LITERATURE REVIEW

2.1. *Leonotis nepetaefolia*

The plant is also known *Granthiparni* or *Granthika* in Ayurveda. *L. nepetaefolia* is known to be native to tropical Africa and southern India. In South Africa and West Indies it is known as *Klip Dagga, Lion's ear, Christmas* and *candlestick. L. nepetaefolia* is known in Trinidad as *shandilay* and the leaves are brewed as a tea for fever, coughs, womb prolapse and malaria [155].

Herb is stout (1.2 -1.8 m high), erect, woody and deciduous. Leaves are cauline and ramal, opposite, charactaceous and membranous, on long petioles, very soft, and coarsely toothed with round teeth. Flowers occur in globes (2.5-3.4 cm) slightly prickly to touch with thin leaves immediately underneath. Flowers are numerous, orange-scarlet, complete and zygomorphic with four stamens with white filaments, light yellow anthers and one pistil. Inflorescence is globuse, axillary whorls. Stem is very rigid and square, plant is taprooted [156].

Table 2.1: Taxonomy of *Leonotis nepetaefolia* [157]

Kingdom	*Plantae* – Plants
Subkingdom	*Tracheobionta* – Vascular plants
Superdivision	*Spermatophyta* – Seed plants
Division	*Magnoliophyta* – Flowering plants
Class	*Magnoliopsida* – Dicotyledons
Subclass	*Asteridae*
Order	*Lamiales*
Family	*Lamiaceae* – Mint family
Genus	*Leonotis* (Pers.) W.T. Aiton – *lion's ear*
Species	*Leonotis nepetifolia* (L.) R. Br. – *Christmas candlestick*

2.1.1 Ethnomedicinal Uses

Roots of *Leonotis nepetaefolia,* known by a common name *Granthiparni* in Sanskrit, is used in various Ayurvedic formulations described below for its various medicinal properties-

- Ayaskriti- pandu, prameha, arsa, svitra, kustha
- Mrtsanjivani sura- sannipata jvara
- Rodhrasava- grahani, pandu, meha, garbhasaya roga, arsa, kustha
- Guduyachi modaka- prameha, somaroga, raktapitta
- Dadhika ghrita- udarroga, grahani dosa, anaha, vata, arsa
- Prabhanjana vimardana taila- vata vriddhi, vataroga, sulagarbha
- Brahatcuduchi taila- udavaratta, vatarakta, kustha
- Mahanarayana taila- pangatva, ardita, hanu stambha, manya stambha

Roots of this plant have been used in *Brahat Guduchi Taila* and *Mritsanjivani Sura*, Ayurvedic formulations and these are used in indications of *swasa* (Asthma and bronchitis), *Kandu* (Fever) and *Visa* (poisonous conditions) [158]. Kala reported that seeds are used in burns in eastern India region [159].

Among patients attending the Chest Clinic in Trinidad the use of herbal remedies in asthma is relatively common on the advice of relatives and friends. Clement et al. concluded that fifty-eight out of 191 patients (30.4%) reported using herbal remedies for symptomatic relief and *L. nepetaefolia* (*shandileer*) was most common plant [160].

Mahabir and Gulliford observed in 622 people with diabetes mellitus attending 17 government health centers on the island of Trinidad and Tobago, herbal medicines were used by 42% of patients surveyed and were used for diabetes by 24%. Leaves of the plant (*Chandley*) have been used for diabetes very frequently by 80% of them [161].

Cheryl Lans reported between 1996 and 2000 whole plant is used for menstrual pain and unspecified female complaints in Trinidad and Tobago [162], the leaf and stem decoction of *Leonotis nepetaefolia* is used as an abortifacient and emmenagogue in the Caribbean [163].

Stasi et al. interviewed 200 medicinal plant users and extractors and, traditional healers in Brazil tropical forest and found that 11.0% of them used leaves infusion of *L. nepetaefolia* L (common name-*Rubim* or *Lion's-ear*) against bad cold, rheumatism, hypotension, stomach complaints, general pains internally and as wound healing externally [164].

2.1.2. Chemical investigations

Phytochemical study on this plant shows presence of iridoid glycosides, phenylethanoid glycosides, labdanoid diterpenoids, labdanic acid;a coumarin, the terpenic alcohols; nepetaefolinol and leonotinine and coumarins in stem [165], diterpenoids, leonotinin from leaves [166, 167], seed oil contains Laballenic acid, a new allenic acid [168].

2.1.3. Biological activity evaluation

Lasserre et al found that leaves of *Leonotis nepetaefolia* had a transient hypotensive activity: 2 or at the latest 5 min after their administration the arterial blood pressures of the treated animals recovered their initial level [169].

Calixto et al have studied effects of crude extract of plant on rat and guinea-pig smooth muscle and rat cardiac muscle. He found it has relaxing effect on rat and guinea-pig smooth muscle and rat cardiac muscle [170]. Gopal reported methanol extract has mild antibacterial effects [171].

Hortensia P.D et al. studied antiinflammatory activity of various extracts of flower, stem and leaves separately using TPA- induced edema model. All the test extracts showed some degree, anti-inflammatory activity in mice. However, the highest activity was obtained with ethyl acetate extract of leaves (65.75%), flowers (69.06%) and stems (72.93%). Scientists working on this also reported isolation of stigmasterole and leonotinin [172].

Clarkson et al. found dichloromethane:methanol (1:1) extract of whole plant of *L. nepetaefolia* was found to be active as antimalerial in *in-vitro* larvicidal experiment [173].David et al. reported methanol extract of aerial parts of the plant has invitro antioxidant activity and significant activity observed in Brine shrimp lethality test [174].

2.2 *Oxalis corniculata*

चांङ्गेरी दीपनी रूच्या रूक्षोष्णा कफवातनुत् ।
पित्तलाम्ला ग्रहण्यर्श: कुष्ठातीसारनाशिनी ।। २४ ।। (भा.प्र. शाकवर्ग २४)

Oxalis corniculata Linn (*Changeri*) is a small procumbent herb also known as wood sorrel, yellow Indian sorrel, with stems rooting and pubescent with appressed hairs, leaves palmately 3-foliolate. *Changeri* is used in Ayurvedic formulation (*changeri ghrita*) in conditions of increased

kapha, vata, hrid roga and piles. It is also known to cure dysentery, skin diseases and the leaves are commonly chewed to treat diarrhoea and mouth ulcers [175].

Table 2.2: Taxonomy classification of *Oxalis corniculata* [157]

Kingdom	*Plantae* – Plants
Subkingdom	*Tracheobionta*– Vascular plants
Superdivision	*Spermatophyta*– Seed plants
Division	*Magnoliophyta*– Flowering plants
Class	*Magnoliopsida* – Dicotyledons
Subclass	*Rosidae*
Order	*Geraniales*
Family	*Oxalidaceae*
Genus	*Oxalis*
Species	*Oxalis corniculata* (L.)

2.2.1. Ethnomedicinal use

Leaf powder mixed with kernel oil and one spoonful is given twice a day during 4 days for diarrhea [176]. Whole plant paste along with *Aframomum sanguineum* is used as antivenom for bites and juice is swallowed [177]. Leaves are well masticated and the juice is kept in mouth for sometime to get relief from aphthae [178]. Whole plant mixed with *Justica adathoda* and *Maesa macrophylla* given in gastric trouble [179].

2.2.2. Phytochemical studies

Phytochemical analysis from previous studies reveals presence of carbohydrate and glycoside, fatty acids, flavonoids, phenolics, volatile oils, proteins etc [179]. Essential oils are also reported in the methanolic extract of leaves of *O.corniculata* [180]. Unni et al analysed whole plant contains *(% dry weight)* 1.8 (Palmitic acid), 3.8 (Mixture of oleic, Linoleic and Lenolenic), 18 oxalic acid and nutritive value of *O. corniculata* is found to be 1.36±0.3(carbohydrate), 13.2±0.7 (fatty acids), 12.5±0.5 (Protein) 6.20±0.3 (fibre), 0.62±0.3 (Tannins) 174.24±4.6 (nutritive value)

[181]. Seal and Sen reported that the leaves contain about 86% water, 0.8% fat, 8.2% carbohydrate, 150 mg calcium, 78 mg phosphorus, 8mg iron, 0.6 mg niacin, 78 mg vitamin C, 6050 microgram beta carotene and between 7-12% oxalate [182]. Three C-glycosylflavones in the leaves of *O. corniculata*, were identified as 6-C-glucosylluteolin (isoorientin), 6-C-glucosylapigenin (isovitexin) and isovitexin 7-methyl ether (swertisin) [183].

2.2.3. Biological activity evaluation

The aqueous extracts showed significant antibacterial activity [179]. Methanol extract had dose-dependent relaxant activity on isolated rabbit ileum and also known to have cardiorelaxant activity on isolated rabbit heart [184]. In anaesthetized rats, a fall in diastolic pressure, with a lesser fall in systolic pressure, was also observed [185]. The alcohol and petroleum ether extract of whole plant of *O. corniculata* (Oxalidaceae) has been evaluated for its wound healing activity [186]. Farre M et al has reported fatal oxalic acid poisoning from sorrel soup in asian countries. High amout of oxalic acid may be responsible for poisoning [187]. Recently Abhilash et al has reported aqueous extract is protective on heart against isoproterenol-induced myocardial infarction [188].

2.3. Research envisaged

In the recent years there has been an upsurge in the clinical use of indigenous drugs. Traditional medicine (TM), consist chiefly of herbal components either plants or their extracts, forms one of the major categories of CAM. Evidence of the beneficial therapeutic effects of these medicinal herbs is seen in their continued use. Despite long existence, popularity and continued use over many centuries, traditional medicine, still officially is not recognized in most of the countries. Consequently, education, training and research in this area have also not been accorded due attention and support. The quantity and quality of the safety and efficacy data on traditional medicine are far from sufficient to meet the criteria needed to support their use world-wide. The main reason is lack of availability of adequate research methodology for their evaluation.

The lack of consistent and reliable botanical products represents a formidable challenge to conduct clinical trials, as well as basic research. Although many botanicals are widely used, most have not been sufficiently characterized or standardized for the conduct of clinical trials capable of adequately demonstrating safety or efficacy, or predicting that similarly prepared products would also be safe and effective in wider public use. Consequently, obtaining sufficient

quantities of well-characterized products for evaluation in clinical trials would be advantageous. Several issues regarding the choice of the clinical trial material require special attention, for example, (*a*) use of different parts of the plants (e.g., roots, seeds, aerial parts, whole plant), (*b*) use of different cultivars and species, (*c*) optimal growing and harvesting conditions, (*d*) use of the whole extract or a specific fraction, (*e*) the method of extraction (e.g., alcoholic, decoction, pressed juice), (*f*) chemical standardization of the product, (*g*) bioavailability of the formulation (e.g., extract, tablet, capsule), and (*h*) the dose and length of administration. Unlike conventional drugs, herbal products are not regulated for purity and potency. Some of the adverse effects and drug interactions reported for herbal products could be caused by impurities, unnamed adulterants, or batch-to-batch variability. The chemical characterization (or fingerprint analysis) and standardization of botanical products would facilitate their evaluation in basic research and clinical studies.

Plants used in CAM may become item of interest, when a new chemical compound is isolated which serves either as active moiety or form a lead to further synthesize a new medicinal compound. Approaches like high-throughput screening, generation of phytochemical profiles, development of quality controls and standardization parameters for raw materials and finished products, and clinical trials, certainly help to derive rationale of their usage in different diseases. Thus, medicinal plants have played a major role in the development of modern medicine and continue to be widely used in their original form.

The research on CAM is not up to the mark in the context of clinical use of these medicines. The evaluations of CAM/TM medicine are lacking due to the paucity of support and interest in modern methods. There is a need for better quality cost-effectiveness research in the field of CAM therapies so that policy makers can make more informed decisions as to the appropriate level of service provision

The systematic evaluation of CAM therapies is essential. This could contribute to more efficient and equitable provision of health care services that takes into account the preferences and choices of patients and would move CAM research towards the model of whole systems research.

The present study is based on development of the evaluation parameters for few medicinal plants used in CAM (*Ayurveda)* and which are used traditionally, but have not been scientifically explored for their therapeutic claims. The study, therefore, was planned to evaluate two plants

mentioned in CAM for ROS generated disorders, using modern scientific methodologies e. g. pharmacognostic, pharmacological and analytical methods, so as to justify their traditional role. The present study was planned on the following line:

- Procurement, identification and preparation of monograph of plant materials as per WHO Guide lines
- Preliminary phytochemical screening of successive extracts using qualitative chemical tests and TLC profiles
- Preparation of extracts, fractions and sub-fractions
- Physical evaluation, chemical evaluation and HPTLC finger print profiles of extracts and fractions
- Isolation and characterization of phytoconstituents from fractions
- Development of analytical methods for isolated bioactive phytoconstituent by using HPTLC and HPLC methods
- Assessment of biological activity of the selected plants using different animal models