

3.23 Family MALVACEAE

There are 82 genera with above 1,500 species having both tropical and temperate distribution.

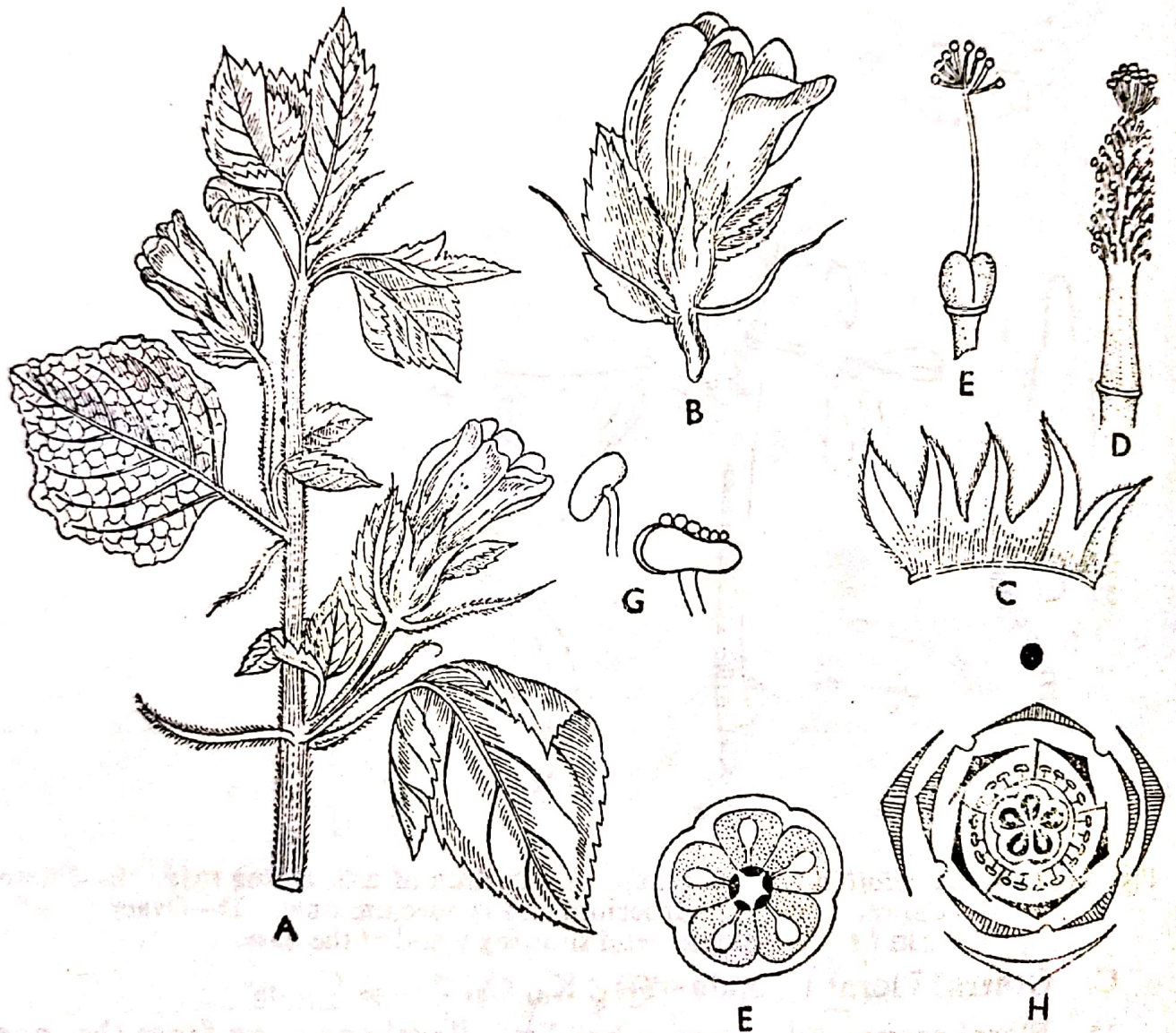


Fig. 3.41—*Malachra capitata* L. (Malvaceae). A—Portion of a flowering twig. B—Flower. C—Calyx split open. D—Flower showing monadelphous stamens and carpels (calyx, corolla removed). E—Gynoecium. F—Ovary in t. s. G—Stamens. H—Floral diagram.

and their arrangement. In *Althea* the number of epicalyx is many, in *Sida* and *Abutilon* the epicalyx is absent. The number of carpels is usually 5, but 15-20 carpels occur in *Abutilon* with whorled arrangement. In *Malope*, carpels are vertically arranged one above the other. The staminal tube may be large exerted or small included, in *Kydia* stamens are 15, carpels 2-3. The flowers of *Napaea* (dioecious plants) are unisexual.

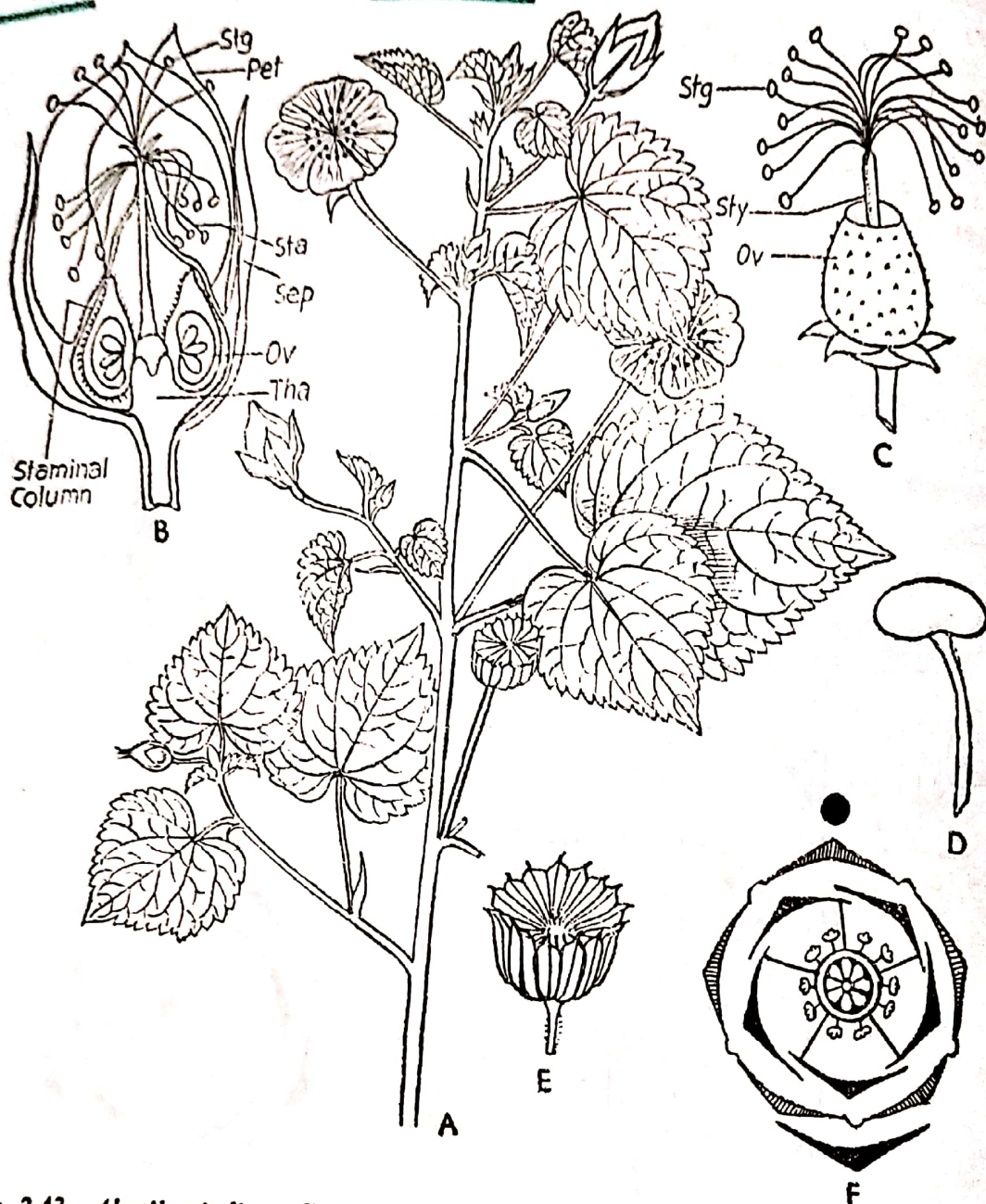


Fig. 3.43—*Abutilon indicum* G. Don. (Malvaceae). A—Portion of a flowering shoot. B—Flower in l.s. (Stg, stigma; Pet, petal; Sta, stamen; Sep, sepal; Ov, ovary; Tha, thalamus). C—Gynoecium (Stg, stigma; Sty, style; Ov, ovary). D—Stamen. E—Fruit. F—Floral diagram.

E. Affinity and systematic position—This family is closely allied to other members of the order Malvales. Systematic position as in Tiliaceae. Hutchinson placed this family under the order Malvales (after Tiliales), division Archichlamydeae (or sub-group Lignosae) and sub-phylum Dicotyledonae.

F. Common plants—*Hibiscus rosa-sinensis* L.; *Gossypium herbaceum* L.; *Abelmoschus esculentus* Moench (Syn. *Hibiscus esculentus* L.); *Abutilon indicum* Don.; *Sida cordifolia* L.; *S. rhombifolia* L.; *S. alba* L. (Syn. *S. spinosa* L.); *Malachra capitata* L.; *Thespesia populnea* (L.) Soland. ex Corr.; *Hibiscus mutabilis* L.; *Urena lobata* L. etc.

G. Economic importance—Various species of *Gossypium* e.g. *G. herbaceum* L., *G. arboreum* L., *G. hirsutum* L. etc. yield cotton fibre of

A. Diagnostic characters: Aromatic herbs or shrubs with square stems covered with glandular hairs. Leaves simple, opposite decussate, exstipulate. Flowers irregular and bisexual in verticillaster inflorescence. Corolla bilabiate. Carpels 2; ovary 2-chambered, but ultimately becomes 4-chambered. Style gynobasic, tip bifid. Fruit of one-seeded 4 nutlets (carcerule).

B. General characters—Plants are mostly aromatic annual or perennial herbs, shrubs or under-shrubs. Stems quadrangular (i.e. square), covered with glandular hairs. Leaves simple showing all grades of incision of the leaf blade to entire form, exstipulate, opposite-decussate or whorled sometimes. Inflorescence verticillaster, rarely biparous cymes or dense spike. Flowers bisexual, hypogynous, zygomorphic (irregular), bracts and bracteoles are

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Fig. 3-62—*Leonurus sibiricus* L. (Labiatae) A—Portion of a flowering twig. B—Flower. C—Corolla split open showing androecium and gynoecium. D—Calyx whorl. E—Gynoecium. F—Ovary in t.s. G—Fruit. H—Floral diagram.

usually present. Sepals 5, connate in a persistent irregular calyx, valvate or imbricate, sometimes bilabiate. Petals 5, connate in a two-lipped (bilabiate) corolla, lobes imbricate, the lower lip typically 3-lobed and often concave. Stamens 4, didynamous, or 2 (e.g. *Salvia*), epipetalous, anterior pair usually

lower lip, the upper lip is not evident. *Mentha* has regular 4-merous or 5-merous corolla. *Coleus* has monadelphous androecium, i.e. stamens are united in a bundle. Stamens are 2 in *Salvia*.

E. Affinity and systematic position—The family Labiatae is closely related to Verbenaceae. It also bears some affinity with the family Boraginaceae.

Bentham and Hooker have treated Labiatae as Natural Order under 7th cohort Lamiales, series Bicarpellatae, sub-class Gamopetalae and class Dicotyledones. Many botanists have placed Labiatae under the order Personales. Engler has placed the family Labiatae under the order Tubiflorae, sub-class Metachlamydeae and the class Dicotyledoneae. Hutchinson placed this family under the order Tubiflorae (Lamiales), division Metachlamydeae (or sub-group Herbaceae) and the sub-phylum Dicotyledonae.

F. Common plants—*Ocimum sanctum* L. ; *Leonurus sibiricus* L. ; *Leucas aspera* Spreng. (Syn. *L. mollissima* Wall.) ; *L. procumbens* Desf. ; *Salvia splendens* Ker-Gawl. (Syn. *S. colorans* Hort. ex Benth.) ; *Anisomeles indica* O. Kuntz. (Syn. *A. ovata* R. Br.) ; *Hyptis suaveolens* Poir. ; *Pogostemon plectranthoides* Desf. ; *Leonotis nepetifolia* R. Br. etc.

G. Economic importance—Many plants of the family Labiatae are useful as they contain essential volatile oils.

Leaves and flowering tops of *Rosmarinus officinalis* L. yields oil of rosemary—used in making toilet soap, it is also used in medicine. Perfumed lavender oil is obtained from the flowers of *Lavandula officinalis* Chaix (Syn. *L. vera* DC.)—oil is used in perfumery.

From *Thymus vulgaris* L., thymol is obtained ; *Mentha piperita* L. yields menthol from leaves—menthol and thymol are used in the preparation of medicine. *Ocimum kilimandscharicum* Guerke is cultivated in India for camphor, the leaves contain oil from which 5% camphor is obtained ; the leaves of *O. sanctum* is used in Kaviraji medicine.

The seeds of *Ocimum basilicum*, *Salvia aegyptiaca* and *Lallemantia royleana* form "topmari" of commerce, used in making popultice for curing boils.

The leaves of *Coleus amboinicus* Lour. (Syn. *C. aromaticus* Benth.) are used for flavouring food products.

Some plants such as *Coleus* sp. *Salvia officinalis* L., *S. splendens* Ker-Gawl., *S. coccinea* L., *Meriandra benghalensis* Benth. etc. are cultivated as ornamental garden plants.

3.37 Family SOLANACEAE

The family with 90 genera having more than 2,200 species is mainly distributed in tropical and temperate regions of the world.

A. Diagnostic characters : Herbs, shrubs mainly. Leaves simple, alternate, exstipulate. Flowers bisexual, regular in cymose inflorescence. Calyx persistent. Corolla rotate or funnel-shaped. Carpels 2, obliquely placed. Placenta thick. Fruit many-seeded berry or capsule. Seeds flat, compressed, with curved embryo.

B. General characters—Plants are herbs, shrubs or small trees, rarely climbing shrubs (e.g. *Solanum trilobatum*, *S. jasminoides*). Leaves alternate (often becoming opposite at or near the inflorescence), simple, exstipulate, margins entire or lobed (often pinnatisect). Inflorescence typically an axillary cyme, sometimes helicoid, or cymose panicle, or flowers may be solitary. Flowers bisexual, regular (actinomorphic), or rarely zygomorphic, hypogynous with pentamerous tetracyclic arrangement of floral members. Sepals 5, connate, imbricate, persistent, often enlarging in fruit. Petals 5, connate in a

rotate or funnel-shaped or bell-shaped corolla or rarely in bilabiate corolla, lobes imbricate, sometimes plicate or convolute, rarely valvate (e.g. *Cestrum*). Stamens 5, epipetalous, alternating with the corolla lobes, rarely 4 and didynamous; anthers 2-celled, with apical porous or longitudinal dehiscence, projections of sterile tissues made up of connective-parenchyma occur within the anther lobes. Hypogynous disc is usually present. Carpels 2, obliquely placed, connate; ovary superior, 2-chambered or falsely 3-5 chambered;

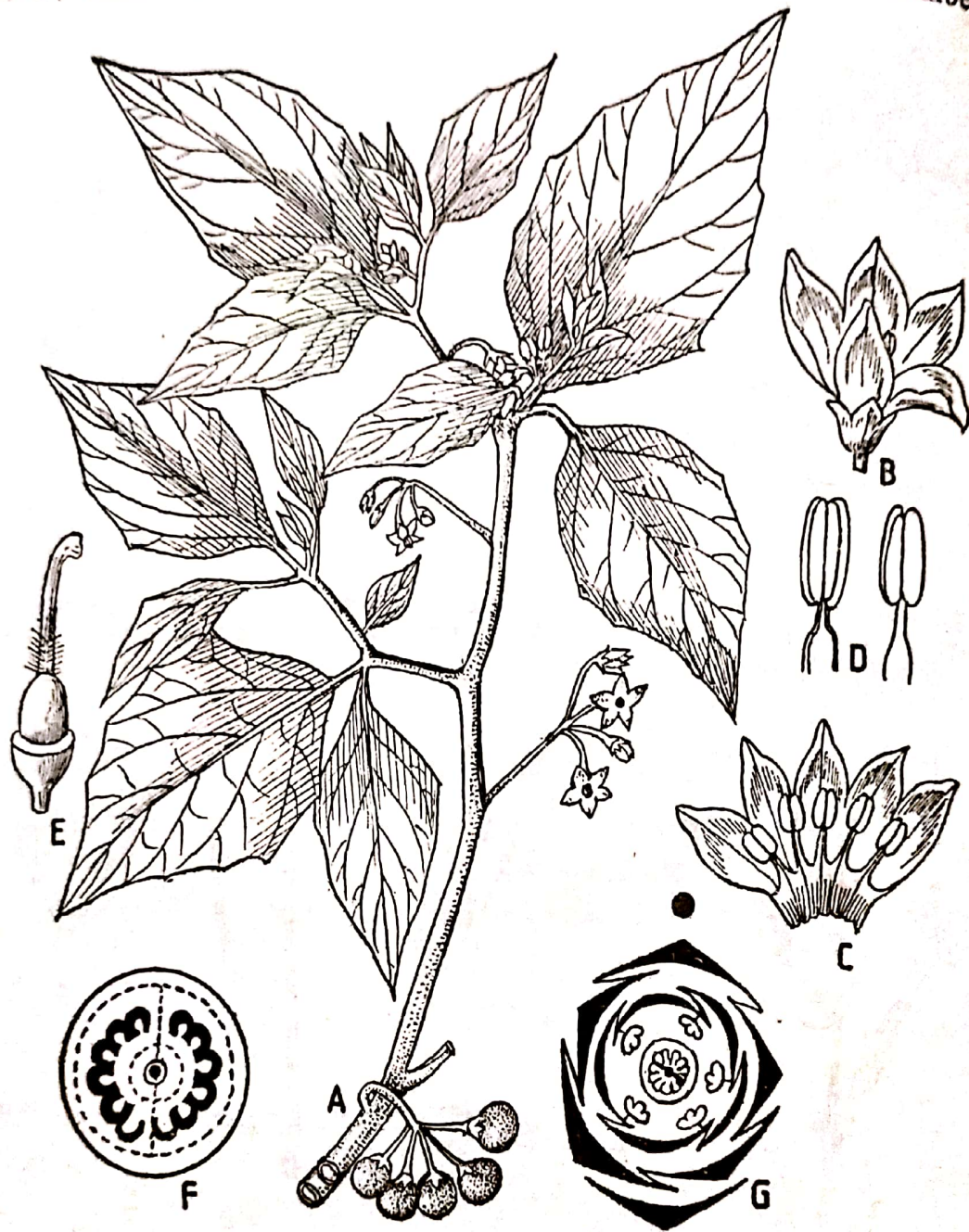


Fig. 3.66—*Solanum nigrum* L. (Solanaceae). A—Portion of a flowering twig. B—Flower. C—Corolla split open showing stamens. D—Stamens. E—Gynoecium. F—Ovary in t.s. G—Floral diagram.

ovules anatropous and many on thick axile placenta; style 1, terminal, simple; stigma capitate or slightly bilobed. Fruit usually many-seeded berry or sometimes capsule (e.g. *Datura*). Seeds compressed flat, often with endosperm; embryo curved or semi-straight.

C. General Floral formula— $\oplus \text{ } \overset{\circ}{\text{K}}_{(5)}, \overline{\text{C}}_{(5)}, \text{A}_5, \underline{\text{G}}_{(2)}$

D. Floral range :—The family Solanaceae has flowers with pentamerous arrangement excepting carpels and is built on plan $\text{K}_5, \text{C}_5, \text{A}_5, \text{G}_{(2)}$. The deviation is manifest in the actinomorphic and zygomorphic flowers, the latter

is confined to a few genera of the last tribe Salpiglossideae comprising *Browallia* (common way side weed). In *Brunfelsia* and *Salpiglossum* corolla is bilabiate and stamens are 4, didynamous. Due to false partition wall, originally 2-locular ovary becomes 4-5 locular in many genera e.g. *Datura*, *Solanum* etc. Anthers in *Solanum* have the tendency to become connivent in a cone. In *Schizanthus* stamens are 2. In *Henonla* the ovary is 1-chambered.



Fig. 3.67—*Cestrum diurnum* L. A—Portion of a flowering twig. B—Corolla split open showing stamens and carpels. C—Calyx whorl. D—Fruit. E—Entire seed. F—L.s. of the seed. G—Floral diagram.

E. Affinity and systematic position—The family Solanaceae is very much allied to the families Convolvulaceae and Scrophulariaceae. Many taxonomists have placed it under Solanales together with Convolvulaceae as the floral constructions of the two families except habit are almost similar. Bentham and Hooker placed Solanaceae as a distinct Natural Order under

suborder Polemoniales, series Hicarpellatae, sub-class Gamopetalae and the class Dicotyledones Engler has placed it under the order Tubiflorae, sub-class Metachlamydeae and the class Dicotyledones. Hutchinson placed this family under the order Solanales, division Metachlamydeae (or sub-group Herbaceae) and sub-phylum Dicotyledones.

F. Common plants—*Solanum torvum* Swartz.; *S. surattense* Wats. (Syn. *S. xanthocarpum* Schrad. and Wendl); *S. nigrum* L.; *S. verbascifolium* L.; *S. trilobatum* L.; *Datura metel* L.; *Nicotiana plumbaginifolia* Wt.; *Cestrum diurnum* L.; *Browallia elata* L. etc.

G. Economic importance—The family contains many useful plants.

Important plants used as vegetables are *Solanum tuberosum* L. (potato, obtained from stem-tubers), *Lycopersicon esculentum* Mill. (Syn. *Solanum lycopersicum* L.)—the tomato obtained from fruits, *Solanum melongena* L. (brinjal—obtained from fruits), *Capsicum frutescens* L. (the chillies—obtained from fruits) etc.

Atropa belladonna L., *Withania somnifera* Dunal, *Datura metel*, *D. stramonium* L., *Solanum surattense* etc. are important medicinal plants—the former yields atropin.

Nicotiana tabacum L. (the tobacco plant) is cultivated for tobacco (obtained from leaves).

Some species are used as favourite ornamental garden plants e.g. *Cestrum nocturnum* L. (night jessmine), *Brunfelsia americana* L. (Lady-of-the-night), *B. latifolia* Benth., *Browallia alata* L. etc.

3.28 Family SCROPHULARIACEAE

Scrophulariaceae is a fairly large family containing about 210 genera and over 3,000 species, distributed all over and in all parts of the world.

A. Diagnostic characters: Usually herbs or under-shrubs. Leaves alternate or opposite or whorled, exstipulate, simple. Flowers usually zygomorphic (irregular) in racemose or cymose inflorescence. Corolla personate usually. Stamen 4, didynamous (rarely 2). Carpels 2, medianly placed. Ovules numerous on thick axile placenta. Embryo straight or slightly curved.

B. General characters—Plants are mostly herbs or undershrubs, rarely shrubs or trees (e.g. *Wightia*); a few are climbers (e.g. *Maurandia*, *Antirrhinum cirrhosum*) and chlorophyll-less total parasites (e.g. *Harveya* and *Hyobanche*). Leaves alternate or opposite, rarely whorled, simple, entire or pinnately lobed or incised, exstipulate. Inflorescence racemose or cymose. Flowers biserial, usually zygomorphic or very rarely actinomorphic (e.g. *Scoparia*), pentamerous (but in *Scoparia* tetramerous), hypogynous, bracteate. Sepals 4-5, united, deeply partite, persistent, imbricate or valvate. Petals 4-5, connate in personate or tubular corolla, rarely corolla rotate (e.g. *Scoparia*), imbricate, one or more anterior petals sometimes produced into a spur (e.g. *Lauria*, *Diascia*) or basally gibbous to saccate (e.g. *Antirrhinum*). Stamens usually 4, didynamous, rarely 5 (e.g. *Verbascum*) or 2 (e.g. *Veronica*), epipetalous; anthers 2-celled, introrse, dehiscing longitudinally. Hypogynous nectar secreting disc (annular or unilateral) is present. Carpels 2, straight and medianly placed, connate; ovary superior, 2-chambered rarely 4-chambered; ovules anatropous or amphitropous, many to several in each ovary chamber, placenta thick, placentation axile; style 1, simple; stigma entire or bi-lobed, or 2 (e.g. *Gratiola*). Fruit usually capsule, rarely berry. Seeds with endosperms; embryo straight or feebly curved.

C. General Floral formula $\ast \overline{K_{(4-5)}} \overline{C_{(4-5)}} A_{4 \text{ or } 2} \underline{G_{(2)}}$

D. Floral range—Departure from typically bisexual zygomorphic flower with pentamerous calyx and corolla occurs in a few genera. In *Verbascum* flowers are actinomorphic (regular) with perfect stamens; in *Scoparia* flowers are actinomorphic and tetramerous; in *Veronica* the calyx is tetramerous due to the suppression of posterior sepal, and the corolla tube is almost absent: in *Antirrhinum* the anterior carpel is larger than the posterior one. Stamens are 2 in many species of *Dopatrium* and *Veronica*. In *Linaria*, *Russelia*, *Antirrhinum* stamens are 4 and didynamous.

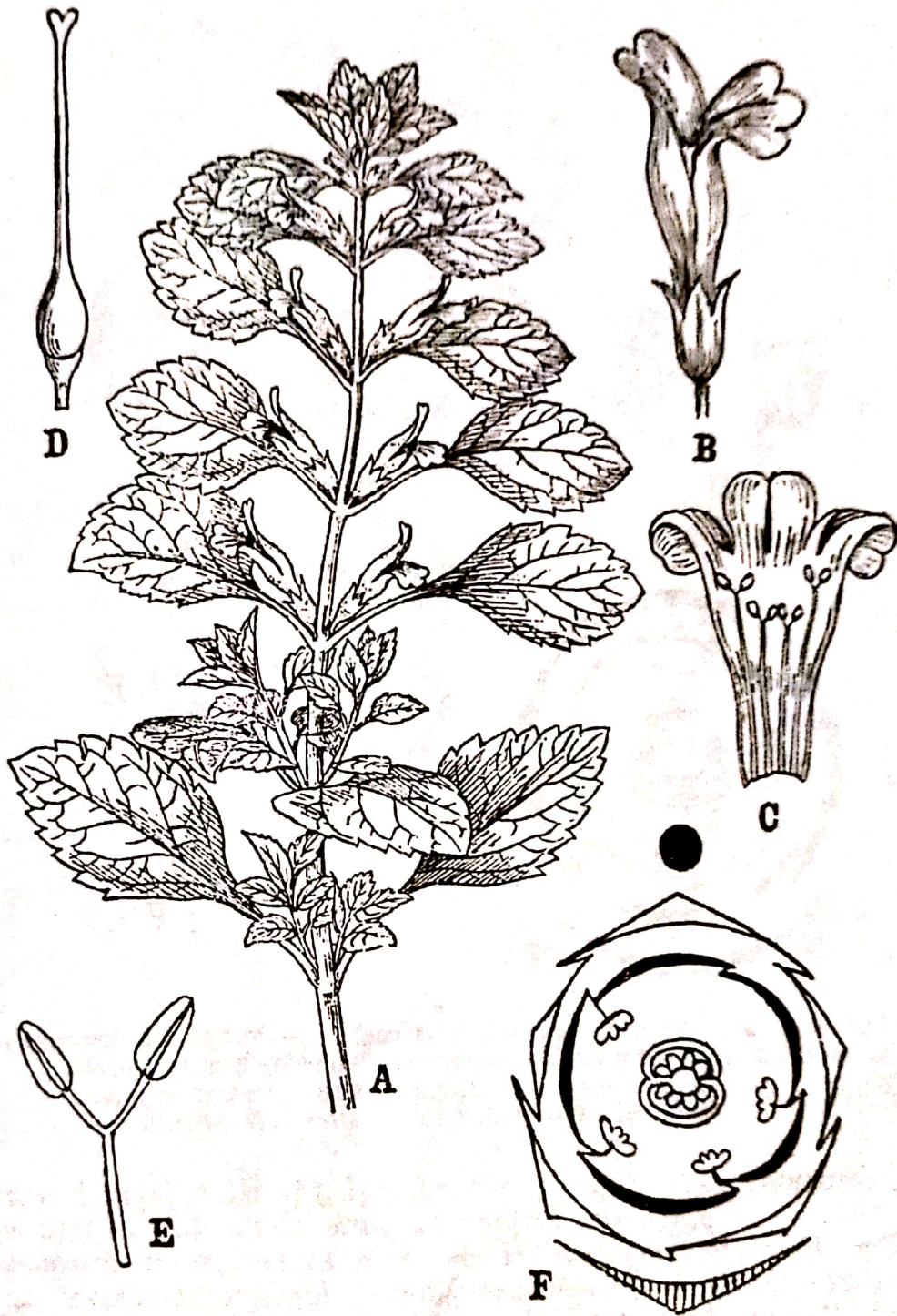


Fig. 3.68—*Lindenbergia indica* O. Ktze. (Scrophulariaceae). A—Portion of a flowering twig. B—Flower. C—Corolla split open showing stamens. D—Gynoecium. E—Single stamen with divaricate anthers. F—Floral diagram.

E. Affinity and systematic position—Scrophulariaceae is very closely related to Solanaceae. Many taxonomists placed the family under the order Personales. Engler and Rendle have placed the family very close to Solanaceae under the order Tubiflorae, sub-class Metachlamydeae and the class Dicotyledoneae. Bentham and Hooker put Scrophulariaceae as Natural

Order under 9th cohort Personales, series Bicarpellatae, sub-class Gamopetalae and class Dicotyledones. Hutchinson placed the family Scrophulariaceae under the order Personales, division Archichlamydeae (or sub-group Herbaceae) and the sub-phylum Dicotyledonae.

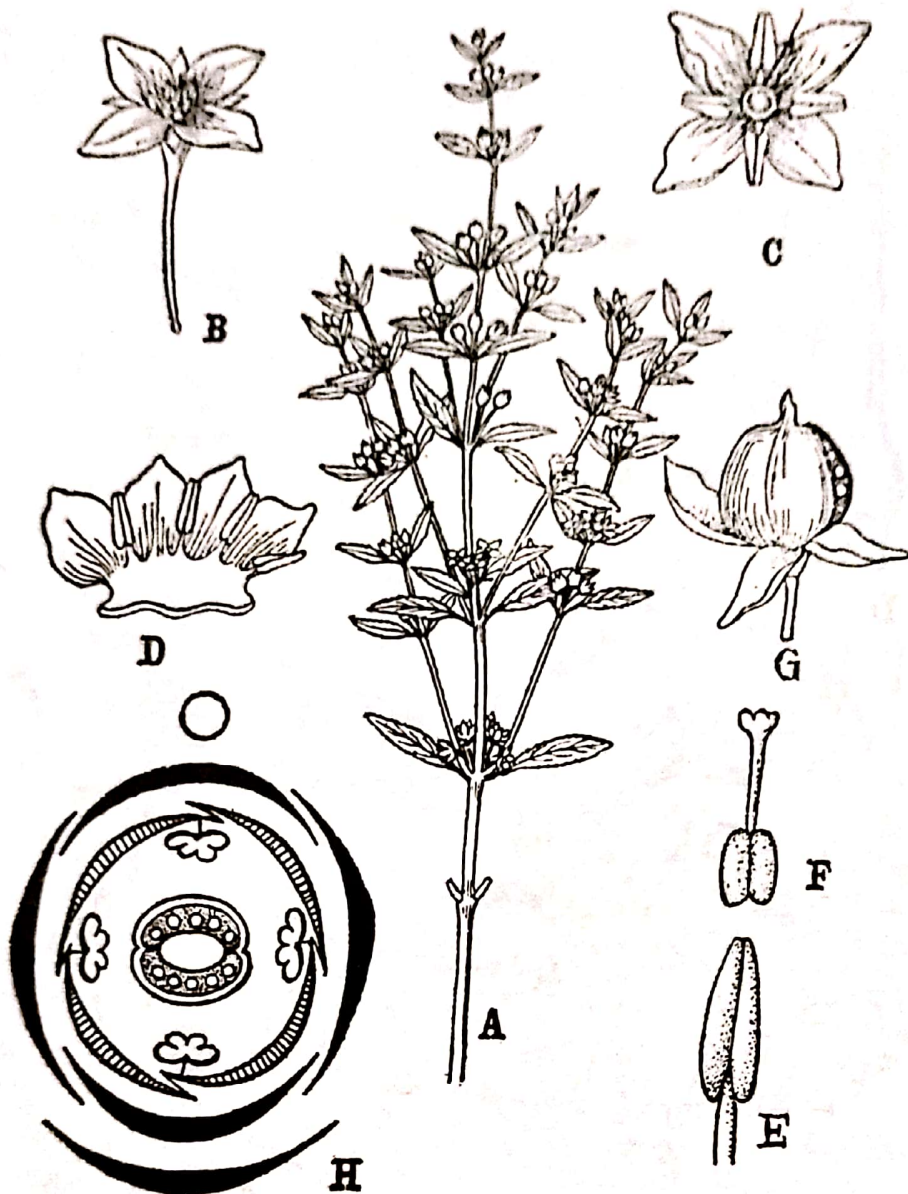


Fig. 3.69—*Scoparia dulcis* L. (Scrophulariaceae). A—Portion of flowering twig. B—Flower. C—Flower in surface view showing bearded corolla. D—Corolla split open. E—Single stamen. F—Gynoecium. G—Fruit. H—Floral diagram. (After J. N. Mitra).

F. Common plants—*Lindenbergia indica* (L.) O. Ktze. (Syn. *L. urticaefolia* Link & Otto.); *L. polyantha* Royle; *Scoparia dulcis* L.; *Bacopa monnieri* Pennel (Syn. *Herpestis monnieri* H. B. & K.); *Verbascum coromandelianus* O. Ktze. (Syn. *Celsia coromandeliana* Vahl.); *Linderria brachiata* Link and Otto. (Syn. *Bonnaya brachiata* Link and Otto.); *L. crustacea* F. Muell. (Syn. *Vandellia crustacea* Benth.); *Limnophila heterophylla* Benth. (an aquatic herb with dissected submerged leaves, a typical example of heterophylly); *Torenia cordata* (Griff.) N. M. Dutta; *Dopatrium junceum* Ham.; *Linaria ramosissima* wall. etc.

G. Economic importance—This family is of little economic importance. *Digitalis purpurea* L. is a medicinal plant—alkaloid *digitalin* is obtained from this plant and which is used in the treatment of heart trouble.