ANCIENT AND RECENT MEDICINAL USES OF CUCURBITACEAE FAMILY

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ABSTRACT

The family Cucurbitaceae includes a large group of plants which are medicinally valuable. It is a family of about 130 genera and about 800 species. Seeds or fruit parts of some cucurbits are reported to possess purgatives, emetics and antihelmintics properties due to the secondary metabolite cucurbitacin content. A number of compounds of this group have been investigated for their cytotoxic, hepatoprotective, anti-inflammatory and cardiovascular effects. Cucurbitacins constitute a group of diverse triterpenoid substances which are well known for their bitterness and toxicity. They are highly oxygenated, tetracyclic triterpenes containing a cucurbitane skeleton characterized. The cucurbitacins are arbitrarily divided into twelve categories, incorporating cucurbitacins A-T. A lot of work has been done by the researchers throughout the world on various plants of the family Cucurbitaceae. Some of the important plants that have been extensively studied are *Momordica charantia*, *Cucurbita pepo*, *Cucurbita andreana*, *Cucurbita ficifolia*, *Cucumis sativus*, *Cucumis melo*, *Citrullus colocynthis*, *Luffa echinata*, *Trichosanthes kirilowii*, *Lagenaria siceraria*, *Benincasa* hispida etc.[1]

KEY WORDS:

cucurbitacin*, Cucumis, Trichosanthes, Cucurbita., Bryonia dioica , Cucumis.*

INTRODUCTION

A. Cucurbitacins

Cucurbitacins constitute a group of diverse triterpenoid substances which are well known for their bitterness and toxicity. They are highly oxygenated, tetracyclic triterpenes containing a cucurbitane skeleton characterized as 19-(10→9β)-abeo-10α-lanost-5-ene (also known as 9β-methyl-19-nor lanosta-5-ene) (Fig. 1) (Pryzek, 1979).

The cucurbitacins are arbitrarily divided into twelve categories, incorporating cucurbitacins A-T. The various cucurbitacins differ with respect to oxygen functionalities at various positions. The structures of a few cucurbitacins (A, C, B and D) are given in Fig. 2. These cucurbitacins are also present in their glycosidic forms such as cucurbitacin B glucoside containing glucose as the glycone moiety. [1]

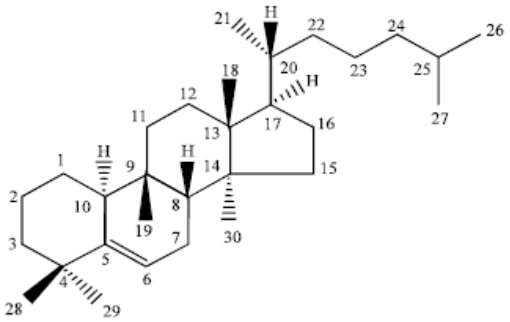
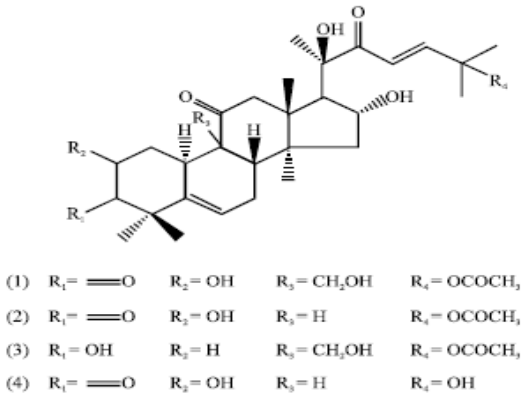


Fig. 1 : Basic structure of cucurbitacins (19-



(1)	R_1= =O	R_2= OH	R_3= CH_2OH	R_4= $OCOCH_3$
(2)	R_1= =O	R_2= OH	R_3= H	R_4= $OCOCH_3$
(3)	R_1= OH	R_2= H	R_3= CH_2OH	R_4= $OCOCH_3$
(4)	R_1= =O	R_2= OH	R_3= H	R_4= OH

Fig.2: Structure of Cucurbitacin A (1), Cucurbitacin B (2), Cucurbitacin C (3) and Cucurbitacin D (4)

B. Morphological study *of* Cucurbitaceae Family

1. VEGETATIVE CHARACTERS:

Plants are mostly annual or perennial weak stemed trailing or decumbent vines, usually climbing by means of tendrils and with plenty

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of juicy sap in the leaves and stems.

Root : Taproot, branched get thickened due to storage of food and water.

Stem : Herbaceous, climbing by means of tendrils or trailing, rooting at nodes, angular.

Leaf : Alternate brood, usually simple but often deeply lobed or divided and palmately veined, reticulate, petiole long and hollow. Tendrils may be simple or branched arising in the axil or opposite to the leaf at the node.[1]

2. FLORAL CHARACTERS:

Inflorescence : Variable flowers often solitary. Large and showy or sometimes in racemes or cymes or in panides, unisexual, male and female borne on the same plant (monoecious e.g.: Luffa, cucumis) or on different plants (dioecious e.g.: Trichasanthes).

Flower : Regular, unisexual, rarely bisexual, smaller or large showy, white or yellow, epigymous.

Male flower : They are usually produced in much larger number, campamulate.

Calyx : Sepals five, fused, pointed, petaloid, campamulate, aestivation is imbricate.

Corolla : Petals five, fused (in momordica only at the base, in cucurbila throughout and campanulate), or free (Luffa) often deeply five lobed, valvate, imbricate, inserted on calyx tube when free. Form of corolla may be campanulate or rotate.

Androecium : usually 5 stamens, sometimes 3, free or combined to form a central column inserted on the calyx tube, anthers 2 called. Form of anthers bay be 1-lobed or 2-lobed, paired stamens have either 2-lobed or 4-lobed anthers.

Female flower : Female flowers are fewer than the male flower.

Calyx : Sepals 5, united, calyx tube adnate to the ovary and often produced beyond it.

Corolla : Petals 5, as in male free or slightly fused.

Staminoles : Rundiments of stamens 0 or 3 or 5.

Gynoecium : Tricapellary syncarpous, ovary, inferior, unilocular but often the placentae intrude far into the chamber of the ovary making the latter falsely trilocular. Most rarely the number to loculi may be one to ten.

Placentation axile but the ovules are not borne in the centre, style short, stingmas 3 often forked.

Fruit : Soft fleshy berry termed as pepo, generally indehiscent and sometimes of enormous size as in water melon or squash (Kadoo).[2]

FLORAL FORMULA:

Male Flower : +, ♀, K(5), C5 or (5), A 5 or (2) + (2) + (1), G0

Female Flower: +, ♀, K(5), C5 or (5), A0 or 3-5 staminate, F (3).[2]

C. Origins and Locations

Cucumbers originated in India and other

Latin Name		Common Name	Varieties
Genus	*species*		
Citrullus	vulgaris	watermelon	
Cucumis	anguria	West Indian gherkin	
Cucumis	melo	cantaloupe, honeydew, casaba, muskmelon	
Cucumis	sativus	cucumber	
Cucurbita	maxima	squash	banana, buttercup, hubbard, kabocha
Cucurbita	moschata	squash	butternut, cheese, golden cushaw
Cucurbita	pepo	squash	acorn, crookneck, delicata, some gourds, pumpkin, scallop, spaghetti, zucchini
Lagenaria	siceraria	hardshelled gourd	
Luffa	acetangula	angled luffa	
Luffa	aegyptiaca	smooth luffa	
Momordica	charantia	bitter gourd (balsam pear, bitter melon)	
Trichosanthes	anguina	snake gourd	

parts of Western Asia. There are relatives of the cucumber that can be found in the foothills of the Himalaya Mountains, but cannot be used agriculturally because of bitter fruit, mainly dormant seeds and delayed maturity. Other relatives of the cucumber can be found in China and the Near and Middle East, however cucumbers were most likely domesticated in Asia. Cultivation of the vegetable as a food source began roughly 3000 years ago. From India, the cucumber was carried to Greece and Italy, where it played a pivotal role in the Roman Empire. From Rome, it spread to China and southern Russia. Spread to the rest of Europe by the Romans, The first records of cucumber cultivation were found in France in the 9th century, Great Britain in the 14th century, Caribbean by late 15th century and North America by mid 16th century. [2]

D. Soil & Climate

Cucurbits should be gown in warm soil that is fertile and well irrigated. There needs to be room for the crop to set roots deep in the soil as well as space to expand on top of the soil also. The climate for large commercial production must be tropical or subtropical at the coldest because a slight frost will kill the young cucurbits very rapidly. The soil cannot be colder than 60 degrees Fahrenheit and should be between 65 and 75 degrees F for the most effective seed germination. Soil temperatures between 65 and 85 degrees F are ideal for maximum plant growth.

The roots of some of the larger cucurbits can penetrate 6 ½ feet down into the soil, so it is imperative to have well fertilized land with a lot of vertical and horizontal growing room. For planting, holes of at least 1½ feet deep by at least 2 feet wide are essential. These holes then must be filled with good manure and compost mixed well with garden loam or a fertile and well-drained soil, containing clay, sand, and a significant amount of decomposed organic matter according . [3]

E. Nutrition and Uses

Cucurbits are a family of healthy foods. Cucumbers in particular are a prime dieting food. They are 96 percent water, with a little fiber and only a few calories. In addition, it provides a good source of vitamins A, K, and C, as well as a large amount of potassium. The National Cancer Institute has identified certain properties of the cucumber as having cancer preventative benefits. *Cucurbits (**Cucurbitaceae**) are among the most important plant families supplying humans with edible products and useful fibers.*

Cucumbers are consumed either raw or pickled. Pickling is a common way to preserve the cucumber for longer periods of time. Historically, it allowed them to be available long after the normal growing season. Cucumbers are soaked in a solution of brine, vinegar and/or various spices. This preserves the cucumber, as well as imbuing it with different flavors.[3]

F. Different genous and species of cucurbitaceae family

Many members of the Cucurbitaceae family are ancient The *Cucurbita* genus (squash) is said to have evolved in the warmer parts of the Americas.

Cucurbits have inspired the creation of an incredible number of cultivars and new ones are developed continuously. An example of this is pumpkins (Cucrbita pepo). [3]

G. Different genous and their uses

Sr. no.	*Genus*	Uses
1.	1. *Bryonia*	
Ex	*Bryonia dioica* (White Bryony)	It is a powerful cathartic and purgative. It is primarily prescribed for painful rheumatic conditions. The root is cathartic, cytotoxic, diaphoretic, expectorant, hydrogogue, irritant, pectoral, purgative and vermifugal. It is used in small quantities internally in the treatment of various inflammatory conditions, bronchial complaints, asthma, intestinal ulcers, hypertension and arthritis. Externally, it is applied as a rubefacient to muscular and joint pains and pleurisy. The whole herb has an antiviral effect.[4]
2.	*Cucurbita*	
Ex	*Cucurbita ficifolia* (leaf gourd):	The plant cure wounds and used to treat hemorrhoids and fever and is use for the treatment of diabetes type 2. It has shown acute hypoglycaemic activity in temporally hyperglycemic rabbits, in alloxan-diabetic rabbits and recently, in type 2 diabetic patients.[5]

	Cucurbita pepo (Pumpkin)	The fruit is cooling and astringent to the bowels, increases appetite, cures leprosy and purifies the blood. Seeds cure sore chests, haemoptysis, bronchitis and fever. The seed extracts of *Cucurbita pepo* modulate immunobiochemical pathways induced by interferons. [6]seeds are useful in management of benign prostatic hyperplasia.[7] seed extract has antioxidant capacity.[8]
	Cucurbita andreana	Phytochemical investigations on this species have yielded cucurbitacins as feeding stimulants for diabrotica.[9] *Cucurbita andreana* exhibited potent anticancer and cyclooxygenase-2 (COX-2) inhibitory activities. Bioassay-guided purification of the fruit extract yielded cucurbitacins B, D, E and I. These cucurbitacins were evaluated for their anti-inflammatory and inhibitory effects on the growth of human colon, breast and lung cancer cell lines.[10]
4.	*Cucumis*	
Ex	*Cucumis sativus* (Cucum-ber)	fruits help in removing constipation and aid indigestion. The fruits are used during summer as a cooling food. Fruit is demulcent. Seeds are cooling, tonic, diuretic and anthelmintic. Flavone glycosides such as isovitexin, saponarin and various acylated flavone C-glycosides are present in the leaves[11]. Antiulcer 9-beta-methyl-19-norlanosta-5-ene type Glycosides have been from *Cucumis sativus* Seeds.[12]
	Cucumis melo (Musk melon)	It is locally known as Kharbuja. The whole fruit is useful in chronic eczema. The fruit is tonic, laxative, galactagogue, diuretic and diaphoretic. The fruit extract has a high Superoxide Dismutase Activity (SOD). The SOD activity is responsible for the *in vitro* and *in vivo* antioxidant and anti-inflammatory properties of the extract .[13] The composition of fatty acids and amino acids present in seeds has been determined. A number of phenolic glycosides have been isolated from the seeds.[14]
5.	*Trichosanthes*	
Ex	*Trichosan-thes kirilowii* (Chinese cucumber)	The seeds have been used in Chinese medicine as an anti-inflammatory agent, a cough medicine and an expectorant. Several multiflorane triterpenoids have been isolated from the seed extract. The most predominant ones include karounidiol and its 3-O-benzoate derivative. These triterpenoids are expected to be potential anti-tumor promoters. Evaluation of the cytotoxic activity of karounidiol against human cancer cell lines exhibited cytotoxicity especially against a human renal cancer.[1]
	Trichosan-thes cucumerina (Snake gourd)	The whole plant have medicinal properties. The root is used as a cure for bronchitis, headache and boils. Both the root and fruit are considered to be cathartic. The fruit is used as an anthelmintic. The seeds are used for stomach disorders and are also considered as antifebrile and anthelmintic. Studies on the pharmacological activities have shown the presence of anti-inflammatory activity in root tubers and antidiabetic activity in seeds.[15] Increasing the protective mucus layer, decreasing the acidity of the gastric juice and antihistamine activity are probable mechanisms by

		which the hot water extract mediates its gastroprotective actions.[16]
	Trichosanthes tricuspidata (Indrayan)	In Thai traditional medicine, the plant is used as a laxative, anthelmintic and in the treatment of migraine. The root extract has shown antioxidant effect in Sildenafil induced migrane in albino mice.[17] From the fruits of *Trichosanthes tricuspidata* 14 cucurbitane glycosides such as cucurbitacin K 2-O-β-glucopyranoside, a hexanorcucurbitane glucoside and octanorcucurbitane glucosides were isolated along with two known cucurbitane glucoside.[18]
6.	Momordica	
Ex	Momordica charantia (Bitter melon)	Its local name is Karela. The fruits are used traditionally used as anthelmintic, antiemetic, carminative, purgative and for the treatment of anaemia, jaundice, malaria, cholera, etc.[19] Unripe fruits of the plant are mainly used for diabetes and extensive investigations have shown that an extract of the fruits has marked hypoglycemic properties both in animals and humans. It has been reported that the extracts of *Momordica charantia* show antihyperglycemic effects upon oral administration in diabetic rats .[20] The water extracts increase glucose uptake and adiponectin secretion in adipose cells .[21] The seed extract normalize the impaired antioxidant status in streptozotocin induced diabetes by scavenging of free radicals there by reducing the risk of diabetic complications. [22] Several constituents such as charantin (mixture of sterol glucosides) , vicine (pyrimidine nucleoside) and insulin like polypeptides responsible for hypoglycemic properties are present.[23]

G. **Different genous and their Chemical constuents**

Sr. no.	Genus	Chemical constuents
1.	*Bryonia*	
Ex.	*Bryonia alba*	the chemical composition of *Bryonia alba* the result being the identification of two white, crystallisable bodies, *bryonin* and *bryonitin*. Seven new triterpene glycosides, bryoniosides A–G (**1**–**7**), have been isolated along with two known triterpene glycosides, cabenoside D and bryoamaride, from a methanol extract of the roots of *Bryonia dioica*. were evaluated for their inhibitory effects on 12-*O*-tetradecanoylphorbol-13-acetate (TPA)-induced inflammation (1 μg/ear) in mice and on Epstein−Barr virus early antigen (EBV-EA) activation induced by TPA. All compounds tested showed marked anti-inflammatory effects, with 50% inhibitory doses (ID_{50}) of 0.2−0.6 mg per ear. In addition, all of the compounds tested except for compound **5** showed potent inhibitory effects on EBV-EA induction (100% inhibition at 1 × 10^3 mol ratio/TPA).[24]
2.	*Cucurbita*	
Ex.	*Cucurbita*	It contain fibre, protein, β-

	pepo (Pumpkin)	carotene, carbohydrates, minerals and fatty acids present in the rind, flesh, seeds and defatted seeds and the triglyceride fatty acid mixture, tetrahydro-thiophene, linoleic acid, calotropoleanly ester, cholesterol and 13(18)-oleanen-3-ol .[25]
Ex.	*cucurbita citrullus*	Part used – Seeds in Painful urination with sense of constriction and backache. Curative for worms.[26]
3.	*Cucumis*	
Ex.	*Cucumis sativus* (Cucumber)	phytochemical screening of the ethanolic extract of leaves and stems *Cucumis sativus* possessed phytoconstituents such as alkaloid, glycoside, steroid, saponin and tannin except gum, flavonoid and reducing sugars while alkaloid, glycoside, steroid, flavonoid, saponin and tannin were found in the crude chloroform extract. the aqueous extract of *Cucumis sativus* fruits revealed the presence of glycosides, steroids, flavonoids, carbohydrates and tannins.[27]
4.	Momordica	
Ex.	Momordica charantia (Bitter melon)	Several constituents such as charantin (mixture of sterol glucosides), vicine (pyrimidine nucleoside) and insulin like polypeptides responsible for hypoglycemic properties are present. Several phytochemicals such as kuguacins F-S (cucurbitane triterpenoids) have been isolated.[1]
5.	*Trichosanthes*	
Ex.	*Trichosanthes kirilowii*	The plant is a source of the toxic anti-HIV type I ribosome-inactiving lectin trichosanthin 7. Several multi-florane triterpenoids have been isolated from the seed extract. The most predominant ones include karounidiol and its 3-O-benzoate derivative. These triterpenoids are expected to be potential anti-tumor promoters. Evaluation of the cytotoxic activity of karounidiol against human cancer cell lines[28]
	Trichosanthes cucumerina	It is rich in protein and vitamin C. The use of the pulp of ripe fruits as a substitute for tomato paste is the major use. The edible part of the immature fruit is 86 – 98% per 100g edible portions, it contains water 94g, protein (0.6g), fat (0.3g),carbohydrate (4g), fibre (0.8g), Ca (26mg), Fe (0.3mg), P (20mg), Vitamin B1(0.02mg), Vitamin B2 0.03ng, Niacin 0.3mg, Vitamin C (12mg). 15 The major active constituents of the drug are triterpenoid saponins viz, cucurbitacins. The plant is richly constituted with a series of chemical constituents like flavonoids, carotenoids, phenolic acids which makes the plant pharmacologically and therapeutically active.[29]
	Trichosanthes dioica	Earlier chemical study reveals that in addition to a number of tetra and pentacyclic triterpenes, the toxic bitter principles cucurbitaceous (a group of often highly oxygenated tetracyclic compounds with a unique carbon skeleton and almost a carbonyl group in ring C) may be considered as a taxonomic character of Cucurbitaceae. Pointed gourd is rich in vitamins and contains Mg (9.0 mg), Na (2.6 mg), K (83.0 mg), Cu (1.1 mg), and S (17.0 mg) per 100 g edible part. The seeds of *Trichosanthes dioica* contain a large amount of peptides. The seed peptides have the unique property of being resistant to the action of

		silver nitrate, a sensitive reagent commonly used to stain proteins. The various chemical constituents present in *T. dioica* are vitamin A, vitamin C, tannins, and saponins. Phytochemical evaluations of aqueous and ethanolic extracts have showed the presence of saponins and tannins. The seed extract of *T. dioica* contains oxidihydrokarounidol-3-benzoate as the most predominant component in the highly polar fraction of the non saponifiable lipid. Two main phytosterols present in *T. dioica* are namely, 24α-ethylcholest-7-enol and 24β-ethylcholest-7-enol. Seeds of *T. dioica* also contain lectin, a carbohydrate (specifically galactose) binding protein which is homologous to Type-II ribosome inhibitory proteins (Type-II RIP)[30]
	Trichosan-thes tricuspida-ta	It contains cucurbitane, hexanorcucurbitane and octanorcucurbitane glycosides from fruits of *Trichosanthes* tricuspidata. Mohamed isolated a tetrahydroxy pentacyclic triterpene "trichotetrol" from the root extract of this vine. From the fruits o*f T. tricuspidata*, 14 cucurbitane glycosides were isolated such as cucurbitacin K, 2-O-β-glucopyranoside, a hexanorcucurbitane glucoside and octanorcucurbitane glucosides were isolated along with two known cucurbitane glucoside. An extract of the fruits of this plant was found to be cytotoxic in KB cells, and two new cucurbitacins were reported: tricuspidatin and 2-O-glucocucurbitacin J. Kaneda and Uchikoba reported a protease from the sarcocarp of the fruits of this plant. The root of plant contains contains methyl palmitate, palmitic acid, suberic acid, α-spinasterol, stigmast-7-en-3-beta-ol, α-spinasterol 3-o-beta-D-glucopyranoside, stigmast-7-en-3-beta-ol-3-O-beta-D-glucopyranoside, glyceryl 1-palmitate, glyceryl 1-stearate, bryonolic acid, cucurbitacin B, isocucurbitacin B, 3-epi-isocucurbitacin B, 23,24-dihydrocucurbitacin D, isocucurbitacin D and Dglucose. It also contains more than 6 times more cucurbitacin than the roots o*f T. kirilowii* Maxim. var. *Japonicum* Kitam. Also three new cycloartane glycosides have been isolated and named cyclotricuspidosides A, B and C, from the leaf and stem parts.[31]

CONCLUSION

After the through literature we have found that Cucurbitaceae Family have tremendous medicinal properties such as anti-HIV, anxiolytic, anti-pyretic, anti-diarrhoeal, carminative, antioxidant, anti-diabetic,antibacterial, laxative, anthelmintic, anti-tuberculosis, and purgative. It is also employed as an abortifacient, diuretic, and cardiotonic agent. They also show strong anti-inflammatory, antitussive, cytotoxic, and expectorant properties. Apart from biological profile Cucurbitaceae Family posses many therapeutically important chemical constituents which required further research to explore the medicinal value of this species.

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