LITERATURE REVIEW

Tanaka et al., (1991) carried out the isolation of two new β-hydroxy chalcones named ponganones I and II from the root bark of Pongamia pinnata; and the structures were characterized as 7-hydroxy-2’,5’-dimethoxy-[6”,6”-dimethyl pyrano(2”’,3”’: 4’’,3’’) chalcone for ponganone I, and 7-hydroxy-2’,5’-dimethoxy-3, 4-methylene dioxy- [6”’,6”-dimethyl pyrano (2”’,3”’: 4’,3’)] chalcone for ponganone II, respectively by means of spectroscopic analysis.

Shameel et al (1996) isolated Six compounds (two sterols, three sterol derivatives and one disaccharide) together with eight fatty acids (three saturated and five unsaturated) from the seeds of Pongamia pinnata. Their structures were elucidated with the help of physico-chemical methods and spectroscopic techniques.

Chauhan and Chauhan (2002) characterized two new flavones glycosides from the seeds of Pongamia pinnata on the basis of chemical and spectral evidence.

Simin K et al (2002) isolated Pongarotene (1), a new rotenoid and karanjin (2), a known flavonol, from the seeds of Pongamia pinnata. The structure determination of these compounds was based on spectral analyses including 2D-NMR. The antifungal, antibacterial and phytotoxicity results of pure compounds 1 and 2 as well as of the methanol (M) and ethyl acetate (E) crude extracts are also being reported.

Kalidhar et al (2003) investigated the chemical composition of the roots of Pongamia pinnata. Four compounds, karanjin, pongachromene, pongapin and demethoxykanugin, were characterized from the methanolic extract of its roots by them.

Ahmad et al (2004) have reported three new furanoflavonoid glycosides, pongamosides A-C, and new flavonoid glycoside, pongamoside D from fruits of Pongamia pinnata. The structures of these compounds were established from the spectral data.

Meera, Bhilma et al (2004) studied phytochemical evaluation of Pongamia pinnata seed oil. Methyl oleate and 3’ methoxy (2” 3”’:7, 8) furanoflavone were isolated from seed oil. These compounds were characterized on the basis of spectral and other data.
Naghmana Rashid et al (2008) isolated Karanjachromene, C$_{21}$H$_{18}$O$_4$, from the seed oil of *Pongamia pinnata*. Karanjachromene is a fluorescent pyranoflavonoid. Such compounds are reported to have many interesting pharmacological and industrial applications. They reported on its isolation in significant yield and X-ray crystal structure.$^{16}$

Birajdar et al (2011) reported Biochemical characterization of primary metabolites such as sugar, starch, protein, lipid, phenol, ascorbic acid and amino acid which are present in different plant parts of *Pongamia pinnata*.\(^{17}\)

Prakash et al (2006) investigated on the production of biodiesel through transesterification of Karanja (*Pongamia pinnata*) oil was studied. The Karanja oil was treated with a lower alcohol (methanol) in the presence of a base catalyst (KOH) to yield methyl esters of fatty acids (biodiesel) and glycerin. The influences of reaction temperature, molar ratio of alcohol to oil, amount of catalyst and reaction time on the product yield were studied. The optimal combination of operating parameters for maximum yield was found out using Taguchi’s method. The performance and emission tests were carried out in a four stroke single cylinder, Kirloskar AV1 D.I.Engine. Different blends of biodiesel with conventional diesel were tested. The results show an appreciable reduction in emission level and marginal increase in performance when compared with sole fuel. The results concluded that the biodiesel from Karanja oil can be used as an effective alternate in existing diesel engines without any engine hardware modifications.$^{18}$

Pritee Wagh et al (2007) studied Different concentration of oils obtained from two plants species belonging to family Fabaceae i.e. *Trigonella foenum-graecum* and *Pongamia pinnata*. They were evaluated for their antifungal and antibacterial activity against *Aspergillus niger*, *A. fumigatus*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* by MIC determination and dry-weight method. Both the oils showed high degree of antymycotic and antibacterial activity. *P. Pinnata* oil was more effective as compared to oil of *T. foenum-gracecum*. *A.niger* and *S. Aureus* were more sensitive to oil of *P. pinnata*. Chemical analysis of oils performed by gas chromatography (GC) and gas chromatography/mass spectrometry (GC-MS) showed the presence of fatty acids.$^{19}$
**Synopsis**

**Madhavarao Buddepu (2011) et al** studied the *In-Vitro* Sunscreen Activity of Essential Oil extracted in soxhlet apparatus using hexane and esterifies with methanol from dried seed of *Pongamia Pinnata* (L.) plant. The extract was found to be highly effective in the UVA region and the known standard drug PABA showed its protective action in the UVB and UVC regions and AVOBENZENE showed highly effective in the UVA region. As the extracts of the seed of the plant showed good absorbance throughout the UV region, the photo absorptive compounds in the seed can be isolated and purified and can be used to formulate highly effective sunscreen preparations.

**Shailja Vohra** isolated chemical compound using methanolic extract of *Pongamia glabra* and analysed for its karanjin and other flavonoid and hydrocarbon content by electrospray ionisation (ESI) mass spectroscopy. It showed the presence of six flavonoids namely karanjin, desmethoxykanugin, pongachalcone, pongapin, glabrachromene I, glabrachromene II and six hydrocarbons namely octadecane, undecane, decane, octane, undecanol and tetradecanol. The karanj based products exhibited outstanding antifungal activity against the soil-borne phytophagous fungus *Sclerotium rolfsii* (Sacc.). Karanj oil in the karanjin was more active than karanj oil without karanjin. Karanjin, however, exhibited moderate antifungal activity. Karanjic acid and their three esters exhibited significant antifungal activity. Karanjic acid showed the highest antifungal activity.

**Singh R. K., Joshi V. K. (1996) et al** carried out a study on Pharmacological actions of *Pongamia pinnata* seeds. Direct ethanolic and sequential petroleum ether, chloroform, acetone and ethanolic extracts (50-100 mg/kg, i.p.) of *P. pinnata* seeds given 30-60 min before revealed anti-inflammatory, analgesic and anti-ulcerogenic activities in rats.

**Srinivasan K. (2001) et al** assessed in rats the anti-inflammatory activity of 70% ethanolic extract of *Pongamia pinnata* leaves (PLE) in acute, subacute and chronic models of inflammation. *Per os* (p.o.) administration of PLE exhibited significant anti-inflammatory activity in acute, subacute and chronic models of inflammation. Both acute as well as chronic administration of PLE (100, 300 and 1000 mg/kg, p.o.) did not produce any gastric lesion in rats. These results indicate that PLE possesses significant anti-inflammatory activity suggesting its potential as an anti-inflammatory agent for use in the treatment of various inflammatory diseases.
Musthafa et al (2005) studied the antihyperammonemic efficacy of the ethanolic leaf extract of *Pongamia pinnata* (PPEt) on blood ammonia, plasma urea, uric acid, non-protein nitrogen and serum creatinine in control and ammonium chloride induced hyperammonemic rats. The levels of blood ammonia, circulatory urea, uric acid, non-protein nitrogen and creatinine increased significantly in rats treated with ammonium chloride and decreased significantly in rats treated with PPEt and ammonium chloride. There were no significant changes in the body weights of the experimental animals when compared to controls. The antihyperammonemic effect of PPEt could be attributed to (1) its nephroprotective effect by means of detoxifying excess urea and creatinine, (2) its free radical scavenging property, and (3) its antioxidant property. The exact mechanism of antihyperammonemic effect PPEt has still to be investigated and isolation of the active constituents is required.

Tamrakar et al (2008) studied the antihyperglycemic activity of pongamol and karangin isolated from the fruits of *Pongamia pinnata*. The results showed that pongamol and karangin isolated from the fruits of *Pongamia pinnata* possesses significant antihyperglycemic activity in Streptozotocin-induced diabetic rats and type 2 diabetic db/db mice and protein tyrosine phosphatase-1B may be the possible target for their activity.

Prabha T, Dorababu M (2009) et al studied the Effect of methanolic extract of *Pongamia pinnata* Linn seed on gastro-duodenal ulceration and mucosal offensive and defensive factors in rats. Thus, the ulcer protective effects of PPSM may be attributed to the presence of flavonoids and the actions may be due to its effects both on mucosal offensive and defensive factors. Optimal effective dose of PPSM (25 mg/kg) showed antiulcerogenic activity against acute gastric ulcers (GU) induced by pylorus ligation and aspirin and duodenal ulcer induced by cysteamine but not against ethanol-induced GU. It healed chronic gastric ulcer induced by acetic acid when given for 5 and 10 days.

Badole et al (2009) studied the antihyperglycaemic activity of aqueous (PPSBAQE) and petroleum ether (PPSB-PEE) extract of stem bark *Pongamia pinnata* in alloxan induced diabetic mice. Based on oral toxicity data, PPSBAE showed no mortality in normal mice up to 5,000 mg/kg. PPSBAE was administered as three doses (i.e., 100, 200 and 400 mg/kg) to diabetic mice, and the serum glucose level and body weight were measured. The onset of serum glucose reduction was observed at 2 h (130.32 mg/dl), peak at 4 h (151.79 mg/dl) and
sustained at 6 h, but waned at 24 h. In the subacute study, maximum reduction (305.72 mg/dl) in serum glucose was observed at a dose of 400 mg/kg on day 28. An oral glucose tolerance test (OGTT) was carried out after administration PPSBAE (200 mg/kg) in non-diabetic mice previously loaded with 2.5 g/kg, per oral of glucose. The PPSBAE (200 mg/kg) showed increased glucose threshold in non-diabetic mice. It was found that the PPSB-PEE but not PPSB-AQE showed antihyperglycaemic activity.

Vismaya et al (2011) studied the gastroprotective properties of Karanj seed and found promising results for the treatment of gastric ulcers. Karanjin, a furano-flavonoid has been evaluated for antiulcerogenic property by employing adult male albino rats. Karanjin (>95% pure) was administered to these rats in two different concentrations, i.e. 10 and 20 mg/kg. Ulcers were induced in the experimental animals by swim and ethanol stress. Serum, stomach and liver-tissue homogenates were assessed for biochemical parameters. Karanjin inhibited 50 and 74% of ulcers induced by swim stress at 10 and 20 mg/kg, respectively. Gastric mucin was protected up to 85% in case of swim stress, whereas only 47% mucin recovery was seen in ethanol stress induced ulcers. H+,K+-ATPase activity, which was increased 2-fold in ulcer conditions, was normalized by Karanjin in both swim/ethanol stress-induced ulcer models. Karanjin could inhibit oxidative stress as evidenced by the normalization of lipid peroxidation and antioxidant enzyme (i.e. catalase, peroxidase and superoxide dismutase) levels. Karanjin at concentrations of 20 mg/kg, when administered orally for 14 days, did not indicate any lethal effects. There were no significant differences in total protein, serum glutamate pyruvate transaminase, serum glutamate oxaloacetate transaminase and alkaline phosphatase between normal and Karanjin-treated rats indicating no adverse effect on major organs. During treatment schedule, animals remained as healthy as control animals with normal food and water intake and body weight gain.

Bibhabasu et al (2011) studied the scavenging potential of methanolic extracts of PPL, PPS and PPF on different free radicals and antioxidant activity by ABTS and DPPH method of Pongamia pinnata seed, leaf and flower. The extract of PPL possessed most potent activity compared to other extracts in scavenging assay for singlet oxygen, hydroxyl radical, superoxide radical and nitric oxide radical. PPF exhibited strongest inhibitory activity against hypochlorous acid and peroxy nitrite anion among these three extracts. PPL was the best amongst three to inhibit lipid peroxidation and Fe²⁺-ferrozine complex formation. PPL
was also found effective in protecting plasmid DNA nicking at lower concentration while both PPS and PPF did the same at higher concentration. PPL presented highest content of phenolics and flavonoids among these three extracts. The present results show that *Pongamia pinnta* acts as an antioxidant, iron chelator and protector of oxidative DNA damage. Overall, PPL showed more potent activity than PPF and PPS. From these results it can be suggested that PPL plays significant role in the antioxidant activity of *Pongamia pinnata*.

**Savita Sagwan et al (2011)** studied *Pongamia pinnata* (L.) Pierre (Family: Fabaceae), popularly known as “Karanj”, a medium-sized glabrous tree which have immense medicinal value. In this study callus was raised from the internode. Maximum callus was obtained on MS medium supplemented with combination of NAA (6mg/L), BAP (1mg/L), TDZ (0.02mg/L) along with additives like citric acid (50mg/L) and ascorbic acid (100mg/L). The callus and different plant parts were used for total phenolic contents and antioxidant activity. The total phenol varied from 7.58 ± 0.15 to 12.2 ± 0.22 mg/gdw in the various extracts. 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging effect of the extracts was determined spectrophotometrically. The highest radical scavenging effect was observed in leaves of *Pongamia pinnata* with IC50 = 40 µg/ml. The greater amount of phenolic compounds leads to more potent radical scavenging effect as shown by leaves extract of *Pongamia pinnata*.

**Sunita Shailajan et al (2011)** studied the wound healing efficacy of Jatyadi Taila (JT) a medicated oil formulation (Taila) and also provides evidence of the dermal absorption kinetics of Karanjin from JT. pharmacokinetics of Karanjin from JT after topical application on pinna of rabbit was estimated by HPTLC method.

JT was applied on rabbit pinna and karanjin was quantified from rabbit plasma using the HPTLC method. In current pharmacokinetic study a peak corresponding to karanjin was detected from rabbit plasma after application of JT, which was absent in plasma before application of JT. As per the concentration–time profile, the Tmax of karanjin was at 2 h. The dose of 1025.7 _g karanjin (from JT) was applied on rabbit pinna but up to 10 hr only 27.873 _g of karanjin was detected from rabbit plasma. This shows poor absorption of karanjin from JT. The detection of karanjin however proves that when JT is applied on rabbit pinna, dermal absorption of phytoconstituents takes place which probably facilitates biochemical changes leading to accelerated wound healing. The HPTLC method developed for the estimation of
karanjin from rabbit plasma is simple, precise and reproducible. Current work is the first attempt in validating an HPTLC method for estimation of karanjin from rabbit plasma and applying it to evaluate the dermal absorption of karanjin from JT. Traditional claim on the wound healing efficacy of JT has been well supported by the results of this study. The use of JT in the management of wounds can thus be scientifically justified. JT, an Ayurvedic medicated oil-based formulation, shows great potential to be developed into an ointment or gel for topical use. The change of the delivery system can enable not only the ease of application but also better absorption of its actives. Findings of the current study provide baseline data for designing further investigations on the therapeutic action of JT especially to evaluate wound healing efficacy in diabetics as well as in chronic ulcers.

Zahid et al (2012) studied antioxidant and antimicrobial attributes of various solvent extracts (absolute methanol, aqueous methanol, absolute ethanol, aqueous ethanol, absolute acetone, aqueous acetone, and deionized water) from bark, leaves and seeds of Pongamia pinnata (L.) Pierre. Maximum extraction yield of antioxidant components from bark (16.31%), leaves (11.42%) and seeds (21.51%) of P. Pinnata was obtained using aqueous methanol (20:80). Of the extracts tested, the bark extract, obtained with aqueous methanol, exhibited greater levels of total phenolics [6.94 g GAE/100 g dry weight (DW)], total flavonoids (3.44 g CE/100 g DW), inhibition of linoleic acid peroxidation (69.23%) and DPPH radical scavenging activity (IC50 value, 3.21 µg/mL), followed by leaves and seeds extracts. Bark extract tested against a set of bacterial and fungal strains also revealed the strongest antimicrobial activity with the largest inhibition zone and lowest minimum inhibitory concentration (MIC).