International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Potential Healing Powers with Jute Plant- A Review

Md. Mahabub Ali[a], Balaram Ray[b], Begum Rokeya[c], Mst. Aleya Nasreen[d], Zakaria Ahmed[e*]

[a,d,e]*Biochemistry and Microbiology Department, Bangladesh Jute research Institute, Manik Mia Avenue, Dhaka–1207, Bangladesh*

[b]*Department of Chemistry, Hajee Danesh Science & Technology University, Dinajpur, Bangladesh*

[c]*Department of Pharmacology, Bangladesh University of Health Science, Mirpur, Dhaka, Bangladesh*

[a]*Email: mabarsha@hotmail.com* , [d]*Email: dr.nasreenbjri@gmail.com*

[e]*Email: zakariaahmed70@gmail.com*

[b]*Email: balaram_roy@yahoo.com*

[c]*Email: b_rokeya@yahoo.com* ,[c]*Email: pharmaco@buhs.ac.bd*

Abstract

Jute (*Corchorus spp*) can be a potential medicinal product for the treatment of many diseases. In traditional medicinal practices, it is used to treat constipation, demulcent, dysentery, worm, carminative anthalmitic, intestinal antiseptic, ascites, pain, piles, tumors, dysuria, febrifuge, stomachic, cystitis etc. Till now more than 80 compounds, including glycosides, triterpenes, ionones, phenolics, phytosterols, organic acids, lignins, alkaloids have been isolated and identified from jute plant. The main phytochemical compounds are cardiac glycosides, corchorin, corchotoxin, helveticoside, corchoroside A and B, olitoriside, erysimoside, straphatidol, glycoside, capsularinsteroids and many other secondary metabolites. Modern studies have revealed several biological activities such as acidic polysaccharide, cardiotonic, anti-obisity, gastroprotective, antidiabetcs, antioxidant, anti-inflammatory and cytotoxic activities. The present review deals to provide comprehensive knowledge on the phytochemistry and pharmacological activities of different plant extracts of jute based on the available scientific literature, provide a potential guide to highlight the available literature on jute plant with respect to ethnobotany, chemical constituents and summary of various pharmacological activities.

Keywords: Jute (*Corchorus* spp); Medicinal plant; Folklore; Phytochemistry, leaves.

---

* Corresponding author.

1. Introduction

Jute is cultivated to provide bark for the production of fibers. Its mucilaginous leaves are used in food as a vegetable. It is grown for both fiber and culinary purposes [1]. The jute plant contains p-coumaric acid, ferulic, caffeic, vanillic, p-hydroybenzoic, protocatechuic, vanillic acids, β–sitosterol in 80% aqueous ethanol extract of *C. capsularis* [2-3]. Demand for medicinal plants is increasing in both usually developed and developing countries due to growing recognition of natural products being equally effective, safe, non-nacotic, affordable and having no side effects. Higher plants represent a rich source of new molecules with pharmacological properties, which are lead compounds for the development of new drugs. Natural products have been an integral part of the ancient traditional medicine system, e.g. Chinese, Ayurvedic and Egyptian [4]. Extracts from natural products containing medicinal, cosmetic, aromatic, dyes or pharmaceutical properties have been studied in many researches. Several researchers have shown that the ingestion of natural extracts containing antioxidants, especially polyphenolic compounds, is associated with lower rates in coronary heart disease, cancer and diabetes [5-6]. The antioxidant potential of polyphones is based on their ability to capture and react with free radicals. Polyphenols are the most abundant secondary metabolites found in plants and include several classes of compounds such as phenolic acid, colorfull anthocyanins, simple and complex flavonoids. In this review, a compilation of literature is made in order to produce a comprehensive report related to phytochemistry of different plant parts of jute and various biological properties exhibited by purified compounds as well as by the crude extracts.

1.1 Common names of jute [7]

Bengali: Paat sag, Tita pat (White jute), Misti pat (Tossa) Nalita, Nalta, Mara Sag; Arabic: Joot abiadh, Melukhiya; Chinese: Huang ma; English: Jute; French: Chanvre de Calcutta; German: Rundkapsel jute; Hindi: Patta shaak, Italian: Juta; Kenya: Mrenda, Murere; Korean: Hwangma; Nigeria: Rama; North Africa: Melukhiya; North Sudan: Khudra; Phillipines: Saluyot; Portuguese: Juta; Seria Leone: Krain; Spanish: Yute blanco; Swedish: Jute and Tamil: Pirattai keetai.

2. Jute components

2.1 Jute leaf

Plants generally produce many secondary metabolites which constitute an important source of many pharmaceutical drugs. The unique chemistry of jute is highly complex. It contains hundreds of different beneficial compounds known as phyto-chemicals. Jute leaf is a unique plant part which is a rich source of many chemical compounds and plays an important role in human body. The crude methanolic extract of jute leaves extract contained the highest amount of polyphenols. It contained also cardiac glycosides, triterpenoids, ionones, flavonoids, coumarins, steroids and many other secondary metabolite. Nutritional chemicals of each 100g of the leaves contained 43 – 58 calories, 4.5–5.6g protein, 0.3g fat, 7.6–12.4g total carbohydrate , 80.4–84.1g water, 1.7-2.0g fibre, 2.4 g ash, 266 -366mg ca, 97–122mg P, 7.2-7.7mg Fe, 12mg Na, 444mg K, 6, 410-7, 850 µg beta carotene equivalent, 0.13–0.15mg thiamine (Vitamin B1), 0.26–0.53 mg riboflavin (Vitamin B2), 1.1–1.2

mg niacin and 53-80 mg ascorbic acid (Vitamin C) [8-9,1]. Folic acid (folate, B vitamin) substantially higher (0.03mg/L) than that of other folacin rich vegetables and iron 72 µg/g. Jute leaves yielded a lot of mucilaginous polysaccharide (acidic polysaccharide) and anthocyanin. Leaf extracts yielded alkaloids, terpenoids, tannins, flavonoids, glycosides [10]. It contain two functional compounds, phytol and monogalactosyl diacylglycerol that protect from free radicals [11]. Capsin and capsugenin isolated from the leaves of *C. capsularis* and capsin responsible for the major bitter taste [12]. β-sitosterol, scopoletin and fusidic acid also isolated from the leaves [13]. Caffeine and catechine isolated from *C. capsularis* leaves extract [14]. Oleanolic acid was isolated from the leaves of *C. olitorius* of *Egyptian* origin. Four triterpenoid glycosides (chorchorusins A,B,C and D) isolated from aerial parts of *C. acutangulus.* Leaves of *C. olitorius* contain ionone glucosides which are corchoionosides A, B and C, an ionone glucoside (roseoside) and a monoterpene glucoside betulabuside A. Leaves of *C. olitorius* gave four higher fatty acids with a trienone system, corchorifatty acids A, B, C, D, an uncanoic acid, corchorifatty acid E and a trihydroxy fatty acid, corrchorifatty acid F. Ali and his colleagues [15] evaluated the biochemical components of different varieties jute leaves as affected by four months storage after direct sundry and hot water treatments (HWT) applied. The results revealed that the products produced by the HWT better than direct sundry treatment, which were similar moisture, protein, fat, fibre, mineral and pigment factor similar to fresh condition. HWT dried leaves showed better results in term of degree of acceptability though sensory evaluation. Ali and his colleagues [16] to study of storage properties of jute leaves by blanching method. Jute leaf was preserved by three different treatments and compared with refrigerator. High density polythene is the best alternative to refrigerator. It preserves 2.5, 3, and 2.5 times nearly beta carotene, ascorbic acid and total chlorophyll respectively better than control condition. In Consider the vitamins, minerals and other phyto-chemicals, the leaf of jute plant of is a power house of nutrients.

2.2 Jute seeds

The seeds are poisonous to mammals and insects. The seeds contain cardiac glycosides, corchorin, corchortoin, corchoroside A and B, biosides, olitoriside, erysimoside, strophantidol glycosides, oligosaccharide and olitoriside. It also contains 2.25% raffinose, 11.3–14.8 oil (16.9% palmitic acid, 3.7% stearic acid, 62.5 linoleic acid, 0.9% linolenic acids, 1.8% behenic acid, 1.1 % lignoceiic acid and 9.1% oleic acid) and large portions of B, Mn, Mo and Zn [17-18]. Active principle of the jute seed is chorchorin, a glycoside ten times bitter than quinine sulfate.

2.3 Jute stem (bark/ fibre)

The polysaccharides and lignin are the major constituents in bark, stem and fibre. Glucose, fructose, sucrose, six low molecular weight sugar alchohols and two inositols were identified and quantified in bark. It contained many free glycosidic and ester –linked phenolic acid. The phenolic acid in fresh bark contained ferulic and p-coumarin acids. Jute fibers collect from the bast or outer region of the stem after biological retting of the whole plant. The lipid and lignin composition of jute fibers has been characterized. The most predominant lipophilic compounds were high molecular weight ester waxes (24% of total extrat), followed by free fatty acids (17%), free fatty alcohols (17%) and α–hydroxyl fatty acids (14%). Additionally, significant amounts of alkanes (6%), ω–hydroxyl fatty acids (6%), sterols (6%), steroid and triterpenoids ketones (3%) and steryl glycosides (1%)

were also identified. The main inter – unit linkage present in, was the β O–4′aryl–ether bond (72%) followed by β–β′resinol– type substructures and with lower amounts of β–5′ phenylcoumaran and β–1′ spirodienone substructures [19].

2.4 Jute root

Cardiac glycosides (corchoroside–A and cannogenol), steroids (β–sitosterol and stigmasterol 3-O-β-Dglucoside), flavonoids (quercetin), terpenoids (betulinic and oleanolic acid), corosin were isolated from root extract of *Corchorus capsularis* [13]. It also contains 0.2% corosin. Ursolic acid, corosolic acid and oxo-corosin were isolated from fresh (non-dried) roots of *C. capsularis* and *C.olitorius* [20].

3. Properties of jute

Jute leaves considered carminative, laxative, febrifuge, purgative, stimulant demulcent, tonic, demulcent, appetizer and stomachic. The seed corchorin considered toxic and poisonous; some studies suggest a digitalis–effect on the heart. Jute fibre is long, soft, shiny, 1-4 meters in length, with a diameter of 17 to 20 microns, with high insulating and anti-static properties, with moderate moisture regain and low thermal conductivity.

3.1 Edible use as food

In many part of the world, the jute plant has become a vegetable source, In Bangladesh, in spring, shorts are pulled from the fields and eaten with rice as a vegetable. It is a favorite food during the summer months, especially in North and East part of Bangladesh. The people use it to produce mucilaginous soup or sauce, stews, curries vegetable dishes or boil the leaves and others [7]. Ali and Nasreen [21] study in direct sun dry freeze dry and blanch dried jute leaf in order to assess their potentiality for food product development as vegetables and herbal tea. The blanched dried leaf was the most acceptable product with a ranking with of 'like very much'. On the other hand, four category of tea justified. Sensory evaluation of dried jute lea was third position in terms of colour, flavor and texture, and over acceptability. In the Philippines, *C. olitorius* is known as *saluyot*, is commonly consumed as a leafy vegetable together with bamboo shoots. In Thai cuisine, the leaves locally known as *bai po*; are eaten blanched, together with plain rice. In North Africa and the Middle East, the young leaves are known in Arabic as *malukhiyah* and used as green leafy vegetables. Malukhiyah is eaten widely in Egypt and some consider it the Egyptian national dish. It is featured in cuisines from Labanon, Palestine, Syria, Jordan and Tunisia. In Turkey and Cyprus, the plant is known as molokhiya or molocha is usually cooked into a kind of chicken stew. It has been a staple Egyptian food since the time of the Pharaohs and it is form there that it gains its recognition and popularity. Varieties of *mallow* leaves stew rice is a well known Middle Eastern cuisine. In Japan dry leaf is used as substitute of coffee and tea. In Europe, jute leaves are used for preparing soup.

3.2 Ethnomedicinal (Folklore) properties

Jute plant use in ethnobotanical medicine as whole plants, especially the leaves and seeds. The leaf is use to treat a wide range of physical aliment. Some physical ailments that could be treated using jute are laxative,

headache, chicken fox, influenza and die worm. If we eat hot day, it reduces the body temperature [7]. *Corchorus species* used as herbal medicine to control or prevent dysentery, worm and conspirator. It has traditional uses for the treatment of fever, chronic cystitis, aches, pains, dysentery, enteritis and pectoral pains [22]. Leaves are used medicinally as demulcent, bitter tonic, stomachic, laxative, carminative anthalmintic, astringent and intestinal antiseptic. Infusion of dried leaves bitter and commonly used as a stomachic tonic also used in fever, bilious trouble dysentery, liver disorders, intestinal colic, gastric catarrh, skin diseases, atonic dyspepsia, mild jaundice and other disorders of digestive system. For the treatment of dysentery, dried leaves (in Bangladesh, according to unpublished, suttani) are eaten with rice. It is also used as a paste over swellings and abscesses. In India, leaves were used in stomachic, as carminative, diuretic and for the treatment of dysentery (dried leaves), while, seeds were used as purgative. Ayurvedics used the leaves for ascites, pain, piles and tumors. It is also used for cystitis, dysuria, fever and gonorrhea. The cold infusion was said to restore the appetite and strength. The aqueous/alcoholic extracts (containing polysaccharides and oligosaccharide) are used in preparations of skin cosmetics or hair preparations for their moisturizing effect. Hidus reduce the plant to ashes, mix it with honey and use it for obstruction of the abdominal viscera. In south India, the dried plant is used as demulcent. Powder of leaves, 5-10 grains, mixed with powdered turmeric in equal parts, used for dysentery. In India infusion of leaves used as tonic and febrifuge. The tribal people of Bolangir use the plant as remedy against threat miscarriage: equal quantities of tender leaves of *C. olitorius* and *Carica papaya* are cooked to boiling point, cooled, then used one tumbler 3x daily. It reduces the appearance of the wrinkles and fine lines in the face and body. Research reveals that it was the source of health and beauty of the Egyptian royalties, including Cleopatra. Regular consumption of saluyot can make you appear young [7]. Powdered seeds with honey and ginger are good for diarrhea. Grains of the powder mixed with equal amounts of *Curcuma longa* used for acute dysentery.

4. Pharmacological effects

4.1 Acidic Polysaccharide

Kimiko and his colleagues [23] isolated acidic polysaccharide in the water soluble mucilage extracted from dried *C. olitorius* leaves. The polysaccharides are rich in uronic acid (65%), and consisted of rhamnose, glucose, galacturonic acid, and glucuronic acid. This polysaccharide mainly consisted of O–4 substituted galacturonic acid and glucuronic acid, and O-2 substituted rhamnoseresidues and most of the (1±4) linked uronic acid residues are substituted at the O-3 position with glucuronic acid residues. This polysaccharide shows proliferative activity toward the murine splenocyte.

4.2 Anticancer effect

Recent epidemiological investigations have been providing increasing evidence that high consumption plans leaves and fruits could be associated with reduced risk of cancer, especially that in the gastrointestinal tract. These epidemiological predictions suggest that plants contain anti-cancer or antitumor promoting components. Toshio and his colleagues [11] identification of two antitumor promoter compounds from jute leaves, which are phytol and mono-galactosyldiacylglycerol. The antitumor promoting activity is examined by an immunoblotting

analysis. The detectable amount of each active components increased by treatment of the leaves with hot water. These findings suggest that treatment of vegetables with hot water effectively increased the amount of active compounds with activity against tumor promoting chemicals that may be consumed with food [1]. Özlem and his colleagues [24] demonstrated the in vitro cytotoxic effect of *C. olitorius* leaves extract (LE) and seed extract (SE) on ARH-77 cells, with relation to total phenol content (TPC) and free radical scavenging activity (FRSA) of the extracts. The LE had high TPC and FRSA, and cytotoxic inhibitory concentration 50 (IC 50) on ARH-77 cells above its IC 50 for FRSA. The LE had significantly higher total phenol 78 mg gallic acid equivalents (GAE) (/g extract) than the SE (2 mg GAE/g extract) with significantly higher FRSA (IC_{50} LE: 23 µg/mL and IC_{50} SE: 10 401µg/mL). Both LE and SE exerted cytotoxic effects on cells after 48 h. The IC_{50} of SE (17µg/mL) was lower than LE (151µg/mL), which demonstrates its higher cytotoxicity on cells. The extracts were applied at 150 and 75µg/mL for LE and at 17 and 8.5 µg/mL for SE, and the results of the comet assay revealed that the extracts induced genotoxic damage on ARH-77 cells. In both 48 h leaf and seed extract treatments, genotoxic damage significantly increased with increasing concentrations at relevant cytotoxic concentrations. Mohamed and his colleagues [25] isolated and identified from the aqueous extract of *C. olitorius*, which protected cell against cytotoxicity of two mycocotoxins [aflatoxin B_1 (AFB_1) and fumonisin B_1 (FB_1)]. The result showed that both mycotoxins decreased cell viability and increased DNA damage. Cytotoxicity was more pronounced when cells were exposed simultaneously to AFB1 and FB1. So, aqueous extract of *C. olitorius* contains a water-soluble natural chemo-preventative agent for cancer.

4.3 Antioxidant properties

Azuma and his colleagues [26] isolation of six phenolic antioxidative compounds [5- caffeoylquinic acid (chlorogenic acid), 3,5–dicaffeoylquinic acid, quercetin 3–galatoside, quercetin 3–glucoside, quercetin 3-(6 – malonylglucoside) and quercetin 3-(6- malonylgalactoside) (tentative)] from the leaves of *C. olitorius* by NMR and FAB-MS. The contents of these phenolic compounds , ascorbic acid and alpha tocopherol in determined and their antioxidant activities measurement using the radical generator initiated per oxidation of linoleic acid. Results showed that 5- caffeoylquinic acid was a predominant phenolic antioxidant. An antioxidant is any substance that when present al low concentrations compared with those of anoxidazable substrate significantly delays or prevents oxidation of that substrate. The air dried leaves of *Corchorus capsularis* (20g) were soaked in distilled water (1:20; w/v) for 72 h at room temperature. The collected supernatants were tested for the free radical scavenging activity against the DPPH and superoxide anion radical scavenging assays. The extract showed remarkable antioxidant activity in both assays with the percentage of inhibition nearly 90% [9].

4.4 Antinociceptive / anti-inflammatory

Zakaria and his colleagues [27] and Zainul and his colleagues [28] investigated in experimental animal model of *C. capsularis* leaves extrac by chloroform. The antinociceptive activity was measured using the writhing, hot plate and formalin test, while the anti-inflammatory activity was measured using the carrageenan induced paw edema test. The extract, obtain after 72h soaking of the air dried leaves in chloroform followed by a vacuo evaporator to dryness, was weighed and prepared by serial dilution in DMSO in the dose of 20,100,and 200 mg/kg. The extract was administering 30 min prior to subsection to the respective assays. The extract was found

to exhibit significant antinociceptive and anti inflammatory activities. This result confirmed that the traditional claims of using to treat various ailments related to inflammation, fever and painful which supporting its folkloric use.

4.5 Cardiotonic/Hypertensive effect

Several workers isolation of corchori, corchorgenin, capsularin, corchoritin, olitoriside, corchosularin and corchortoxin from jute seeds. A group of medicines extracted from jute seeds that are called cardio –tonic activity (similar to digitalis genus). It works by inhibiting sodium potassium ATPase. It acts on the contractile force of the cardiac muscle. Because of their potency in disrupting the function of heart, most are extremely toxic. Jute seeds extract showed better activities than corchortoxin. It's corchoroside A and B show digitalis like action [18-19, 29-31].

4.6 Anti–obesity

Dietary supplementation with polyphenolic compounds is associated with reduced diet induced obesity and metabolic disorders in human. The antioxidative properties of polyphenolic compounds contribute to their anti-obesity effect in animal. Wang and his colleagues [32] investigate the antiobesity of polyphenolic compounds from the molokheiya leaves in LDLR (Low density lipoprotein receptor) /- mice fed high fat diet. The effect was associated with a reduction in oxidative stress and enhancement of B-oxidation in the liver. The results suggest that the consumption of molokheiya leaves may be beneficial for preventing diet induced obesity.

4.7 Blood chemistry effects

Oyedeje and Bolarinwa [33] study on the effect of aqueous extract of *C. olitorious* (AECO) at doses of 250mg/kg, 500mg/kg, 750mg/kg BW on haematological and plasma biochemical parameters in male albino rats. 30 days with all doses of AECO caused insignificant changes in PCV, RBC, MCV, MCHC, MCH, platelet, neutrophil, lymphocyte, esinophil and monocyte values relative their respective controls, but caused significant decrease in TWBC count relative to the control. Treatment 750mg/kg BW of AECO cause significant increase in total protein level relative to the control but others caused significant reduction globulin levels. It showed both harmful and beneficial potentialities on the blood chemistry. The effect on human blood chemistry is unknown. It may be recommended in its consumption by people with blood disorder. An increase in body weight (including weight of liver) was noticed in test animals after feeding with a protein-enriched diet from *C. olitorius* seeds. AST, ALT and total lipid of liver increased significantly whereas AST and ALT of serum decreased. A cholesterol free diet containing dried green leaves powder of *C. olitorius* lowered hepatic cholesterol concentration and increased neutral fecal bile acid and neutral sterols excretion in rats [34]. Effects of multiple weekly dose of methanol extract of C. *olitorius* (15, 20, 25 mg/kg.i.p.) on liver and kidney functions and haematological parameters in mice were studied. No significant alteration of RBC count and hemoglobin content was observed in all dose levels of the treatment whereas significant increase in clotting time was seen in moderate and high doses. The extract caused significant increase in WBC count only at a high dose level of treatment. SGOT, SGPT, NPN and plasma cholesterol levels increased significantly at medium and high dose

levels. Serum alkaline phosphatase and total bilirubin levels were also increased by both moderate and high dose levels of treatment. Low doses of the extract did not exhibit any significant change of creatinine and serum protein levels, but the high dose level significantly increased creatinine level [35].

4.8 Gastroprotective effect

Rami and his colleagues [36] studied on the gastroprotective effect of ethanolic leaf extract of *C. olitorius* against ethanol induced gastric ulcers in adult Sprague dawley rats in animal model. The results show a gastroprotective property comparable to reference control drug omeprazole. Mezui and his colleagues [37] were find out the possible antiulcer activity of the extract *of C. olitorius* leaf in rats attributed to its ability to reduce acid secretion, to enhance mucosal defense and in vivo antioxidant status.

4.9 Antimicrobial and Synergism-Antagonism with antibiotics

Semra and his colleagues [38] investigated the petroleum ether extract of *C. olitorius* a good activity against *E. coli, Staphylococcus aureus* and *Yersinia enterocolitica*. On the other hand ethyl acetate and water extract a good activity against *Geotrichum condidum* and *Botrytis cinerea*. Rume [9] experiment of the antibacterial and antifungal activity of the leaves methanolic extract of *C. capsularis* . It acts as against gram positive bacteria (*Bacillus subtilis, Staphylococcus aureus, Beta-hemolytic streptococcus, Bacillus cereus and Streptococcus pyrpgen*), gram negative bacteria (*Shigella boydii, Salmonella typhi, E. coli, Klebsiella spp.* and *Vibrio mimicus*), yeast and fungi (*Candida albicans, Saccharomyces cerevisiae* and *Bacillus megaterium*). Ashidi and his colleagues [39] described the in *vitro* interaction of an ethanol extract of leaf of C. olitorius with five antibiotics on methicillin sensitive and methicillin resistant *Staphyloccus aureus*. The extract synergized the antibacterial potential of ciprofloxacin and ampicillin/cloxacillin mixture and antagonized gentamycin, streptomycin and erythromycin on *S. aureus*.

4.10 Anticonvulsive and Arsenic induced toxicity / Protective effect properties

Malaya and his colleagues [40] methanolic extract of both *Cuscuta reflexa* stem and *C. olitorius* seed showed marked protection against convulsion induced by chemo- convulsive agents in mice. Results suggest significant increases in catecholamines and GABA system, both considered to have significant roles with respect to CNS depressant and anticonvulsive properties of the processed extract. Das and his colleagues [41] find out the treatment with aqueous extract of *C. olitorius* leaves against sodium arsenite induced cardiotoxicity in experimental rats. The leaf has significant protecting effect against arsenic induced myocardial injury.

4.11 Atopic Dermatitis and Wound healing activities

Satoshi and his colleagues [42] investigated the skin hydration effect of *C. olitorius* leaf extract excluding high molecular weight compounds on atopic dermatitis (allergic diseases like eczema) in mice. Results suggest that the leaf extract has therapeutic potential for atopic dermatitis due to its suppression of the plasma immunoglobulin E (IgE) level and degranulation of mast cells. Barku and and his colleagues [10] demented that *C. olitorius* displayed significant free radical scavenging activity and ferric reducing antioxidant power (FRAP).

It also showed by excision model which proved that the traditional uses of this plan to treat wound has therefore been confirmed.

4.12 Antidiabetic and Bio- adsorbent properties

Maxwell and his colleagues [43] studied the ethanolic seed extract of *C. olitorius* in animal model. They found that it has great potentials as an antidiabetic remedy due to the ability of the extract to lower blood glucose levels in normal rats, diabetic rats and also suppress postprandial rise in blood glucose level. Saliu and his colleagues [44] carried out of the supplementation of *C. olitorius* dried leaves as diet in type-2 diabetic rats. They showed that it has antihyperglycemic, antihyperlipidemic and antiperoxidative effects. It also exhibited modulatory effects on purinergic enzymes involved in the prevention of platelet abnormality and consequent vascular complications in diabetic state. Omeje and his colleagues [45] investigated the effect of *C. olitorius* extract on platelet aggregation. The results of the aggregation test showed that *C. olitorius* has the ability to aggregate blood plates. Sanjida and his colleagues [46] found that the methanol extract of *C. olitorius* aerial parts led to dose–dependent reduction blood glucose level in mice. Kingsley and his colleagues [47] investigated the effect of ethanolic extract of *C. olitorius* leaves to ascertain its anti-hyperglycemic property. Diabetes was induced intraperitorially, by injecting streptozotocin with a single of 50mg/kg body weight. After oral administration of extract for thirty day, the plant extract has high safety index as no toxicity or mortality was record at after the oral administration 5000 mg/kg body weight. The extract significantly decreased the activities of catalase, superoxide dismutase and liver function enzymes assayed alanine aminotransferase (ALT), alkaline phosphatase (ALP), and aspartate aminotransferase (AST) when compared to the untreated groups. The results indicate that the extract possesses anti- hyperglycemic effect. So, it could be used in the management diabetes mellitus. Subasri and his colleagues [48] evaluated the potential use of *C. olitorius* nano carbon as adsorbent for removal of Rhodamine–B dye (dye contaminated waste water passed out from industries like textile). The results suggest that the activated *C. olitorius* nano carbon (ACONC) may be utilized as a low cost adsorbent for Rhodamine–B dye removal from aqueous solution.

4.13 Anti-nutrients and Insecticidal effect

Musa and Ogbadoyi [49] investigate on the anti-nutrient and toxic substance of *C. olitorius* (Jute mallow). The concentration of cyanide in the fresh sample is lower (128mg/Kg) than maximum permissible level of 200mg/ Kg fresh weight vegetables. This result indicates that the cyanide concentration in the fresh and pressed samples may not be high enough to induce toxicity in man. The concentrations of nitrate (3107 mg/Kg), soluble (3.49 g/Kg) and total oxalates (5.85 g/ Kg) in fresh are higher than the permissible levels. The negative health problems associated with high intake of these photo-toxins can be averted though cooking and sun drying. With moderate cooking being the preferred method, since it reduce the plant toxins to tolerable level without compromising the nutritional potentials of this plant. Elangovan and his colleagues [50] observed among the experimental larval groups treated with leaves methanol extract of *C. capsularis.* They found that the minimum lethal concentration (LC_{50}) with 176.19ppm and 182.06ppm against *Anophele stephensi* (malarial vector) and *Aedes aegypti* (dengue vector). Other hand, with regard to the ovicidal activity of acetone, ethyl acetate and methanol extract of *C. capsularis* against the eggs of *An. Stephensi* and *Ae. aegypti*. The eggs exposed to ethyl

acetate and methanol extract were shown more susceptibility. The result showed that no hatchability 300 - 450 ppm concentration on *An. Stephensi* and 375-450pp concentrations on *Ae. aegypti* respectively. So, it can be used as eco-friendly mosquito control. On the other hand, Roy [51] experiment of the role of jute leaf phytochemicals on feeding, growth and reproduction of *Diacrisia casignetum* Kollar (Lepidoptera: Arctiidae), it appeared that the larval and post larval developmental duration was shorter on mature jute leaf fed insects whereas adult longevity was higher in relative to young and senescent leaf fed insects. Fecundity of *D. casignetum* was also highest on mature leaves followed by young and senescent leaves. The growth and development of *D. casignetum* were related to the nutrient content relative to the secondary metabolites of these three types of jute leaves. Higher levels of nutritional factors (total carbohydrates, proteins, lipids, nitrogen and amino acids including water content) and lower levels of anti-nutritional factors (secondary metabolites) in mature jute leaves have influenced lower developmental time along with higher growth rate, fecundity and accumulated survivability of *D. casignetum* than the young and senescent leaves.

5. Conclusion

Jute is a well known bast fibre plant with less known medicinal scientific data. Each and every part of it is useful having medicinal activities. The folkoric medicinal value imparts tremendous value of this herb. On the hand, it may be to obtain key chemical compounds for making new drug molecules. This review summarizes the updated research studies on the phytochemisty and pharmacological effects of *Corchorus spp.* The present information helps in bridging the gap between modern scientific studies and available traditional medical reports on this plant. As chemical constituents of *Corchorus spp.* vary depending on the origin and plant parts, a protocol needs to be standardized to isolate and obtain pure compounds. Though various chemical compounds have been isolated, purified and characterized, many compounds are yet to be studied in detail. Till now, limited efforts are made in the pharmacokinetics investigations related to the mechanism of action of the individual isolated compounds under *in vivo* conditions. Also, research should be emphasized on the toxicity and safety aspects of *Corchorus spp.* compounds using animal models. Further, therapeutic prospects of many new chemical compounds from *Corchorus spp* under *in vitro* and *in vivo* conditions should be explored in detail. In future, its aerial parts are used in multiple use as edible food products such as functional food.

Reference

[1] Islam MM. 2013. Biochemistry, Medicinal and Food values of Jute (Corchorus capsularis L. and C. olitorius L.): A Review. I. J. of Enhanced Research in Science Tech. Eng. 2 (11): 35 -44.

[2] Mosihuzzaman M., Theander O and Amanb P. 1982. Analysis of Carbohydrates in the Jute Plant (Corchorus capsularis) . J. Sci. Food Agric. 33: 1207-12.

[3] Mosihuzzaman M., Fazlul HM and Chowdhury TA. 1988. Phenolic Acids in Fresh and Retted Jute Plants (Corchorus capsularis and C. olitorius L.). J. Sci. Food Agric. 42: 141 –47.

[4] Sarker SD and Nahar L. 2007. Chemistry for Pharmacy Students General Organic and Natural Product Chemistry. J Natural Product Chemistry. 1: 283 – 59.

[5] Bazzano LA, Ogden LG, Loria CM, Vupputuri S, Myers L. and Whelton PK. 2002. Fruit and vegetable intake and risk of cardiovascular disease in US adults: the first national health and nutrition examination survey epidemiologic follow up study. American J. Clinical Nutrition 76(1): 93-99.

[6] Costa M S, Duarte ARC, Cardoso MM and Duarte CMM. 2007. Supercritical antisolvent precipitation of PHBV microparticals. Inter. J. Pharmaceutics. 328 (1): 72 – 77.

[7] Ali MM, Nasreen A, Akhter S, Alam MA and Hossain A. 2013. Survey of indigenous knowledge of jute leaf in Bangladesh. Int. J. Sustain. Agri. Tech. 9(11): 1-4.

[8] Islam MM and Rahman M. 2008. In: Hand book on agricultural technologies of jute, kenaf and mesta crops. Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka-1207, Bangladesh. 92

[9] Rume JM. 2010. Phytochemical, antimicrobial and biological investigations of methanolic extract of leaves of Corchorus capsularis. Thesis for bachelor degree of pharmacy, East West University.

[10] Barku VYA, Boye A and Quansah N. 2013.Antioxidant and wound healing on the extrats of Corchorus olitorius leaf. World Essays J. 1(3): 67-73.

[11] Toshio F, Rong W, Katsuichiro O, Feroj AFMH, Idrish MA, Akira K and Hiroshi F. 2002. Antitumor promoters in leaves of jute (Corchorus capsularis and C. olitorius). Food Sci. Technol. Res., 8(3): 239-43.

[12] Hasan CM, Islam A, Ahmed M, Ahmed M and Waterman PG. 1984. Capsugenin, a dammarane triterpene from Corchorus capsularis . Phytochemistry. 23(11): 2583- 87.

[13] Ramadevi D and Ganapaty S. 2013. Phytochemical examination of Corchorus capsularis roots. Int. J. Pharmacognosy and Phytochemical Research. 5 (3): 173-76.

[14] Tabassum T. 2009. Extraction, identification and estimation of caffeine and catechin from Corchorus capsularis leaves extract. Thesis of a bachelor degree in pharmacy, East West University.

[15] Ali MM, Nasreen A, Sarker SC and Assaduzzaman M. 2014. Biochemical, physical and sensory evaluation of Jute leaves (Corchorus Spp) as affected by storage periods after direct sundry and hot water treatments. Bangladesh J. Jute Fib. Res. 31 (1-2): 75-80.

[16] Ali MM, Hossen MZ, Akhter S and Tahmina. 2015. Study on storage properties of jute leaves by blanching method. Int. J. Sustain. Agri. Tech. 11(12): 12-16.

[17] Rao EV, Rao DV, Pavanaram SK, Von Euw Jand Reichstein T. 1971. Structure of Corchoroside β-Glycosides and aglycones. Helv Chim ACta. 54(7): 1960-68.

[18] Rao MR Liu TP and Meng ZJ. 1979. Comparative studies on the cardiotonic actionof corchoroside A,

ouabain and strophanthim K on the heart–lung preparation of guinea pig and cat. Yao Xue Xue Bao. 14(5): 257– 66.

[19] Del Rio JC, Marques G, Rencoret J, Jimenez–Barbero J, Martinez AT and Gutierrez A. 2009. Chemical composition of lipophilic extractives from jute (Corchorus capsularis) fibers used for manufacturing of high quality paper pulps. Industrial Crops and Products 30(2): 241–49.

[20] Manzoor–i- Khuda M & Gerhad H. 1979. Chemical constituents of Corchorus capsularis and C. olitorius (jute plant part IV, isolation of corosolic acid, ursolic acid and oxo–corosin and correlation of corosin with tormentic acid. Z. Naturforsch. 29: 1320-25.

[21] Ali MM and Nasreen A. 2016. Sensory evaluation of dried jute leaf as vegetable and herbal tea. Int. J. Sustain. Agri. Tech. 12(1): 23-26.Amanabo M, Emmanuel O and Ogbadoyi. 2012. Effect of cooking and sun drying on micronutrients, Antinutrients on Toxic Substance in C. olitorius (Jute Mallow). J of Nutri. & Food Sciences. 2(3): 1-8.

[22] Zakaria ZA, Sulaiman MR, Gopalan HK, Abdul Ghoni ZD, Raden MNRN, Mat JAM, Abdullah C. 2007. Antinociceptive and antiinflamatory properties of Corchorus capsularis L. leaves chloroform extract in experimental animal model. J. Pharmaceutical Society of Japan. 127(2): 359 –65.

[23] Kimiko O, Kouji O, Uki Y, Isao Y and Akira M. 1995. Characterization of an acidic polysaccharide isolation from the leaves of Corchorus olitorius (Moroheiya). Biosci. Biotech. Biochem., 59(3): 378 - 81.

[24] Özlem Dİ, Erkan Y, Feride IS and Mehmet H. 2013. Corchorus olitorius (jute) extract induced cytotoxicity and genotoxicity on human multiple myeloma cells (ARH-77). Pharm Biol, 51(6): 766–70.

[25] Mohamed IMI, Rialet P, Skena HAA, Anna MVWCCB, John PG, Masaad A and Abdel W. 2015. Aqueous extract of Corchorus olitorius decreases cytotoxicity of aflatoxin B_1 and fumonisin B_1 in H4 IIE –luc cells. Hepatoma Research 1(2): 75-85.

[26] Azuma K, Nakayama M, Koshioka M, Ippoushi K, Yamaquchi Y, Kohata K, Yamauchi Y, Ito H. and Hiqashio. 1999. Phenolic antioxidants from the leaves of C. olitorious L. J. Agric. Food Chem. 47(10): 3963-66.

[27] Zakaria ZA, Sulaiman MR, Gopalan HK, Abdul GZD, Raden MNRN, Mat JAM, Abdullah C. 2007. Antiiflammatory and Antipyretic activity of C. olitorius in rats. J. Pharmaco. Toxicol. 1: 134-40.

[28] Zainul AZ, Sulaiman MR, Gopalan HK, Abdul Ghani ZDF, Raden MNRNS, Mat JAM and Abdullah FC. 2007. Antinocicceptive and anti-inflammatory properties of Corchorus capsularies leaves chloroform extract in experimental animal models. Yakugaku Zasshi. 127(2): 359 –65.

[29] Frerejacque M and Durgeat M. 1954. Digitalis like poisons of jute seed. Compt Rend. 238: 507–509.

[30] Karrer P and Banergee P. 1949. Corchortoxin a cardiac agent from jute seeds. Helv Chim Acta. 32 : 2385-92.

[31] Negm S, El- Shabrawy O, Arbid M and Radwan AS. 1980. Toxicologyical study of the different organs of Corchorus olitorius L. plant with special reference to their cardiac glycosides content. Zeitsc Ernaehrungsw. 19(1): 28-32.

[32] Wang L, Masyiuki Y, Takuya K, Xufeng S, Yukikazu Y and Kuninori S. 2011. Anti-obesity effect of polyphenolic compounds from molokheiya (C. olitorious) leaves in LDL receptor deficient mice. European J. Nutrition. 50(2): 127-33.

[33] Oyedeje KO and AF Bolarinwa AF. 2013. Effect of C. olitorius extract on haematological and plasma biochemical parameters in male albino rats. JOSR J. Dental and Medical science. 3(5): 68-71.

[34] Innami S, Tabata K, Shimizu J, Kusunoki K, Ishid MM, Wada M, Sugiyama N and Kondo M, Drie. 1998.Green leaf powders of Jew's mellow (Corchorus olitorius), persimmon (Diosphyros kaki) and sweet potato (Ipomoea batatas Poir) lower hepatic cholesterol concentration and increase fecal bile acid excretion in rats fed a cholesterol free. Plant Foods Hum Nutr. 52(1): 55–65.

[35] Mazumder UK, Gupta M, Pal DK and Bhattacharya S. 2003. Chemical and toxicological evaluation of methanol extract of Cuscuta reflexa Roxb. stem and Corchorus olitorius Linn seed on haematological parameters and hepatorenal functions in mice. Acta Pol Pharm. 60: 317-23.

[36] Rami AB, Fouad AB, Mahmood AA, Mazen MJ, Al- obaidi, Maryam H, Pouya H, Mustafa F, Shahram G and Samaneh T. 2013. Gastoprotective effects of C. olitorius leaf extract against ethanol induced gastric mucosal hemorrhagic lesions in rats. J. Gastroenterol. Hepatol. 28(8): 1321-29.

[37] Mezui C, Amang AP, Nkenfou C, Sando Z, Betou D, Moulioum H, Tan PV. 2013. Anti- ulcer and antioxidant activity of the leaf aqueous extract of Corchorus olitorius (Tiliaceae) in rats. J. homepage: www.onlineijp.com

[38] Semra I, Filiz S and Ferdag C. 2007. Antibacterial and antifungal activity of C. olitorius extracts. Int. J. Natural and Eng. Sci. 1 (3): 59-61.

[39] Ashidi JS, Efuntoye MO, Odunbaku OA and Biliaminu SA. 2012. The in vitro effect of Corchorus olitorius on the antibacterial activities of five antibiotics. Global Research J. Microbiology. 2(2): 113 – 17.

[40] Malaya G, Upal KM, Dilipkumar P, Shailaditya B and Sumit C. 2003. Studies on Brain Biogenic Amines in Methanol Extract of Cuscuta refexa and Corchorus olitorius Seed Treated Mice. Acta Poliniac

Phamaceutica-Drug Research. 60 (3): 207-10.

[41] Das AK, Sahu R, Dua TK, Baq S. Gangopadhyay M. Sinha MK and Dewanjee S. 2010. Arsenic Induced Myocardial Injury: Protective role of C. olitorius leaves. Food Chem Toxicol. 48(5): 1210 -7.

[42] Satoshi Y, Keiichi H, Takahiko F, Hiroya K, Nobuyuki K, Shu S, Makoto I and Kazuya O . 2014. Skin Hydration Effects of C. olitorius leaf extract in mouse model of atopic dermatitis. J. Cosmetics, Dermatological Sci and Applications . 4: 1-6.

[43] Maxwell OE, Emmanuel UE, Shaibu OB and Sanusi WH. 2013. Anidiabetic activity of ethanolic seed extract of C. olitorius. Int. J. Sci : Basic and Applied Research (IJSBAR). 12(1): 8-21.

[44] Saliu JA, Oboh G, Schetingeer MR, Stefanello N, Rocha JBT. 2015. Antidiabetic Potentials of Jute Leaf (C. olitorius) on type -2 diabetic rats . J. Emerging Trends in Engineering and Applied Sci. 6 (7): 223-30.

[45] Omeje KO, Odiba AS, Ejembi DO, Chukwuka RS. 2014. Platelet Aggregation Effect of C. olitotorus extract as an index of managing blood clotting Disorders. J. Dental and Medical Sci. 13 (10) 58-60.

[46] Sanjida P, Moytry M, Sanjaana R, Anul KD, Sanjida H and Mohammed R .2015. Preliminary phytochemical screening, antihyperglycemic, analgesic and toxicity studies on methanolic extract of aerial parts of C. olitorius. J. Applied Pharm. Sci. 5(9): 68 –71.

[47] Kingsley OO, Tobechukwu CE, Henry CO and Benjamin OE. 2013. Effect of ethanol extract of Corchorus olitorus leaf on glucose level and antioxidant enzymes of Streptozotocin induced hyperglycemic rat. Nigerian Society for Experimental Biology (http://nisebpublications. Org).

[48] Subasri S, Arivoli S, Marimutha V and Mani N. 2015. Equilibrium, Kinetic and Thermodynamic Study on Rhodamine –B Removal from Aqueous Solution Using Activated C. olitorius leaves . Inter. J. Plant, Animal and Environmental Sci. 5(1): 208–18.

[49] Musa A and Ogbadoyi EO. 2012, Effect of Cooking and Sun Drying On Micronutrients, Antinutrients and Toxic Substances in Corchorus Olitorius (Jute Mallow). J Nutr Food Sci 2:14.

[50] Elangovan A, Dhanasekaran S, Anandan A, Krishnappa K, Gokulakrishnan J and Elumalai K.2012. Mosquitocidal activities of Corchorus capsularisL (Malvaceae) against a common mal aria vector, Anopheles stephensi (Liston) and a dengue vector Aedes aegypti (L) (Diptera: Culicidae). I. J. Recent Scientific Research. 3(6): 564-8.

[51] Roy N. 2014. Role of Chorchorus capsularis phytochemicals on the feeding dynamics of Diacrisia casignetum Kollar (Lepidoptera: Arctiidae). J. Entomology and Zoology Studies. 2 (4): 227 -36.