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COMPARATIVE REVIEW OF *MOMORDICA CHARANTIA* AND *MOMORDICA DIOICA*: AN UPDATE

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ABSTRACT: *Momordica charantia* and *Momordica dioica* species belong to the Cucurbitaceae family. *Momordica charantia* and *Momordica dioica* climbing creeper plants are used both in the prevention and cure of various diseases and in the food of humans. *Momordica charantia* is also known as bitter gourds, bitter melon, karela, and balsam pear. *Momordica charantia* contain phytochemical constituents such as alkaloids, tannins, flavonoids, saponins, glycosides, steroids, phenolic compounds, terpenoids, proteins, mucilages and oleanolic acids as well as moisture, ash, carbohydrates, minerals and vitamins used as nutritional significance. It has been used in the treatment of tumor, inflammation, antioxidant, diabetes, hyperglycemic, hyperlipidemic, hepatoprotective, obesity, cancer, viral, viral infections (HIV, herpes, hepatitis, influenza and measles), bacterial infections, asthma, cough, skin disorder, eye diseases, immunomodulatory, microbial, cardiovascular, wound healing activities. *Momordica dioica* contains alkaloids, steroids, triterpenoids, flavonoids, glycosides, saponins, vitamins, protein, carbohydrates, momordicin. It has been used in the treatment of malaria, inflammation, antioxidant, diabetes, hyperglycemic. Both species are great potentiality from the economic and botanical points of view. This paper reviews the work done so far in the Literature Survey of plants *Momordica charantia* and *Momordica dioica*.

INTRODUCTION: *Momordica charantia* and *Momordica dioica* belong to the family Cucurbitaceae [1] and under the genus Momordica, a genus of annual or perennial herbaceous climbers that contains about 80 species [2]. The plant *Momordica charantia* is also known as bitter gourds, bitter melon, karela, and balsam pear. These species include *M. angustisepala*, *M. balsamina* Linn, *M. cochinchinensis* Spreng, *M. cabrei*, *M. dioica*, *M. elaterium*, *M. foetida*, *M. grosveroni*, M. tuberosa or cymbalaria [3].

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Momordica charantia Linn. is a monoecious climber found in tropical and subtropical regions, often under cultivation up to an altitude of 1500 m. It is mainly found in Africa, Asia, and Australia [4]. Its many varieties differ substantially in the shape and bitterness of the fruit. Bitter melon originated in India and was introduced into China in the 14th century.

It is widely used in the cuisines of East Asia, South Asia, and Southeast Asia. *Momordica charantia* is an important vegetable crop in tropical countries, including China and India. A wide range of genetic diversity exists in India [5]. The fruit morphology varies greatly in colour, size, and exocarp characteristics. Indian *Momordica charantia* cultivars bear large fruits, whereas wild, free-living M. muricata ecotypes develop small, round fruits [6]. *Momordica charantia* was originated from India

and carried to China in the 14th century. It is a tropical and subtropical vine of the family Cucurbitaceae, widely grown in Asia, Africa, and the Caribbean. The fruit juice and/or a leaf tea are employed for diabetes, malaria, colic, sores and wounds, infections, measles, hepatitis, and fevers. Leaves are used for treating catarrh, constipation, dermatitis, diabetes, diarrhoea, eczema, fever, leprosy, malaria, rheumatism, breast cancer, snake bite, anaemia, dysentery, gonorrhoea, measles, rheumatoid arthritis. It is used for the treatment of cancer, diabetes, a potent hypoglycemic agent, and many ailments [7-12]. *Momordica chlarantia* used in diabetes, dyslipidemia, microbial infections, cytotoxic agent for certain types of cancer [13-16].

Fruits of *Momordica charantia* are used in asthma, burning sensation, colic, constipation, cough, diabetes, fever (malaria), gout, helminthiases, inflammation, leprosy, skin diseases, ulcer, and wound. It has also been shown to have hypo-glycaemic properties in animal as well as human studies. Juice of the plant leaves is used to treat piles completely. It is used as a blood purifier due to its bitter tonic properties. It can heal boils and other blood-related problems that show up on the skin. Juice of karela is also beneficial in treating and preventing liver damage [17, 18]. In India, *Momordica charantia* is used by tribal people for abortions, birth control, increasing milk flow, menstrual disorders, vaginal discharge, constipation, food, diabetes, hyperglycemia, jaundice, stones, kidney, liver, fever, gout, eczema, fat loss, hemorrhoids, hydrophobia, intestinal parasites, skin, leprosy, pneumonia, psoriasis, rheumatism, scabies, snakebite, vegetables, piles, tonic, anthelmintic, purgative. However, it is commonly consumed as vegetable [19].

Momordica dioica climber plant, commonly known as Teasle Gourd, Kakrol, Kankro, Kartoli, Kantoli, Kantola, Kantroli, Ban karola or Small bitter-gourd is a relatively small oval to ovoid vegetable. It is also called as janglee karela [20]. This genus is essentially a native of tropical regions in Asia with extensive distribution in China, Japan, South East Asia, Polynesia besides tropical Africa and South America. As many of the species of this genus have been found to grow wildly in India, Bangladesh, Srilanka, Myanmar, Malay, *etc.* [21] It indicated that this region might be the origin of *Momordica dioica*. The plant is sometimes found growing wild and is common in hedges. It is often cultivated for its fruits, which are used as vegetables [22]. The Teasle gourd is a cucurbitaceous popular summer vegetable. The fruits, young twigs, and leaves of this crop are used as a vegetable or cooked as a vegetables [23]. It is available in the forest of dry and moist deciduous in feeding months August to February [24]. The Teasle gourd is an important summer vegetable in Bangladesh and the Indian subcontinent. It has many advantages, like high market price, good nutritional value and keeps quality longer [25].

It has two different types of varieties, male & female as well as fruited variety & fruitless variety. *Momordica dioica* (chormosome number 28) dioecious and propagated vegetatively through tuberous root [26]. It has two different types of varieties male & female as well as fruited variety & fruitless variety [27, 28]. Female plants tubers are larger than those of the male plants [29]. 120 genera in Cucurbitaceae [30]. In Momordica species total 60 species are reported worldwide, and out of them 7 are available in India. *Momordica dioica* (kartoli or spine gourd) is also found in cultivated or semi wild form. For cultivation require lowland for annual. It is dioecious, perennial in nature, having tuberous roots. Green fruit is extensively used as vegetable by cooking or frying. Leaves 1.5-4 inches long, cordate, acute more or less 3-5 lobed; Flowers large, dioecious and yellow in colour; Fruit 1-3 inches long, shortly beaked, densely covered with soft spines [31].

This study also shows that it is useful in the treatment of numerous diseases. The literature survey focuses on how plants have been or are used, managed, and perceived in human societies and includes plants used for food, medicine, divination, *etc.* These new approaches enhance the use of the plant in medicinal use as well as economic point of view. In the present review, interest is focused on their folk uses, pharmacological, phytochemical, and general study. We believe that the folk uses of *Momordica charantia* and *Momordica dioica* medicinal plant presented in this review will be useful to researchers, as well as practitioners. The aim of this review is to collate all available data on *Momordica charantia* and *Momordica dioica* plants with a

literature survey. In such a way, the present paper describes a rapid, simple, and comparatively efficient Literature Survey of plant *Momordica charantia* and *Momordica dioica* - An Update

TABLE 1: BOTANICAL DIFFERENCES AMONG THE SIGNIFICANT MOMORDICA SPECIES OF INDIA [32]

Part	*Momordica charantia*	*Momordica dioica*
Plant	A much-branched climbing annual.	A dioecious, perennial climber with a tuberous root.
Stem	Angled, grooved, young parts densely hairy, older branches more or less pubescent.	Slender, glabrous to rarely sparsely pubescent, angled and sulcate.
Leaves	Almost orbicular or reniform in outline, lobes ovate-oblong, acute or subacute, apiculate.	Many variables, membranous, ovate, obtuse or acute and mucronate, lobes triangular.
Flowers	Monoecious, male flowers solitary, peduncles slender, glabrous or somewhat pubescent; Corolla somewhat irregular, lemon yellow; Female flowers on 5-10 cm long slender peduncles, bracteate usually at or near the base.	Male flowers solitary, glabrous peduncles which are hairy, Corolla yellow, Female flowers bracteate or ebracteate.
Fruit	Bright orange colored, 5-15 cm long, fusiform, ribbed, with numerous triangular tubercles giving it the appearance of crocodile skin.	Ellipsoid, shortly beaked, denselyechinate with soft pines, apex shortly prostrate and annular, base usually rounded.
Seeds	Compressed, oblong, sub bi-dentate at base and apex, sculptured on sides, cream or grey colored.	Many, many variables in size and shape, turgid, more or less pyriform quite smooth.

TABLE 2: VERNACULAR NAME [33, 34, 35]

S. no.	Language	*Momordica charantia*	*Momordica dioica*
1	Sanskrit	Sushavi, Karavella	Karkotaki, Karkoti
2	English	Bitter gourd, Balsam pear, Balsam apple.	Small bitter gourd, Bur cucumber
3	Hindi	Karela, Kardi	Kikoda, Khekhasaa, Jangli karela,
4	Marathi	Karali, Karale	Kartole, Vaajnh-kartoli, Kartholi, Kartoli, Kertoli
5	Bengali	Karela, Uchchhe, Kerula	Kakrol, Ghi korola, Titkaankarol
6	Tamil	Pakal, Pavaka, Paharkai	Mezhuku-pakal, Pazhu-pakal
7	Kannada	Hagal	Maadadaangal
8	Malayalam	Kaipp, Kaippavlli, Paval	Ben-pavel, Erimapasel
9	Guajarati	Karela	Kankoda, Baanjhakartolaa
10	Telgu	Koekara, Kaaya	Boda kakara, Aagaakar
11	Urdu	Karela	Azaraqi, Kuchla
12	Oria	Kalara, Salara	Kankada
13	Assam	Kakiral, Kakral	Bhat-kerela
15	Manipuri	Karon akhabi	Karot
16	Chhattisgarhi	Wild Karela	Kheksi
17	Konkani	Kaaraate	Phagil/Phagala

TABLE 3: TAXONOMIC CLASSIFICATION [36]

Scientific name	*Momordica charantia*	*Momordica dioica*
Kingdom	Plantae	Plantae
Subkingdom	Tracheobionta	Tracheobionta
Superdivision	Spermatophyta	Spermatophyta
Division	Magnoliophyta	Magnoliophyta
Class	Magnoliopsida	Magnoliopsida
Subclass	Dilleniidae	Dilleniidae
Order	Cucurbitales/Violales	Cucurbitales/Violales
Family	Cucurbetaceae	Cucurbetaceae
Genus	Momordica	Momordica
Species	Charantia	Dioica

Literature Review:

TABLE 4: ETHNOMEDICAL CLAIM / TRADITIONAL USE

S. no.	*Momordica dioica*	*Momordica charantia*
Fruits	Cure vata, biliousness, asthma, leprosy, bronchitis, fever, tumors, tridosha, urinary discharges, excessive salivation, troubles of the heart, inflammation, errhine effect[37]	asthma, burning sensation, constipation, colic, diabetes, cough, fever (malaria), gout, helminthiases, leprosy, inflammation, skin

	Inflammation caused by urine of house-lizard, errhine effect[38] Errhine effect & provokes a copious discharge from the schneiderian mucous membrane[39]	diseases, ulcer and wound. It has also been publicized to have hypoglycaemic (antidiabetic) properties
Leaves	Aphrodisiac, anthelmintic, cure tridosha, fever, consumption, asthma, bronchitis, hiccough, piles[37] Headache relieves[38]	menstrual troubles, burning sensation, constipation, fever (malaria), colic, infections, worms and parasites, as an emmenogogue, measles, hepatitis and helminthiases. In Guyana traditional medicine, leaf tea is used for diabetes, to expel intestinal gas, to promote menstruation, and as an antiviral for measles, hepatitis, and feverish condition. It is used topically for sores, wound, infections and internally and externally for worms and parasites.
Roots	Head troubles, urinary calculi & complaints, errhine in jaundice, bleeding (toasted), all kinds of poisoning like snake bite & scorpion- sting, inflammation of urine of house-lizard, ulcers, fever, sedative in high fever with delirium (as paste)[37] Antiseptic, scorpion sting, ulcer by snake bites, bleeding piles, bowel affections, expectorant, powder to skin soft, supple and lessens perspiration[38]. Piles bleeding, urinary complaints, sedative in high fever with delirum (as paste), snake-bite, scorpion-sting, antiseptic[39]. Anti-allergic, bronchial asthma, antimalarial[40]. Spermatorrhea, leucorrhoea[41]. Contraceptive[42]. Spermicidal activity and anthelmintic activity[43].	Syphilis, rheumatism, ulcer, boils, septic swellings, opthelmia, and in Prolapsusvagenae. *Momordica charantia* juice helps to reduce the problem of Pyorrhea (bleeding from the gums). *Momordica charantia* capsules and tinctures are widely available in the United States for the treatment of diabetes, colds flu, viruses, tumors, cancer, high cholesterol and psoriasis.
Seeds		ulcers, liver and spleen problems, diabetes, high cholesterol, intestinal parasites, and intestinal gas, heal wounds and stomachache
General	mental disorders[43]. In bilious affections, piles, jaundice, worms, leprosy, dysmenorrhoea & externally intractable ulcers, skin affections, burning in feet, night blindness, liver complaints of children, headache & inflammation caused by contact with the urine of the house-lizard[44]. For Diabetes and Hair lengthening[45]. Seed paste applied on the lower abdomen in dysuria and also to cure constipation[46]. To dandruff control tender paste applied on head 1 hour before bath[47]. Eye diseases, poisoning and fever[48].	abortions, birth control, increasing milk flow, vaginal discharge, menstrual disorders, constipation, food, hyperglycemia, diabetes, jaundice, stones, kidney, liver, fever (malaria), eczema, gout, fat loss, hemorrhoids, hydrophobia, intestinal parasites, skin, pneumonia ,leprosy, psoriasis, rheumatism, scabies, piles, snakebite, vegetables, anthelmintic, purgative[49-56].

Phytochemical Study: The main constituents of bitter melon *Momordica charantia* are triterpene, protein, steroid, alkaloid, inorganic, phenolic, and lipid compounds. *Momordica charantia* consists the following chemical constituents those are alkaloids, momordicin and charine, momorchanins, momordicilin, charantin, momordicius, momordenol, momordin, momordolol, crypto-xanthin, cucuritacins, cucurbitns, cycloartenols, cucuritanes, erythrodiol, elaeostearic acids, galacturonic acid, gentisic acid, goyaglycosides, goyasaponins, and multiflorenol, cucurbitacins, cucurbitanes, diosgenin erythrodiol, guanylate cyclase inhibitors, gypsogenin, lauric acid, karounidiols, hydroxytryptamines, lanosterol, linoleic acid, linolenic acid, momordenol, momordicinin, momordicosides [57-59]. It contains Lectins, proteins, triterpenes, and vitamins [60]. The fruit contains a high amount of vitamin C26. The fruit is rich in ascorbic acid and contains iodine [61]. The fruit also contains an alkaloid, flavonoids, glycosides, and amino acids [62]. *Momordica dioica* also contains an alkaloid, a fragrant extractive matter, and ash 3 to 4 p.c. Ash contains a trace of manganese [63]. *Momordica dioica,* as the average nutritional value per 100 g edible fruit, was found to contain 84.1% moisture, 7.7 g carbohydrate, 3.1 g protein, 3.1 g fat, 3.0 g fiber, and 1.1 g minerals. It also contained small quantities of essential vitamins like ascorbic acid, carotene, thiamin, riboflavin, and niacin [64]. It also contains protein in the leaves, and the dry weight of aerial plant parts remained higher in male as compared to female defruited, and monoecious plants [65].

From *Momordica dioica* fruit isolated 6-methyl tritriacont-50on-28-of and 8-methyl hentracont-3-ene along with the known sterol pleuchiol. Momodicaursenol, an unknown pentacylic triterpene isolated from the seeds, had been identified as urs-12, 18(19)-dien-3 beta-ol on. Phytochemical investigations have revealed the presence of traces of alkaloids and ascorbic acid in fruits. Lectins, β-sitosterol, saponin glycosides, triterpenes of ursolic acid, hederagenin, oleanolic acid, β-spiranosterol, stearic acid, gypsogenin, two novel aliphatic constituents [66-69]. From the dry root of *Momordica dioica* isolated three triterpenes and two steroidal compounds. These were alpha-spinasterol octadecanonate(I), alpha-spinasterol-3-O-beta-D-glucopyranoside (II), 3-O-beta-D-glucuronopyranosyl gypsogenin (III), 3-O-beta-D-glucopyranosyl gypsogenin (IV) and 3-O-beta-D-glucopyranosyl hederagenin (V). Constituent III was a new compound [69].

Pharmacological Study: From the literature survey, it was found that the whole plant leaves and mainly fruits of the plant *Momordica charantia* are used in the treatment of various diseases.

Hepatoprotective and Antioxidant Activities: *Momordica dioica* roots alcoholic extract significantly reduced CCl_4 induced hepatotoxicity in rats [70]. *Momordica dioica* leaves ethanolic extract found more potent hepatoprotective activity against aqueous extracts was evaluated against carbon tetrachloride (CCl_4) induced hepatic damage in rats. Also, *in-vivo* antioxidant and free radical scavenging activities were also screened, which were positive for both extracts due to the presence of flavonoids in the extracts [71]. *Momordica dioica* fruits ethanolic extract shows hepatoprotective activity against carbon tetrachloride (CCl_4) induced hepatic damage. Fruit is reported for hepatoprotective activity [72].

Antioxidant Activity: *Momordica charantia* different parts of the plant have been used in the Indian medicinal system for a number of ailments besides diabetes. Antioxidant activity of extracted phenolic compound from bitter melon has been reported; the Antioxidant properties of *Momordica charantia* seeds on Streptozotocin induced-diabetic rats has been studied, and results clearly suggest that seeds of *Momordica charantia* may effectively normalize the impaired antioxidant status in streptozotocin induced-diabetes [73-74].

Antidiabetic, Hypoglycemic, Hypocholesterolic and Hypolipidemic Activities: *Momordica charantia* is a choice of fruit used for complementary and alternative medicine [75]. Water extract of *Momordica charantia* was tested on alloxan-induced diabetic rats experimentally a fall of blood sugar level after 3 weeks treatment. The aqueous extract of *Momordica charantia* fruit was tested on the streptozocin-induced diabetes mellitus type II rats. The results showed that a reduction of blood glucose and increment in insulin level [76]. The oral administration of fresh Fruit juice (dose 6 c.c. /kg. body wt.) lowered the blood sugar level in normal and alloxan-diabetic rabbits. Oral administration of alcoholic extracts of the plant to some diabetic patients did not produce any hypoglycaemic action. Karela preparations have been shown to significantly improve glucose tolerance without increasing blood insulin levels and to improve fasting blood glucose levels. Blood and urine sugar levels and postprandial (after eating) blood glucose levels also fell [77].

The effects in diabetes mellitus treatment with *Momordica charantia* fruit juice reduced blood glucose levels, improved body weight, and glucose tolerance. *Momordica charantia* fruit juice can also inhibit glucose uptake by the gut and stimulate glucose uptake by skeletal muscle cells [78]. *Momordica charantia* is beneficial for treating type II diabetes. Mechanisms such as the stimulating or regenerating effect on beta cells or extrapancreatic effects are proposed for the hypoglycaemic action of these herbs [79]. The different fractions of the extract have cell repairing activity and its ability to stimulate insulin secretion [80].

The anti-diabetic properties of alcoholic extract of *Momordica charantia* showed blood sugar never fell below normal values even with a high dose in pancreatic islets; beta cells showed definite improvement [81]. The inhibition on the postprandial rise in hyperglycaemia in normoglycaemic rats by the *Momordica charantia* powder [82]. The pre-clinical studies have documented the anti-diabetic and hypoglycaemic effects of *Momordica charantia* through various mechanisms [83]. The water extract of the fruits of *Momordica charantia*

produced a hypoglycaemic effect [84]. *Momordica dioica* fruit pulp extracts show the hypoglycemic and hypolipidemic activities on alloxan-induced diabetic rats [85]. *Momordica dioica* fruits show the anithyperglycemic activity in alloxan-induced diabetic rats. In this study, the ethyl acetate and ethanol showed significant antidiabetic activity with compare to chloroform [86]. This plant also possesses hypoglycemic [87].

Antidiabetic Activity: *Momordica charantia* contains bitter chemicals like vicine, charantin, glycosides, and karavilosides, along with polypeptide-p plant insulin, which is hypoglycemic in action and improves blood sugar levels by increasing glucose uptake and glycogen synthesis in the liver, muscles, and fat cells. Some research reports indicate that they also improve insulin release from pancreatic beta cells and repair or promote new growth of insulin-secreting beta cells. P-Insulin, a polypeptide from the fruits and seeds, rapidly decreased and normalized the blood sugar level in rats. Bitter melon contains another bioactive compound *i.e.* lectin that has insulin-like activity. The insulin-like bioactivity of lectin is due to its linking together 2 insulin receptors. This lectin lowers blood glucose concentrations by acting on peripheral tissues and, similar to insulin's effects in the brain, suppressing appetite. This lectin is a major contributor to the hypoglycemic effect that develops after eating *Momordica charantia*. Charantin extracted by alcohol is a potent hypoglycemic agent composed of mixed steroids, which is sometimes used to treat diabetes to lower blood sugar levels [88-92].

Hypocholesterolemic Activity: Experiments carried out in normal as well diabetic animals have shown hypo-cholesterolemic effects by *Momordica charantia*. In a study, sunflower-fed rats were fed with conjugated octadecatrienoic fatty acid isolated from *Momordica charantia* seeds for 4 weeks. After 4 weeks, these rats showed significant lowering of the plasma lipid peroxidation and erythrocyte membrane lipid peroxidation as well as nonenzymatic liver tissue lipid peroxidation [93].

Anti-obesity Activity: *Momordica charantia* increase the activity of adenosine 5 monophosphate kinase (AMPK), an enzyme that facilitates cellular glucose uptake and fatty acid oxidation. Compounds in bitter melon improve lipid profiles. They reduce liver secretion of apolipoprotein B (Apo B) – the primary lipoprotein of low-density "bad" cholesterol reduce apolipoprotein C- III expression, the protein found in very-low-density cholesterol which turns into LDL/Bad Cholesterol and increases the expression of apolipoprotein A-1 (ApoA1) the major protein component of high density "good" cholesterol [94].

Anti-inflammatory and or Analgesic Activity: Anti-inflammatory activity was studied by Carrageenin-induced edema in rats, and 60% oedema inhibitions were observed with 300 mg/kg methanol extract of dried leaves of *Momordica charantia*, which was nearly equivalent to that of 10 mg/kg of indomethacin. The anti-inflammatory effect was significant ($p<0.001$) in the dose of 100, 200, and 300 mg kg^{-1} of methanol extract when compared to the control Group [95]. *Momordica dioica* fruits pulp hexane extract and ethyl acetate extract significantly exhibited analgesic and anti-inflammatory activities [96]. *Momordica dioica* root ethanolic extract exhibited significant analgesic activity. The aqueous extract was found paralysis of earthworms after 1 h. as 91.6 percent [97].

Antidepressant Activity: The propylene glycol as vehicle control (5 ml kg^{-1}); 100, 200, and 300 mg kg^{-1} of methanol extract of *Momordica charantia* leaves were administered orally to the groups I to IV respectively and 5 mg kg^{-1} of imipramine (drug control) was administered intraperitonealy.

The extract treatment showed antidepressant effect by decreasing mobility time of subjected rats to forced swimming dose of 300 mg/kg extract, the swimming behaviour of the animals was comparable to the standard drug imipramine [98].

Acute Renal Failure Activity: *Momordica dioica* seeds ethanol extract possesses marked nephroprotective and curative activities without any toxicity due to its antioxidant activity and could offer a promising role in the treatment of acute renal injury caused by nephrotoxin-like gentamicin [99].

Antiallergic Activity: *Momordica dioica* roots show antiallergic activity for alcoholic extract [100].

Antiviral Activity: *In-vitro* antiviral activity against numerous viruses including Epstein-Barr, herpes, and HIV viruses. In an *in-vivo* study, a leaf extract has the ability to increase resistance to viral infections as well as to provide an immuno-stimulant effect in humans and animals (increasing interferon production and natural killer cell activity). Anti-viral activities of ribosome inactivating proteins from *Momordica charantia* an interesting paradigm emerges which may safely be used in treating viral diseases. It has been reported that ribosome inactivating proteins are a member of the single-chain ribosome inactivating protein (SCRIP) family which act irreversibly on ribosome by removing adenine residue from eukaryotic ribosomal RNA. Various activities of ribosome inactivating proteins include anti-tumor, broad anti-viral, ribonuclease, and deoxyribonuclease. MAP30 (Momordica Anti-HIV Protein), α- and β-momorcharins inhibit HIV replication in acutely and chronically infected cells and thus are considered potential therapeutic agents in HIV infection and AIDS [101].

Karela and its isolated phytochemicals also have been documented with *in-vitro* antiviral activity against numerous viruses, including Epstein-Barr, herpes, and HIV viruses [102, 103]. In an *in-vivo* study, a leaf extract demonstrated the ability to increase resistance to viral infections as well as to provide an immunostimulant effect in humans and animals (increasing interferon production and natural killer cell activity) [104]. Two proteins known as alpha-and beta- momorcharin (which are present in the seeds, fruit and leaves) have been reported to inhibit the HIV virus *in-vitro*).

In one study, HIV-infected cells treated with alpha- and beta-momocharin showed a nearly complete loss of viral antigen while healthy cells were largely unaffected [105]. In 1996 the inventors of the chemical protein along MAP-30 filed a U.S. patent, stating it was "useful for treating tumors and HIV infections. In treating HIV infection, the protein is administered alone or in conjunction with conventional AIDS therapies [106]. Another clinical study showed that MAP 30's antiviral activity was also relative to the herpes virus *in-vitro*.

Anticancer Activity: The $CHCl_3$ extract of *Momordica dioica* roots and five isolated constituents showed anticancer activity in pharmacologic testing on cancer cell [107]. The aqueous extract killed human leukaemia lymphocytes in a dose-dependent manner. Bitter Melon and Bitter Melon Extracts inhibit cancer and tumor. An inhibitory action on both viral and host cell RNA and protein synthesis. One clinical trial found very limited evidence that bitter melon might improve immune cell function in people with cancer, but this needs to be verified and amplified in other research.

Cytotoxic activity is a group of ribosomein activating proteins named alpha- and beta-momorcharins, momordins, and cucurbitacin B. Experimental studies reported that water extract blocked the growth of rat prostate carcinoma and hot water extract of the entire plant inhibited the development of mammary tumors in mice [108]. The clinical trials have not been conducted using *Momordica charantia* extracts in cancer patients; *in-vitro* studies indicate bitter melon fruit and seed extracts inhibit the growth of a number of cancer cell lines, including prostate adenocarcinoma, human colon cancer (Caco-2 cells), and the very much metastatic breast cancer cell line MDA-MB 231 [109, 110].

Antifeeedant and Antioviposition Activity: *Momordica dioica* fruit pulp hexane extract and ethyl acetate soluble fraction of methanolic extract exhibited moderate and concentration-dependent antifeedant activity against Spodoptera litura [111]. The methanol extract of bitter melon leaves exhibited strong oviposition deterrent activity against *Liriomyza trifolii* females on the host plant leaf when it was dipped in the methanol extract at a concentration of 1 gm of fresh leaf equivalent/ml [112].

Antimalarial and Mosquito Larvicidal Activity: *Momordica dioica* alcoholic extract screened *in-vivo* & *in-vitro* for antimalarial against NK 65 strain of Plasmodium bergheli, Jurinea macro-cephala, *Aegle marmelos*, were found to possess schizontocidal activity [113]. *Momordica charantia* was shown good larvicidal activity. The mosquito larvicidal property of *Momordica charantia* against three mosquito species- anopheles stephensi, *Culex quinquefasciatus* and *Aedes aegypti* (Diptera: Culicidae) [114].

Momordica charantia is traditionally regarded by Asians, as well as Panamanians and Colombians, as useful plant for preventing against used treating malaria. Laboratory studies have confirmed that various species of *Momordica charantia* have anti-malarial activity. Leaves are brewed in hot water to create a tea to treat malaria [115].

Antimicrobial, Antibacterial and Antifungal Activity: *Momordica dioica* root powder chloroform extract used to isolate two steroidal glycosides and alkaloids by a separate method, Glycosides were screened revealed a moderate antibacterial and a poor antifungal activity [116]. *Momordica dioica* fruits methanolic extract showed more promising antimicrobial and antioxidant activity as compared to aqueous extract [117]. The *in-vitro* studies have shown bitter melon extracts and the MAP30 protein analog, isolated from the seeds of *Momordica charantia* extracts, possess broad-spectrum antimicrobial activity. *Momordica charantia* extracts inhibit infection and growth of several viruses, including HIV, Epstein Barr virus.2 A and 24 Herpes simplex, a preliminary report on the effect of *Momordica charantia* extract in three HIV patients showed normalization of CD4/CD8 ratios with *Momordica charantia* treatment. It is believed *Momordica charantia* extracts inhibit HIV replication by preventing the syncytial formation and cell-to-cell infection. *Momordica charantia* extracts also appear to inhibit the growth of numerous gram-negative and gram-positive bacteria, including Salmonella, *E. co*li, Shigella, Staphylococcus, Pseudomonas, Streptococcus, Streptobacillus, & *H. pylori*, and parasitic organisms *E. histolytica* and Plasmodium falciparum [118-120].

Postcoital and or Antifertility Activity: The ethanol and water extracts of the fruit and leaf (ingested orally) to be safe during pregnancy However the seeds have demonstrated the ability to induce abortions in rats and mice, and the root has been documented with a uterine stimulant effect in animals. The fruit and leaf of bitter melon have demonstrated an *in-vivo* antifertility effect in female animals in male animals, it was reported to affect the production of sperm negatively. The momorcharins are effective in inducing early and mid-term abortions but have teratogenic effects [121]. *Momordica dioica* root aqueous and ethanol extracts were found to be most effective in causing significant postcoital antifertility activity [122].

Insecticidal activity: *Momordica dioica* seed oil solvent extract was found to be satisfactory mortality of mustard aphid provided 100% mortality in 24 h at 4% concentration due to presence of alkaloid momordicin in the oil [123].

Wound Healing Activity, Gastroprotective and Ulcer Healing Activities: *Momordica charantia* fruit powder, in the form of an ointment (10% w/w dried powder in simple ointment base) showed a statically significant response ($P < 0.01$) in terms of wound contracting ability, wound closure time, period of epithelisation, the tensile strength of the wound and regeneration of issues at wound site when compared with the control group, and these results were comparable to those of reference drug povidone-iodine ointment in excision, incision, and dead space wound model in rats [124]. *Momordica dioica* plant also gives gastroprotective and ulcer healing activities [125].

Immunomodulatory Activity: Immunomodulatory activity of *Momordica charantia* showed that it has a variable effect on the immune system in some conditions, like allograft rejection, someplace it was shown to have immuno-suppressive effect and in some other cases immunostimulant. Immunomodulatory activity has been attributed to an increase in interferon production and natural killer cell activity [126].

Anxiolytic Activity: The oral administration of 5 ml kg^{-1} of propylene glycol (vehicle control) Methanol extract of dried leaves of *Momordica charantia* (Cucurbitaceae) was investigated for anxiolytic activities in animal models. Anxiolytic activity of methanol extract of dried leaves of *Momordica charantia* was tested by elevated plus-maze test. The results showed a significant anxiolytic effect comparable with diazepam in all the tested doses [127].

Teratogenic Activity: The safety of its use during pregnancy has not been fully investigated. The water extract of the unripe fruit was given to pregnant Sprague Dawley rats on days 7, 8, 9, 10, 11, 12, 13, and 14 of gestation. The litter size was determined for each group, and the litters were examined for gross malformations.

The gross and histological examinations of various organs of the litters were also carried out. Results show that 8.65% of the litters from experimental animals were malformed as against 1.62% of control. It also showed that 31.2% of all the malformed litters had multiple congenital malformations. It also showed that the experimental rats had nine resorption sites while the control had none. This demonstrates that the water extract of *Momordica charantia* is teratogenic in Sprague Dawley rats and should be used with caution in man [128].

Anti-genotoxic Activity: The *Momordica charantia* decrease the genotoxic activity of methyl-nitrosamine, methanesulfonate and tetra-cycline, as shown by the decrease in chromosome breakage [129, 83].

General Study: *Momordica dioica* studied for the high-frequency plant regeneration from cotyledon derived callus [130]. *Momordica dioica* was studied for the adventitious shoot regeneration from immature embryo explant obtained from female and female [131]. *Momordica dioica* was studied for the techniques for propagation and breeding from the seed and pollen [132]. *Momordica dioica* studied for the organogenesis of four types of explants *viz.* node, shoot tip, leaf and the cotyledon, the cotyledon showed the best performance [133]. Shoot regeneration only from specific cotyledonary parts [134]. *Momordica dioica* studied for the Genetic relatedness (diversity) and cultivar identification by randomly amplified polymorphic DNA (RAPD) markers [24]. *Momordica dioica* studied for the morphological and physiological variation collected from different agro-ecological zones of Bangladesh, were evaluated for 29 morpho-physiological characters [31]. *Momordica dioica* studied for the tubers for perennating and prolonged tuber dormancy of 4–5 months [135]. The tetraploid and triploid forms in *Momordica dioica* reported collected from Khashi and Jayantia Hills of Assam, India [136, 137]. Teasle gourd grows in warm and humid weather, and tuberous roots are planted in pits. The vines are trained in bowers, and 5–10% of male parents are provided for a good fruit set. The plantation is done at the beginning of the summer when monsoon starts, lowering starts in April, and fruiting ends in October–November. The plants remain dormant in winter. The tubers are left in situ, and they overwinter [138, 139]. Genetic diversity in teasle gourd based on morpho-physiological variation [140, 31]. *Momordica dioica* evaluated as a grain protectant against callosobruchus chinensis on the stored legume-pulse grains [141]. *Momordica dioica* studied for local & botanical names, description, chemical compositions, parts used & medicinal uses [142]. *Momordica dioica* studied the disappearing medicinal plant of kottayam district of Kerala state [143]. *Momordica dioica* studied for the folk medicinal claims of western Utter Pradesh, India [144].

Toxicological Studies: The alcoholic extract of *Momordica charantia* fruits was found to enhance T3, T4 was reduced. Since two higher doses inhibited thyroid hormone concentrations and increased hepatic lipid peroxidation so *Momordica charantia* fruit extract, when used in excess, may prove to be harmful with respect to thyroid function and lipid peroxidation [145]. The administration of *Momordica charantia* extract up to 800 mg/kg^{-1} body weight is safe (P>5mg/kg) and tolerated by the body. *Momordica charantia* is, therefore, safe to use as an Ethnochemotherapeutic agent [146]. The plant contains substances with antidiabetic properties such as charantin, vicine, and polypeptide-p as well as other unspecific bioactive components such as antioxidants. Metabolic and hypoglycaemic effects of bitter gourd extracts have been demonstrated in cell culture, animal, and human studies [147]. There was a significantly decreased formation of micronucle, inhibited the formation of chromosomal aberrations, and increased the mitotic index. Hence, *Momordica charantia* has significant antimutagenic activity [148]. The Bitter melon may have hypoglycaemic effects, but data are not sufficient to recommend its use in the absence of careful supervision and monitoring [149].

CONCLUSION: The traditional knowledge system in the world is fast disappearing. So there is an urgent need for inventorying, recording & investigating all ethnobotanical information. In this paperwork on Literature Survey of plant *Momordica charantia* and *Momordica dioica* uses of plant been documented for their ethano-medicinal, phytochemical, pharmacological, and general study. This medicinal plant has dual

significance; firstly for promising future food, secondly for future pharmacological activities due to its some active constituents. These literature survey data may provide a base to start the search related to phytochemistry, pharmacology, pharmacognosy, and general investigations to researchers and practitioners related to this plant. Therefore, attention should also be made to the proper exploitation and utilization of this medicinal plant.

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