

Pharmacognostic and Phytochemical Investigation of *Morus Alba Linn.*

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Abstract : The present review is aimed at providing a comprehensive summary on the botany, utility, phytochemistry, pharmacology, and clinical trials of *Morus alba* (White Mulberry). The mulberry is the primary food for the silkworms for centuries. *Morus Alba* contains various Phytoconstituents such as Flavonoids as major constituents, Rich in Anthocyanins, Alkaloids, Terpenoids, Chalcones, Phenolic acids, Stilbenoids, Coumarins. *Morus alba* is native to China, India and Japan, where it has cultivated in North America, Europe and Africa. *Morus alba* possess various biological activities including like Anti-obesity, Antiviral, Antioxidant, Antihypoglycemic, Antibacterial, Anti-atherosclerotic, Anti-dopaminergic, Anticancer, Hepatoprotective, Hyperlipidemic, Immunomodulatory, Skin Brightening And Neuroprotective Activity.

Keywords: *Mulberry, Phytochemicals, Antihypoglycemic, Pharmacological properties, Morus AlbLinn*

I. Introduction: *Morus alba* Linn generally known as white mulberry has a place with family Moraceae is otherwise called Tut in India. *Morus alba* is a decently measured tree, 3 to 6 meters high. White mulberry is developed all through the world, any place silkworms are raised. The leaves of white mulberry are the primary food hotspot for the silkworms. In European nations it is developed for natural product creation and it is likewise utilized as vegetable in various regions of the planet, while in Japan mulberry leaves are utilized as tea and powder juice. 1-3 It is accounted for that in Chinese medication white mulberry has been broadly utilized in medication since 659 A.D and Chinese pharmacopeia records the root bark, stem, foods grown from the ground as a constituent in restorative preparations. Different plants have been accounted for their organic exercises, for example, anthelmintic, hostile to parasitic and against diarrheal properties. Because of its great remedial action and low poisonousness *M. alba* has been widely utilized in regular Chinese medication. *M. alba* is accounted for to have neuroprotective, skin tonic, cell reinforcement, hostile to hyperglycemic, antibacterial, antihypertensive, and against hyperlipidemic activities. Both the leaves and the natural products can be found in numerous food products. Fresh white mulberry leaves for tea are handled by whitening and not blanching. In the primary case tea tone is green and the other black. Mulberry tea leaves areas of strength for have properties. White mulberry leaves and wheat flour utilized for baking "paratha" - flatbread Indian famous all through the Indian subcontinent and other Asian nations. (3)

II. History/Origin

Morus alba is local to China, India and Japan, where it has developed in North America, Europe and Africa. *Morus alba* every now and again known as white mulberry. It has been accounted for that the general name of *Morus alba* got from Latin word *Mora* (delay) and *alba* (white). At the hour of Virgil, who passed on in 19 B.C. the expression of silkworm was not being perceived and silk framed as the result of mulberry leaves. Justinian from Constantinople was the first which presented silkworm culture. White mulberry is developed in all aspects of the world, any place silkworms are expanded. The significant nourishment for silkworms is mulberry leaves. During nineteenth and mid 20th hundreds of years, silk creation was significant in Europe and it was reached to its most extreme point in Korea and Japan in 20th 100 years. These days silk creation is overwhelmed by China and India. In Southern Jointed State, Southern Europe and in Asia, mulberry trees are utilized for arranging. (1)

III. Scientific Classification

Kingdom: Plantae

Subkingdom: Tracheobionta

Division: Magnoliophyta

Super division: Spermatophyta

Class: Magnoliopsida

Subclass: Hamamelidiales

Order: Urticales

Family: Moraceae

Genus: *Morus*

Species: *Morus Alba Linn.* (11)

Official Name- Morus Alba Linn.

IV. Synonym -: Sanskrit: Tutam; Hindi: Tut; English: Mulberry, White Mulberry; Malayalam: Malbari; Tamil: Musukette (2).

V. Morphological characterization

Leaf Colour- Pale Green

Leaf Lobe- lobed Or Unlobed

Length- 10-15cm

Shape- Acute

Fruit Colour: White

Fruit Taste: Little Sweet

Fruit Shape: Broad

Seed: Gray/Greyish Yellow (5)



FRUITS



STEM



LEAF



WHOLE PLANT



FLOWERS



ROOTS

VI. HABIT

Bush or tree 3.10 m tall. Bark dark, shallowly wrinkled. Branches fine shaggy. Winter buds rosy brown, ovoid, finely bristly. Stipules lanceolate, 2.3-5 cm, thickly covered with short pubescence. Petiole 1.5-5.5 cm, pubescent; leaf cutting edge praise to comprehensively applaud, sporadically lobed, 5.30 × 5.12 cm, abaxially scantily pubescent along midvein or in tufts in axil of midvein and essential horizontal veins, adaxially dazzling green and glabrous, base adjusted to ± cordate, edge coarsely serrate to crenate, pinnacle intense, taper, or coldhearted. Male catkins pendulous, 2.3-5 cm, thickly white bristly. Female catkins 1.2 cm, pubescent; peduncle 5.10 mm, pubescent. Male blossoms: calyx curves light green, comprehensively elliptic; fibers inflexed in bud; anthers 2-loculed, globose to reniform. Female blossoms: sessile; calyx curves ovoid, ± packed, with negligible hairs; ovary sessile, ovoid; style missing; marks of shame with mastoid like projection, branches disparate, papillose. Syncarp red when juvenile, blackish-purple, purple or greenish white when developed, ovoid, ellipsoid or barrel shaped, 1.2-5 cm. Fl. Apr-May. fr. May-Aug (4).

VII. HABITAT

Morus alba is local of India, China and Japan. It is every so often developed somewhere else in Europe, North America, and Africa. *Morus alba* is normally known as white mulberry. White mulberry is developed all through the world, any place silkworms are raised. The leaves of white mulberry are the fundamental food hotspot for the silkworms (2).

VIII. PLANT DESCRIPTION

The plant is normally a monoecious bush or a medium estimated tree with a barrel shaped stem and unpleasant, brown, in an upward direction fissured bark. Leaves are variable in size and shape, normally 5 to 7.5 cm long, frequently profoundly lobed, edges serrate or crenate-serrate, peak intense or presently sharpen, base cordate or shorten; 3 basal nerves, parallel nerves forked close to the edges. Blossoms are subtle and greenish: male spikes (catkins) are wide, round and hollow or ovoid, female spikes are ovoid and followed. Natural product (syncarp) comprises of numerous drupes encased in a plump perianth, ovoid or subglobose, up to 5 cm long, white to pinkish white, purple or dark when ready. (9)

IX. CULTIVATION

Mulberry trees can be spread by seeds, cuttings, or graftings. Seeds ought to be treated with camphor water prior to planting to avert illness. Flimsy layer of soil and cinders spread over seed subsequent to planting. Beds are kept soggy. Seeds sprout in 9 to 14 days, contingent upon the season. At the point when seedlings are around 7.5 cm tall, they are diminished and weeded. For bramble mulberries, seedlings 10 to 15 cm tall are utilized as transfers; for trees, seedlings are permitted to become 1.3 m and prepared prior to relocating. Branches are sliced into pieces 22 to 30 cm long with 3 buds and planted right away. Mulberry plants from seedlings are more costly, however give preferable plants over those from cuttings. Root joining is typically polished in India. Established cuttings are established in pits or wrinkles. At the point when water system is utilized, cuttings are established in wrinkles in April or May, 10 cm separated, the wrinkles being 22 cm separated. With this extremely close planting, 110,000 to 200,000 cuttings/ha are required. Joined plants foster a preferred root foundation over those from seedlings, cuttings, or layering, and are utilized solely in Japan. Joined trees are established 1.6 m separated every way, around 4,000/ha, and are particularly reasonable for flooded regions. Different procedures are utilized to prune and prepare mulberry plants. After each pruning, the field is developed and manured. (12)

X. POST- HARVEST TECHNOLOGY/ COLLECTION

Mulberries are exceptional as they are succulent and it very well may be tracked down in pre-summer. Best time for reaping leaves is at night. Ideal method for gathering mulberries, is tenderly shake stems subsequent to spreading a snare under each stem which will permit matured mulberries to tumble down. In any case, an extraordinary distinction is seen in new and dried white mulberries. New white mulberries are succulent with extreme flavor whose power enormously lost when it utilized in dry structure (16).

It is very hard to store them in soggy circumstances, since they have short life. These can be put away in cooler for 2-3 days as it were. In this manner, for the drawn out stockpiling white mulberries can be dried out in the sun. Dehydrator can likewise be utilized for drying reason. When white mulberries dried totally they can be utilized more than 1-2 years around. As that of ready natural product, leaves of white mulberry can likewise be put away for long haul subsequent to drying. Assuming that dried leaves are cut into shreds, they lost the vast majority of their fragrance and flavor. White mulberry leaves and matured natural products are store in shut jolts from temperature and focused energy heat. One more method of capacity in freezing, as freezing is the simplest way for conservation (8).

XI. PROCESSING

Like different berries, white mulberry is used in a different way for assortment of purposes. The matured natural products or leaves of white mulberries are put away by freezing them which increment their shell life. The dried type of white mulberries products of the soil can be utilized for 1-2 years by putting away those in air tied boxes safeguarded from intensity, dampness and temperature. White mulberry leaves rejuvenating balm can be separated by two different extraction techniques named as traditional hydro refining (HD) and dissolvable free microwave extraction (SFME). Many detailed concentrate on show that mulberry leaves are without caffeine, brimming with amino acids and 16-27% proteins, contingent on species (7).

XII. PHYTOCHEMISTRY OF M.ALBA

M. alba leaves have cancer prevention agent parts, which incorporates rutin, isoquercitrin, astragalins and quercetin-3-(6-malonyl) glucoside among which quercetin - 3-(6-malonyl) glucoside is most plentiful in dried mulberry leaf separate. M. alba extricates have 13 known compounds. The particular inhibitory impact of caffeic corrosive on leukotriene biosynthesis and inferred that M. alba has high measure of caffeic corrosive, which specifically hinders leukotriene biosynthesis, that obviously assume a crucial part in different illnesses like asthma, unfavorably susceptible responses and irritation. The determination of the extraction dissolvable is exceptionally basic stage to extricate the greatest amount of dynamic constituents since cancer prevention agent parts have shifting polarities. Most productive answer for the extraction of polyphenolic compound is 40% and 80% watery arrangement of ethanol and methanol. In any case, the most reasonable extraction dissolvable for all out phenolic contents extraction in hazelnuts is 80% ethanol arrangement decided three additional mixtures in mulberry leaves which are quercetin 3-O- β glucopyranoside-7-O- α -rhamnopyranoside, kaempferol-7-O-glucoside and quercetin-3-O-rhamnopyranoside-7-O glucopyranoside. This study presumed that mulberry leaves are most extravagant wellspring of phytochemicals, which are gainful for the wellbeing and can be utilized as vegetable. Complete scope of polyphenolic compounds quantitatively resolved is recorded underneath in following table (11)

Table 1

<i>Compound class and name</i>	<i>Part</i>
Terpenoids	
Betulinic acid	Root bark
Ursolic acid	Root bark
Uvaol	Root bark
Alkaloids	
Calystegins B2, C1	Root
1-Deoxynojirimycin	Root
2 α , 3 β -Dihydroxynortropane	Fruit
2 β , 3 β -Dihydroxynortropane	Fruit
1, 4-Dideoxy-1, 4-imino-pD-arabinitol	Root
1, 4-Dideoxy-1, 4-imino-pD-ribitol	Root
1, 4-Dideoxy-1, 4-imino-(2-O- β -pD-glucopyranosyl)-d-glucopyranosyl)-D-arabinitol	Root
Fagomine	Root
3-epi-Fagomine	Root
2-[2-Formyl-5-(hydroxymethyl)-1-pyrrolyl-]3-methyl pentanoic acid lactone	Fruit
2-(5-Hydroxymethyl-2', 5'-dioxo-2', 3', 4', 5'-tetrahydrobipyrrole) carbaldehyde	Fruit
2-(5-Hydroxymethyl-2-formylpyrrol-1-yl) isovaleric acid lactone	Fruit
2-(5-Hydroxymethyl-2-formylpyrrole-1-yl) propionic acid lactone	Fruit
2-(Hydroxymethyl-2-formylpyrrole-1-yl) isocaproic acid lactone	Fruit
N-Methyl-1-deoxynojirimycin	Root
Methyl 2-[2-formyl-5-(methoxymethyl)-1H-pyrrol-1-yl]-3-(4-hydroxyphenyl) propanoate	Fruit
Methyl 2-[2-formyl-5-(methoxymethyl)-1H-pyrrole-1-yl] propanoate	Fruit
Morroles B-F	Fruit

Chalcones	
Morachalcones B, C	Leaf
Flavonoids	
Astragalin	Leaf
Atalantoflavone	Leaf
Benzyl d-glucopyranoside	Leaf
Cyclomorusin	Leaf, Root bark
3', 8-Diprenyl-4', 5, 7-trihydroxyflavone	Leaf
Dihydrokaempferol 7-O- β -D-glucopyranoside	Leaf
Cyclomulberrin	Leaf
Epigallocatechin	Fruit
Epigallocatechin gallate	Fruit
Euchrenone a7	Leaf
Gallocatechin	Fruit
Gallocatechin gallate	Fruit
6-Geranylapigenin	Twig
8-Geranylapigenin	Leaf
6-Geranylnorartocarpetin	Twig
7-Hydroxyl-8-hydroxyethyl-4'-methoxyflavane-2'-O- β -D-	Leaf
Isoquercitrin	Leaf
8-Hydroxyethyl-7, 4'-dimethoxyflavane2'-O- β -D-glucopyranoside	Leaf
Isorhamnetin glucuronide	Fruit
Isorhamnetin hexoside	Fruit
Isorhamnetin hexosylhexoside	Fruit
Kaempferol	Leaf
Kaempferol 3-O- β -D-rutinoside	Leaf

Kaempferol 3-O- β -D-glucopyranoside	Leaf
Kaempferol glucuronide	Fruit
Kaempferol hexoside	Fruit
Kaempferol hexosylhexoside	Fruit
Kaempferol rhamnosylhexoside	Fruit
Kuwanons A–C, E, G, H, J, S, T	Leaf, Root bark
7-Methoxyl-8-ethyl-2', 4'-dihydroxyflavane-2''-O- β -D-glucopyranoside	Laf
7-Methoxyl-8-hydroxyethyl-2', 4'-dihydroxyflavane	Leaf
7-Methoxyl-8-hydroxyethyl-4'-hydroxyflavane-2'-O- β -D-glucopyranoside	Leaf
Morusin	Leaf, Root
Naringin	Fru
Norartocarpetin	Leaf
Oxydihydromorusin	Root bark
Quercetin	Leaf, Fruit, Twig
Quercetin 3, 7-di-O- β -D-glucopyranoside	Leaf
Quercetin 3-O-(6''-O-acetyl)- β -D-glucopyranoside	Leaf
Quercetin 7-O- β -D-glucopyranoside	Leaf
Scopolin	Leaf
Anthocyanins	
Cyanidin 3-O-glucoside	Fruit
Cyanidin 3-O-rutinoside	Fruit
Delphinidin acetylhexoside	Fruit
Delphinidin hexoside	Fruit
Delphinidin rhamnosylhexoside	Fruit
Pelargonidin 3-O-rutinoside	Fruit
Pelargonidin hexoside	Fruit

Phenolic acids	
Ellagic acid	Fruit
Ferulic acid	Leaf, Fruit
Gallic acid	Leaf, Fruit
Gentisic acid	Fruit
Stilbenoids	
Alabafuran A	Root bark
Artoindonesianin O	Root bark
Chalcomoracin	Leaf
Coumarins	
Isoscooletin 6-(6-O- β -apiofuranosyl- β -glucopyranoside)	Stem
5, 7-Dihydroxycoumarin 7-(6-O- β -D-apiofuranosyl- β -d-glucopyranoside)	Bark
5, 7-Dihydroxycoumarin 7-O- β -D-glucopyranoside	Root bark
5, 7-Dihydroxycoumarin 7-O- β -d-apiofuranosyl-(1 \rightarrow 6)-O- β -D-glucopyranoside	Root bark
6, 7-Dihydroxycoumarin 7-(6-O- α -rhamnopyranosyl- β -D-glucopyranoside)	Bark

XIII. PHARMACOLOGICAL REVIEW

Anti-obesity effect

Mulberry leaves stifled body weight gain instigated by ongoing ingestion of high-fat eating regimen. Toward the finish of study, the last body weight of creatures took care of with mulberry leaves was lower than the benchmark group. The heaviness of instinctive fat tissues and muscle to fat ratio mass additionally reduced. The above results from anthropometric estimation were affirmed by minute examination. It was exhibited that mulberry leaves fundamentally brought down the quantity of adipocytes, as well as the number and size of lipid drops in the cells. Besides, a continuous height of flowing adiponectin level, which is the counter adiposity cytokine, was seen after long haul ingestion of mulberry leaves. Restraint of adipogenesis was expressed as the significant component of activity. As to western smudge examination, the lower articulation levels of SREBP-1 and PPAR-c, which are transcriptional elements of adipocyte separation, in the cells treated with mulberry leaves extricate were recognized. Articulation of the key lipogenic catalysts, for instance, FAS and acetyl-coenzyme A carboxylase (ACC), likewise notably were declined by mulberry leaves. Moreover, adipocyte apoptosis was upgraded by the concentrate in vitro models, adding to the declines in experienced and practical adipocytes. It was theorized that phenolics were liable for against weight impact of mulberry leaves.(14)

XIV. Antiviral Activity

A characteristic substance, 1-deoxynojirimycin, found in mulberry roots and seeds might be viable in the treatment of Helps contamination. The liquor concentrate of San Baipi (Morus alba root), a conventional Chinese medication for hack, asthma and different illnesses, showed movement against HIV in-vitro. Three enemy of HIV flavonoids: morusin, kuwanon H and morusin-4 ϕ - glucoside were secluded. The AntiHIVactivity and cytotoxicity of the subsidiaries morusin-2 ϕ - glucoside, morusin-4 ϕ - glucoside, kuwanon H-6 ϕ - acetic acid derivation, kuwanon H-7-acetic acid derivation and triacetate mulberrofuran D still up in the air. Another examination detailed that a prenylated flavonoid,moralbanone, alongside seven realized flavonoid compounds kuwanon S, mulberroside C, cyclomorusin, eudraflavone B hydroperoxide, oxydihydromorusin, leachianone G and a - acetylamyrin disengaged from the root bark of Morus alba varied in their antiviral movement. Leachianone G showed powerful antiviral action (IC 50 = 1.6 m g/ml), while mulberroside C showed frail action (IC 50 = 75.4 m g/ml) against Herpes Simplex sort 1 infection (HSV-1). (15)

XV. Antioxidant Activity

M. alba is rich in polyphenolic intensifies particularly the flavonoids and among the flavonoids quercetin 3-(6-malonylglucoside) is generally critical for cell reinforcement capability of mulberry plant. The leaves of mulberry contains higher measure of quercetin which is answerable for decrease of oxidation process in vivo and in vitro. The ethanolic concentrate of *M. alba* leaves contains oxyresveratrol and 5,7-dihydroxycoumarin 7-methyl ether which rummage superoxide and have cell reinforcement potential. Comparably fluid concentrate of *M. alba* leaves showed most noteworthy cancer prevention agent properties assessed through ferric diminishing/cell reinforcement power measure. Anthocyanin parts from *M. alba* organic product were confined and recognized to really take a look at their cell reinforcement action and revealed that cyanidin 3-glucoside and cyanidin 3-rutinoside are vital as antioxidants. Mulberroside A will be a significant stilbene glycoside of *M. alba* and It showed inhibitory impacts against FeSO₄/H₂O₂-prompted lipid per oxidation in microsomes of rodent and furthermore found that Mulberroside An affect DPPH (1,1-diphenyl-2-picrylhydrazyl) extremist detailed that the anthocyanin is available in mulberry concentrate and it is a characteristic colorant constituent for the plant. Anthocyanins showed cell reinforcement movement by searching the peroxy revolutionaries in catching response. (11)

XVI. Anti Hypoglycemic Activity

Hypoglycemia is a condition that happens when glucose level is too low in body. Diabetes mellitus is brought about by the insufficiency of the insulin created by pancreas. The Diabetes mellitus is a gathering of metabolic problems. It is described by high glucose (glucose) levels. This high glucose (glucose) levels is because of the imperfections in insulin discharge, or its activity, or both. The sickness diabetes mellitus was first recognized as an illness related with "sweet pee," and unnecessary muscle misfortune in the old world. Expanded degrees of blood glucose (which may likewise called as hyperglycemia) lead to spillage of glucose into the pee, consequently the term sweet pee. Because of deficiency of insulin discharged by pancreas the fixation level of glucose expansion in blood which hurt many body frameworks in explicitly the veins and nerves. The leaves of mulberry are one of the significant home grown meds utilized for the treatment of hyperglycemia. It is compelling in adjusting the nitric oxide synthase articulation in the nerve center of streptazotocin treated rodents. *M. rubra* leaf remove applies its antidiabetic movement in streptazotocin actuated diabetic rodents by diminishing the fasting glucose levels, glycosylated hemoglobin and expanding the plasma insulin and C-peptide levels. A concentrate on mulberry leaf concentrates and found that mulberry leaf remove goes about as a characteristic inhibitor of α glucosidase due to deoxynojirimycin (DNJ) and its subsidiary. 1-Deoxynojirimycin (DNJ), a known antidiabetic guideline from mulberry has been displayed to repress gastrointestinal glucosidases bringing about decrease of blood glucose. Fagomine, one of the parts present in mulberry leaves is fit for prompting insulin emission in segregated rodent islet cells. Moracin M, steppogenin-4'-O- β -D-glucoside and mulberroside A were likewise secluded from the root bark of *M. Alba* and every one of the three flavones showed hypoglycemic impact in alloxan actuated diabetic mice. The concentrates from the root bark of mulberry tree contains some components which showed hypoglycemic capability, had guarded outcomes on pancreatic β cells, deter their degeneration and diminished lipid peroxidation. (17)

VII. Hepatoprotective Activity

Extricates from leaves of *M. alba* displayed hepatoprotective action. Carbon tetrachloride created tremendous changes in biochemical boundaries (expansions in serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), alanine phosphatase (Snow-capped mountain) and serum bilirubin) and histological (harm to hepatocytes), utilizing Standard medication Liv-52. Pretreatment with alcoholic and fluid concentrates essentially forestalled the biochemical and histological changes actuated by CCl₄ in the liver. The current review shows that the drunkard and watery concentrates had hepatoprotective action. (12)

VIII. Hyperlipidemia activity

Hyperlipidemia is a described by overabundance cholesterol and greasy substances in the blood. Hyperlipidemia is a gamble factor for coronary illness. Diabetes mellitus is connected with various types of lipid characteristic. The lipaemia, cholesterol, particularly LDL (low-thickness lipoprotein) and VLDL (Exceptionally low-thickness lipoprotein) cholesterol are participated in the development of atherosclerosis and related irregularities. *Morus Alba* known for its restorative properties and generally utilized for hypolipidemic exercises. Utilization of MRBF-2 part of *M. Alba* L. root bark (70% liquor extricate) may go about as strong hypocholesterolemic supplement and hindrance of LDL antherogenic adjustments and lipid peroxidase arrangement in hypocholesterolemic rats. Moracin present in mulberry leaves are fit for hindering lipid peroxidation that firmly shows their job as scrounger. Mulberroside An arranged from ethanol root concentrate of *M. Alba* and its aglycone subsidiary (oxyresveratrol) delivered from mulberroside A by enzymatic transformation have been assessed for their antihyperlipidemic impacts in two rodent models. Mulberry remove showed the hypolipidemic impacts which raise (Low thickness lipoprotein receptor) LDLR quality articulation and the leeway capability of LDL (Low-thickness lipoprotein) and a decrease in the lipid biosynthesis. (10)

XIX. Antibacterial Activity

Kuwanon G disengaged from the ethyl acetic acid derivation part of methanol concentrate of *Morus alba* showed antibacterial action against oral microorganisms. MIC of kuwanon G against *Streptococcus mutans* causing dental not entirely set in stone to be 8.0 m g/ml. Kuwanon G totally inactivated *S. mutans* at the fixation 20 m g/ml quickly. Kuwanon G likewise altogether repressed the development of other cariogenic microorganisms, for example, *Streptococcus sobrinus*, *Streptococcus sanguis* and *Porphyromonas gingivalis* causing periodontitis. Transmission electron microscopy (TEM) of kuwanon G treated cells exhibited wonderful morphological harm of the cell wall and buildup of the cytoplasm. The accompanying prenylated flavonoids from *Morus alba*, kuwanon C, mulberrofuran G, albanol B showed solid antibacterial action with 5-30 m g/ml of MICs, while morusin,

sanggenon B and D, were compelling to just gram positive microbes. Nine 2-arylbenzofurans secluded from *Morus* species including *M. alba* were tried for their antimicrobial exercises against methicillin-touchy *Staphylococcus aureus* (MSSA), methicillin-resistant *S. aureus* (MRSA), *Micrococcus luteus*, *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Among these mixtures, chalconorcin (a leaf phytoalexin of mulberry tree) displayed significant antibacterial action against MRSA (MICs 0.78 mg/ml). The purified compound, 1-deoxynojirimycin (DNJ) of *M. alba* applied an eightfold more prominent decrease of MIC against *Streptococcus mutans* than the unrefined concentrate (MICs, 15.6 and 125 mg/l, individually). The concentrate firmly hindered biofilm development of *S. mutans* at its dynamic collection and level stages. The cleaned compound prompted a 22% more prominent decrease in salt dissolvable polysaccharide than in water-solvent polysaccharide. DNJ likewise misshaped the biofilm engineering of *S. mutans*. The discoveries proposed a forthcoming job of DNJ as a helpful specialist by controlling the excess and biofilm development of *S. mutans*. (15)

XX. Anti-atherosclerotic activity

Advantageous impact of dietary admission for quite some time of 1% *Morus alba* leaf powder on atherogenesis in apolipoprotein E-lacking mice have been accounted for, apparently expanding slack season of lipoprotein oxidation in the *Morus alba* separate treated bunch contrasted and control bunch. Remove treated bunch additionally shows 40% decrease in atherosclerotic sore size in the aorta. Thus antioxidative mixtures in with solid free extreme *Morus alba* rummaging and lipoprotein oxidation restraint movement can assist with forestalling atherosclerosis. Water remove bring down the serum cholesterol and fatty oil and smother movement of atherosclerosis in elevated cholesterol diet-took care of bunnies, perhaps because of deterrent impact of anthocyanins against Low Thickness Lipoprotein-oxidation in the blood vessel wall. Subsequently water concentrate may be investigated for bringing down the occurrence of atherosclerosis and coronary illness. In one review the degrees of fatty substance, cholesterol and low-thickness lipoprotein in the serum of hares treated with natural product remove were lower than that in the benchmark group. Correspondingly freeze-dried mulberry organic product powder (5% and 10%) brought down serum and liver absolute cholesterol, fatty substance, hindered lipid peroxidation and expanded cancer prevention agent protein movement in rodents, subduing improvement of atherosclerosis in hyperlipidemic rodents. (18)

XXI. Anti-dopaminergic Activity

The methanolic concentrate of *Morus alba* L. leaves was assessed on haloperidol and metoclopramide actuated catalepsy, foot shock-induced hostility, amphetamine-prompted generalized conduct and phenobarbitone incited resting in mice. Further the inhibitory impact of the concentrate on dopamine was concentrated on utilizing disconnected rodent vas deferens. The concentrate created critical portion subordinate potentiation of haloperidol and metoclopramide prompted catalepsy in mice. The concentrate essentially diminished number of battles and expanded idleness to battles in foot shock-prompted hostility; it likewise diminished amphetamine instigated generalized conduct in a portion subordinate way. The dozing time incited by phenobarbitone also was delayed. The concentrate hindered constrictions created by dopamine on separated rodent vas deferens. The results propose that the leaves of *Morus alba* L. may have likely clinical application in the administration of mental problems (20).

XII. Immunomodulatory Activity

The impact of *Morus alba* on the insusceptible framework was assessed by utilizing different trial models, for example, carbon leeway test, cyclophosphamide instigated neutropenia, neutrophil bond test, impact on serum immunoglobulins, mice lethality test and roundabout 17 haemagglutination test. *Ocimum sanctum* was utilized as standard medication. *Morus alba* extricate uninterested portions expanded the degrees of serum immunoglobulin and forestalled the mortality prompted by ox-like *Pasteurella multocida* in mice. It likewise expanded the circling counter acting agent titre in roundabout haemagglutination test. Then again, it showed critical expansion in the phagocytic file in carbon freedom measure, a huge security against cyclophosphamide prompted neutropenia and expanded the bond of neutrophils in the neutrophil grip test. Subsequently, it was inferred that *Morus alba* increments both humoral resistance and cell intervened invulnerability (21).

In another review fluid leaf concentrate of *Morus alba* was assessed for the immunomodulatory movement. Wistar rodents were utilized as the example. The concentrate is tried for extreme touchiness and haemagglutination response involving sheep red platelets as the antigen. The *Morus alba* offers an expansion in postponed type extreme touchiness response and the impact is similar with that of the standard medication levamisole. It actuates no critical modifications in neutralizer titer esteem. *Morus alba* anyway works with a significant expansion in complete leukocyte, lymphocyte, neutrophil and eosinophil count portions conditionally. *Morus alba* was found to incite a superior immunomodulatory movement. It is surmised that *Morus alba* fluid concentrate invigorates the natural or vague resistant framework in a portion dependant way and doesn't animate the versatile safe framework in intervening immunomodulatory property (22)

XIII. Skin-brightening properties

Mulberrosin F present in methanol leaf concentrate of *Morus alba* shows hostile to tyrosinase movement a lot more grounded than kojic corrosive and furthermore represses melanin development in melana cells. Oxyresveratrol displays an inhibitory movement that is 32-overlay more grounded than kojic corrosive (24).

Oxyresveratrol having four hydroxy gatherings and resveratrol having three hydroxy gatherings are two hydroxystilbenes viewed as in. *Morus alba* Additionally present are norartocarpetin, euchrenone and quercetin showing antityrosinase action, which is essentially more grounded than kojic corrosive Morin, resveratrol, maclurin, rutin, isoquercitrin. Furthermore, morin have been

segregated from ethanol mulberry twig remove. Resveratrol has skin brightening movement and is likewise compelling in different neurodegenerative and cardiovascular illnesses, diabetes and disease. (23)

XIV. Neuroprotective activity

Cyanidin 3-O- β -D-glucopyranoside (C3 G) introduced free revolutionary searching and aggravation smothering action and shielded mind from endothelial brokenness. Usage of mulberry leaves decreases the gamble of Alzheimer's illness. Mulberry leaf remove gave a reasonable treatment to Alzheimer's illness through the hindrance of amyloid beta-peptide fibril development and constriction of amyloid β -peptide initiated neurotoxicity. (6)

XV. Anticancer Activity

Across the globe various types of malignant growth is the most lethal sickness. Many kinds of prescriptions are accessible on the lookout for the therapy of malignant growth yet the quantity of effective and safe medication is not very many. Anthocyanins removed from the M. Alba organic product shows an attack in human lung metastatic A549 carcinoma cells. Flavonoids separated from the leaves of this plant goes about as a disease restraining profile specialist. From root bark of mulberry Albanol A (Mulberrofuran G) can be removed which prompt strong cytotoxicity in HL60 (Human Leucemia Cell line) by hindering topoisomerase II movement. M. alba leaf remove shows hostile to proliferative lectin actuated cell demise by apoptosis in human bosom disease (MCF-7) and colon malignant growth (HCT-15) by prompting DNA fracture and morphological changes. Flavanone glycosides present in the root bark of M. alba having hostile to expansion action against human ovarian disease in Ho-8910 cells (19)

XVI. Anti-inflammatory activity

The methanol root bark concentrate of M. alba has been answered to have calming movement. Nitric oxide is estimated utilizing the Griess strategy, and iNOS and proteins controlling NF- κ B and ERK1/2 flagging are dissected by Western blotting. Results show that the calming impact of the concentrate is interceded through hindrance of NF- κ B and actuation of ERK1/2. Of the compounds detached from the methanol root bark separate, kuwanons C and G have mitigating action. Additionally, the methanol branch concentrate of M. alba and its dynamic compound oxyresveratrol additionally have mitigating action. The logical system includes the hindrance of CXCR-4-intervened chemotaxis and MEK/ERK pathway in T what's more, other safe cells.(13)

VII. Conclusion

Mulberry being the primary food for silkworm mulberry plant is also considered as the important traditional herbs widely used in medicine from centuries ago .Mulberry is rich in phenols anthocyanins, flavonoids , alkaloids, Terpenoids , Chalcones , Stilbenoids , Coumarins possess pharmacological properties including antioxidant, anti-inflammatory, anticarcinogenic, antibacterial, antiviral, anti-obesity, anti-apoptotic, anti-diabetic, neuroprotective activities. The Phytochemical composition varies with the species of Morus and the plant part use.

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