## CHAPTER 2

### Chapter-2 Literature Survey

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CHAPTER 2

Literature survey

2.1. Ethnobotanical survey of medicinal plants used in southern Eastern Ghats of India.

An ethnobotanical survey was carried out on traditional used medicinal plants of southern Eastern Ghats of India. Kollimalai (Tamil Nadu), Tirupati hills and Nallamalla (Andhra Pradesh) regions were mainly focused to establish the traditional finding on medicinal plants and to explore its analgesic, antipyretic, and anti-inflammatory activity. In the present study few medicinal plants were selected. These plants were found to be mentioned under IUCN Red List of Threatened Species which was used by the indigenous people of southern Eastern Ghats of India.

**Table 2.1: List of IUCN Red List of Threatened Species found in southern Eastern Ghats of India.**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Botanical Name</th>
<th>Family</th>
<th>Folklore Use</th>
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<tbody>
<tr>
<td>1</td>
<td><em>Shorea roxburghii G. Don.</em></td>
<td>Dipterocarpaceae</td>
<td>Anti-inflammation, analgesic, worm infection, wound healing, anti-diabetic, ophthalmic infection.</td>
</tr>
<tr>
<td>2</td>
<td><em>Shorea tumbuggaia Roxb.</em></td>
<td>Dipterocarpaceae</td>
<td>Joint pains, inflammation, fever, CNS stimulant, anti-diabetic, anti-depressant, worm infection in GIT, wounding healing.</td>
</tr>
<tr>
<td></td>
<td><strong>Plant Name</strong></td>
<td><strong>Family</strong></td>
<td><strong>Ethnomedicinal Uses</strong></td>
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<td>----------------------------------------</td>
<td>---------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td><em>Alpinia glanga</em> L. wild.</td>
<td>Zingiberaceae</td>
<td>Wounding healing, anti-cancer, astringent, antiseptic, anti-bacterial, analgesic, anti-fungal, skin infections</td>
</tr>
<tr>
<td>4</td>
<td><em>Chonemorpha fragrans</em></td>
<td>Apocyanacea</td>
<td>Wound healing, anti-diabetic, skin infection</td>
</tr>
<tr>
<td>5</td>
<td><em>Holostemma adai-Kodien Schult.</em></td>
<td>Asclepiadaceae</td>
<td>Emollient, refrigerant, stimulant, aphrodisiac, galactogogue, leucoderma and expectorant, orchitis, pain, stomach ache, gonorrhea and in ophthalmic disorders</td>
</tr>
<tr>
<td>6</td>
<td><em>Ranwolfia Serpentina</em></td>
<td>Apocynaccac</td>
<td>Hyper tension, insomnia, analgesic</td>
</tr>
<tr>
<td>7</td>
<td><em>Solanum Xanthocarpum</em></td>
<td>Solanaceae</td>
<td>Diuretic, Anti-inflammatory, Appetiser, Stomachic.</td>
</tr>
<tr>
<td>8</td>
<td><em>Utleria salicifolia Beddome.</em></td>
<td>Ascelpiadaceae</td>
<td>Anti-microbial, analgesic, fever, worm infections</td>
</tr>
<tr>
<td>9</td>
<td><em>Ampelocissus araneosa.</em></td>
<td>Vitaceae</td>
<td>Anti-inflammation, analgesic, wound healing, skin infections.</td>
</tr>
<tr>
<td>10</td>
<td><em>Biophytum reinwardtii.</em></td>
<td>Oxalidaceae</td>
<td>CNS stimulant, wound healing, skin infection,</td>
</tr>
</tbody>
</table>

Based upon the ethno medicinal uses and availability of the plant material two medicinal plants were selected for the present investigation to establish a validated scientific documentation on the ethno medicinal uses of the selected plants. Two plants selected for
the present investigation were *Shorea tumbuggaia* Roxb. (Dipterocarpaceae) and *Holostemma ada-Kodien* Schult. (Asclepiadaceae).

### 2.2 Antioxidant activity

Free radicals are the molecules or molecular species which on fragmentation produces one or more unpaired electrons in outer orbit. The cellular redox process is responsible for the production of by-products which plays major dual role as toxic and favorable effect in the human system, such as reactive oxygen species (ROS) and reactive nitrogen species (RNS). These reactive species also includes lipid peroxide (LOO⁻), superoxide (O₂⁻), nitric oxide (NO⁻), hydroxyl (OH⁻), peroxyl (ROO⁻), alkoxyl (RO⁻), and nitrogen dioxide (NO₂⁻) radicals.

Ferda Candan *et al.*, (2003), have investigated the essential oil and methanolic extracts of *Achillea millefolium* (Asteraceae) for its *in-vitro* antimicrobial and antioxidant activity. The oil was found to contain 36 compounds and 60.7 % of compounds were camphor, α-tocopherol, eucalyptol, borneol and β-pinene. Antioxidant studies were performed by DPPH, hydroxyl radical scavenging effect and also exhibits lipid peroxidation. The methanolic extract showed the potent antioxidant activity³⁴.

Aroke S.Ahmed *et al.*, (2012), investigated four species of *Bauhinia*, traditionally used by medical practitioners and it is indigenous ethno medicine found in South Africa. Majorly used for
the treatment of ailments this includes GIT, inflammation, infectious diseases and diabetes. They have adopted DPPH, ABTS radical scavenging and reducing power by ferric chloride (FRAP) methods for the determination of antioxidant activity. They have reported that the polyphenolic compound present in the *Bauhinia* species were responsible anti-oxidant and antimicrobial activity by hindering the organisms in the concentrations ranging from 39 to 2500µg/ml and enzyme inhibitory assays were studied for the anti-inflammatory activity by using soybean and cyclooxygenase 15-lipoxygenase models and the extract were free from cytotoxicity determined by *Vero cell line*. They have concluded that the biological activity is due to the presence of phenolic rich content in all the extracts of *Bauhinia* species\(^{35}\).

Micheline N.Albano *et al.*, (2013), reported that the hydroalcoholic extract of *Casearia sylvestris* Sw. (Salicaceae) was subjected for the *in-vitro* antioxidant activity for the determination of possible mechanism for anti-inflammatory activity of the extract. Lipid peroxide studies were adopted for possible protein oxidative damage and its pathway and further anti-inflammatory studies were performed by using cell migration inhibition by myeloperoxidase (MPO) enzymatic activity and the nitrate/nitrite\(^{36}\).

Agnieszka Bazylko *et al.*, (2013), reported the antioxidant and anti-inflammatory activity of the *Potentilla recta*, found abundant in Poland, species of cinquefoil. Antioxidant activity was performed for the different extracts and was found that the ethyl acetate fraction
possessed a strong antioxidant activity using DPPH and other related radicals (O$_2^-$, H$_2$O$_2$ and HClO) models in cell-free system. The compounds which are response for anti-inflammatory and antioxidant are due to the presence of tannin like compound. Further, isolation and spectral studies have proven that the tannins agrimoniin was responsible for the suggested activity and agrimoniin showed the reduction of oxygen species and counting xanthine oxidase reserve activity (enzyme inhibition)$^{37}$.

![Agrimoniin](image)

Agrimoniin

Filomena Conforti et al., (2008), studied the inhibition of linoleic acid oxidation by DPPH radical scavenging, β-Carotene bleaching antioxidant method and liposome peroxidation activity on bovine brine and topical anti-inflammatory activity was performed for the hydroalcoholic extracts of Calabria (Italy), an edible plant used as medicine for the treatment of inflammation by the traditional healers$^{38}$. 
Cuelloa S et al., (2011), reported the antioxidant ability and anti-inflammatory activity of polyphenolic and flavonoid present in the ethanolic extract of *Fabiana* species (Solanaceae) by using the 2,2’-azino-bis 3-ethylbenzothiazoline-6-sulfonic acid (ABTS), SC$_{50}$ values 2.56 ± 0.10 µg GAE/mL, 1,1-diphenyl-2-picrylhydrazyl (DPPH) SC$_{50}$ values of (3.85 ± 0.24). Scavenging assays and β-carotene-linolenic acid assay was used. Enzyme linked anti-inflammatory assay was found to show the inhibition of the inflammation and also it showed the interesting effect of mutagenesis TA98 (+S9) and TA100 (+S9/−S9) strains$^{39}$.

Plant phenols play an important role in antioxidant activity flavonoids in particular kampferol and quercetin have proven for their strong antioxidant and anti-inflammatory activity, isolated from *Pogonatherum crinitum* (Wang, G.J et al., (2008)$^{40}$. Flavonoids as an antioxidant is associated with the inhibition of enzyme linked with enrichment oxygen radical Pietta, P.G (2000)$^{41}$. Antioxidant activity of *Aster tataricus* proven to possess a strong antioxidant compounds under the class polyphenol such as coumarin (scopletin) and esculetin were found to be producing free radical-scavenging activity Ng et al (2003)$^{42}$.

Gil M.I et al., (2000), have identified that the presence of tannin (punicalagin) isolated from juices of pomegranate and the commercially available products like green leaves tea and red wine were compared with the tannins of pomegranate for the correlation
with phenolic content by antioxidant activity. The studies were carried out by using the 1, 1-diphenyl-2-picrylhydrazyl (DPPH), N,N-dimethyl-p-phenylenediamine (DMPD), 2,2'-azino-bis 3-ethyl benzothiazoline-6-sulfonic acid (ABTS) and ferric reducing ability of plasma (FRAP). The phenolic correlation of punicalagin (1500-1900 mg/L) was studied⁴³.

Punicalagin

Mohammad Ali Ebrahimzadeh et al., (2008), thalassemia is a condition associated with iron excess (anemia) due to the potentiation of ROS which causes the damage to the biological system and major effect seen in cardiac system and the poor bioavailability, side effects and less plasma half-life leads to the anemia condition due to the oxidation. The extracts of *Mellilotus arvensis* consists of *phenols* and flavonoids as the major phytoconstitution. The AlCl₃ metal chelating assay have shown that the extracts composed of the phenol concentrated showed the highest chelating activity⁴⁴.
Jayanthi. P and Lalitha. P (2011), investigated the antioxidant activity by reducing power ability of *Eichorina crassipes* (Mart.) by solvent extraction method using solvents in increasing polarity\(^{45}\).

Rabeta M.S and Nur Faraniza R (2013), Ferric reducing assay was performed for the two species *Garcinia atrivirdis* and *Cynometra cauliflora* were used for the determination of proximate presence, mineral content and antiradical assay. The phenolic content was estimated by (TPC) and antioxidant activity by (FRAP)\(^{46}\).

Zeynep Tunalier *et al.*, (2007), *Lythrum salicaria*, species were studied for the antioxidant, anti-inflammatory and analgesic activities. The PDA-HPLC studies have conform the polar fractions were found to be enriched with (isovitexin and isoorientin ) flavonoids\(^ {47}\).

Farrukh AQIL *et al.*, (2006), have investigated the free radical scavenging activity for the 12 species of traditionally used medicinal plants. Antioxidant activity was established by diphenyl picryl hydrazyl (DPPH) radicals. Major Phytoconstituents estimated were glycoside, tannins, flavonoids, steroids and alkaloids. The extracts were selected according to the presence of total phenolic content and
these extracts were assayed for DPPH studies. From the studies it was concluded that among the 12 species only nine species showed scavenging activity on DDPH assay\textsuperscript{48}.

Matlou Phineas Mokgotho et al., (2013), proved that 3,4',5-trihydroxystilbene (C\textsubscript{14}H\textsubscript{12}O\textsubscript{3}) isolated from root parts of \textit{Senna italic} have highest antioxidant activity\textsuperscript{49}.

Resveratrol (3,4',5-trihydroxystilbene)

Shruti Shukla et al., (2009), investigated the ethanolic leaves extract of \textit{Stevia rebaudiana} for antioxidant and total phenolic content. The ethanolic extract was inhibiting the superoxide anions hydroxyl radical and nitric oxide; hence it was evident that plant has natural antioxidant activity\textsuperscript{50}.

Filomena Conforti et al., (2002), have isolated bio flavonoids from the methanolic extract of aerial parts of \textit{Hypericum triquetrifolium}. The isolated compounds were subjected for antioxidant activity by DPPH and thiobarbituric acid test. The isolated flavonoids compounds were identified as quercetin-3-O-galactoside, kaempferol, therein, 3, II8-biapigenin (y)-epicatechin, 3-O-glycoside, and hypericin\textsuperscript{51}.
Gabrieli, C.N. et al., (2005), have isolated nine flavones from the methanolic fraction of aerial parts of *Sideritis raeseri Boiss.* The isolated compounds were subjected for the antioxidant activity with the DPPH radical scavenging and Co (II)-EDTA-induced luminol chemiluminescence activity. The antioxidant activity was seen for the 5 and 8-o-flavones. The isolated flavones were 7-o-allosyl glucosides\(^{52}\).
Elliot K Hersh et al., (2000), reported that the most of the pain and inflammation mechanism are manifested by the biochemical changes involved with the corresponding damage to the cell which in turn releases some biochemicals which involves in the sensation of pain, inflammation and hyperpyrexia. It is believed that the bio toxic chemicals released by the enzymatic bio-reaction leads to release of chemical like COX (cyclooxygenase) a prostaglandins substance produced from arachidonic acid. The damaged cell liberates toxic chemical (arachidonic acid) which on exposures to phospholipase A₂ ubiquitous enzyme. The identification of two prostaglandins, (PGE₂
and PGE$_{2\alpha}$) which are response for the inflammation process was inhibited by aspirin and indomethacin. The inhibition was not found in morphine (narcotic). Now it is evident that the inflammation is mediated by prostaglandins and arachidonic acid, but the prostaglandins will not involve in cause of pain. The pain receptor get alerted on free nerve ending to other inflammatory peacekeepers embraces (serotonin, histamine and bradykinin)$^{53}$.

Md. Al Amin et al., (2012), reported anti-inflammation activity for the whole plant of *Asteracantha longifolia* (Acanthaceae) Nees $^{54}$.

Olumayokun A. Olajide et al., (2000), reported antipyretic, anti-inflammation and analgesic activity with a statistical significant of (P<0.05) for *A. boonei* $^{55}$.

Numerous research works confirmed the contribution of several intermediaries including cytokines, PG (prostaglandins (PG E$_1$ and PG E$_2$) and NO (nitric oxide) in inflammatory events Ferreira S.H (1973)$^{56}$. The production of prostaglandin and nitric oxide are induced by the catalytically by the enzyme synthase molecules such as NO (Nitric oxide synthase) and cyclooxygenase (COX) for the production cytokines or other inflammatory mediators Moncada, S et al., (1991)$^{57}$. The biological reaction may be the clue to the prevention of the inflammation in the biological system my researcher have proven by the molecular gene expression in the prevention of these substance (COX-2 and iNOS) in mutation by cell culture regulation. Further the natural compounds have proven to produce potent activity on
prevention of inflammation especially flavonoids isolated from the mushrooms Kim H.K et al., (1994)\(^5^8\).

![Chemical structures](image)

Quercetin  
Wogonin  
Apigenin  
Luteolin

Laid Selloum et al., (2003), investigated that the polyphenols like flavonoids having the carbon (15) configuration arranged in C\(_6\)-C\(_3\)-C\(_6\) has proven to inhibit the inflammation. Many studies have shown the presence of flavonoids or any other polyphenolic compounds from the plant kingdom are considered to have a significant role in the inhibition of the inflammation causative biological studies. Rutin a phenolic compound under flavone were subjected for the anti-inflammation study by comparing with non-steroidal compound aspirin\(^5^9\).
Mani Vasudevan et al., (2007), have investigated the anti-inflammatory and analgesic activity for the ethanolic bark extract of *Thespesia populnea* (TPE). The statistical studies have shown that the paw edema (inflammation) was reduced for concentrations of 200 to 400mg/kg and there was a significant effect on acute model in the same concentration\(^6\).

Zakaria Z.A et al., (2010), performed studies on aqueous extract of *Piper sarmentosum*. The study reported that the extract showed both central and peripheral anti-nociceptive and in reduction in inflammation\(^6\).

Shah Amol S and Alagawadi Kallangouda R (2011), Acute arthritis was studied for the pet. ether and ethanol extracts for the analgesic, anti-inflammatory and antipyretic activity of *Thespesia populnea* Sol. ex Correa (Malvaceae), Indian tulip tree. The anti-inflammatory activity was studied by carrageenan induced sub-plantar inflammation, the reduction or inhibition of the paw edema was measured by plethysmometer. Pyrexia was studied using brewer’s
yeast model and analgesic activity was carried out by heat induced (tail immersion) pain model. The dose-dependent reduction was observed for the oral administration of 200 and 400mg/kg body weight\textsuperscript{62}.

Agnel Arun John. N et al., (2012), studied the inhibition of inflammation caused by formalin induced model for the aqueous extract obtained from \textit{Talinum fruticosum} L. The preliminary phytoconstitution studies revealed the presence of tannins, saponin, flavonoids, alkaloids and quinines were estimated. \textit{In-vivo} screening for the inflammation studies were performed by formalin induced anti-inflammatory. After the study the animals were monitored for fifteen days and the blood sample were assessed for the presence of phytoconstituents and reduction in the (ALP, SGPT, lipid peroxide (LOP) CK, and SGOT) and the histopathological studies showed that the reduction in the damage to the cartilage, and osteoblast hyperplasia\textsuperscript{63}.

A. Ahmadiani et al., (2001), have reported that the alkaloids present in the Iranian medicinal plant, \textit{Trigonella foenum-graecum} (TFG) were examined for the hyperthermia by brewer’s yeast (20\%) and formalin induced model for the anti-inflammatory studies. The extracts were given in the dose range of 1000 and 2000mg/kg body weight (i.p and p.o). Sodium salicylate was served as control. The extracts showed the reduction of the inflammation as well as pyrexia. Further, the presence of alkaloids and absence of the polyphenols
were suggested that the extract does not follow the NSAID proposed mechanism and the pain inhibition was also seen in the tail-flick model\textsuperscript{64}.

Ignacimuthu S \textit{et al.}, (2009), \textit{Albizia lebbeck}, is folk medicine for the treatment of inflammation. The rats were selected for the screening of the anti-inflammatory activity by chemical induction of inflammation (Freud’s, carrageenan, cotton pellet, and dextran) for the various extracts obtained by increasing in the polarity (petroleum ether, chloroform and ethanol extract), the extracts were administered by (p.o.) dose ranging from 100/200/400 mg/kg body weight. At 400mg/kg the ethanolic extracts showed the inhibition of inflammation when compared with other extracts\textsuperscript{65}.

Amabeoku G.J \textit{et al.}, (2001), the hydro-distillated, essential oil isolated from the \textit{Lippia multiflora} Moldenke belong to the family verbenaceae, were given at the dose of two, four and 8 ml /Kg (o.s), the reduction of pain were observed in writhing model induced by the acetic acid at an dose-dependence inhibition of pain and at the highest concentration (8ml/kg) of the essential oil showed an potent hyperexia and granuloma was not effective\textsuperscript{66}.

Sajeli Begum \textit{et al.}, (2010)\textsuperscript{94} extensively studied various extracts of \textit{Hyoscyamus niger} for anti-inflammatory (acute and sub-acute inflammation. The methanolic extract showed significant effect on the pharmacological studies performed. Further fractionation on methanolic extracts yields Cleomiscosin derivatives compounds\textsuperscript{67}. 
Cleomiscosin derivatives

Anindya Bose et al., (2007), *Cleome rutidosperma* traditionally used medicinal plant was extracted with ethanol and extract was fractionated. The study showed an inhibition on pain, inflammation and fever for the crude and the fractionated ethanolic extract. The phytoconstituents revealed that the plants were having polyphenolic compound. Flowers extracts of *Phrygilanthus acutifolius* was investigated for the anti-pyretic, acute inflammation and analgesic activity. The rats were treated with the aqueous extracts were able to withstand the acute inflation caused by the formalin model. Further the studies on the inhibition of the pain was observed to produce dose dependence reaction, pyrexia was also evident at the highest dose of the aqueous extract 200 mg/kg Daud A et al., (2006). Methanol roots extract of *Clitoria ternatea* were also reported for the inhibition of the acute inflammation, pain and fever compared with the positive control. Subhash C.Mandal et al., (2003).
Yu-Ling Ho and Yuan-Shiun Chang (2002), formalin induced inflammation was effectively reduced by the root of extracts (methanolic) *Isatis indigotica*. The reduction in the licking response for the earlier and late phase was evident for the potent acute anti-inflammatory action of the methanolic extract at the dose-dependent response\(^7\). Isolation of the parthenolide and costunolide from the dichloromethane fractions was evident to produce a strong anti-inflammatory and antipyretic activity for the Brazilian medical plant *Magnolia ovate* also known as *Talauma ovate* Aleksander Roberto Zampronio et al., (2009)\(^7\).

![Chemical structures of Costunolide (A) and Parthenolide (B)](image)

Zhao Yongna et al., (2005), have demonstrated the chemical induced (acetic acid) writhing by discharging endogenous affluences, which then stimulation of nerve ending to produce pain. The abdominal narrowing is linked with sensitization of nociceptive receptors to prostaglandins. The formalin model, which evaluates the way of animal, rejoins to sensible unremitting pain engendered by incapacitated tissue. The effects of drugs on licking rejoinders in the early and late phases indicated that the drug possess the anti-nociceptive exploit on sensory receptor stimulus and anti-
inflammatory activity. The study was carried out by using aqueous extract of the stem of *Urtica macrorrhiza*. Formalin model animals showed the response on the pain threshold at the early and last phase. These are considered that the extract to inhibition pain. But the extract fails to produce the significant effect on hot plate model, thus the mechanism of the extract may be working through peripheral system\textsuperscript{73}.

Nadine Backhouse C, *et al.*, (2001), investigated the anti-inflammatory and antipyretic activity for the various extracts from the medicinal plant *Psoralea glandulosa* L. belonging to the family Papilionaceae were studied for the pet.ether, dichloromethane and methanolic extracts obtained from the aerial parts. Further, the bioactive compounds were isolated from the fractionated extracts pet.ether (bakuchiol); and cyclobakuchiols (A and B) and angelicin from dichloromethane extract were reported\textsuperscript{74}.

\begin{center}
\includegraphics[width=\textwidth]{chem_structures}
\end{center}

Bakuchiol \hspace{2cm} Angelicin

Cyclobakuchiols (A and B)
Narayanan N et al., (2000), investigated the traditional finding and folk medicine for the treatment of inflammation, pain and pyrexia for the ethanolic root extract of *Premna herbacea*. The rabbit model showed the antipyretic activity on oral administration of the extract at 8.0g/kg, and peripheral acting analgesic effect on chemical (acetic acid) and thermal (hot plate) method was observed in mice, but the inflammation model (carrageenan) for both chronic and acute inflammation did not showed any effect on inhibition compared with standards.\(^7\)

Wei Jia et al., (2003), Xuan-Ju agent, are traditionally used herbal remedy for the immuno-deficient (rheumatoid arthritis) management to establish scientific evident based upon pharmacological mechanism on the herbal medicine were carried out by using animal model by chemically induced inflammation (carrageenan and adjuvant) edema on paw in the rat. The inhibition of the inflammation was evident at the dose of 0.20 to 0.80g/kg. Thus, the Xuan-Ju agent (F. cnidii, F. lycii, F. fusca, and H. epimedii ) herbal preparation was further valuated enzyme based rheumatoid arthritis.\(^7\)

Il-Ok Lee and You-Seong Jeong (2002), experiment was aimed at the effect of formalin at different concentration was correlated with the behavioral response of the animal. The different concentrations of formalin 2.5, 5 and 10% was injected in right paw and the flinching or licking response were tabulated for the phase I at zero to five minutes
of the injection and also the phase II was measured at 20 to 60 minutes. The edema was measured at a different time interval; from the studies at an higher concentration and low concentration the rat were showing licking effect in the phase I period was recorded and phase II studies (2.5 and 5% injection) long duration of licking response control group (p<0.05). The licking response was observed at all the concentration and flinching was observed at 5% of formalin injection and at 10% concentration mostly favorable for the edema. Hence the highest concentration for the inflammation studies was not suited since they undergo dissociation nociception mechanism due to the strong development of oedema.

2.4 Anthelmintic activity

Md. Mizanur Rahman Moghal et al., (2013), have correlated the presence of total phenolic content and anthelmintic activity for various concentrations of methanolic extract obtained from *Crinum latifolium Linn*.

Nilani P et al., (2012), studied the anthelminthic effect of oil obtained from the Moringa oleifera. The oil of *Moringa* at concentration of 25 and 50 mg/ml showed the potent activity, the death time seen in 33 min for the highest concentration. The oil consists of oleic acid (72%), and the anthelmintic activity may be due to the presence of oleic acid.

Sini K.R et al., (2011), studied anthelmintic potency of ethanolic leaves extract of *Capparis grandiflora* and reported that ethanolic
extract possess anthelmintic activity. Its possible mechanism of action was similar to piperazine citrate\textsuperscript{80}.

Dhaked P.S \textit{et al.}, (2011), studied anthelmintic potency of \textit{Caesalpinia pulcherrima} (Linn.) using \textit{Pheretima posthuma}. The maximum paralytic and death time was observed with the group containing 100mg/ml of ethanolic extract. Pet. ether and water extract did not possess any significant effect on the Indian earthworm\textsuperscript{81}.

J. Horton (2000), studied the genetic mechanism for the resistant of parasites toward the synthetic drugs. The studies have recommended that the benzimidazole classified albendazole produces the significant effect in controlling hookworms. Albendazole was recommended as a safe dose regiment for adult and children\textsuperscript{82}.

Gunasekaran Balamuragan and Shinnaraj selvarajan (2009), investigated anthelmintic potential of \textit{Indigofera tinctoria}. The study confirms that methanolic extract showed potent anthelmintic activity than that of standard group. Presence of tannins, flavonoids, steroids and alkaloids secondary metabolites may be responsible for the anthelmintic activity of the methanolic extracts\textsuperscript{83}.

Eguale T \textit{et al.}, (2007), have investigated the anthelmintic activity of Hedera helix ripe fruits against the egg and adult nematode (\textit{Haemonchus contortus}) parasites. The hydroalcoholic extract possess a strong anthelmintic activity\textsuperscript{84}.

Adedapo Adedayo Adeniran and Mubo Adeola Sonibare (2013), investigated the \textit{Dioscorea bulbifera L.} for the anthelmintic activity.
The potent extracts were chromatographed and quercetin was isolated. The studies were executed for the determination of natural medicine for the treatment of anthelmintic since the parasite shows resistant over synthetic drugs85.

Pallavi S. Adate et al., (2012), have studied the effect of albendazole, aqueous and ethanolic extract of Piper betle L on the earthworm for the assessment of anthelmintic activity. The ethanolic extract was found to have similar mechanism same as that of the reference compound86.

Patil S. H. et al., (2012), investigated the anti-paralytic effect of Alocasia indica Schott. using the Indian earthworm. The alcoholic extract showed the presence of phenolic compound and in the past the natural phenolic compound was observed to possess the anthelmintic activity by the degenerative and reduction ATP in the intestine of earthworm using albendazole as standard reference compound87.

Piyush Jain et al., (2013), have identified many folklore medicinal plant species belonging to the Sagar (M.P, India) with anthelmintic activity. The study concluded that the secondary metabolites like tannins, phenols, flavonoids, steroids and alkaloids might be working on many pathways in producing the paralytic and death of worms88.
2.5. Pharmacognostical and pharmacological studies of Shorea tumbuggaia Roxb.

The pharmacognostical and phytochemical studies on stem, bark and leaves were evaluated for the Shorea tumbuggaia, major source for various secondary metabolites like tannins, triterpenoids, anthocyanins, phenols, and flavonoids. Presence of tannins was reported for the Shorea robusta Negi S.S, (1982)\textsuperscript{89}. Leaves comprising fan and star formed fashioned sphaerites and sclereid cells and presence of paracytic stomata are circulated\textsuperscript{90-91}.

Ragini V et al., (2011), investigated the anti-glycemic and hypolipidemic activity was studied on leaves extract (ethanolic) of Shorea tumbuggaia Roxb, the extracts was showing potent activity\textsuperscript{92}.

Venkateswarlu P et al., (2010), synthesis of silver nanoparticles was investigated for the bark of Shorea tumbuggaia on exposed to the silver ion formation of silver nanoparticles was observed hence the method was evaluated for the green synthesis of nanoparticles\textsuperscript{93}.

Isolation of 90 phenolic compounds was studied by using positive and negative ESI / MS for the bark extracts obtained from Shorea tumbuggaia R. among them, 20 phenols compound have been isolated and spectra studies were established. The bark extracts were also studied for the presence of antioxidant activity\textsuperscript{94}.
2.5.1. Pharmacological studies on other species of *Shorea* and its biological activities

Singh, A.K. *et al.*, (2002), *Shorea robusta* Gaertn, have been traditionally used for the treatment for the women sterility for the three days of menstruation cycle, for 12 to 15 weeks and also reported for the externally for sciatica\(^95\).

Methanolic extract were studied to have potent activity on anti-inflammation and analgesic activity was studied by Jyothi *et al.*, (2006)\(^96\).
Hemanta Mukherjee et al., (2013), wound healing activity and isolation of active principles was studied for the chromatographed fractions of *Shorea robusta*. The wound healing property was studied in the rat model using povidone-iodine, the studies were shown that fractionated formulation showed the better activity that the standard drug, isolated compounds were identified as bergenin and ursolic acid\(^{97-98}\).

![Bergenin](image1.png) ![Ursolic acid](image2.png)

Triterpenoids were isolated from the resins of *Shorea robusta* resin, five compounds were isolated and intensive studies were made for 2 compound for their identification and spectral characterized Laxmi N. Misra. Ateeque Ahmad (1997)\(^99\). Chalcone glycoside and hopeaphenol was also identified from the heartwood of *Shorea robusta*. Anjali Jain et al., (1997)\(^100\).

![3,25-epoxy-1,2,3,11-tetrahydroxyurs-12-en-28-oic acid](image3.png)
Shorea roxburghii stem bark was evaluated for the antioxidant studies (DPPH, ABTS, H$_2$O$_2$, and ferric reducing ability, radical scavenging activity) were studied for the methanolic extract of the stem bark. The extract possessed a good antioxidant activity when compared with the standard, and due to the antioxidant activity and the extract can be used for the silver nanoparticle green synthesis$^{101}$.

2.6. Pharmacological studies of Holostemma ada-kodien Schult.

Peter, K.V, and Swami, Nathan (2007), presence of major phytoconstituents present in the root are 4 % (protein), 24% (sugar), 32.5 % (starch), 12.2% (fiber) and 3.07% (ash); ethanolic root extract contains aminoacids (aspartic acid, glycine, serine, alanine threonine and valine), benzene extract consist of amyrin, lypeol and $\beta$-sitosterol$^{102}$. 

3,25-epoxy-1,2,3-trihydroxyurs-12-en-28-oic acid

$4'\text{-}\text{hydroxychalcone 4'O-}\beta\text{-d-glucopyranoside}$

Hopeaphenol
Y. Janapati et al., (2008), ethanolic leaves extract possessed the antidiabetic effect on alloxan induced diabetic in rodent using reference standard glibenclamide\textsuperscript{103}.

Geetha SP et al., (2009), made studies on propagation of *Holostemma ada-kodien* S. along with *Ipomoea mauritiana* for the increasing yield of medicinal plant\textsuperscript{104}.

Sini, S. and Malathy, N.S. (2005), reported the antimicrobial activity for the various root extract of *Holostemma ada-Kodien Schultes* studied against *B. pumilis* and *E. coli* \textsuperscript{105}.

Meena Thomas Irimpan et al., (2011), reported the antibacterial activity and phytoconstituents for the various extracts of aerial parts of *Holostemma ada Kodien Schultes*. The phytochemical studies showed the presence of flavonoids, saponines, steroids, amino acids, tannins and sugars\textsuperscript{106}.

Mallikarjuna B et al., (2011), reported antioxidant activity for the various extract of root tuber of *Holostemma ada-Kodien Schultes*. They studied for free radical scavenging activity (DPPH), nitric oxide radical activity and superoxide model were accessed for the studies \textsuperscript{107}.

From the literature survey it was found that many traditional uses of the above mentioned plants were not explored scientifically, thus the author is interested to explore the various pharmacological activities and to isolate the phytoconstituent responsible for the activity.