IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IVY GOURD: NUTRITION AND PHARMALOGICAL VALUES

Satbir singh saini

Department of food science & nutrition

Lovely Professional University- 144411

Abstract

Ivy Gourd, Coccinia grandis (L), also known as little gourd or baby watermelon plant, that is a member of the family of Cucurmbitaceae. It is one of the most beneficial medicinal herbs in traditional and ayurvedic medicine. The fruits of Coccinia Grandis are recognized to have active constituents similar to amyran, lupeol, taraxerone, taxerol and glycoside cucurbitacan B. The subsistence of secondary metabolites like alkaloids, flavonoids, saponins, glycosides etc. in the plant may give to their medicinal value. The tender green fruits are nutritious and are a good source of calcium, protein, calcium, fiber and beta carotene, Vitamin-A. It has been used in traditional medicine as a domestic remedy for a variety of diseases. The entire plant of Coccinia grandis having pharmacological actions such as analgesic, antipyretic, anti- inflammatory, antimicrobial, antiulcer, antidiabetic, antioxidant, hypoglycemic, hepatoprotective, antimalarial, antidyslipidemic, anticancer, antitussive, mutagenic. Therefore, the final note emphasizes this plant broadly being used for treatment of diabetes, jaundice, hypertension, fever and gastrointestinal exertion and to relieve pain. The Coccinia grandis has good likely of medicinal values and chemical constituents.

Keywords: Ivy gourd, pharmalogical activities, Coccinia grandis, antidiabetic

I. Introduction

Ivy gourd also known as Coccinia grandis is a member of Cucurmbitaceae family in the order Violales. The coccinia grandis (L) voigt family comprises more than 900 species. It is also known as baby melon or little gourd or sometimes tam lueng. It is a native plant of East Africa but also found in Asia, Australia, the Caribbean islands and Pacific islands. Ivy gourd is a tropical plant having ovoid shape fruit having green color during raw and turns to red color when ripen (Umamaheswari, 2008). The green fruit have number of nutrients such as calcium, protein, fiber and beta carotene, Vitamin. The shelf life of the fruit is 3-4 days at room temperature and 7 to 8 days at refrigerated temperature condition. Fruit color changes to pink during initial ripening and lose its weight during storage due to wilting. Leaves are aligned alternately to the stem and have heart to pentagon shaped. The surface of the leaf is hairy from the lower and hairless on the upper side. The color of leaves is dark green in color. The flowers of ivy gourd are large and white in color having star like shape. The calyx has five subcuticles with recurved lobes. Each lobe is 2-5mm long on the hypanthium. The ivy gourd flower has three stigma and its ovary is inferior. Generally, flowering occurs in the month of june to august. All the parts of the plant are beneficial in medicines preparation and treatment of various diseases. Whole plant has number of phytochemicals and possesses pharmalogical properties.

Table:1 Taxonomy of coccinia grandis

Kingdom	Plantae
Division	Magnoliopsida
Class	Magnoliophyta
Order	Violales
Family	Cucurbitaceae
Sub family	Cucurbitoideae
Tribe	Benincaseae
Sub tribe	Benincasinae
Genus	Coccinia Wight & Arn
Species	Coccinia Grandis L Vight.

Table. 2: Vernacular names of Coccinia grandis

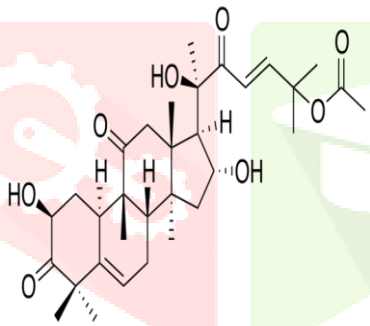
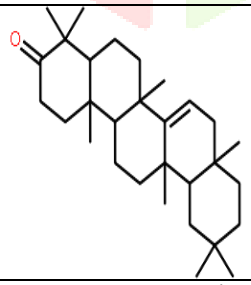
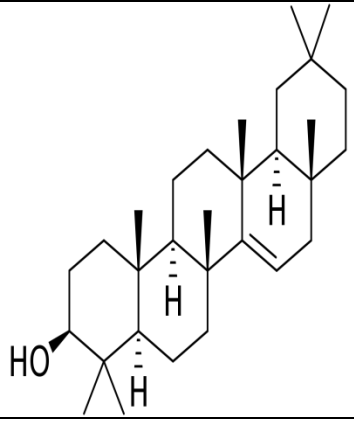
English	Scarlet
Hindi	Parval, Tindora, Tinda, Kundru
Kannada	Tondekayi
Telagu	Dondakaya
Marathi	Tindora, Tondli
Malayalam	Tendli, ghiloda, kundri, kowai
Japanese	Yasai, karasuuri
Danish	Skariagenagurk
Malay	Pepasan, Kovakka, Kovai
Spanish	Pepino, cimaron
Chinese	Hong Qua

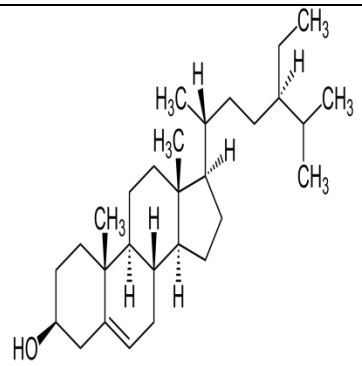
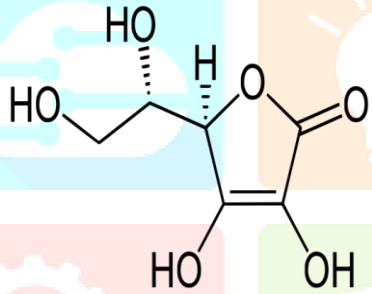
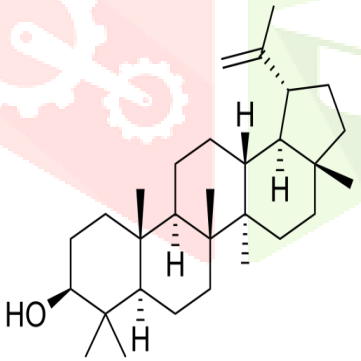
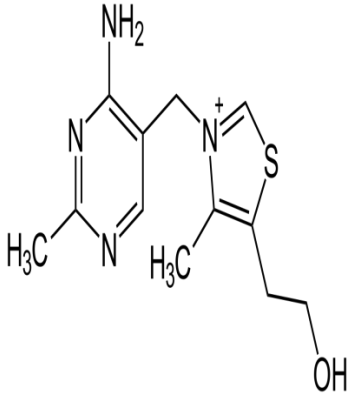
Source: Ajmal Ali et al., 2005

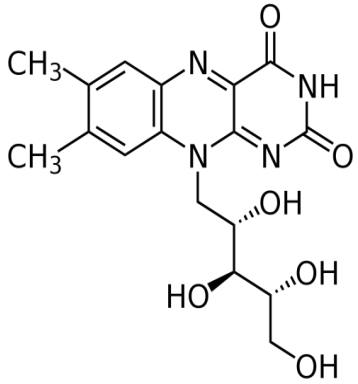
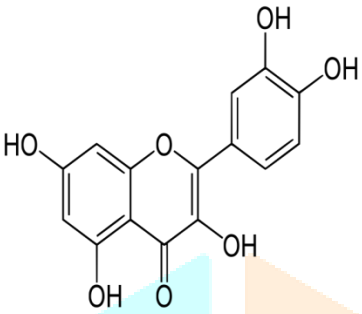
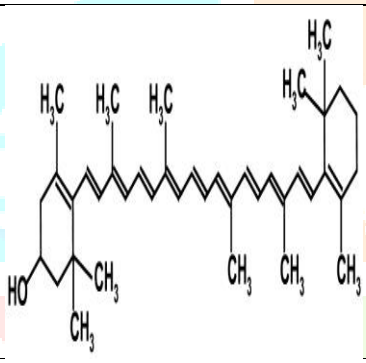
II. Nutritional composition of ivy gourd

Ivy gourd contains 12.62%-carbohydrates, 15%-total proteins, 11.25%- water soluble proteins, 4.0%- fats, 25.55mg/100g-vitamin C, 61.92mg/100g-total phenols, 70.05mg/100g-β-carotene, 3.3mg-potassium, 1.15mg/100g-phosphorous, 0.95mg/100g- sodium, 2.23mg/100g and 3.79mg/100g- calcium.. Sutar et al., 2010 reported that the ivy gourd fruit consist of ellagic acid, lignin, terpenoids, other compound like, saponin, tannins, flavonoids, alkaloids, glycosides, B-amyrin acetate, phenols, carotenoids, lupeol, taraxerol, lycopene, cryptoxanthin, β-sitosterol, β-carotene and xyloglucen. The extract of coccinia grandis contain alkaloids, carbohydrates, glycosides, tannin, saponins, flavonoids and other phytoconstituents like lupeol, sigma-7-en-3- one, cephalandrol, taraxerone and taraxerol (Sutar Niranjan, 2010). The root element of ivy gourd contains starch, fatty acids, triterpenoid, resin, β-amyrin, carbonic acid, saponin coccinoside, alkaloids, flavonoid glycoside, taraxerol lupeol and β-sitosterol (Deokate et al., 2011).

Table 3. Chemical properties of major phytochemicals present in ivy gourd

Compound	**Structure**	**Molecular formula**	**Systematic name**	**Pharmacological activities**
Cucurbitacin B		$C_{32}H_{46}O_8$	(2β,9β,10α,16α,23E)-25-(acetyloxy)-2,16,20-trihydroxy-9-methyl-19-norlanosta-5,23-diene-3,11,22-trione	Anti tumor Anti-artherosclerotic activity Anti-inflammatory activity
Taraxerone		$C_{30}H_{48}O$	(4*aR*,6*aR*,6*aS*,8*aR*,12*aR*,14*aR*,14*bR*)4,4,6*a*,6*a*,8*a*,11,11,14*b*-octamethyl-2,4*a*,5,6,8,9,10,12,12*a*,13,14,14*a*-dodecahydro-1*H*-picen-3-one	Anti-leishmanial activity Anti-tumour activity
Taraxerol		$C_{30}H_{50}O$	(3S,4aR,6aR,8aR,12aR,12bS,14aR,14bR) 4,4,6a,8a,11,11,12b,14b-Octamethyl-1,2,3,4,4a,5,6,6a,8,8a,9,10,11,12,12a,12b,13,14,14a,14b-icosahydro-3-piceno	anti-allergic Anti tumor Anti-artherosclerotic activity Anti-inflammatory activity Anti-cancer activity

				Antioxidant
Beta-sitosterol		$C_{29}H_{50}O$	(3*S*,8*S*,9*S*,10*R*,13*R*,14*S*,17*R*)-17-[(2*R*,5*R*)-5-ethyl-6-methylheptan-2-yl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1*H*-cyclopenta[a]phenanthren-3-ol	Anti atherosclerosis Ant diabetes Antioxidant Antihyperlipidemic activity Immunomodulatory Anti cancer Anti- inflammatory
Ascorbic acid		$C_6H_8O_6$	(2*R*)-2-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxy-2*H*-furan-5-one	Anti oxidant Lower the risk of heart diseases
Lupeol		$C_{30}H_{50}O$	(1*R*,3*aR*,5*aR*,5*bR*,7*aR*,9*S*,11*aR*,11*bR*,13*aR*,13*bR*)-3*a*,5*a*,5*b*,8,8,11*a*-hexamethyl-1-prop-1-en-2-yl-1,2,3,4,5,6,7,7*a*,9,10,11,11*b*,12,13,13*a*,13*b*-hexadecahydrocyclopenta[a]chrysen-9-ol	Anti cancer Anti inflammatory Anti microbial Anti tumor
Thamine		$C_{12}H_{17}N_4OS^+$	2-[3-[(4-amino-2-methylpyrimidin-5-yl)methyl]-4-methyl-1,3-thiazol-3-ium-5-yl]ethanol	Antioxidant Erythropoietic Cognition-and mood-modulatory Antiatherosclerotic Putative ergogenic Detoxification activities

Riboflavin		$C_{17}H_{20}N_4O_6$	7,8-dimethyl-10-[(2*S*,3*S*,4*R*)-2,3,4,5-tetrahydroxypentyl]benzo[g]pteridine-2,4-dione	Antioxidant Anticancer
Quercitine		$C_{15}H_{10}O_7$	2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxychromen-4-one	Hepatoprotective Antihypertensive Anti- inflammatory Anti microbial
Cryptoxathin		$C_{40}H_{56}O_3$	(1*R*,3*S*,6*S*)-1,5,5-trimethyl-6-[(1*E*,3*E*,5*E*,7*E*,9*E*,11*E*,13*E*,15*E*,17*E*)-3,7,12,16-tetramethyl-18-[(1*S*,6*R*)-2,2,6-trimethyl-7-oxabicyclo[4.1.0]heptan-1-yl]octadeca-1,3,5,7,9,11,13,15,17-nonaenyl]-7-oxabicyclo[4.1.0]heptan-3-ol	Anticancer Antioxidant

Source: Orech et al., 2005; Umamaheswari and Chatterjee, 2008; Shaheen et al., 2009

Fig.1 Traditional uses of ivy gourd

III. Pharmalogical activities

3.1 Antibacterial

The aqueous extract of coccinia grandis leaves showed the antibacterial activity against Escherichia coli, Salmonella choleraesuis, Shigella flexneri NICED, Shigella dysenteries, Bacillus subtilis and Shigella flexneri. Study revealed that the aqueous extract of coccinia grandis leaves have more significant antibacterial activity than the ethanol extract. The antibacterial property is due to the polar moiety of the extract (Bhattacharya et al., 2010). Sivaraj et al. (2011) evaluated the antibacterial activity against five bacterial species with leaf extract of Coccinia grandis with solvents such as methanol, aqueous, ethanol, acetone, and hexane. The highest antibacterial activity against K. Pneumonia, S. pigeons, S. aureus E. Coli and B. Ceres was showed by the ethanol leaf extract (Sivaraj et al., 2011). In different solvent extraction, hexane extract of coccinia cordifolia was highly effective Pseudomonas aeruginosa and sarcina lutea while chloroform extract was moderately active against Bacillus subtilis, Sarcina lutea. The ethyl acetate extracts was also active alongside staphylococcus aurous (Tamilselvan N, Thirumalai T, Elumalai EK, Balaji R, 2011). The aqueous extract of leaves and ethanolic extract of stem was effective against Shigella boydii and Pseudomonas aeruginosa respectively. However, In vitro studies revealed that the leave and stem extract of cocconia grandis L. have highly effective against Klebsiella pneumonia, Staphylococcus aureus, Salmonella typhi, Escherichia coli (ETEC), Bacillus cereus, Proteus mirabilis, Streptococcus pyogenes, Pseudomonas aeruginosa, , Corynebacterium diptheriae, and Shigella boydii. Water extract of leaves and ethanolic extract of stem showed significant activity against bacteria (Umbreen Farrukh, Huma Shareef & Rizwani, 2008).

3.2 Antioxidant

The fruit extract of coccina grandis was investigated for the antioxidant activity. Three in vitro assays were used for evaluation in comparison to standard Butylated hydroxyanisole (BHA). The results revealed that the extract of coccinia grandis fruit have a potential source of antioxidant. (Deshpande et al., 2011). Moideen (2011) reported that the ethanol extract of root of Coccinia grandis showed the antioxidant due to the presence of flavonoids and similar with the methanol extracts of Coccinia grandis fruit that ,have glycoside and flavonoid, possess the potent antioxidant activity. The reducing power of coccinia grandis is due to the it's hydrogen peroxide scavenging potential (Moideen, 2011). In the study of Coccinia grandis antioxidant, antiglycation and insulinotrophic properties, it was found that the unripe fruit extract of Coccinia grandis have potential to prevent the diabetes complications (Meenatchi, Purushothaman and Maneemegalai, 2016). Different extractions from different extracts were evaluated for the antioxidant and anti- inflammatory activity of coccinia grandis. Antioxidant activities of unlike fractions from different extracts were evaluated by InVitro antioxidant assay models such as phosphomolybdenum and reducing power assay. The result obtained by this study C.grandis has potent antioxidant activity (Ashwini et al., 2012). Fractions of coccinia grandis leaf extract was evaluated for the antioxidant activity using the nine different in vitro assays. The results were compared with the standard antioxidants such as α tocopherol, metal chelating ability, ascorbic acid, butylated hydroxyl toluene and curcumin. All the fractions of leaf extract showed effective inhibition of β- carotene bleaching, free H donor activity, radical scavenging activity and reducing power. On increasing the amount of fraction, antioxidant activity also increases (Chatterjee, 2008).

3.3 Antiulcer

The aqueous extract of Coccinia grandis leaves were evaluated for the anti-ulcer activity in pylorus ligation and ethanol induced ulcer models in experimental rats, In both models the common parameter determined was ulcer index. The dose of 250 and 500mg/kg (aqueous extract) had shown that significant inhibition of the gastric lesions induced by pylorus ligation induced ulcer and ethanol induced gastric ulcer. Significant ($P<0.05$) reduction in free acidity, gastric volume and ulcer index as compared to control was observed with the extract dose (250 mg/kg&500 mg/kg). The aqueous extract of Coccinia grandis has a potential antiulcer activity in the both models (Girish, C & Vineela, S & NarasimhaReddy, Y & Reddy, O.V.S. & Rajasekhar, K.K. & Shankarananth, 2011). In the investigation of antiulcerogenic activity of the aqueous and methanol leaves powder of coccania gradis L. against Aspirin-induced gastric ulcer model in rats, it was observed that both extracts increased the mucus secretion and activity level of lipid peroxidation (LPO) and decreased the Superoxide dismutase (SOD) (Mazumder et al., 2008). Manoharan (2010) reported that the Coccinia grandis aqueous, total aqueous and ethanol extract have significant reduction in ulcex index in pylorus ligation induced gastric ulcer. 400mg/kg of ethanolic plant extracts exhibited antiulcerogenic activity as that of omeprazole. The aqueous extract of Coccinia grandis leaves showed the anti-ulcer activity aqueous in pylorus ligation and ethanol induced ulcer models in experimental rats. Ulcer index was determined in both models. The dose of 250 and 500 mg/kg has significant inhibition of the gastric lesions induced by ethanol induced gastric ulcer and pylorus ligation induced ulcer. The extract showed significant reduction in ulcer index, gastric and free acidity (Girish et al., 2011)

3.4 Hypoglycemic

Islam et al. (2011) studied the hypoglycmic effect of ethyl acetate extract and petroleum ether extract of Coccinia grandis on alloxan induced diabetic rats. It was observed that the hypoglycemic activity is due to the presence of alkaloid, flavonoid, triterpines, B-carotene. Leave extract of Coccinia indica showed significant decrease in hypoglycemic activity on cholesterol and blood glucose, TG, LDL, VLDL level in alloxan induced diabetic rats (Manjula et al., 2007). The ethanolic extract of Coccinia grandis fruit exhibit the

hypoglycaemic activity by lower the blood glucose level in alloxan induce diabetic rat. The Coccinia grandis fruit pectin reduce the blood glucose by increasing liver glycogen and decreasing the absorption of glucose from the intestine and decreasing glycogen phosporylase (Ramakrishnan et al., 2011). Combined Methanolic extract of leaves of Coccinia indica and salvadora oleoides shows the hypoglycemic activity (SaklaniI et al., 2012). The Combined extracts of Musa paradisiaca and Coccinia indica aqueous extract of leaf exhibits the antidiabetic activity in streptozotocin induced diabetes rats (Mallick, 2007). At the dose of 100 or 200 mg/kg of ethanolic extract of the aerial part, a significant decrease in blood glucose levels and lipid parameters in streptozotocin induced diabetic rats was observed. Alcoholic extract of Coccinia grandis stem and leaves have the capacity to lower the blood glucose level in normal fasted rats (Doss et al., 2008 and Eliza Jose, 2010). A significant reduction in blood glucose level and reduced the cholesterol, protein and urea with prolonged treatment of aqueous extract of Coccinia grandis was observed in diabetic rat liver. Increased treatment with Coccinia grandis extract stimulated gluconeogenesis, or inhibited glycogenolysis, increases the total protein, SGPT, SGOT (Doss et al., 2008).

3.5 Anticancer

The photochemical in vegetables are effective in reducing the risk of cancer. One of them is Coccinia grandis. Coccinia grandis have good amount of antioxidants which possesses anticancer activity. The antioxidant of Coccinia grandis reduces the ferrocynaide to ferrous and scavenges the hydrogen peroxide to neutralize it to water (Behera et al., 2012). Bhattacharya (2011) investigated the anticancer efficacy of an aqueous extract of Coccinia grandis leaves. Nitric oxide is a free radical that plays a major role in the pathogenesis of pain and inflammation. Coccinia grandis' antioxidant principle reduces the nitrite generated by decomposition Coccinia grandis significantly reduced viable cell count while increasing non viable cell count, representing anticancer activity comparable to that of the reference drug (vinblastine) (Nanasombat et al., 2009; Bhattacharya et al., 2011).

3.6 Anthelmintic

The anthelmintic activity of methanolic extract of Coccinia grandis was studied on the pheretime posthuma worm. Different concentrations of the extract are used that acts through paralyzing the worm. The activity is measured by the time taken to paralyzing the worm and death (Tamilselvan N, Thirumalai T, Elumalai EK, Balaji R, 2011). The crude extract of Coccinia grandis, Schima wallichii and Diospyros peregrina extracts caused paralysis followed by death of all selected worms at the selected concentrations (Dewanjee et al., 2007).

3.7 Antitussive

The methanol extract of Coccinia grandis fruit showed antitussive activity similar effect as compared to codeine phosphate in a dose dependant manner. A significant decrease in cough was observed with methanol extract in 90 min. The dose of 400 mg/kg has the highest inhibition of cough (56.71%) at 90 min. Pattanayak (2009) reported that the methanol extracts of coccinia grandis fruit posseses analgesic property. Due the presence of triterpenoid, tannin, steroid, glycoside, alkaloid, carbohydrates and reducing sugar, it can give relief from asthma and cough. The methanol extract has been compared with that of codeine (Antitussive drug) for significant differences.

3.8 Hepatoprotective

Vadivu, (2008) studied the effect of alcoholic extract of the fruit of Coccinia grandis on CCl4- induced Hepatotoxicity in experimental rats for Hepatoprotective activity. The results showed that treatment with 250 mg/kg ethanolic extract of fruit significantly reduced the SGPT (Serum glutamic pyruvic transaminase), SGOT (serum glutamic-oxaloacetic transaminase) and bilirubin level. Hepatoprotective activity of Coccinia grandis leaves against Carbon Tetrachloride Induced Hepatic injury rats (Sunilson, et al 2009). Investigation of the fruits of Coccinia grandis Linn. Exhibited the hepatoprotective activity. (Kumar et al., 2009)

3.9 Wound healing

Chloroform extract of Coccinia grandis exhibited the wound healing property on excision, incision and deep space wound model in rats. The effect of Coccinia grandis fruit extract was formulated as ointment and could therefore explain the boils, success sores and wounds. The wound healing effect of extract was very effective against the deep wounds (Deepti et al., 2012)

IV. Conclusion

In the nutshell, Coccinia grandis has number of pharmalogical and medicinal chemicals. It plays an important role to prevent and cure the diseases. It cannot be denied that the ivy gourd is a miraculous plant that has various health benefits. It has an ability to compete with the industrial medicines in curing some critical diseases. Plant extracts have significant antioxidant, anticancer, anti-inflammatory, antimicrobial, antiulcer, antidiabetic, hypoglycemic, hepatoprotective, analgesic, antipyretic, antimalarial, antidyslipidemic, antitussive, mutagenic activity in different animal models. This review gives a lookout on further research on the pharmalogical properties of Coccinia grandis in order to extract more information about its potential.

References

[1] Alamgir, A.N.M. and Rahman, M., 2014. Phytochemical Characteristics, Antimitotic, Cytotoxic and Antiinflamatory Activities of Coccinia grandis (L.) J. Voigt. *Alamgir ANM, Rahman M and Rahman A*, pp.218-225.

[2] Ajay, S.S., 2009. Hypoglycemic activity of Coccinia Indica (Cucurbitaceae) leaves. *International Journal of PharmTech Research*, *1*(3), pp.892-893.

[3] Ashwini, M., Lather, N., Bole, S., Vedamutrhy, A.B. and Balu, S.A.M., 2012. In vitro antioxidant and anti-inflammatory activity of Coccinia grandis. *Int J Pharm Pharm Sci*, *4*(3), pp.239-242.

[4] Bhadauria, P., Arora, B., Vimal, B. and Kulshrestha, A., 2012. In vitro antioxidant activity of Coccinia grandis root extracts. *Indo global J Pharm Sci*, *2*, pp.230-238.

[5] Umamaheswari, M. and Chatterjee, T.K., 2008. In vitro antioxidant activities of the fractions of Coccinia grandis L. leaf extract. *African Journal of Traditional, Complementary and Alternative Medicines*, *5*(1), pp.61-73.

[6] Deepti, B., Sasidhar, K., Sadhana, G. and Thaakur, S., 2012. Wound healing activity of chloroform extract of Coccinia grandis on excision, incision & dead space wound model in rats. *International Journal of Research in Pharmaceutical Sciences*, *3*, pp.470-475.

[7] Deshpande, S.V., Patil, M.J., Daswadkar, S.C., Suralkar, U. and Agarwal, A., 2011. A study on anti-inflammatory activity of the leaf and stem extracts of Coccinia grandis Voigt. *Int J Appl Bio Pharm*, *2*, pp.247-250.

[8] Dewanjee, S., Maiti, A., Kundu, M. and Mandal, S.C., 2007. Evaluation of anthelmintic activity of crude extracts of Diospyros peregrina, Coccinia grandis and Schima wallichii. *Dhaka University Journal of Pharmaceutical Sciences*, *6*(2), pp.121-123.

[9] Girish, C., Balakrishnan, S., Koner, B.C., Jayanthi, S., Rao, K.R., Rajesh, B. and Pradhan, S.C., 2011. Evaluation of antiulcer activity of Coccinia grandis leaves. *Res J Pharmacology & Pharmacodynamics*, *3*, pp.2011-2013.

[10] Khatun, S., Pervin, F., Karim, M.R., Ashraduzzaman, M. and Rosma, A., 2012. Phytochemical screening and antimicrobial activity of Coccinia cordifolia L. plant. *Pakistan journal of pharmaceutical sciences*, *25*(4).

[11] Kumar, P.V., Sivaraj, A., Elumalai, E.K. and Kumar, B.S., 2009. Carbon tetrachloride-induced hepatotoxicity in rats-protective role of aqueous leaf extracts of Coccinia grandis. *Int J Pharm Tech Res*, *1*(4), pp.1612-15.

[12] Manoharan, P. and John, S., 2010. Anti-ulcer effect of Coccinia grandis (Linn.) on pylorus ligated (albino) rats. *International Journal of Research and Development*, *2*(5), pp.1-9.

[13] Mazumder, P.M., Sasmal, D. and Nambi, R.A., 2008. Antiulcerogenic and antioxidant effects of Coccinia grandis (Linn.) Voigt leaves on aspirin-induced gastric ulcer in rats.

[14] Meenatchi, P., Purushothaman, A. and Maneemegalai, S., 2017. Antioxidant, antiglycation and insulinotrophic properties of Coccinia grandis (L.) in vitro: Possible role in prevention of diabetic complications. *Journal of Traditional and Complementary Medicine*, *7*(1), pp.54-64.

[15] Munasinghe, M.A.A.K., Abeysena, C., Yaddehige, I.S., Vidanapathirana, T. and Piyumal, K.P.B., 2011. Blood sugar lowering effect of Coccinia grandis (L.) J. Voigt: path for a new drug for diabetes mellitus. *Experimental diabetes research*, *2011*.

[16] Tamilselvan, N., Thirumalai, T., Elumalai, E.K., Balaji, R. and David, E., 2011. Pharmacognosy of Coccinia grandis: a review. *Asian Pacific Journal of Tropical Biomedicine*, *1*(2), pp.S299-S302.

[17] Farrukh, U., Shareef, H., Mahmud, S., Ali, S.A. and Rizwani, G.H., 2008. Antibacterial activities of Coccinia grandis L. *Pak. J. Bot*, *40*(3), pp.1259-1262.

[18] Kumar, S., Malhotra, R. and Kumar, D., 2010. Euphorbia hirta: Its chemistry, traditional and medicinal uses, and pharmacological activities. *Pharmacognosy reviews*, *4*(7), p.58.

[19] Chun, M.E., 2001. iology and Host Specificity of Melittia oedipus (Lepidoptera: Sesiidae), a Biological Control Agent of Coccinia grandis (Cucurbitaceae).

[20] Ramachandran, K. and Subramaniam, B., 1983. Scarlet gourd Coccinia grandis little-known tropical drug plant. *Economic Botany*, *37*(4), pp.380-383.

[21] Manandhar, N.P., 2002. *Plants and people of Nepal*. Timber press.

[22] Umamaheswari, M. and Chatterjee, T.K., 2008. In vitro antioxidant activities of the fractions of Coccinia grandis L. leaf extract. *African Journal of Traditional, Complementary and Alternative Medicines*, *5*(1), pp.61-73.

[23] Munasinghe, M.A.A.K., Abeysena, C., Yaddehige, I.S., Vidanapathirana, T. and Piyumal, K.P.B., 2011. Blood sugar lowering effect of Coccinia grandis (L.) J. Voigt: path for a new drug for diabetes mellitus. *Experimental diabetes research*, *2011*.

[24] Kohli, S. and Kumar, P.N., 2014. Combined effect of Coccinia indica leaf extract with acarbose in type II diabetes induced neuropathy in rats. *J. Innov. Pharm. Biol. Sci*, *1*(2), pp.77-87.

[25] Rahman, M.A., Sarker, J., Akter, S., Mamun, A.A., Azad, M.A.K., Mohiuddin, M., Akter, S. and Sarwar, M.S., 2015. Comparative evaluation of antidiabetic activity of crude methanolic extract of leaves, fruits, roots and aerial parts of Coccinia grandis. *Journal of Plant Sciences*, *2*(6-1), pp.19-23.

[26] Shaheen, S.Z., Bolla, K., Vasu, K. and Charya, M.S., 2009. Antimicrobial activity of the fruit extracts of Coccinia indica. *African Journal of Biotechnology*, *8*(24).

[27] Farrukh, U., Shareef, H., Mahmud, S., Ali, S.A. and Rizwani, G.H., 2008. Antibacterial activities of Coccinia grandis L. *Pak. J. Bot*, *40*(3), pp.1259-1262.

[28] Bulbul, I.J., Nahar, L. and Haque, M., 2011. Antibacterial, cytotoxic and antioxidant activity of chloroform, n-hexane and ethyl acetate extract of plant Coccinia cordifolia. *Agriculture and Biology journal of north America*, *2*, pp.713-719.

[29] Sivaraj, A., Jenifa, B.P., Kavitha, M., Inbasekar, P., Senthilkumar, B. and Panneerselvam, A., 2011. Antibacterial activity of Coccinia grandis leaf extract on selective bacterial strains. *Journal of Applied Pharmaceutical Science*, *1*(7), p.12.

[30] Kavitha, A., Reddy, K., Niharika, J., Vutla, V.R. and Babu, N., 2016. Evaluation of anti bacterial activity of Coccinia grandis leafs and stem extracts. *The Pharma Innovation*, *4*(4, Part A).

[31] Sakharkar, P. and Chauhan, B., 2017. Antibacterial, antioxidant and cell proliferative properties of Coccinia grandis fruits. *Avicenna journal of phytomedicine*, *7*(4), p.295.

[32] Niazi, J., Singh, P., Bansal, Y. and Goel, R.K., 2009. Anti-inflammatory, analgesic and antipyretic activity of aqueous extract of fresh leaves of Coccinia indica. *Inflammopharmacology*, *17*(4), pp.239-244.

[33] Chatterjee, A. and Chatterjee, S., 2012. Proximate analysis, phyto-chemical screening and anti-inflammatory activity of Coccinia indica. *Int J Pharm Chem Biol Sci*, *2*(3), pp.299-304.

[34] Orech, F.O., Akenga, T., Ochora, J., Friis, H. and Aagaard-Hansen, J., 2005. Potential toxicity of some traditional leafy vegetables consumed in Nyang'oma Division, Western Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, *5*(1).

[35] Umamaheswari, M. and Chatterjee, T.K., 2008. In vitro antioxidant activities of the fractions of Coccinia grandis L. leaf extract. *African Journal of Traditional, Complementary and Alternative Medicines*, *5*(1), pp.61-73.

[36] Shaheen, S.Z., Bolla, K., Vasu, K. and Charya, M.S., 2009. Antimicrobial activity of the fruit extracts of Coccinia indica. *African Journal of Biotechnology*, *8*(24).