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AN UPDATED PHARMACOLOGICAL ACTIVITY OF *COCCINIA INDICA* (WIGHT & ARN.)

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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 anthelmintic activity, antioxidant activity, anti-inflammatory, analgesic and antipyretic activity, antimicrobial activity, antihyperglycemic activity, hepatoproetcective activity. This review provides adequate information to develop suitable therapeutics out of these plant parts.

INTRODUCTION: Plants had been used for medicinal purposes long before recorded history. Ancient Chinese and Egyptian papyrus writings describe medicinal uses for plants as early as 3,000 BC. Indigenous cultures (such as African and Native American) used herbs in their healing rituals, while others developed traditional medical systems (such as Ayurveda and Traditional Chinese Medicine) in which herbal therapies were used. Researchers found that people in different parts of the world tended to use the same or similar plants for the same purposes.

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In the early 19th century, when chemical analysis first became available, scientists began to extract and modify the active ingredients from plants. Later, chemists began making their own version of plant compounds and, over time, the use of herbal medicines declined in favor of drugs. Almost one fourth of pharmaceutical drugs are derived from botanicals.

Recently, the World Health Organization estimated that 80% of people worldwide rely on herbal medicines for some part of their primary health care. In Germany, about 600 - 700 plant based medicines are available and are prescribed by some 70% of German physicians. In the past 20 years in the United States, public dissatisfaction with the cost of prescription medications, combined with an interest in returning to natural or organic remedies, has led to an increase in herbal medicine use [1]. There are many herbal products proved to be

having good antidiabetic potential. *Coccinia indica* (Bimba, kanduri, Cucurbitaceae) is famous for its hypoglycemic and antidiabetic properties in Ayurvedic system of medicine. (**Fig. 1**) *Coccinia indica*, the ivy gourd, also knownas baby watermelon, little gourd, gentleman's toes, tindora or gherkin (inaccurately) is a tropical vine. It is also known as *Cephalandra indica* [2]. It is indigenous to Bengal and other parts of India. *C. indica* grows abundantly all over India, Tropical Africa, Australia, Fiji and throughout the oriental countries.

The plant has also been used extensively in Ayurvedic and Unani practice in the Indian subcontinent [3]. Seeds or fragments of the vine can be relocated and lead to viable offspring. This can occur when humans transport organic debris or equipment containing *C. grandis*. Once the ivy gourd is established, it is presumably spread by birds, rats, and other mammals.

In Hawaii, it has been suggested that the fruit may be dispersed by pigs [4]. Long-distance dispersal is most commonly carried out by humans due to its culinary uses or by mistake. In certain parts of the U.S., the ivy gourd is known as Rashmato (singular) or Rashmati (plural). Some people have begun using the plural term Rashmatoes, since it is sounds more like potatoes or tomatoes. In parts of the Caribbean it is known as lizard food.

FIG. 1: *COCCINIA INDICA* (ADOPTED FROM FLORA-EXOTICA)

1.1. *Coccinia Indica* Wight & Arn:

A. Synonyms:

Cephalandra, Physedra, Staphylosyce

B. Scientific Classification:

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

1.2 Morphological Profile: [5]

1. Leaves: Leaves are 5-10 cm, long and broad, bright green above, paler beneath, studded and sometimes rough with papillae, palmately 5-nerved from a cordate base, often with circular glands between the nerves, obtusely 5-angled or sometimes deeply 5-lobed, the lobes broad, obtuse or acute, apiculate, more or less sinuate toothed, petioles 2 - 3.2 cm. long.

2. Flowers: Male flowers: Peduncles are 2 - 3.8cm. long and subfiliform. Calyx-tube is glabrous, broadly campanulate 4 -5 mm. long. Corolla is 2.5 cm. long, veined, pubescent inside and glabrous outside. Female flowers: Peduncles are 1.3 - 2.5cm. long. Ovary is fusiform, glabrous and slightly ribbed.

3. Fruits: Fruits are fusiform-ellipsoid, slightly beaked, 2.5-5by 1.3-2.5 cm. sized, marked when immature with white streaks, bright scarlet when fully ripe.

4. Seeds: Seeds are obovoid and rounded at the apex, slightly papillose, much compressed and yellowish grey.

5. Roots: The fresh root is thick, tuberous, long tapering, more or less tortuous with a few fibrous rootlets attached to it. Roots are flexible, soft and break with a fibrous fracture. A transaction of root shows circular outline and is characteristic of storage type. Parenchyma is full of starch grains and thorough permeation of parenchyma with vascular elements is observed. The cork is composed of rows of cells.

2. Cultivation: *Coccinia indica* is a well-known vegetable grown in the coastal which is high in nutritive value. The ripe fruit which is red in color is a well-known anti diabetic & is being exported to many countries for this purpose.

Vegetable farming method is widely used for its cultivation. Both physical and chemical recommended for weed control. Hand-harvesting normally does not kill the plant but rather breaks the vine blankets into smaller pieces and the plant is able to re-establish when it touches the ground. These methods can make the infestation worse and further the need for more rigorous control methods. Picking the fruit and placing them in plastic bags can help decrease the seed back that is present with the soil. When utilizing chemical controls, that ivy gourd responded well to a thin-lined bark application of 100% Garlon 4 (triclopyr), leaving plants in place so as not to translocate the herbicide or spread the pest [6, 7].

3. Chemical Constituents: Plant contains resins, alkaloids, fatty acids, flavonoids and proteins as chief chemical constituents. Aspartic acid, Glutamic Acid, Asparagine, Tyrosine, Histidine, Phenylalanine and Threonine, Valine, Arginine are also found. The methenolic extract of fruit contains alkaloids, steroids, tannins, saponins, ellagic acid, phenols, glycosides, lignans and triterpenoids [8].

Roots containes Triterpenoid, saponincoccinioside, Flavonoid glycoside ombuin 3-o- arabino furanoside, Lupeol, β-amyrin and β- sitosterol and Stigmast -7- en-3-one [9 - 11]. (**Table 1)**

TABLE 1: PHYTOCHEMICAL REVIEW OF PLANT *COCCINIA INDICA*

Plant part	Constituent reported
Roots [21 - 25]	Triterpenoid, saponin coccinioside – k(i). $C_{41}H_{66}O_{12}$
	Flavonoid glycoside ombuin 3-o- arabinofuranoside
	3- o- β- (α-l- arabinopyranosyl)-(1→2) –β-d-glucopyranosyl- (1→3)- β- hydroxylup – 20(29)- en-28- oic acid.
	Lupeol, β-amyrin and β- sitosterol
	Stigmast -7- en-3-one
Fruits [26 - 29]	Taraxerone, taraxerol, and (24R)-24- ethylcholest- 5- en- 3β- ol glucoside
	B- carotene, lycopene, cryptoxanthin, and apo- 6'- lycopenal
	B- sitosterol and taraxerol
Aerial parts [30 - 31]	Heptacosane, Cephalandrol, $C_{29}H_{58}O$ tritriacontane $C_{33}H_{68}$
	B- sitosterol alkaloids Cephalandrine a and Cephalandrine b
Whole plant [32]	Aspartic acid, Glutamic Acid, Asparagine, Tyrosine, Histidine, Phenylalanine and Threonine Valine Arginine

4. Medicinal Uses: The plant has wide spread medicinal uses as shown in **Fig. 2**. Many clinical trial studies has proven effectiveness and safety of this plant parts and derived formulations for antidiabetic effect. Anti-inflammatory, analgesic and antipyretic activity of fruit and leaves were also found to be significant.

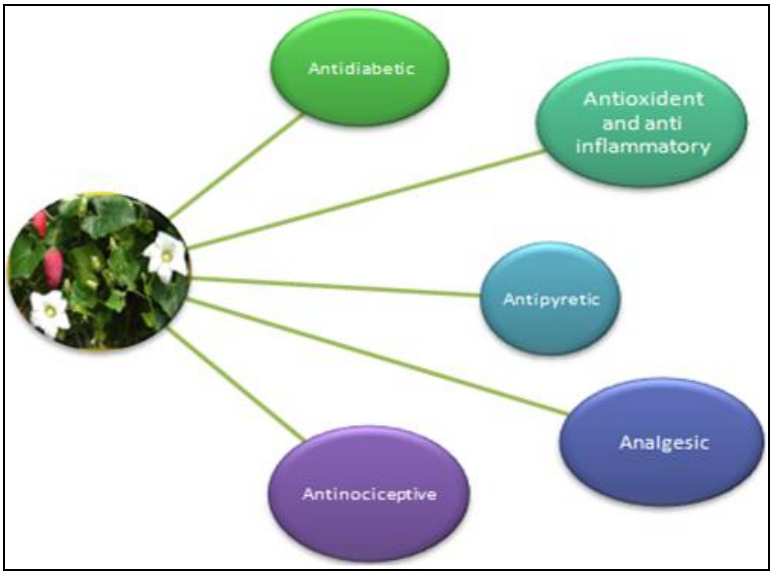

FIG. 2: MEDICINAL USE OF *COCCINIA INDICA*

Pharmacological activities:

4.1. Anthelmintic Activity: Methanol extract of *Coccinia indica* fruits in the concentration of 50 mg/ml showed potent anthelmintic activity against *Pheretima posthuma* [12].

4.2. Antioxidant activity: Oral administration of ethanolic extract of *Coccinia indica* (leaf) extract (CLEt) (200 mg/kg body weight) for 45 days resulted in a significant reduction in thiobarbituric acid reactive substances and hydroperoxides in rats [13].

4.3. Anti-inflammatory, Analgesic and Antipyretic activity: Aqueous extract of *Coccinia indica* (leaves) produced marked analgesic and antipyretic activity at 300mg/kg dose when compared with standard drugs (Morphine and Paracetamol). The extract also showed significant anti-inflammatory activity [14]. The activity was measured using tail flick model and yeast induced hyperpyrexia. The effect was equivalent to 25 mg/Kg dose of diaclofenac.

4.4. Antimicrobial Activity: Petroleum ether and methanolic extract of *Coccinia indica* showed the highest antimicrobial activity against gram positive organisms (*Bacillus cereus, S. pyrogens* and *S. aureus*) [15]. Ethanol and aqueous extracts of *Coccinia indica* showed promising antibacterial activity against the *E. aerogenes, Pseudomonas aeruginosa, Staphylococcus epidermidis, Bacillus subtilis* and *Salmonella typhimurium* by agar well diffusion method and broth dilution method.

4.5. Antihyperglycemic Activity: Chronic administration of *Coccinia indica* (fruits) extract at dose of 200mg/kg for 14 days reduces the blood glucose level of the diabetes induced animals as compared to diabetic control group [16]. Dried extract of Whole plant was utilized. Ingredients present in the extract act like insulin, correcting the elevated enzymes G-6-P (ase), LDH in glycolytic pathway and restore the LPL activity in lypolytic pathway with the control of hyperglycemia in diabetes [17, 18].

4.6. Hepatoproetcective Activity: *Coccinia indica* leave extract at dose 400 mg/kg bodyweight showed potent hepatoproetcective activity in albino rats [19]. Sylimarin was utilized as positive control. Reduction in SGPT and SGOT was observed [20]. The other updated pharmacological studied done on *Coccinia indica* are mention **Table 2** below:

TABLE 2: PHARMACOLOGICAL ACTIVITY OF *COCCINIA INDICA*

S. no.	Activity /Year	Model	Plant Part	Remark
1	Antidiabetic activity [34] (1992)	Alloxan diabetic albino rats	95% ethanolic extracts	Found to be active
2	Antidiabetic activity [35] (2008)	Streptozotocin included diabetic rats	n-hexane extract	Found to be active
3	Antidiabetic activity with testicular disorders [36] (2007)	Streptozotocin induced Diabetic Rat For Testicular Dysfunctions	Formulation of Musa paradisiacal, *Tamarindus indica, E. jambolana* and *Coccinia indica*	Found to be active
4	Antidiabetic activity [37] (2003)	Normal and streptozotocin (STZ) diabetic rats.	Leaves	Evaluated for effect on blood glucose, plasma insulin, cholesterol, triglycerides, free fatty acids, and phospholipids and fatty acid compound. Of total lipids in liver, kidney and brain
5	Antidiabetic activity [38] (1953)	Alloxan diabetes in rabbits	Roots	Found to be active
6	Antidiabetic activity [39] (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 G6PDH
7	Hypoglycemic activity [40] (1963)	Normal rats	Pectin isolated from the fruit	Glycogen synthetase activity was highly significant significant redn. in phosphorylase activity
8	Hypoglycemic activity [41] (1963)	Normal rats	Water soluble Alkaloid fraction	Found to be active
9	MOA of hypoglycemic activity [42] (1993)	Glucose tolerance test	Alcoholic extarct of *Coccinia indica* (100mg/kg.),	May be due to indirect stimulation of insulin secretion or to retardation of glucose absorption. Use of these drugs
10	Hypoglycemic activity [43] (1972)	Rabbits	Alcoholic and aqueous extract of root powder	Found to be active
11	Clinical trial in type 2 diabetic patients [44] (1979)	Double- blind, placebo-controlled, randomized trial	Alcoholic extract of the herb	Have potential hypoglycemic action in patients with mild diabetes
12	Clinical trial in diabetic patients [45] (2008)		Dried extract of Whole plant	Ingredients present in the extract
13	Antidiabetic activity [46] (1985)	Dog	Dried extract of Whole plant	Found to be active
14	Antioxidant activity [47] (2003)	Streptozotocin- diabetic rats	Ethanolic extract of leaves	Found to be active
15	Anti-inflammatory activity [48] (2004)	Carrageenin and histamine induced paw edema	Fruit juice powder	Found to be active
16	Antinociceptive activity [48] (2004)	Writhing induced by acetic acid in mice	fruit juice powder	Found to be active
17	Post- and pre- treatment anti-inflammatory activity [49] (2009)	Carrageenan- induced paw oedema method	Aqueous extract of fresh leaves	Found to be active
18	Analgesic activity [49] (2009)	Tail flick model in rats	Aqueous extract of fresh leaves	Found to be active
19	Antipyretic activity [49] (2009)	Yeast- induced hyperpyrexia in rats	Aqueous extract of fresh leaves	Found to be active
20	Larvicidal activity [50] (2008)	Early fourth instar larvae of *Aedes aegypti* L. and *Culex quinquefasciatus* (say) (Diptera: Culicidae).	Hexane, ethyl acetate, petroleum ether, acetone and methanol extracts of the leaf *Citrullus colocynthis, C. indica*	Found to be active
21	Hypolipidemic activity [51] (1997)	Streptozotocin-diabetic rats	Ethanolic extract of leaves	Found to be active
22	Hepatoprotective activity [52] (2003)	CCl_4 induced hepatotoxicity in rats	Ethanolic extract of fruits	Found to be active
23	Antituberculosis activity [53] (1958)	Experimental tuberculosis in Guinea pigs	Extract of fruit	Found to be active
24	Sex mechanism [54] (1952)	Critical cytological investigation of different sex types	Flower	Found to be active
25	Antigibberellins [55] (1973)	Proliferated tissue	Seed	Found to be active
26	A Histopathological Study [56] (1975)	Gall formation due to attack of the larvae	Stem	Found to be active
27	Chitooligo saccharide specific lectin [57] (1994)	*Coccinia indica* agglutinin (CIA)	Chitooligo saccharide-specific lectin with two binding sites	Found to be active
28	*Coccinia indica agglutinin*(CIA) by thermodynamic analyses [58] (1998)	Fluorescence spectra	Fruit	Found to be active
29	Antihepatotoxic Activity [59] (2001)	CCl_4 Liver function	Light petroleum, alcohol, extracts of the leaves	Found to have good activity
30	Treatment of diabetes [60] (2003)	Lipid profile of	Leaves water extract	Treatment of

		Streptozotocin (STZ) induced albino rats		Streptozotocin (STZ) diabetic rats, the fasting blood sugar came down to almost normal value and improvement in glucose tolerance and serum lipid profile
31	The hypoglycemic activity [61] (2004)	Injecting alloxan monohydrate intraperitoneally	Fruit / The dried alcoholic extract were a semisolid mass and were successively extracted with toluene, chloroform, ethyl acetate and n-butanol.	The results of the present study indicate that the toluene fraction was the only active fraction. The active principles in this fraction were found to be triterpenes which may be responsible for the antidiabetic activity
32	The stimulation of glucose transport in L8 myotubes [62] (2006)	Glucose transport induced	Stem	Triterpenoids and carbohydrates were detected in water extract
33	Induced diabetes mellitus [63] (2008)	Administering streptozotocin (STZ) intraperitoneally	Leaves	Leaves extract significantly lowered blood glucose level
34	Boon to Vegetable [64] (2008)	The quality parameters of DRC-1	Fruit	Investigation, DRC-1 genotype was found
35	Antimicrobial activity [65] (2009)	Well diffusion method	Fruit / organic extracts (petroleum ether and methanol) showed the highest activity	Activity was more pronounced on gram-positive organisms with *Staphylococcus aureus* being more Susceptible and *Salmonella paratyphi*
36	Antibacterial Activity [66] (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
37	Mucilage Extract as coagulant for water treatment [67] (2010)	Coagulation-filtration test	Fruit mucilage extract	Mucilage extract was found to be effective in the treatment of high turbid waters
38	Antdiabetic effect [68] (2010)	Alloxan induced diabetic rats	Aqueous fruit extract	Found to be active
39	Hepatoprotective activity [69] (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 hepatoprotective drug
40	Pharmacognostic and antihyperglycemic study [70] (2010)	Post -hoc Newman-Keuls multiple comparison test	Aqueous and ethanolic fruits extracts	Whole fruit extract shows significant anti diabetic activity
41	Evaluation of Anthelmintic Activity [71](2011)	Paralysis (P) and death (D) for *P. posthuma* worms	Fruits/petroleum ether, ethyl acetate methanol and water as solvents	Methanolic extract exhibited more anthelmintic activity
42	Mucilage as suspending agent in paracetamol suspension [72] (2011)	Compound tragacanth, CI mucilage has the potential as a suspending agent even at lower concentration	Fruits	Obtained mucilage is Partially soluble in water and easily soluble in acetone
43	Protective effect [73] (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

44	Antihepatotoxic activities [74] (2012)	CCl_4 induced hepatotoxic Changes in male albino wistar rats,	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
45	Combined effect [75] (2012)	Blood glucose level and certain other biochemical parameters in alloxan induced diabetic rats.	Leaves Methanolic Extract	Intra-peritoneal administration of alloxan monohydrate produced significant increase in serum glucose levels
46	Proximate analysis, Phytochemical screening and Anti inflammatory activity [76] (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 and aqueous extracts	Inhibition of Prostaglandin synthesis
47	Wound healing activity [77] (2011)	Wound model and wound model	Ethanol and aqueous fruit extracts	Significant promotion of wound healing activity
48	Studies on anti-stress and free radical scavenging activity [78] (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
49	Effect of leaf essential oil on egg hatchability and different larval [79] (2010)	Egg hatching inhibition concentration	Leaf essential oil	Possessed excellent larvicidal and egg hatching inhibition activity against *A. stephensi*
50	Antilithiatic activity [80] (2013)	Male albino rats	Fruit	Found to be active
51	Ovicidal and Repellent Properties [81] (2011)	The repellent efficacy was determined against three mosquito species at three concentrations *viz*., 1.0, 2.5, 5.0 mg/cm	Leaves extract, Methanol extract have most promising ovicidal Activity	On repellent effects of leaf extract was reported in the present study, confirm their potential for control of the mosquito Populations
51	Acute Toxicity Study [82] (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 and drug of indigenous medicinal System
52	Anticonvulsant activity [83] (2013)	Male albino rats	Fruit	Found to be active

CONCLUSION: The multiple benefits of *Coccinia indica* it a true miracle of nature. Numerous studies have been conducted on different parts of *Coccinia indica*, this plant has yet developed as a drug by pharmaceutical industries. 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.

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CONFLICT OF INTEREST: We declare that we have no conflict of interest.

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