3. REVIEW OF LITERATURE

A detailed and thorough literature survey was carried for the four selected plants from well established institutes (IIT Chennai, CLRI Chennai, The T.N.Dr.M.G.R Medical University Chennai, Govt. Siddha Medical College, Chennai, Palayamkottai, National Institute of Siddha Chennai, CCRS Chennai)

The collected scientific reports were presented,

3.1 ETHNOBOTANICAL REVIEW

3.1.1 PLANT PROFILE (*Adathoda vasica* Nees)

Botanical Source: *Adathoda vasica* Nees
Family: Acanthaceae
Parts Used: Leaves, roots, flowers and stem bark.

Taxonomic classification

Kingdom: Plantae
Division: Angiosperms
Class: Eudicots
Order: Lamiales
Family: Acanthaceae
Genus: *Justicia*
Species: *Justicia. Adhatoda*

Vernacular Names (Prajapati et al., 2007)

Sanskrit: Vasa
Hindi: Adusa
Kannda: Adusoge
Malayalam: Adalodakam

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English : Malabarnut, Vasaka.
Tamil : Adathodai,
Telugu : Addasaramu.

**Distribution** (Ahmed, 2010)

The plant is widely distributed in all over the plains of India and in the lower Himalayan ranges. It is also found in Sri Lanka, Burma and Malaysia.

**Description of plant** (Prajapati *et al.*, 2007).

It is a small evergreen, sub herbaceous bush. The leaves are 10 to 16 cms in length, minutely pubescent and broadly lanceolate. The inflorescence is dense, short pendunculate, bractate and spike terminal. The corolla is large and white with lower lip streaked purple. The corolla is a 4-seeded small capsule.

**Habit**

The plant is a small tree or large shrub.

**Chemical Constituents**

**Leaves**

The leaves contain essential oil and alkaloids vasicine and vasicinone.

**Roots**

The roots contain vasicinolone, vasicol, peganine and 2-glucosyl-oxychalcone.

**Flowers**

Flowers contain β-sitosterol D-glucoside, Kaempferol, its glycosides and quercetin.

**Traditional Medicinal Uses**

In Siddha, it is prescribed commonly for Bronchitis, Bronchial asthma, cold, cough and other respiratory disorders due to its expectorant action. Plant is bitter, astringent, diuretic, antispasmodic, expectorant and alternative. It cures Vomiting, thirst, dermatosis, jaundice, fever and haematemesis (Murugesamudaliyar, 1998). The leaf extract has been used for treatment of bronchitis and asthma for many centuries. It relieves cough
and breathlessness. It is also prescribed for bleeding due to idiopathic thrombocytopenic purpura, local bleeding due to peptic ulcer, piles menorrhagia, etc (Prajapati et al., 2007). The leaf juice is used to cure diarrhea, dysentery and glandular tumour, and it is given as an emmenagogue (Nadkarni, 1954). Flowers and roots with ginger are given in rheumatism, constipation, asthma, chronic bronchitis and other chest infections. Shoots are used in liver enlargement (Joshi, 2007). The Ayurvedic Pharmacopoeia of India indicates its use in dyspnoea. It is a bitter bronchodilator, respiratory stimulant, hypotensive, cardiac depressant, uterotonic and abortifacient. Fresh leaf juice is used in haemoptysis and menorrhagia, also as an antiasthmatic. Jacobinia tinctoria Henl. is equated with the red-flowered var. of Vaasaa.

In Ayurvedic medicine, malabar nut (Adhatoda vasica) has been used for a multitude of disorders including; bronchitis, leprosy, blood disorders, heart troubles, thirst, asthma, fever, vomiting, loss of memory, leucoderma, jaundice, tumors, mouth troubles, sore-eye, fever, and gonorrhea. Adhatoda vasica is useful in treating bronchitis, tuberculosis and other lung and bronchiole disorders. A decoction of the leaves of Vasaka may be used to help with cough and other symptoms of colds. The soothing action helps irritation in the throat and the expectorant will help loosen phlegm deposits in the airway. A poultice of the leaves of Vasaka may be applied to wounds for their antibacterial and anti-inflammatory properties. The poultice is also helpful in relieving rheumatic symptoms when applied to joints. Vasaka has been used to control both internal and external bleeding such as peptic ulcers, piles and bleeding gums. Vasaka exhibits antispasmodic, expectorant and blood purifying qualities. Adhatoda Vasaka is a very well known remedy available everywhere and it is especially popular in rural areas. The plant has pungent and astringent taste.

It is cold in action. It normalizes kapha and pitta and improves the voice. It is useful in ridding the patient of coughing and asthma and can be given as a cure in any disease with which these symptoms are associated. It is beneficial to the tuberculosis patient. Vasaka’s special virtue is stopping bleeding due to the aggravation of pitta, through the mouth, nose, genitals, or the urinary systems. The leaves are dampened and then pounded, and one teaspoon of the resultant juice is useful in cases of chronic bronchitis, asthma and tuberculosis. This is not to say that it always cures all these diseases but it does give immediate relief (Murugesamudhaliyar, 1998). Being a very
good expectorant, it draws out all kapha (phlegm) accumulated in the lungs. In many cases where bronchitis is due to lack of appetite and poor digestion, the juice of Vasaka is mixed with the juice of ginger and honey and given in the early morning on an empty stomach. Given in the early stages of tuberculosis, the juice of Vasaka, thrice a day, helps a patient who is prone to incessant coughing.

**Figure 7: Entire plant of *Adathoda vasica* Nees**

A. **Separate leaf of *Adathoda vasica* Nees**
3.1.2 PLANT PROFILE (Ocimum tenuiflorum Linn)

Botanical Source : Ocimum tenuiflorum Linn
Family : Lamiaceae
Synonyms : Ocimum hirsutum, Ocimum tomentosum, Ocimum virde, Ocimum sanctum.
Parts Used : Whole plant

Taxonomic classification

Kingdom : Plantae
Class : Magnoliopsida
Order : Lamiales
Family : Lamiaceae
Genus : Ocimum
Species : Ocimum tenuiflorum

Vernacular Names (Prajapati et al., 2007)

Sanskrit : Surasah, Tulasi
Hindi : Kalatulasi, Tulsi
Kannda : Karitulasi
Malayalam : Krsnattulasi, Tulasi, Trttavu, Karuttatrttavu
English : Holybasil, Sacred basil
Tamil : Karuttulaci, Tulaci
Telugu : Tulasi

Distribution

Throughout India as well as cultivated

Description of plant (Prajapati et al., 2007)

An erect much branched softly pubescent undershrub, 30-60cm high with red or purple subquaruangular branches; leaves simple, opposite, elliptic, oblong, obtuse or acute, entire, serrate or dentate, pubescent on both sides, minutely gland dotted, petioles slender, hairy; flowers purplish in elongate racemes in close whorls, stamens exserted, upper pair with a small bearded appendage at the base; fruits nutlets, smooth, not mucilaginous when wetted.

~ 30 ~
Habit

An erect herbaceous, much-branched, softly hairy annual.

Other Species (Nadkarni, 1982)

*Ocimum americanum,*
*Ocimum basilicum*
*Ocimum campechianum*
*Ocimum fruticosum*
*Ocimum gratissimum*
*Ocimum kilimandscharicum*
*Ocimum tenuiflorum*

Chemical Constituents


Traditional Medicinal Uses

In Siddha the plant is used for stomachic, cholagogue, anthelmintic, antipyretic, asthma, bronchitis, vomiting, foul smells, pains, hiccough, prulent discharge of the ear. The plant is having bitter taste and pungent odour (Murugesan mudaliyar, 1998). The roots are given in decoction as a diaphoretic in malarial fevers. The leaves have expectorant properties, and their juice is used in catarrh and bronchitis. This preparation also applied to ring worm, and other cutaneous skin diseases (Nadkarni, 1982). The fresh roots are ground with water and applied to the stings of wasps and bees and the bites of worms and leeches. A decoction of leaves is used in Indian homes to cure common colds; seeds are useful in complaints of urinary system. Decoction of root is given for malarial fever to bring about sweating (Ahmed, 2010). *The Ayurvedic Pharmacopoeia of India* recommends the use of the leaf and seed in rhinitis and influenza; the seed is used in psychological disorders, including fear-psychosis and obsessions. Tulasi extracts are used in ayurvedic remedies for a variety of ailments. Traditionally, Tulasi is taken in many forms: as herbal tea, dried powder, fresh leaf or mixed with ghee. Karpoora tulasi is
mostly used for medicinal purposes and in herbal cosmetics, and is widely used in skin preparations and for fever, colds and infections.

Figure 8: Entire plant of *Ocimumtenuiflorum* Linn

![Entire plant of Ocimumtenuiflorum Linn](image)

A. Separate leaf of *Ocimumtenuiflorum* Linn

![Separate leaf of Ocimumtenuiflorum Linn](image)
3.1.3 PLANT PROFILE (*Solanum xanthocarpum* Schrad. & Wendl)

Botanical Source: *Solanum xanthocarpum* Schrad. & Wendl.

Family: Solanaceae

Synonyms: *Solanum surattense* Burm.f.; *Solanum maccanni* Sant.; *Solanum virginianum* Linn (Joshi, 2007)

Parts Used: Whole plant.

**Taxonomic classification**

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Asteridae
- Order: Solanales
- Family: Solanaceae
- Genus: *Solanum*
- Species: *Solanum xanthocarpum*

**Vernacular Names** (Prajapati et al., 2007)

- Sanskrit: Kantakari, Nidigdhika
- Hindi: Remgani
- Kannda: Nelagulle
- Malayalam: Kantakariccunta, Kantankattiri
- English: Yellow – berried nightshade
- Tamil: Kantankattiri
- Telugu: Callamulaga, Pinnamulaka, Vakuda

**Distribution** (Prajapati et al., 2007)

Throughout India, and in dry situation as a weed on road side and in waste land.

**Description of plant**

A prickly, diffuse bright green, perennial under shrub, woody at the base, with zigzag branches that spread close to the ground covered over with strong, broad, sharp, compressed, straight, yellowish white prickles; leaves ovate, stellately hairy on both
sides, armed on the mid rib and the nerves with long yellow sharp prickles; flowers blue or bluish – purple, in extra axillary cymes; fruits glabrous, glandular drooping berry, yellow or white with green veins, surrounded by the calyx; seeds many, small, reniform, smooth and yellowish brown.

**Habit**

A perennial herb with prickly prostrate.

**Other Species** (Nadkarni, 1982)

- *Solanum aviculare*
- *Solanum capsicastrum*
- *Solanum crispum*
- *Solanum laciniatum*
- *Solanum laxum*
- *Solanum pseudocapsicum*
- *Solanum rantonnetii*

**Chemical Constituents** (Prajapati et al., 2007)

Carpesteral, Gluco-alkaloids, Solasodine, Solasonine, and Solanocarpine. Solanine on hydrolysis yields alkaloid and Solanidine.

**Traditional Medicinal Uses**

The plant is having astringent, stimulant, diuretic, pungent, bitter, digestive, expectorant, febrifuge, and laxative. In Siddha it is used in fever, cough, asthma, bronchitis, influenza, enteric fever and allergic conditions. A decoction of plant is used in gonorrhea. It promotes conception in females. The juice in combination with black pepper is prescribed in rheumatism. Stems flowers and fruits having bitter and carminative and are prescribed in burning of feet (Murugesar mudhalayar, 1998). In the Ayurveda, plant is described as pungent, bitter, digestive, and astringent. Stems, flowers, and fruits are bitter. Root decoction is used as febrifuge, diuretic, and expectorant (Vadnere et al., 2008). Charaka and Sushruta used the extract of entire plant and fruits in internal prescription for bronchial asthma, tympanitis, misperistalsis, piles, and dysuria and for rejuvenation. Kantkari Ghrita of Charaka is specific for cough and asthma. Lincture prepared from the stamens of flowers is prescribed for chronic cough in children (Khare, 1995). The whole
plant is used traditionally for curing various ailments. Decoction of the plant is used in gonorrhea; paste of leaves is applied to relieve pains; seeds act as expectorant in cough and asthma; roots are expectorant and diuretic, useful in the treatment of catarrhal fever, cough, asthma and chest pain (Ghani, 1998). The plant is also known to have pest repellent properties and used as a contact poison and mollusicide. Roots are one of the constituents of well known Ayurvedic preparation “Dasmul Asava” and used as an expectorant, cough, asthma, and chest pain in Ayurvedic medicine (Khare, 1995).

**Figure 9: Entire plant of *Solanum xanthocarpum* Schrad. & Wendl**

![Entire plant of *Solanum xanthocarpum* Schrad. & Wendl](image)

**A. Stem, Leaves, Fruit, Root of *Solanum xanthocarpum* Schrad. & Wendl**

![Stem, Leaves, Fruit, Root of *Solanum xanthocarpum* Schrad. & Wendl](image)
3.1.4 PLANT PROFILE(*Tylophora indica* (Burm.f.) Merrill)

- **Botanical Source**: *Tylophora indica* (Burm.f.) Merrill.
- **Family**: Asclepiadaceae
- **Synonyms**: *Tylophora asthmatica* W & A.; *Asclepias asthmatica* Linn.f.; *Cynanchum indicum* Brum.f (Joshi, 2007)
- **Parts Used**: Leaves and Root

**Taxonomic classification**

- **Kingdom**: Plantae
- **Subkingdom**: Angiosperms
- **Division**: Eudicots
- **Class**: Asterids
- **Order**: Gentianales
- **Family**: Gentianales
- **Subfamily**: Asclepiadaceae
- **Genus**: *Tylophora*
- **Species**: *Tylophora Indica*

**Vernacular Names** (Prajapati *et al.*, 2007)

- **Sanskrit**: Lataksiri
- **Hindi**: Jamgli pikvam
- **Kannda**: Nipaladaberu
- **Malayalam**: Vallippala
- **English**: Emetic swallow-wory, Country ipeacacuanha
- **Tamil**: Naippalai, Nancaruppan
- **Telugu**: Vettipala, Verripala, Tellayadala

**Distribution**

Konkan, Maharastra, Bengal, Assam forests.

**Description of plant**

A slender, much branched, tough lacticiferous climber with long fleshy, knotty roots; leaves simple, opposite, somewhat fleshy, ovate to orbicular, cordate, often apiculate, glabrous, acute or acuminate, more or less pubescent; flowers in umbels,
greenish yellow outside, purplish, pedicels filiform with hairy bracts at their base; fruits fusiform, glabrous, follicles tapering to a fine point at the apex; seeds ovate with long coma.

**Habit**

A twining perennial.

**Other Species (Nadkarni, 1982)**

*Tylophora arenicola*

*Tylophora astephanoides*

*Tylophora augustiniana*

*Tylophora barbata*

*Tylophora benthamii*

*Tylophora brownii*

*Tylophora urceolata*

**Chemical Constituents**

Contains three alkaloids A,B and C, Alkaloid B is desmethyl tylophorine and Alkaloid C is desmethy tylophorinine. Alkaloid A is not identified.

**Leaves**

The leaves contain α – amyrin, tylophorine, kaempterol and quercetin.

**Traditional Medicinal Uses**

In Siddha leaves are used for emetic and expectorant. A decotion of the leaves and root bark were used in dysentery, asthma, bronchitis. It is used as a substitute for Ipecacuanha. Root powder is given in dysentery or diarrhea even in earliest stages of fever (Kannusamy pillai, 2010). The plant has been traditionally used as a folk remedy in certain regions of India for the treatment of bronchial asthma, bronchitis, rheumatism, and dermatitis. In the latter half of 19th century, it was called Indian *Ipecacuanha*, as the roots of the plant have often been employed as an effective substitute for *Ipecac*. Its use to induce vomiting led to the inclusion of *Tylophora* in Bengal Pharmacopoeia of 1884. The dried leaves are emetic, diaphoretic and expectorant, useful in over-loaded states of the stomach and other cases requiring the use of emetics. It has also been found useful in
Figure 10: Entire plant of *Tylophora indica* (Burm.f.) Merrill

A. Separate leaf of *Tylophora indica* (Burm.f.) Merrill

...dysentery, catarrh, and other affections in which *Ipecacuanha* has been employed. It may be regarded as one of the best indigenous substitutes for *Ipecacuanha*. These historical and laboratory findings have been supported by several human clinical trials using differing preparations of *Tylophora*, including the crude leaf, tincture, and capsule. One
clinical trial with asthmatic patients, found that *Tylophora* leaf chewed and swallowed daily in the early morning for six days led to moderate or complete relief of asthma symptoms. Patients using *Tylophora* may experience temporary nausea and vomiting, soreness of the mouth, and loss of taste for salt, particularly with the fresh leaf and tincture. The safety of its usage during pregnancy and breast-feeding has not been established. In Homoeopathy, the leaves are used for preparation of mother tincture.
PHYTOCHEMICAL REVIEW

- **Anonymous, (1996)** reported that the Leaves have been found to be a rich source of alkaloids of which vasicine and vasicinone are bioactive. A non-nitrogenous neutral principle, vasakin, vasicinone, two new quinazoline alkaloids, one of which was named as adhvasinone and two new pyrroloquinazoline alkaloids, desmethoxyaniflorine and 7-methoxyvasicinone were identified from the ethanolic extract of the leaves.

- **Golshahi et al., (2011)** reported that tulsai contain some of the main chemical constituents of are: oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, β-caryophyllene (about 8%), β-elemene (c.11.0%), and germacrene D (about 2%).

- **Ahmed et al., (2012)** investigated and reported tulasi contains b-bisabolene (13-20%), methyl chavicol (3-19%), 1,8-cineole (9-33%), eugenol (4-9%), (E)-a-bisabolene (4-7%) and a-terpineol (1.7-7%) are the main constituents of tulsi.

- **Prakash et al., (2005)** have been identified Holy Basil contain numerous constituents of: eugenol, cinnamyl acetate, and beta-elemene. Extraction of the fresh leaves and stems of Ocimum sanctum yielded the following compounds: cirsimaritin, isothymusin, isothymonin, apigenin, rosmarinic acid, and appreciable quantities of eugenol.

- **Samudralwar and Garg, (1996)** have been found and reported that, polysaccharides along with flavonoids, including orientin and vicenin. Holy Basil also includes trace levels of zinc and other minerals, ursolic acid and at least five fatty acids (stearic, palmitic, oleic, linoleic and linolenic acids).

- **Josekutty, (1998)** showed that the fruits of Solanum xanthocarpum contain alkaloid saponins which can be extracted in alcohol and have a heart-stimulating function.

- **Saiyad and Kangra, (1936); Sato & Latham, (1953)** carried out different studies on this plant and demonstrated the isolation of solasonine and solasodine.

- **Heble et al., (1968)** carried out different studies on this plant and demonstrated the isolation of β-sitosterol and carpesterol.
Gupta and Dutt, (1938) reported the study of the fruits and showed that fruits contained 20.71% of dry seeds, 4.62% of pericarp and 74.67 percent of moisture. The powdered seeds yielded 19% of greenish-yellow oil which did not contain nitrogen or sulphur. The composition of the oil was calculated as oleic acid, 42.93; linolic acid, 36.18; palmitic acid, 5.37; steric acid, 9.77; arachidic acid, 0.35, and unsaponifiable matter, 1.2 percent. The berries are the main source of solasodine and diosgenin. Solasodine is N-analogue of diosgenin and used as a steroidal precursor in the steroid drug industry for the manufacture of corticosteroids, antifertility drugs, anabolic steroids etc. It is present in the form of a glycoside in most of the berries of the plant belonging to the genus

Bector & Puri, (1971) reported that solanum and the glycoalkaloids are variously known as solasonine, solamargine etc. with the common spiro aminoketal alkaloid or aglycon namely solasodine. Solanum xanthocarpum has a high concentration of solasodine alkaloid, a spiroketal alkaloid sapogenin with a heterocyclic nitrogen atom, which is the alkaloid sapogenin with a heterocyclic nitrogen atom.

Asolkar and Chadha, (1979) investigated and reported that solasodine content of the berries of Solanum xanthocarpum is to vary from 1.1% to 4.6% depending apparently on climatic and soil conditions. The solasodine content of the unripe berries was 1.7% (on dry weight basis) as against 0.75% noted for the ripe berries.

Emmanuel et al., (2006) reported satisfactory content of solasodine (0.84%) in the plant. Further, they reported that the control of temperature, time of extraction and concentration of hydrochloric acid has some influence on the percentage recovery of solasodine. They also mentioned that the temperature should be low throughout the process of isolation of solasodine as overheating may affect actual recovery of solasodine.

Heble et al., (1968) reported the isolation and identification of 31-sitosterol and diosgenin from callus tissues of Solanum xanthocarpum. Chemical examination of Solanum xanthocarpum berries also resulted in the isolation of diosgenin. They concluded that the tissue cultures of Solanum xanthocarpum have yielded 31 sitosterol.

Saiyed and Kanga, (1936) isolated the substance carpesterol along with a steroidal alkaloid glycoside. Carpesterol was the first compound isolated from the
lipid fraction of plant and it was hoped that a structural knowledge of carpesterol would shed some light on the biogenetic pathway leading to solasodine, which is the major alkaloid accompanying carpesterol in Solanum xanthocarpum and commonly found among many other solanum species.

- **Sato & Latham, (1953) ; Beisler & Sato, (1971)** Subsequently investigated the extracts of Solanum xanthocarpum and confirmed the presence of diosgenin and 13-sitosterol.

- **Chungath and Nair, (1989)** reported the variation in the solasodine content, at different stages of fruit maturity viz. berries when green in color and color changing from green to yellow. It was concluded that the berries of Solanum xanthocarpum in the initial stages of fruit development are very small, green in color with white blotched stripes. On growing, it develops yellow color which signifies the beginning of ripening. On ripening it attains yellow color. Berries on further standing in the plant becomes deep yellow in color, at which stage the stalk through which the berries are attached turns brown in color from the original green. During fruit development or maturity, an associated change in the steroidal glycoalkaloid content and therefore, in the steroidal alkaloid content has been reported. They used colorimetric method for the determination of the solasodine content. Solasodine forms yellow colored complex with methyl orange and is extractable in chloroform and gives maximum absorbance at 425 nm. It was shown that, the berries collected during various months from the same area differed in the solasodine content. The greatest amount of solasodine was present when berries were yellow in color (i.e. when the berries were ripe).

- **Kusano & Takemoto, (1975)** carried chemical examination from the fruit extract of Solanum xanthocarpum, and identified cycloartanol, sitosterol, stigmasterol, campesterol, cholesterol, sitosteryl glucoside, stigmasteryl glucoside, solamargine, and 3-solamargine.

- **Saiyed and Kanga,(1936)** carried out chemical examinations of berries of Solanum xanthocarpum were initially done by which led to the isolation of glycoalkaloid solasonine

- **Gupta & Dutt, (1938)** carried out chemical examination of the fruits and reported to contain several steroidal alkaloids like solanacarpine.
- Siddique et al., (1983) carried out chemical examination of the fruits and reported to contain several steroidal alkaloids like solamargine and caffeic acid.

- Tupkari et al., (1972) carried out chemical examination of the fruits and reported to contain several steroidal alkaloids like coumarins like aesculetin and aesculin.

- Sato & Latham, (1953) carried out chemical examination of the fruits and reported to contain several steroidal alkaloids like steroids carpesterol, diosgenin, campsterol, daucosterol, and triterpenes like cycloartanol.

- Gupta, (2003) reported satisfactory that the leaves and roots of the plant contain 0.2-0.46 % therapeutically important alkaloids viz. tylophorine, tylophorinine and tylophorinidine. desmethyltylophorine, desmethyltylophorinine, desmethyltylophoridine, anhydrous dehydrotylo-phorinine Apart from these, some rare alkaloids namely tyloindicines H, I and J, desmethyltylophorine, desmethyltylophorinine, isoylocrebrine, 4, 6- desmethylisodroxy-o-Methyltylophorinindine.

- Gupta et al., (2010) Reported the non-alkaloidal compounds isolated from Tylophora indica are kaempferol, quercetin, α- and β- amyrins, tetratriacontanol, octaosanyl octacosanoate, sigmasterol, β-sitosetrol, tyloindane, cetyl-alcohol, wax, resin, couotchone, pigments, tannins, glucose, calcium salts, potassium chloride, quercetin and kaempferol.
PHARMACOLOGICAL REVIEW

- **Inamdar et al., (1960)** Studied that the petroleum ether extract of the leaves 50mg/kg bw i.p. and i.v showed Bronchodilator activity.

- **Amin and Mehta, (1959); Gupta et al., (1977)** studied that Vasicinone isolated from the leaves had a bronchodilator action. Vasicine showed bronchodilator activity in both in vivo and in vitro experimental studies.

- **Dhuley, (1999)** carried out experimental models in the plant extract and evaluated for antitussive activity.

- **Inderjit Kaur et al., (2012)** studied on antioxidant and antimicrobial activity of aqueous and methanolic extracts of *Adhatoda vasica* were evaluated against the bacteria isolated from the sputum samples of asthmatic patients. From antioxidant study the SOD activity was observed to maximum in methanolic extract as compared to aqueous extract of *Adhatoda vasica*. Among the two extracts of *Adhatoda vasica*, the highest activity of catalase was observed in aqueous extract and lowest in methanolic extract. *Adhatoda vasica* showed a broad spectrum of antibacterial activities against Gram-positive (*Staphylococcus aureus* and *Streptococcus pneumoniae*) bacterial species in comparison to the Gram-negative (*E.coli and Klebsiella pneumoniae*) bacterial species. On the basis of the results obtained in the present study, they concluded that the aqueous and methanolic extract of *Adhatoda vasica* has significant amounts of antioxidant and antimicrobial agents.

- **Sunita Singh et al., (2012)** studied on various pharmacological activity of *Adhatoda vasica* such as antispasmodic, fever reducer, anti-inflammatory, anti-bleeding, bronchodilator, antidiabetic, disinfectant, anti-jaundice, oxytocin and expectorant. Phytochemical analysis of its leaf extracts shows the presence of alkaloids, sugar, tannins, sterols, phenols and flavonoids. The extracts were chemically analysed for glycosides, saponin, proteins and amino acids also. The Rf values of vasicine and vasicinone were found as 0.54 and 0.62 by detecting under ultraviolet light at wavelength of 254 nm.

- **Sawant et al., (2013)** studied on the antimicrobial activity of alcoholic extracts and alkaloids extracted from this plant *Adhatoda vasica*. The hot and cold Methanolic extracts of *Adhatoda vasica* and alkaloids isolated from the hot
methanolic extract, were evaluated for antimicrobial activity against clinically important bacteria such as *Staphylococcus aureus* ATCC 25923, *Staphylococcus aureus* NTCC 3750, *Escherichia coli* ATCC 25922, *Proteus mirabilis*, a Clinical isolate, *Salmonella typhi* NTCC 786, *Pseudomonas aeruginosa* ATCC 27853, *Candida albicans* MTCC 183 and *Cryptococcus neoformans* NCIM 3542. In vitro antimicrobial activity was performed using agar cup diffusion method. Both the (hot and cold) methanolic extracts of *Adhatoda vasica* were found to be active only against *S. aureus* and *P. aeruginosa*, but alkaloids isolated from these extracts’ exhibited excellent antimicrobial activity against organisms investigated.

- **Meignanalakshmi S et al., (2013)** carried out a study to evaluate the antimicrobial activity of aqueous and methanol extracts of *Adhatoda vasica* against mastitis pathogens. The methanol extract was found to be having significant antibacterial activity against *Staphylococcus aureus*, *Streptococcus agalactiae*, *Klebsiella pneumonia*, *Streptococcus dysgalactiae* and *Escherichia coli* with zone of inhibition 21.7±0.58 mm, 18.3±0.58mm, 21.3±0.58, 18.3±0.58 and 28.3±0.58mm respectively at 200 mg/ml concentration.

- **Subhashini S et al., (2011)** carried out investigations on the phytochemical activities and wound healing properties of *Adhatoda vasica* leave in Swiss albino mice. The present study demonstrated that the aerial parts of *Adhatoda vasica* promote wound healing activity in mice as a preclinical study.

- **Raageeva Bimal and Shahnawaz, (2012)** established the protocol for single step proliferation of 14±2 shoots in the presence of CW + BAP on MS nutrient medium which seems to be the highest number of shoots produced per node in vitro and has the potential for clonal propagation of *A. vasica*.

- **Pant Mamta et al., (2012)** carried out a study on anti-oxidant activity and cytoprotective potential of ethanolic extract of *Adhatoda vasica*. On the basis of the results obtained in the present study, it can be concluded that an ethanolic extract of *A. vasica* leaf powder exhibits high antioxidant and free radical scavenging activities which may be accounted for the high phenolics and flavonoids content.

- **Prasannabalaji et al., (2012)** evaluated the in vitro antibacterial activity of various solvent extracts of South Indian traditional medicinal plants *Ocimum*
sanctum, Ocimum gratissimum, Aegle marmelos, and Adhatoda vasica. The result demonstrated that the Indian traditional medicinal plants Ocimum sanctum, Ocimum gratissimum, Aegle marmelos methanol leaf extract has potent antibacterial activity and the studied plants may be new source for novel antibacterial compound discovery for treating drugs resistant human pathogens.

Mohammad Shahriar, (2013) carried out a study on phytochemical screenings and thrombolytic activity of the leaf extracts of Adhatoda vasica. Based on the results he concluded that the extracts of the Adhatoda vasica can be used to design different as thrombolytic agent and further work is needed to isolate the secondary metabolites of this extracts. This in vitro study demonstrated that folk medicine can be as effective as modern medicine to combat pathogenic microorganisms. The use of these plants in folk medicine suggests that they represent an economic and safe alternative to treat infectious diseases.

Shalini Bandi and Vasundhara, (2012) described a cost effective and environment friendly technique for green synthesis of silver nanoparticles from 1mM AgNO3 solution through the Methanolic extract of Adhatoda vasica as reducing as well as capping agent. Nanoparticles were characterized using UV– Vis absorption spectrophotometry, FTIR and SEM. SEM analysis showed the average particle size of 15-20nm as well as spherical to oval in shape. The synthesized nanoparticles shown high DPPD free radical scavenging activity and reducing power activity. Further these biologically synthesized nanoparticles were found to be an anti diabetic agent and highly toxic against different human pathogens.

Jayant, (1999); Bucher, (1958) carried out a study with Adathoda vasica extract produced marked anti tussive activity, comparable to codeine against peripherally induced cough. The extract was 1/20 as active as the opiate in centrally induced cough (by vagus nerve stimulation) in the anaesthetized guinea pigs. Nevertheless in peripherally induced cough model i.e. mechanical stimulation of rabbit tracheal mucosa and electrical stimulation of guinea pig tracheal mucosa, the extracts was 1:10 and 1:4 as active as codeine respectively. These results indicate that oral administration of the extract has a better antitussive activity in peripheral cough model as compared to the central cough model.
Gupta et al., (1978); Chandokhe et al., (1978) carried out the abortifacient effect of vasicine like its uterotonic effect was more marked under the priming influence of oestrogens. Vasicine-induced abortion was studied in rats, guinea pigs, hamsters and rabbits. Study showed that vasicine acted through the release of PGs.

Rao et al., (1982) Synthesized vasicine and vasicinone derivatives in in-vitro studies and were found to have oxytoxic activity at the dose above 1 tg/ml.

Sethi et al., (1987) found that the aqueous solution of the leaves at the dose of 175 mg/kg bw revealed 100 percent abortifacient activity in albino rats.

Bhatt and Panwar, (1990) carried out study on the extract of the plant at 2 per cent concentration level revealed abortifacient activity.

Gupta et al., (1979) was found that Vasicine showed uterotonic activity on human myometrium strips which was in some cases even more marked than that of two known oxytocics, pitocin and methergin. The response of the uterus to drugs depended on its hormonal status.

Grange and Snell, (1996) it was found that bromhexine and ambroxol, the semi-synthetic derivatives of vasicine have activity against Mycobacterium tuberculosis in-vitro Anti tuberculer activity.

Dhar et al., (1968) Hypoglycaemic effect was found in Ethanolic extract of the leaves of Adathoda vasica.

Wakhloo et al., (1980) investigated the safety of use of vasicine in 24 human volunteers using 0.5-16 mg dose of vasicine injected i.v. in 500 ml saline in 3 h with the objective of determining any acute human toxicity, tolerance, pharmacological action, any untoward effect and safe dosage range.

Pahwa et al., (1987) have conducted the chronic toxicity study of Adhatoda vasica in rats (2.5 mg/kg, 5 mg/kg and 10 mg/kg, low dose, 2x ED50, med dose, 4x ED50 and 8x ED50 respectively) and monkeys (5, 10 and 20 mg/kg as above criteria) for 6 months. They reported that, there is no change in mortality rate and body weight. Autopsy and histological examination of major organs did not reveal any abnormality.

Inderjit Kaur et al., (2012) studied on antioxidant and antimicrobial activity of aqueous and methanolic extracts of Adhatoda vasica were evaluated against the
bacteria isolated from the sputum samples of asthmatic patients. From antioxidant study the SOD activity was observed to maximum in methanolic extract as compared to aqueous extract of *Adhatoda vasica*. Among the two extracts of *Adhatoda vasica*, the highest activity of catalase was observed in aqueous extract and lowest in methanolic extract. *Adhatoda vasica* showed a broad spectrum of antibacterial activities against Gram-positive (*Staphylococcus aureus* and *Streptococcus pneumoniae*) bacterial species in comparison to the Gram-negative (*E.coli* and *Klebsiella pneumoniae*) bacterial species. On the basis of the results obtained in the present study, they concluded that the aqueous and methanolic extract of *Adhatoda vasica* has significant amounts of antioxidant and antimicrobial agents.

- **Baby Joseph and Vrundha M. Nair, (2013)** carried out a review on Ethno pharmacological and Phytochemical Aspects of Ocimum sanctum Linn- the Elixir of Life. This review elucidates in depth literature survey particularly focussing the phytochemical constituents of Tulsi as well as extrapolating its Ethno pharmacological proper.

- **Prakash and Neelu gupta, (2005)** carried out a review on therapeutic uses of *ocimum sanctum linn* (tulsi) with a note on eugenol and its pharmacological actions.

- **Govind Pandey and Madhuri S, (2010)** carried out a review to congregate the botanical, phytochemical, ethnomedicinal, pharmacological and toxicological information on *Ocimum sanctum* Linn.

- **Balaji R et al., (2011)** carried out a investigations on antioxidant activity of methanol extract of *Ocimum tenuiflorum*. The present study reveals that the *Ocimum tenuiflorum* leaf extracts have moderate to significant antioxidant activity and free radical scavenging activity than stem extract.

- **Vinod Singh, (2010)** carried out a review on *Ocimum sanctum* for its antibacterial, antioxidant, antiulceric, antimalarial, antidiabetic, anti-inflammatory, antilipidemic, anticancer and immunomodulatory properties. This review also incorporated the description of chemical and bio-pharmacological properties of *Ocimum* species.

- **Khogare, (2011)** carried out a investigations on effect of Tulasi (*Ocimum
Sanctum) on Diabetes mellitus. The present study reveals that tulasi has anti hyperglycemic action which was confirmed by lowering of triglyceride level in serum

- **Rathnayaka, (2013)** carried out investigations on antibacterial activity of *Ocimum Sanctum* Extracts against Four Food-Borne Microbial Pathogens. Based on the results of the study, chloroform extraction was found to be the best extraction method to extract phytochemicals from *Ocimum* leaves. He concluded that, *Ocimum* extracts found to be containing chemical compounds useful in food preservation and development of drugs against food borne microbial pathogens.

- **Kamlesh Chandra Joshi et al., (2013)** carried out a study on *In vitro* anthelmintic activity of *Ocimum sanctum*. They made an attempt to evaluate anthelmintic potential against *Pheretema posthuma* and found that aqueous extract is more potent than ethanolic extract. Aqueous extract at concentration 2, 4 and 10 mg showed paralysis and consequent death of the organism time that was comparable to piperazine at same concentrations.

- **Ramal and Syama Sundar, (2013)** carried out a study on phytochemical constituent and antioxidant activity of extract from the leaves of *Ocimum sanctum* green and purple. In this study the phenols, flavonoids and antioxidants of green and purple were rich, it showed that green and purple *O.sanctum* could be sources of natural antioxidants and phenolic compounds but purple variety had little more effective. These findings showed that the rich content of phenols and antioxidants of *Ocimum sanctum* green and purple may responsible for a large number of pharmacological activities.

- **Prasad et al., (2012)** carried out a study on antibacterial activity of *ocimum* species and their phytochemical and antioxidant potential. In this study methanol extracts from the leaves of *Ocimum species* (*O. sanctum purple, O. sanctum green, O. gratissimum, O. basilicum and Camphor basil*) were investigated for their phytochemical constituent and antioxidant activity. The results of this study suggested that the phyto-chemical content and its antioxidant properties can be further studied for its application in health and in food industries. Furthermore, these species can be used as a source of novel drugs for the treatment of infectious diseases caused by pathogenic microorganisms.
Mamta et al., (2010) carried out a study on ameliorating effect of tulsi (Ocimum sanctum) leaf powder on pathology of Salmonella gallinarum infection in broiler chickens. Based upon this study investigation, they can be concluded that Tulsi dry leaf powder had protective effects on pathology of experimental S. gallinarum infection in broiler chickens as evident from reduced severity of gross and histopathological lesions in chicks fed Tulsi leaves and inoculated with S. gallinarum.

Maity et al., (2000) studied the effect Ocimum sanctum, on mouse swimming performance in a methanol extract, obtained from the roots of were studied using three different doses. On the basis of he has found, a high dose (400 mg/kg, i.p.) of the extracts of Ocimum sanctum increased the swimming time suggesting a central nervous system stimulant and/or antistress activity. The effect produced by the extract was comparable to that of desipramine, an antidepressant drug.

Shetty et al., (2006) proved chewing tulsi leaves relieves cold and flu. During the rainy season, when malaria and dengue fever are widely prevalent, tender leaves, boiled with tea, act as preventive against these diseases. In case of acute fevers, a decoction of the leaves boiled with powdered cardamom in half a liter of water and mixed with sugar and milk brings down the temperature. Water boiled with basil leaves can be taken as drink in case of sore throat. This water can also be used as a gargle. Evaluated A decoction of the leaves, with honey and ginger is an effective remedy for bronchitis, asthma, influenza, cough and cold.

Khanna et al., (2003) proved the alcoholic leaf extract of Ocimum sanctum was tested for analgesic activity in mice. In the glacial acetic acid (GAA)-induced writhing test, OS (50, 100 mg/kg, i.p.; and 50, 100, 200 mg/kg, p.o.) reduced the number of writhes. OS (50, 100 mg/kg, i.p.) also increased the tail withdrawal latency in mice. Naloxone (1 mg/kg, i.p.), an opioid antagonist, and DSP-4 (50 mg/kg, i.p.), a central noradrenaline depletor, attenuated the analgesic effect of OS in both the experimental models, whereas, PCPA (300 mg/kg, i.p.), a serotonin synthesis inhibitor, potentiated the action of OS on tail flick response in mice.

lining and increases the protection of protective stomach. Antimicrobial effect inhibits growth of \textit{E.coli}. Enhances the digestion and absorption. Lowers the stress induced release of adrenal hormones. Antiaging effect. Reduces the asthmatic and other allergic reactions. Antiviral effect is seen especially in viral hepatitis and AIDS virus.

- **Biswas et al., (2005)** studied Improves the metabolic breakdown and elimination of dangerous chemicals in the blood hence also acts as liver protective. Used in Eczema and treatment of malaria. Used in treating bronchial asthma- As it has bronchodilatory action and expectorant action.

- **Nadig et al., (2005)** studied anti-tussive activity of \textit{Ocimum sanctum} Linn in guinea pigs. Once material comes in contact with ciliated epithelium, it is transported by ciliary beating towards the trachea where there is the highest density of cough receptors.

- **Pratibha et al., (2005)** studied \textit{Ocimum sanctum} Linn traditionally, the fresh fruit and leaf juice were commonly used in the treatment of cough as demulcent, mild upper respiratory tract infection, general stress syndrome, worm infestations, superficial fungal infections, and also as a diuretic. This plant has been evaluated pharmacologically for immunomodulatory, antistress, antimicrobial, anti-inflammatory antiasthmatic, hypoglycemic, hypotensive and analgesic activities and found to be effective in varying degrees in the animal models.

- **Friedman et al., (2003)** showed estrogenic activity of solanidine in an \textit{in vitro} assay

- **Emmanuel et al., (2006)** studies revealed anti-inflammatory activity of solasodine against carrageenan-induced paw edema in rats. Solasodine showed significant reduction of the inflammatory reaction.

- **Mohan et al., (2007)** carried a pilot study on the clinical efficacy of \textit{Solanum xanthocarpum} and \textit{Solanum triobatum} in bronchial asthma proved the significant use of herbs in treatment of asthma.

- **Vadnere et al., (2008)** studied effects of \textit{Solanum xanthocarpum} flower extract on some of the parameters like smooth muscle relaxation, and antagonism of asthma mediators such as histamine and eosinophils, which seemed to be prominent in pathophysiology of asthma. Further, they showed that ethanol extract
of Solanum xanthocarpum revealed a significant antihistaminic activity in histamine-induced contraction in goat tracheal chain preparation. This indicates that the Solanum xanthocarpum flower has antihistaminic (H1 receptor antagonist) action. Also, ethanolic extract of Solanum xanthocarpum has been shown to reduce milk-induced eosinophilia.

- Nadkarni, (1954) reported Solanum xanthocarpum is widely used by practitioners of the Siddha system of medicine in southern India to treat respiratory diseases. The powder of whole dried plant or a decoction is used for this purpose.

- Govindan et al., (1999) showed that treatment with Solanum xanthocarpum improved the pulmonary functions to a significant level in patients suffering from mild to moderate asthma. Subjective relief from asthmatic symptoms was reported by the patients an hour after administration of Solanum xanthocarpum powder.

- Davies, (1990) reported that the effect lasted for about 6–8 hr; however, responses observed were apparently less when compared to that of deriphilline or salbutamol. The dose of Solanum xanthocarpum was well tolerated and no untoward effects were reported. It was suggested that relief from the symptoms of bronchial asthma produced by Solanum xanthocarpum may be due to: (a) a direct bronchodilator effect, (b) reduction in the bronchial mucosal edema, and/or (c) reduction in the secretions within the airway lumen. Kondh tribes of Dhenkanal district of Orissa, India use the hot aqueous extract of the matured fruits as a traditional medicine for the treatment of diabetes mellitus.

- Kar et al., (1996) reported the hypoglycemic activity of the aqueous extract of the fruits of Solanum xanthocarpum.

- Gupta et al., (2005) studied on the aqueous extract that showed significant hypoglycemic effect in both normal and streptozotocin induced diabetic rats. The activity was comparable to that of standard oral hypoglycemic agent glibenclamide. The results indicated that Solanum xanthocarpum exhibited a potent blood glucose lowering property both in normal and streptozotocin induced diabetic rats. The LD50 of the extract was found to be high indicating high margin of safety.

- Najmi et al., (2005) investigated the DPPH-free radical scavenging, hepatoprotective and antioxidant activity of Jigrine against galactosamine-induced...
hepatotoxicity in rats.

- **Pasnani, (1988)** postulated that Abana, a polyherbal formulation containing *Solanum xanthocarpum*, causes: (i) A direct sensitization of the atrium through an increase in permeability to Ca$^{2+}$ and (ii) down regulation of adrenoceptors.

- **Mohan et al., (2006)** reported the larvicidal potential of crude extracts of *Solanum xanthocarpum* and suggested its suitability as an ecofriendly, effective larvicide in the management of mosquito populations and in limiting the outbreak of various vector borne epidemics.

- **Singh & Bansal, (2003)** reported that the plant has been used in the various fields of pest management.

- **Rajkumar & Jebanesan, (2005)** reported that the fruit extracts of *Solanum xanthocarpum* revealed larvicidal activity against *An. stephensi* and *Cx. Quinquefasciatus* and one culicine species *Aeges aegypti*.

- **Mohan et al., (2006)** investigated that volatile oil obtained from *Solanum xanthocarpum* exhibited repellency against mosquito *Cx. quinquefasciatus* at a very lower concentration. The root extract is also effective against anopheline and culicine mosquito species, though at higher concentrations in comparison to fruit extract

- **Dixit and Gupta, (1982)** reported antiandrogenic activity of solasodine.

- **Dixit, (1986)** reported further study showed antifertility effects of solasodine in male rats and dogs Carpesterol and four steroidal glycosides isolated from methanol extract of *Solanum xanthocarpum* fruits exhibited inhibitory effects on the radial growth of *Aspergillus niger* and *Trichoderma viride*.

- **Singh & Kaushal, (2007)** showed that methanolic extract from dried fruits of *Solanum xanthocarpum* showed antifungal activity against *A. brassicae*.

- **Shivpuri et al., (1972)** observed a brief exposure of human peripheral leukocytes from asthmatic children to tylophorine (an alkaloid occurring in *Tylophora asthamatica*) caused the stimulation of adenylcylase. This effect was not observed in the leukocytes from the non asthmatic children or adults.

- **Bhavan,(1992)** tested the total alkaloids of *Tylophora indica* for mast cell stabilizing effect I comparision with disodium cromoglycate by challenging
against three different mast cell degranulators, diazoxide, carbachol and polymixinB, in vitro. The results suggest that tylophora alkaloids may have similar mechanism of action disodium cromoglycate through cyclic AMP.

- **Linyi et al., (2006)** carried out the DPPH (1, 1- diphenyl- 2- picrylhydrazyl) radical scavenging activity of methanolic extract of *Tylophora indica* was carried out and it suggested that it may be used as antioxidant.

- **Dhananjayan et al., (1979)** observed the anti-allergic effect of *Tylophora indica* and the compound with that of disodium cromoglycolate on perfused rat lung in sensitized rats by observing the changes in the volume of the perfusate per minute. Administration of aqueous extract of *Tylophora indica* and disodium chromoglycolate during perfusion of sensitized rat lung significantly increased the rate of flow. The action of *Tylophora indica* may be due to direct bronchodilator property and membrane stabilizing and immune-suppressive effects

- **Ahmad Bashir et al., (2009)** carried out a study on biological activities of aerial parts of *Tylophora hirsuta* Wall. In this study, the methanolic extract from the aerial parts of *Tylophora hirsuta* was screened for various in vitro biological activities including antileishmanial, insecticidal, phytotoxicity, general toxicity, antibacterial and antifungal. The extract was found to have significant antileishmanial activity against Leishmania major; reasonable insecticidal activity against L. minor L., low and non-significant antibacterial activity against *Shigella flexenari* and *Bacillus substils*, respectively, and moderate antifungal activity against *Fusarium solani*. No significant general toxicity was observed with the extract at the tested concentrations.

- **Malathi et al., (2011)** carried out a study to evaluate the prevention role of *Tylophora asthamatica* against acetaminophen induced lipid peroxidation in hepatic damage. Based on the evaluation results they found that *Tylophora asthamatica* have significant effect on prevention of Lipid Peroxidation in Acetaminophen Induced Hepato Toxicity in Rats.

- **Jancy Stephen and Vijayammal, (2000)** carried out a study on anti-tumor activity of *Tylophora Asthmatica*. They found that the intraperitoneal injection of PE extract obtained from the powdered entire plant material to the tumor cell transplanted animals arrests the tumor growth and prevents the formation of the
tumor.

- **Singh et al., (2011)** carried out a review on antiasthmatic, anti-allergic, cytotoxic, hepatoprotective and immunomodulator activities of *Tylophora asthmatica*. The review also described the several clinical trials carried out in case of bronchial asthma, chemistry, pharmacology and toxicology of *T. asthmatica*.

- **Ponnanikajamideen et al., (2013)** carried out a research on antibacterial activity of different solvent extracts of *Tylophora asthmatica* (leaves) against different bacterial strains. In this study they prepared the crude extracts using the solvents Benzene, Ethyl acetate and Isopropyl alcohol. And then to analyze the antibacterial activity of the three crude extracts against pathogenic bacteria. Based on the evaluation results they found that ethyl acetate extract showed higher inhibition activity, the remaining two extracts were showed lower inhibition activity.

- **Kumar Sunil and Sharma Priya, (2012)** carried out a review on *Tylophora indica* an Indian Ipecacuahna. They described this plant has longstanding reputation as a remedy for asthma, root or leaf powder is used in diarrhea, dysentery and intermittent fever. This review also focused on emetic, diaphoretic and expectorant properties of *Tylophora indica*. They also mentioned this plant as one of the best indigenous substitute for ipecacuanha, so it was considered as Indian Ipecacuahna since late 19th century.

- **Tarun Chandra Taid et al., (2014)** carried out a study on the medicinal plants used by the local traditional healers of Dhemaji district, Assam, India for curing reproductive health related disorders. Based on the evaluation results they concluded that even though the accessibility of the modern system of medicine for simple and complicated diseases is available, many people in the studied area still continue to depend on medicinal plants, for the treatment of different types of diseases.

- **Rathinavel and Sellathurai, (2010)** carried out a study on in vitro Regeneration and Phytochemical Screening of *Tylophora indica* - an Endangered Medicinal Herb. This study revealed the presence of alkaloids, steroids and carbohydrates both in adult leaf and in vitro derived callus. They concluded that further standardization of hormonal combinations could helpful for large scale
propagation and extraction of drugs for pharmaceutical application.

- **Unnam Nagaraju Chowdary et al., (2013)** carried out a research on phytochemical evaluation of *calotropis gigantea, tylophora indica sarcostemma secommone*. In this study, the, Crude dry powder analysis, ash value, solublility, extractive value, fluorescence analysis, qualitative analysis of phytochemicals and mineral contents of the chosen plants were studied using various solvents.

- **Ashutosh Pathak et al., (2013)** carried out a research for the isolation of DNA from fresh leaf tissue of *Tylophora indica* and *Bacopa monnieri*. The results of this study revealed that the isolated DNA was suitable for carrying out genomic studies.

- **Gupta et al., (2010)** carried out investigations on the methanolic extracts of *Tylophora indica* leaves and screened for hepatoprotective activity in carbon tetrachloride induced hepatotoxicity in albino rats. *Tylophora indica* leaves exhibited significant reduction in serum hepatic enzyme when compared to rats treated with carbon tetrachloride alone.

- **Mujeeb et al., (2009)** studied the hepatoprotective activity of alcoholic (ALLT) and aqueous (AQLT) extracts of leaves of *Tylophora indica* against ethanol-induced hepatotoxicity. Ethanol induced significant changes in physical, biochemical, histological, and functional liver parameters. Pretreatment with ALLT and AQLT extract significantly prevented the physical, biochemical, histological and functional change induced by ethanol in the liver.

- **Nayampalli and Sheth,(1979)** carried out investigation on the flavone fraction from *Tylophora indica* leaves showed significant dose dependent lysosomal enzyme inhibiting activity against adjuvant-induced arthritis at20-50 mg/kg. Flavone fraction showed statistically significant inhibition of arthritis lesions (p<0.05) from day 18, (p<0.025) from day 20 and (p<0.001) from day 21 onwards in the adjuvant-induced arthritis studies which was compared to response of standard drug Indomethacin.

- **Gupta et al., (2010)** were tested the aqueous and alcoholic extracts of *Tylophora indica* leaves for diuretic activity in rats. The aqueous and alcoholic extract of *Tylophora indica* leaves possess good diuretic activity. It is investigated that ethanol is most effective in increasing urinary electrolyte concentration of all the
ions i.e sodium, potassium and chloride followed by chloroform and aqueous extracts while other extracts did not show significant increase in urinary electrolyte concentration.

- **Nadkarni, (1976)** reported Tylophorine not only retards the S-phase progression but also dominantly arrests the cells at G1 phase in HepG2, HONE-1, and NUGC-3 carcinoma cells. Moreover, tylophorine treatment results in down regulated cyclin A2 expression and over expressed cyclin A2 rescues the G1 arrest by tylophorine. Thus, we are the first to report that the down regulated Cyclin A2 plays a vital role in G1 arrest by tylophorine in carcinoma cells.

- **Gopalakrishnan et al., (1979)** observed that the tylophorine had an inhibitory effect on cyclic AMP response elements, activator protein-1 sites, or nuclear factor- kappaB binding site-mediated transcriptions. these analogs a unique class of antitumor compounds that have a mode of action different from known antitumor drugs.

- **Gopalakrishnan et al., (1980)** reported that Polar phenanthrene-based tylophorine derivatives (PBTs) were designed, synthesized and evaluated as potential antitumor agents. The newly synthesized PBTs were evaluated for cytotoxic activity against the A549 human cancer cell line. Among them, N-(2,3-methylenedioxy-6-methoxy-phenanthr-9-ylmethyl)-l-2-piperidinemethanol and N(2,3-methylenedioxy-6-methoxy-phenanthr-9-ylmethyl)-5-aminopentanol showed the highest potency with IC50 values of 0.16 and 0.27 µM, respectively.

- **Reddy et al., (2009)** reported that the hydroalcoholic extract of Tylophora indica (HETI) was screened for experimentally induced myocardial infarction in rats. Albino rats were treated with HETI at doses of 100 mg/kg, (HETI100) or 200 mg/kg (HETI-200) and propranolol 10 mg/kg (PRO-10) for 30 days orally. MI was induced by subcutaneous administration of isoprenaline (IPL) 150 mg/kg for two consecutive days. Pretreatment of animals with PRO-10 and HETI-200 provided significant myocardium protection from IPL damage as indicated by significant decrease in lactate dehydrogenase (LDH) and creatine phosphokinase-MB (CK-MB) activities in serum and an increase in activities of these enzymes in heart tissue homogenate (HTH). HETI in higher doses improves the myocardial recovery from injury induced by IPL.
Wei et al., (2006) reported that Tylophora indica has been used traditionally as a remedy for various anti-inflammatory activities against asthma, bronchitis, bronchial asthma, hay fever and rheumatism. The major alkaloid tylophorine is conceivable to account for the therapeutic efficacies. Anti-inflammatory activity of phenanthroindolizidine alkaloids were examined in an in vitro system mimicking acute inflammation by studying the suppression of lipopolysaccharide (LPS) / interferon (IFN) induced nitric oxide production in RAW264.7 cells. Two of the phenanthroindolizidine alkaloids, tylophorine and ficuseptine-A, exhibited potent suppression of nitric oxide production and did not show significant cytotoxicity to the LPS/IFN stimulated RAW264.7 cells.

Gao et al., (2004) reported that Tylophorine and its analogs have gained attention for drug development and have been proposed to exert antitumor effects in a novel mode of action.

Mao et al., (2009) reported that Tylophorine analogs were found to inhibit the activity of cAMP response elements in HepG2 lung carcinoma cells treated with forskolin, TPA, and TNFα respectively. Tylophorine retarded S-phase progression along with arrest of growth at G1 phase in HepG2, HONE-1 and NUGC-3 in carcinoma cells.

Rao et al., (1997; Rao et al., (2000) reported that another two phenanthroindolizidine alkaloids namely, pergularine and tylophorinidine, were found to inhibit the activity of dihydrofolate reductase and thymidylate synthase, highlighting the mechanism of action for anticancer activity.

Nayampalli and Sheth, (1979) Studies were carried out to elucidate the anti-allergic activity of tylophorine and other related alkaloids. The anti-allergic effect of aqueous extract of Tylophora indica was compared with that of disodium cromoglycate on perfused rat lung in sensitized rats by observing the changes in the volume of the perfusate per minute. Administration of extract intraperitoneally (5 mg/kg) increased the rate of flow from 7.65 to 19.55 ml/min. The action of Tylophora indica may be due to direct bronchodilator property and membrane stabilizing and immuno-suppressive effects.

Gujrati et al., (2007) reported that alcoholic (ALLT) and aqueous (AQLT) extracts of leaves of Tylophora indica were assessed for hepatoprotective activity
in ethanol-induced hepatotoxic rats. Ethanol produced significant changes in physical, biochemical, histological and functional liver parameters but pretreatment with ALLT or AQLT extract significantly prevented all these changes induced by ethanol in the liver. This clearly indicates that both the extracts possessed hepatoprotective activity although it was much higher in the alcoholic extract as compared to aqueous extract.

- **Mujeeb et al., (2009)** reported methanolic extract of *T. indica* leaves was also screened for hepatoprotective activity in carbon tetrachloride induced hepatotoxic albino rats. Significant reduction in serum hepatic enzymes was observed when compared to rats treated with carbon tetrachloride alone.

- **Ganguly et al., (2001)** claimed Immunomodulatory activity of *Tylophora* alkaloids were studied in *in vivo* systems. Crude extract of the leaves of *Tylophora indica* inhibited delayed hypersensitivity reaction to sheep red blood cells in rats when the alkaloid mixture was administered before and after immunization with these cells. The alkaloid mixture also inhibited contact sensitivity to dinitro-fluorobenzene in mice when given prior to or after contact sensitization.

- **Raina and Rain, (1980)** showed Antibacterial activity of ethyl acetate and methanol extracts of plant was investigated by well-diffusion method against bacterial pathogens associated with HIV. The plant extracts showed better inhibitory activity against the tested organisms. Methanolic leaf extract of *Tylophora indica* showed highest inhibitory activity. The activity showed against the *Klebsiella pneumoniae*, *Escherihcia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Salmonella typhi* known to be found among the HIV patients.