Since early Vedic periods plants are being used for a wide range of medicinal purposes. The practice of using plants and its products for curing the ailments of man and animals is continuous unbroken tradition for ever the years. This is evident in living folk tradition and in the codified knowledge systems such as Ayurveda, Siddha and Unani. Several important drugs used in the modern system of medicine are obtained from plants.

The plants have contributed more than several thousands of different compounds described as primary and secondary metabolites which are used as drugs, laxatives, anticancer, hormones, contraceptives, anesthetics, anti-inflammatory, antioxidant agents etc. metabolites are compounds synthesized by plants for both essential functions, such as growth and development (primary metabolites), and specific functions, such as pollinator attraction or defence against herbivory (secondary metabolites). The primary metabolites are found universally in the plant kingdom because they are the components or products of fundamental metabolic pathways or cycles such as glycolysis, the Krebs cycle, and the Calvin cycle. Because of the importance of these and other primary pathways in enabling a plant to synthesize, assimilate, and degrade organic compounds, primary metabolites are essential. In addition to having fundamental roles in plant growth and development, some primary metabolites are precursors (starting materials) for the synthesis of secondary metabolites. Many thousands of secondary metabolites have been isolated from plants, and many of them have powerful physiological effects in
humans and are used as medicines. It is only since the late twentieth century that secondary metabolites have been clearly recognized as having important functions in plants.

The dietary plants are also considered to be medicinally which are going to reduce the risk of several chronic diseases. In recent years a lot of research has been done in the development of chemopreventive agents derived from foods that constitute integral parts of the human diets (Reddy et al., 2003; Shukla and Kumar Pal, 2004; Surh, 2003). Grain legumes are traditionally consumed as human foods, along with cereals in various forms. Among food crops, legumes contain the highest amount of protein, generally twice the level found in cereal grains. Legumes, which play a crucial role in many diets worldwide are thought to be related with beneficial health implications in chronic diseases such as certain cancer types (colon, breast, prostate) (Mathers, 2002), cardiovascular diseases (Kushi et al., 1999) and diabetes (Venn and Mann, 2004). Except from their known high nutritive value (Messina, 1999), significant quantities of phytochemical compounds are identified in legumes and considered to be responsible for their beneficial effects (Rochfort and Panozza, 2007; Kris-Etherton, 2002; Champ, 2002).

_Cajanus cajan_ (L.) Millsp (In English: Red gram, Hindi: Tur or Arhar, Kannad: Togari, Sanskrit: Adhaki) is a perennial member of the family Fabaceae. Other common names are pigeon pea, congo pea, gungo pea and no-eye pea (Ambasta, 2004). Among the “Pigeon pea” is the globally
popular name that was coined by Plukenet (1692) in Barbados, where the crop was in barren lands for feeding its seeds to pigeons. The *C. cajan* plant can survive up to 3-4 years. The traditional *C. cajan* cultivars and most landraces are tall and take about 180-280 days to mature. It is originated in Asia and is being cultivated over 3000 years. *C. cajan* is grown throughout the tropical and subtropical countries especially in South Asia, eastern and southern Africa, Latin America and Australia. It is widely grown about 14 countries which includes over 4 million hectare. The major producers of *C. cajan* in the world include India followed by all other 13 countries (Sinha, 1977). About 90% of the World production of *C. cajan* is contributed by India where it is cultivated in semi-arid regions as Kharif. It is the most widely grown grain legume, covering an area of about 2.9 million hectares with an annual yield of about 1.6 million tons (Nene et al., 1990). It is mainly grown in regions lying between 14 and 28 N latitudes covering 73 districts in 5 states. In Karnataka *C. cajan* is grown in an area of 5.83 lakh hectares with a production of 2.57 lakh tonnes. It is largely grown in the northern parts of the state in Gulbarga, which is known as “Pulse bowl of Karnataka”. *C. cajan* is very prominent crop in this district and covers approximately an area of 2.5 lakh hectares occupying 65% of the total area under *C. cajan* cultivation in the state. No other districts in Karnataka, other than Gulbarga produce better quality and quantity of pulse particularly *C. cajan*.

The *C. cajan* is a multipurpose plant as its seeds are extensively eaten as ‘dhal’ contains approximately 22% protein depending on cultivar’s
and location. The leaves are used for rearing of silkworms; green pods are used as vegetables; husk, green leaves and tops are used as fodder and also as green manure (Ambasta, 2004). Amongst its many medicinal uses, *C. cajan* leaves is indicated in the relief of pain in traditional Chinese medicine and as a sedative (Ahsan and Islam, 2009 a, b). In recent years it has also been explored for the treatment of ischemic necrosis of the caput femoris, aphtha, bedsore and wound healing. Chemical investigations of leaves have revealed the presence of two globulins, cajanin and concajanin (Ambasta, 2004). It has been used widely for many years for treating diabetes, sores, skin irritations, hepatitis, measles, jaundice, dysentery and many other illnesses; for expelling bladder stones and stabilizing menstrual period (Yuan-gang *et al.*, 2010; Aiyeloja and Bello, 2006; Chen *et al.*, 1985; Li *et al.*, 2001; Luo *et al.*, 2008). Dried roots of *C. cajan* are sometimes used as an alexeritic, anthelmintic, expectorant, sedative and vulnerary. The flowers are prepared in an infusion for dysentery and menstrual disorders. In Argentina floral decoctions are used for bronchitis, coughs and pneumonia, sometimes used as an alexeritic, anthelmintic, expectorant, sedative and vulnerary.

The seeds are infused to use as a diuretic. In Brazilian the seeds are prepared in a tea for inflammation and blood disorders. Scorched seed, added to coffee, are said to alleviate headache and vertigo. Fresh seeds are said to help incontinence of urine in males, while immature fruits are believed of use in liver and kidney ailments (Duke, 1981). The seeds are
astringent, acrid, sweet, cooling, anthelmintic, resolvent, hepatitis, expectorant and constipation (Kirtikar and Basu, 1998; Naryan et al., 2007).

In India, *C. cajan* seeds are commonly processed by dehulling or milling to improve its cooking and nutritional properties. Dehulling of this legume results in different types of milled fractions such as cotyledon, embryonic axe and seed coats. The cotyledon also known as ‘dhal’ obtained after dehulling of these legumes is main reserve for protein and starch and is consumed in a diversity of forms. The by-products of dehulling such as seed coat, embryonic axe fraction and powder have comparatively low value, because they are used as feed material in livestock production farms (Maheri-Sis et al., 2007). The by-product of dhal milling industry including seed coats has the potential to be used as ingredients in the preparation of speciality products for human consumption (Ramakrishnaiah et al., 2004). Generally the seed coats of legumes, which act as protective barriers for the cotyledon, possess highest concentration of phenolic compounds. Abundant phenolic compounds in the seed coats of legumes are believed to work synergistically to promote human health through a variety of different mechanisms, such as enhancing antioxidant activity, impacting cellular processes associated with apoptosis, platelet aggregation blood vessel dilation and enzyme activities associated with starch, protein and lipid digestion, carcinogen activation and detoxification (Shahidi et al., 1992).

Antioxidant supplements or foods rich in medicinal plants are used to help the human body in reducing oxidative damage by free radicals and
active oxygen. Currently, research interest has been focused on the role of antioxidants as well as antioxidant enzymes, in the treatment and preservation of many diseases. Antioxidants may guard against ROS toxicities by the preservation of ROS construction, by disruption of ROS attack, by scavenging reactive metabolites and converting them to loss reactive molecules or by enhancing the resistance of sensitive biological target to ROS attack. Recently, natural foods and derived antioxidants such as vitamins and phenol phytochemicals have received growing attention. This is because they are known to function as chemopreventive agents against oxidative damage. Natural antioxidants are known to exhibit a wide range of biological effects including antibacterial, antiviral, hepatoprotective, anti-inflammatory, antiallergic, antithrombic, vasodilatory, anticarcinogenicity, anti-immunogenicity and anti-aging activity. Hence, compounds especially from natural sources, capable of protecting against ROS mediated damage may have potential application in the prevention and/or curing of diseases. Traditional medicine is an important source of potentially useful new compounds for the development of chemotherapeutic agents.

An extensive research work has been carried out on phytochemical, antioxidants and pharmacological investigation has been done by so many research scientists are till the date among them few most Important investigations are useful in the present investigation by Jagroop (1999); Joseph et al. (2004); Pal et al. (2006); Kasturi Sarkar et al. (2006); Ighodaro and Omel, 2010; Pal et al. (2007); Pal (2008); Pal et al. (2008); Dolly Jaiswal
et al. (2008); Jaiswal (2008); Luo et al. (2008a); Luo et al. (2008b); Ashan and Islam (2009a); Ashan and Islam (2009b); Suman Pattanayak et al. (2009); Pranay Dogra (2009); Pal and Mitra (2010); Pal et al. (2010); Oyewole et al. (2010); Anwar Habib et al. (2010); Adobe et al. (2010); Singh et al. (2010); Luo et al. (2010); Zhang et al. (2010); Nicholson (2010); Mohanty et al. (2011); Sidharth Singh et al. (2011); Anjana Male et al. (2012).

It is evident from the available literatures that the search for crude drugs of plant origin with phytochemical and pharmacological studies has become a central focus of research. In accordance with this, the present study was focused on analyzing the in vivo and in vitro pharmacological aspects of C. cajan.

In Karnataka State Gulbarga District produce better quality and quantity of pulses particularly C. cajan. This may be agro climatic conditions of this region that is favorable for the production of several varieties of C. cajan. Among var. Maruti (ICP-8863) (Plate-1.1) producing maximum in this region. The seeds are used as ‘dhal’. Leaves and seeds are used as medicine.

Despite many scientific validations attempted and reported on leaves and seeds of C. cajan, not many studies on highlighting its phytochemical, and pharmacological properties have been reported. The present study was undertaken to analyze the different parts of C. cajan for phytochemical,
Plate 1.1: a - Crop of *C. cajan* var. Maruti (ICP-8863); b - *C. cajan* plant with pod; c - Mature and dried pod showing the seeds.
in vitro and in vivo pharmacological aspects such as antioxidant, antimicrobial and hepatoprotective activity. Further, it is worthwhile in the present study to investigate to the leaves, seed coat and cotyledon of *C. cajan* for phytochemical and pharmacological aspects. The objectives of the present investigation are; preliminary phytochemical screening, quantitative analysis of primary and secondary metabolites; pharmacognostic studies of different parts of plant; antimicrobial activity of leaf, seed coat and cotyledon extracts; antioxidant activity of leaf, seed coat and cotyledon extracts; acute toxicity and hepatoprotective activity of ethanolic extract of seed coat and cotyledon.

Thus, the present thesis comprises six chapters. The first chapter gives a brief general introduction to the field of Phytochemical and Pharmacological studies on *C. cajan* and which indicating the scope, motivation and objective of the present investigation.

The second chapter gives phytochemical studies it includes a brief introduction and related review available to this study. Experimental details includes plant material collection, extraction and to analyze the phytochemicals such as primary and secondary metabolites using different methods. Results obtained by various parameters were discussed in the light of the available literature.

The third chapter gives a pharmacognostic studies it includes a brief introduction and related review available to this study, the methods used for the pharmacognostic standardization of drug and obtained results are discussed.
The fourth chapter gives an antioxidant activity it includes a brief introduction and related review available to this study. The methods used for analysis of antioxidant contents and \textit{in vitro} antioxidant activity. Results obtained by various parameters are discussed.

The fifth chapter gives an antimicrobial activity it includes a brief introduction and related review available to this study. Experimental details for screening the \textit{in vitro} antibacterial activity. The obtained results are discussed.

The sixth chapter gives a hepatoprotective activity it includes a brief introduction and related review available to this study. Material chosen for this study is ethanolic extract of seed coat and cotyledon. Experimental details of acute toxicity and hepatoprotective activity on albino mice. The results on effect of ethanolic extract of seed coat and cotyledon of \textit{C. cajan} on CCl\textsubscript{4} induced hepatotoxic mice were observed and discussed in different biochemical, \textit{in vivo} antioxidant and histopathological parameters.

The results obtained in the present study, the summary and conclusions drawn from them are presented in the seventh chapter. The last chapter gives the conclusion of the present work on current achievements of phytochemical, pharmacolognostic, antioxidant, antimicrobial and hepatoprotective activity.