International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

Pharmacognostical Studies and Pharmacological Activities of Cardiospermum Halicacabum –A Review

Vedhachalam.V *3, T. Sampath Kumar[1], C. Jothimanivannan[2], Kayalvizhi[3], Chanduru[3], Gokulraj[3]

[1]*Department of Pharmacognosy, SS Institute of Pharmacy, Sankari, Salem 637301.*
[2]*Department of Pharmaceutical chemistry, SS Institute of Pharmacy, Sankari, Salem 637301.*
[3]*Students, SS Institute of Pharmacy, Sankari, Salem 637301*
Corresponding author: Vedhachalam

Submitted: 07-09-2022 Accepted: 17-09-2022

ABSTRACT: Cardiospermum halicacabum (Sapindaceae) commonly known as balloon vine, balloon plant or love in a puff is important plant used traditionally for medicinal purposes. Several chemical constituents like **f β-sitosterol, Stigmasterol, Flavones Alkaloids, Steroids, Terpenoids, Saponins, Sugars, Essential oil, Resin, Tannin** etc., have been identified. Cardiospermum halicacabum extract shows promising results in **rheumatism, lumbago, earache and fever.** This plant has various pharmacological activities like antibacterial, antioxidant, analgesic, anti-inflammatory, hepatoprotective, anxiolytic, antimalarial, anticancer, snake venom, antihyperglycemic, anticonvulsant, antiparasitic, anti-arthritic etc. This paper explains the evidence-based information regarding the phytochemistry and pharmacological activity of the plant which helps the researchers for more qualitative research.

Keywords: Cardiospermum halicacabum, Flavonoids, Anti-arthritis, Balloon vine, Anti-cancer, Anti diabetic.

I. INTRODUCTION

The balloon vine is a strongly overgrown, perennial herbaceous climbing plant that can even become lignified at the base. Growing over 10 meters high, it can bloom at a height of around 25 cm. The slender, grooved stems are hairy bald to sparsely downy. The 5 to 6 cm long, triangular foliage leaves distributed on the stem are divided into a petiole and pinnate leaf blade. The petiole is (0.5 to) 1.5 to 3.5 cm long and the rachis is 0.4 to 2 cm long. The opposite leaflets are 1 to 2 cm long and the terminal leaflets are 4 to 6 cm long. The leaf margins are serrated. The stipules are reduced to tiny, early-falling scales. On the side of a 5 to 9 cm long, sparsely downy hairy inflorescence stem, there are two 1 mm long bracts, two circularly rolled tendrils and three to seven flowers in a zymous inflorescence. The functionally unisexual flowers
are zygomorphic and fourfold double perianth. Of the four free, concave, durable sepals, the outer two are circular, 2 mm long and ciliate, while the inner two are oblong-ovate, 3 to 4 mm long and glabrous. The four white to yellowish petals is obovate and about 3 mm long, the upper two are each adorned with woolly scales and the lower two have large, leaf-shaped scales and two glands. In the male flowers are two circles with four free stamens each and rudimentary stamps present. The compressed stamens are hairy and about 2 mm long and the anthers are about 0.5 mm long. In the female flowers are obovate, 2 to 3 mm long and hairy, insulated draft tube ovary with a short fluffy hairy stylus, which ends in a three-part scar and eight staminodes present. The conspicuous, membranous, almost spherical or broad pear-shaped capsule fruits have a diameter of 3 to 5 cm, initially fluffy hairy, light green "balloons" brown when ripe. There is only one seed in each of the three fruit chambers. A noticeable feature of the individual seeds is a large, light heart-shaped spot on the otherwise almost black seed. The kidney-shaped seeds have a diameter of about 6 mm and at their base a white, heart-shaped aril about 5 mm wide. The 1989 book records that "The root is diuretic and demulcent. It is mucilaginous, but has a nauseous taste, and is used to treat rheumatism. Sanskrit writers describe the root as emetic, laxative, stomachic and they prescribe it in rheumatism, nervous disease. The leaves are used in amenorrhoea. Rheede says that on the Malabar coast the leaves are administrated for pulmonic complaints. It is also used in homeopathy to treat eczematic skin. For this purpose, a mother tincture is made from the flowering parts of the plant. This is also processed

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

into creams and ointments. The green parts of the plant are eaten as vegetables. According to Ainslie, the root is considered laxative, and is given in dosages of half a cupful twice daily. "It would appear that in rheumatism the Hindus [sic.] administer the leaves internally rubbed up with castor-oil, and also apply a paste, made with them, externally; a similar external application is used to reduce swellings and tumours of various kinds." (Dymock.). Its ingredients include triterpene saponins, halicaric acid, catechin tannins, terpenes, phytosterols, flavo noids and quebrachitol. In future studies this article will help to formulate new formulations.[1]

II.PHARMACOGNISTIC STUDIES

Profile of Cardiospermum halicacabum Linn.

Botanical Name : Cardiospermum halicacabum Linn.

Common Names : Balloon vine, Blister creeper, Heart seed, Heart pea, Love in a puff, Winter cherry.

Family: Sapindaceae The plant is Herbaceous, climber in nature of 1-3 meter height with presence of tendrils. Hindi – Kanphuti ,Sanskrit – Jyotishmati

Parts used: Whole plant

Distribution : Commonly found as a weed throughout India,

Description : An annual or sometimes perennial climber, Around 3.5m in height.

Leaf - Alternate, compound with pinnate venation, Leaflets beared lobed margins, lanceolate in shape, acute, rachis 5 to 7 cm long, upper surface dark green, lower pale,

Stem - slender, cylindrical, glabrous, internodes 6 to 7 cm in length and 2-4 mm in diameter, Weak.

Inflorescence - umbellate cyme

Flowering Time: C. halicacabum flowers from July to August.

Pollinator : Pollinated by bees, wasps, flies, and butterflies.

Flower - White-yellow in colour,, 2-3 mm long in clusters, irregular, complete, bisexual, green, gamosepalous, outer two small, flower beared four sepals, two large and two small, four whitish petals 4mmlong, Stamens 8, creamy white, free, filaments up to 2mm long, Ovary superior, trilocular, style very short, stigma trifid. Fruit – Membranous, inflated, green capsules, around 25 mm long. Green converting into brown after maturation, fruits were green, balloon like papery capsules with three chambers, 3-4 cm in diameters.

Seed - Round, Black, Kidney shaped. Seeds were black, opaque smooth with a white heart shaped spot at the micropyle, seeds ripen from August to October.

PHYTOCHEMISTRY

The whole plant contains Alkaloid, flavanoids, apigenins and phytosterols etc. Whole plant contains alkaloids, â-sitosterol, L-triacontanol, n-pentacosane and ntriacontane. Leaves of the plant contain tannins, saponins, flavonoids, glycosides and cardiac glycosides. Plant also contains oxalic acid, amino acids. Plant also contains oxalic acid, amino acids.

MEDICINAL PROFILE/ PHARMACEUTICAL ACTIVITIES

The plant is main source of many active chemical compounds with important traditional medicinal uses among human society. The plant is utilized singly as well as by mixing with different plant parts of varied plant species. It has multifold ethnomedicinal uses such as –

Ethnobotanical Uses: C. halicacabum has been used in the treatment of many disorders. It is useful as diaphoretic, diuretic, emetic, laxative, refrigerant, stomachic, antibacterial, antioxidant, Wound healing, anti inflammatory , antidiarrhoeal, antidiarrhoeal, antiulcer, nervous diseases, itching, fruits are used for boils etc.[2]

III.PHARMACOLOGICAL ACTIVITIES

1.Acetaminophen-induced nephrotoxicity:

Nephrotoxicity induced by several synthetic drugs is a major problem of modern age. Medicinal plants and phytomedicine are the prime choice of research as they possess better activity and lesser side effects. To investigate the protective effect of Cardiospermum halicacabum Linn. (Sapindaceae), methanol and petroleum ether extracts against acetaminophen-induced nephrotoxicity in rats. Nephrotoxicity was induced by the administration of acetaminophen suspension (750 mg/ kg, p.o.) after the pretreatment with methanol extract (MECF) and petroleum ether extract (PEECF) of Cardiospermum halicacabum for 7 days. Forty-eight h after the acetaminophen administration estimations of serum alkaline phosphate, creatinine, blood urea nitrogen, uric acid, total proteins, cholesterol, albumin level and histological analysis of kidney injuries were determined. In nephrotoxic animals, a significant ($P < 0.01$) elevation of serum alkaline phosphate, creatinine, blood urea nitrogen, uric acid,

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

cholesterol and depletion of total proteins and albumin were observed. Pretreatment with MECF and PEECF (400 mg/kg) significantly ($P < 0.01$, $P < 0.05$) decreased serum alkaline phosphate, creatinine, blood urea nitrogen, uric acid, cholesterol level and causes elevation of total protein and albumin level, though MECF produces better effect than PEECF in rats. Histopathological studies also confirm the protective effect of extracts. The protective effect of Cardiospermum halicacabum was associated with restoration of serum alkaline phosphate, creatinine, blood urea nitrogen, uric acid, cholesterol, total protein and albumin level. Methanol and petroleum ether extracts of Cardiospermum halicacabum had a significant nephroprotective activity against acetaminophen-induced nephrotoxicity in rats.[3]

2.Anxiolytic activity:

The present study was designed to investigate anti anxiety effects of alcoholic and aqueous root extracts of Cardiospermum halicacabum in mice. Mice were treated with the alcoholic or aqueous extract (100 or 300 mg/kg p.o.) 1 hr before subjecting the animals to various anxiety models. Anti anxiety activity was evaluated using elevated plus maze (EPM), light-dark model (LDM) and open field test (OFT). In EPM, treatment with alcoholic and aqueous extracts increased the time spent in open arm and total locomotion time. In light dark model treatment with these extracts showed increase in time spent in light compartment and in Open field test treatment with these extracts increased the time spent in central compartment. These results suggest that alcoholic and aqueous extracts of Cardiospermum halicacabum possess anti anxiety activity.[4]

3.Antibacterial activity:

The crude extracts from leaf and stem of cardiospermumhelicacabum in different solvent, were subjected to pharmacognostic and fluorescence analysis, phytochemical and antimicrobial screening against selected Gram positive and Gram negative bacteria. Acetone, alcohol, benzene, chloroform and aqueous extracts of leaf and stem were used for phytochemical screening and antimicrobial activity. Phytochemical studies indicated that the leaf and stem contain a broad spectrum of secondary metabolites. Phenol, tannins and saponins were predominantly found in all the five tested solvent extracts of leaf followed by steroids, sugars, flavonoids and terpenoids (Benzene and acetone). Like wise, phenol, tannin, amino acids were predominantly found in all the tested solvent extracts of the stem. Triperpenoids were not found in any of the solvent extracts of stem. All the extracts showed varying degree of inhibitory potential against all the tested bacteria. Acetone and chloroform extracts of leaf had higher inhibitory action against Salmonella typhi and Streptococcus subtilis respectively. Acetone extracts of stem showed maximum inhibitory action against S. typhi and benzene extracts of stem had moderate inhibitory action against Escherichia coli.[5]

4.Anti-Microbial activity:

The phytochemical screening and In-vitro anti-microbial activity leaves of cardiospermum halicacabum linn (Sapindaceae) were investigated. The preliminary phytochemical analysis revealed the presence of alkaloids, carbohydrates, proteins and saponins. The extracts exhibited marked anti-microbial activity against both Gram +ve and Gram-ve bacteria. When the concentration of the extracts was increased the zone of inhibition also increased.[6]

5.Antioxidant &Anticancer activity:

To investigate the in vitro antioxidant and anticancer activity of chloroform and ethanol extracts of Cardiospermum halicacabum L. leaves. Phytochemicals were analysed by using standard methods. In vitro antioxidant studies were carried out for the chloroform and ethanol extracts of the Cardiospermum halicacabum using various free radical models such a DPPH, Reducing power assay, nitric oxide scavenging, hydrogen peroxide (H_2O_2) Preliminary phytochemical analysis of the Cardiospermum halicacabum L. was carried out and it revealed the presence of alkaloids, coumarine, flavones, saponins, steroids, sugar, tannins and terpenoids. The results revealed that the chloroform extract has significant antioxidant potential than ethanol extract. The result revealed that the chloroform extracts of Cardiospermum halicacabum L. showed pronounced anticancer activity against Ehrlich Ascites Carcinoma (EAC) cell line than ethanol extract.) scavenging, super oxide scavenging activity and ABTS. In vitro cytotoxic assay such as trypan blue dye exclusion and MTT assays were carried out against EAC cell line. The result of the present study concluded that the chloroform extract of Cardiospermum halicacabum L have significant antioxidant and anticancer activity then the ethanolic extract. The potential antioxidant and anticancer activity of

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

Cardiospermum halicacabum L might be due to the presence of phytochemicals.[7]

6.Snake Venom Induced property:

Snakebite is a serious medical and socio-economic problem affecting the rural and agricultural laborers of tropical and sub-tropical region across the world leading to high morbidity and mortality. In most of the snakebite incidences, victims usually end up with permanent tissue damage and sequelae with high socioeconomic and psychological impacts. Although, mortality has been reduced markedly due to anti-venom regimen, it is associated with several limitations. Snake venom metalloprotease, hyaluronidase and myotoxic phospholipase A2 are the kingpins of tissue necrosis and extracellular matrix degradation. Thus, inhibition of these enzymes is considered to be the rate limiting step in the management of snakebite. Unfortunately, tissue necrosis and extracellular matrix degradation persists even after the administration of anti-venom. At present, inhibitors from snake serum and plasma, several synthetic compounds and their analogs have been demonstrated to possess anti-snake venom activities, but the use of plant metabolites for this purpose has an added advantage of traditional knowledge and will make the treatment cheaper and more accessible to the affected population. Therefore, the clinical and research forums are highly oriented towards plant metabolites and interestingly, certain phytochemicals are implicated as the antibody elicitors against venom toxicity that can be exploited in designing effective anti-venoms. Based on these facts, we have made an effort to enlist plant based secondary metabolites with antiophidian abilities and their mechanism of action against locally acting enzymes/toxins in particular. The review also describes their functional groups responsible for therapeutic beneficial and certainly oblige in designing potent inhibitors against venom toxins.[8]

7.Antihyperglycaemic effect:

The present study was designed to investigate the antihyperglycaemic effect of ethanolic extract of Cardiospermum halicacabum Linn. (Sapindaceae) leaves on normal and streptozotocin (STZ) diabetic rats. Diabetes was induced into male albino Wistar rats by intraperitonial administration of STZ. The Cardiospermum halicacabum leaf extract (CHE) was administered orally at three different doses to normal and STZ-diabetic rats for 45 days. The diabetic rats showed an increase in levels of blood glucose and glycosylated haemoglobin (HbA1c) and a decrease in the levels of insulin and haemoglobin (Hb). In addition, diabetic rats showed a significant reduction in the activity of glucokinase and an elevation in the activities of gluconeogenic enzymes such as glucose-6-phosphatase and fructose-1, 6-bisphosphatase. Treatment with CHE significantly decreased plasma glucose and HbA1c, and increased the levels of insulin and Hb. CHE administration to diabetic rats reversed these enzyme activities in a significant manner. Thus, the results show that CHE possesses an antihyperglycaemic activity and provide evidence for its traditional usage in the control of diabetes. The 200 mg dose of the extract produced a better effect than 50 or 100 mg doses.[9]

8.Anticonvulsant activity:

The aim of the present study was to evaluate the anticonvulsant effects of alcoholic root extract of Cardiospermum halicacabum L., Sapindaceae (ARECH), on the various murine models of epilepsy. The root extract of the plant was administered p.o. to male swiss albino mice at doses of 30, 100 and 300 mg/kg before evaluation. The brain monoamine levels were determined after two days administration. ARECH at doses of 100 and 300 mg/kg significantly delayed the onset of clonus and tonus in pentylenetetrazol, isoniazid and picrotoxin-induced convulsions. Tonic hind limb extension was also decreased at doses of 100 and 300 mg/kg as compared to vehicle control in maximal electroshock model. No significant motor toxicity was observed even at a highest dose administered, i.e.900 mg/kg. Brain monoamine analysis by HPLC revealed a significant increase in GABAergic activity in C+ (in cerebellum) and C- (except cerebellum). These results suggested that ARECH possesses a significant anticonvulsant activity with a low motor toxicity profile. This activity may be attributed to an increase in GABAergic activity.[10]

9.Antioxidant activity:

Fresh and dried materials of C.halicacabum was evaluated for their total phenolic Content (TPC) and antioxidant activity using DPPH (1, 1-diphenyl-2picrylhydrazyl), TPC (Total phenol content) and FRAP (Ferric Reducing Antioxidant Power) methods showed a significant reduction in antioxidant property for microwave treated plant material when compared to other

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

drying treatments. Highest DPPH radical scavenging effect was observed in methanol extraction of microwave treated sample. The highly significant total phenol content (3.08±0.002) was recorded with freshly used plant material extracted with distilled boiled water. Proposionate to the phenolic content, extract from boiling water showed significant ferric reducing activity (5.080±0.006),due to greater solubility of compounds, breakdown of cellular constituents as well as hydrolysis of tannins. A strong free radical scavenging activity in the chosen plant material suggests that it has great potential in the food industry as a functional food ingredient.[11]

10.Antiparasitic activity:

Extracts of Cardiospermum halicacabum, medicinal plant, were tested in vitro for their effectiveness against third-stage larvae of Strongyloidesstercoralis. Third-stage larvae of S. stercoralis were isolated from cultures of dog's feces using agar plate culture method. The larvae (1,000 larvae/ml), suspended in phosphate buffer saline solution, pH 7.4, were exposed to aqueous and alcohol extracts (2,000 microg/ml) of C. halicacabum at 37 degrees C with 5% CO2. Ivermectin (250 microg/ml) and piperazine (2,000 microg/ml) were also used as the reference drugs. The survival of Strongyloides larvae based on its motility was determined daily for 7 days. Strongyloides larvae were viable after contact with ivermectin, piperazine and C. halicacabum (aqueous and alcohol) solutions, but most of them were immobilized, after exposure to aqueous and alcohol extracts of C. halicacabum within 72 and 48 h, respectively, while ivermectin took from 72 to 144 h, and piperazine more than 7 days, to achieve the same rate of nonmotility. Clearly, the viability of S. stercoralis larvae was significantly reduced when exposed to extracts of C. halicacabum. Further study is needed on the antiparasitic activity of aqueous and alcohol extracts of C. halicacabum against S. stercoralis.[12]

11.Antifilarial activity:

The in vitro effects of ethanol and aqueous extracts of the medicinal plant Cardiospermum halicacabum on adult worms and microfilariae of Brugia pahangi were investigated. With or without the plant extracts in culture medium, the motility of adult worms, microfilariae and microfilarial release from female worms were monitored daily. After 7 days of culture, viability or tissue damage of adult worms was assessed using the MTT assay. At > 500 microg ml-1, the aqueous extract significantly reduced motility of adult females after 24 h of exposure and adult males after 3 days. The aqueous extract, at > 500 microg ml-1, also significantly reduced microfilarial release from female worms, starting on day 2. The reduction in the motility of adult worms and the pattern of microfilarial release from female worms were concentration and time dependent. The MTT assay results revealed that adult worms cultured in the presence of aqueous extracts at > 500 microg ml-1 were damaged. However, the aqueous extract did not affect the motility of microfilariae with the exception of those in higher concentration extracts. Higher concentrations of ethanol extracts (2 mg ml-1) inhibited both the motility of adult worms and the release of microfilariae from females. Little effect of ethanol extracts was detected by the MTT assay, as only slight damage was caused to worms exposed only to the highest concentration (2 mg ml-1). However, ethanol extract at 500 microg ml-1 rapidly reduced the motility of microfilariae on day 2. The present study revealed that an aqueous extract of C. halicacabum has mild but definite direct macrofilaricidal action on B. pahangi.[13]

12.Repellent properties:

To determine repellent activity of hexane, ethyl acetate, benzene, chloroform and methanol extract of Cardiospermum halicacabum (C. halicacabum) against Culex quinquefasciatus (Cx. quinquefasciatus), Aedes aegypti (Ae. aegypti) and Anopheles stephensi (An. stephensi) Evaluation was carried out in a net cage (45 cm×30 cm×25 cm) containing 100 blood starved female mosquitoes of three mosquito species and were assayed in the laboratory condition by using the protocol of WHO 2005; The plant leaf crude extracts of C. halicacabum was applied at 1.0, 2.5, and 5.0 mg/cm2 separately in the exposed area of the fore arm. Only ethanol served as control. In this observation, the plant crude extracts gave protection against mosquito bites without any allergic reaction to the test person, and also, the repellent activity was dependent on the strength of the plant extracts. The tested plant crude extracts had exerted promising repellent against all the three mosquitoes.From the results it can be concluded the crude extract of C. halicacabum was potential for controlling Cx. quinquefasciatus, Ae. aegypti and An. stephensi mosquitoes.[14]

13.Hepatoprotective activity:

Hepatoprotective activity of petroleum ether (pet ether), chloroform (CHCl3) and ethanol

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

(EtOH) extracts of the whole plant Cardiospermum helicacabum Linn. has been evaluated using CCl4 induced hepatic damage in Wistar rats. Previous reports on toxicological evaluation of Cardiospermum helicacabum Linn. revealed that the drug is safe and is not toxic up to 40g/kg in rats and based upon this, doses are selected and the extracts were administered in three graded doses, low dose 200mg/kg, moderate dose 400mg/kg and high dose 800mg/kg. The hepatoprotective activity was assessed by measuring biochemical parameters like serum bilirubin (TB), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), total protein (TP). It was observed that moderate and high dose of EtOH and high dose of pet ether showed highly significant results. Among all the extracts the hepatoprotective activity of EtOH was found to be more pronounced and promising. Preliminary qualitative phytochemical investigation showed the presence of flavonoids in the EtOH extract of Cardiospermum helicacabum, it is quite relevant to correlate the presence of high concentration of flavonoids to its antioxidant property.[15]

14.Antiarthritic activity:

The present work was carried out to investigate the free radical scavenging activity of the ethanol extract of C. halicacabum leaves (EECH), to study its antioxidant properties and anti-rheumatic effects in Wistar rats with CFA-induced arthritis, and to profile the phenolic components thereof by LC–MS/MS. The free radical scavenging activities of the extract was evaluated by NO and superoxide anion scavenging assays. Arthritis was induced to the albino Wistar rats by CFA. Fifteen days after CFA induction, arthritic rats received EECH orally at the doses of 250 and 500 mg/kg daily for 20 days. Diclofenac sodium was used as reference standard. EECH is subjected to LC–MS/MS analysis for the identification of phenolic compounds.The IC_{50} value of the EECH to scavenge the NO and superoxide radicals are 83 and 60 µg/ml respectively. Ultrasonography and histology images of hind limb in EECH treated groups confirmed the complete cartilage regeneration. The LC/MS/MS analysis indicated the presence of anti-inflammatory compounds luteolin-7-O-glucuronide, apigenin-7-O-glucuronide and chrysoeriol.These findings lend pharmacological support to the reported folkloric use of C. halicacabum in the treatment and management of painful, arthritic inflammatory conditions.[16]

15.Antipyretic activity:

Cardiospermum halicacabum extracts have been evaluated for their antipyretic activity against yeast-induced pyrexia in rats. The ethanol as well as n-hexane extracts (400 mg/kg) of the whole plant powder showed potent antipyretic activity. The water extract was devoid of significant activity. The antipyretic activity of the ethanol extract was concentration dependent.[17]

16.Antiulcer activity:

Ethanol extract of Cardiospermum halicacabum Linn. (Sapindaceae), in a concentration dependant manner (200-600mg/kg) inhibited gastric ulcers induced by oral administration of absolute ethanol. Further, the extract administration to rats resulted in an increase in levels of gastric glutathione and a decrease in alkaline phosphatase activity. The extract also exhibited potent in vitro hydroxyl radical scavenging and inhibition of lipid peroxidation activities. The extract was found to be devoid of any conspicuous acute and short-term toxicity in rats.[18]

17.Antidiarrhoeal activity:

To evaluate the antidiarrhoeal activity of whole plant extracts of Cardiospermum halicacabum (Linn) in rats. Petroleum ether (PeCH) and alcoholic (AlCH) extracts of whole plant of Cardiospermum halicacabum (Linn) were prepared, with successive extraction in soxhlet apparatus and aqueous (AqCH) extract, by the maceration process. LD50 studies for all the three extracts were carried out up to the dose limit of 2000 mg/kg in albino mice. One-fifth of the maximum dose of LD50 of each extract was selected to study the antidiarrhoeal activity in different experimental models such as castor oil-induced diarrhoea, prostaglandin E2 (PGE2)-induced enteropooling and charcoal meal test in rats.Preliminary phytochemical studies revealed the presence of sterols, carbohydrates, tannins and triterpenes in the PeCH extract; sterols, saponins, carbohydrates, flavonoids and tannins in the AlCH extract; sterols, saponins, carbohydrates, flavonoids and tannins in the AqCH extract. No mortality was observed with any of the three extracts up to the maximum dose of 2000 mg/kg. Further, all the three extracts at 400 mg/kg, p.o . had significantly ($P < 0.01$) reduced the fecal output in castor oil-induced diarrhoea, intestinal secretions in PGE2 - induced enteropooling and peristaltic movement in charcoal meal test, indicating antidiarrhoealactivity.The present study revealed

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 5 Sep-Oct 2022, pp: 327-334 www.ijprajournal.com ISSN: 2456-4494

the antidiarrhoeal activity of the extracts of Cardiospermum halicacabum, which may be due to the presence of phytochemical constituents such as sterols, tannins, flavonoids and triterpenes.[19]

18.Antiviral activity:

Current inadequate and inefficient market drugs used for the control and management of human immunodeficiency virus (HIV) coinfection with hepatitis viruses (HBV) poses serious threats to public health. The medicinal plant Cardiospermum halicacabum, having known anticancer and immunostimulatory activity was explored for their control in this study. The plant active principles extracted using five solvents were identified, and tested for antiHIV, antiHBV and phytochemical constituents. Methanol extract inhibited both HIV-RT (91%) and HBsAg (79%) and has 11 compounds. Among the compounds, Benzene dicarboxylic acid yielded a dock score −4.85 against HIV receptor and −4.71 against HBV receptor. The obtained results indicated C. halicacabum bioactive principles potentiality as HIV and HBV co-infection controlling novel therapeutics lead compounds.[20]

IV.CONCLUSION

Since the dawn of civilization, the importance of medicinal plants in the treatment of a variety of human ailments has been immense. In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects. Although some of the uses of this herb have been studied in details to some extent, the lack of clinical trials to support its other therapeutic uses imposes several limitations for its use as a multi-purpose medicinal agent. If these traditional claims for usefulness of this plant are scientifically evaluated, they may prove to be a good remedy against the same.

V.REFERENCE

[1]. Kumar TS, Muthuraj S, Muthusamy P, Radha R, Ilango K. Formulation and Evaluation of in vitro antidiabetic Polyherbal tablets form some traditional used Herbs. J Phytopharmacol 2021; 10 (3):173 - 179.

[2]. Muthuraj S, Seeni MK, Muthusamy P, Sampathkumar T. Review on Scope of Pharmacognosy graduate in various government research institute in India. J Phytopharmacol 2021; 10(4):266-271. doi: 10.31254/phyto.2021.10409

[3]. B. Parameshappa, Md Sultan Ali Basha, Saikat Sen, Raja Chakraborty, G. Vinod Kumar, G. Vidya Sagar, L. Sowmya, K. Kantha Raju, P.K.Ram Sesh Kumar & A.V.S.M. Lakshmi (2012) Acetaminophen-induced nephrotoxicity in rats: Protective role of Cardiospermum halicacabum, Pharmaceutical Biology, 50:2, 247-253.

[4]. S. Malaviya, K. Nandakumar, J. Vaghasiya, Y. Bhalodiya, N. Jivani, N. Sheth, R. Manek, S. Chauhan: Anxiolytic activity of root extracts of Cardiospermum halicacabum in mice. The Internet Journal of Pharmacology. 2009 Volume 7 Number 1.

[5]. Maluventhan Viji, Mani Sathiya, Sangu Murugesan. Phytochemical analysis and antibacterial activity of medicinal plant cardiospermum helicacabum linn. Pharmacologyonline 2: 445-456 (2010).

[6]. T. Deepan, V. Alekhya, P. Saravanakumar and M.D. Dhanaraju. Phytochemical and Anti-Microbial Studies on the Leaves Extracts of Cardiospermum halicacabum Linn.

[7]. Aishwarya v, sheik abdulla s., Dheeba b, renuka r. In vitro antioxidant and anticancer activity of cardiospermum halicacabum l. Against eac cell line. Int J Pharm Pharm Sci, Vol 6, Issue 8, 263-268.

[8]. M. Sebastin Santhosh, M. Hemshekhar, K. Sunitha, R.M. Thushara, S. Jnaneshwari, K. Kemparaju and K.S. Girish. Snake Venom Induced Local Toxicities: Plant Secondary Metabolites as an Auxiliary Therapy. Mini-Reviews in Medicinal Chemistry,2013,Vol.13, No.1.

[9]. Chinnadurai Veeramani, Ganesan Pushpavalli, Kodukkur Viswanathan Pugalendi. Antihyperglycaemic effect of Cardiospermum halicacabum Linn. leaf extract on STZ-induced diabetic rats. J. Appl. Biomed. 6: 19–26, 2008 ISSN 1214-0287.

[10]. Anticonvulsant activity of alcoholic root extract of Cardiospermum halicacabum Daniel Dhayabaran et al. Rev. Bras. Farmacogn. Braz. J. Pharmacogn. 22(3): May/Jun. 2012.

[11]. G.Ponmari, r.Sathishkumarand p.T.V.Lakshmi. Effect of drying treatment

on the contents of antioxidants in Cardiospermum halicacabum Linn.

[12]. T Boonmars 1, W Khunkitti, P Sithithaworn, Y Fujimaki., In vitro antiparasitic activity of extracts of Cardiospermum halicacabum against third-stage larvae of Strongyloidesstercoralis., PMID: 16151739

[13]. W Khunkitti 1, Y Fujimaki, Y Aoki., In vitro antifilarial activity of extracts of the medicinal plant Cardiospermum halicacabum against Brugia pahangi., PMID: 10953224

[14]. M Govindarajan, R Sivakumar., Repellent properties of Cardiospermum halicacabum Linn. (Family: Sapindaceae) plant leaf extracts against three important vector mosquitoes., doi:10.1016/S2221-1691(12)60105-1,2012 by the Asian Pacific Journal of Tropical Biomedicine, journal.

[15]. GS Hiremath, Hepatoprotective activity of cardiospermum helicacabum linn against CCl4 induced Hepatotoxicity May 2012International Journal of Pharmaceutical Sciences4(1):1928-1932

[16]. Ramachandran Jeyadevi, Thilagar Sivasudha, Angappan Rameshkumar & Lakshmanan Dinesh Kumar., Anti-arthritic activity of the Indian leafy vegetable Cardiospermum halicacabum in Wistar rats and UPLC–QTOF–MS/MS identification of the putative active phenolic components., Published: 29 September 2012.

[17]. V V Asha 1, P Pushpangadan., Antipyretic activity of Cardiospermum halicacabum., 1999 Apr;37(4):411-4.

[18]. M.S.Sheeba, Asha., Effect of Cardiospermum halicacabum on ethanol-induced gastric ulcers in rats., https://doi.org/10.1016/j.jep.2005.12.009.

[19]. T. Sampath Kumar, C. Jothimanivannan, V. Sasi Kumar, & M. Vanitha. (2021). A complete review on a complete medicinal plant: Cucurbita: DOI: https://doi.org/10.54037/WJPS.2021.9910. World Journal of Pharmaceutical Sciences, 9(9), 223–229.

[20]. Sampath Kumar T, C. Jothimanivannan, A. Abdul Azim, K. Kayalvizhi, S. Gokulraj, & V. Vedhachalam. (2022). Pharmacognostical studies and pharmacological activities of Morinda Tinctoria Roxb – A review article: https://doi.org/10.54037/WJPS.2022.100604. World Journal of Pharmaceutical Sciences, 10(06), 87–91.