ANTIBACTERIAL AND HYPOGLYCEMIC ACTIVITY OFCOCCINIAGRANDIS (L.) VOIGT PLANT

Priya Dhote* and Alka Chaturvedi
Department of Botany, RTM Nagpur University, Nagpur-440033
*E-mail: priyadhote9@gmail.com

ABSTRACT

Family Cucurbitaceae is known for food, medicine and for musical instruments etc. Some not worthy plant species are *Citrullus colocynthis* (L.) Schrad, *Cocciniagrandis* (L.) Voigt, *Corallocarpusconocarpus* C.B. Clarke, *Luffa echinata*Roxb., *Momordica charantia* L., *Solenaamplexicaulis* (Lam.) Gandhi and *Trichosanthescucumerina* L. etc.

***Cocciniagrandis* (L.) Voigt (Cucurbitaceae) commonly known as 'Ivy gourd' and 'Kundru' in Hindi. In India, ivy gourd is often recommended to diabetics due to its low glycemic index and its possible ability to help regular blood glucose. Ivy gourd is rich inbeta-carotene.**

***Cocciniagrandis* juice from the roots and leaves is used to treat diabetes and juice from the stem is dripped into the eyes to treat cataracts. The leaves are used as a poultice in treating skin eruptions. Aqueous and ethanolic extracts from the plant have shown hypoglycaemic principles (Chopra *et al.*, 1980; Manandhar 2002). The roots, stems, leaves and whole plant of *C. grandis*are used in the treatment of jaundice, bronchitis, skin eruptions, burns, insect bites, fever, indigestion, nausea, eye infections, allergy, syphilis, gonorrhoea, etc. (Kirthikar and Basu,1987;Wasantwisut and Viriyapanich,2003). Leaves of *Cocciniagrandis* (L.) Voigt exhibit significant antioxidant activity in ethanolic treated rats. It is claimed that these products help regulate blood sugar levels.**

Thus,the above literature reveals that the *Cocciniagrandis* has ahuge potential to explore for the benefits of mankind's. The objective of the present work is to make an analysis of the ethnobotanical information on these plantsused for diabetes mellitus control.

Introduction:

*Cocciniagrandis*L. is distributed in tropical Asia, Africa and is commonly found in Pakistan, India and Srilanka (Cooke, 1903). Sastri, (1950) observedthat fruit of *Cocciniagrandis*is used as vegetable when green and eaten fresh when ripened into bright scarlet colour.Effect of indigenous antidiabetic drugs against the acutehyperglycemic response of anterior pituitary extract in glucose-fed albino rats was observed(Gupta, 1963; Brahmachari*et al.*, 1963). They also isolatedorally effective hypoglycemicprinciples from *Cocciniaindica.*

Jeffrey (1967) has investigated about 125 genera in Cucurbitaceae, including 960 species as plant of human consumption from Tropical East Africa.Mukerjee*et al.*, (1972) identified *Cocciniaindica*as a potential hypoglycemic. Nasir& Ali(1973) found, oil of this plant is used as an injection into chronic sinuses. The plant is used indecoction for gonnorhoeae(Nadkarni, 1976), diabetes and also useful in dropsicalcondition, pyelitis, cystitis, strangury, snake bite, urinary gravel and calculi (Nadkarni, 1976).

Every part of *Cocciniagrandis* is valuable in medicine and various preparationshave been mentioned in indigenous system of medicine for various skin diseases,bronchial catarrh, bronchitis and Unani systems of medicine for ring worm, psoriasis,small pox, and scabies, antilithic observed (Jayaweera,1980; Perry, 1980).

Antimicrobial activity of leaf of*Cocciniagrandis was* detected by Reddy & *Reddy* (1981).Linney, (1986) observed distribution of *Cocciniagrandis.* He found that

this species is mostly used as a food crop throughout the world because it is capable of thriving well in warm, humid, tropical regions. Kirtikar and Basu(1987),Nagata (1988) reported use of *Cocciniagrandis* in the treatment of jaundice, bronchitis, skin eruptions, burns, insect bites, fever, indigestion, nausea, eye infections, allergy, syphilis, gonorrhea, etc. Lee(1988) found antitumor activity of some Chinese medicine, where this plant was one of the ingredients.

Singh, (1990) studied cytogenetics and evolution in Cucurbitaceae.Usefulness of this plant was found in itchy skin eruptions and ulcers(Behl*et al*.,1993).

There are many published reports on the effectiveness of traditional herbs against gram-positive and gram-negative microorganisms, and as a result, plants are still recognized as the bedrock for modern medicine to treat infectious diseases(Evans W. 1996).Hypolipidimicactivity (PresannaKumar *et al*., 1997) antimutagenic (Kusamran*et al*., 1998; Nahar *et al*., 1998) was observed.

Garrett *et al*.(2001), found that traditional medicinal plant *(Cocciniagrandis)* has unique properties like antifertility, antispermatogenic, antioxidant, antitumor and antibacterial.

The leaves of *Coccinia*species are widely used in Indian folk medicine for reducing the amount of sugar in urine of patients suffering from diabetes mellitus. Literature suggests the use of *C.grandis* plant in the treatment of diabetes (Venkateswaran& Pari, 2003). The crude hydromethanol extract of the leaves of *C. grandis* has been reported for its xanthine oxidase inhibitory and hypouricaemic activities (Umamaheswari M., *et al.,* 2007).

The antimicrobial activity of methanol extract of *Cocciniagrandis* leaves was evaluated by Dewanjee*et al.* (2007).

In vitro antibacterial activity of leaves and stem extracts of *C. grandis* has been investigated byUmbreen Farrukh, (2008) against *Bacillus cereus, Corynebacterium diptheriae, Staphylococcus aureus,Streptococcus pyogenes, Escherichia coli,Klebsiella pneumonia, Proteus mirabilis,Pseudomonas aeruginosa, Salmonella typhi* and *Shigella boydii*. Water extract of leaves and ethanolic extract of stem showed significant activity against *Shigella boydii* and *Pseudomonasaeruginosa* respectively.

Bhattacharya(2010) worked on antibacterial activities in *C. grandis,* he also observed that this plant possessing significant antidiabetic property. Other plants in the family Cucurbitaceae also reported to possess diuretic, aphrodisiac, bitter stomachic, purgative and emetic properties.

Ivy Gourd is a wonderful plant having antidiabetic activity, different parts of the plant extracted with different solvents shows the antidiabetic effect. The hypoglycemic effect of orally administered extract of leaves and roots of Ivy Gourd has been reported earlier but none of the literature or paper showed the antidiabetic activity of fruit of the above plant as in crude extract of fruit of the above plant. The pectin isolated from the fruit of the above plant at a dose of 200 mg/100g BW/day showed a significant hypoglycemic action in normal rats (Shibib. *et al*., 1993). The alcoholic extract of Ivy Gourd leaves is found to be safe for biological study as no lethal effect was observed at 600mg/kg orally in mice.

The leaves of *Cocciniaindica* species are widely used in Indian folk medicine for reducing the amount of sugar in urine of patients suffering from diabetes mellitus. Literature suggests the use of this plant in the treatment of diabetes (Venkateswaran and Pari, 2003).

The crude extract of the plant was found to have hypoglycemic activity. The decrease in blood glucose was comparable to that of an oral hypoglycemic drug. Crude extract of the plant had a definite potential therapeutic value for its being a source of hypoglycemic agents (Hemalatha, *et al.,* 2004).

There was a reduction in body weight in rats which may be due to the effect of ethanol as it reduces body fat mass and adipose tissue (Das & Vasudevan, 2005). Rats treated with the fractions of *C. grandis* showed significant gain in body weight similar to the control rats. This may be due to the attenuation of malnutrition caused by ethanol. Treatment with the pet-ether, choloformand ethyl acetate fractions of *C. grandis* reduced gliosis in brain tissues. These observations reveal that the fractions confer protection against ethanol toxicity presumably by enhancing the antioxidant potential.

Leaf extract of *Cocciniaindica*significantly depressed the glucose-6-phosphates and fructose -1, 6-disphosphatese activities in both normal and streptozotocin-diabetic rates (Vadivu*et al.*, 2008). Hydromethanolic mixture of root and leaf of *C. indica*in composite manner in STZ treated diabetic rats not only resets the blood glucose homeostasis to the control level but also corrects the protein metabolic disorders.

Material and Methods:

Determination of Antibacterial activity:

On the basis of ethnobotanical information following bacterial strains were selected for the screening:

Gram+ve*Staphylococcus aureus*

Gram-ve*Escheria coli*

Culture of these bacterial strains was obtained from the Department of Microbiology, University Campus, Nagpur.

The culture of these bacteria was inoculated in 10ml nutrient broth and incubated for 24hr. Petri plates, dishes and nutrient agar medium was sterilized by autoclaving. To this sterilized nutrient medium 1ml of one day old bacterial culture was added. Cultures were inoculated and stirred well; this medium was poured in Petri dishes.

The filter paper disc impregnated with plant extract was aseptically and carefully placed on the nutrient agar plate. The disc soaked in methanol and water was used as negative control. The antibiotic disc (Himedia octo disc) was placed on nutrient agar plates as positive controls.

All the nutrient agar plats were incubated at 37°c for 24hr after which the plates were observed for clear zone inhibition. Observations were recorded.

3.5 Antidiabetic test:

a) Collection of plant

The leaves of *Cocciniagrandis* plants were collected from the local area of Itwari, old Hislop College and Campus premises of Nagpur in Maharashtra State, India.

b) Extraction and preparation of drug in tween-20

The leaves of *Cocciniagrandis* were dried in shade and powdered in a grinder. The air-dried powder was subjected to hot condition extraction with Tween-20 extractor, (4g powder +2ml of polyoxyethylinemonoluriate**{Tween-20}** +18ml of distilled water) and filtered. The filtrate was evaporated at room temperature and concentrated in a water bath to a dry residue.

c) Animals Experimental

Wistar rat were used for the study. They were maintained at a temperature of 25±10° C and relative humidity of 45% to 55% under 12-hr light: 12-hr dark cycle. The animals had free access to food pellets and water.

d) Induction of diabetes

Diabetes was induced in Wistar rat by a single intravenous injection of aqueous monohydrate (70mg/kgi.v.) solution (Kameswararao*etal*.1999). After 48h, the animals with serum glucose levels above 200mg/di (diabetic) were selected for the study.

II Experiment:

a) Preparation of plant powder and extracts

Aqueous, ethanol and chloroform extracts of leaves were prepared following standard procedures. The*Cocciniagrandis* plants powder (500g) was extracted sequentially with 2.5 liters of 70% ethanol and 2.5liters of 60% chloroform in a soxhlet apparatus at 65º C until the powder became exhausted totally. The resulting extracts were filtered. The extracts were stored in desiccators for subsequent experiments.

b) Animal Experimentation:

Healthy adult Wistar albino rats weighing 180-240g were used for this study. Animals were allowed to acclimatize for a period of 15 days in the laboratory environment prior to the experiment. Rats were housed in slandered polypropylene cages maintained under standard laboratory conditions. The animals were fed with standard rat pellet diet.

Hyperglycaemia was induced in overnight fasted adult rat weighing 180-240g by a single intraperitoneal injection of freshly prepared alloxan monohydrate in normal saline (150 mg/kg body wt) in a volume of 2ml/kg body wt. (Kastumata&Kastumata, 1999). Hyperglycaemia was confirmed by the elevated glucose level in plasma determined at 48h after injection. The hyperglycaemic rats were used for antihyperglycaemic study.

Result and Discussion:

DESCRIPTION OF PLANT

Dioecious, climbing perennial herbs with a tuberous rootstock producing annual stems up to several m long, hispid. Leaves broadly ovate in outline with a basal sinus, blades 3-10 cm long, 4-10 cm wide, 5 angled to palmately 3-7 lobed, the lobes shallow to deep and lobulate, upper surface glabrate, lower surface hispid and bearing 3-8 glands near attachment of petiole and major vein branchings, margins denticulate, apex obtuse, mucronate, petioles 1-3 cm long, tendrils unbranched. Staminate flowers solitary, rarely in axillary clusters of 2-3, pedicels 15-50 mm long, calyx lobes subulate, recurved, 2-5 mm long, corolla lobes white, ovate, 15-20 mm long; pistillate flowers solitary on stalks 10-30 mm long, hypanthium 10-15 mm long. Fruit red, ovoid to ellipsoid, 25-60 mm long, 15-35 mm in diameter, glabrous, on stalks 10-40 mm long, pulp red. Seeds tan, 6-7 mm long, margins thickened." (Wagner *et al*. 1999).

Ivy gourd is occasionally cultivated as a garden vegetable in the tropical and sub-tropical regions of the world and was probably introduced to the Northern Territory prior to European settlement. Small populations are scattered throughout the northern coastal parts of Queensland, the Northern Western Australia. However, an infestation was reported from riparian vegetation along Wolston Creek in the western suburbs of Brisbane in February 2011, well outside the previously known range of this species in Australia. Since then it has been spotted spreading from gardens in other parts of Brisbane. It is spread throughout India, cultivated as well as found growing wild

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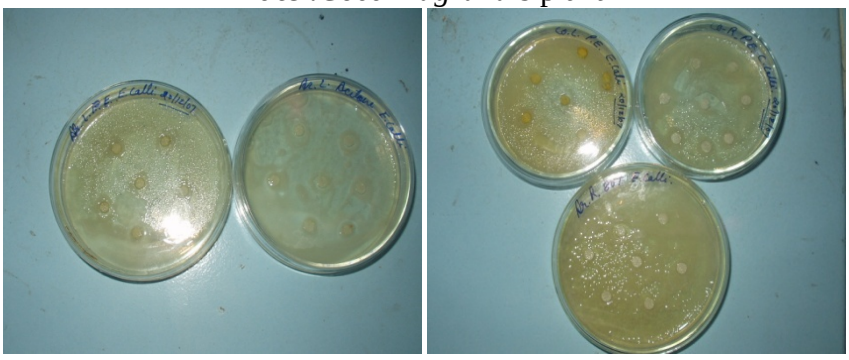
Plate :*Cocciniagrandis* plant



CocciniagrandisEscherichia coli

Antibacterial activity of plant extract.

The extracts from both the plants present antibacterial activity to at least one of the two tested microorganisms. the extracts from *Cocciniagrandis*showed antibacterial activity against only one bacteria.The Acetone,Ethanol and Water extracts obtained from leaf, stem and root of *Cocciniagrandis*inhibit growth of*Staphylococcus auerus* by forming 2mm, 4mm, and 6mm zone of inhibition. While the water extracts of leaf did not show any antibacterial activity

For *Cocciniagrandis*

Group I- Induced (2ml/kg body wt)/ Control(non induced)?

Group II-Diabetic + Alloxan (2ml/kg body wt)

Group III- Diabetic + aqueous extracts of *C. grandis* leave extract (250mg/kg body wt)

Group IV- Diabetic + ethanol extracts of *C. grandis*leaves (250mg/kg body wt)

Group V – Diabetic +chloroform extracts of *C. grandis*leaves (250mg/kg body wt)

Group VI- Diabetic + Glibenclamide (1mg/kg body wt).

Collection of blood and determination of serum glucose

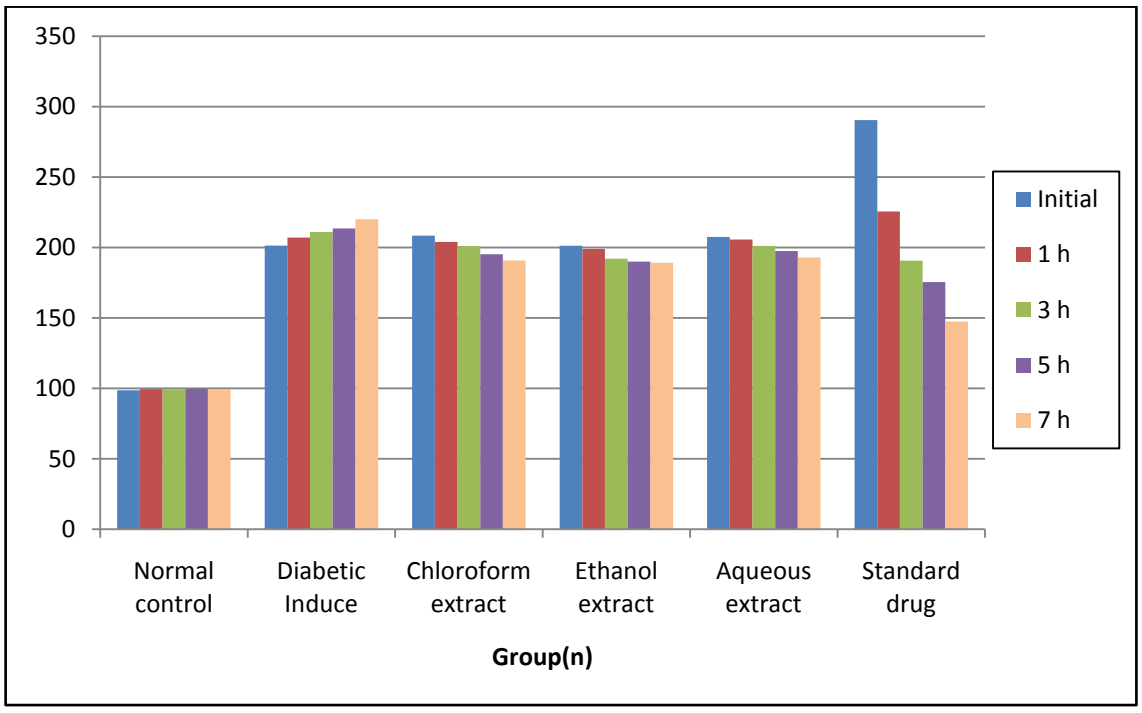
Blood was withdrawn from the tail vein and glucose levels were estimated using glucose oxidase-peroxidase reactive strips and a glucometer.

Result and Discussion:

Statistical Analysis

Group(n)	Dose	Blood glucose level (mg/100ml)(mean ± SEM)				
		Initial	1 h	3 h	5 h	7 h
Normal control	2ml saline	98.63 ± 0.762	99.46±0.486	99.30±0.890	99.67±1.111	99.51±1.101
Diabetic Induce (Alloxan monohydrate)	2ml saline 150mg/kg b.wt.	201.4±2.991	207.1±3.385	211.0±2.880	213.5±3.01	220.1±3.088
Chloroform extract	250mg/kg b.wt.	208.4±2.182	204.0±2.321	201.0±2.121	195.2±1.845	190.8±2.111
Ethanol extract	250mg/kg b.wt.	201.2±1.781	199.0±1.612	192.1±1.181	190.0±1.158	189.2±1.125
Aqueous extract	250mg/kg b.wt.	207.5±3.451	205.7±3.121	201.1±3.201	197.5±2.481	193.0±2.721
Standard drug (Glibenclamide)	1mg/kg b.wt.	290.45±9.44	225.56±7.26	190.67±5.32	175.5±8.11	147.55±6.34

Table : Effect of *Cocciniagrandis* leaves on blood glucose level of **alloxan – induced**wistar albino diabetic rats. (b.wt.=body weight).



Graph : Effect of *Cocciniagrandis* leaves on blood glucose level of **alloxan – induced**wistar albino diabetic rats. (b.wt.=body weight).

Conclusion:

Cocciniagrandis L. Voigt is a very common weed belonging to Cucurbitaceae family. It is distributed throughout India, tropical Asia and Africa.

Survey of literature about the ethno botanical uses of*Cocciniagrandis*states the potential of these plants for medicinal properties. In addition to number of other theraupeutic properties, they are also reported in treatment of infections and to reduce amount of sugar in urin.

To explore the potential of molecular diversity engineered by nature in *C. grandis* phytochemical analysis of the plant was done.

- During antibacterial screening, the extracts of*C. grandis*against *Staphylococcus aureus and E.coli*presented the highest activities, i.e. they were able to inhibit microorganism with formation of 8mm and 6mm zone of inhibition respectively.

Thus, results revealed the importance of plant extracts, to control resistant bacteria,which are becoming a threat to human health.

Present work proves that the synergistic effect of different phytochemicals against resistant bacteria leads to new choice for the treatment of infectious diseases and may be more effective as compared to their individual compounds.

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