ejpmr, 2016,3(8), 277-287

SJIF Impact Factor 3.628

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

PHYTOCHEMICAL AND PHARMACOLOGICAL OVERVIEW OF CUCURBITA MAXIMA AND FUTURE PERSPECTIVE AS POTENTIAL PHYTOTHERAPEUTIC AGENT

G. Neelamma*[1], B. Durai Swamy[2] and P. Dhamodaran[3]

[1]Research Scholar, Department of Pharmacognosy and Phytopharmacy, JSS College of Pharmacy, Ooty-643001, Tamil Nadu, India.

[2]Head of Department, Department of Pharmacognosy and Phytopharmacy, JSS College of Pharmacy, Ooty-643001, Tamil Nadu, India.

[3]Professor, Department of Pharmacognosy and Phytopharmacy, JSS College of Pharmacy, Ooty-643001, Tamil Nadu, India.

Corresponding Author: G. Neelamma

Research Scholar, Department of Pharmacognosy and Phytopharmacy, JSS College of Pharmacy, Ooty-643001, Tamil Nadu, India.

Article Received on 14/06/2016 **Article Revised on 05/07/2016** **Article Accepted on 26/07/2016**

ABSTRACT

Cucurbita maxima, winter squash, pumpkin, calabaza, or marrow, is a species in the gourd family (Cucurbitaceae). Elated cultivated species also known as squash or pumpkins are C. pepo (summer squash, also called marrow), and C. mixta and C. moschata (both of which are also known as pumpkin or winter squash). It can be difficult to ascertain which varieties are derived from which species, because the names “winter squash” and “pumpkin” are used to refer to several different species, and those species may also have other common names. C. maxima plants are frost-intolerant annual herbaceous plants. The stems, more or less prickly, are generally trailing or climbing vines, with tendrils that allow that allow them to clasp supports. Leaves are simple, alternate, and shallowly to deeply lobed. Fruits (technically referred to as pepos) are relatively large and usually require a long growing season for development. Winter squashes are eaten as a vegetable, mashed or in purees, soups, or pies. The blossoms are also edible, and may be cooked into fritters. Seeds are high in protein and minerals, and are eaten raw, toasted, or pressed to make oil. Squash contain mostly carbohydrates, little protein and almost no fat. As its yellow color indicates, squash is filled with the mineral provitamin A, beta-carotene, as well as calcium and potassium. Squash is filled with soluble vegetable fiber, which provides lasting satiation. The soluble fiber in squash provides a mild laxative effect, making it important for digestive health. Summer squash provides a huge supply of antioxidants, with the skin of squash being especially rich in antioxidants. Steaming and freezing, rather than boiling or microwaving, retains the nutrients within squash. Cooking squash with less water preserves the amount of phenolic compounds, which are associated with color vibrancy and flavor in vegetables. The carotenoids lutein and zeaxanthin protect the eyes. In order to receive the full spectrum of nutrients that squash has to offer, eat skin, seeds and flesh. Squash consumption is recommended to regulate blood sugar and for those with type-2 diabetes.

KEYWORDS: Herbaceous, tendrils, beta-carotene, antioxidant and type-2 diabetes etc.

INTRODUCTION

Cucurbita (Latin for gourd)[1] is a genus of herbaceous vines in the gourd family, Cucurbitaceae, also known as cucurbits, native to the Andes and Mesoamerica. Five species are grown worldwide for their edible fruit, variously known as squash, pumpkin, or gourd depending on species, variety, and local parlance, and for their seeds. First cultivated in the Americas before being brought to Europe by returning explorers after their discovery of the New World, plants in the genus Cucurbita are important sources of human food and oil. Other kinds of gourd, also called bottle-gourds, are native to Africa and belong to the genus Lagenaria, which is in the same family and subfamily as Cucurbita but in a different tribe. These other gourds are used as utensils or vessels, and their young fruits are eaten much like those of Cucurbita species. Most Cucurbita species are herbaceous vines that grow several meters in length and have tendrils, but non-vining "bush" cultivars of C. pepo and C. maxima have also been developed. The yellow or orange flowers on a Cucurbita plant are of two types: female and male. The female flowers produce the fruit and the male flowers produce pollen. Many North and Central American species are visited by specialist bee pollinators, but other insects with more general feeding habits, such as honey bees, also visit. The fruits of the genus Cucurbita are good sources of nutrients, such as vitamin A and vitamin C, among other nutrients according to species. The plants contain the toxins, such as cucurbitin, cucurmosin, and cucurbitacin. There is

debate about the taxonomy of the genus, as the number of accepted species varies from 13 to 30. The five domesticated species are Cucurbita argyrosperma, C. ficifolia, C. maxima, C. moschata, and C. pepo. All of these can be treated as winter squash because the full-grown fruits can be stored for months; however, C. pepo includes some cultivars that are better used only as summer squash.Cucurbita fruits have played a role in human culture for at least 2,000 years. They are often represented in Moche ceramics from Peru. After Christopher Columbus's arrival in the New World, paintings of squashes started to appear in Europe early in the sixteenth century. The fruits have many culinary uses including pumpkin pie, biscuits, bread, desserts, puddings, beverages, and soups. Pumpkins and other Cucurbita fruits are celebrated in festivals and in flower and vegetable shows in many countries.

DESCRIPTION

Cucurbita species fall into two main groups. The first group are annual or short-lived perennial vines and are mesophytic, i.e. they require a more or less continuous water supply. The second group are perennials growing in arid zones and so are xerophytic, tolerating dry conditions. Cultivated Cucurbita species were derived from the first group. Growing 5 to 15 meters (16 to 49 ft) in height or length, the plant stem produces tendrils to help it climb adjacent plants and structures or extend along the ground. Most species do not readily root from the nodes; a notable exception is C. ficifolia, and the four other cultivated mesophytes do this to a lesser extent. The vine of the perennial Cucurbita can become semiwoody if left to grow. There is wide variation in size, shape, and color among Cucurbita fruits, and even within a single species. C. ficifolia is an exception, being highly uniform in appearance.[2] The morphological variation in the species C. Pepo[3] and C. Maxima[4] is so vast that its various subspecies and cultivars have been misidentified as totally separate species.[3]

Fig 1: C. pepo pumpkins: two bright orange ones in center right, and squashes C. Maxima: all others.

Fig 2: The leaves of Cucurbita moschata often have white spots near the veins.

The typical cultivated Cucurbita species has five-lobed or palmately divided leaves with long petioles, with the leaves alternately arranged on the stem. The stems in some species are angular. All of the above-ground parts may be hairy with various types of trichomes, which are often hardened and sharp. Spring-like tendrils grow from each node and are branching in some species. C. argyrosperma has ovate-cordate (egg-shaped to heart-shaped) leaves. The shape of C. pepo leaves varies widely. C. moschata plants can have light or dense pubescence. C. ficifolia leaves are slightly angular and have light pubescence. The leaves of all four of these species may or may not have white spots.[5] There are male (staminate) and female (pistillate) flowers (unisexual flowers) on a single plant (monoecious), and these grow singly, appearing from the leaf axils. Flowers have five fused yellow to orange petals (the corolla) and a green bell-shaped calyx. Male flowers in Cucurbitaceae generally have five stamens, but in Cucurbita there are only three, and their anthers are joined together so that there appears to be one.[6,7] Female flowers have thick pedicels, and an inferior ovary with 3–5 stigmas that each have two lobes.[5,8] The female flowers of C. argyrosperma and C. ficifolia have larger corollas than the male flowers.[5] Female flowers of C. pepo have a small calyx, but the calyx of C. moschata male flowers is comparatively short.[5]

Cucurbita fruits are large and fleshy[6] Botanists classify the Cucurbita fruit as a pepo, which is a special type of berry derived from an inferior ovary, with a thick outer wall or rind with hypanthium tissue forming an exocarp around the ovary, and a fleshy interior composed of mesocarp and endocarp. The term "pepo" is used primarily for Cucurbitaceae fruits, where this fruit type is common, but the fruits of Passiflora and Carica are sometimes also pepos.[9,10] The seeds, which are attached to the ovary wall (parietal placentation) and not to the center, are large and fairly flat with a large embryo that consists almost entirely of two cotyledons.[8] Fruit size varies considerably: wild fruit specimens can be as small as 4 centimeters (1.6 in) and some domesticated

specimens can weigh well over 300 kilograms (660 lb).[8] The current world record was set in 2014 by Beni Meier of Switzerland with a 2,323.7-pound (1,054.0 kg) pumpkin.[11]

Taxonomy

Botanical nomenclature by Linnaeus in his Genera Plantarum[12] the fifth edition of 1754 in conjunction with the 1753 first edition of Species Plantarum.[16] Cucurbita pepo is the type species of the genus.[13,14] Linnaeus initially included the species C. pepo, C. verrucosa and C. melopepo (both now included in C. pepo), as well as C. citrullus (watermelon, now Citrullus lanatus) and C. lagenaria (now Lagenaria siceraria) (both are not Cucurbita but are in the family Cucurbitaceae.[15] The Cucurbita digitata, C. foetidissima, C. galeotti, and C. pedatifolia species groups are xerophytes, arid zone perennials with storage roots; the remainder, including the five domesticated species, are all mesophytic annuals or short-life perennials with no storage roots.[16] The five domesticated species are mostly isolated from each other by sterility barriers and have different physiological characteristics.[16] Some cross pollinations can occur: C. pepo with C. argyrosperma and C. moschata; and C. maxima with C. moschata. Cross pollination does occur readily within the family Cucurbitaceae.[17,18] The buffalo gourd (C. foetidissima), which does not taste good, has been used as an intermediary as it can be crossed with all the common Cucurbita.

Reproductive biology: All species of Cucurbita have 20 pairs of chromosomes.[20] Many North and Central American species are visited by specialist pollinators in the apid tribe Eucerini, especially the genera Peponapis and Xenoglossa, and these squash bees can be crucial to the flowers producing fruit after pollination.[21,22] Male flower, part of the perianth and one filament removed. When there is more pollen applied to the stigma, more seeds are produced in the fruits and the fruits are larger with greater likelihood of maturation[23] an effect called xenia. Competitively grown specimens are therefore often hand-pollinated to maximize the number of seeds in the fruit, which increases the fruit size; this pollination requires skilled technique.[24,25] Seedlessness is known to occur in certain cultivars of C. pepo.[26,27] The most critical factors in flowering and fruit set are physiological, having to do with the age of the plant and whether it already has developing fruit.[28] The plant hormones ethylene and auxin are key in fruit set and development.[29] Ethylene promotes the production of female flowers. When a plant already has a fruit developing, subsequent female flowers on the plant are less likely to mature, a phenomenon called "first-fruit dominance"[28] and male flowers are more frequent, an effect that appears due to reduced natural ethylene production within the plant stem.[30] Ethephon, a plant growth regulator product that is converted to ethylene after metabolism by the plant, can be used to increase fruit and seed production.[24,31] The plant hormone gibberellin, produced in the stamens, is essential for the development of all parts of the male flowers. The development of female flowers is not yet understood[32] Gibberellin is also involved in other developmental processes of plants such as seed and stem growth.[33]

Fig 3: Cucurbita female flower with pollinating squash bees

Germination and seedling growth

Seeds with maximum germination potential develop (in C. moschata) by 45 days after anthesis, and seed weight reaches its maximum 70 days after anthesis[34] Some varieties of C. pepo germinate best with eight hours of sunlight daily and a planting depth of 1.2 centimeters (0.47 in). Seeds planted deeper than 12.5 centimeters (4.9 in) are not likely to germinate[35] In C. foetidissima, a weedy species, plants younger than 19 days old are not able to sprout from the roots after removing the shoots. In a seed batch with 90 percent germination rate, over 90 percent of the plants had sprouted after 29 days from planting.[36] Experiments have shown that when more pollen is applied to the stigma, as well as the fruit containing more seeds and being larger (the xenia effect mentioned above), the germination of the seeds is also faster and more likely, and the seedlings are larger. Various combinations of mineral nutrients and light have a significant effect during the various stages of plant growth. These effects vary significantly between the different species of Cucurbita. A type of stored phosphorus called phytate forms in seed tissues as spherical crystalline intrusions in protein bodies called globoids. Along with other nutrients, phytate is used completely during seedling growth[37] Heavy metal contamination, including cadmium, has a significant negative impact on plant growth[38] Cucurbita plants grown in the spring tend to grow larger than those grown in the autumn.[39]

Fig 4: Kabocha seedling seven days after being sown

Nutrients

As an example of Curcubita, raw summer squash is 94% water, 3% carbohydrates, and 1% protein, with negligible fat content (table). In 100 grams, raw squash supplies 16 calories and is rich in vitamin C (20% of the Daily Value, DV), moderate in vitamin B6 and riboflavin (12-17% DV), but otherwise devoid of appreciable nutrient content (table), although the nutrient content of different Curcubita species may vary somewhat.[90] Pumpkin seeds contain vitamin E, crude protein, B vitamins and several dietary minerals (see nutrition table at pepita).[40] Also present in pumpkin seeds are unsaturated and saturated oils, palmitic, oleic and linoleic fatty acids[41] as well as carotenoids.[42]

Toxins

Cucurbitin is an amino acid and a carboxypyrrolidine that is found in raw Cucurbita seeds.[43,44] It retards the development of parasitic flukes when administered to infected host mice, although the effect is only seen if administration begins immediately after infection.[45] Cucurmosin is a ribosome inactivating protein found in the flesh and seed of Cucurbita,[46,47] notably Cucurbita moschata. Cucurmosin is more toxic to cancer cells than healthy cells.[48] Cucurbitacin is a plant steroid present in wild Cucurbita and in each member of the family Cucurbitaceae. Poisonous to mammals[49] it is found in quantities sufficient to discourage herbivores. It makes wild Cucurbita and most ornamental gourds, with the exception of an occasional C. fraterna and C. sororia, bitter to taste. This bitterness is especially prevalent in wild Cucurbita; in parts of Mexico the flesh of the fruits is rubbed on a woman's breast to wean children[50], While the process of domestication has largely removed the bitterness from cultivated varieties, there are occasional reports of cucurbitacin causing illness in humans. Cucurbitacin is also used as a lure in insect traps.[51]

CUCURBITA MAXIMA

Scientific classification

Kingdom: Plantae
(unranked): Angiosperms
(unranked): Eudicots
(unranked): Rosids
Order: Cucurbitales
Family: Cucurbitaceae
Genus: Cucurbita
Species: C. Maxima Duchesne

Binomial name

Cucurbita maxima.

Subspecies[52]

C. maxima subsp. Andreana, C. maxima subsp. Maxima.

Synonyms[53]

Cucumis rapallito Carrière, Cucumis zapallito Carrière, Cucurbita farinae Mozz. ex Naudin, Cucurbita maxima var. triloba Millán, Cucurbita maxima var. turgida L.H.Bailey, Cucurbita maxima var. zapallito (Carrière) Millán, Cucurbita maxima var. zipinka Millán, Cucurbita pileiformis M.Roem., Cucurbita rapallito Carrière, Cucurbita sulcata Blanco, Cucurbita turbaniformis M.Roem, Cucurbita zapallito Carrière, Pepo maximus Peterm, Pileocalyx elegans Gasp. Cucurbita maxima, one of at least five species of cultivated squash, is one of the most diverse domesticated species.[54] This species originated in South America from the wild Cucurbita andreana over 4000 years ago.[55] The two species hybridize quite readily but have noticeably different calcium levels.[56]

Cultivation

Different squash types of this species were introduced into North America as early as the 16th century. By the American Revolution, the species was in cultivation by Native American tribes throughout the present-day United States. By the early 19th century, at least three varieties are known to have been commercially introduced in North America from seeds obtained from Native Americans. Secondary centers of diversity include India, Bangladesh, Myanmar, and possibly the southern Appalachians. The large red-orange squashes often seen at Halloween in the United States are C. maxima, but not to be confused with the orange type used for jack-o-lanterns, which are C. Pepo.[57]

Types

Many different cultivars of Cucurbita maxima have been developed. As in C. pepo, plants exist with a "bush" habit that is particularly evident in young plants, although older plants grow in the wild-type vining manner.[58] Arikara squash is an heirloom variety of C. maxima. Fruits weigh from four to eleven pounds. The shape of the fruit can be tear-drop or round, and they are colored in a mottled orange and green pattern. It is desired both for its eating qualities and as a seasonal decoration. This variety traces its ancestry to the Arikara tribe of the Dakotas, among whom its cultivation predates white settlement. Banana squash has an elongated shape, with light blue, pink or orange skin and

bright orange flesh. Boston marrow sweet tasting, narrow at one end and bulbous at the other.[59] Buttercup squash is one of the most common varieties of this winter squash, with a turban shape (a flattish top and dark green skin), weighing three to five pounds, and normally heavy with dense, yellow-orange flesh.[60] The Candy Roaster landrace was originally developed by the Cherokee people in the southern Appalachians. Another heirloom variety, it is quite variable in size (10-250+ lbs), shape (round, cylindrical, teardrop, blocky, etc.), and color (pink, tan, green, blue, gray, or orange), yet most have fine-textured orange flesh. This variety enjoys continued popularity, particularly in the southern Appalachians. Hubbard squash is another cultivar of this species that usually has a tear-drop shape. They are often used as a replacement for pumpkins in cooking. According to one source,[61] the name comes from Bela Hubbard, settler of Randolph Township, Ohio in the Connecticut Western Reserve. Many other sourc**es** list an alternate history.[62,63] These sources state the hubbard squash (at the time nameless) came to Marblehead, Massachusetts through Captain Knott Martin. A woman named Elizabeth Hubbard brought the fruit to the attention of her neighbor, a seed trader named James J. H. Gregory. Mr. Gregory subsequently introduced it to the market using Mrs. Hubbard's name as the eponym. Gregory later bred and released the blue hubbard, which has a bluish-gray skin. The other major variety, the golden hubbard squash, has a bright orange skin. Gregory advertisements for the squash date from at least 1859.[64] The hubbard squash, including questions regarding the name, is even the subject of a children's ditty, "Raising Hubbard Squash in Vermont".[65] Jarrahdale pumpkin is a pumpkin with gray skin. It is nearly identical to 'Queensland Blue' and 'Sweet Meat' varieties. Kabocha is a Japanese variety. Lakota squash is an American variety. The Nanticoke squash is a rare heirloom variety that was traditionally grown by the Nanticoke people of Delaware and Eastern Maryland. It is a turban-type squash and one of only a few surviving Native American winter squashes from the Eastern woodlands. Turk's turban, also known as "French turban", an heirloom predating 1820, and closely related to the buttercup squash.

Subspecies, cultivars and varieties.[66] A plant of a bush cultivar of Cucurbita maxima**.** The Systax database at the University of Ulm lists the following subspecies: Cucurbita maxima Duchesne (including variety 'Queensland Blue' et al.) C. maxima Duchesne ssp. andreana (Naudin) Filov. C. maxima Duchesne ssp. maxima (including varieties 'Golden Delicious', 'Hubbard Squash', et al.). C. maxima Duchesne ssp. maxima convar. bananina Grebensc. C. maxima Duchesne ssp. maxima convar. hubardiana Grebensc. (including variety 'Golden Delicious', 'Green Hubbard', 'Hubbard's Squash', 'Yellow Hubbard' et al.). C. maxima Duchesne ssp. maxima convar. zapallitina Grebensc. (includes typical cultivated form of summer squash "zapallito" popular in Argentina, Uruguay, Bolivia, Chile, Brasil). C. maxima Duchesne ssp. maxima convar. maxima. C. maxima Duchesne ssp. maxima convar. turbaniformis.

Fig 5: Winter squash-Plant: Cucurbita maxima, one of at least five species of cultivated squash, is one of the most diverse domesticated species.

Culinary and Medicinal Uses

Both squash and blossoms are edible and can be prepared in a variety of ways. Squash blossoms can be added to soups and stews, as well as be sauteed, stuffed, and dipped in batter and fried. Squash can be made into french fries and used raw for salads. Winter squash are more nutritious than summer. Summer squashes cook quickly and are eaten with the skin. Winter squash can be baked whole or sliced in half, placed on a baking sheet, brushed with oil and left to bake at 400 F. For steaming and boiling, remove skin from winter squash. A simple and delicious way to prepare acorn squash is by baking and serving with butter. Butternut squash has a similar taste to sweet potato, and can be used as a substitute in recipes calling for sweet potato. Butternut squash is commonly made into soup. Spaghetti squash is a large, light yellow variety that is unique due to its spaghetti-like flesh.[67] The stringy flesh is delicate and has a consistency similar to angel-hair pasta with a mild flavor. To prepare, slice the squash in half and scoop out the seeds. Place the squash face down on a pan with a bit of water on the bottom, and bake for 30-40 minutes. Once tender, the insides can be scraped out and made into long strands. Serve right away with marinara sauce, butter or olive oil.[68] Zucchini , like pumpkin, is highly versatile and can be made into a variety of sweets such as zucchini bread, brownies, and cakes. Zucchini is an ingredient in the dish Ratatouille, and is also delicious when stuffed with cheese and baked.[69] Pumpkin can be made into beer by fermenting persimmons, hops, maple sugar, and pumpkin.[70] Both summer and winter varieties can be prepared savory or sweet, with pumpkin pie being a classic example of sweet seasoning. The seeds of several squash varieties can be dried out, mixed with oil, salt and pepper, and toasted on a cookie sheet at 350 F until golden and crispy.[71] Different varieties of summer squash have little difference in taste, while winter squash have a broader range of flavors.

Squash contain mostly carbohydrates, little protein and almost no fat. As its yellow color indicates, squash is filled with the mineral provitamin A, beta-carotene, as well as calcium and potassium. Squash is filled with soluble vegetable fiber, which provides lasting satiation. The soluble fiber in squash provides a mild laxative effect, making it important for digestive health. Summer squash provides a huge supply of antioxidants, with the skin of squash being especially rich in antioxidants. Steaming and freezing, rather than boiling or microwaving, retains the nutrients within squash. Cooking squash with less water preserves the amount of phenolic compounds, which are associated with color vibrancy and flavor in vegetables.[72] The carotenoids lutein and zeaxanthin protect the eyes. In order to receive the full spectrum of nutrients that squash has to offer, eat skin, seeds and flesh. Squash consumption is recommended to regulate blood sugar and for those with type-2 diabetes.

Seeds have anti parasitic properties, and the seeds and oil extracted from seeds have a history of use in botanical and folk medicine. Dried summer squash seeds are used in some cultures around the world to heal intestinal worms and parasites. The antioxidant supply in squash is linked to cancer prevention.[73] Squash also has the three strongest anticarcinogens, those being vegetable fiber, vitamin C, and Beta-carotene, making the consumption of this starchy vegetable important for cancer prevention.[74] The sodium and potassium contained in squash reduces hypertension. Squash without salt is highly recommended for those with hypertension. The pulp in squash neutralizes excess stomach acid, and also soothes the stomach, healing stomach disorders.[74] An early colonist named Elizabeth Skinner found that the seeds of pumpkins can be ground into a meal and applied to skin to "taketh away freckles and all spots.[75]" When the plants of the Three Sisters plot are eaten together, they provide a nutritional balance of carbohydrates, protein, healthy fats and vitamins.

PHARMACOLOGY

Antimicrobial / Anti-inflammatory / Neuro Effects: Extracts of leaves, fruits and flowers of C. maxima were subjected to pharmacologic and microbiological studies. Results showed complete inhibition of B. subtilis and partial inhibition of E. coli. Fruits and leaves showed neuro effects: decrease motor activity, ataxia, temporary palpebral ptosis among others. Ethyl acetate extracts of flowers showed decreased respiratory rate, analgesia, diarrhea and exophthalmos.[76]

Toxicity evaluation of Cucurbita maxima seed extract in mice: Hydroalcoholic extract of CM seeds had a considerable safety margin and devoid of acute toxicity.[77]

Antigenotoxicity/Spinasterol: Study on antigenotoxic constituents of squash flowers showed isolate SQFwB2D (spinasterol) from the chloroform extract to possess the most antigenotoxicity, decreasing the mutagenicity of tetracycline by 64.7%.[78]

Pumpkin Seed Oil / BPH: Pumpkin seed oil has been approved by the Germany's Commission E since 1985 for the treatment of BPH (benign prostatic hyperplasia).

Antiparasitic: Study showed that pumpkin seed can produce an antihelminthic effect. There was alteration in helminthic motility and a protheolithic effect. Egg destruction was noted in the gravid proglottids.[79]

Hypoglycemic: Study evaluated the hypoglycemic activity of fruit juice and hydro-alcoholic extract of C. maxima in STZ-induced diabetic rats. Both caused significant decrease in hyperglycemia, with the extract showing more hypoglycemic effect than the fruit juice.[80]

Immunomodulatory / Seeds: Cm seeds were tested for immunomodulatory effects using a dexamethasone-induced immunosuppression model in rabbits. Results showed Cucurbita maxima possesses potential to act as an immunomodulator.[81]

Antidiabetic/Aerial Parts: Study of antidiabetic activity of methanol extract of aerial parts in Wistar albino rats against STZ-induced diabetes showed fasting blood glucose reduction in a treatment-duration dependent manner[82]

Anticancer / Aerial Parts: Study evaluated the antitumor activity of a methanol extract of C. maxima Duschesne aerial parts on Ehrlich Ascites Carcinoma model in mice. Results revealed significant anticancer activity attributed to its cytotoxicity and antioxidant properties.[83]

Sterols / Antimicrobial Activity: Study of flowers afforded a 4:1 mixture of spinasterol and 24-ethyl-5a-cholesta-7, 22, 25-trien-3ß-ol. Results showed slight activity against fungi A. niger and C. albicans and bacteria B. subtilis and P. aeruginosa.[84]

Anthelmintic / Schistosomiasis: Study of a decoction prepared from C. maxima var. alyaga seeds showed a killing effect on S. japonicum somulae in vitro, with a dose-effect relationship in the mean percentage somula death[85]

Hepatoprotective: Study showed the hepatoprotective activity of methanol extracts of C maxima and Legenaria siceraria seeds against paracetamol-induced hepatotoxicity.[86]

Anthelmintic Activity / Comparative Study: Study compared the in-vitro anthelmintic activity of Asparagus racemosus and C. maxima against Indian model. Both ethanolic and aqueous extracts of both plants showed

significant anthelminthic activity, with the EE of A. racemosus showing better activity.[87]

Human Overactive Urinary Bladder / Pumpkin Seed Oil: Study evaluated the effect of pumpkin seed oil from C. maxima on urinary dysfunction in human overactive bladder. Pumpkin seed oil significantly reduced the degree of OABSS (overactive bladder symptoms score)[88]

Anti-Inflammatory / Fruit: Study evaluated a methanol extract of fruit for anti-inflammatory activity in rats using a carrageenan induced paw edema model. Results showed potent anti-inflammatory activity. Standard reference drug was indomethacin[89]

Humoral Immune Response / Seeds: Study evaluated the humoral immune response in rabbits treated with Curcubita maxima seeds. Results showed C. maxima seed powder has the ability to modulate humoral immune response in normal and immunosuppressed rabbits.[90]

Protease Inhibitory Activity / Seed Coat Extracts: Curcubita maxima and Citrullus lanatus seed coat extracts showed good protease inhibitor activity.[91]

Corrosion Inhibition: Study evaluated the inhibitive action of peel of Curcubita maxima on mild steel corrosion. Results showed the extract functions as a good corrosion inhibitor with IE increasing with extract concentration.[92]

Anti-Inflammatory / Seed Extract / Foregut Induced Injury: Results showed CMSE has the ability to maintain foregut mucosal integrity normalizing redox system activity and inflammatory mediators.[93]

CNS Stimulant Activity / Seed Oil: Study evaluated the CNS stimulant activity of crude drug extract in swiss albino mice. Results showed a petroleum ether extract showed good CNS stimulant effect that can be explored for therapeutic use as alternative treatment in medical conditions associated with dizziness and sedation.[94]

Anti-Giardial Activity: Study evaluated the antigiardial activity of C. maxima, D. curcubita pepo, and L. siceraria. Curcubita maxima petroleum ether extract of seeds showed the highest activity against Giardia lamblia. The activity could be due to the presence of triterpene (curcubitacins).[95]

Antihelmintic: Study evaluated the antiparasitic activity of C. maxima using canine tapeworms on exposed albino rats. Results showed an anthelmintic effect at MIC of 23 gr. of pumpkin seed in 100 cc of water. Superficial non-erosive gastritis was noted in rats after 4 hours of 9 gr/kg[96]

Antidiabetic / Antihyperlipidemic: Study evaluated the antidiabetic and antihyperlipidemic effect of various extracts of seeds of C. maxima in STZ-induced diabetic wistar albino rats. Results showed significant reduction ($P<0.05$) in blood glucose and significant decrease in total cholesterol, LDL, VLDL, triglycerides, and marked increase in serum insulin and HDL-cholesterol[97]

Cytotoxicity / Seeds: In brine shrimp lethality assay, the LD50 of a methanol extracts and petroleum ether fraction of Pumpkin seed were 31.70 ppm and 21.95 ppm respectively[98]

Antibacterial: Study of ethanol seed extract showed a spectrum of inhibition on Staph aureus, B. subtilis, P. mirabilis, K. pneumonia and E coli.

Diuretic: Study of a hydroalcoholic extract showed significant ($p<0.01$) diuretic activity at the dose of 300 mg/kg when compared to control acetazolamide.[99]

Toxicity Study / Aerial Parts: Study in mice evaluated the safety of methanol extract of aerial parts. Extract was well tolerated up to 2g/kg in acute toxicity study. In subacute toxicity study, it exhibited no significant alterations in any parameters.[100]

Analgesic Study / Aerial Parts: Study evaluated the analgesic effect of hydroalcoholic extract of CMD in a formalin model in rats. Results showed reduction of acute pain and chronic pain in all concentrations. Naloxone inhibited the analgesic effect of the extract.[101]

Lipid Composition / Seeds: Lipid analysis of pumpkin seed oil yielded an oil content of 12% with oleic acid, stearic acid, palmitic acid, and linolein acid. The high degree of unsaturation makes it suitable as a drying agent, and the lower fatty acid content makes it suitable for edible use. (see constituents above)[102]

Triterpene Esters / Cytotoxicity and Melanogenesis Inhibition / Seeds: Study on seeds yielded three new multiflorane-type triterpene esters (compounds 1-3). Compound 1 exhibited melanogenesis inhibitory activity. Compounds 1 and 3 showed weak cytotoxicity against HL-60 and P388 cells.[103]

CONCLUSION

The overview of this article gives a new plat form about the diverse pharmcological action of Cucurbita maxima and its pharmacognostic features and opening a new area for further research on isolation and characterization bioactive compounds and evaluation of new therapeutic activity in future.

REFERENCES

1. Burrows, George E.; Tyrl, Ronald J. Toxic Plants of North America. Oxford: Wiley-Blackwell, 2013; 389–391. ISBN 978-0-8138-2034-7.
2. Nee, Michael. "The Domestication of Cucurbita (Cucurbitaceae)". Economic Botany (New York: New York Botanical Gardens Press) (Supplement: New Perspectives on the Origin and Evolution of

New World Domesticated Plants): 1990; 44(3):56–68. JSTOR 4255271.
3. Decker-Walters, Deena S.; Staub, Jack E.; Chung, Sang-Min; Nakata, Eijiro; Quemada, Hector D. "Diversity in Free-Living Populations of Cucurbita pepo (Cucurbitaceae) as Assessed by Random Amplified Polymorphic DNA". Systematic Botany (American Society of Plant Taxonomists), 2002; 27(1): 19–28. doi:10.2307/3093892. JSTOR 3093892.
4. Millán, R. "Variaciones del Zapallito Amargo Cucurbita andreana y el Origen de Cucurbita maxima". Revista Argentina de Agronomía (in Spanish), 1945; 12: 86–93.
5. Saade, R. Lira; Hernández, S. Montes. "Cucurbits". Purdue Horticulture. Retrieved, September 2, 2013.
6. Mabberley, D. J. The Plant Book: A Portable Dictionary of the Vascular Plants. Cambridge: Cambridge University Press, 2008; 235. ISBN 978-0-521-82071-4.
7. Lu, Anmin; Jeffrey, Charles. "Cucurbita Linnaeus". Flora of China. Retrieved, February 21, 2015.
8. "Cucurbitaceae--Fruits for Peons, Pilgrims, and Pharaohs". University of California at Los Angeles. Retrieved, September 2, 2013.
9. "A Systematic Treatment of Fruit Types". Worldbotanical. Retrieved, October 10, 2013.
10. Schrager, Victor. The Compleat Squash: A Passionate Grower's Guide to Pumpkins, Squash, and Gourds. New York: Artisan, 2004; 25. ISBN 978-1-57965-251-7.
11. "2014 - Beni Meier and his 2323.7 pound World Record Giant Pumpkin!". BigPumpkins.com. 2014. Retrieved, February 12, 2016.
12. Linnaeus, Carl. "Cucurbita". Genera Plantarum 1. Stockholm: Impensis Laurentii Salvii via Biodiversity Heritage Library, 1754; 441.
13. Linnaeus, Carl. "Cucurbita". Species Plantarum 2. Stockholm: Impensis Laurentii Salvii via Biodiversity Heritage Library, 1753; 1010.
14. "Cucurbita". The Linnaean Plant Name Typification Project. Natural History Museum. Retrieved, November 4, 2013.
15. "Cucurbita". The Plant List. Retrieved, 1 January 2015.
16. Whitaker, T.W.; Bemis, W.P. "Origin and Evolution of the Cultivated Cucurbita". Bulletin of the Torrey Botanical Club, 1975; 102(6): 362–368. doi:10.2307/2484762. JSTOR 2484762.
17. Janssen, Don (August 14, 2006). "Curbit Family & Cross-Pollination". University of Nebraska - Lincoln. Retrieved, January 14, 2015.
18. Rakha, M. T.; Metwally, E. I.; Moustafa, E. A.; Etman, A. A.; Dewir, Y. H. "Production of Cucurbita Interspecific Hybrids ThroughCross Pollination and Embryo Rescue Technique". World Applied Sciences Journal, 2012; 20(10): 1366–1370.
19. Rhodes, A. M.; Bemis, W. P.; Whitaker, Thomas W.; Carmer, S. G. "A Numerical Taxonomic Study of Cucurbita". Brittonia (New York Botanical Garden Press), 1968; 20(3): 251–266. doi:10.2307/2805450. JSTOR 2805450.
20. Hurd, Paul D.; Linsley, E. Gorton. "Squash and Gourd Bees (Peponapis, Xenoglossa) and the Origin of the Cultivated Cucurbita". Evolution (St. Louis, MO: Society for the Study of Evolution), 1971; 25(1): 218–234. doi:10.2307/2406514. JSTOR 2406514.
21. Whitaker, Thomas W.; Bemis, W. P. "Evolution in the Genus Cucurbita". Evolution, 1964; 18(4): 553–559. doi:10.2307/2406209. JSTOR 2406209.
22. Winsor, J. A.; Davis, L. E.; Stephenson, A. G. "The Relationship Between Pollen Load and Fruit Maturation and the Effect of Pollen Load on Offspring Vigor in Cucurbita pepo". The American Naturalist, 1987; 129(5): 643–656. doi:10.1086/284664. JSTOR 2461727.
23. Robinson, Richard W. "Rationale and Methods for Producing Hybrid Cucurbit Seed". Journal of New Seeds, 2000; 1(3-4): 1–47. doi:10.1300/J153v01n03_01.
24. Stephenson, Andrew G.; Devlin, B.; Horton, J. Brian. "The Effects of Seed Number and Prior Fruit Dominance on the Pattern of Fruit Production in Cucurbita pepo (Zucchini Squash)". Annals of Botany, 1988; 62(6): 653–661.
25. Robinson, R. W.; Reiners, Stephen. "Parthenocarpy in Summer Squash" (PDF). Hort Science, July 1999; 34(4): 715–717.
26. Menezes, C. B.; Maluf, W. R.; Azevedo, S. M.; Faria, M. V.; Nascimento, I. R.; Gomez, L. A.; Bearzoti, E. "Inheritance of Parthenocarpy in Summer Squash (Cucurbita pepo L.).". Genetics and Molecular Research, March 2005; 31(4): 39–46. PMID 15841434.
27. Stapleton, Suzanne Cady; Wien, H. Chris; Morse, Roger A. "Flowering and Fruit Set of Pumpkin Cultivars under Field Conditions" (PDF). HortScience, 2000; 35(6): 1074–1077.
28. Martínez, Cecelia; Manzano, Susana; Megías, Zoraida; Garrido, Dolores; Picó, Belén; Jamilena, Manuel. "Involvement of Ethylene Biosynthesis and Signalling in Fruit Set and Early Fruit Development in Zucchini Squash (Cucurbita pepo L.)". BMC Plant Biology, 2013; 13(139). doi:10.1186/1471-2229-13-139.
29. Krupnick, Gary A.; Brown, Kathleen M.; Stephenson, Andrew G. "The Influence of Fruit on the Regulation of Internal Ethylene Concentrations and Sex Expression in Cucurbita texana". International Journal of Plant Sciences, 1999; 160(2): 321–330. doi:10.1086/314120.
30. Murray, M. "Field Applications Of Ethephon For Hybrid And Open-Pollinated Squash (Cucurbita Spp) Seed Production". Acta Horticulturae, 1987; 201: 149–156.
31. Pimenta Lange, Maria João; Knop, Nicole; Lange, Theo. "Stamen-derived Bioactive Gibberellin is Essential for Male Flower Development of Cucurbita maxima L.". Journal of Experimental

Botany, 2012; 63(7): 2681–2691. doi:10.1093/jxb/err448. PMC 3346225. PMID 22268154.
32. "Plant Hormones". Charles Sturt University. Retrieved, January 15, 2014.
33. Wilson, Mack A.; Splittstoesser, Walter E. "The Relationship Between Embryo Axis Weight and Reserve Protein During Development and Pumpkin Seed Germination". Journal of Seed Technology, 1980; 5(2): 35–41. JSTOR 23432821.
34. Oliver, Lawrence R.; Harrison, Steve A.; McClelland, Marilyn. "Germination of Texas Gourd (Cucurbita texana) and Its Control in Soybeans (Glycine max)". Weed Science, 1983; 31(5): 700–706. JSTOR 4043694.
35. Horak, Michael J.; Sweat, Jonathan K. "Germination, Emergence, and Seedling Establishment of Buffalo Gourd (Cucurbita foetidissima)". Weed Science, 1994; 42(3): 358–363. JSTOR 4045510.
36. Beecroft, Penny; Lott, John N. A. "Changes in the Element Composition of Globoids From Cucurbita maxima and Cucurbita andreana Cotyledons During Early Seedling Growth". Canadian Journal of Botany, 1996; 74(6): 838–847. doi:10.1139/b96-104.
37. Subin, M. P.; Francis, Steffy. "Phytotoxic Effects of Cadmium on Seed Germination, Early Seedling Growth and Antioxidant Enzyme Activities in Cucurbita maxima Duchesne". International Research Journal of Biological Sciences, 2013; 2(9): 40–47. doi:10.1139/b96-104.
38. Fenner, G. P.; Patteron, G. W.; Lusby, W. R. "Developmental Regulation of Sterol Biosynthesis in Cucurbita maxima L.". Lipids, 1989; 24(4): 271–277. doi:10.1007/BF02535162.
39. "What's So Great About Winter Squash?" (PDF). University of the District of Columbia. Retrieved, January 14, 2015.
40. Mansour, Esam H.; Dworschák, Erno; Lugasi, Andrea; Barna, Barna; Gergely, Anna. "Nutritive Value of Pumpkin (Cucurbita Pepo Kakai 35) Seed Products". Journal of the Science of Food and Agriculture, 1993; 61(1): 73–78. doi:10.1002/jsfa.2740610112.
41. Stevenson DG, Eller FJ, Wang L, Jane JL, Wang T, Inglett GE. "Oil and tocopherol content and composition of pumpkin seed oil in 12 cultivars". J Agric Food Chem, 2007; 55(10): 4005–16. PMID 17439238.
42. Durante M, Lenucci MS, Mita G. "Supercritical carbon dioxide extraction of carotenoids from pumpkin (Cucurbita spp.): a review.". Int J Mol Sci., 2014; 15(4): 6725–40. doi:10.3390/ijms15046725. PMC 4013658. PMID 24756094.
43. Peirce, Andrea. The American Pharmaceutical Association Practical Guide to Natural Medicines. New York: Stonesong Press, William Morrow & Company, 1999; 212–214. ISBN 0-688-16151-0.
44. Mihranian, Valentine H.; Abou-Chaar, Charles I. "Extraction, Detection, and Estimation of Cucurbitin in Cucurbita Seeds". Lloydia (American Society of Pharmacognosy), 1968; 31(1): 23–29.
45. Assessment report on Cucurbita pepo L. (pdf) (Report). Committee on Herbal Medicinal Products (HMPC), European Medicines Agency, 13 September, 2011; 25–26. Retrieved 21 November 2015.
46. Preedy, Victor R.; Watson, Ronald Ross; Patel, Vinwood B. Nuts and Seeds in Health and Disease Prevention. London: Academic Press, 2011; 936. ISBN 978-0-12-375688-6.
47. Barbieri, L.; Polito, L.; Bolognesi, A.; Ciani, M.; Pelosi, E.; Farini, V.; Jha, A. K.; Sharma, N.; Vivanco, J. M.; Chambery, A.; Parente, A.; Stirpe, F. "Ribosome-inactivating Proteins in Edible Plants and Purification and Characterization of a New Ribosome-inactivating Protein From Cucurbita moschata". Biochimica et Biophysica Acta, May 2006; 1760(5): 783–792. doi:10.1016/j.bbagen.2006.01.002. PMID 16564632.
48. Hou, Xiaomin; Meeha n, Edward J.; Xie, Jieming; Huang, Mingdong; Chen, Minghuang; Chen, Liqing. "Atomic Resolution Structure of Cucurmosin, a Novel Type 1 ribosome-inactivating Protein From the Sarcocarp of Cucurbita moschata". Journal of Structural Biology, October, 2008; 164(1): 81–87. doi:10.1016/j.jsb.2008.06.011.
49. Tallamy, Douglas W.; Krischik, Vera A. "Variation and Function of Cucurbitacins in Cucurbita: An Examination of Current Hypotheses". The American Naturalist (The University of Chicago Press), 1989; 133(6): 766–786. doi:10.1086/284952. JSTOR 2462036.
50. Vidal, S., ed. "4". Western Corn Rootworm: Ecology and Management. Wallingford, UK: CAB International. 2005; 67–71. doi:10.1079/9780851998176.0000.
51. "Systax database at the University of Ulm". University of Ulm. Retrieved, November 15, 2014.
52. "Cucurbita maxima". The Plant List. Retrieved November 15, 2014.
53. Ferriol, María; Picó, Belén; Nuez, Fernando. "Morphological and Molecular Diversity of a Collection of Cucurbita maxima Landraces". Journal for the American Society for Horticultural Science, 2004; 129(1): 60–69.
54. Sanjur, Oris I.; Piperno, Dolores R.; Andres, Thomas C.; Wessel-Beaver, Linda. "Phylogenetic Relationships among Domesticated and Wild Species of Cucurbita (Cucurbitaceae) Inferred from a Mitochondrial Gene: Implications for Crop Plant Evolution and Areas of Origin" (PDF). Proceedings of the National Academy of Sciences of the United States of America (Washington, DC: National Academy of Sciences), 2002; 99(1): 535–540. Bibcode: 2002PNAS...99..535S. doi:10.1073/pnas.012577299. JSTOR 3057572.

55. Skilnyk, Hilary R.; Lott, John N. A. "Mineral analyses of storage reserves of Cucurbita maxima and Cucurbita andreana pollen". Canadian Journal of Botany, 1992; 70(3): 491–495. doi:10.1139/b92-063.
56. Nee, Michael. "The Domestication of Cucurbita (Cucurbitaceae)". Economic Botany (New York: New York Botanical Gardens Press) (Supplement: New Perspectives on the Origin and Evolution of New World Domesticated Plants), 1990; 44(3): 56–68. JSTOR 4255271.
57. Mark G. Hutton and R.W. Robinson. "Gene List for Cucurbita spp.". Retrieved, 16 November 2014.
58. "Boston Marrow Squash". Rare Seeds. Retrieved, September 3, 2013.
59. Smarrelli Jr., John; Watters, Michelle T.; Diba, Louise H. "Response of Various Cucurbits to Infection by Plasmid-Harboring Strains of Agrobacterium". Plant Physiology, October, 1986; 82(2): 622–624. doi:10.1104/pp.82.2.622. JSTOR 4270240. PMC 1056173. PMID 16665082.
60. Troyer, Loris C. Portage Pathways. Kent, OH: Kent State University Press, 1998; 8. ISBN 978-0-87-338600-5.
61. Watson, Ben. Taylor's Guides to Heirloom Vegetables: A Complete Guide to the Best Historic and Ethnic Varieties. Boston: Houghton Mifflin Harcour, 1996; 268. ISBN 978-0-39-570818-7.
62. "James J. H. Gregory: A Timeline of his Life". SaveSeeds.org. Retrieved, November 15, 2014.
63. 64. Downing, Andrew Jackson. The Horticulturalist, and Journal of Rural Art and Rural Taste 14. New York: C. M. Saxton, Barker & Co., May 1859; 4.
64. Cady, Daniel Leavens. Rhymes of Vermont Rural Life. Rutland, VT: The Tuttle Company, 1919; 100.
65. Systax database at the University of Ulm". University of Ulm. Retrieved, November 15, 2014.
66. How To Cook Spaghetti Squash in the Oven." The Kitchn. Apartment Therapy, Web, 14 Nov. 2014. http://www.thekitchn.com/how-to-cook-spaghetti-squash-in-the-oven-cooking-lessons-from-the-kitchn-178036.
67. Squash, Summer." The World's Healthiest Foods. The George Mateljan Foundation, Web, 14 Nov. 2014. http://www.whfoods.com/genpage.php?tname=foodspice&dbid=62.
68. Nov. 2014. http://harmonyvalleyfarm.blogspot.com/2014/10/vegetable-feature-winter-squash.html.
69. Edible Gourds." Seeds of India. Web. 18 Nov. 2014. http://www.seedsofindia.com/ed gourds.htm.
70. Zucchini Recipes." Allrecipes.com. Web. 18. Nov. 2014.http://allrecipes.com/recipes/fruits-and-vegetables/vegetables/squash/summer squash/zucchini.
71. Food in Every Country." Food in Zimbabwe. Web. 17 Nov. 2014. http://www.foodbycountry.com/Spain-to-Zimbabwe-Cumulative-Index/Zimbabwe.htm.
72. http://foodsanddiseases.com/squash-properties-and-health-benefits-medicinal-uses.
73. Health Benefits, Side Effects and Nutritional Value of Squash." Health Benefits, Side Effects and Nutritional Value of Squash. Web. 18 Nov. 2014. http://www.zhion.com/herb/Squash.html.
74. Harmony Valley Farm." : Vegetable Feature: Winter Squash. Web.
75. doi:10.3390/molecules19044802.
76. Microbiological and pharamcological studies on extracts of Cucurbita maxima / VILLASENOR I. M.; BARTOLOME A. L. O et al / PTR. Phytotherapy research, 1995; 9(5) 376-378 / INIST-CNRS, Cote INIST : 21695, 35400005373809.0130
77. Toxicity evaluation of Cucurbita maxima seed extract in mice / Summary Pharmaceutical Biology/, 2006; 44(4): 301-303
78. Antigenotoxic spinasterol from Cucurbita maxima flowers / Irene Villaseñor et al / Mutation Research/Environmental Mutagenesis and Related Subjects, 10 June 1996; 360(2): 89-93 / doi:10.1016/0165-1161(95)00071-2
79. Preclinical studies of cucurbita maxima (pumpkin seeds) a traditional intestinal antiparasitic in rural urban areas / Díaz Obregón D, Lloja Lozano L, Carbajal Zúñiga V. / Revista de gastroenterología del Perú / 2004 Oct-Dec; vol 24 (issue 4) : pp 323-7.
80. 80. Effect of Hydro-Alcoholic Extract of Cucurbita Maxima, Fruit Juice and Glibenclamide on Blood Glucose in Diabetic Rats / Lal, V.K., P.P. Gupta, Awanish Pandey and P. Tripathi / American Journal of Pharmacology and Toxicology, 2011; 6(3): 84-87.
81. 81. Comparative Effect of Cucurbita Maxima Seed with Immunomodulators on Biochemical Parameters in Rabbits / V. Ranganathan and S. Selvasubramanian / Journal of Applied Pharmaceutical Science, 2012; 02(06): 191-193
82. Antidiabetic Activity of Cucurbita maxima Aerial Parts / P. Saha, A. Bala, B. Kar, S. Naskar, U.K. Mazumder, P.K. Haldar and M. Gupta / Research Journal of Medicinal Plant, 2011; 5(5): 577-586 / DOI: 10.3923/rjmp.2011.577.586
83. Anticancer activity of methanol extract of Cucurbita maxima against Ehrlich ascites carcinoma / Prerona Saha, U. K. Mazumder, P. K. Haldar, Sagar Naskar, Sriparna Kundu, Asis Bala, Biswakanth Kar / Int. J. Res. Pharm. Sci., 2011; 2(1): 52-59.
84. Sterols from Cucurbita maxima / Consolacion Y. Ragasa and Kathleen Lim / Philippine Journal of Science, December 2005; 134(2): 83-87.
85. A PRELIMINARYSTUDY ON THE KILLING EFFECTOF CUCURBITAMAXIMA VARIETY ALYAGA (SQUASH) SEED DECOCTION ON SCHISTOSOMULAEOF SCHISTOSOMAJAPONICUM IN VITRO* / I. Cua, R. Dimaano, M L Fontanilla, C. C. M. Jorge et al / acta medica philippina
86. Hepatoprotective Effect of Methanolic Extract of C. maxima and L. siceraria Seeds / Jain Nidhi and A K

Pathak / Intern Journ of Pharmaceutical, Chemical, and Biological Sciences, 2012; 2(2): 151-154
87. Phytochemical Screening and In Vitro Comparative Study of Anthelmintic Activity of Asparagus racemosus and Cucurbita maxima / G. V. N. Kiranmayi, K. Ravishankar, P. Priyabandhavi / Journal of Pharmacy Research, 2012; 5(3).
88. Pumpkin seed oil extracted from Cucurbita maxima improves urinary disorder in human overactive bladder / Mie Nishimura, Tatsuya Ohkawara, Hiroji Sato, Hiroshi Takeda, Jun Nishihira / Journal of Traditional and Complementary Medicine, 2014; 4(1): 72-74 / DOI: 10.4103/2225-4110.124355
89. EVALUATION OF ANTI-INFLAMMATORY ACTIVITY OF CUCURBITA MAXIMA FRUIT / Hardik Patel, Bhagirath Patel, Alpesh Prajapati* / J Adv Pharm Res Biosci, 2013; 1(1): 28-31.
90. Estimation of humoral immune response in rabbits fed with Cucurbita maxima seeds / V. Ranganathan, S. Selvasubramanian and S. Vasanthakumar / Vet World 6(7):396-399 / doi:10.5455/vetworld, 2013; 396-399.
91. Protease Inhibition Studies and Metallic Responses of Cucurbita maxima and Citrullus lanatus Seed Coat Extracts / Mr. Sreenu Barla, Dr. DSVGK Kaladhar, Dr. Govinda Rao Duddukuri / IJSR - INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH, Sept 2013; 2(9).
92. MILD STEEL CORROSION INHIBITION BY CUCURBITA MAXIMA PLANT EXTRACT IN HYDROCHLORIC ACID SOLUTION / K.Anbarasi*, V.G.Vasudha / IENT Conference Proceedings / doi:http://dx.doi.org/10.13074/ient.2013.07.13328
93. Anti-inflammatory effect of Cucurbita maxima sweet seed extract on foregut induced injury: role of oxidative stress / Irena Pshyk-Titko and Oksana Zayachkivska / The FASEB Journal.
94. CENTRAL NERVOUS SYSTEM STIMULANT EFFECT OF THE OILS OBTAINED FROM SEEDS OF CUCURBITA MAXIMA / Doke P.P.*, Tare H.L., Sherikar A.K., Shende V.S., Deore S.R., Dama G.Y. / Journal of pharmaceutical biology, 2011; 1(1): 30-36.
95. Antigiardial Activity of some Cucurbita Species and Lagenaria Siceraria / Ihsan Mohamed Elhadi, Waleed S. Koko*, Mahmoud M. Dahab, Yahia Mohamed El Imam, Mona Abdu Elmonem Abdu El Mageed / JOURNAL OF FOREST PRODUCTS & INDUSTRIES, 2013; 2(4) 43-47.
96. Preclinical studies of cucurbita maxima (pumpkin seeds) a traditional intestinal antiparasitic in rural urban areas / Díaz Obregón D, Lloja Lozano L, Carbajal Zúñiga V. / Rev Gastroenterol Peru, Oct-Dec, 2004; 24(4): 323-7.
97. Antidiabetic and Antihyperlipidemic Activity of Cucurbita maxima Duchense (Pumpkin) Seeds on Streptozotocin Induced Diabetic Rats / Ashok Sharma*, Ashish K. Sharma, Tara Chand, Manoj Khardiya, Kailash Chand Yadav / Journal of Pharmacognosy and Phytochemistry, 1(6).
98. CYTOTOXICITY AND PHYTOCHEMICAL STUDIES OF PUMPKIN SEED (CUCURBITA MAXIMA LINN.) EXTRACT. / Matiar Rahman / Journal of Biomedical and Pharmaceutical Research, 2014; 3(2).
99. Physico-chemical studies and evaluation of diuretic activity of Cucurbita maxima / Venkattapuram Sampath Saravanan, Sellimuthu Manokaran / Bangladesh Journal of Pharmacology, 2012; 7(4).
100. Acute and Subchronic Toxicity of C. maxima Aerial Parts / P. Saha, U.K. Mazumder* and P.K. Haldar / International Journal of Research in Pharmaceutical and Biomedical Sciences, Apr – Jun 2011; 2(2).
101. Evaluating the analgesic effect of Cucurbita maxima Duch hydro-alcoholic extract in rats / Arezoo Basim, Mohammad Reza Hojjati *, Zahra Alibabaei , Hossein Fathpoor / JSKUM Journal of Shahrekord University of Medical Sciences, Oct-Nov 2014; 16(4).
102. Nutritional and Lipid Composition Analysis of Pumpkin Seed (Cucurbita maxima Linn.) / Ahsan Habib, Shahangir Biswas, Abdul Hai Siddique, Manirujjaman M, Belal Uddin, Sohel Hasan, Khan MMH, Meftah Uddin, Minarul Islam, Mahadi Hasan, Muedur Rahman, Asaduzzaman M, Sohanur Rahman M, Khatun M, Islam MA and Matiar Rahman* / J Nutr Food Sci., 5: 374. doi: 10.4172/2155-9600.1000374
103. Three New Triterpene Esters from Pumpkin (Cucurbita maxima) Seeds / Takashi Kikuchi, Shinsuke Ueda, Jokaku Kanazawa, Hiroki Naoe, Takeshi Yamada and Reiko Tanaka * / Molecules, 2014; 19: 4802-4813 / doi:10.3390/molecules19044802.