Fabaceae family (5 species) is adequately used in the preparation of ethnomedicine followed by Acanthaceae, Poaceae, Malvaceae, Euphorbiaceae and Zingiberaceae (each with two species) and rest of the families have only one species each. Analysis of habit forms indicated herbs (14), trees (10), shrubs (8), twiners (2) and climber (1).

The medicinal uses of some ethnomedicinal plants used against the gastro-intestinal problems among the rural people inhabiting Gingee hills of Villupuram district in Tamil Nadu was reported by Muralidharan and Narasimhan (2012). They have stated that a total of 28 dicot plants belong to 24 families are used to cure gastrointestinal problems like stomachache, indigestion, constipation, dysentery, piles and diarrhoea. Among the different plant parts used, leaves were most frequently used part (18 plant species) followed by bark, stem, root, seeds and tuber. The study showed *Sauropus bacciformis* and *Morinda pubescens* leaves are exclusively used to cure indigestion and dysentery for children. *Vicoa indica* leaves are used to cure both indigestion and dysentery and the mode of administration is same for both ailments.

About 72 medicinal plants species are utilised by the local people of Alagar Hills Madurai district, Tamil Nadu. (Palaniappan *et al*., 2012. Ranganathan (2012) carried out an investigation on the medicinal plants and their utilization by the villagers in Jawadhu hills of Thiruvanamalai district in Tamil Nadu. Totally 50 angiospermic plants were enumerated with their medicinal uses. He reported that, most of the plants were used for the treatment of snake bite, diarrhoea, dyspepsia and fever.

An ethnobotanical survey was conducted on the utilisation of medicinal plants amongst people of six selected villages from Jawadhu hills , which are located in Tamil Nadu, by Ranganathan *et al*., (2012). They have documented the medicinal uses of 25

plant species and also found that the Malayali tribes use forest plants, weeds, fruit plants, vegetables, spices, ornamental plants, ferns and many others as traditional medicine. Although many of these species are known as medicinal plants, others are mainly used for non-medicinal purposes such as preparing agricultural implements. *Santalum album, Terminalia bellirica, Cassia fistula, Gymnema sylvestre, Melia dubia* and *Rauvolfia tetraphylla* are the leading species used as remedies against variety of complaints.

Sathiyaraj *et al*.,(2012) undertook an ethobotanical study about the use of antifertility medicinal plants used by the local people in Kathiyavadi village of Vellore district in Tamil Nadu. This ethnobotanical survey revealed that 25 medicinal plants belonging to 22 families were used as traditional remedies in the contraceptive purpose. They have informed that different parts of a plant such as leaf, root, bark, and in some cases whole plants, rhizomes and fruits were freshly collected and these were taken internally or applied externally in the form of infusion, decoction, paste or powder. The most frequently used contraceptive plants were *Aristolochia bracteolata*, *Azadirachta indica*, *Bambusa vulgaris*, *Hibiscus rosa-sinensis*, *Aegle marmelos*, *Solanum surattense* and *Ricinus communis*.

Traditional uses of medicinal plants, used by the rural people inhabiting different localities of Sivagangai district in Tamil Nadu, were documented by Shanmugam *et al*., (2012). Their study revealed that 71 plant species (70 of angiospermic and 1 of pteridophytic plants) of 61 genera belonging to 36 families were found in the different areas of Sivagangai district possess medicinal values and are used to cure various dis orders like diarrhoea, diabetes, asthma, fever, jaundice, rheumatism, for the healing of wounds, cuts, stomach pain, for the relief of cough, cold, and as antidotes in poisonous bites. Amaranthaceae has been represented by the highest number of species (7 species, followed by Convolvulaceae (6 species), Euphorbiaceae (5 species) and Malvaceae (4 species). 7 families were represented by 3 species, 6 families were 2 species and 19 by 1 species.

An ethnobotanical survey was done amongst the locals residing in Thiruppachethi village , Sivagangai district, Tamil Nadu, India. Totally 50 informants (30 males and 20 females) between the ages of 20 and 85 were referred to collect medicinal information and they were using 25 species of plants belonging to 19 families. Among the plants, 19 were herbs 4 were shrubs, 2 were climbers. The most commonly represented families were Euphorbiaceae (4 species) and Lamiaceae (2 species). The informants using these plants to cure diseases like fever, cough, asthma, disorders of tooth, diabetes, bronchitis, piles, stomach pain rheumatism, jaundice, ear diseases, joint pain, inflammation, cold, cough, dandruff and blood purification (Suresh *et al*., 2012).

Azadirachta indica, *Andrographis paniculata*, *Brassica juncea*, *Cassia auriculata*, *Moringa oleifera* and *Ocimum sanctum* are commonly used by the local people of Jhavadu hills (Tirumalai *et al*.,(2012) for diabetes.

Johnsy *et al*., (2013) carried out an ethnobotanical survey on the medicinal plants used for the treatment of diarrhoea and dysentery among the rural people living in various localities of Kanyakumari district in Tamil Nadu. They interviewed around 67 inhabitants by using structured questionnaires. They gathered the information on 50 plant species reported by the informants to cure diarrhoea and dysentery. The reported species were distributed among 37 families. Rutaceae (3 species) and Menispermaceae (3 species) was best represented in terms of the number of species, followed by Caesalpiniaceae (2 species), Acanthaceae (2 species), Anacardiaceae (2 species), Liliaceae (2 species), Lauraceae (2 species), Fabaceae (2 species), Euphorbiaceae (2 species) and Myrtaceae (2 species).

Mayilsamy and Rajendran (2013) undertook an ethnobotanical survey through questionnaire and personal interviews to collect information on the use of medicinal plants from Paliyar traditional healers in Dindigul district of Tamil Nadu. 50 species of medicinal plants belonging to 35 families were documented in their study and are mostly used to cure skin diseases, stomachache, diarrhea, dysentery, diabetes, fever, cough, cold, hair growth, headache, wounds and dental problems. Dominant families recorded in their

study are Solanaceae, Rutaceae and Asteraceae with 3 species each and leaves are most frequently used for the treatment of disease

The medicinal plants used by the Malayali tribes of Kolli hills in Tamil Nadu were studied by Natarajan and Udhayakumar (2013). A sum of 83 plant species of ethnomedicinal values available in Kolli hills, belonging to 76 genera and 41 families were recorded during this study and this study reflects the high degree of ethnobotanical novelty and the uses of plants as herbal medicines by the Malayali tribes and the revival of interest in traditional folk medicines prepared from medicinal herbs.

A qualitative ethnobotanical survey was carried out among the local Irular tribals of Kalavai village located in Vellore district of Tamil Nadu. 250 respondents were interviewed and a total of 50 species of plants are described in this study based on questionnaire, interviews and discussions with the local people. Several plants were found to be effective in curing asthma, skin disease, headache, wound healing, cough, cancer, fever, cold, rheumatism, hepatitis, diarrhoea, paralysis, dyspepsia, ulcers, dysentery, tumors, some viral infections and scorpion bite. Plants of families Euphorbiaceae and Malvaceae were largely represented (4 species each) followed by Asteraceae, Lamiaceae, Cucurbitaceae, Moraceae, Fabaceae and Solanaceae (3 sp. each). The rest of the families recorded with one or two species only. Among them, 42% plants were herbs, 27% tree species, 24% shrubs and 7% climber species. Among the various plant parts used, the leaves represent the major part used with 51%, while the use of others (fruit - 13%, bark - 7%, flower 7%, seed - 7%, whole plant - 7%, latex - 5% and root - 3%) is relatively low (Natarajan *et al*., 2013).

Pradheeps and Poyyamoli (2013) documented the medicinal plant resources of Sigur plateau of Nilgiri Biosphere Reserve in Tamil Nadu, inhabited by the Irular tribes. About 74 plant species, which belonged to 65 genera and 42 families were recorded during the study, which include 28 trees (35%), 5 lianas (5%), 17 shrubs (28%) and 24 herbs (32%). The percentage of plant species used for medicinal purpose were classified by plant parts' proportions as follows : leaves and leaf paste (34%), fruits (9%), bark and bark paste (23%), root (12%), latex (7%), whole plant (7%), and flower

and inflorescence (3%), tubers (3%), seeds and seed oil (2%). Traditional healers have used these various plants for therapy of more than 28 ailments, mainly poisonous bites (snakes, scorpions), syphilis, gonorrhea, jaundice, typhoid, dysentery, rheumatism, bone fractures, skin diseases, ulcer, diarrhoea, common cold and fever, etc.

57 species belonging to 34 families under 53 genera of ethnomedicinally important plant species were noticed to have medicinal properties to cure more than 40 diseases like asthma, anaemia, bronchitis, cough, cold, diabetes, diarrhoea, skin diseases, respiratory problems etc.,and were used by the villagers in Mandapam coastal regions, Tamil nadu (Rameshkumar *et al*., 2013).

Rekha *et al*., (2013) studied about the medicinal plants used by the people living in Koothanallur and Marakkadai villages of Thiruvarur district in Tamil Nadu. They collected the medicinal information of 49 plant species belonging to 34 families. These medicinal plants are used to treat symptoms of cough, cold, fever, headache, stomachache, diarrhoea, dysentery,in the therapy of skin diseases, poisonous bites, wounds, diabetes, piles and rheumatism.

Deepak and Gopal (2014) focuses on the indigenous knowledge of Kurumba tribes living in Nilgiri hills of Tamil Nadu, for the treatment of the gastrointestinal problems. They have reported that about 21 plant species, belonging to 20 genera and 16 families were used as traditional remedies for various gastrointestinal ailments. The preliminary analysis of the data gathered clearly depicted that leaves (38%) are primarily used for the medicinal preparations for treating the gastrointestinal ailments, followed by bark (19%), entire plant (14.2%), seed (9.5%), fruit (9.5%) and stem (4.7%), respectively. The study also reveals that most of the preparations are administered orally in the form of decoction by powdering the plant part, leaf juice or bark infusion (57%), as a food supplement (38%), applied externally on the abdominal region (9.5%).

Diversity of ethnomedicinal plants used by Malayali tribals in Yelagiri hills of Eastern Ghats in Tamil Nadu, India, was documented by Salai Senthilkumar *et al*.,

(2014). This investigation revealed that the Malayali tribal of the Yelagiri hills were using

175 species of plants belonging to 56 families for medicinal usage. Based on the life forms there are 34.9% of herbs, 24% of tree, and 14.3% of shrub and under shrub 3.4%. The most commonly represented families were Euphorbiaceae with 13 species, Caesalpiniaceae with 11 species, Fabaceae with 10 species, Acanthaceae with 10 species, Apocynaceae with 9 species and Rubiaceae with 8 species to cure diseases like fever, cough, ophthalmic obligation, intestinal worms, inflammation, indigestion, wounds, rheumatism, ear wounds, cold, bone fracture, muscle cramps, etc.

An ethnomedicinal survey among the villages of Thenpuranadu at Pachamalai, a part of Eastern Ghats of Tamil Nadu, India was conducted by Sisubalan *et al*., (2014). This study revealed that 50 medicinal plant species belonging to 29 families that are frequently used for treatment of more than 20 diseases by local traditional healers. Among the plants recorded, 90% of the medicinal plants are dicotyledons and the remaining 10% are monocotyledons. These 50 plants comprise trees (40%), shrubs (36%), and herbs (24%). Most predominantly used plant part is leaves (36%) followed by bark (26%) and other parts of plants. The families Leguminosae (14%), Verbenaceae (10%), Euphorbiaceae (10%) occupied dominantly from that 29 families. The local traditional practitioners commonly used medicinal preparative methods like decoction (40%) followed by infusion (20%), for handling common diseases to dreadful diseases like malaria, asthma etc.

Sivasankari *et al*., (2014) carried out an ethnobotanical study of indigenous knowledge on the medicinal plants used by the village people of Thoppampatti in Dindigul district of Tamil Nadu, India. This study provides significant ethnopharmacological information, both qualitative and quantitative on medicinal plants. A total of 139 species of plants, mostly trees and herbs, belonging to 54 families were identified in this study. These are used to treat 142 diseases and ailments. These ailments were categorised into 18 major categories. Leaves were the most frequently used parts, while decoction and juice are the most common method of preparation to treat various diseases. The percentage value

of important species given according to their use value were *Cynodon dactylon* (0.79%), *Azadirachta indica* (0.73%), *Ocimum tenuiflorum* (0.71%), *Moringa oleifera* (0.68%), *Coriandrum sativum* (0.62%), *Abelmoschus esculentus* (0.61%), *Acalypha indica* (0.59%) *and Hibiscus rosa-sinensis* (0.59%).

The local inhabitants of Gingee taluk in Villupuram district, Tamil Nadu, India. (Thamacin Arulappan and John Britto, 2014) use 36 species of medicinally important plants belonging to 29 families. High number of medicinally important plants species are observed in Euphorbiaceae (5), Amaranthaceae (2) Solanaceae (2) and Lamiaceae (2).

Vijayalakshmi *et al*., (2014) studied the ethnomedicinal plants used by the Irulas tribe of Thirumurthi hill in Western Ghats of Tamil Nadu, India. The results of this study showed that a large number of medicinal plants are traditionally used by the tribal community of Thiumurthi hill for the treatment of various diseases or health disorders. In this study, 72 plant species belonging to 51 genera and 32 families with a highest representative of five species belong to the family Asteraceae and four species belong to the family Asclepiadaceae, Caesalpiniaceae, Fabaceae and Lamiaceae.

Phytochemistry and Pharmacological efficacy of medicinal plants

Extensive literature is available on the phytochemical, pharmacognostic, antimicrobial and biological activities of medicinal plants and it is difficult to quote the entire survey of literature. Hence the selected recent literature on phytochemical analysis of medicinal plants has been given. Medicinal plants are of great importance to the health of individuals and communities. The medicinal value of these plants are due to chemical substances which produce a definite physiological action on the human body. Alkaloids, tannins, flavonoids, and phenolic compounds are the most important bioactive constituents of these plants (Hill, 1952).

Medicinal plants that form the backbone of traditional system of medicine in India, have in the last few decades been the subject of interest for pharmacological studies. This has been brought about by the acknowledgement of the value of medicinal

plants as potential source of novel bioactive compounds of therapeutic prominence (Prusti *et al*., 2008). Medicinal plants are rich source of novel drugs that forms the ingredients in traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates, bioactive principles and lead compounds in synthetic drugs (Chakravarthy and Gode, 1985; Ebi and Ofoefule, 2000; Ncube, 2008).

In recent years, multiple drug/chemical resistance in both human and plant pathogenic microorganisms has been developed due to indiscriminate use of synthetic drugs in the treatment of infectious diseases. This drives the need to screen medicinal plants for novel bioactive compounds as a basis for pharmacological studies since the bioactive principles obtained from the plants are biodegradable, safe and have fewer side effects.

The genus *Cissus* belongs to the family Vitaceae and consists of 350 species in the world. There are 13 species in India and eleven species have been reported from Tamil Nadu. So far 14 species of *Cissus* other than *Cissus quadrangularis* have been reported for their medicinal properties (Table-1).

Table-1 List of different species of *Cissus* genus used in medicine

S.No	Name of the species	Country	Medicinal property	Reference
1	*C.araloides*	Cameroon	Antimicrobial, Antiinflammatory, Antioxidant	Assob *et al.*, (2011) Ezeja *et al*.,(2015)
2	*C.arnottiana*	India	Anti diabetic	Sama *et al* ., 2012
3	*C.assamica*	China, India, Cambodia, Bhutan, Nepal,Tailand	Anti-snake venom	Yang *et al* (1998)
4	*C.cornifolia*	West cornifolia	Antioxidant	Chipiti *et al.*, (2015)
5	*C.debilis*	Cameroon	Anti- cell proliferation	Line –Edwige *etal* (2009)
6	*C. hamaderohensis*	Yemen	Antiviral	Oleski *et al.*, (2006)
7	*C. hypoglauca*	*Australia*	Sore throat	Lassack (1997)
8	*C.ibuensis*	Nigeria, Niger, Ghana	Rheumatism, arthritis, Gastrointestinal tract	Dalzeil (1958) Irvine (1961)
9	*C. populnea*	Nigeria	Increase proliferation of Sertoli cells Skin diseases, boils, infected wounds which also suggested its antibacterial activity	Osibote *et al* ., (2011) (Kone *et al* ., 2004).
10	*C.rependa*	India	Antioxidant. Reduce the CCl_4 induced liver damage	Kardong *et al*., (2014)
11	*C.rotundifolia*	Africa, South America	Antiparasitic, Antidiabetic	Onyechi *et al.*, (1998) and Alzoreky and Nakamura(2003)
12	*C.rubiginosa*	Congo	Antidysentery, anti-diarrhoea	Otshudi *et al.*, (2000)
13	*C.sicyoides*	Brazil	Antidiabetic,diuretic,anti-inflammatory, anti-convulsant, anxiolytic,antioxidant	Salgado *et al*.,(2009) Khalil *et al*.,(2008)
14	*C.verticillata*	Trinidad and Tobago	Anti-cholesterol, Anti-diabetic	Lans (2006)

In the present investigation, it is observed that *C.quadranglaris* is used by both Kuknas and Soligas. The stem is rich in mucilage and the tribals use it for bone fracture; moreover, the stem is used as vegetable due to its fleshy nature.

C.quadranglaris is a perennial plant of the grape family, Vitaceae. It is commonly known as Veldt Grape or Devil's Backbone. It is probably native to India or Sri Lanka, but is also found in Africa, Arabia, and Southeast Asia. It has been imported to Brazil and the southern United States. *C. quadrangularis* stem is used medicinally in the indigenous systems of medicine both in the ayurvedic and unani systems (Vasu 2012; Sen, 2011).

The phytochemistry, pharmacognostic and therapeutic properties of stem and leaves or whole plants of *C.quadrangularis* have been reviewed by Misra *et al.,* (2010), Justin Raj and Baby Joseph, (2011), Shah, (2011), Sen and Dash, (2011) Fernandes and Banu, (2012) Kaur and Malik (2014) Kaur and Malik, 2014 and Seema (2015).

Previous reports on *C.quadrangularis* showed the presence of alkaloids, saponins, triterpenoids, steroids, lipids, stilbenes, flavonoids and iridioids (Bhutani *et al*., 1984; Gupta 1990, 1991; Adesanya *et al.,* 1999; Singh *et al.,* 2007; Vijayakumari *et al*., 2012).

Methanolic and ethyl acetate extracts of *C.quadrangularis* were evaluated for antioxidant activity by β-carotene linoleic acid model and also by 1,1-diphenyl-2-picrylhydrazyl model. The methanolic extract has less efficacy as antioxidant than that of ethyl acetate extract (Murthy *et al*., 2003).

Four marker constituents were reported i.e. onocer-7-ene-3α, 21β-diol, δ-amyrin, δ-amyrone from the plant of *C. quadrangularis* (Mehta *et al*., 2001). Ethanolic extract of *C. quadrangularis* was evaluated for its anti-osteoporotic activity in ovariectomized rat model of osteoporosis at two different dose levels of 500 and 750 mg/kg per day and the ethanolic extract of the plant showed a definite anti-osteoporotic effect (Shirwaikar *et al*., 2003).

C. quadrangularis extract was reported for its gastroprotective effect. This study was undertaken on aspirin-induced ulcerogenesis in pyloric ligated (ASP-PL) model in

rats. The antisecretory and cytoprotective property of the extract of *C. quadrangularis* protect the gastric mucosa against ulceration (Jainu *et al*., 2006).

The 90% methanolic extract of stems of *C.quadrangularis* showed antibacterial activity against *E. coli, S. aureus,* and *P. aeruginosa* and mutagenicity against *Salmonella microsome (*Austin *et al*., 2003). The stem and root extract possesses antimicrobial activity (Murthy *et al.,* 2003).

Oben *et al*. (2006) stated that *C.quadrangularis* contains potassium, calcium, zinc, sodium, iron, lead, cadmium, copper, calcium oxalate and magnesium. Some other constituents of the plant are resveratrol, piceatannol, pallidol and parthenocissin.

The methanolic extract of *C.quadrangularis* showed analgesic and anti-inflammatory activity. In the analgesic test, *C. quadrangularis* provoked a significant reduction of the number of writhes in acetic acid-induced writhing response in mice and in acute phase of inflammation *C. quadrangularis* elicited the inhibitory effect on the edema formation of the rats' ear induced by ethyl phenylpropiolate (Panthong *et al*., 2007). The alcoholic extract of upper part of plant was found to possess antiplasmodial activity against *Entamoeba histolytica* (Bah, 2007).

Two new iridoids 6-O-[2,3-dimethoxy]-trans-cinnamoyl catalpol, and 6-O-meta-methoxy-benzoyl catalpol, along with a known iridoid picroside 1, two stilbenes quadrangularin A and pallidol were reported in *C. quadrangularis* (Singh *et al*., 2007).

Srivastava *et al*., (2011) studied the chemical composition of the ethyl acetate extract of *C.quadrangularis* stem. They found that the total ash value, acid insoluble ash value and water soluble ash value were 12.5%, 2.5% & 10.0%, respectively and the percentage yields for ethyl acetate, hydroalcoholic were 2% and 1.8% respectively.

The phytochemical analysis of *C. quadrangularis* revealed the presence of some additional compounds such as taraxeryl acetate, taraxerol, isopentadecanoic acid, phenol,

tannin, α-amyrin and β- sitosterol. It also contains 31 methyl tritiacontanoic acid and 7 -Oxo onocer-8-ene-3, 21- diol. *C.quadrangularis* is a very good source of vitamin C and beta- carotene (Kumar *et al*., 2012).

Manikandan and Muhammad Ilyas (2013) carried out a study on antioxidant, proximate analysis, antimicrobial activity and phytochemical analysis of stem of *C. quadrangularis* by GC-MS. This study stated that tannin, phlobatannins, saponin, flavonoids, steroids, terpenoids, and cardiac glycosides are present in *C.quadrangularis.* At 100% concentration of extraction zone of inhibition is high. But 25%, 50% and 75% showed the lowest inhibition activity. Proximate analysis indicated the efficacy of nutrients. In GC-MS of analysis of *C.quadrangularis* some of the phytocomponents screened are Eugenol, n-Hexadecanoic acid, 1, 2- Benzenedicarboxylic acid, diisooctyl ester, Phenol, 2, 4-bis (1-phenylethyl). HPLC analysis of the *C.quadrangularis* extract revealed the presence of quercetin and Kaemphenol (Kalpana, 2013).

Traditional knowledge on the medicinal properties and pharmacological activities of *C. quadrangularis* had been reported by many authors (Table- 2).

Table-2 Traditional knowledge of medicinal properties and pharmacological activities of *Cissus quadrangularis*

S.No	Parts used	Medicinal property	References
1.	Stem	Broken bones	Rostogi (1993)
		Muscular pains	Anonymous (1992)
		Treat scurvy, menstrual disorders and Epistaxis	Anonymous (1992)
		Asthma,burns,and wounds ,bites of poisonous insects	Guhabakshi (2001)
		Stomachic	Asolkar (1992)
		Wound	Kirtikar (1996)
		Gonorrhoea	Burkill (2000)
2.	Shoots	Anthelmintic	Anonymous (1992)
3.	Leaves	Bowel infections	Rostogi (1993)
4.	Aerial parts	Wounds,lumpy skin disease and as tick Repellent	Luseba (2006)
5.	Ash of plant	Substitute for baking powder	Anonymous (1992)
6.	Aerial parts	Wounds, lumpy skin disease and as tick Repellent	Luseba (2006)
7.	Root	Hemarrhoids,bone healing	Kumbhojkar *et al.*,(1991)
Pharmacological activity			
1.	Whole plant	Accelerating fracture healing	Udupa *et al.*, (1964)
		Antipyretic activity	Singh *et al.*, (1984) (Vijay & Vijayvergia 2010)
		Antineoplastic activities	(Opoku *et al*., 2000)
		Restore the biomechanical properties and structure of the bone	Shirwaikar *et al.*, (2003)
		Antioxidants	(Jainu and Devi 2005)
		Antiosteoporotic activity	Sanyal *et al.*, (2005)
		Antiprotozoal	Rajpal (2005)
		Antihemorrhoidic activity	Panthong *et al.*, (2007)
		Reduce blood glucose levels and serum Lipids	Oben *et al.*,(2006)
		Analgesic properties	Panthong *et al.*,(2007) Singh *et al.*,*(* 2008) Vijay & Vijavergia (2010)
		Osteoblastogenesis	Potu *et al.*, (2009)

S.No	Parts used	Medicinal property	References
		Reduce body weight	Hasani-Ranjbar *et al.*, (200
		Suppresses chronic ulcers	Jainu *et al.*, (2010)
		Anti-inflammatory and Antipyretic	Vijay & Vijavergia (2010)
		Antifungal activity	Anitha *et al.*, (2012)
		Treatment for Osteoporosis	Joseph *et al.*, (2013)
		Antibacterial activity	Luseba *et al.*, (2007) Sen *et al.*, (2012)Baskar an Mohammed (2013) Anitha *et al.*, (2012)
		Antibacterial	Baskar and Mohammed (2013)
		Antiarthritic	Kumar *et al.*, (2015)
2.	Aerial parts	Estrogenic activity	Aswar *et al.*, (2010)
		Anti-tumour properties	Nalini *et al.*, (2011) Prema *et al.*,(2012)
3.	Stem	Pharmacological and Toxicological evaluation	(Venkata 1970)
		Accelerating healing process	Deka *et al.*, (1994)
		Antioxidant Activity	(Murthy, *et al.*,(2003) Jainu & Devi (2005) Oben (2007) Shah (2011) Netaji *et al.*, (2015) Viswanatha *et al.*, (2010)
		Antibacterial activity	(Kashikar *et al.*, 2006) (Jigna & Chandra, 2008) (Parekh & Chanda, 2008) (Parekh & Chanda, 2007) Paulsen *et al.*,(2007) Anitha & Akila *et al.*, (201
		Neutrophil mediated tissue protective	Mallika *et a*l.,(2006)
		Gastroprotective	Jainu *et al.*, (2006)
		Reduce blood glucose levels and serum lipids	Oben *et al.*,(2006)
		Neutrophil mediated tissue protective	Mallika *et al.*,(2006)
		Gastroprotective effect	Jainu *et al.*,(2006)
		Anti-inflammatory	Thisayakorn *et al.*, (2007)

S.No	Parts used	Medicinal property	References
			Netaji *et al.,* (2015)
		Obesity and obesity induced oxidative Stress	Oben *et al.,* (2007)
		Management of Weight loss	Oben *et al*., (2008)
		Anti-inflammatory and Analgesic agents	Singh *et al.,(* 2008)
		Stimulates the Growth of Foetal Bone	Potu *et al.,* (2008)
		Alleviating insulin resistance	(Chidambaram & Carani 2010)
		Increases mineralization	Kumar *et al.,* (2010)
		Increases alkaline phosphatase activity	Kumar *et al.,* (2010)
		Reduce body weight	Greenway & Bray (2010)
		Restore the biomechanical properties an structure of the bone	Potu *et al.,* (2011)
4.	Leaf	Gastroprotective	(Soldato & Wallace 2002)
		Antibacterial	Paulsen *et al.,*(2007) Merinal & Viji (2012)
		Anticonvulsant properties	Panthong *et al.,* (2007)
		Antifungal	Merinal (2012)
		Restore the biomechanical properties and structure of the bone	Potu *et al.,* (2011)
	Stem	Antioxidant	(Spiegelman & Flier 2001)
		Gastroprotective	(Soldato & Wallace 2002)
		Suppresses chronic ulcers	Sanchez Fidalgo *et al.,* (2004)
		Antiviral	Balasubramanian *et al.,* (2010)
	Fruit	Antibacterial	Paulsen *et al.,*(2007)
	Root	Analgesic	Viswanathasamy *et al.,* (2006)
		Anticonvulsant	Panthong *et al.,* (2007) Hatazawa (2007)
		Antiepileptic, Anticonvulsant, Analgesic, Muscle relaxant	Kumar *et al* (2010)
		CNS activity depressor	Kumar *et al.,* (2010)
		Aphrodisiac potentials	Gupta *et al.,* (2013)
		Anthelmintic	Mohanambal *et al.,* (2012)
		Antiulcer	Enechi, *et al.,* (2013)