Review
of
Literature
REVIEW OF LITERATURE

VERBENACEAE

This family contains naphthaquinones & used as oral contraceptive in Central Europe due to presence of hormonal substances.

A family of about 100 genera & 3000 species; herbs, shrubs and trees, many lianes. Genera include Tectona (3 species), Lippia (220 species), Verbena (250 species), Callicarpa, (140 species), Vitex (250 species), Nyctanthes, Duranta & Stilbe. Teak is obtained from Tectona grandis; Verbena oil from Lippia citriodora; & Vervain, formerly official, from Verbena officinalis. Among the constituents found in the family are volatile oils, saponins, tannins, quinines, iridoids, piscicidal substances; alkaloids seem to be rare.


*Habit and leaf form:* Trees, shrubs, and herbs, or lianas (many); non-laticiferous and without coloured juice; bearing essential oils. ‘Normal’ plants and switch-plants; sometimes with the principal photosynthesizing function transferred to stems. Leaves well developed, or much reduced (occasionally). Plants non-succulent. Self supporting, or climbing; the climbers stem twiners, or scrambling; Clerodendrum twining clockwise. Mesophytic and xerophytic. Leaves opposite (usually), or whorled, or alternate (rarely); petiolate to sessile; foetid, or without marked odour, or aromatic; simple, or compound; epulvinate; when compound, ternate to pinnate (e.g. Vitex), or palmate. Lamina dissected, or entire; when dissected,
pinnatifid; pinnately veined; cross-venulate. Leaves exstipulate; without a persistent basal meristem. Domatia recorded (4 genera); represented by pits, or pockets, or hair tufts.

*Leaf anatomy*: The mesophyll with sclerenchymatous idioblasts, or without sclerenchymatous idioblasts. Minor leaf veins without phloem transfer cells (6 genera).

*Stem anatomy*: Young stems tetragonal (often), or cylindrical, or oval in section. Cork cambium present; initially deep-seated (rarely), or superficial. Nodes unilacunar (1–several traces). Internal phloem absent. Secondary thickening developing from a conventional cambial ring. The secondary phloem not stratified. 'Included' phloem absent. Xylem with libriform fibres; with vessels. Vessel end-walls simple. Vessels without vestured pits.

*Reproductive type, pollination*: Plants hermaphrodite (usually). Entomophilous.

*Inflorescence, floral, fruit and seed morphology*: Flowers usually aggregated in 'inflorescences'; in cymes, in racemes, in spikes, in heads, and in verticils. The terminal inflorescence unit cymose, or racemose. Inflorescences terminal, or axillary; with involucral bracts (often, these commonly coloured), or without involucral bracts; pseudanthial (sometimes), or not pseudanthial. Flowers bracteate; small to medium-sized; very irregular (usually), or regular to somewhat irregular. The floral irregularity involving the perianth and involving the androecium. Flowers (4–)5(–8) merous; cyclic; tetracyclic. Free hypanthium absent. Hypogynous disk present, or absent; when present, annular.
Perianth with distinct calyx and corolla; (7-) 10 (-16); 2 whorled; isomerous, or anisomerous. Calyx (2-) 5(-8); 1 whorled; gamosepalous; entire, or lobulate, or blunt-lobed, or toothed. Calyx lobes markedly shorter than the tube to markedly longer than the tube. Calyx unequal but not bilabiate, or regular, or bilabiate (e.g. Phyla); persistent; when K5, with the median member posterior. Corolla (4-) 5(-8); 1 whorled; gamopetalous. Corolla lobes markedly shorter than the tube, or about the same length as the tube. Corolla imbricate; tubular (usually), or campanulate (rarely); unequal but not bilabiate, or bilabiate, or regular (rarely).

**Androecium (2-) 4(-5)**: Androecial members adnate (to the corolla tube); markedly unequal (usually), or all equal (rarely); free of one another; 1 whorled. Androecium exclusively of fertile stamens, or including staminodes. Staminodes when present, 1-3; in the same series as the fertile stamens; representing the posterior median member, or the posterior median member and the posterior-lateral pair; non-petaloid. Fertile stamens representing the posterior-lateral pair and the anterior-lateral pair (usually), or the anterior-lateral pair, or the posterior median member, the posterior-lateral pair, and the anterior-lateral pair. Stamens (2-) 4(-5) (the posterior member usually, and sometimes the three upper members, reduced or missing); inserted near the base of the corolla tube, or midway down the corolla tube, or in the throat of the corolla tube; usually didynamous; reduced in number relative to the adjacent perianth (usually), or isomerous with the perianth; oppositisepalous; alternating with the corolla members. Anthers connivent (in pairs), or separate from one another; dorsifixed; dehiscing via longitudinal slits; introrse; tetrasporangiate. Endothecium developing fibrous thickenings. Anther epidermis persistent. Microsporogenesis simultaneous. The initial microspore tetrads tetrahedral, or isobilateral, or decussate. Anther wall initially with one middle layer; of
the 'dicot' type, or of the 'monocot' type. Tapetum glandular. Pollen grains
aperturate; (2-) 3 (-5) aperturate, or 6 aperturate; colpate, or colporate, or
rugate; 2-celled, or 3-celled.

**Gynoecium**: 2 carpelled (usually), or 4 carpelled, or 5 carpelled.
Carpels reduced in number relative to the perianth (usually), or isomerous
with the perianth. The pistil 2–10 celled. Gynoecium syncarpous; eu-
syncarpous; superior. Ovary 2 locular, or 4-5 locular (but the original locules
(usually two) early becoming divided by a 'false septum' in each - cf.
Labiatae). Locules secondarily divided by 'false septa' (usually), or without
‘false septa’. Gynoecium usually median; stylate. Styles 1; attenuate from
the ovary, or from a depression at the top of the ovary (but the ovary apex no
more than slightly lobed); apical, or lateral. Stigmas 1; 1 lobed, or 2 lobed;
wet type; papillate; Group III type and Group IV type. Placentation basal to
axile, or axile. Ovules 2 per locule (i.e. in the true locules, one each in the
locelli); pendulous, or horizontal, or ascending (but always with the
micropyle directed downwards); non-arillate; orthotropous, or
hemianatropous, or anatropous; unitegmic; tenuinucellate. Endothelium not
differentiated. Embryo-sac development Polygonum-type. Antipodal cells
formed; 3; not proliferating; ephemeral (usually), or persistent. Synergid
usually hooked (and beaked). Endosperm formation cellular. Endosperm
haustoria present; chalazal and micropylar (the latter usually the less well
developed). Embryogeny onagrad.

**Fruit**: fleshy (usually), or non-fleshy; dehiscent (rarely), or
indehiscent (mostly), or a schizocarp. Mericarps when schizocarpic, 4
(usually), or 8–10, or 2; comprising nutlets, or comprising drupelets. Fruit
when non-schizocarpic a drupe (usually), or a capsule. Capsules valvular
(with 2–4 valves). The drupes with separable pyrenes, or with one stone.
Seeds non-endospermic (except Nesogenes). Cotyledons 2 (expanded, flat). Embryo achlorophyllous (5/5); straight.

**Seedling:** Germination phanerocotylar, or cryptocotylar.

**Physiology & biochemistry:** Cyanogenic, or not cyanogenic. Alkaloids present, or absent. Iridoids detected; ‘Route I’ type (normal, in some Verbena), or ‘Route II’ type (mostly, normal and decarb.). Arthroquinones detected (Tectona); derived from shikimic acid. Verbascosides detected (5 genera, excluding Phyla). Cornoside detected (Phyla). Proanthocyanidins absent. Flavonols absent. Ellagic acid absent (5 genera, 6 species). Ursolic acid present. Saponins/sapogenins present, or absent. Aluminium accumulation not found. Sugars transported as oligosaccharides + sucrose (the 8 genera screened all particularly rich in oligosaccharides). C₃. C₃ physiology recorded directly in Verbena. Anatomy non-C₄ type (Cleodendron, Lantana, Premna, Stachytarpheta, Verbena, Vitex).

**Geography & cytology:** Temperate, or sub-tropical to tropical (mainly). Very widespreadtemperate and tropical, but absent from central and Northern Eurasia. X = 5–12.

**Taxonomy:** Subclass Dicotyledonae; Tenuinucelli. Dahlgren’s Superorder Lamiiflorae; Lamiales. Cronquist’s Subclass Asteridae; Lamiales. APG (1998) Eudicot; core Eudicot; Asterid; Euasterid I; Lamiales. Species about 3000. Genera about 90; Acantholippia, Adelosa, Aegiphila, Aloysia, Amasonia, Archboldia, Asepalum, Baillonia, Bouchea, Burroughsia, Callicarpa, Caryopteris, Casselia, Chascanum, Citharexylum, Clerodendrum, Coelocarpum, Coelocarpum, Cornutea, Cyclocheilon, Dimetra, Diostea, Dipyrena, Duranta, Faradaya, Garretia, Geunsia, Glandularia, Glossocarya, Gmelina, Hierobotana, Holmskioldia, Hosea, Huxleya, Hymenopyramis, Junellia, Karomia, Lampaya, Lantana, Lippia, Monochilus, Nashia,
Neorapinia, Neosparton, Nesogenes, Oncinocalyx, Oxera, Paravitex, Parodianthus, Peronema, Petitia, Petraevitex, Petraea, Phyla, Pitraea, Premna, Priva, Pseudocarpidium, Recordia, Rehdera, Rhaphithamnus, Schnabelia (or Labiatae), Stachytarpheta, Stylodon, Surfacea, Tamonea, Tectona, Teijsmanniodendron, Tetraclea (or Labiatae), Teuridium, Tsoongia, Ubochea, Urbania, Verbena, Verbenoxylum, Vitex, Viticipremna, Xeroaloysia, Xolocotzia.

**Economic uses, etc** : Timber from Tectona grandis (teak); some notable ornamentals, e.g. Clerodendrum, Callicarpa, Vitex, Lantana, Verbena; noxious, photosensitizing weeds (Lantana).

**Floral Features** : Flowers bisexual and zygomorphic often with a colorful involucre. K 4-5 lobed and toothed, C 4-5 lobed and tubular, A epipetalous and alternate with C lobes, G superior with axile placentation. Inflorescence racemose or cymose.

**Fruit and Seed Features** : Fruit drupe, less commonly a capsule or schizocarp. Seeds with straight, oily embryo and little to no endosperm.

**Vegetative Features** : Habit varies from trees to lianas to shrubs and herbs. Leaves usually simple, opposite (rarely whorled or alternate), entire or divided; no stipules.

**Vitex (Vitex negundo-heterophylla)**

<table>
<thead>
<tr>
<th>Part Used</th>
<th>Leaves/berries</th>
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<tbody>
<tr>
<td>Main function</td>
<td>Herb to Clear Wetness/Phlegm patterns</td>
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<tr>
<td>Thermal qual.</td>
<td>Warm</td>
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Taste Spicy

Functions
- Clears Phlegm
- Dispels Exterior Wind Cold
- Regulates Stagnant Qi
- Controls pain

Cautions
- Contraindicated in hypertension & heart disease.

Toxicity
- Relatively safe for long term use.

Phyto-chemicals
- Flavonoids, caryophyllene, cardiac glycosides, alkaloids, elemene & pinene.

Western Properties
- Anti-tussive, diaphoretic, anti-pyretic, expectorant, anti-asthmatic, anti-bacterial, analgesic, anti-rheumatic, stomachic & bronchodilator.

Notes
- Used for colds, flu, coughs, dysentery, malaria, arthritis, asthma, digestive problems, headaches, excess mucus, bronchitis & fevers.
**Vitex Negundo**

**Common name:** Nirgundi (Indian Arnica) (English – Indian Privet)

From Brahamvarchas: “निर्गुंडि शरीर रक्षति रोगेम्य: तत्समादृ निर्गुंडः”

**Brief description** : A large shrub or small tree to 5 m with quadrangular branchlets. Leaves are palmately compound, opposite; leaflets are 5, elliptic-ovate to lanceolate, entire, pinnately veined, grayish-tomentose beneath, margins serrate-toothed to entire. Flowers are perfect, lilac to lavender, in loose, terminal, panicled clusters. Fruits are a small drupe.

**Leaf** : Opposite, palmately compound, 2 to 6 inches across, usually five leaflets per leaf (3-7), leaflets ovate, obovate or lanceolate with entire or toothed margins, light green above and pale-pubescent below, very aromatic when crushed.
**Flower**: Lilac, in loose slender spiked panicles at the branch tips, to 8 inches, midsummer.

![Lilac](image)

**Fruit**: Round green and fleshy, drying and turning brown, 1/8 inch in diameter, persistent through winter, held cup-like.

**Twig**: Slender, opposite, gray-brown, quadrangular, buds are wedge-shaped to rounded and gray-brown.

**Bark**: Initially smooth and gray-brown, becoming blocky on older stems.

**Form**: A large shrub or small tree to 15 feet. When planted too far north it may freeze to the ground.
**Medicinal Importance:**

Vitex is also known by the names Chaste Tree, Chasteberry, Monk’s Pepper, Hemp Tree, Indian Spice, Sage Tree, and Agnus-castus. In the Illiad by Homer, Vitex is depicted as a symbol of chastity. Both words, "agnus" and "castus" translate to "chaste". One of its properties was to reduce sexual desire, and it is recorded that Roman wives whose husbands were abroad with the legions spread the aromatic leaves on their couches for this purpose. The name Monk’s Pepper is because monks chewed the berries to reduce their sexual desire. Vitex grows in Mediterranean countries and Central Asia. The dried fruit, which has a pepper-like aroma and flavor, is used in herbal medicine preparations. Vitex contains several different constituents, including flavonoids, iridoid glycosides, and terpenoids. The whole fruit extract, rather than one of its individual constituents, appears to be necessary for the medicinal activity of Vitex. However, Vitex does not contain
hormones. The benefits of Vitex stem from its actions upon the pituitary gland - specifically on the production of a hormone called luteinizing hormone (LH). Vitex also keeps prolactin secretions in check. The ability to decrease mildly elevated prolactin levels may benefit some infertile women as well as some women with breast tenderness associated with premenstrual syndrome (PMS). Vitex may also help in reducing some of the undesirable symptoms of menopause such as hot flashes associated with the reduction in the production of progesterone. Vitex can stabilize the cycle after withdrawal from progesterone birth control pills. Several studies indicate that Vitex can help control acne in teenagers, young women and men. For women who are trying to get pregnant, Vitex may be helpful to help regulate the ovulatory cycle.
MORACEAE

Mainly confined to the Angiosperms and abundant in the Apocynaceae & Asclepiadaceae. Except Cannabinaceae, small number of members of these families have been examined, chemically.

The Moraceae has about 53 genera & 1400 species. They are mainly tropical or subtropical shrubs or trees containing latex. The fruit is often multiple, as in Ficus, the fig. The large genus Ficus (about 800 species) includes trees and shrubs of very varied habit. These include F. bengalensis (banyan), F. elastica (India rubber tree) and F. carica (common fig.). The latex is often anthelmintic, owing to the proteolytic enzyme ficin. Another genus, Castilliooa (10 species) yields from C. elastica, Panama rubber or Caoutchouc. Among other constituents reported in the family are Cardenolides (in 5 genera) and pyridine alkaloids (in 2 genera).

**Habit and leaf form**: Trees, or shrubs, or lianas (including ‘stranglers’), or herbs (a few); *laticiferous (usually), or with coloured juice* (*Malaysia, Fatoua*); resinous, or not resinous. ‘Normal’ plants. Perennial. Self supporting, or epiphytic, or climbing. *Mesophytic*. Heterophyllous, or not heterophyllous. *Leaves evergreen*; medium-sized to large; alternate, or opposite; when alternate, spiral, or distichous; leathery, or ‘herbaceous’; petiolate; *non-sheathing*; simple; *epulvinate*. Lamina dissected, or entire; when dissected, pinnatifid, or palmatifid; pinnately veined, or palmately veined; cross-venulate. *Leaves variously stipulate*. Stipules interpetiolar, or intrapetiolar; free of one another, or concrescent; ochreate, or not ochreate; sometimes minute; caducous (often), or persistent. Leaves without a persistent basal meristem. Domatia recorded (2 genera); represented by pockets, or hair tufts.
General anatomy: Plants with laticifers (usually, non-articulated and branched), or without laticifers (rarely).

Leaf anatomy: Hydathodes present (occasionally), or absent. Mucilaginous epidermis present, or absent.

Adaxial hypodermis present, or absent Cystoliths very commonly present. The mesophyll with sclerencymatous idioblasts, or without sclerenchymatous idioblasts. Minor leaf veins without phloem transfer cells (Ficus, Maclura).

Stem anatomy: Secretory cavities present, or absent with latex, or with mucilage. Cork cambium present; initially superficial. Nodes trilacunar, or penta-lacunar. Cortical bundles absent. Medullary bundles absent. Internal phloem absent. Secondary thickening developing from a conventional cambial ring. The secondary phloem stratified into hard (fibrous) and soft (parenchymatous) zones, or not stratified. ‘Included’ phloem absent. Xylem with fibre tracheids, or without fibre tracheids; with libriform fibres, or without libriform fibres; with vessels. Vessel end-walls simple. Vessels without vestured pits. Wood storied, or partially storied; parenchyma typically paratracheal. Sieve-tube plastids S-type (with or without starch).

Reproductive type, pollination: Fertile flowers functionally male and functionally female, or functionally male, or functionally female. Plants monoecious, or dioecious. Anemophilous, or entomophilous.

Inflorescence, floral, fruit and seed morphology: Flowers tightly aggregated in ‘inflorescences’, or solitary (rarely); in spikes, in heads, and in umbels (etc.). The terminal inflorescence unit cymose. Inflorescences axillary; mostly with the small flowers packed into spikes, in heads or
hollowed receptacles, on disks, etc.; with involucral bracts, or without involucral bracts; pseudanthial, or not pseudanthial. Flowers small (reduced); regular; cyclic.

Perianth sepaline (usually), or vestigial to absent (rarely); 0 (rarely), or (1-) 4-5, or 8 (rarely); more or less joined; 1 whorled, or 2 whorled. Calyx (1-) 4-5 (-8); gamosepalous (basally connate); entire, or lobulate, or blunt-lobed; regular; persistent; imbricate, or valvate.

Androecium 1-4 (-8) (in male flowers). Androecial members free of the perianth; free of one another. Androecium exclusively of fertile stamens. Stamens 1-4 (-8); isomerous with the perianth (usually), or reduced in number relative to the adjacent perianth (10%); oppositisepalous (usually isostemonous); erect in bud (Moreae), or inflexed in bud. Anthers dehiscing via longitudinal slits (not dehiscing explosively); extrorse, or introrse; tetrasporangiate. Endothecium developing fibrous thickenings. Anther epidermis persistent. Microsporogenesis simultaneous. The initial microspore tetrads tetrahedral, or isobilateral, or decussate. Anther wall initially with more than one middle layer (2 to 5); of the ‘monocot’ type. Tapetum glandular. Pollen grains aperturate; 2–4(–5) aperturate; porate; 2-celled.

Gynoecium in female flowers 2(–3) carpelled (1–2 usually abortive). Carpels reduced in number relative to the perianth. The pistil 1 celled, or 2 celled. Gynoecium syncarpous; synovarious to synstyolovvarious; superior to partly inferior. Ovary 1(–2) locular. Gynoecium stylate. Styles 2; free to partially joined; apical, or lateral. Stigmas 2; dry type; papillate, or non-papillate; Group II type. Placentation apical (usually, the ovule pendulous), or basal (rarely, the ovule then erect). Ovules in the single cavity 1; pendulous (usually), or ascending (rarely, when basal); anatropous to
campylotropous, or hemianatropous; bitegmic; crassinucellate. Outer integument not contributing to the micropyle. Embryo-sac development Polygonum-type, or Allium-type. Polar nuclei fusing prior to fertilization. Antipodal cells formed; 3; proliferating (Dorstenia), or not proliferating; ephemeral, or persistent (Dorstenia). Synergids hooked. Hypostase present, or absent. Endosperm formation nuclear. Embryogeny asterad (or remaining at the octant stage in Ficus).

**Fruit** fleshy, or non-fleshy; indehiscent; a drupe, or achene-like; enclosed in the fleshy receptacle (often, and the inflorescence axis often constituting a common fleshy receptacle), or without fleshy investment. **The drupes with one stone.** Gynoecia of adjoining flowers combining to form a multiple fruit (frequently), or not forming a multiple fruit. The multiple fruits coalescing (often, these sometimes explosively discharging the ‘seeds’), or not coalescing. Dispersal unit the seed, or the fruit, or the inflorescence. Fruit 1 seeded. Seeds endospermic, or non-endospermic. Endosperm oily, or not oily. Cotyledons 1 (by suppression), or 2; flat. Embryo chlorophyllous (Streblus asper), or achlorophyllous (7/8); straight, or curved. The radicle dorsal. **Micropyle not zigzag.**

**Seedling.** Germination phanerocotylar, or cryptocotylar.

**Physiology & Biochemistry** : Cyanogenic, or not cyanogenic (mostly). Alkaloids present (rarely), or absent. Iridoids not detected. Proanthocyanidins present, or absent; when present, cyanidin (Ficus). Flavonols present, or absent; quercetin, or kaempferol and quercetin. Ellagic acid absent (13 species, 6 genera). Arbutin absent. Saponins/sapogenins present, or absent. Aluminium accumulation not found. Sugars transported as sucrose, or as sugar alcohols + oligosaccharides + sucrose. C₃. C₃ physiology recorded directly in Ficus, Morus. Anatomy non-C₄ type (Artocarpus, Ficus).
Geography & Cytology: Temperate (a few), or temperate to subtropical (most). Widespread in tropical, subtropical and warm regions. $X = 7$-many.

Taxonomy: Subclass Dicotyledonae; Crassinucelli. Dahlgren’s Superorder Malviflorae; Urticales. Cronquist’s Subclass Hamamelidae; Urticales. APG (1998) Eudicot; core Eudicot; Rosid; Eurosid I; Rosales. Species 1400. Genera about 40; *Antiaris, Antiaropsis, Artocarpus, Bagassa, Batocarpus, Bosqueiopsis, Brosimum, Broussonetia, Castilla, Clarisia, Craterogyne, Dorstenia, Fatoua, Ficus, Helianthostylis, Helicostylis, Hullettia, Maclura, Maquira, Mesogyne, Metatrophis, Milicia, Morus, Naucleopsis, Olmedia (= Trophis), Olmediopsis, Parartocarpus, Perebia, Poulsenia, Prainea, Pseudolmedia, Scyphosyce, Sorocea, Sparattosyce, Streblus, Treculia, Trilepisium, Trophis, Trymatococcus, Utsetela.

Economic uses, etc: Economically important for many edible ‘fruits’, e.g. figs (*Ficus*), VER ARTICULO SOBRE

Family: Moraceae  Local Name: Peepal.

Medicinal Uses: Good in leucorrhoea., It is used in impotency. It is astringent, expectorant, laxative and coective. Taken in asthma, whooping cough and genito-urinary troubles.

The fruit is laxative & helps digestion. The seeds are said to be cooling & alternative. The leaves & young shoots are used as a purgative. An infusion of the bark is given internally in scabies.

In Sri Lanka, the juice of the bark is used as a mouthwash for toothache & for strengthening the gums.
OVERVIEW

*F. religiosa* is a sacred tree native to India where it grows up to elevations of 5,000 ft (1,524 m) (Neal 1948). It is said to be the tree that Buddha was born under and also where he sat for six years of meditation and enlightenment. Elsewhere in the world and in Hawai‘i, trees are occasionally cultivated and are most often seen planted near temples. This large tree with attractive heart shaped glossy leaves is also occasionally planted as a specimen tree in landscaping for its aesthetic shape and form. In Hawai‘i, *F. religiosa* does not reproduce sexually due to the lack of its associated pollinator wasp and must be propagated from cuttings. In Israel, where *F. religiosa* is also cultivated, the pollinator wasp, *Blastophaga quadraticeps*,...
has successfully invaded and established (Galil and Eisikowitch 1968) and is now producing seedlings near irrigated areas and in exceptionally moist microhabitats. The pollinator wasp should be prohibited from Hawai'i to avoid reproduction and spread of this species.

**TAXONOMY**

**Family:** Moraceae (mulberry family).

**Latin name:** *Ficus religiosa* L.

**Common names:** Bo tree, peepal tree, sacred tree.

**Taxonomic notes:** Neal (1965) reports that one tree was brought from India in 288 B.C. to Ceylon, is the oldest tree known historical tree, and is said to be the parent of all peepal trees there.
Nomenclature: This sacred tree is associated with Buddha and is planted beside temples, hence the species name, *religiosa*.

**Related species in Hawai‘i:** Over 60 species of *Ficus* have been introduced to Hawai‘i (Wagner et al. 1999).

**DESCRIPTION**

"Small tree, or taller strangling climber, with wide-spreading branches, semi- or fully deciduous in monsoon climates, and broadly ovate, glossy, leathery, dark green leaves, 5-7 in (12-18 cm) long, with unusual tail-like tips. Bears pairs of rounded, flat-topped green figs, to 1/2 in (1.5 cm) across, ripening to purple with red dots" (Brickell and Zuk 1997).

**BIOLOGY & ECOLOGY**

**Cultivation:** *F. religiosa* is widely planted in the tropics (Bailey and Bailey 1976). The tree is very long lived and one tree near Bombay is reported to be over 3,000 years old (Neal 1965). *F. religiosa* are mostly planted near Buddhist temples. They are steeped in legends associated with Buddha and are also sacred to Vishnu who is also said to have been born beneath a bo tree. Hindus associate the bo tree with fertility in women. It is also cultivated as an ornamental, for medicinal uses, such as toothaches, and in the making of shellac.

**Invasiveness:** This species reported to be able to set viable seeds in two places, Israel and Florida. In Israel, the pollinator wasp successfully invaded and established allowing the tree to begin to spread. In Florida, sporadic seeding events have been documented, though have not persisted, perhaps due to an unsuccessful colonization of the associated pollinator wasp or an
intrusion from a pollinator wasp of the native *Ficus aurea* (Nadel et al. 1992).

**Pollination:** The fruit (syconium or fig) and reproduction systems of species in the genus *Ficus* are unique. Each species of *Ficus* has an associated species of agaonid wasp (Hymenoptera: Chalcoidea: Agaonidae). *Ficus* species can only be pollinated by their associated agaonid wasps and in turn, the wasps can only lay eggs within their associated *Ficus* fruit. The pollinator wasp for *F. religiosa* is *Blastophaga quadraticeps*.

**Propagation:** In places where the pollinator wasp is not present, trees are propagated from cuttings.

**Dispersal:** In Hawai‘i, plants are spread mainly through horticulture trade. Various birds observed foraging and roosting in *Ficus* spp. trees on Maui that could be potential dispersal agents of *F. religiosa* seeds should they become viable include mynah birds (*Acridotheres tristis tristis*), blue faced doves (*Geopelia striata*), lace necked doves (*Streptopelia chinensis*), Japanese white-eye (*Zosterops japonicus*), Northern cardinals (*Cardinalis cardinalis*), and house sparrows (*Passer domesticus*), though there are probably more. Other animals, such as bats, pigs, rodents, parrots, and monkeys may be capable of spreading fruit.

**Pests and Diseases:** Nadel et al. (1992) report several pests including various ants which were seen carrying off pollinator wasps from *Ficus* fruits, Hymenoptera and mites that may be parasites of the pollinator wasps, and staphylinids which were seen entering *Ficus* fruits and eating the pollinator wasps.
Native range: *F. religiosa* is native from India to southeast Asia (Bailey and Bailey 1976). In India, it occurs both wild and cultivated up to 5,000 ft (1,524 m) (Neal 1948).

Global distribution: *F. religiosa* is cultivated in various tropical areas of the world. In the United States, it is grown in southern California, Florida, and Hawai‘i. In Florida, seedlings were found in Homestead in 1975 and in Miami in 1988, though these were isolated events and did not persist (Nadel et al. 1992). The wasps for these sporadic events were never recovered so it is uncertain whether the pollinator wasps simply did not survive or if other pollinator wasps were responsible. The pollinator wasp for the native *F. aurea*, *Pegoscapus jimenezii* (Grandi), has been found intruding into syconia of two non-native figs, *F. septica* and *F. religiosa*. In Israel, *F. religiosa* and it's associated pollinator wasp, *Blastophaga quadratileps* are now both established and producing seedlings near irrigated areas and in exceptionally moist microhabitats.

State of Hawai‘i distribution: *F. religiosa* is cultivated in Hawai‘i. Exact distribution for islands other than Maui is uncertain.

Island of Maui distribution: On Maui, only a few (about 9) cultivated locations of *F. religiosa* were found during island wide surveys. A few temples near the coast in Lahaina and Baldwin Beach, Paia have one large tree each located near the temple. It is also cultivated as an ornamental or specimen tree in the Flemming Arboretum on West Maui, along the Mokulele Hwy. near Kihei, by buildings in Kahului at the Maui Community College, and in yards in Wailuku Heights, Ha‘iku and Kula.
CONTROL METHODS

Cultural Control: Currently *F. religiosa* does not spread in Hawai‘i. One might argue that removal of the trees now while they are in limited distribution and not yet a problem would be the easiest, least costly strategy, and most definite way to prevent invasiveness in the future. However, because of the sacredness and charisma of this tree, control would probably be met by public opposition. Perhaps a middle of the road tactic would be to prevent the introduction of its associated pollinator wasp to avoid unwanted spread.

Physical control: *F. religiosa* can most likely be cut down but will probably re-grow without chemical treatment.

Chemical control: A cut stump treatment with a chemical such as Garlon (triclopyr) would probably be effective in control.

Biological control: Currently there are no known biological controls for *F. religiosa*.

Noxious weed acts: None.

MANAGEMENT RECOMMENDATIONS

*F. religiosa* currently does not spread in Hawai‘i and is only occasionally cultivated on Maui. It is an attractive tree and has been associated with legends of Buddha. This species may become invasive if the pollinator were introduced. Efforts should be made to prevent the unintentional introduction of wasps, by not bringing in live materials from other places where wasps are present, as well as the intentional introduction of wasps by prohibiting their introduction.
DIABETES

History of Diabetes:

Diabetes was described more than 2000 years ago in Egypt (1500 B.C, as an illness associated with the passage of excess urine) & in an ancient Indian Ayurveda (500 B.C., as Madhumeha or honey urine or sweet urine) by Indian physician Sushruta.

2nd Century A.D: ARETAEUS of Cappadocia gave the name diabetes ("a passer through").

1647: THOMAS WILLIS rediscovers the sweetness of urine and the name Mellitus (honey) was established. For the past 200 years, it has featured in the history of modern medicine. After the discovery of Insulin, work on Diabetes at both cellular and clinical levels has expanded.

Pancreatic disorders: Diabetes Mellitus – This is a disorder of glucose metabolism that result from an absolute or relative lack of insulin and of complications that include accelerated atherosclerosis, retinopathy, nephropathy and neuropathy. The interrelationship between the glucose intolerance & the vascular disease has not been defined clearly. Type - I diabetes (insulin - dependant diabetes; formerly called as 'Juvenile onset diabetes') is believed to be an autoimmune disorders. It is characterized by marked insulin deficiency and rapid onset. Late onset and a diminished insulin response characterize type – II diabetes (also called as non-insulin dependant diabetes, formerly as 'adult onset diabetes').

Epidemiology: According to recent estimates, the prevalence of diabetes mellitus in adult was around 4% worldwide and this means that over 143 million persons are now affected. It is projected that the disease
prevalence will be 5.4% by the 2025 with global diabetic population reaching 300 million. About 4.2 million diabetics are in the USA. The incidence is higher in relatives of diabetics, people older than 45 year, & those who are currently or were obese.

Recent epidemiological data showed that the prevalence of diabetes in India is 8 to 10%. According to WHO survey the prevalence of disease in adult was found to be 2.4% in rural and 4 to 11.6% in urban population affected by the diabetes. Over the past decade prevalence of the disease among adults has increase by 33%. It is the 4th leading of the death by disease. Each year approximately 798000 people are diagnosed with diabetes.

**Etiology**: Both type have a genetic predisposition, which is more obvious in the case of type – II diabetes. Destruction of pancreas by chronic pancreatitis, hemochromatosis or carcinoma results in diabetes. Other endocrine disorders, such as Cushing's syndrome, hyperpituitarism and hyperthyroidism are associated with the disease. Glucose intolerance occurs during pregnancy or times of excessive stress and with the administration of glucocorticosteroids, thiazides and oral contraceptives.

**Classification of Diabetes**: WHO classified diabetes in the following categories –

1. **Diabetes Mellitus (DM)**
   (i) Insulin dependant diabetes mellitus (IDDM type I)
   (ii) Non - insulin dependant diabetes mellitus (NIDDM type II)
   (iii) Malnutrition related diabetes mellitus (MRDM)
(iv) Other types (Secondary to pancreatic disease, hormonal intolerance, drug – induced or genetic disorder)

2. **Impaired Glucose Tolerance (IGT)**

3. **Gastrointestinal Diabetes Mellitus (GDM)**

**Clinical Classification**: Two main types of diseases have long been recognized, clinically -

1. **The Juvenile onset type** – usually develops during the first 40 years of life in a patient of normal or less than normal weight. In this case, administration of insulin is required so called as insulin depended diabetes.

2. **The adult or maturity onset type**: usually develops in obese persons of middle age or elder. It is controlled by oral hypoglycemic drugs with diet control.

**Pathology**: The β-cells of the pancreas are decreased in number or are degranulated in diabetes. The reduction in number of β-cells corresponds to the lack of insulin. In Type-I diabetes, there are no β-cells: in Type-II diabetes, only about one half of them are present. In some cases, these cells are infiltrated with lymphocytes, suggesting an autoimmune mechanism for Type-I diabetes. The presence of anti-islet antibodies supports an autoimmune hypothesis in Type-I diabetes. The atherosclerosis that occur in diabetes is the same as the atherosclerosis previously discussed, but it occurs as frequently in females as in males & at an earlier age. In the kidney, nodular glomerulosclerosis (Kimmelsteil-Wilson's) is seen, which is deposition of glycoprotein in ball – like masses in the mesangial regions of the capillary tufts. Diffuse glomerulosclerosis, which is the deposition of glycolprotein in the
mesangiun, also is seen, as well as tubular membrane thickening. The earliest finding of diabetic retinopathy is microaneurysms. Proliferative retinopathy, the formation of new blood vessels around the optic disc, occurs with long standing diabetes. Repeated hemorrhages cause scar formation that may lead to retinal detachment. The changes of hypertensive retinopathy also are seen in diabetics with hypertension.

**Pathophysiology**: The lack of insulin results in a peripheral underused and hepatic overproduction of glucose, which results in hyperglycemia. Insulin facilitates the entry of glucose in cells of adipose tissue and muscle, stimulates fat synthesis in cells, & stimulates protein synthesis. The lack of glucose in muscle cells leads to glycogenolysis and the release of amino acid for gluconeogenesis. Lack of insulin and glucose in adipose tissue impairs triglyceride synthesis & release of free fatty acids. The liver metabolizes free fatty acids to ketones, which are used by muscles for energy, to a limited extent. Lack of insulin also results in hepatic overproduction of glucose from glycogenolysis and gluconeogenesis. Another hormone, glucagon, is increased in diabetes. Glucagon effects oppose insulin physiologically.

Hyperglycemia results in glycosuria when the serum level of glucose exceeds the renal threshold for reabsorption of glucose. The osmotic diuresis causes polyuria (increased urine production due to an inability of reabsorb water), polydipsia (excessive thirst) and polyphagia (excessive eating) and may result in dehydration. Excess ketones also are excreted in the urine, as keto acids. This results in urinary loss of bicarbonate, sodium and potassium and dehydration.

Normally insulin is released only in response to a glucose load such as a carbohydrate-containing meal. Serum insulin levels rise within 15 to 20 minutes after eating. Patients with Type – I diabetes do not produce insulin.
Those with Type-II diabetes produce too little insulin too late to prevent hyperglycemia. Obese people have hypertrophied adipose cells, which, because of their size, are less sensitive to the action of insulin.

The vascular complications of diabetes mellitus have been related to the hyperglycemia. It is postulated that glycoprotein is deposited in capillaries when glucose levels are elevated. Formation of cataracts and neuropathy are thought to occur because glucose is metabolized to sorbitol by aldose reductase in hyperglycemia. The sorbitol causes osmotic swelling and damage.

Glucose is food undergoes metabolism and forms various Advance Glycation End Products (AGEs), which play an important role in pathophysiological changes in diabetes such as development of cataract formation and other host of complications. Any chemical having potential to inhibit or break the AGEs can prevent secondary damage observed in diabetes mellitus.

**Symptoms and Signs**: The onset of Type – I diabetes is sudden and characterized by polyuria, polydipsia, polyphagia, weight loss decreased muscle strength, irritability and perhaps a return of bed wetting. The presentation may be ketoacidosis. About one – third of these patients have a remission shortly after the onset of diabetes. The remission may last for weeks to 1 year & the patient does not require insulin during this time. After the remission, Type-I diabetes require insulin for the remainder of their life time. They are very sensitive to the effect of insulin and physical activity. Both hypoglycemia and ketoacidosis punctuate their course. The clinical presentation of adult – onset diabetes may be the insidious onset of weight loss, nocturia, vascular complications, decreased or blurred vision, fatigue, anemia or symptoms and signs of neuropathy. The disease may be diagnosed
from an elevated glucose level without any symptoms. Type – II diabetics usually are not prone to ketoacidosis. Most Type –II diabetics respond to weight loss.

The diagnosis of diabetes mellitus is based on the documentation of elevated fasting blood sugar, elevated blood glucose 2 hours after a meal, or an abnormal glucose tolerance test. Diet, physical activity, age, underlying diseases, and drugs influence the accuracy of a glucose tolerance test.

Complications: Ketoacidosis occurs in diabetic patients who developed high levels of glucose and ketones plus metabolic acidosis. The usual cause is lack of compliance with insulin therapy, but ketoacidosis may be the first episode for an undiagnosed diabetic or a manifestation of an infection. The symptoms and signs of ketoacidosis include nausea, vomiting, abdominal pain, & air hunger (Kussmaul breathing – heavy, labored breathing to compensate for the decreased PH). Dehydration may be severe. Oliguria and hypotension may be present. Hyperglycemia, decreased serum bicarbonate, hypokalemia, azotemia and acidosis may be seen on laboratory evaluation.

Hyperglycemia hyperosmolar nonketotic coma occurs in Type - II diabetics. The patients are usually elderly and have some renal impairment. Polyuria and polydipsia precede neurological manifestations. The patient present with hyperpyrexia, hypotension, tachycardia, hyperventilation, & the signs of dehydration. Hyperreflexia, mild disorientation, confusion, seizures, or coma reflect the intracellular dehydration of CNS. Laboratory examination is remarkable for increased serum osmolarity and hyperglycemia without ketosis for hypernatremia.

Neuropathy may result from the sorbitol pathway or from ischemia resulting from the vascular disease. Diabetic neuropathy most frequently
involves the peripheral nerves but can involve any nerve. Manifestations of diabetic neuropathy include sexual dysfunction in the male, gastric atony, nocturnal diarrhea, fecal incontinence, orthostatic hypotension, neurogenic bladder, paresthesias, & loss of sensation.

*Diabetic ulcers & gangrene* results from the neuropathy, the vascular disease or both. The painless foot is more prone to injury. The ischemic foot is less likely to heal. The patient usually has a history of intermittent claudication, nocturnal leg pain and cramps, loss of hair, and muscle atrophy. Both feet and legs usually become involved.

*Nephropathy* occurs with diabetes of 15 year or more duration and usually occurs along with the other complications. The first sign out diabetic nephropathy is microalbuminuria, the excretion of 30 to 300 mg of albumin per day. This progress to dipstick-positive proteinuria. Later, the nephrotic syndrome may appear, and renal function deteriorates, or progressive renal failure occurs with out the nephrotic syndrome. Diabetic nephropathy may cause hypertension. Urinary tract infections and pyelonephritis are more common in the diabetic and may contributed to the renal failure.

*Diabetic Eye Complication* : Diabetes related eye disease include diabetic retinopathy, cataract, glaucoma and macular degeneration.

*Diabetic retinopathy* is a potentially blinding complication of diabetes that damages the retina (most active part) of eye. It affects about 50% of diabetics. It occurs when diabetes damages the tiny blood vessels in the retina – the light sensitive tissue at the back of the eye. At this point, most people do not notice any changes in their vision.

Some people develop a condition called 'Macular Oedema' ; when the damaged blood vessels leak fluid and lipids on to the macula (located in the
central part of the retina, responsible for creating the sharpest vision). The fluid makes the macula swell and blurring vision. As the disease progresses, it enters an advanced, or proliferative, stage. Fragile, new blood vessels grow along the retina and in the clear, gel-like vitreous that fills the inside of the eye. Without timely treatment, these new blood vessels can bleed, cloud vision and destroy the retina.

**Symptoms of diabetic retinopathy:**

1. Leaking blood vessels
2. Retinal swelling, such as macular oedema
3. Pale, fatty deposits on the retina – sign of leaking blood vessels
4. Damaged nerve tissue.
5. Any changes in the blood vessels and red spots.

*It can be detected during an eye examination by:*

(i) Visual Acuity Test
(ii) Pupil dilation
(iii) Ophthalmoscopy
(iv) Tonometry
(v) Fluorescein Angiography

**Causes of Diabetic Retinopathy:**

1. Glycosylated proteins & free radicals
2. Lack of oxygen to the retina
3. Sorbitol accumulation
4. Elevated Homocysteine levels
Treatment of Diabetic Retinopathy:

1. Laser surgery
2. Macular Edema
3. Proliferative Retinopathy
4. Vitrectomy

Cataracts: It is a clouding of the lens within the eye. Normally painless, people with cataracts often begin to complain about glare, & may need increased light to read. Cataracts are the most common cause for reduced vision. It can be addressed with modern surgical techniques (Success rate is about 95% or more), replacing the clouded lens within the synthetic implant. This surgery should be done as soon as the visual blur 'gets in the way' of normal activity, there is no need to wait for a cataract to 'be ripen'.

Glaucoma: It is a condition that can damage the optic nerve of the eye. Normally, painless, caused by elevated pressure from a build-up of flow within the eye. Usually starting with a loss of peripheral vision, progressing slowly or rapidly and leading to a total loss of vision if not detected and treated. So, it is the leading cause of blindness. It can be controlled easily after following careful medication.

Age related macular degeneration (AMD): It diminishes sight in a dramatic way by affecting central vision. Although it rarely causes blindness, those with AMD find it difficult to read, drive & perform other daily activities. Frequency of this disorder increases substantially after age 60. "Dry AMD" represent 80% of the cases as while "Wet AMD" represent 10%. Dry one progresses slowly and rarely leads to blindness, but is not medically treatable; and wet one often progresses rapidly and frequently leads to vision loss, with some cases treatable by laser surgery.
**Prevention and Care of diabetes**: There are mainly three categories of prevention: primary, secondary and tertiary.

**Primary Prevention:**

1. *Population strategy* – not possible in the case of IDDM as while possible in the case of NIDDM. Preventive majors include maintenance of normal body weight, by diet control (restricted in sugar and rich in protein and fibers) and exercises.

2. *High risk strategy* – By changing sedentary life style, avoid over eating and controlling the body weight.

**Secondary Prevention:**

In it, adequate treatment is required for maintaining blood sugar level (close to normal one): by controlling diet alone, diet and oral hypoglycemic drugs or by diet control and insulin. Self care is necessary for urine and blood sugar tests.

**Tertiary Prevention:**

In it, diabetic clinics and units for diagnosis and treatment of disease are compulsory because many complication like blindness, kidney failure, coronary, thrombosis and gangrene of the lower limbs take place.

Several PPARγ (peroxisome proliferator – activated receptor) agonists such as thiazolidinediones have been recommended for the treatment of diabetes by improving insulin sensitivity & glucose uptake. A new protein "Resistin" secreted from adipocytes has been shown to impair glucose tolerance and antagonize the effect of insulin. Some thiazolidinediones decrease the production of resistin making it a molecular target for the development of antidiabetic drugs.
Herbal help for diabetics: Apart from several synthetic antidiabetics like tolbutamide and chlorpropamide etc., the natural oral antidiabetic drugs and a few herbs have shown promise for assisting in the management of diabetes:-

Pterocarpus (Indian Kino) is aqueous infusion of wood is much use in diabetes. The alcoholic, as well as, aqueous extracts of heartwood have reported to possess hypoglycemic action. The cups made up of wood are available with Khadi & Gramodyog Industries for cure of diabetes. It is also used as powerful astringent (so, in the treatment of diarrhea and dysentery), passive haemorrhage and toothache and in dyeing, tanning and printing.

Bitter Melon (Momordica charantia) is a green, cucumber – shaped tropical fluid with gourd-like bumps that is eaten unripe like a vegetable. Clinical trials with Type - II diabetics has established that use of bitter melon extract can effectively lower blood sugar levels and improve glucose tolerance. Bitter melon contains a mixture of steroids which have a potent hypoglycemic effect. Recent experiments found that polypeptide – p isolated from the fruit could mimic insulin activity.

Animal and human studies have shown that consumption of Fenugreek seeds (Trigonella foenum graceum) can lower blood sugar levels in diabetics. Research in India found that glucose tolerance improved, urinary glucose excretion decreased 70%, and insulin responses were reduced in diabetics after defatted fenugreek was used for 10 days. Total serum cholesterol, LDL cholesterol, & triglyceride levels, but not HDL cholesterol, all significantly decreased about 20% when fenugreek was added to the diet. These changes in blood lipids are important factor for a diabetic who usually has elevated blood lipids. A daily use of 25 – 100 mg of fenugreek seeds could serve as an effective supportive therapy in the management of
diabetes. New research has revealed that the soluble dietary fiber is partly responsible for the blood sugar – lowering effect of fenugreek.

Recent studies have shown that Gurmar (Gymnema sylvestre), a native plant of the forests of India, can effectively be used in the management of Type-I & II diabetic mellitus. Gymnema contains certain components that block the sensation of sweeteners when applied to the tongue, but it thus not block absorption of sugar. An extract of the leaves of G. sylvestre reduces insulin requirements or oral hypoglycemic drug dosage, improves fasting blood glucose levels, and improves blood sugar control by enhancing the action of insulin & possibly by regenerating the β-cells of the pancreas. These effects are observed in diabetics only, but not in healthy volunteers.

A number of other herbs show potential for the management of hyperglycemia subjects who consumed bread containing 25% Flaxseed meal (Linum usitatissimum) revealed almost 30% improvement in a glucose tolerance test compared with those who ate plain bread. Flax seed is known to be very rich in soluble fiber.

An extract from Cinnamon (Cinnamomum zeylanicum) has been found to potentiate insulin activity. For centuries, Ginseng (Panax ginseng) has been used to treat diabetes by traditional Chinese medical practitioners. In a double – blind, placebo – controlled study, patients with Type-II diabetes who took 200mg of ginseng for 8 weeks experienced improved fasting blood sugar levels and improve glycated haemoglobin levels.

Preliminary studies have reported antihyperglycemic activity or improved glucose tolerance from a number of other herbs including garlic, onion, bay leaves, cloves, coriander, cumin, nutmeg, witch hazel, green
and black teas (enhances insulin activity due to presence of epigallocatechingallate), sage, mushrooms, brewer's yeast, juniper berries, prickly pear cactus, turmeric, ivy-gourd leaves jambhul, Cassia auriculata, Ptrocarpus marsupium wood, Murraya koenigii leaves, Asparagus racemosus leaves, Butea monosperma roots, Brassica oleracea (Knol – Khol juice is widely prescribed in naturopathy for anti diabetic therapy), Hibiscus vitifolius (manjal tuthi) flowers, Annona squamosa (custard apple) leaves, Solanum melongena leave and Casearia esculenta bark.

Further research is warranted to validate these findings and discover if there is any clinical significance to the hypoglycemic effect of these herbs.

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New approaches for the prevention and treatment of diabetes mellitus

1. **The Immunosuppressive Approach** – Of the many approaches to a more specific attack on the immune destruction, anti-T-lymphocyte therapy with diphtheria toxin linked to interleukin-2 has proven effective in mice.

2. **Adjuncts to Dietary Restriction**

   α-glucosidase inhibitors have been developed to block the absorption of sugars derived from starches and secondarily to reduce plasma lipids. Only one, acarbose, has achieved limited licensing to date, and it has been associated with a modest reduction in glyco-sylated hemoglobin.

   Tetrahydrolipostatin, a drug that directly inhibits intestinal lipase and thus may counter the effects of a diet inappropriately high in fat, is undergoing clinical trials.

   The inevitable side-effects are flatulence and occasional diarrhea, which may prompt the patient to reduce food intake or which may require adjustment of the dosage.

3. **Thermogenic Agents that Increase Lipolysis and Reduce Insulin Resistance**

   β-3 adrenoceptor agonists with minimal beta-1 and -2 stimulation have potential advantages for the person with obesity and insulin-resistant diabetes.

4. **Agents that Minimize the Complications of Diabetes**

   Accumulation of sorbitol and depiction of myomositol are established in animals as promoters of diabetic neuropathy, retinopathy, and capillary basement membrane thickening.
Somatostatin was originally isolated from the hypothalamus as an inhibitor of release of growth hormone from the pituitary. It was later isolated from the delta cells of the pancreatic islets and other tissues, and was found to be a potent inhibitor of the release of both insulin and glucagon. As such, it has been a useful tool for research in diabetes. Analogues with a half-life in plasma of 8-12 hours have been produced that are valuable in management of several hormone producing tumors. A potential use of these analogues in diabetes is in control of early morning hyperglycemia, the so-called "dawn phenomenon," which has been attributed to increased secretion of growth hormone during the late hours of the night.

5. **New Oral Hypoglycemic Agents**

The thiazolidinedione derivatives like CS-045 & pioglitazone (a potent second-generation thiazolidinedione derivative).

The drugs have (a) increases insulin sensitivity by increasing insulin-stimulated receptor kinase activity, and is ineffective in the face of insulin deficiency; (b) reduces hepatic glucose output by increasing phosphoenolpyruvate carboxykinase and not by affecting GLUT2 in liver; (c) increases glucose transport in muscle and adipocytes by increasing GLUT4 in the presence of insulin; and (d) lowers plasma triglycerides and cholesterol. Clinical trials are in progress, and the only adverse effect reported to date has been mild tremor.

6. **Appetite Suppressant Having Direct Hypoglycemic and Lipid-lowering Activity**

Agents that suppress appetite by blocking reuptake of serotonin at the nerve terminal may be useful in this connection. For example fenfluramine and Dex-fenfluramine, the active isomer, has somewhat greater effectiveness, and those with central obesity and those who crave
carbohydrates appear to benefit most and the antidepressant fluoxetine (Prozac) has similar effects.

A summary of the options for management of the various subtypes and stages of diabetes. I/G and C-Pep/G are the ratios of fasting and stimulated insulin and C-peptide to glucose in plasma.
7. A Hypolipidemic Agent that Reduces Hyperinsulinemia

Bensfluorex have shown:

(1) Inhibition of hepatic fatty acid synthesis from acetate and an inhibition of triacylglycerol synthesis;

(2) A decrease in plasma insulin concentrations;

(3) A decrease in insulin resistance;

(4) Improvement in hypertension; and

(5) Improvement in hyperlipidemia – all in the absence of weight loss.

8. Transplantation & Gene Therapy:

Provocative approaches to replacement of insulin. Segmental pancreatic transplantation has been employed successfully in several hundred patients. However, the surgery is technically complex and usually is considered only in patients with advanced disease and complications.

Islet-cell transplants are theoretically less complicated. They have been accomplished in experimental rodent models of diabetes and recently in a small group of type IDM patients along with a novel glucocorticoid-free immunosuppressive regimen.

Insulin dependent diabetes mellitus by introducing insulin- I gene into liver to act as an ectopic site for insulin production.
*Pan, J.G. et al* found that India is one of the richest country in the world in natural resources. Forty compounds including alpha-pinene, linalool, terpinyl acetate, beta-caryophylline, and caryophylline oxide etc., were identified in the essential oil obtained from the leaves of *vitex negundo* and other species of *vitex* by GC-MS.

*Nirgundi* plant is reported in Ayurveda to be effective against all types of inflammatory disorders like sinusitis, endometriosis, colitis and in wound healing. The leaves are used in pain and oedema seen in arthritic patients; and headache, catarrhal fever & cervical spondylitis. It exhibit free radical scavenging activity (natural defense mechanism of cancer).

The anti-inflammatory activity has been evaluated by Carageenan induced 'Rat pain oedema inhibition'. On phytochemical evaluation, the hydroalcoholic extract of leaves revealed the presence of flavanoids and irridoids.

The histological section of plant revealed epidermal cells, collenchyma, palisade cells, mesophyll, xylem and phloem. The upper as well as lower epidermis showed the presence of covering & glandular trichomes; and paracytic stomata.

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Gupta, M. et al revealed that Methanolic extract of the leaves of *vitex negundo* exhibits CNS depressant activity in a dose dependent manner in mice.

*Pushpalatha, E. & Muthukrishnan, J.* showed that Larvicidal activity of partially purified extracts of leaves of *Vitex negundo*, *Nerium oleander* and seeds of *Syzygium jambolanum* on different instars of *Culex quinquefasciatus* and *Anopheles stephensi* was estimated. Petroleum ether (PE): Ethyl acetate (EA) 3:1 fraction of *V. negundo*, 1:1 fractions of *N. oleander* and *S. jambolanum* inflicted considerable larval mortality and interfered with pupal-adult metamorphosis. At very low concentration the active fractions of these plant extracts extended the duration of the various larval instars and of pupation. In general, I and II instar larvae were more susceptible to the active fractions. Species and stage specific differences in the susceptibility of the mosquitoes to the active fractions of the plant extracts were observed.

*Avadhoot, Y. and Rana, A.C.* found Alcoholic extract of seeds of *vitex negundo* Linn, was obtained by maceration. A dose of 250mg/kg (1/6 of LD$_{50}$) of the extract was selected to study the hepatoprotective action against carbon tetrachloride-induced liver damage. The extract was found to be effective in preventing liver damage which was evident by morphological, biochemical and functional parameters.

*Bhargava, S.K.* represented the ability of the flavonoid-rich fraction (5,7,3'-tri hydroxy, 6,8,4'-trimethoxy flavones) of *Vitex negundo* seeds to antagonize the androgen action of exogenous testosterone propionate on the male reproductive system was studied in castrated prepubertal and intact adult dog. The flavonoid-rich fraction (F) was administered 10 mg/kg i.p. every other day either alone or in combination with testosterone propionate. The duration of treatment was 30 days in castrates and 60 days in intacts.
Treatment with F caused disruption of the latter stages of spermatogenesis. The epididymides were devoid of spermatozoa. Protein, sialic acid and RNA contents of the testes and epididymides were reduced significantly while testicular cholesterol and phosphatase activity in testes and epididymides were elevateds effects in dogs.

Chawla, A.S. et al revealed that the chloroform extract of the defatted seeds of Vitex negundo exhibited anti-inflammatory activity and yielded four triterpenoids: 3 beta-acetoxyolean-12-en-27-oic add [1], 2 alpha, 3 alpha-dihydroxyoleana-5,12-dien-28-oic add [2], 2 beta,3 alpha-diacetoxyoleana-5,12-diep-28-oic add [3], and 2 alpha,3 beta-diacetoxy-18-hydroxyoleana-5,12-dien-28-oic add [5]. This is the first report of the isolation of compounds 2, 3, and 5 from a natural source.

Hebbalkar, D.S. et al exhibited oil obtained from stream distillate of V. negundo leaves was fractionated by column chromatography. Mosquito repellence activity, as evaluated against Aedes aegypti was mainly confined to the most polar fractions. The protection period against mosquito bites by polar fractions ranged between 1-3 h. However, the mean protection period values of these fractions did not show significant increase in the subsequent subtractions.

Shrivastava, S.C. and Sisodia, C.S. showed analgesic activity on vitex negundo and Valeriana wallichii.

Munasinghe, T.C. et al presented antiradical and anti lipoperoxidative effect was exerted in the whole plant extract, used by Srilankan traditional medical practitioners for cardioprotection.

Perunval Samy, R. et al have experiments on a total of 34 plant species belonging to 18 different families, selected on the basis of folklore medicinal reports practised by the tribal people of Western Ghats, India,
were assayed for antibacterial activity against Escherichia coli, Klebsiella aerogenes, Proteus vulgaris, and Pseudomonas aerogenes (gram-negative bacteria) at 1000-5000 ppm using the disc diffusion method. Of these 16 plants showed activity; among them Cassia fistula, Terminalia arjuna and Vitex negundo showed significant antibacterial activity against the tested bacteria. This findings confirm the traditional therapeutic claims for these herbs.

*Damayanti, M. et al* showed antifungal activity on the pineapple fruit-rotting fungus, Ceratocystis paradox.

*Li, S. and Guan, S.* had been examined the stability of medicinal volatile oil with β-cyclodextrin of Vitex negundo in China.

*Virendra Singh; et al* isolated twelve pure compounds, and characterized by spectral data (UV, IR, NMR and MS) from the different extractives of the Vitex negundo leaves. Squalene is reported for the first time from its leaves. Agnuside was found to possess significant hepatoprotective activity while viridiflorol exhibited dose dependant antifeedant activity against *Sitophilus oryzae* and ovipositional activity against *Callosobruchus chinensis*.

*Tewari, K.K.* showed the efficacy of leaf extracts (15-20 percent) of *Pongamia pinnata*, *Cathumillius roseus*, *Vitex negundo*, *Ocimum sanctum*, *Psoralea corylifolia* and *Azadirachta indica* has been investigated against transmission of cucumber mosaic virus (CMV) disease on *Cucumis melo* cultivars (Arkajeet, Arkarajhans). catharanthus roseus and Vitex negundo leaf extracts completely inhibited me the fruitfly *Dacus cucurbitae* population and the incidence of CMV and the rest of plant extracts reduced the various transmission partially.
Srinivas, K et al isolated five compounds from the methanolic extract of the roots of Vitex negundo and purified by crystallization and preparative TLC. They were identified as 2β, 3α - diacetoxyoleana-5,12 -dien - 28-oic acid; 2α, 3α-dihydroxyoleana-5,12-dien-28-oic acid; 2α, 3 β-diacetoxy-18-hydroxy leana-5,12-dien-28- oic acid, vitexin and isovitexin by spectral data and chemical conversions.

Sundararajan, G. screened methanolic extract of Vitex negundo for insecticidal activity against the fourth instar larve of helicoverpa arniger a by applying dipping method of the leaf extracts at various concentrations (0.25, 0.5, 1.0, 1.5 & 2.0) on young tomato leaves. Vitex negundo is found to show higher rate of mortality (82.5%) at 2% concentration.

Mousa, O. found the extract of ficus religiosa (Peepalbanti) had significant antibacterial activity, but no antifungal activity. This supports the traditional use of plant in folk medicine for respiratory disorders and certain skin diseases.

Agarwal, V. & Chauhan, B.M. revealed that Ficus religiosa had about 40-50% dietary fibers exhibiting hypolipidaemic effect. And effect of feeding the food as source of dietary fiber on biological utilization in rats was reported including parameters like food intake, weight gain, feed efficiency ration (FER), dry matter digestibility (DMD) and true protein digestibility (TPD).

Cherian, S. et al represented the antidiabetic effect of a dimethoxy derivative of pelargonidin 3-0-α-L rhamnoside (250 mg/kg, single dose study and 100 mg/kg/day long term study) isolated from the bark of Ficus bengalensis Linn; has been compared with that of glibenclamide (2 mg/kg and 0.5 mg/kg/day respectively) in moderately diabetic rats. The single dose
glycoside treatment decreased fasting blood glucose by 19% and improved glucose tolerance by 29%. The corresponding effects of glibenclamide were 25% and 66% respectively over the control values. On one-month treatment the fasting blood glucose levels went down almost to half of the pretreatment levels in both the groups and their glucose tolerance improved by 41% in glibenclamide group and by 15% in glycoside treated group. Urine sugar decreased to traces in both the groups and they appeared healthy. *In vitro* studies showed that insulin secretion by β-cells was more in presence of the pelargonidin derivative than in presence of a leucocyanidin derivative, reported to be a good anti-diabetic agent.

*Gupta, A.K. et al* studied that in a pot culture experiment *Ficus religiosa* was exposed to brick industry pollution. Ambient air quality monitoring and biochemical foliar analysis at control site and polluted site was done fortnightly. The obtained values showed positive correlation through t-test. Reduction in sugar and pigment, carotenoids in the leaves was observed.

*Duhan et. al.* revealed the presence of zinc in high amount in *Ficus religiosa* and *Ficus glomerata*. Gullar (*Ficus glomerata*) also contained about 15 times the amount of calcium present in wheat.