



Document heading

doi:10.12980/JCLM.1.20133D55

© 2013 by the Journal of Coastal Life Medicine. All rights reserved.

Morphology, pharmacological activity, pharmaceutical preparation, doses and side effect of *Coccinia indica* (Wight & Arn.): An overview

Mayank Kumar^{1*}, Shashi Alok¹, Sanjay Kumar Jain¹, Amita Verma², Alok Mahor¹, Monika Sabharwal³

¹Institute of Pharmacy, Bundelkhand University, Jhansi (U.P.), India

²Department of Pharmacy, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (U.P.), India

³Society of Pharmaceutical Sciences and Research, Panchkula (Haryana), India

PEER REVIEW

Peer reviewer

Prabodh Shukla, Department of Pharmacy, Pranveer Singh Institute of Technology, Kanpur (U. P.), India.
Tel: +91 9450 130612
E-mail: shuklapp2000@gmail.com

Comments

This paper is a good review paper on Ayurvedic and pharmacological activities of *C. indica* (Wight & Arn). Citations used are also a good resources for reviewing and very informative to all the Ayurvedic and traditional practitioners.
Details on Page 335

ABSTRACT

Traditional system of medicine consists of large number of plants with various medicinal and pharmacological importances and hence represents a priceless tank of new bioactive molecules. *Coccinia indica* belongs to the family Cucurbitaceae. It is a rapidly growing, perennial climber or trailing vine. Traditionally different parts of this plant namely the roots, leaves and fruits are used in folklore medicine for several purposes like jaundice, diabetes, wound healing, ulcers, stomach ache, skin disease, fever, asthma, cough. The leaf and its constituents have been reported to possess hypoglycaemic, hypolipidemic and antioxidant properties. This review provides adequate information to develop suitable therapeutics out of these plant parts.

KEYWORDS

Coccinia indica (Ivy Gourd), Antidiabetic activity, Antibacterial activity

1. Introduction

Coccinia indica (Synonym: *Coccinia grandis*, *Coccinia cordifolia*) (*C. indica*) family Cucurbitaceae commonly called little gourd or Rantondli in Marathi, Bimba in Sanskrit and Kanduri ki bel in Hindi. It is indigenous to Bengal and other parts of India. *C. indica* grows abundantly all over India, tropical Africa, Australia, and Fiji and throughout the oriental countries. The plant has also been used extensively in Ayurveda and Unani practice in the Indian subcontinent[1].

In India use of the different parts to cure specific ailments has been in vogue from ancient times. The indigenous system of medicine, namely, Ayurveda, Siddha, and Unani has been in existence for several centuries. Some drugs from Ayurveda approaching modern diseases, have already

reached market places[2].

About 40% doctors especially in India and China have reverted to increasing use of indigenous drugs and natural medicines[3,4]. The WHO estimates that about 80% populations living in the developing countries rely almost exclusively on traditional medicine for their primary health care needs. Many clinical trial studies has also proven effectiveness and safety of this plant parts and derived formulations for ant diabetic effect.

Anti-inflammatory, analgesic and antipyretic activity of fruit and leaves were studied and found to be significant. Plant contains saponins, flavonoids, sterols and alkaloids. The whole plant is traditionally used for various medicinal purposes. Leaves of this plant are used in Indian folk medicine for treatment of number of ailments including diabetes, wounds, ulcers, inflammation, in eruptions

*Corresponding author: Mayank Kumar, Institute of Pharmacy, Bundelkhand University, Jhansi (U.P.), India.
Tel: +91 8115 196565 , +91 9450 036362
E-mail: mayank.pharma89@gmail.com; shashialok83@gmail.com

Article history:

Received 29 Aug 2013

Received in revised form 3 Sep, 2nd revised form 10 Sep, 3rd revised form 13 Sep 2013

Accepted 28 Oct 2013

Available online 28 Nov 2013

of skin, fever, asthma and cough. Earlier scientific investigation of *C. indica* showed that the crude extract has hepatoprotective, antioxidant, anti-inflammatory and anti-nociceptive, anti-diabetic, hypolipidemic, anti-bacterial, and anti-tussive activities[5].

2. Morphology of *C. indica* Wight & Arn.

2.1 Synonyms

Cephalandra, *Physedra*, *Staphylosyce*.

2.2 Scientific classification

Kingdom: Plantae
Order: Cucurbitales
Family: Cucurbitaceae
Sub family: Cucurbitoideae
Tribe: Benincaseae
Sub tribe: Benincasinae
Genus: *Coccinia* Wight & Arn.
Species: *C. indica*[6].

2.3 Vernacular names

Sanskrit: Tundika
Assam: Kawabhaturi
Bengal: Bimbu, Telaakuch
English: Ivy-Gourd
Gujrat: Kadavighilodi, Ghilodi
Hindi: Kundaru ki bel
Punjab: Kanduri
Tamil: Kovai
Urdu: Kunduru[7].

2.4 Description/Morphological / Macroscopic characters

2.4.1 Leaves of *C. indica*

Leaves have bright green upper surface and pale-green underneath, with characteristic odour and astringent taste. Leaves are simple, sub flashy, alternate, ovate, palmately 5 lobed with obtuse apex, ranging from 8.0 cm long and 6.5 cm wide, denate margin and cordate base. It shows reticulate venation with glabrous surface. Leaves is triangular or pentagonal in shape. Petiole stout, cylindrical, smooth, 3.0 cm long, slightly flashy. Margins are denate, upper surface glabrous and attachment of petioles and major vein branching occur. Apex obtuse, petioles 3.0 cm long and tendrils are unbranched[8].

2.4.2 Flower of *C. indica*

Flower is monoecious, solitary, rarely in axillary clusters of 3 pedicles 50.0 mm long, corolla lobes white, ovate, hypanthium 15.0 mm long[9].

2.4.3 Fruit of *C. indica*

Fruit is slimy in touch, pulpy and ovoid to ellipsoid shaped. It is green in colour when it ripens, 5.0 cm long and 2.5 cm in diameter, glabrous, pulp red. The fruit possesses

numerous seeds which are oblong, 7.0 mm long, margins thickened.

2.4.4 Seed of *C. indica*

Seed is ovoid rounded at the apex, slightly papillose, much compressed and yellowish grey[9].

2.5 Habitat of *C. indica*

It is growing wild throughout India and also cultivated in various parts of India. It is commonly known as kundru[5].

2.6 Distribution of *C. indica*

C. indica (Family: Cucurbitaceae) commonly known as little gourd and locally known as 'Kovai', grows abundantly and widely all over India, particularly in Uttar Pradesh, Madhya Pradesh, Andhra Pradesh and Karnataka and also grows in Africa and Asia. The plant is known by various regional names in different languages in India as Bimba (Sanskrit) Tondekaya (Kannada) and kunduri (Hindi)[10]. It is considered as a valuable wild vegetable by the indigenous people of Southeast Asia and India[11].

2.7 Plant parts used

Fruit, leaf, flower, root, stem. Some plant parts of *C. indica* given below in Figure 1.



Figure 1. Different plant parts of *C. indica*.

a: A twig showing aerial parts, b: Flower, c: Edible fruits, d: Fruit showing seed longitudinal section of fruit showing arrangement of seeds.

2.8 Chemical constituents

a) Roots: Triterpenoid, saponin coccinioside, flavonoid glycoside, lupeol[12].

Fruits: Taraxerone, taraxerol, B-carotene, lycopene, cryptoxanthin[13].

Leaves: Heptacosane, cephalandrol, alkaloids, cephalandrine A and B[14].

Table 1Pharmacological activity of *C. indica*[16–62].

Activity/Year	Model	Plant Part/Extracts	Remark
Antidiabetic activity[16] (1992)	Alloxan diabetic albino rats	95% ethanolic extracts	Found to be active
Antidiabetic activity[17] (2008)	Streptozotocin included diabetic rats	<i>n</i> -hexane extract	Found to be active
Antidiabetic activity with testicular disorders[18] (2007)	Streptozotocin induced diabetic rat for testicular dysfunctions	Formulation of <i>Musa paradisiacal</i> , <i>Tamarindus indica</i> , <i>Eugenia jambolana</i> and <i>C. indica</i>	Found to be active
Antidiabetic activity[19] (2003)	Normal and streptozotocin	Leaves	Evaluated for effect on blood glucose
Antidiabetic activity[20] (1953)	Alloxan diabetes in rabbits	Roots	Found to be active
Antidiabetic activity[21] (1998)	Normal and streptozotocin-induced male diabetic rats	Leaves	Lowered blood glucose by depressing its synthesis, on the one hand though depression of the key gluconeogenic enzymes glucose-6-phosphatase and fructose-1,6-biphosphatase and on the other by enhancing glucose oxidation by the shunt pathway through activation of its principal enzymes.
Hypoglycemic activity[22] (1963)	Normal rats	Pectin isolated from the fruit	Glycogen synthetase activity was highly significant redn. in phosphorylase activity.
Hypoglycemic activity[23] (1963)	Normal rats	Water soluble alkaloid fraction	Found to be active
MOA of hypoglycemic activity[24] (1993)	Glucose tolerance test	Alcoholic extaret of <i>C. indica</i> (100 mg/kg)	May be due to indirect stimulation of insulin secretion or to retardation of glucose
Hypoglycemic activity[25] (1972)	Rabbits	Alcoholic and aqueous extract	Found to be active
Clinical trial in type 2diabetic patients[26] (1979)	Double-blind, placebo-controlled, randomized trial	Alcoholic extract of the herb	Have potential hypoglycemic action in patients with mild diabetes
Clinical trial in diabetic patients[27] (2008)		Dried extract of whole plant	Ingredients present in the extract.
Antidiabetic activity[28] (1985)	Dog	Dried extract of whole plant	Found to be active
Anti-inflammatory activity[30] (2004)	Carrageenin and histamine induced paw edema	Fruit juice powder	Found to be active
Antinociceptive activity[30] (2004)	Writhing induced by acetic acid in mice	fruit juice powder	Found to be active
Post- and pre- treatment anti-inflammatory activity[31] (2009)	Carrageen an- induced paw oedema method	Aqueous extract of fresh leaves	Found to be active
Analgesic activity[31] (2009)	Tail flick model in rats	Aqueous extract of fresh leaves	Found to be active
Antipyretic activity[31] (2009)	Yeast- induced hyperpyrexia in rats	Aqueous extract of fresh leaves	Found to be active
Larvicidal activity[32] (2008)	Early fourth instar larvae of <i>Aedes aegypti</i> L. and <i>Culex quinquefasciatus</i> (say) (Diptera)	Hexane, ethyl acetate, petroleum ether, acetone and methanol	Found to be active
Hypolipidemic activity[33] (1997)	Streptozotocin-diabetic rats	Ethanolic extract/leafs	Found to be active
Hepatoprotective activity[34] (2003)	CCl ₄ induced hepatotoxicity in rats	Ethanolic extract of fruits	Found to be active
Antituberculosis activity[35] (1958)	Experimental tuberculosis in Guinea pigs	Extract of fruit	Found to be active
Sex mechanism[36] (1952)	Critical cytological investigation of different sex types	Flower	Found to be active
Antigibberellins[37] (1973)	Proliferated tissue	Seed	Found to be active
A histopathological study[38] (1975)	Gall formation due to attack of the larvae	Stem	Found to be active
Chitooligo saccharide specific lectin[39] (1994)	<i>C. indica</i> agglutinin	Chitooligo saccharide-specific lectin with two binding sites	Found to be active
<i>C. indica</i> agglutinin by thermodynamic analyses[40] (1998)	Fluorescence spectra	Fruit	Found to be active
Antihepatotoxic activity[41] (2001)	CCl ₄ Liver function	Light petroleum, alcohol, extracts of the leaves	Found to have good activity
Treatment of diabetes[42] (2003)	Lipid profile of streptozotocin induced albino rats	Leaves water extract	Treatment of streptozotocin diabetic rats, the fasting blood sugar

Table 1, to be continued:Pharmacological activity of *C. indica*[16–62].

Activity/Year	Model	Plant Part/Extracts	Remark
The hypoglycemic activity[43] (2004)	Injecting alloxan monohydrate intraperitoneally		Found to be active
The stimulation of glucose transport in L8 my tubes[44] (2006)	Glucose transport induced	Stem	Triterpenoids and carbohydrates were detected in water extract.
Induced diabetes mellitus[45] (2008)	Administering streptozotocin intraperitoneally	Leaves	Leaves extract significantly lowered blood glucose level.
Boon to vegetable[46] (2008)	The quality parameters of DRC-1	Fruit	Investigation, DRC-1 genotype was found.
Antimicrobial activity[47] (2009)	Well diffusion method	Fruit/organic extracts (petroleum ether and methanol) showed the highest activity	Activity was more pronounced on Gram-positive organisms with <i>Staphylococcus aureus</i> being more susceptible and <i>Salmonella paratyphi</i> .
Antibacterial activity[5] (2010)	Agar well diffusion method and broth dilution method.	The aqueous and organic solvent (Petroleum ether, chloroform and ethanol) extracts from the leaves	Ehanol and aqueous extracts were found to have a more potent inhibitory effect comparing with the other extracts.
Mucilage extract as coagulant for water treatment[48] (2010)	Coagulation–filtration test	Fruit mucilage extract	Mucilage extract was found to be effective in the treatment of high turbid waters.
Antidiabetic effect[49] (2010)	Alloxan induced diabetic rats	Aqueous fruit extract	Found to be active
Hepatoprotective activity[50] (2010)	Carbon tetrachloride induced liver toxicity in rats	Diethyl ether extract of the leaves	Comparable with standard treatment 125 mg/kg body weight of silymarin, a known epatoprotective drug.
Pharmacognostic and antihyperglycemic study[51] (2010)	Post-hoc Newman–Keuls multiple comparison test.	Aqueous and ethanolic fruits extracts	Whole fruit extract shows significant anti diabetic activity.
Evaluation of anthelmintic activity[52] (2011)	Paralysis (P) and death (D) for Pheretima posthuma worms	Fruits/petroleum ether, ethyl acetate methanol and water as solvents	Methanolic extract exhibited more anthelmintic activity
Mucilage as suspending agent in paracetamol suspension[53] (2011)	Compound tragacanth, CI mucilage has the potential as a suspendingagent even at lower concentration	Fruits	Obtained mucilage is partially soluble in water and easily soluble in acetone.
Protective effect[54] (2011)	Alcohol combines with CCl ₄ and paracetamol induced hepatotoxicity	Leaf extracts	Leaf extract protected the liver from alcohol–CCl ₄ and paracetamol induced hepatic damage.
Antihepatotoxic activities[55] (2012)	CCl ₄ induced hepatotoxic albino wistar rats,	Changes in male Isolated from ethanolic fruits extracts and leaves	On hepatic liver peroxide, liver weight and antioxidant enzyme activities with reference to the control and standard hepatoprotective agent silymarin
Combined effect[56] (2012)	Blood glucose level and certain other biochemical parameters in alloxan induced	Leaves methanolic extract	Intra–peritoneal administration of alloxan monohydrate produced significant increase in serum.
Proximate analysis, phytochemical screening and anti–inflammatory activity[58] (2012)	Carrageenan–induced rat hind paw edema was used as the animal model of acute inflammation	Whole plant investigation, petroleum ether extract, 60% methanolic extract.	Inhibition of prostaglandin synthesis
Wound healing activity[59] (2011)	Wound model and incision wound	Ethanol and aqueous fruit	Significant promotion of wound healing
Studies on anti–stress and free radical scavenging activity[60] (2010)	Swimming performance time test in mice post swimming motor function test cold– restraint stress	Ethanolic extract of whole plant	Showed significant antistress and free radical scavenging activity

Table 1, to be continued:Pharmacological activity of *C. indica*[16–62].

Activity/Year	Model	Plant Part/Extracts	Remark
Effect of leaf essential oil on egg hatchability and different larval[60] (2010)	Egg hatching inhibition concentration	Leaf essential oil	Possessed excellent larvicidal and egg hatching inhibition activity against <i>Anopheles stephensi</i> .
Ovicidal and repellent properties[61] (2011)	The repellent efficacy was determined against three mosquito.	Leaves extract, methanol extract have most promising.	On repellent effects of leaf extract was reported in the present study.
Acute toxicity study[62] (2011)	Swiss albino mice	Root	This study is not a complete toxicity study. It emphasizes the call for carrying out toxicity studies even in natural plant products.

Whole plant: Aspartic acid, glutamic acid, asparagine, tyrosine[15].

3–6 g drug in powder form.
5–10 mL Svarasa.
10–20 mL Swarasa.

3. Pharmacological activities of *C. indica*

There are different pharmacological activities of *C. indica* given below in Table 1.

4. Pharmaceutical preparation of *C. indica*

4.1 May support normal blood sugar levels when used as part of a healthy?

Ivy gourd, *C. indica*, is a member of the cucumber family. It is a source of food in Asia and has been used in Thai and Ayurveda herbalism for many years. It inhibits the activity of the enzyme glucose–6–phosphatase, which in turn supports the body's own system for maintenance of healthy and balanced blood glucose levels when used as a part of a healthy diet and lifestyle program[63].

4.2 Oral ivy–Boericke and Tafel: 1(OZ)

Boericke and Tafel oral Ivy a homeopathic remedy for itching and burning associated with poison ivy, oak and sumac exposure[64].

4.3 Enzymatic therapy (90 tabs)

Ivy leaves extract benefit buildings and maintaining healthy lungs and bronchial passageway function[64].

4.4 English ivy extract–Natural's products (90 tabs)

Ivy extracts supports respiratory health it contains saponins which help controls high cholesterol[64].

5. Doses of *C. indica*

The appropriate dose of ivy gourd depends on several factors such as the user's age, health, and several other conditions. At this time there is not enough scientific information to determine an appropriate range of doses for ivy gourd. Keep in mind that natural products are not always necessarily safe and dosages can be important. Be sure to follow relevant directions on product labels and consult your pharmacist or physician or other healthcare professional before using[65]

6. Ivy gourd side effect and safety

Ivy gourd appears to be safe for most people when taken by mouth for up to six weeks. There is not enough information to know if ivy gourd is safe for longer–term use[65].

7. Special precautions and warnings

7.1 Pregnancy and breast–feeding

Not enough is known about the use of ivy gourd during pregnancy and breast–feeding. Stay on the safe side and avoid use[65].

7.2 Diabetes

It might lower blood sugar if you have diabetes checks your BGL[65].

7.3 Surgery

Ivy gourd might lower blood sugar. There is some concern it might interfere with blood sugar control during and after surgery. Stop using ivy gourd at least 2 weeks before a scheduled surgery[65].

8. Conclusion

The multiple benefits of *C. indica* is a true miracle of nature. Numerous studies have been conducted on different parts of *C. indica*. This plant has also developed as a drug by pharmaceutical industries. These drug so few side effects with the higher doses administration. A detailed and systematic study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plant.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

The authors are grateful to Mr. Shashi Alok and Mr. Alok Mahor Assistant Professor in Department of Pharmacy Bundelkhand University, Jhansi, India for providing the necessary laboratory facilities and we are also thankful with our deepest core of heart to Dr. S.K. Jain for his valuable guidance.

Comments

Background

This is a review paper on the benefits of *C. indica* (Wight & Arn) as an alternative medicine for many diseases. The pharmacological effects exhibited by this plant have been elaborated in depth with citations from studies that have been conducted using this Ayurvedic plant.

Research frontiers

There is no lab experiment being done in this manuscript since it is a review paper. However, the author cited latest and recent publications on works done in this particular field, in which bring the readers to the recent analytical approach for pharmacological potential of this plant.

Related reports

The author cited different papers in his manuscript to support the therapeutic potential of *C. indica* (Wight & Arn) in traditional medicine. Past studies mostly presented the pharmacological activities of this plant done *in vitro* and *in vivo*.

Innovations and breakthroughs

This review paper is one of its own in which it summarizes any research that have been conducted on *C. indica* (Wight & Arn) specifically in medicinal field. It is a good source of literature survey for researchers who intended to do studies in this particular field, and using this plant.

Applications

This paper could be applied by most Ayurvedic practitioners in their medication activities to treat patients with different types of diseases.

Peer review

This paper is a good review paper on Ayurvedic and pharmacological activities of *C. indica* (Wight & Arn). Citations used are also a good resources for reviewing and very informative to all the Ayurvedic and traditional practitioners.

References

- Council of Scientific & Industrial Research. Wealth of India: A dictionary of Indian raw materials and industrial products. Raw material, New Delhi: Council of Scientific & Industrial Research; 1992, p. 312.
- Kumar S, Malhotra R, Kumar D. Euphorbia hirta its chemistry, traditional and medicinal uses and pharmacological activities. *Pharm Rev* 2010; **4**(7): 58–61.
- Agarwal SS, Paridhavi M. *Herbal drug technology*. Hyderabad: Universities Press Private Limited; 2007, p. 625.
- Kokate CK, Purohit AP, Gokhle SB. *Pharmacognosy*. 5th ed. Delhi: Vallabh Prakashan Publishers; 2004, p. 597.
- Hussain A, Wahab S, Zarin I, Hussain S. Antibacterial activity of the leaves of *Coccinia indica* (W. and A) W of India. *Adv Biol Res* 2010; **4**(5): 241–248.
- Holstein N, Renner SS. A dated phylogeny and collection records reveal repeated biome shifts in the African genus *Coccinia indica* (Cucurbitaceae). *BMC Evol Biol* 2011; **11**: 28.
- Government of India, Ministry of Health and Family Welfare, Department of Ayush. The Ayurvedic pharmacopoeia of India. Vol–IIND, Part– I. New Delhi: Government of India, Ministry of Health and Family Welfare, Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha And Homoeopathy; 2007, p. 80–88.
- Wagner WL, Herbst DR, Sohmer SH. *Manual of the flowering plants of Hawaii (Bishop Museum special publication, 2 Vol. Set)*. HonoluluHI: University of Hawaii and Museum Press; 1999.
- Gupta AK, Neerajn TT, Madhu S. Quality standard of Indian medicinal plants. *Med Plant Unit (ICMR)*. 2008; **5**: 157–167.
- Shyam KB, Gnanasekaran D, Jaishree V, Channabasavaraj KP. Hepatoprotective activity of *Coccinia indica* leaves extract. *Int J Pharm Biomed Res* 2010; **1**(4): 154–156.
- Syed SZ, Krishna B, Kandukuri V, Singara CMA: Antimicrobial activity of the fruit extracts of *Coccinia indica*. *Afr J Biotechnol* 2009; **8**(24): 7073–7076.
- Vaishnav MM, Praveen J, Gupta KR. Coccinioside–K, triterpenoid saponin from *Coccinia indica*. *Orient J Chem* 2001; **17**(3): 465–468.
- Kundu, Sujata, Ray AB. Chemical examination of *Coccinia indica* fruits. *J Indian Chem Soc* 1987; **64**(12): 776–777.
- Khaleque A, Wahed MA. Chemical investigations on *Cephalandra indica*. II. Constituents of dry aerial parts. *Sci Res (Dacca, Pakistan)*. 1968; **5**(1): 71–72.
- Deokate UA, Khadabadi SS. Pharmacology and phytochemistry of *Coccinia indica*. *J Pharmacogn Phytother* 2011; **3**(11): 155–159.
- Hossain MZ, Shibib BA, Rahman R. Hypoglycemic effects of *Coccinia indica*: Inhibition of key gluconeogenic enzyme, glucose–6–phosphatase. *Indian J Exp Biol* 1992; **30**(5): 418–20.
- Shakya VK. Antidiabetic activity of *Coccinia indica* in streptozotocin induced diabetic rats. *Asian J Chem* 2008; **20**(8): 6479–6482.
- Malliek C, Mandal S, Barik B, Bhattacharya A, Ghosh D. Protection of testicular dysfunctions by MTEC, a formulated herbal drug, in streptozotocin induced diabetic rat. *Biol Pharm Bull* 2007; **30**(1): 84–90.
- Pari L, Venkateswaran S. Protective effect of *Coccinia indica* on changes in the fatty acid composition in streptozotocin induced diabetic rats. *Pharmazie* 2003; **58**(6): 409–412.
- Mukerji B. Effect of *Coccinia indica* on alloxan diabetes in rabbits Indian. *J Med Sci* 1953; **7**: 665–672.
- Kamble SM, Kamlakar PL, Vaidya S, Bambole VD. Influence of *Coccinia indica* on certain enzymes in glycolytic and lipolytic pathway in human diabetes. *Indian J Med Sci* 1998; **52**(4): 143–146.
- Gupta SS. Pituitary diabetes III. Effect of indigenous antidiabetic drugs against the acute hyperglycemic response of anterior pituitary exatrt in glucose fed albino rats. *Indian J Med Res* 1963; **51**(4): 716–724.
- Brahmachari HD, Augusti KT. Orally effective hypoglycemic principles from *Coccinia indica*. *J Pharm Pharmacol* 1963; **15**(6): 411–412.
- Kumar G, Presanna SS, Vijayalakshmi NR. Hypoglycemic effect of *Coccinia indica* mechanism of action. *Plant Med* 1993; **59**(4): 330–332.
- Mukherjee K, Ghosh NC, Datta T. *Coccinia indica* as a potential hypoglycemic agent. *Indian J Exp Biol* 1972; **10**(5): 347–349.
- Azad Khan AK, Akhtar S, Mahtab H. *Coccinia indica* in the treatment of patients with diabetes mellitus. *Bangladesh Med Res Council Bull*

- 1979; **5**(2): 60–66.
- [27] Kuriyan R, Rajendran R, Bantwal G, Kurpad AV. Effect of supplementation of *Coccinia cordifolia* extract on newly detected diabetic patients. *Diabetes Care* 2008; **31**(2): 216–220.
- [28] Singh N, Singh SP, Vrat S, Misra N, Dixit K, Kohli RP. A study on the anti-diabetic activity of *Coccinia indica* in dogs. *Indian J Med Sci* 1985; **39**(2): 27–29.
- [29] Venkateswaran S, Pari L. Effect of *Coccinia indica* leaves on antioxidant status in streptozotocin-induced diabetic rats. *J Ethnopharmacol* 2003; **84**(2–3): 163–168.
- [30] Rao GM, Rao V, Sudhakara M, Pandey MM, Rawat AKS, Sirwaikar A, et al. Anti-inflammatory and antinociceptive activities of *Coccinia indica* W. & A. fruit juice powder in animal. *Nat Prod Sci* 2004; **10**(1): 20–23.
- [31] Niazi J, Singh P, Bansal Y, Goel RK. Anti-inflammatory, analgesic and antipyretic activity of aqueous extract of fresh leaves of *Coccinia indica*. *Inflammopharmacology*. 2009; **17**(4): 239–244.
- [32] Rahuman AA, Venkatesan P. Larvicidal efficacy of five Cucurbitaceous plant leaf extracts against mosquito species. *Parasitol Res* 2008; **103**(1): 133–139.
- [33] Kumar GP, Sudheesh S, Ushakumari B, Valsa AK, Vijayakumar S, Sandhya C, et al. A comparative study on the hypolipidemic activity of eleven different pectins. *J Food Sci Technol* 1997; **34**(2): 103–107.
- [34] Rao GM Mohana, Vijayakumar M, RaoCh V, Rawat AKS, Mehrotra S. Hepatoprotective effect of *Coccinia indica* against CCl₄ induced hepatotoxicity. *Nat Prod Sci* 2003; **9**(1): 13–17.
- [35] Mukerji B, Gupta SK. Indigenous drugs in experimental tuberculosis. *Chemotherapy Proc Symposium Lucknow* 1958; 90–101.
- [36] Kumar LSS, Visevshwaraiyah S. Sex mechanism in *Coccinia indica* Wight and Arn. *Nature* 1952; **170**(4321): 330–333
- [37] Guha J, Sen SP. Antigibberellins of the Cucurbitaceae. *Nat New Biol* 1973; **244**: 223–224.
- [38] Unni PN, Raghavan P, Philip VJ. A histopathological study of anomalous growth in the stem of *Coccinia indica* W. & A. infested with neolasiptera cephalandrae Mani. *Ann Bot* 1976; **40**(3): 493–497.
- [39] Sanadi AR, Surolia A. Studies on a chitoooligosaccharide-specific lectin from *Coccinia indica*: Thermodynamics and kinetics of umbelliferol glycoside binding. *J Biol Chem* 1994; **269**: 5072–5077.
- [40] Sanadi AR, Ananthram V, Surolia A. Elucidation of the combining site of *Coccinia indica* agglutinin (CIA) by thermodynamic analyses of its ligand binding. *Pure Appl Chem* 1998; **70**(3): 677–686.
- [41] Gopalkrishnan V, Rao KN, Devi M, Paadmaha N, Lakshmi PM, Srividya T, et al. Antihepatotoxic activity of *Coccinia indica*. *Anc Sci Life* 2001; **21**(1): 1–4.
- [42] Halim ME. Effect of *Coccinia indica* (L.) and *Abroma augusta* (L) on glycemia, lipid profile and on indicators of ends-organ damage in streptozotocin induced diabetic rats. *Indian J Clin Biochem* 2003; **18**(2): 54–63.
- [43] Dhanabal SP, Koate CK, Ramanathan M, Elango K, Suresh B. The hypoglycemic activity of *Coccinia indica* Wight & Arn. and its influence on certain biochemical parameters. *Indian J Pharmacol* 2004; **36**: 249–250.
- [44] Purintrapiban J, Niwat K, Chaweewan J. Role of the water extract from *Coccinia indica* stem on the stimulation of glucose transport in L8 myotubes. *Songklanakarinn J Sci Technol* 2006; **28**(6): 1199–1208.
- [45] Amanullah A, Mostofa M, Ahmed BS, Das AR. Comparative efficacy of Telakucha (*Coccinia indica*) leaves and Amaryllid(R) Tablet (Glimepiride) in induced diabetes mellitus in rat. *J Bangladesh Agric Univ* 2008; **6**(2): 335–339.
- [46] Dharmatti PR, Patil RV, Patil SS, Athani S. A new *Coccinia* (*Coccinia indica*) Variety DRC-1, a Boon to Vegetable Growers. *Karnataka J Agric Sci* 2008; **21**(1): 99–103.
- [47] Syed SZ, Krishna B, Kandukuri V, Singara CMA. Antimicrobial activity of the fruit extracts of *Coccinia indica*. *Afr J Biotechnol* 2009; **8**(24): 7073–7076.
- [48] Punita P, Varsha P. A preliminary study on *Coccinia indica* fruit mucilage extract as coagulant-flocculant for turbid water treatment. *J Pure Appl Sci* 2010; **18**: 27–30.
- [49] Rajesh P, Manish K, Dharmendra KS, Mahesh C, Deepmala V. Antidiabetic effect of *Morinda citrifolia* and *Coccinia indica* in alloxan induced diabetic rats. *Adv Bio Res* 2010; **1**(1): 75–77.
- [50] Shyam BK, Gnanasekaran D, Jaishree V, Channabasavaraj KP. Hepatoprotective activity of *Coccinia indica* leaves extract. *Int J Pharm Biomed Res* 2010; **1**(4): 154–156.
- [51] Manish G, Goutam KJ, Jha AK, Umashanker M. Pharmacognostic antihyperglycemic study of *Coccinia indica*. *Int J Phytomed* 2010; **2**: 36–40.
- [52] Yogesh S, Prashant S, Priya S, Sonal D, Sourabh SB. Evaluation of anthelmintic activity of *Coccinia indica* (fruits). *J Chem Pharm Res* 2011; **3**(1): 488–491.
- [53] Ushasri B, Kiranmai M, Ibrahim M. Evaluation of *Coccinia indica* mucilage as suspending agent in paracetamol. *Int J Drug Formulation Res* 2011; **2**(6): 237–247.
- [54] Maheswari C, Babu P, Meenakshi. Protective effect of *Coccinia indica* leaf extract against alcohol combined with carbon tetra chloride and paracetamol induced liver damage in rats. *Int J Pharm Sci Res* 2011; **2**(10): 2660–2664.
- [55] Shivaji PG, Chandrasekhar Rao MV. Antihepatotoxic activities of Ci compound β sitosterol isolated from fruits and leaves of *Coccinia indica*. *Indian J Pharma Educ Res* 2012; **46**(1): 4–8.
- [56] Versha P, Akanksha S, Ishan D, Deepak K. Combined effect of *Coccinia indica* (Wight & Arn) and *Salvadora oleoides* (Decne) on blood glucose level and other risk factors associated with Type-2 diabetes mellitus in alloxan induced diabetic. *Int J Pharm Pharm Sci* 2012; **4**(4): 79–84.
- [57] Sumana C, Aritra C. Proximate analysis, phyto-chemical screening and anti inflammatory activity of *Coccinia indica*. *Int J Pharm Chem Biol Sci* 2012; **2**(3): 299–304.
- [58] Bambal VC, Wyawahare NS, Turaska AO, Deshmukh TA. Evaluation of wound healing activity of herbal gel containing the fruit extracts of *Coccinia indica* Wight & Arn. (Cucurbitaceae). *Int J Pharm Pharm Sci* 2011; **3**(4): 319–324.
- [59] Chandira M, Vankateswarlu BS, Gangwar RK, Sampathkumar KP, Bhowmik D, Jayakar B, et al. Studies on anti-stress and free radical scavenging activity of whole plant of *Coccinia Indica* Linn. *Int J Pharm Sci* 2010; **1**(1): 50–54.
- [60] Sankaran RK, Arulsamy J, Rajarathinavelu N. Effect of leaf essential oil of *Coccinia indica* on egg hatchability and different larval instars of malarial mosquito *Anopheles stephensi*. *Asian Pac J Trop Med* 2011; **4**(12): 948–951.
- [61] Govindranjan M. Ovicidal and repellent properties of *Coccinia indica* Wight and Arn. (Family: Cucurbitaceae) against three important vector mosquitoes. *Euro Rev Med Pharmacol Sci* 2011; **15**: 1010–1019.
- [62] Yogesh S, Sourabh SB, Sonal D, Prashant S, Priya S. Acute toxicity study of aqueous extract of *Coccinia indica* (Roots). *Asian J Res Pharm Sci* 2011; **1**(1): 23–25.
- [63] Amazon. Source naturals ivy gourd extract. [Online] Available from: <http://www.amazon.com/Source-Naturals-Gourd-Extract-Tablets/dp/B000GJNAW0>. [Accessed on 12 April, 2012].
- [64] Seacoast Natural Health. Discounted *Coccinia indica* ivy gourd extract. [Online] Available from: <http://www.seacoast.com/topic.php?health=discounted+coccinia+indica+ivy+gourd+extract>. [Accessed on 12 April, 2012].
- [65] WebMD. Find a Vitamin or Supplement: Ivy gourd. [Online] Available from: <http://www.webmd.com/vitamins-supplements/ingredientmono-1104-IVY+GOURD.aspx?activeIngredientId=1104&activeIngredient>. [Accessed on 12 April, 2012].