Phytochemical and pharmacological potentials of *Pedalium murex* Linn and its traditional medicinal uses

Muhammad Imran¹,², Naresh Kumar¹, Ferozuddin Nohri³, Dileep Kumar¹, Tayyuba Kousar⁴, Muhammad Tauseef Sultan⁵, Shabnam Shahida⁶

¹Underground Coal Gasification Project Thar, Islamkot, Pakistan
²Dept. of Chemistry, The university of Azad Jammu & Kashmir Muzaffarabad, AJK, Pakistan
³IARSCS University of Sindh Jamshoro, Sindh, Pakistan
⁴Dept of Plant Breeding and Genetics, PMAS-Arid Agriculture University Rawalpindi Pakistan
⁵Dept. of Food and horticultural Sciences Bahauddin Zakariya University, Multan, Punjab, Pakistan
⁶Dept. of Chemistry, University of Poonch Rawalakot, AJK, Pakistan

1. Introduction

*Pedalium* is a genus of plant in the *Pedaliaceae* family comprising one species, *Pedalium murex*. It is distributed in India, Pakistan, Sri Lanka and Tropical Africa.

*Pedalium murex* (*P. murex*) Linn (*Family: Pedaliaceae*) is an annual herb, grows abundantly in the coastal area of, Tharparkar & Cholistan in Pakistan, Sri Lanka, Mexico, South India and tropical Africa. *P. murex* has great medicinal importance. The leaves extract of *P. murex* contains the dinatoin glycoside and diosmetin glucuronides[1, 2]. Gonorrhea and dysuria diseases are curable by using infusion obtained from leaves and stems. Many flavonoids have been extracted from the flowers and leaves. Recently two more new compounds are extracted and isolated from the fruit of *P. murex* (Heptatriacontan-4-one, tetratriacontanyloctacosanoate[³]. A broth of its fruit is used as antispasmodic, diuretic, demulcent and aphrodisiac while the broth of its root is used for antibiliary. Clinical uses of *P. murex* are prove to have depository of different medicinal active compounds in its different plant parts which ensures its pharmacological potential, therefore, it gives confidence to investigate further aspects of its medicinal uses. Some researchers believe that *P. murex* can be explored as biopesticidal plant and potent fertility enhancing drug[⁴]. Urinogenital disorders were treated from triacotanyldotriacontanoate and 2′, 4′, 5′-trihydroxy 5, 7-dimethoxy flavones; sourced from its fruits[⁵].

Historically has been used for the cure of ulcers, fevers, puerperal diseases, wounds, general debility, digestive tonics and disorders. The plant is also studied for the character of pre phytochemicals. Study of phytochemicals encourages us about the new knowledge of a more attractive synthesis of pharmaceuticals. Ethanobotanical uses of *Pedalium murex* for different purposes are shown in table-1. Indians are using this plant for the cure of various ailments since the time immemorial. An enormous data about the uses of plant is likely to be amassed in regions wherever the utilization of *P. murex* against different illnesses is still having a lot of significance. Phytochemicals are very important remedial chemicals in plant which have potential to influence the particular physiological

---

**ARTICLE INFO**

**Abstract**

**Objective**: The aim of this study is to assess the pharmacological and phytochemical aspects of the *Pedalium murex* (*Linn*) and it has traditional medicinal uses of different parts of the plant. Flavonoids, phenolic compounds, glycosides, carbohydrates, reducing sugars, phytosterol, tannins, triterpenoids, alkaloids, xanthoproteins, aromatic oil, stable oil, saponins and resins are the main phytochemicals that have been found in different chemical extracts of *P. murex*. Pharmacological activities of *Pedalium murex* have proven its importance for medicinal uses. This review will be helpful to create interest to use the *P. murex* by developing new formulation in therapeutic medicines.

**Article history**:

Received 4 Jul 2015
Accepted 25 Jul 2015

**Keywords**:

*Pedalium murex* medicinal plant
Medicinal uses
Pharmacological activities
Phytochemicals

---

*Corresponding author: L
changes on the animal body and they are considered to have therapeutic attributes. The majority of vital bio-active compounds of these plants are flavonoids, alkaloids phenolic compounds and tannins.

**Table-1:**
Ethanobotanical information on *Pedalium murex* (Watt, 1962; Anonymous, 1966; Singh & Panda, 2005)

| S.No | Traditional uses | Active Part | Preparation |
|------|------------------|-------------|-------------|
| 1    | Antibilious      | Root        | Dissection  |
| 2    | Aphrodisiac      | Fresh leaves & Shoots | Mucilaginous infusion |
| 3    | Aphthae          | Leaves      | Juice       |
| 4    | Ardor Urinae     | Stem        | Extract     |
| 5    | Calculi          | Dried Fruits | With sugar  |
| 6    | Demulcent        | Leaves      | Infusion    |
| 7    | Diuretic         | Leaves      | Infusion    |
| 8    | Dysuria          | Stem        | Extract     |
| 9    | Emmenagogue      | Leaves      | Juice       |
| 10   | Gonorrhoea       | Fruit, stem, Leaves | Milk for exudates |
| 11   | Gonorrhoeal rhematism | Leaves | Powder |
| 12   | Incontinence of urine | Dried Fruits | Decocition |
| 13   | Puushik          | Root        | Powder      |
| 14   | Spermatorrhoea   | Stem        | Extract     |
| 15   | Strangury        | Dried Fruits | Decocition |
| 16   | Ulcer            | Leaves      | Extract     |

In developing countries, the inhabitant plants are still significantly used for ordinary diseases treatment. A widespread investigation and dealings with local herbal drug vendors, ethano-pharmacologists and rural healers exposed that the local *P. murex* plant parts are regularly and extensively employed for the healing of different disorders of live-stock and humans.

**Figure-1:** Whole Plant of *Pedalium murex* Linn

**Figure-2:** Flowers of *Pedalium murex* Linn

**Figure-3:** A close view of flower and Plant; *Pedalium murex* Linn

**Figure-4:** Fresh green and dry fruits of *Pedalium murex* Linn

*P. murex* has different names in different languages, such as Urdu-Farid booti, Telugu-Yenugupallera, Sanskrit Brihatgokshur, Hindi-Bada gokhura, English-Large caltrops.

**Taxonomy:**

This plant belongs to Kingdom: Plantae, Phylum/Division: Magnoliophyta, and Class: Magnoliopsida (Dicotyledonae). Furthermore, it is sub classed in Lamiiidae with Order: Caryophyllales and Family: Pedaliaceae. Moreover, it has given
Genus: *Pedalium*, naming Species as *P. murex* L.

Flowering period of this plant is May to December and Fruiting period June to January.

2. Botanical explanation

It has creeper lengthening about two to three feet and branches spread all over, when the leaves are in twosomes of five to eight with irregular shape shown in figure-1.[1] Small yellow colored flowers are shown in figure-2 & figure-3. While figure-4 depicts fruits as round and having five to twelve chambers and every chamber carrying a seed. Brown aromatic nature roots are four to five inches elongated as shown in figure-5. The seeds hold aromatic oil. Early winter is the season for the plant to flower than turning into fruits. *Pedilum murex* L. (*P. murex*) is juicy aromatic plants originate close to sea coast of south India, Tharparkar & Cholistan deserts of Pakistan. It appears during the month of May – January. It grows widely as a weed in crop lands and nutrient rich soils at a temperature range of 25-45 °C.

3. Phytochemistry

Fruit is rich with Alkaloids (3.5% –5%), glycosides, stable oil, resins aromatic oil, triterpenoids, carbohydrates and saponins.

Stem contains phytosterols, saponins, tannins, herman and carbohydrates.

Root is filled with Reducing sugars, xanthoproteins, saponins, alkaloids, triterpenoids, flavonoid compounds.

Leaves have splendid alkaloids, resins, flavonoids, saponins, proteins and steroids.

Initial investigation for chemical composition of *P. murex* shows subsistence occurrence of diverse chemical components. Every part of *P. murex* is reported to carry therapeutic potential phytochemical; Generally fruits consist of alkaloids (3.5% –5%), resins, carbohydrates, saponins, stable oil, aromatic oil, triterpenoids, and glycosides and also two more significant flavonoids i.e triacontanyldotriacontanoate and 2’,4’,5’-trihydroxy-5,7-dimethoxy flavones[1, 2]. *P. murex* accounts some essential flavonoids like dinatin and 7-glucoronide, diosmetin and its 7-glucoronicide, pedalin and pedaltin in its leaves. Moreover, steroids, alkaloids, saponins, proteins and resins are as well extracted. The root is enclosed with unique phenolic compounds like phenol 2-(5, 6-dimethyl pyrazinyl) methyl[1, 6]. Saponins, phytosterols, tannins and carbohydrates were obtained from stem. Flower accounted for the source of querimcitrin, quercetin, dinatin, and an unidentified diglycoside of quercetin. Some phytochemicals with their structures and groups found in *Pedilum murex* are shown in table-2. While table-3 shows estimation of primary metabolites (mg/gfw) in *P. murex*. Yield of flavonoids isolated from various plant parts of *Pedilum murex* has been estimated by Priyanka et.al. given in table-4[7]. Ecological position & relative density of Pedilum along with other 12 medicinal plants in community have been reported by Debabrata Das shown in bar graph-1 & Table- 5[8].

4. Pharmacological Uses

4.1. Antifeedent and biopesticidal activity

Ethanolic extract (0.1%, 0.2%, 0.4% and 0.8%) of *Pedilum murex*’s root was tested against anti-feedant and insecticidal activities of different stage larvae of *Spodoptera litura* through leaf dip methodology. As indication of ant-feeddant activity of *Pedilum murex*, *Spodoptera litura* was found having reduction in food consumption...
index, approximate digestibility, growth rate, food conversion efficiency of ingestion and food conversion efficiency of digestion. Being stronger biopesticidal plant in contrast to Neem gold, P. murex can be adopted as biopesticidal plant in coming days [1, 9].

**Table-2:**
Structures and phytochemical groups found in Pedilum Murex

| Sr. No. | Compound      | Structure | Phytochemical Group | Part Of Plant |
|---------|---------------|-----------|---------------------|---------------|
| 1       | Ursolic acid  | [Image]   | Amino Acid          | Fruit         |
| 2       | Arginin       | [Image]   | Amino Acid          | Fruit         |
| 3       | Diosgenin     | [Image]   | Steroid             | whole plant   |
| 4       | Histidine     | [Image]   | Amino Acid          | Fruit         |
| 5       | Tyrosin       | [Image]   | Amino Acid          | Fruit         |
| 6       | Threonin      | [Image]   | Amino Acid          | Fruit         |
| 7       | Aspartic Acid | [Image]   | Amino Acid          | Fruit         |
| 8       | Glutamic Acid | [Image]   | Amino Acid          | Fruit         |
| 9       | Vanillic Acid | [Image]   | Phenol              | Fruit         |
| 10      | Quercetin     | [Image]   | Aglycones           | Flowers       |
| 11      | Vanillic Acid | [Image]   | Phenolic Acid       | Leaves        |
| 12      | Luteolin      | [Image]   | Flavonoids          | Fruit         |
| 13      | Nonacosane    | [Image]   | Hydrocarbon         | Fruit         |

**Table-2:**
Structures and phytochemical groups found in *Pedilum Murex*

| No. | Compound                  | Structure |
|-----|---------------------------|-----------|
| 14  | Glucoside                 | [Image]   |
| 15  | Flavones                  | [Image]   |
| 16  | Tri terpenoids            | [Image]   |
| 17  | Beta Sitosterol           | [Image]   |
| 18  | Caffeic Acid              | [Image]   |
| 19  | Ferulic Acid              | [Image]   |
| 20  | Diosmetin                 | [Image]   |
| 21  | Glucouronide              | [Image]   |
| 22  | Hispidulin                | [Image]   |
| 23  | 4',5,7-trihydroxy-3'-methoxy flavone | [Image] |
| 24  | Pedalitin (3',4,5,6- Tetrahydroxy-7'-methoxyflavone) | [Image] |
| 25  | 3- Amyrin acetate (3')-Urs-12-en-3'-yl acetate | [Image] |
Table 2:
Structures and phytochemical groups found in Pedalium Murex

| S.No | Plant Parts | Primary metabolites (mg/gfw) used in P.murex |
|------|-------------|---------------------------------------------|
| 26   | Leaf        | Rubuscin acid (3H,7H-Dihydroxynor-lanost-12-en-28-oic acid) |
| 27   | Stem        | Lupeol Acetate |
| 28   | Calyx       | Tocopherol |

In high fat diet fed rats with doses of (200 mg/kg & 400 mg/kg of body weight) ethanol extract of Pedalium murex fruit was tested against the anti hyperlipidemic potential. P. murex in comparison with the reference standards gemfibrozil and atorvastatin was tested against some biochemical components like cholesterol (total) of blood serum, lipoproteins (high density, low density, very low density) and triglycerol concentrations were observed within the treated animals. At different tested doses the ethanolic extract have shown remarkable decline of very low density lipoproteins triglycerols total cholesterol low density lipoproteins and very prominent boost in high density lipoproteins (P < 0.05) concentrations {((P < 0.01), (P < 0.01), (P < 0.001), (P < 0.001), respectively}.[1,10]

4.3. Anti-nephrolithiatic activity

At the coastal areas of Pakistan and India P. murex (Linn), is found abundantly with a very good remedial use for ailment against urinary diseases. For the evaluation of anti nephrolithiasis activity of P. murex, different extracts like aqueous, ethanolic, petroleum ether and chloroform were prepared and tested on Albino rats that shown that P. murex has great anti- nephrolithiasis activity[1, 11].

4.4. Nephroprotective activity

Nephro-protective efficacy in rats having induced renal damage by cisplatin dosage was tested against ethanol in fruit extract of Pedalium murex.

Cisplatin 5 mg per kg body mass was fed to Wistar rats to induced nephro-toxicity. Losses in body weight and blood urea and serum creatinine were observed as kidney damage indicators by dosing 250 mg/kg orally concurrent ethanolic extract of P. murex. Ethanolic extract was found very effective to protect the kidneys damage. Therefore it can be concluded that cystone ethanolic extract of Pedalium murex is significantly nephroprotective[1, 12].

Peptic ulcer and acid peptic diseases are inducer of gastro intestinal bleeding that are caused due to bad eating habits and modern life styles[1, 13]. Herbal medicines are more suitable in contrast to drugs with high effectiveness and very nominal side effect. Due to presence of biochemically active phytochemicals and their ethanomedicinal uses, Pedalium murex importance has been boosted[1, 14].

4.5. Antiulcer activity

The changes in lifestyles and eating habits have induced the peptic in human beings. The water extract of leaves of Pedalium murex on gastric damages induced by feeding ethanol was tested for antiulcer activity. For this purpose a number of chemical contents like ulcer index, glutathione, acid volume, total acid and total protein were investigated. 36 hours fasted rats were orally fed ethanol 80% (1 mL per kg) to induced the ulcer, one hour ahead leaves extract in water of Pedalium murex with feed level of 50 mg per kg, 100 mg per kg & 200 mg per kg body mass and reference drug famotidine (3mg per kg dosage of body mass) were fed to them. Hence, presence of flavonoids and mucilage within the leaves extract of Pedalium murex attributed the plant a valuable antiulcer drug[1, 15].
Various medicinal significances of different parts i.e root, leaves and seeds of *Pedalium murex* and *Abutilon indicum* were studied. It was found that *Pedalium murex* has relatively more anti-inflammatory activity than *Abutilon indicum*. Albino wistar rats were studied for carrageenan induced paw edema principle. Concentration level of paw was observed in each wistar rat before the injection of carrageenan with intervals of 1h, 2h, 3h, 4h, 5h, and 24h followed by injection of carrageenan, and it was found that concentration level of paw was significantly increased after injecting carrageenan in subsequent intervals. The edema component of inflammation was determined[1, 16].

4.7. Anti-oxidant efficacy

Rat liver intoxicated with carbon tetrachloride (CCL4) was investigated against methanolic extract of *Pedalium murex* (MEC). The rats with hepatoxic effect were given MEC orally at a dosage level of 70 mg per kg of body mass, for 90 days on daily basis. Its healing inwith hepatotoxic effect were given MEC orally at a dosage level of 70 mg per kg of body mass, for 90 days on daily basis. Its healing effect was assessed. The ethanolic extract of *Pedalium murex* has revealed decline of thiobarbituric acid components, hydroperoxides and boost in level of superoxide dismutase, catalase, glutathione peroxidase, and reduction of glutathione-S-transferase & glutathione. The ethanolic extract of *Pedalium murex* (200mg per kg of body mass) has shown larger efficacy in comparison to glibenclamide a standard reference drug.[1, 26]

4.8. Anti-bacterial efficacy

12 different pathogenic microbes were tested for their anti-bacterial efficacy against methanolic extract of leaf and fruit. Hence, result Positive control (streptomycin) was found without any inhibition with negative control[1, 20]. Phytochemicals like alkaloids, glycosides, flavonoids, phenols, steroids, and tannins were found in methanolic extract of *Pedalium murex*. Bacteria species like *Streptococcus progeny* and *Enterococcus faccals* (Gram positive) have shown more antibiotic efficacy of methanolic extract of *Pedalium murex* as compared to the gram negative bacteria[1, 19].

4.9. Hepatoprotective activity

In the pathogenesis of liver damage the function of reactive oxygen species (ROS) generation and oxidative stress is ascertained. The reasons behind are addiction of alcohol and different drugs. As per AOT 425 guidelines the extreme toxicity of water and ethanolic/methanolic extracts of the fruit of *Pedalium murex* were tested by oral dosage to the Swiss albino mice. For alcohol and isoniazide induced liver damage, alcohol and water extracts of *Pedalium murex* at dose level of 400 mg per kg of body mass has been investigated for hepatoprotective efficacy. By dosing aqueous-alcoholic fruits extract of *Pedalium murex* the high-level of (intoxicatied by isoniazide) the biochemical parameters like TG, TB, TC, SGOT & SGPT in rats were decreased extensively upto regular range. The main phytochemicals of tannin and flavonoid groups from aqueous-alcoholic extract of *Pedalium murex* are liable for hepato-protective activity by scavenging free radicals.[1, 22-25].

4.10. Ant-diabetic effect

Ethanolic extract of *Pedalium murex* root (PMEt) was investigated for ant-diabetic efficacy on alloxan-induced diabetes rats. By dosing ethanolic extract of *Pedalium murex* for three weeks with dosage of 100 mg per kg & 200 mg per kg of body mass, considerable decline of blood sugar level as well as boost of blood insulin were observed. The free radical formation in liver & kidney organ’s tissues were decreased by ethanolic extract of *Pedalium murex*. In addition to its ant-diabetic efficacy, the antioxidant properties of *Pedalium murex* ethanol extract have revealed decline of thiobarbituric acid components, hydroperoxides and boost in level of superoxide dismutase, catalase, glutathione peroxide, and reduction of glutathione-S-transferase & glutathione. The ethanolic extract of *Pedalium murex* (200mg per kg of body mass) has shown larger efficacy in comparison to glibenclamide a standard reference drug.[1, 26]

5: Toxicity limit

The acute toxicity studies of *Pedalium murex* plant dosage with range of 2-260mg per kg of body mass in mice were reported to be safe. The study were performed on the male Swiss albino mice (20-25g) which was orally administrated with ethanolic extract of *Pedalium murex* and according to CPCSEA guidelines experiential for any symptoms of toxicity upto 48 h. Karber’s method was used to investigate the LD50 that resulted within level of 2-260mg per kg, p.o. Keeping in view these findings based on the results 250 mg/kg dosage was set for future pharmacological studies. Even after 48 hrs span 2-260mg/kg body weight orally dosage of ethanolic extract of *Pedalium murex* to the Swiss albino mice no any side effects or toxicity was observed.[27] *Pedalium murex* mucilage was found safe with LD50 >2000 mg/kg without any toxic syndromes symptoms.[28]

Conclusion

Through literature survey it is revealed that *Pedalium Murex* is very important medicinal plant with very diverse phytochemical constituents. Being non-toxic, very economical and easily available herbal medicines have attained great preferences over synthetic drugs. *Pedalium murex* contains a number of valuable phytochemicals with various pharmacological activities and gained alot of importance in ethno-medicinal ailments. Hence, the plant persuades exploring its new curative uses. Scientists have investigated a number of biological active components from leaves, branches, roots and fruits extracts of *Pedalium murex*. Extensive research is required to use *Pedalium Murex* for the formulation of natural therapeutic drugs. However, parameters like toxicity, bioactivity and chemical biomarker must be investigated to support the traditional use of *Pedalium murex* in therapeutic medicine.
Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

We are grateful to Director/CE Chemical UCG Project Thar for providing technical guidance, resources, moral and financial support via Grant No. Chemistry-K10 for this work.

References

[1] Rajashekar V, Upender RE, Srinivas P. Biological activities and medicinal properties of Gokhru (Pedalium murex L.). Asian Pac J Trop Biomed 2012; 2(7): 581-585.

[2] Sankara SS, Nair AGR. Flavonoids of the leaves of P. murex. Phytochemistry 1972; 11:464-465.

[3] Yogendra N, Shukla RS, Thakur S. Hepta triacontan-4-1, tetra triacontanyl octacosanoate and other constituents from P. murex. Phytochemistry 1983; 22(4):973-974.

[4] Prasad TNV, Sastry KV. A note on the chemical examination of P. murex leaves. Ind Drugs 1989; 25(2):84.

[5] Mangle MS, Jolly CI. HPTLC studies on Tribulus terrestris L.(Chota Gokhru) and P. murex L.(Bada Gokhru). Indian Drugs 1998; 35(4):189-194.

[6] Sharma P, Sarin R. In Vivo and in Vitro biochemical investigation of primary metabolite from Pedalium murex. IJRRPAS; 2(3): 550-555.

[7] Sharma P, Sarin R. Isolation and characterization of Quercetin and Kaempferol in vivo and in vitro from Pedilium murex. IJRIJ 2012; 3(6): 184-187.

[8] Das D. Pedalium Murex L. (Pedaliaceae): A New Record of Purba Medinipur District to the State Of West Bengal. IOSR-JBM 2013; 13 (4) 54-56.

[9] Sahayaraj K, Venkateshwar M, Balasubramanian. Insecticidal and Antifeedent effect of P. murex root and on Spodoptera littura (Lepidoptera: Noctuidae) J Agri Technol 2008; 4(2):73-80.

[10] Mukundh V, Balasubramanian, Muralidharan P, Balamurugan G. Anti-hyperlipidemic activity of P. murex, fruits on high fat diet and fed rats. Int J Pharmaco 2008; 4(4):310-313.

[11] Thanishmohizh M, Mulaicharam AR, Muruges S. Phytochemical and pharmacognostical studies on Pedalium murex Linn. Int J Res Ayurveda Pharm 2011; 2(1):253-258.

[12] Shelke TT, Kothai R, Adkar PP, Bhaskar VH, Juvalke KC, Kamble BB, et al. Nephroprotective activity of ethanolic extract of dried fruits of P. murex L. J Cell & Tissue Res. 2009;9(1):1687-1690.

[13] Gerard T, Grabowski SR. Principles of anatomy and physiology. NJ: John Wiley & Sons Inc 2003; 10: 899-905.

[14] Chaturvedi A, Kumar MM, Bhawani G, Chaturvedi H, Kumar M, Goel KR. Effect of ethanolic extract of Eugenia jambolana seeds on gastric ulceration and secretion in rat. Ind J Physiol Pharmacol 2007; 51(2):131-140.

[15] Banji D, Singh J, Otiila JFB, Shanthamurthy M. Scrutinizing the aqueous extract of leaves of P. murex for the antiulcer activity in rats. Pak J Pharm Sci 2010; 23:295-299.

[16] Parmaladevi B, Davidraj C, Tamil Chelvan N, Rama Subramaniaraja R. Evaluation of anti-inflammatory activity of methanol extract of Abutilon indicum and P. murex: A comparative study. J Pharm Res 2010; 3(10); 2425-2426.

[17] Srinivas P, Venkateshwarlu L, Madhubabu A, Anil Kumar Ch. Antioxidant activity of P. murex fruits in carbon tetra chloride-induced hepatopathy in rats. 2011; 2:622-628.

[18] Patel DK, Kumar R, Prasad SK, Hemalatha S. P. murex L. (Pedaliaceae) fruits: a comparative antioxidant activity of its different fractions. Asian Pac J Trop Biomed 2011; 1(5): 395-400.

[19] Thakkar JH, Solanki AN, Thakka MH, Solanki HK and Patel NJ. In vitro antioxidant activity of aqueous fruit extract of Pedalium murex, Internat. J Preclin Pharmaceut Res 2011; 2(1): 26-29.

[20] Sermakkani M. Evaluation of phytochemical and antibacterial activity of P. murex L. Root. IRJP 2011; 2 (3): 131-134.

[21] Muruganathan S. In vitro anti-bacterial activity of P. murex L. Int J Univ Pharm & Life Sci 2011; 1(2):37-44.

[22] Ladani K, Patel NJ, Patel N, Solanki A. Hepatoprotective activity of aqueous alcoholic extract of P. murex (Bada Gokhru) on ethanol and Isoniazide hepatotoxic rats, Int J Pre Clin Pharm Res 2008; 4:124-128.

[23] Refaat AT, Shahat AA, Ehsan NA, Yassin N, Hammouda F, Tabl EA, Phytochemical and biological activities of Crataegus sinaica growing in Egypt. Asian Pac J Trop Med 2010; 3:257-261.

[24] Chaves SMC, Batista DSA, Moura TF, Pereira DSPC, Macedo RRM, Honório JIER, et al. Therapeutic and biological activities of Calotropis procera (Ait.) R. Br. Asian Pac J Trop Med 2010; 3:332-336.

[25] Jombo GTA, Emerwee UE, Amelele EN, Damen JG. Nosocomial and community acquired uropathogenic isolates of Proteus mirabilis and antimicrobial susceptibility profiles at a university hospital in Sub-Saharan Africa. Asian Pac J Trop Dis 2012; 1:7 11.

[26] Ravi kumar R, P. Krishnamoorthy. Antidiabetic effect of pedalium murex: effect on lipid peroxidation in alloxan induced diabetes. IJRAP 2011; 2(3) 816-821.

[27] Shelke TT, Kothai R, Adkar PP, Bhaskar VH, Juvalke KC, Kamble BB, et al. Nephroprotective activity of ethanolic extract of dried fruits of Pedalium murex linn. J Cell Tissue Res 2009; 9(1):1687-1690.

[28] Yeole NB, Sandhya P, Chaudhari PS, Bhujaal PS. Evaluation of Malva sylvestris and Pedalium murex mucilage as suspending agent. Int J PharmTech Res 2010; 2(1):385-389.