

T A X O N O M Y

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Linnaeus in *Philosophia Botanica* (1763) applied the name 'Columniferae' to one of his natural groups, which included the genus "Gossypium" and most of the modern genera of Malvaceae as it is presently understood.

Family 'Malvaceae' first described by de Jussieu (1789) was properly classified by Bentham and Hooker (1862). Malvaceae was included by them in the cohort Malvales, series Thalamiflorae of sub-class Polypetalae and characterised by indefinite stamens, valvate calyx and axile placentation. Further, the family was divided into 4 tribes viz. Malveae, Ureneae, Hibisceae and Bombaceae. The same classification was followed by Masters (1868). Schumann (1890) in his treatment of the family in Englar and Prantl's "*Die natürlichen Pflanzenfamilien*", put the family in the 26th order of Archichlamydeae and also divided it into tribes Malopeae, Malveae, Ureneae and Hibisceae. He raised Bombaceae to a level of a separate family. Warming (1895) did not separate Bombaceae from the Malvaceae and considered the family as closely allied to Sterculiaceae but quite

distinct from Tiliaceae, mainly because of its unilocular anthers. He divided the family into two groups on the basis of carpel-arrangement. His group II contains only the Malopeae. The group I is further divided into Sect. A (including Gossypieae and Bombaceae) and Sect. B (including Malveae and Ureneae) on the basis of fruit character and number of styler branches. Hutchinson (1926) while, excluding Bombaceae from rest of the Malvaceae, places it in a monotypic order Malvales. Edlin (1935) grouped the genera Hibiscus, Abelmoschus, Thespesia and many others into the family Bombaceae because of their loculicidal capsules or baccate fruits. He further, on the basis of septicidally dehiscent schizocarpic fruits included Urena, Pavonia, Malachra and other genera in the family Malvaceae. Kearny (1951) and Hutchinson (1967) have followed Schumann's (1890) treatment with some modifications.

The various classifications proposed for the family on the basis of obvious morphological characters have subsequently been verified by workers in other disciplines of Botany. Rao (1952) and Ahuja (1964) on

the basis of anatomical studies do not support amalgamation of the tribe Hibisceae with Bombaceae as suggested by Edlin (1935). Prasad (1963) studied the pollen morphology of various genera of the family, describing the common features of pollen. Chaudhuri (1965), Chaudhuri and Malik (1965) on the basis of pollen characteristics, supported Hutchinson's (1964) splitting of the order Malvales into two closely allied orders Tiliales (comprising Tiliaceae, Sterculiaceae etc.) and Malvales containing the only family Malvaceae.

In the present work the Schumann's treatment as modified by Hutchinson (1967) has been followed.

Tribe I Malopeae -

Tribe II Hibisceae

Genus - Hibiscus Linn.

Section Furcaria DC.

1. H. sabdariffa Linn.
2. H. cannabinus Linn.

Section Pterocarpus Garcke

3. H. vitifolius Linn.

Section *Trionum* DC.4. *H. mutabilis* Linn.5. *H. trionum* Linn.Section *Solandra* Hochr.6. *H. lobatus* (Murr.) O.KuntzeSection *Hibiscus* Borss.7. *H. hirtus* Linn.8. *H. ovalifolius* (Forsk.) VahlSection *Trichospermum* Hochr.9. *H. panduraeformis* Burm.Section *Ketmia* DC.10. *H. caesius* GarckeGenus *Abelmoschus* Medik.11. *A. manihot* (Linn.) Medik.12. *A. angulosus* (Steud.) Wt. & Arn.Genus *Azanza* Alef.13. *Azanza lampas* (Cav.) Alef.

Genus Thespesia Soland. ex Corr.

14. Thespesia populnea (Linn.)

Soland. ex Corr.

Tribe III Malveae —

Tribe IV Abutileae —

Tribe V Ureneae

Genus Malachra Linn.

15. Malachra capitata Linn.

Genus Urena Linn.

16. Urena lobata Linn.

Genus Pavonia Cav. (nom. cons.)

17. P. zeylanica Cav.

18. P. patens (Andr.) Chiov.

Hibiscus Linn.

The genus Hibiscus of Linnaeus (1737, 1753 and 1754) has been an assemblage of Ketmia Tourn. Malvaviscus Dill., Trionum Linn. and Hibiscus Linn.. It has been accepted that Malvaviscus is distinct from the remaining genera of the assemblage.

Miller (1754) splits up Hibiscus Linn. into Ketmia and Hibiscus restricting Hibiscus to a single species i.e. H. malvaviscus Linn. and other species of Hibiscus known at that time to Ketmia. This treatment was not very convincing because the single species placed under Hibiscus by Miller is Malvaviscus (M. arboreus Cav.).

Fabricius (1759) united Ketmia, Hibiscus and Malvaviscus and called this new genus Malvaviscus reducing Ketmia and Hibiscus to synonymy. This treatment was not accepted by the subsequent authors.

Cavanilles (1787) treated Malvaviscus as a distinct genus based on Hibiscus malvaviscus Linn. since then the two genera Hibiscus and Malvaviscus are widely accepted as distinct. Borssum Waalkes et al. (1966) have rightly

proposed to conserve the two generic names to avoid further complications in future.

The different species described here under the genus Hibiscus are kept under different sections following Hochreutiner (1900) (refer page nos. 20-21).

Abelmoschus Medik.

The spathaceous calyx splitting on one side and its deciduous nature formed the basis for Medikus's (1787) genus Abelmoschus. This concept has been accepted by Hochreutiner (1924) as in this genus the calyx, corolla and stamens are fused together at the base and fall as one piece after anthesis. In an earlier publication (1900) however, he considered Abelmoschus as a section of the genus Hibiscus. The generic status of Abelmoschus has been accepted by many workers (Schumann, 1890; Hochreutiner, 1924; Hu, 1955; Santapau, 1955, 1962, 1967; Borssum Waalkes et al., 1966; Rakshit and Kundu, 1970). Although there were quite a few botanists (Masters, 1872; Hochreutiner, 1900; Prain, 1903; Duthie, 1903; Gamble, 1957; Cooke, 1958), who considered Abelmoschus only as a section.

Azanza Alef.

Schumann (1890) and Hochreutiner (1900) refer to Thespesia lampas as Hibiscus lampas under the Sect. Columnaris. This has been done because of a number of characters such as distinctly lobed styles, non caducous involucre, clearly 5 lobed calyx and many seeded dehiscent woody capsule. Indian workers also accepted Hochreutiner's view (Santapau, 1962). Borssum Waalkes et al. (1966) however, consider the species as a part of Thespesia on an account of its compound stigma and cupular or minutely 5-toothed calyx. Rakshit and Kundu (1970) based on their study of living specimen concluded that the stigmatic lobes and their arrangement are distinct morphological deviations from all the species of Hibiscus; the characters are more inclined to Thespesia. Pollen morphological studies (Rakshit and Kundu, 1970) indicate an intermediate position of this taxon between the genera Hibiscus and Thespesia. From these morphological observations it is evident that this genus represents a connecting link between Hibiscus and Thespesia, a fact which is subsequently borne out by the cytological observations reported in the thesis.

Tribe - Ureneae

Hutchinson (1967) considers tribe Ureneae as probably the most recently evolved and places it after Hibisceae. He has supported Davie (1933) who considers Ureneae to be more advanced than Hibisceae in having one ovulate carpels and reduction in the number of loculi to half that styles. Bentham and Hooker (1862), Masters (1868) and Schumann (1890) do not subscribe to this view and place the tribe Ureneae before Hibisceae.

Tribe Hibisceae

Genus Hibiscus Linn.

Hibiscus sabdariffa Linn. Sp. Pl. 696, 1753;

FBI. 1 : 340; C. 1: 117; Rakshit and Kundu,

BBSI. 12(1-4) : 162, 1970.

An erect annual, 1.2 m - 1.5 m high. Stem terete, green or red-purple, glabrescent. Leaves, deeply or shallowly 3-5 lobed, cuneate at the base, lobes lanceolate or oblong, mid-lobe the longest, serrate, with a glandular dot on the midrib beneath, often

blotched with purple; petiole 7 cm - 10 cm long, green or reddish-purple; stipules 1.0 cm - 1.3 cm long, linear, acute. Flowers axillary, yellow with a white or purple centre; pedicel very short, stout, jointed near the base, purple or green; involucral bracts 8-10, lanceolate, shorter or longer than the calyx, adnate to its base, green or purple, fleshy, covered with hairs; calyx lobes 5, 1.6 cm - 1.8 cm by 1.0 cm - 1.2 cm, fleshy, lanceolate, 3-nerved, provided with an oblong-ovate gland at the base of each lobe, green or red, accrescent in fruit; corolla lobes 5, 3.5 cm - 4.0 cm by 2.0 cm - 2.5 cm; staminal tube 1.6 cm long, Capsule ovoid, beaked, villose, shorter than the calyx. Seeds reniform, dark brown, covered with minute stellate hairs. (Fl. & Fr. : October - January).
ADG.- 7, 60, 61, 62, 63.

Cultivated for its fibres and fleshy, edible calyx.

These populations show morphological differences and thus were subjected to polygraphic study (Fig. 1).

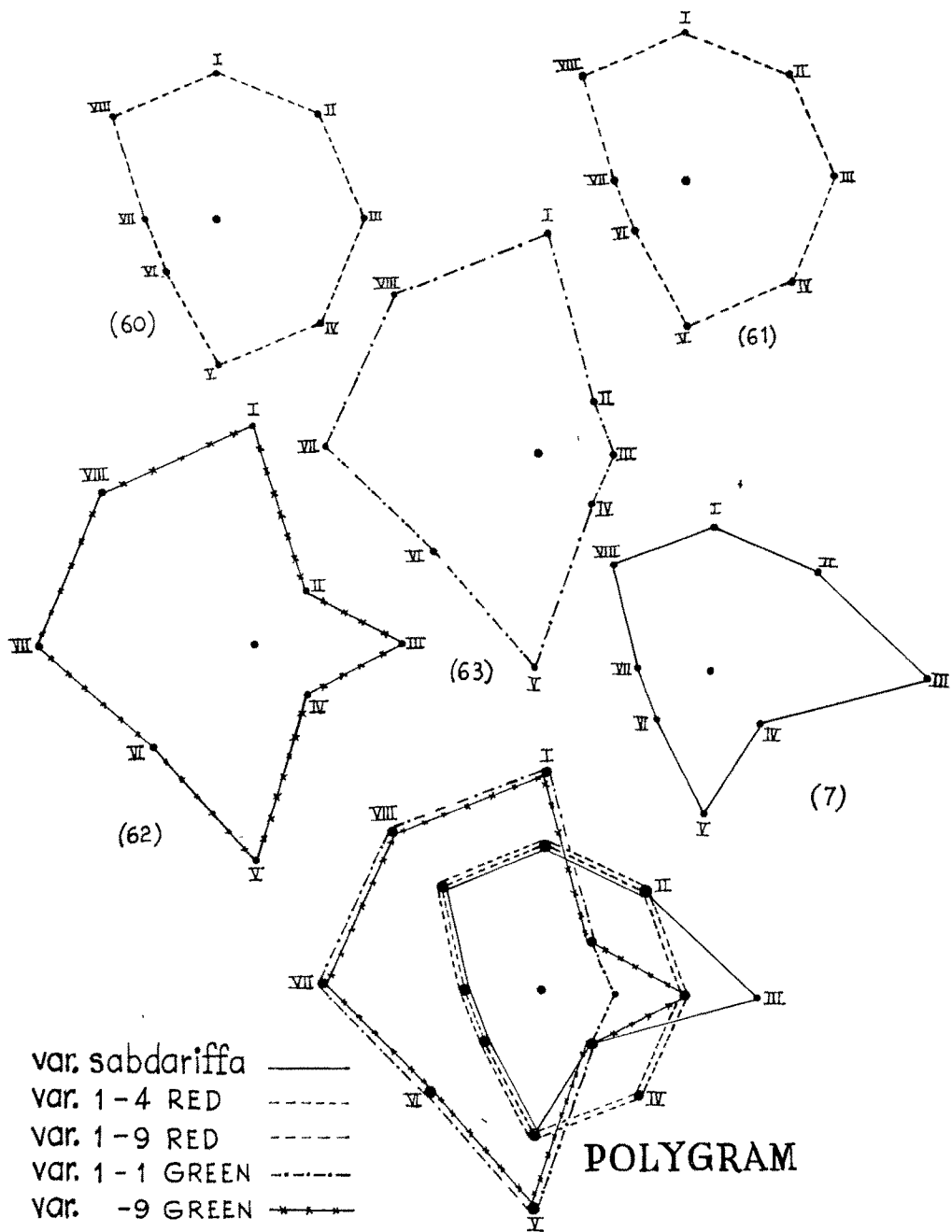
Morphological characters

| Characters | Variations | Index value |
|----------------------------------|-----------------------------------|-------------|
| I. Vestiture of Plant | glabrate | 1 |
| | covered with soft scattered hairs | 3 |
| | covered with setaceous hairs | 5 |
| | | |
| II. Stem color | Green | 1 |
| | reddish-green | 3 |
| | red | 5 |
| III. Leaf-lobing | all 3-lobed | 1 |
| | all 5-lobed | 3 |
| | 3 and 5-lobed mixed | 5 |
| IV. Epicalyx length (in flowers) | shorter than the calyx | 1 |
| | equal to calyx | 3 |
| | longer than the calyx | 5 |
| V. Epicalyx color | Red | 1 |
| | Reddish green | 3 |
| | Green | 5 |

| Characters | Variations | Index value |
|--------------------|---------------------------------|-------------|
| VI. Corolla | Yellow with a purple centre | 1 |
| | Pale yellow with a white centre | 3 |
| | Yellow without distinct centre | 5 |
| VII. Staminal tube | Purple | 1 |
| | Yellow | 3 |
| | Light yellow | 5 |
| VIII. Stigma | Dark red | 1 |
| | Red | 3 |
| | White | 5 |

Polygraphs and polygram of 5 populations, representing the commonly cultivated variety in Gujarat and 4 varieties obtained from Agriculture College, Dharwar, were drawn to highlight the similarities and differences found in them (Fig. 1).

Fig. 1 - Polygraphs and a polygram of different
varieties of H. sabdariffa Linn.



Hibiscus sabdariffa Linn.

It is obvious from the polygram that var. 9-green (Coll. No. 62) and 1-1 green (Coll. No. 63) resemble greatly in all characters (vegetative and floral) except for leaf lobing (III). The commonly cultivated variety (Coll. No. 7) and other two varieties (i.e. var. 1-4 red Coll. No. 60 and var. 1-9 red Coll. No. 61) share common characters but differ among themselves in two characters, viz. leaf lobing (III) and epicalyx length (IV).

2. Hibiscus cannabinus Linn. Syst. Nat. 10: 1149, 1759;

FBI. 1: 339; C. 1: 116; Rakshit and Kundu,

loc. cit. 164.

An erect, undershrub, 1.8 m - 2 m in height. Stem sparsely prickly. Leaves 8 cm - 10 cm by 5 cm - 6 cm, glabrous, cordate (those near the base often undivided), upper deeply palmately 3-5 lobed, lobes 8 cm - 10 cm by 1.3 cm - 1.5 cm, usually narrow lanceolate, serrate, mid-nerve with a glandular dot at the base beneath; petiole 8 cm - 12 cm long, lower longer than the blade, prickly; stipules 0.5 cm - 0.7 cm by 0.1 cm, linear. Flowers axillary, solitary or in terminal racemes, large, showy, yellow with a purple centre; pedicels short,

0.2 cm - 0.4 cm long; involucral bracts 7 - 10, free, 1 cm long, shorter than the calyx, linear, acute, often prickly; calyx 5-lobed, lobes 1.6 cm by 0.6 cm, lanceolate, acute with a strong midrib and thickened prickly margins, oblong ovate gland present at the base of each lobe; corolla lobes-5, 4.5 cm by 1.5 cm, yellow, obliquely obovate; staminal tube 2.5 cm long, deep red, truncate, antheriferous throughout. Capsule ovoid, beaked, covered with white silky hairs; seeds large, greyish, reniform, 3-angled, covered with stellate scales. (Fl. & Fr. : October - January). ADG. - 2, 14, 22, 24.

Cultivated in fields for fibre and vegetables.

3. Hibiscus vitifolius Linn. Sp. Pl. 696, 1753; FBI. 1:338; C. 1: 115; Rakshit and Kundu, loc. cit. 166.

An erect annual, 0.8 m - 1.6 m high, sparingly branched. Stem terete, tomentose, covered with glandular and stellate hairs. Leaves 10 cm - 15 cm by 9 cm - 13 cm, cordate, 3-7 lobed, lobes acute or acuminate, crenate, tomentose beneath, petiole 10 cm - 14 cm long; stipules 0.5 cm long, subulate, setaceous. Flowers axillary, solitary or clustered at the end of the branches nodding

or sub-erect, sulphur-yellow with a purple centre;
 pedicel 5 cm - 10 cm long, jointed about the middle;
 involucral bracts 7 - 12, 0.3 cm - 0.1 cm by 0.1 cm,
 free, linear, acute and hairy; calyx 5-lobed, campanulate,
 lobes 1 cm - 1.5 cm by 0.5 cm - 0.8 cm, ovate-lanceolate,
 acute, 3-5 nerved, accrescent; corolla lobes-5; staminal
 tube 2.5 cm long, violet-red in colour, ribbed, truncate,
 anthers regularly arranged all along the length of
 staminal tube. Capsule hairy, apiculate, 5-winged, wings
 reticulately veined; seeds black or brownish black,
 reniform, minutely tubercled. (Fl. & Fr. : September -
 January). ADG. - 4, 21, 33.

Observed on open areas along with grasses as an
 undergrowth of forests.

4. Hibiscus mutabilis Linn., Sp. Pl. 694, 1753;

FBI.1: 344; C. 1: 120; Rakshit and Kundu,

loc. cit. 167.

A small deciduous tree, about 2.4 m high. Stem stellate-
 tomentose and with golden glandular hairs. Leaves cordate,
 sub-orbicular, 5-7 angled or lobed, irregularly crenate
 or dentate, often entire at the base, hairy; petioles

7.5 cm - 22.5 cm long, terete, stipules linear-lanceolate. Flowers axillary and sub-corymbose at the end of the shoots, white or pink in the morning and turn deep red by evening; pedicel 7.5 cm - 12.5 cm, nearly as long as the leaf, jointed near the flower; bracts 7-10, linear-lanceolate, 2.0 cm - 2.5 cm long, shorter than the calyx; calyx 5-lobed, lobes 3 cm - 4 cm long, ovate-lanceolate, acuminate, velvety-glandular-hairy, 5-nerved, yellowish-green; corolla-5 lobed or more, orbicular-obovate, hairy below, nearly twice as long as calyx; staminal tube shorter than corolla, white or yellowish white, antheriferous all through. Capsule sub-globose, hirsute; seeds reniform, brown, densely bearded on the side away from the raphe. (Fl. & Fr. : September - November). ADG. - 44.

Cultivated in gardens.

5. Hibiscus trionum Linn. Sp. Pl. 697, 1753;

FBI. 1: 334; C. 1: 111; Rakshit and Kundu,
loc. cit. 168.

An annual herb, 0.3 m - 0.5 m high, pubescent; stem terete, reddish-green; leaves orbicular-ovate, palmately

3-5 lobed, lobes 0.5 cm - 0.8 cm by 0.2 cm - 0.3 cm, ovate or oblong, pinnatisect, punctate, hairy on both the sides; petiole 1.2 cm - 1.5 cm long, hairy; stipules 0.2 cm long, subulate, covered with long stiff hairs. Flowers axillary, solitary, yellow with dark purple centre; pedicels 1.5 cm - 1.8 cm long, jointed near the flower; involucre bracts 8-10, 0.5 cm - 0.7 cm by 0.15 cm, linear, less than half or long as the calyx, ciliate with long hairs arising from thickened bases, persistent; calyx 5-lobed, lobes 1.5 cm by 0.4 cm, divided above the middle, ovate, acute, membranous, with many hispid tortuous nerves, nerves green at first afterwards turning purple, persistent; corolla 5-lobed, lobes 1.2 cm by 0.6 cm; capsules oblong, obtuse, pubescent, 5-valved; seeds small, black, sub-reniform, glandular, rugose. (Fl. & Fr. : October - January). ADG. - 47.

Observed as a weed in cultivated fields.

6. Hibiscus lobatus (Murr.) O. Kuntze, Rev. Gen. Pl.

3(2): 19, 1898; Hochr. Fl. Madag. Fam. 129 :42, 1955;

Rakshit and Kundu, loc. cit. 169.

Solandra lobata Murr. Comm. Soc. Reg. Sc.: Goett.

6 : 21, t. 11, 1784.

Hibiscus solandra L'Her.Strip. 1 : 103, t. 49, 1784;

FBI. 1 : 336; C. 1: 114.

An erect annual herb, 0.9 m - 1.3 m high. Stem slightly branched, pubescent. Leaves polymorphous, covered with simple and stellate hairs on both the surfaces, ovate, cordate or orbicular, 3-lobed to 3-fid, base cordate, acute to obtuse, crenate or coarsely serrate; petiole 2.5 cm - 13.0 cm, long, slender, pubescent; stipules 0.1 cm - 0.6 cm by 0.05 cm - 0.1 cm, subulate or slightly broad and unequally lobed at the tip. Flowers arranged in a terminal lax racemes, white; pedicels 2.5 cm - 3.8 cm long, jointed near the top; epicalyx absent; calyx 5-lobed, divided upto the middle, puberulous, lanceolate, 3-nerved, as long as or smaller than the capsule; corolla lobes white or white with pinkish tinge, obliquely obtuse; staminal tube 0.7 cm - 0.8 cm long. Capsule ovoid, wrinkled; hairy, beak short; seeds obovate, tetrahedral, smooth or rugose. (Fl. & Fr. : September - January). ADG. - 5, 15, 17, 25, 46.

Fairly common, observed in hedges, along forest paths and in open fields.

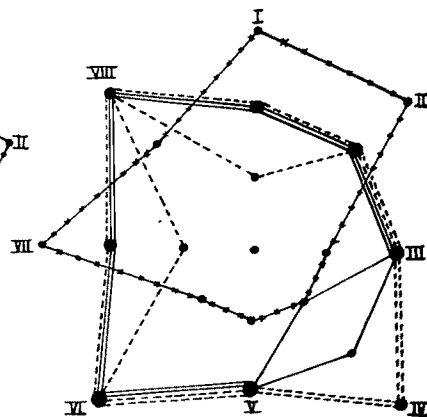
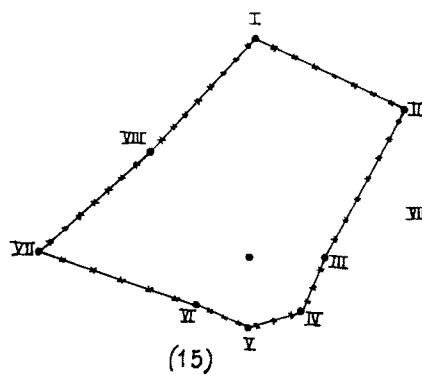
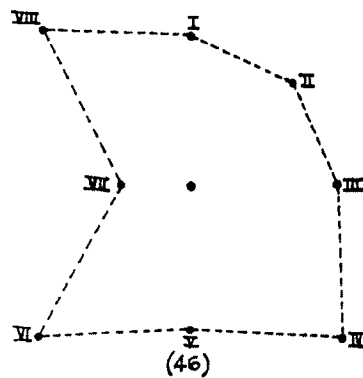
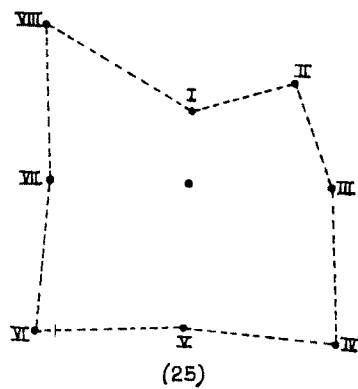
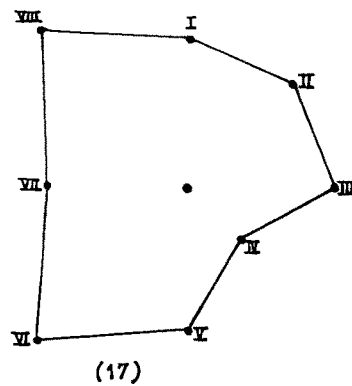
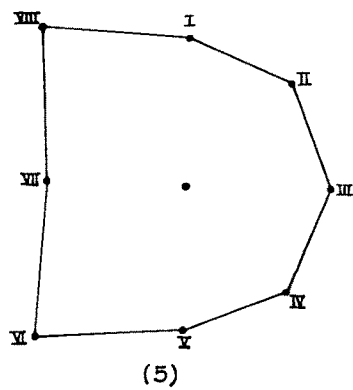
The populations collected from different localities showed some marked variations, and hence were subjected to polygraphic study by selecting certain note-worthy features (Fig. 2).

Morphological characters

| Characters | Variations | Index value |
|-------------------------------|---|-------------|
| I. Leaf size (Basal) L X B | Large (225 square cm or more) | 1 |
| | Medium (100 to less than 225 square cm) | 3 |
| | Small (less than 100 square cm) | 5 |
| II. Leaf incision | Leaves all entire | 1 |
| | Basal lobed, upper unlobed | 3 |
| | Leaves all lobed | 5 |

| Characters | Variations | Index value |
|--------------------------|---|----------------|
| III. Stipules | All subulate | 1 |
| | Lower subulate and upper broad and unequally lobed at the tip. | 3 |
| | Subulate and lobed intermixed | 5 |
| | | |
| IV. Calyx color | Green throughout | 1 |
| | Green with greenish red tips | 3 |
| | Green with distinctly red tips | 5 |
| | | |
| V. Calyx nerve | Strongly nerved | 1 |
| | Not strongly nerved | 3 |
| | Nerves indistinct | 5 |
| VI. Anther mass color | Yellow | 1 |
| | Light yellow | 3 |
| | White | 5 |

Fig. 2 - Polygraphs and a polygram of different
populations of H. lobatus (Murr.) O. Kuntze



POLYGRAM

Hibiscus lobatus (Murr.) O. Kuntze

| Characters | Variations | Index value |
|--------------------|----------------|-------------|
| VII. Stigma color | Pink | 1 |
| | Light pink | 3 |
| | White | 5 |
| VIII. Mature seeds | Brown | 1 |
| | Dark brown | 3 |
| | Brownish black | 5 |

It is evident from the polygram that one collection (No. 15) is markedly distinct from the others in all characters except for the calyx colour (Character No. IV). In other 4 populations there is great uniformity in characters. They differ among themselves in one or two characters (I, IV and VII) only. The present observation shows 3 distinguishable ecological forms among the 5 populations of H. lobatus studied.

7. Hibiscus hirtus var. hirtus Linn. Sp. Pl. 694, 1753;

Wt. Ic. t. 41; FBI. 1: 335; C. 1: 113;

Rakshit and Kundu, loc. cit. 170.

An erect, perennial shrub about 3 m - 4 m high, covered with stellate hairs. Stem terete, woody, much branched, hairy. Leaves 4 cm - 7 cm by 1.0 cm - 2.5 cm, ovate, crenate-serrate, acute to acuminate, hairy on both the surfaces, often with a gland on the midrib near the base; petiole 4 cm - 5 cm long, hairy; stipules 1.0 cm - 1.2 cm long, subulate. Flowers axillary, solitary, dark pink in colour; pedicel 3 cm - 5 cm long, jointed near the base of the flower, involucral bracts 7 - 10; 0.4 cm by 0.02 cm, linear, as long as or shorter than the calyx, hairy, persistent; calyx 5-lobed, lobes distinct, 0.6 cm by 0.2 cm, linear-lanceolate, acute, hairy; corolla 5-lobed, lobes 1.1 cm by 0.6 cm, staminal tube 0.9 cm long, anthers in groups on short filaments. Capsule globose; seeds reniform, cottony. (Fl. & Fr. : September - January). ADG.- 54.

Cultivated in the garden.

8. Hibiscus ovalifolius (Forsk.) Vahl, Syst. Bot. 1: 50, 1790; Santapau and Janardhanan, BBSI. 8: 11, 1966.

Urena ovalifolia Forsk. Aeg.-Arab. 124, 1775.

Hibiscus micranthus Linn. f. 308, 1781; FBI. 1: 335;

C. 1: 113, Rakshit and Kundu, loc. cit. 171.

An erect, almost unbranched shrub, 1.5 m to 2.0 m high; stem and branches covered with stellate scabrid bristles. Leaves 3 cm - 5 cm by 2.5 cm - 3.5 cm, simple, ovate or oblong, more or less scabrid, hairy, serrate, 1 - 3 nerved; stipules small, filiform, hairy. Flowers axillary; pedicel slender, jointed above the middle; involucre bracts 8 - 10, 0.15 cm long, shorter than the calyx, filiform, hairy, persistent; calyx 5-lobed, lobes 0.5 cm long, deeply divided, lanceolate, hairy on outer surface only; corolla pink or white, lobes small 0.6 cm by 0.3 cm, stellately hairy outside; staminal tube short, 0.3 cm long. Stamens in tufts. Capsule 0.9 cm by 0.2 cm, globose; seeds reniform black and cottony. (Fl. & Fr. : September - December). ADG. - 28, 56.

Observed in hedges and along forest paths.

9. Hibiscus panduraeformis Burm. Fl. Ind. 151, 1768;

FBI. 1 : 338; C. 1: 115; Rakshit and Kundu,

loc. cit. 172.

An erect, annual herb, 1.5 m - 1.8 m high, hoary. Stem and branches terete, clothed with glandular and stellate hairs. Leaves 5.0 cm - 10.5 cm by 4.5 cm - 10.0 cm, hairy, lower ovate-cordate, shallowly lobed, upper oblong-lanceolate, acute, irregularly toothed; petiole 4 cm - 10 cm long, hairy; stipules 0.4 cm by 0.1 cm. Flowers solitary, axillary, clustered at the end of the branches, tubular, yellow with a purple centre; pedicel short, stout, jointed in the middle; involucre bract 6-9, 1.2 cm long, densely ciliate, spatulate, free, persistent; calyx 5-lobed, lobes 1.6 cm by 0.3 cm, hispid, lanceolate, acute, 3-nerved; corolla lobes 1.8 cm by 0.7 cm; staminal tube 1 cm long, white, distinctly 5-toothed at the apex, antheriferous all throughout; anthers orange in colour. Capsules 4 cm - 5 cm by 3.0 cm - 3.5 cm, ovoid, shorter than the calyx, densely covered with appressed, white, silky bristles; seeds shaggy, densely pubescent. (Fl. Fr. : October - January). ADG.- 3, 9, 26, 37.

Observed as a weed in cultivated fields, along roadsides and on open barren lands.

10. Hibiscus caesius Garcke, Bot. Zeit. 7 : 850, 1849;

C. 1: 116; Rakshit and Kundu, loc. cit. 173.

H. gibsoni Stocks ex Harv. & Sond., Fl. Cap. 2: 587,

1861-62; FBI. 1 : 339.

An annual erect herb, about a meter or more in height; stem and branches light green, glaucous, branches covered with minute bristle-pointed prickles. Leaves 3-5 partite, deeply divided up to the base, lobes 5 cm - 14 cm by 1.0 cm - 4.5 cm, lanceolate, sharply serrate, more or less stellately hairy; petiole 2.5 cm - 9.0 cm long, covered with small prickles and scattered bristles; stipules subulate, hairy. Flowers solitary, axillary, yellow with a purple centre; pedicels 11 cm - 15 cm, longer than the petiole, jointed above the middle, slender and prickly; involucral bracts usually 9 - 10, 2.0 cm - 2.5 cm, free, much longer than the calyx, linear, straight or slightly curved, spreading like a ray beneath the flower, prickly; calyx 5-lobed, lobes 1.5 cm by 0.8 cm, divided nearly to the base, lanceolate, strongly nerved, distantly ciliate, persistent; corolla lobes 4.5 cm by 2.0 cm, stellately hairy on outer side; staminal tube

1.8 cm long, anthers arranged all along its length.
 Capsules shorter than the calyx, ovoid, pointed; seeds
 black, pilose. (Fl. & Fr. : September - December).
 ADG. - 43, 55.

Observed as an undergrowth in the forests.

Genus - Abelmoschus Medik.

11. Abelmoschus manihot (Linn.) Medik. Malv. Fam. 46, 1787;

Bates, Bailey, 16(3) : 99-112, 1968.

Hibiscus manihot Linn. Sp. Pl. 696, 1753.

Hibiscus tetraphylla Roxb. Hort. Beng. 52, 1814;

nom. nud.; Fl. Ind. 3: 211, 1832; FBI 1: 341;

C. 1: 118.

An erect shrub or undershrub, 0.8 m - 1.6 m high.
 Stem terete, prickly. Leaves 6 cm - 10 cm by 11 cm -
 15 cm, scabrid, cordate at the base, acutely angled or
 more or less deeply lobed, lobes 5- 7, serrate; petiole
 9 cm - 12 cm long, prickly; stipules 0.6 cm - 0.7 cm
 long, linear with stiff bristles on the margins. Flowers

solitary, axillary or clustered at the end of branches, light yellow with purple centre; pedicels 2.5 cm - 3.0 cm long, stout, sometimes with a few prickles; involucral bracts 4 - 5, 2.6 cm by 1.1 cm, foliaceous, as long as or shorter than the calyx, ovate-lanceolate, hirsute; calyx 2.6 cm by 2.5 cm, connate to the very tip, splitting down on one side, ovoid, acuminate in bud, softly villose, deciduous; corolla lobes 5.5 cm by 3.5 cm; staminal tube 3 cm long, light yellow, antheriferous throughout the length, anthers with short filaments. Capsule 5 cm - 8 cm long, ovoid, 5-angled, hispid, cuspidate; seeds brown, faintly pubescent. (Fl. & Fr. : October --February). ADG. - 8.

Commonly observed as a weed in fields and in forest areas.

12. Abelmoschus angulosus (Steud.) Wt. & Arn. Prodr. 53, 1834; Sant. Fl. Saur. 1 : 51, 1962.

Hibiscus angulosus Steud. Nomencl. 2, 1 : 758, 1841; FBI. 1 : 341; C. 1 : 118.

An erect plant, 0.9 m - 1.0 m high, younger parts

hispid with long white shining simple and stellate hairs. Leaves deeply lobed with broad sinus, lobes 3-7, 13 cm - 19 cm by 4. cm - 7 cm, irregularly toothed, acute, hairy on both the surfaces, less hairy when matured; petiole 10 cm - 13 cm long, hairy; stipules 1.6 cm - 1.3 cm by 0.2 cm - 0.3 cm, subulate, acuminate, hairy. Flowers axillary solitary or in terminal racemes, yellow with a purple centre; pedicel about 4 cm long, hairy; involucre bracts 4 - 5, 1.8 cm by 1.0 cm, ovate-lanceolate, acute, faintly nerved, hirsute, persistent; calyx 2.5 cm by 3.5 cm, spathaceous, membranous, pubescent, connate to the very tip, splitting down on one side, caducous; corolla 5-lobed, lobes 5.2 cm by 3.0 cm, obovate, strongly nerved, faintly hairy on outer surface near the base; staminal tube 2 cm long, light yellow, anthers on short stalks all along its length. Capsule 4 cm - 5 cm long, ovoid, acuminate, densely hairy with stiff shining hairs; seeds reniform, black-brown, faintly pubescent along striae. (Fl. & Fr. : October - December). ADG. - 52.

Genus - Azanza Alef.

13. Azanza lampas (Cav.) Alef. Bot. Zeit. 19 : 298, 1861;

Raizada, Ind. For. 92(5) : 303, 1966.

Hibiscus lampas Cav. Diss. 3 : 154, t. 56, f. 2,
1787; Wt. Ic. t. 5.

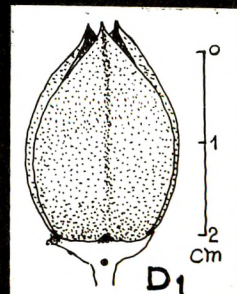
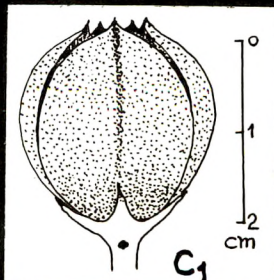
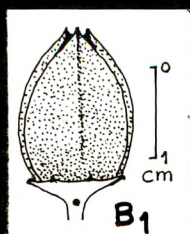
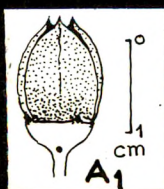
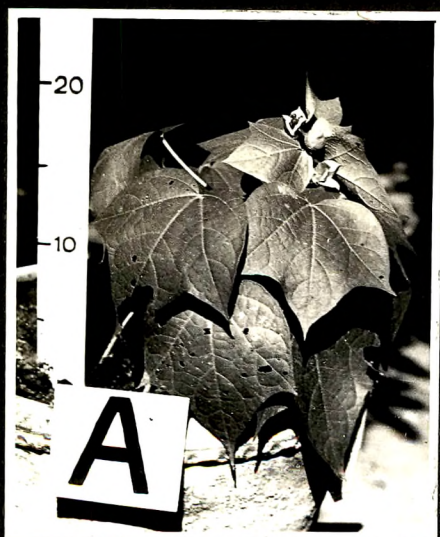
Thespesia lampas Dalz. & Gibs. Bomb. Fl. 19, 1861;
FBI. 1 : 345.

T. macrophylla Bl. Bijdr. 73; C. 1 : 121.

An erect shrub or undershrub, variable in height. Stem terete, woody, lenticular. Leaves variable in size, cordate, 3-5 nerved, entire or 3-lobed, lobes triangular, acuminate, pilose above, tomentose beneath, middle nerve with a glandular dot at the base beneath; stipules 0.2 cm, subulate. Peduncle 3 flowered, axillary or terminal, pedicel 2 cm long, jointed near the top; leafy bracteole present at the joint; involucral bracts 3-5, 0.2 cm long, subulate, fugacious, 3 glands below the epicalyx; calyx cupular, glandular, pilose, persistent, teeth subulate, 0.2 cm long; corolla campanulate, yellow with a crimson centre; ovary 3-5 locular, with a hairy ridge on the inner wall; stigma clavate. Capsule brown, ovoid, villose, pointed or blunt at the apex; seeds black or brownish black, glabrous or glabrescent. (Fl. & Fr. : October - January). ADG. - 10, 12, 31, 32 and 51.

Fig. 3 - Plant height and fruit size in different populations of Azanza lampas (Cav.) Alef.

| | | |
|----------------------|---|-----------------------|
| A and A ₁ | - | Coll. No. 10 |
| B and B ₁ | - | Coll. No. 32 |
| C and C ₁ | - | Coll. No. 52 |
| D and D ₁ | - | Coll. Nos. 12 and 31. |



Observed as an undergrowth of forest and along forest path as well.

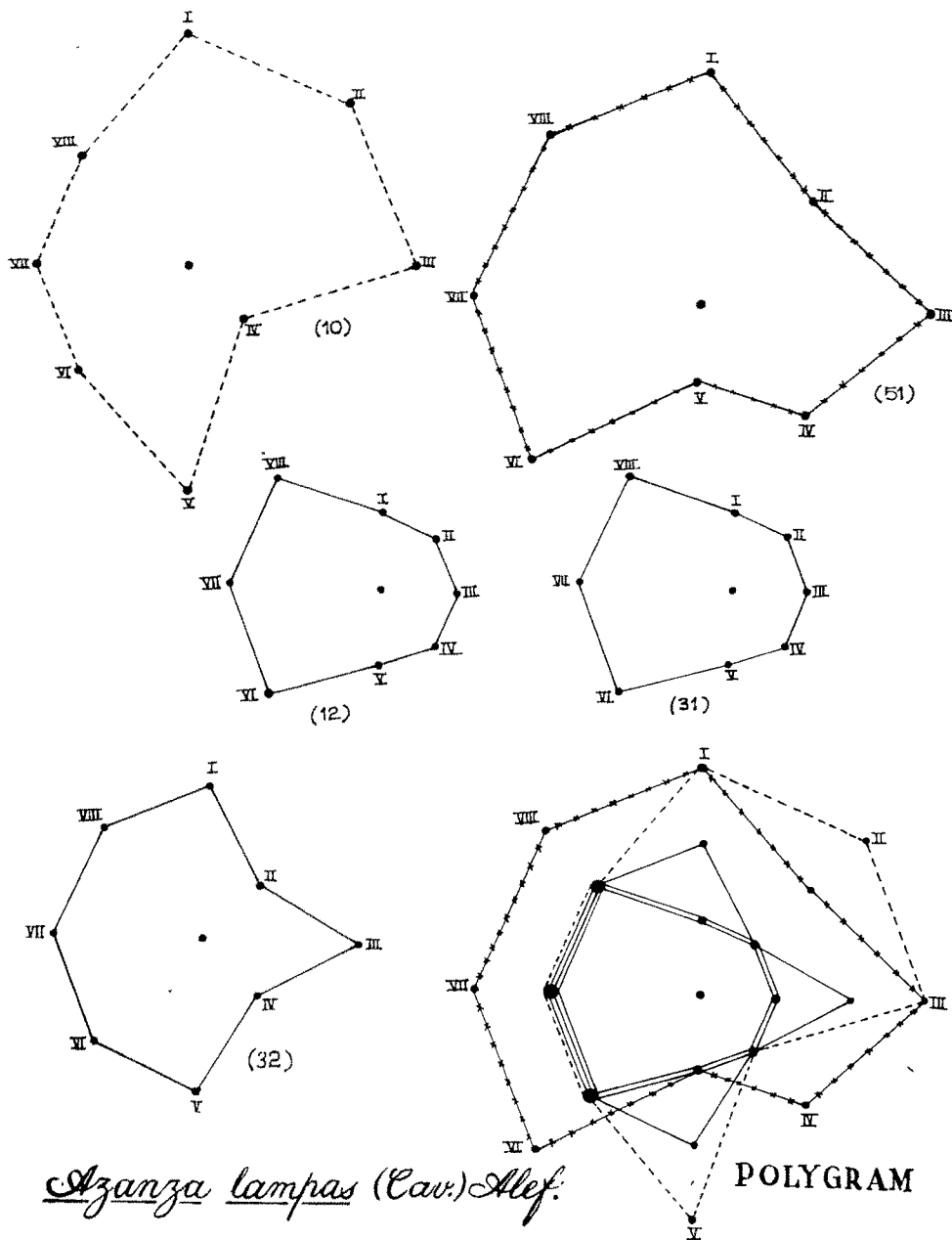
5 populations studied showed some striking morphological differences among themselves. These variable characters were selected for polygraphic study (Figs. 3 & 4).

Morphological characters

| Characters | Variations | Index Value |
|----------------------------|----------------------|-------------|
| I. Plant height | More than 100 cm | 1 |
| | Less than 100 cm but | |
| | more than 50 cm | 3 |
| | Less than 50 cm | 5 |
| II. Internodal length | More than 5 cm | 1 |
| | Less than 5 cm but | |
| | more than 3 cm | 3 |
| | Less than 3 cm | 5 |
| III. Leaf size (L X B) | More than 250 sq. cm | 1 |

| Characters | Variations | Index value |
|-----------------|--|----------------|
| | Less than 250 sq. cm but more than 200 sq. cm. | 3 |
| | Less than 200 sq. cm. | 5 |
| IV. Calyx teeth | Subulate | 1 |
| | Lanceolate-linear | 3 |
| | Linear | 5 |
| V. Fruit-size | More than $\left[\begin{array}{l} 25 \text{ mm long} \end{array} \right]$ & $\left[\begin{array}{l} 15 \text{ mm} \\ \text{broad} \end{array} \right]$ | 1 |
| | Less than $\left[\begin{array}{l} 25 \text{ mm, but} \\ \text{more than} \end{array} \right]$ & $\left[\begin{array}{l} \text{less than 15 mm} \\ \text{but more than} \\ 10 \text{ mm broad} \end{array} \right]$ 18 mm long | 3 |
| | Less than $\left[\begin{array}{l} 18 \text{ mm long} \end{array} \right]$ & $\left[\begin{array}{l} \text{less than} \\ 10 \text{ mm broad} \end{array} \right]$ | 5 |
| VI. Fruit shape | Elliptical | 1 |
| | Ovate | 3 |
| | more or less globose | 5 |

Fig. 4 - Polygraphs and a polygram of different
populations of Azanza lampas (Cav.) Alef.



| Characters | Variations | Index value |
|---|---------------------|-------------|
| VII. Number of locules in a capsule | Less than 3 locules | 1 |
| | 3 locules | 3 |
| | 5 locules | 5 |
| VIII. Seed surface | Densely hairy | 1 |
| | Sparsely hairy | 3 |
| | Glabrous | 5 |

It is obvious from the polygram that characters such as plant height (I), internodal length (II), leaf size (III) and fruit size (V) are variable, while the other characters like calyx teeth (IV), fruit shape (VI), number of locules in a capsule (VII) and seed surface (VIII) are consistent in Coll. Nos. 10, 12, 31 and 32. Of the five populations **studied** Coll. No. 10 shows marked distinction in 2 characters (II and V) while the majority of the characters (II, IV, VI, VII and VIII) are quite distinct in Coll. No. 51.

Genus - Thespesia Soland. ex Corr.

14. Thespesia populnea (Linn.) Soland. ex Corr., Ann. Mus.

9 : 290, 1807; FBI. 1 : 345; C. 1 : 121.

A small tree. Leaves 6 cm - 11 cm by 5 cm - 9 cm, broadly cordate, acuminate, entire, smooth with 5-7 prominent nerves; petiole 5 cm - 8 cm long; stipules subulate, deciduous. Flowers axillary, yellow with a purple centre; pedicel 4 cm - 7 cm, shorter or longer than the petioles; involucral bracts absent; calyx cupular, truncate, covered with minute peltate scales, persistent; corolla 3 cm - 4 cm by 2.0 cm - 2.5 cm. Capsule globose, 2 cm in diameter, covered with minute peltate scales; seeds 1 cm long, ovoid, pubescent. (Fl. & Fr. : August - February). ADG. - 49, 50.

Often planted as a roadside tree.

Tribe - Ureneae.

Genus - Malachra Linn.

15. Malachra capitata Linn. Syst. 12, 2 : 458, 1767;

FBI. 1 : 329; C. 1 : 105.

An erect, hispid annual herb or undershrub, 0.75 m to 1.00 m in height. Stem terete, sturdy. Leaves 15 cm -



18 cm by 5.5 cm - 7.5 cm, ovate-cordate or sub-orbicular, entire or lobed; petiole 2 cm - 11 cm long, jointed below the blade; stipules 0.9 cm - 1.3 cm long, simple, more often 2-3 branched, branches hispid, connate near the base, filiform at the tips. Flowers sub-sessile, yellow, 4-6 in a group on branches (different length) of a short, stout axillary peduncle; involucral bracts 4, 1.2 cm - 1.4 cm by 1.3 cm, unequal in size, bristly on the margins and nerves beneath, variously lobed and toothed, with a white spot at the base and with 2 opposite ciliate appendages; calyx 5-lobed, lobes 0.7 cm by 0.3 cm, membranous, ovate, acute, prominently nerved; corolla lobes 1.5 cm by 0.9 cm; staminal tube 1.5 cm long, hairy at the base, anthers stalked. Fruit white, reticulated with brownish veins; seeds pyriform, 3-angled, black, smooth. (Fl. & Fr. : September - December). ADG. - 36 and 38.

Observed in waste land.

Urena Linn.

Urena lobata Linn. Sp. Pl. 692, 1753; FBI. 1 : 329

(excl. Syn. U. palmata); C. 1 : 106;

Santapau, Fl. Khandala 17, 1953.

U. sinuata Linn. Sp. Pl. 692, 1753; FBI. 1 : 329;

C. 1 : 106; Blatter, JBNHS. 34 : 631, 1931.

An erect, perennial undershrub, 1.4 m - 1.7 m high. Stem terete, covered with harsh tomentum. Leaves 9 cm - 13 cm by 3.5 cm - 12.0 cm, angled or irregularly 3-5 lobed, stellately hairy on both the surfaces, cordate, serrate, pale beneath with a large gland at the base of the midrib alone or sometimes on one or both of the adjoining nerves below; petiole 3 cm - 7 cm long, stellately hairy; stipules 0.1 cm long, subulate. Pedicels short, clustered; involucral bract 0.55 cm - 0.75 cm by 0.1 cm - 0.2 cm, longer or shorter than the calyx, alternate with sepals, linear-oblong, acute, minutely pubescent; calyx 5-lobed, lobes 0.5 cm - 0.6 cm by 0.2 cm, connate at the base forming a campanulate tube, minutely pubescent, lanceolate; corolla lobes 1.4 cm - 1.8 cm by 0.6 cm, pink; staminal tube 1.0 cm - 1.1 cm long, with sub-sessile anthers; ovary 5-celled, branches of the style 10. Capsule pubescent, echinate; seeds brown, rounded on the back, wedge-shaped on the inner-side, smooth. (Fl. & Fr. : October - January). ADG. - 27, 29, 41, 48.

Observed along roadsides and forest paths.

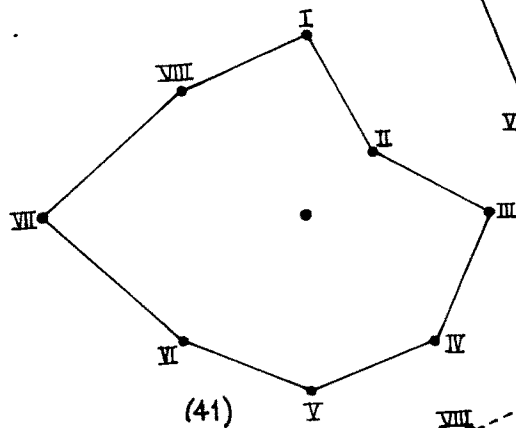
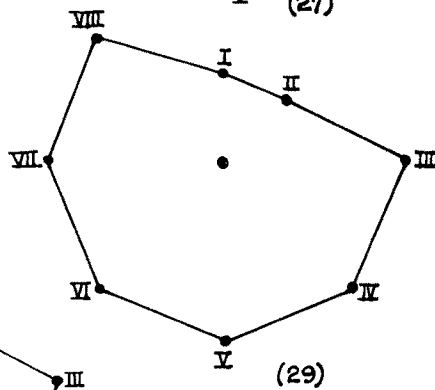
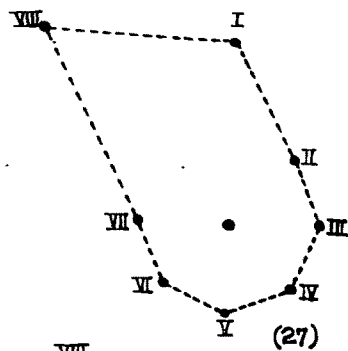
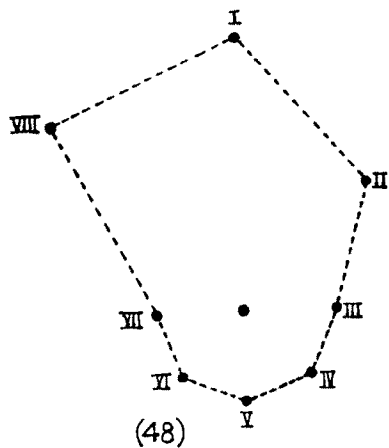
Different populations collected, showed morphological variations in a number of characters. In order to understand these variations, all the populations collected were subjected to a polygraphic study (Fig. 5). The following morphological characters and their variations were used for this study.

Morphological characters

| Characters | Variations | Index Value |
|------------------------|---|-------------|
| I. Nature of branching | Branching from the base, branches crowded | 1 |
| | Branching from the base, branches sparse | 3 |
| | Branching all along the stem, branches sparse | 5 |
| II. Internodal length | 5 cm or more | 1 |
| | Less than 5 cm but more than 3 cm | 3 |
| | Less than 3 cm | 5 |

| Characters | Variations | Index value |
|---|---|-------------|
| III. Leaf shape | Shallowly lobed, lobes acute-obtuse | 1 |
| | Deeply lobed, lobes oblong and irregularly pinnatifid | 3 |
| | More or less unlobed | 5 |
| IV. Number of veins with gland near the leaf base | More commonly 3 | 1 |
| | More commonly 1 | 3 |
| | Both 1 and 3 mixed | 5 |
| V. Flower size | More than 2 cm | 1 |
| | Less than 2 cm but more than 1 cm | 3 |
| | Less than 1 cm | 5 |
| VI. Flower colour | Light pink | 1 |
| | Dark pink | 3 |
| | Red | 5 |

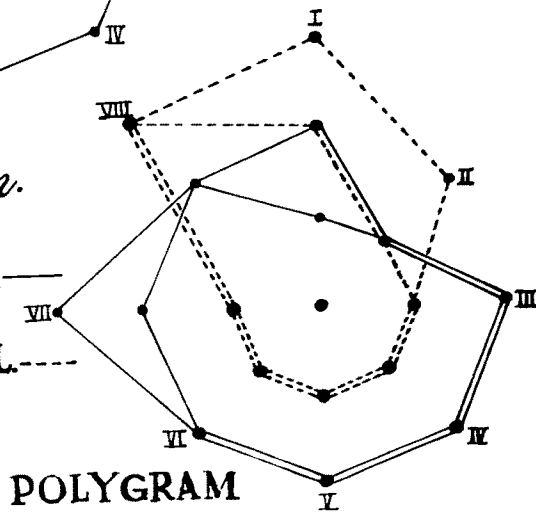
Fig. 5 - Polygraphs and a polygram of different
populations of Urena lobata Linn. and
U. sinuata Linn.



Urena Linn.

Urena lobata L. —

Urena sinuata L. - - -



| Characters | Variations | Index value |
|-------------------|---|-------------|
| VII. Epicalyx | Linear and longer than the calyx | 1 |
| | Linear-oblong and equal to calyx | 3 |
| | Oblong-lanceolate and shorter than the calyx | 5 |
| VIII. Calyx shape | Lanceolate | 1 |
| | Narrowly lanceolate | 3 |
| | Narrowly lanceolate and notched near the base | 5 |

Earlier recognized species viz. U. lobata and U. sinuata of Linnaeus (1753) were merged into one i.e. U. lobata by Hochreutiner (1900). Subsequently, following him Santapau (1953) also supported his view and considered the variations in leaf lobing not to be of great significance in maintaining of 2 distinct species. However, the present study of 4 populations of Urena,

showed that associated with leaf lobing, there are other characters, when considered together, make the distinction between the two species more specific. In Coll. Nos. 27 and 48, along with shallow lobing of leaves, other characters such as number of veins with gland (IV), flower size (V), flower colour (VI), epicalyx (VII) and calyx shape (VIII) are consistent, but distinctly differ from the other two populations (Coll. Nos. 29 and 41) having deeply lobed leaves.

Pavonia Cav. (nom. cons.)

16. Pavonia zeylanica Cav. Diss. 3 : 134, t. 48, f. 2, 1787; FBI. 1 : 331; C. 1 : 108.

An erect, much-branched, glandular hairy, perennial undershrub, about 1.0 m - 1.5 m high. Branches slender, terete. Leaves 2. cm - 5 cm by 2.5 cm - 5.0 cm, cordate or truncate at the base, entire orbicular or lobed, mid-lobe the longest, dentate; petiole 1 cm - 5 cm long, viscous hairy; stipules 0.1 cm - 0.2 cm long, filiform. Flowers axillary, solitary, light pink; pedicels 3 cm - 4 cm long, slender, hairy, jointed about three fourth of their length from the base; involucral bracts 10-12, 0.7 cm

by 0.1 cm, free, twice as long as the calyx or more, filiform and persistent; calyx 5-lobed, lobes 0.3 cm by 0.2 cm, lanceolate, persistent; corolla lobes 0.7 cm by 0.5 cm, longer than the epicalyx; staminal tube 0.9 cm long, light pink, anthers on long filaments. Fruit pale brown, rounded on the back, wedge-shaped, slightly wrinkled, keeled at the edges, glabrous; seeds brown-black, minutely pubescent. (Fl. & Fr. : August - January). ADG. - 40 and 57.

Observed on open waste land, along with grasses on river banks.

17. Pavonia patens (Andr.) Chiov., Ann. di Bot. 13 : 409, 1915; Saur. 1 : 51.

Sida patens Andr. Bot. Rep. 9 : t. 571, 1809.

Pavonia glechomifolia (A. Rich.) Garcke, Schweinf. Beitr. Fl. Aeth. 1 : 54, 1867; FBI. 1 : 330; C. 1 : 107.

Rigid, semierect or procumbent shrub, 0.9 m - 1 m high. Stem branching from the base, terete, tomentose.

Leaves 10 cm - 15 cm by 5 cm - 6 cm, ovate, cordate, acute, crenate-serrate, tomentose, somewhat 3 lobed, mid-lobe the longest; petiole 3 cm - 5 cm long, hairy; stipules 0.1 cm long, subulate. Flowers axillary, solitary, yellow with red centre; pedicel slender, 2 cm - 4 cm long, jointed near the base; involucral bracts 5-6, 0.8 cm by 0.6 cm, leafy, broadly lanceolate, accrescent, much longer than the calyx; calyx 5-lobed; 0.6 cm by 0.4 cm, deeply divided, ovate, acute, tomentose; corolla lobes 1.1 cm by 0.6 cm; staminal tube 0.6 cm long, yellow, anthers on long filaments. Fruit muricated with a serrulate crest; seeds chest nut coloured, reniform, smooth. (Fl. & Fr. : September - December). ADG. - 16.

Observed in waste land.
