REVIEW OF LITERATURE

Carmona retusa (Vahl) Masam. (Lorence *et. al.*, 1995; Wagner *et. al.*, 1999), Family – Boraginaceae was previously known as *Ehretia microphylla* Lam. Dassanayake (1991) reported that *Carmona* is a monotypic genus namely *Carmona retusa* which is widely distributed in India.

The plant was known by various synonyms, but in Flora of Ceylon (Dasanayake, 1991) and Flora of Tamil Nadu (Henry *et. al.,* 1987) the plant was referred by the name of *Carmona retusa* (Vahl) Masam., The herbarium plant specimen was identified by Botanical Survey of India, Coimbatore, Chennai as *Carmona retusa* (Vahl) Masam. In the present study also the plant name is referred as *C. retusa* (Vahl) Masam.

Carmona retusa (Vahl) Masam, is a shrub (small tree) with many erect branches covered with glossy dark green coarse leaves. Synonyms are *Ehretia buxifolia* Roxb., *Carmona microphylla* (Lam.) G. Don., *Carmona retusa* (Vahl) Masam., *Carmona heterophylla* Cav., *Carmona microphylla* (Lam.) G. Don., *Ehretia buxifolia* Boxb*., Ehretia heterophylla* Spreng., *Ehretia microphylla* Lam., (Lorence *et. al.,* 1995; Bailey and Bailey, 1976; GRIN, 2001).

Foreign Names:

Chinese **:** Ji ji shu;

English **:** Fukien tea, Philippine tea, Scorpionbush;

Indonesia : Kinangan, Serut lanang (Javanese), Pinaan (Madurese);

Philippines **:** Putputai (Bikol), Alangit (Bisaya), Tsaang gubat (Tagalog);

Thailand : Khoi cheen (Bangkok), Chaa yeepun (Central), Chaa (ChiangMai)

Vietnam : Kim li[ee]n, c[uf]m r[uj]n, b[uf]m r[uj]n.

Sri Lanka : Hintambole

Vernacular names:

Marathi – Pala;

Deccan – Pale;

English – Ceylon Boxwood;

Hindi – Pala;

Kannada - Bute, Ennebutige;

Oriya - Kujapponno, Ponnamari

Telugu – Bapanapuri, Barranki, Pichakaburi, Pittapisunukayi

Siddha **--** Kuruvingi, Kattuvettilai;

Tamil **-** Kurangu vethilai, Kurinjan chedi, Kattuvettilai, Kuruvingi

Boraginaceae:

The taxonomy of this family has been contentious: the earlier Cronquist botanical classification system placed it in the order Lamiales, and the first version of the Angiosperm Phylogeny Group (APG) system treated it as part of Solanales. With a lack of consensus regarding its evolutionary history, Boraginaceae was placed in the Euasterids I (lamiids) clade without an order by The Angiosperm Phylogeny Group*[1] (APG III) in 2009.

Some of the more typical borages show colour changes of the corolla (the petals, collectively) upon aging, from pink to blue, yellow to pink to blue, or yellow to white; this transformation is caused by changes in the pH of the cellular fluids and this may be a signal to pollinators that a flower was old and depleted of pollen and nectar.

Most members of this family have hairy leaves. The coarse character of the hairs was due to cystoliths of silicon dioxide and calcium carbonate. These hairs can induce an adverse skin reaction, including itching and rash.

Simpson (2010) described the family Boraginaceae – Borage family (Latin burra, a hairy garment, in allusion to the hairy leaves) 142-148 genera and 2450-2740 species (The Boarginaceae consists of herbs, shrubs, trees, rarely lianas, often with hirsute or hispid vestiture. The leaves are simple, spiral, or opposite exstipulate. The inflorescence unit is a monochasial scorpioid cyme (often circinate), rarely of solitary, axillary flowers. The flowers are pink, purple, yellow or white but it is predominantly blue. The flowers are usually bisexual, heterostylous in some taxa, actinomorphic or zygomorphic, hypogynous, bracteate or not. The perianth biseriate and dichlamydous. The calyx apo or synsepalous with 5 (4-8), imbricate rarely valvate sepals or lobes. The corolla sympetalous, often salver form or rotate, with 5 (4-6), convolute or imbricate (rarely valvate) lobes. The stamens are 5 (4-6), whorled, epipetalous from corolla tube. Anthers are longitudinally dehiscent. The gynoecium syncarpous, with a superior ovary, 2 (4-16) carpels and 1, 2, 4, --- locules. The styles are terminal or gynobasic, in the alter case the ovary typically deeply 4-lobed by formation of false septa dividing each carpel. Ovules are anatropous to hemitropous, unitegmic. Nectaries are present in some as a ring around ovary base. The fruit a drupe, capsule or schizocarpic of usually 4 (2) nutlets. The seeds are endospermous.

The Boraginaceae may be tentatively divided into the following 6 sub-families, all of which have been treated as separate families in various past treatments.

1. Boraginoideae - usually woody herbs, with a deeply 4-lobed ovary, gynobasic style, and fruit a schizocarp of typically 4(1-3) nutlets.
2. Cordioideae – mostly trees, ovary with a terminal, 4-branched style, the fruit is a drupe with 4-locular endocarp (ex. *Cordia*).
3. Ehretioideae – mostly trees, ovary 4-lobed with a terminal 2-branched style, the fruit a drupe with 2 (2-seeded) or 4 (1-seeded) pyrenes (ex. *Ehretia*).
4. Heliotropoideae – herbs or shrubs, the style terminal, unbranched with short stigma (ex. *Heliotropium*).
5. Hydrophylloideae (water leaf family) – trees, shrubs or herbs, the ovary unlobed, style terminal, the fruit usually 1-locular capsule (ex. *Hydrolea*).
6. Lennoideae (sand food family) - achlorophyllous, root parasitic herbs with a fleshy, circumscissile capsule (*Lennoa*).

The Boraginaceae have a worldwide distribution.

Most of the plants of Boraginaceae family are grown as ornamental plants, although some of them are a source of dye, have medicinal uses and used as herbal supplements (e.g., *Borago officinalis*) and several plants were cultivated as ornamentals. The most well-known members of the Family include Forget me Not (*Myosotis*), Heliotrope (*Heliotropium*), the Comfreys (*Symphytum*), Borage (*Borago*), and Hound's Tongue (*Cynoglossum*) (Ranjitham *et. al*., 2014).

Boraginaceae

Mathew (1983) in The Flora of Tamil Nadu Carnatic, Boraginaceae and Cordiaceae are the two different families. Boraginaceae consists of 4 genera *Cynoglossum*, *Heliotropium*, *Trichodesma* and *Coldenia* and Cordiaceae consists

of 4 genera namely *Carmona*, *Cordia*, *Ehretia* and *Rotula*. The plant *C. retusa* comes in the family Cordiaceae.

Henry *et. al*. (1987), in Flora of Tamil Nadu, Boraginaceae consists of about 9 genera namely *Carmona*, *Coldenia*, *Cordia*, *Cynoglossum*, *Ehretia*, *Heliotropium*, *Rotula*, *Tournefortia* and *Trichodesma*.

Kritikar and Basu (1998), in Indian Medicinal Plants stated that Boraginaceae consists of 11 genera *Cordia*, *Ehretia*, *Coldenia*, *Rotula*, *Heliotropium*, *Trichodesma*, *Ctnoglossum*, *Caccinia*, *Lithosporium*, *Microtomia* and *Onosma*. There are two species of *Ehretia* in India namely *Ehretia aspera* Willd. and *Ehretia microphylla* Lam.,

Nadkarni (1976) in Indian Materia Medica mentioned that there are two species namely *Ehretia buxifolia* Roxb., the plant was widely distributed in South India and *Ehretia obtusifolia* Hochst.

Khare (2007) has also reported that there are two species. *Ehretia buxifolia* Roxb., is common in dry scrub forests of the Deccan Peninsula and *Ehretia laevis* Roxb. var. *aspera* (Willd.) (Syn: *Ehretia aspera* Willd., *Ehretia obtusifolia* Hochst. ex DC.,)

Mayuranathan (1981) reported five genera i.e., *Trichodesma*, *Coldenia*, *Cordia*, *Ehretia* and *Heliotropium* in Boraginaceae in The Flowering Plants of Madras City and its immediate neighbourhood, in which the genus *Ehretia* consists of three species *E. microphylla*, *E. ovalifolia* and *E. pubescens*. *E. microphylla* differs from other two species by styles 2, or 1 divided almost at the base.

In Flora of the Presidency of Madras (Gamble, 1921), the family Boraginaceae includes 9 genera. The genera *Ehretia* consists of 8 species namely

E. acuminata, E. laevis, E. canarensis, E. aspera, E. ovalifolia, E. wightiana, E. pubescens and E. microphylla. The plant *E. microphylla* Lamk., was known by its synonym *Ehretia buxifolia* Roxb. Cor.

Hooker (1997) in The Flora of British India, Vol.-IV, the order Boragineae has been divided into IV Tribes. Cordieae, Ehretieae, Heliotropiaeae and Borageae. In the Ehretieae there are two sectors, Euehretia and *Carmona* to which *Ehretia buxifolia* Roxb. belongs to Carmona.

According to Yoganaraimhan (2009), the plant *Carmona retusa* (Vahl) Masammune. comes in Boraginaceae.

Dassanayake (1991) reported Boraginaceae as widely distributed family with as many as 100 genera and at least 2000 species. Nine species were found in Ceylon but two are monotypic and two are represented by only one species *Carmona* – 1: *Royula* – 2; *Cordia* – 8: *Tournforte* – 2: *Ehretia* – 1; *Coldenia* – 1; *Trichodesma* – 1; *Cynoglosum* – 1. *Carmona* consists of a single species originally describes as a species of *Cordia*. It has also been included in *Ehretia* but differs in habit, leaves, pollen and fruit structure.

Asolkar *et. al.* (1992) reported Ehretiaceae and Boraginaceae are the two different families. C. retusa Masu in Ehretiaceae comes in *Carmona retusa* Masu. (Syn: *Ehretia buxifolia* Roxb.; *Ehretia microphylla* Lamk.).

Carmona retusa is reported to be medicinally useful in Indigenous System of Medicine (Chopra *et. al.,* 1980). This plant is also recorded in Siddha Materia Medica as Kuruvichi or Kuruvichi poondu (Murugesa Mudaliyar, 1956; Kannusamy Pillai, 1939).

Native:

Carmona retusa is native of India to Malay Peninsula and the Philippines (Bailey and Bailey, 1976: GRIN, 2001). More specific detail of the native range is provided listing the following. In temperate Asia, the plant is native to Guangdong and Hainan, China; the Ryukyu Islands of Japan; and Taiwan. In tropical Asia, it is native to India; Indochina; Indonesia; Malayasia; Papua New Guinea; Philippines; and Sri Lanka. It is also native to the Solomon Islands in the Pacific (Dassanayake, 1991).

Ecology:

Carmona retusa found in sandy soil and scrub forest (Dassanayake, 1991) in open, dry, sunny habitats, such as thickets, shrub vegetation, teak forest at low and moderate elevations and is also common in dry scrub forests of the Deccan Peninsula (Khare, 2007).

The plant is also cultivated as an ornamental in Hawaii, where it is not native and the plant is introduced and cultivated as hedge plant, but it is naturalized the secondary vegetation and has become an invasive weed (Butz, 2004).

In Chennai the plant is widely present in scrub jungle of Guindy, Pallavaram, Avadi, Vandalur, Tambaram and Ennore (Mayuranathan, 1981).

Traditional Uses:

C. retusa is used for leprosy, eczema due to venereal diseases, chronic dysentery, infertility and toxic diarrhoea in children. It has anti-inflammatory, antibacterial, analgesic, anti-allergic, anti-mutagen, anti-diarrheal, antimicrobial and anti-tumour activity. The leaves are used as a stomachic, in the ailments of

cough, fever and constitutional syphilis. The roots of the plants are used in Southern India for cachexia and syphilis and as an antidote for certain vegetable poisons (de Padua *et. al.,* 1982; Quisumbing, 1978; Guevara, 1999).

The plant is one of the most important medicinal plants in the Philippines, and is widely used for a variety of medicinal purpose. The decoction of the leaves was used as cure for coughs, and was prescribed for the treatment of diarrhoea with bloody discharge and for dysentery (Quisumbing, 1978; Star *et. al.,* 2003). A decoction of the leaves was prescribed for cough and stomach troubles (Pullaiah, 2006) in traditional medicinal practice in Southern India.

The leaves of the plant was commonly used as tea or tonic drink to treat stomach ailments and popular as antibacterial and have a high potential infighting the growth and multiplication of cancer cells (Jowi, 2008).

The plant was used in Siddha for leprosy, sterility, diarrhoea, skin disorders caused by congenital venereal diseases, digestive disorders and astringent. In Ayurveda (Charmekaravate) the bark of the plant was used for polyuria and snake bite poisoning (Yoganarasimhan, 2009).

Indigenous system of Medicines: The plant is also used in the treatment of skeletal fractures in Sri Lanka (Ekanayake, 1980). The root of this plant is used for cachexia and syphilis and as an antidote for vegetable poisons. The decoction of the leaves is used to cure diarrhea accompanied with discharge of blood and also for cough (Fareena Ruzaik, 2013).

Folklore claims in Philippines & Sri Lanka: Leaf decoction or infusion for abdominal colic, cough, diarrhea and dysentery (Starr *et. al.,* 2003). Root decoction used as an antidote for vegetable poisoning. For diarrhoea 8 tbsp of

chopped leaves in 2 glasses of water boiled for 15 minutes, strained and cooled. 1/4 of the decoction very two or three hours is used. This can also been used as a dental mouthwash. Decoction of leaves used as disinfectant wash after childbirth. In Sri Lanka, used for diabetes: 50 gm of fresh leaves or roots are chopped; 100 cc of water is added, and 120 cc of juice is extracted by squeezing and given once or twice daily (Ediriweera and Rathnasoorya, 2009).

Phylogenetic Analysis:

Gottschling and Hilger (2004) made both morphological studies of the fruits and molecular data of various species of *Ehretia* ((Ehretiaceae). They divided *Ehretia* into 3 clades namely *Ehretia* I, *Ehretia* II and *Ehretia* III. *Ehretia* I is characterized by fruits with 4 endocarpids. *Ehretia* II (including Carmona retusa) with undivided endocarp. *Ehretia* III is characterized by four endocarpids but it differs in the presence of distinct lamellae on the abaxial surface of each endocarp. The author claimed that both molecular (ITS1 - sequence [First Internal Transcribed Spacer]) and morphological data supported the recognition of three clades which exhibit close relationships. On the basis of the results the author produced a cladogram based on maximum like hood of *Ehretia*. Finally they stated that the available data were not adequate to resolve the question of phylogenetic relationships of the members of Ehretiaceae and the data are still wanted.

Pharmacognostical Studies:

Aarthi *et. al.* (2014) reported the pharmacognostical studies on leaf, young stem and fruit of *Ehretia microphylla* and brought out the HPTLC photo documentation of the chloroform extract of the aerial portion.

Phtyochemical analysis:

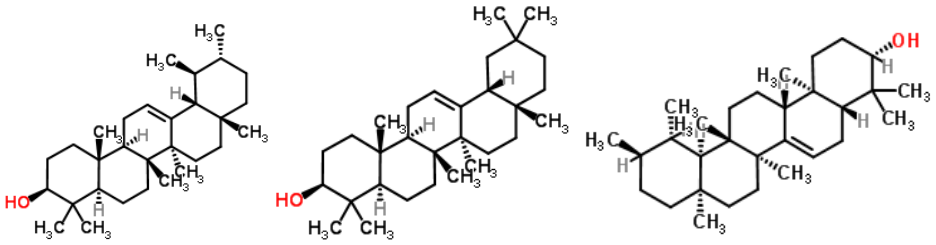
Reglos-Zara *et. al.* (2010) reported the *in vitro* plant regeneration of tsaang gubat (*Carmona retusa* (Vahl) Masam. via direct and indirect methods using shoot tip explants. Levels of phenolics, flavonoids and tannins were higher in the leaves of tissue-culture-raised plants than those of *in vivo* grown plants. Likewise, plants maintained for long-term (24 wk) under *in vitro* conditions produced these secondary metabolites, although at lower levels compared with the field-grown materials.

Agarwal *et. al.* (1980) reported a novel natural product, microphyllone (a unique quinonoid compound) isolated from *Ehretia microphylla* Lamk., together with two triterpenes baurenol and ursolic acid. Spectroscopic techniques, derivative formation and finally X-ray diffraction have been utilized in the structure elucidation of microphyllone. The structure appears to be 4a, 5, 8,8a - tetrahydro -11, 14- dihydroxy-7-methyl-4a-(3-methyl-2-butenyl)-5, 8a-*o*-benzeno-1, 4-naphthoquinone.

From the methanolic extract of leaf of *E. microphylla*, rosmarinic acid was isolated as one of the active anti-histamine release inhibitory constituents. Astragalin, nicotoflorin, bauerenol, α-amyrin and β-amyrin were also isolated from the leaves (Rimando *et. al.,* 1987).

The repeated rapid column chromatography of the chloroform fraction of the ethanol extract of the fresh leaves of *Carmona retusa* resulted in the isolation of titerpenoids. Gas Chromatographic and Mass Spectral (GC-MS) analysis led to the identification of triterpenoids which are structural isomers of α-amyrin (12-

ursen-3-β-ol), ß-amyrin (12-oleanen-3β-ol) and baurenol (7-bauren-3-0l) (Villasenor *et. al.,* 1992; 2004).



α-amyrin ß-amyrin baurenol

Villasenor *et. al.* (1993) reported an antimutagenic compound structure from leaf extract of *C. retusa* has been elucidated by spectral analysis to be 4-hydroxy-7,8,11,12,15,7',8',ll',12',15'-decahydro-β- ψ-carotene.

Yamamura *et. al.* (1995) isolated a dimeric prenylbenzoquinones from ethyl acetate-soluble portion of the methanol extract of aerial part of *E. microphylla*. The fraction afforded five biologically active compounds. By means of chemical and spectroscopic methods, the structures of these compounds microphyllone, dehydroxymicrophyllne, hydroxymicrophyllone, cyclomicrophyllone and allomicophyllone were reported.

Selvanayagam *et. al.* (1996) isolated the Ehretianone (1), a new quinonoid xanthene, together with known sterols from methanol extract of root bark of *Ehretia buxifolia*. The structure of ehretianone was elucidated as 7-hydroxy-9aR-(3-methylbut-2-enyl)-4aR,9R-(2-methylprop-2-enyl)-4a,9a-dihydro-1,4-dioxoxanthene on the basis of spectroscopic data and X-ray crystallographic analysis. In addition to ehretianone, a sterol mixture containing β-sitosterol, stigmasterol, stigmastanol, α-spinasterol, campesterol and cholesterol were also reported.

LI Li *et. al.* (2010) summarized the research progress on phyto-chemical and biological activities of the genus *Ehretia* Linn. and provided scientific evidence for better utilization as herbal medicine of the genus. The various chemical constituents like phenolic acids, flavonoids, benzoquinones, cyanogenic glycosides, fatty acids, alkaloids and others were isolated from the genus *Ehretia*. Nearly 68 chemical constituents reported of which 20 phenolic acids, 13 flavonoids, 7 benzoquinones, 6 cyanogenic glucosides, 7 fatty acids and its related derivatives, 2 alkaloids and nearly 13 other chemical constituents were reported.

Benzoquinones is one of the most characteristics in the family Boraginaceae. There are 7 benzoquinones of which 6 benzoquinones were isolated from *E. microphylla*.

Antioxidant Activity:

Ranjitham *et. al.* (2014) reported the *in vitro* antioxidant properties of methanol extract of aerial parts of two traditional medicinal plant species namely *Ehretia microphylla* and *Erythroxylon monogynum* were assessed by using reducing power assay, DPPH and ABTS radical scavenging activities. Both the plant showed remarkable activity in terms of all the three assays. Among the two plants *E. microphylla* was more prominent. Therefore both the species were found to be the most effective potent source of natural antioxidants.

Chandrappa *et. al.* (2013) screened the ethanol extract of aerial parts of *C. retusa* for antioxidant activity. The extract exhibited maximum antioxidant activity in DPPH and H_2O_2. The reducing power and FRAP increased with increasing concentration of the sample. The scavenging activity was found maximum in DPPH, FRAP, hydrogen peroxide scavenging and reducing power

assay of 95.35%, 9.296%, 78.539% and 82.9% respectively. Percentage of antioxidant capacity was found to be 8.875 comparable with that of the standard.

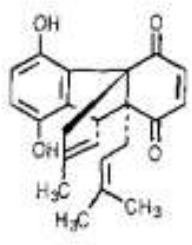
Pharmacological Studies:

Twenty three Philippine medicinal plants were tested for their anti-histamine release properties using rat mast cells. Of these plants tested, *Blumea balsamifera*, *Cordia myxa*, *Ehretia microphylla* and *Vitex negundo* were shown to be strongly active (Rimando *et. al.,* 1987).

Villasenor *et. al.* (1993) reported an antimutagenic principle from the alcohol extract of leaves of *Carmona retusa.* The micronucleus test is an in-vivo method, using albino mice as the test system for monitoring the antimutagenic activity. At a dosage of 23.4 mg/kg body weight, the pure isolate reduced by 68.4% the number of micronucleated polychromatic erythrocytes induced by the mutagen tetracycline a known mutagen.

The leaves also possess antimutagenic activity against mitomycin C, tetracycline, and dimethylnitrosamine (Sylianco *et. al.,* 1987).

Yamamura *et. al.* (1995) reported that the microphyllone, dehydroxymicrophyllne, hydroxymicrophyllone, cyclomicrophyllone and allomicophyllone were bio assayed for their inhibitory activity on exocytosis of rat basophils caused by antigen induced stimulation. Among them 1 and 5 showed strong activity, while 2 and 4 had weaker activity and 3 was inactive. The data suggest that the quinonoid structure of the B-ring may be responsible for some of the activity.



Microphyllone

Villaseñor *et. al*. (2004) reported the triterpene mixture exhibited 51% analgesic activity and 20% anti-inflammatory activity at 100 mg/kg bw of mouse. The charcoal tracing test showed 29% anti-diarrheal activity which increased to 55% at the higher dosage. The triterpene mixture was also effective in anti-diabetic activity at 100 mg/kg bw.

Aarthi *et. al.* (2012) reported that Kuruvinchi Poondu chooranam prepared from *E. microphylla* on female Wister Albino rats promoted the pituitary-ovary axis activities and caused an elevation in the serum concentrations of Luteinizing hormone (LH), Follicle stimulating hormone (FSH) and Estradiol hormones levels as well as increased the mean numbers of follicles and eventually ovarian weight. The results suggest that the chooranam has significant stimulatory effect on female reproductive activity which can enhance fertility in female adult rats.

Aarthi (2012) reported that Kuruvichi Poondu Chooranam prepared from *E. microphylla* was effective in ovulation disorders and irregular menstrual cycle with 82% improvement in irregular menstrual cycle which helps in the management of Kapavayu (Polycystic Ovarian Syndrome) in clinical trial.

Antimicrobial Studies:

Villaseñor *et. al.* (2004) reported the triterpene mixture isolated from the methanol extract of leaves was inactive against *Escherichia coli* and possessed

moderate activities against *Staphylococcus aureus*, *Candida albicans* and *Trichophyton mentagrophytes.*

Penecilla and Magno (2011) reported that the extract of aerial part of *C retusa* showed antibacterial activity against *Staphylococcus aureus*, *Bacillus subtilis* and *Pseudomonas aeruginosa* where as there was no activity against *Escherichia coli*. Chandrappa *et. al.* (2012) also reported that the stem extract showed antibacterial activity against *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Shigella flexnari* and *Bacillus subtilis*.

Folk Medicines:

The root bark of the plant was used by the Irula tribe as an antidote to *Echis carinatus* envenomation (Selvanayagam *et. al.,* 1995). The root bark powder was given orally and claimed to stop hemorrhaging caused by the venom.

Selvanayagam *et. al.* (1996) reported that the root bark of *E. buxifolia* showed to possess antisnake venom activity. The ehretianone possess antisnake venom activity against *Echis carinatus* (Indian saw scaled viper) venom in mice.

Sekhar *et. al.* (2011) reported that the paste of whole plant of *C. retusa* about 15-20gm administered orally for every 2 hours upto 12 hours as a best antidote for Russell Viper *bite.*

Sandeep *et. al.* (2012) reported that nearly 258 medicinal plants were concentrate on the diverse traditional, folk herbs practises globally exhibiting anti-snake venom properties. Certain pure compounds have already been isolated, which have been reported to possess anti-snake venom activity. In this article *E. buxifolia* (Makhija *et. al.,* 2010) root paste was applied externally.

Mouli *et. al.* (2009) reported that the natural products appeared to be a promising source for new types of compounds to test for antitumor activity. He listed about 52 medicinal plants as phyto-resources as potential therapeutic agents for cancer treatment and prevention.

Amudha *et. al.* (2013) reported that the plant *Carmona retusa* leaf juice taken internally for 3 days before or after the menstrual period for 3 or months to induce fertility.

Chandrappa *et. al.* (2013) reported the alcohol extract of the stem possess significant *in-vitro* antiproliferative and antimitotic activity. Chandrappa *et. al.* (2013) reported the *in-vitro* anti-inflammatory activity of ethanol extract of stem of *C. retusa* was found to be maximum in human red blood cell membrane stabilization, heat induced hemolysis and proteinase inhibitory activity as 55.72%, 56.37% and 61.75% respectively. The IC50 value showed that the plant would be a potential source of anti-inflammatory agent.

Cytotoxicity and Cell line Study:

Chandrappa *et. al.* (2014) reported the significant and concentration-dependent anticancer activity at 100µg/ml and 80µg/ml doses after 24h and 48h of treatment on HepG2 cell line in MTT assay, significant cell apoptosis at 53µg/ml concentration in Hoechst 33342 staining and a significant activation of Caspase-3 observed at 100µg/ml after 24h and even 48h of incubation using quercetin isolated from *C. retusa*. The HPLC analysis of the plant *C. retusa* yield 99.7% of pure quercetin.

Tsaang Gubat - One of the important Medicinal Plants in Philippines:

The Philippine Department of Health (DOH) through its "Traditional Health Program" has endorsed a list of 10 medicinal plants to be used as herbal medicine in Philippines due to its health benefits. The following are the 10 Medicinal Plants in the Philippines endorsed by DOH is 1. *Cassia alata* L., 2. *Momordica charantia* L**.,** 3. *Allium sativum* L, 4. *Psidium guajava* L., 5. *Vitex negundo* L., 6. *Quisqualis indica* L. **7.** *Blumea balsamifera* L, 8. Tsaang Gubat (*Carmona retusa* (Vahl.) Masam., 9. *Peperomia pellucida* (L.) Kunth. and 10. *Clinopodium douglasii* L.

Tsaang Gubat or Wild Tea (*Ehretia microphylla* Lam.), occurs abundantly in the Philippines and was used as a herbal medicine for the treatment of skin allergies including eczema, scabies, itchiness wounds in child birth, effective in treating intestinal motility and antispasmodic for abdominal (stomach) pains. This plant is registered as a herbal medicine at the Philippine Bureau of Food & Drug (BFAD). In folklore medicine, the leaves has been used as a disinfectant wash during child birth, as cure for diarrhea, as tea for general good health. Research and test now prove its efficacy as an herbal medicine aside from the traditional way of taking. Tsaang Gubat, it is now available commercially in capsules, tablets and tea bags (Philippines Medicinal Plants, 2001).

Tsaang gubat was also used as herbal medicine for the following stomach problems such as stomach pains, gastroenteritis, intestinal motility, dysentery and diarrhea or loose bowl movement (LBM). It can also be used for mouth problems such as mouthwash in stomatitis and teeth strengthened because the leaves of this shrub have high fluoride content.

Pharmacological studies showed that the Tsaang Gubat tablet (at a dose of 1 tablet every 4hr) alleviate the abdominal colic and retard the vermicular motion of bowels. And this tablet was also effective in severe cases of diarrhoea at a dose of 2 tablets every 4hr (Maraba, 1984).

Bonsai Plant – *Carmona retusa* was very popular bonsai plant in China and to a lesser extent in Japan. The plant popularity was due to readily available from discount stores, bonsai nurseries and many online sources. The other species in *Ehretia* was suitable for Bonsai was *E. anacua*, *E. dicksonii* and *E. thrysifolia* (Smith, 1999).