Part II

PHARMACOGNOSIC STUDIES
Begonia crenata Dryand. (Khattibhaji)

Cassia hirsuta Linn. (Devthorhan)

Eulophia pratensis Lindl. (Ban shingada)

Habenaria grandifloriformis Blatt. & Mc. Cann. (Chotta Ghodatap)

Costus speciosus (Koen. ex. Retz.) Sm. (Bhumka)

Tacca leontopetaloides (L.) O. Kuntz. (Jatashankar)

Iphigenia indica (L.) A. Gray (Lasani)

Commelina suffruticosa Blume. (Ghodighas)

Curculigo orchioides Gaertn. (Kali Musali)
OXALIDACEAE R. Br.


(V. *Teen pani* K. *Teen patti*, K. *Tenpaku*)

**Macromorphology**

Small herbs, 5 x 1.5 cm. with an ovoid bulb; stolons, bearing ovoid bulblets. Leaves radical, 6-10; leaflets3, sessile, broadly ob-deltoid, with 2 obtuse divergent lobes base cuneate; petiole 15 cm long. Sepals 5, lanceolate, 0.6 x 0.3 mm. Petals 5, purple, ob lanceolate, 1.7 x 0.3 cm clawed, connate. Stamens 5+5; 5 longer filaments and 5 shorter. Ovary elongate, 2.5 mm, 5 - lobed; ovules 4 per cell, styles 5; stigmas laciniate (Figs. A-E)

**Occurrence** - Abundant in Coffee plantations.

**Flrs. & Frts.** - April - June and October - December

**Exsiccata** - VDD 2

**Micromorphology**

**Root** (Fig.1)

Triarch. Epiblema thin walled with many root hairs. Cortex narrow, 3-4 layered at times even single layered - parenchymatous; cells thin-walled enclosing small intercellular spaces. Endodermis distinct, cells without casparian strips. Pericycle of thin-walled cells; some of the cells larger than the others and contain food material. Little secondary growth noted. Secondary growth normal. Secondary phloem produced in larger amount than the xylem.
**Oxalis latifolia** Kunth.

**Macromorphology (Figs. A - E)**

A. Habit sketch.
B. Single flower bud.
C. Flower cut open.
D. Long & Short stamen
E. Ovary

**Micromorphology (Figs. 1 - 11)**

1. Sector magnified
2. Diagramatic sketch
3. Sector magnified
4. Diagramatic sketch
5. Sector magnified
6. Upper epidermis.
7. Lower epidermis.
8. V. S. Lamina.
10. T. S. Scape, diagrammatic sketch.
11. Sector magnified.
Oxalis latifolia Kunth.
**Stem.** (Figs 2 & 3)

Stem in the form of compound bulb. Fleshy bulblets parenchymatous with abundant starch. Epidermal cells completely filled with some dark brown content. In the ground tissue there are canals containing dark brown substance. Towards the base of bulblets number of canals in more, gradually towards apex it decreases to three and in the base of petiole, there is no such canal found. Vascular bundles three; arranged in one series just above these canals. Some parenchymatous cells surrounding the bundle contain some dark brown substance. At the base of petiole all the three vascular bundles come together forming a shallow, continuous crescent shaped arch, at higher level the arch splits into four separate vascular bundles that get arranged in ring in the petiole. Vascular bundles conjoint, collateral, cambium not distinct; each surrounded by a parenchymatous sheath. Cells of sheath with dark brown contents.

**Leaf** (Figs 4-9)

**Petiole** cylindrical. Epidermis cutinized and cuticularized; followed by 1-2 layers of chlorenchymatous hypodermis. Ground tissue parenchymatous; cells large, enclosing small intercellular spaces. Vascular bundles 4, arranged in the center forming a ring. Vascular bundles conjoint, collateral, cambium indistinct. **Lamina** hypostomatous. Cells of both epidermis sinuous. Stomata anomocytic, guard cells comparatively quite small. in v. s. slightly sunken, with outer ledge. Mesophyll differentiated into single layered palisade and 2-3 layered spongy parenchyma. **Midrib** parenchymatous. Cells of abaxial epidermis smaller than those of adaxial. Cortical parenchymatous cells on abaxial side conspicuously large. Vascular bundles two. Palisade and a layer of spongy tissue continuous below the adaxial epidermis. Spongy tissue may extend upto the vascular bundle of the midrib. Most simple type of hydathodes, represented by simple pare, are present at the tips of leaf teeth; associated with vein ending.

**Scape** (Figs. 10 & 11)

Cylindrical; Epidermis cuticularized; hypodermis 2 layered, cells thin walled, chlorenchymatous. Ground tissue parenchymatous. No endodermis and pericycle
differentiated. Vascular bundles small, arranged in a ring. No cambium present in vascular bundle.

**Chemistry**

Total amino acids present nine. They are Aspartic acid, Theronine, DL-Alanine, Lycine-monohydro-chloride, Methionine, Isoleucine Tryptophan and up8 & unp9. 
Alkaloids, Flavonoids, Phenolics (Catechol) and Steroids Present. 
Ash contains Sulphur, Calcium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**
- Leaf juice given against acidity. Leaves as vegetables.

**Recorded uses**
- Leaves used for Chutney and also as vegetable (Ref. 112).

**CAESALPINIACEAE. R. Br.**

*(V. Devtarota K. Devtorthan)*

**Macromorphology**

Diffuse undershrubs; 5-7 ft. high, softly villous; stems strongly ribbed. Leaf evenly unipinnate, 15-20 cm long; leaflets in 4-5 pairs, uppermost largest, 11x4 cm; lowest smallest extending beyond leaflets in the form of appendage. Inflorescence few-flowered axillary raceme, condensed in to a cluster. Flowers large, 2.5-3 cm across, yellow. Calyx 5, unequal, densely villous, greenish brown. Corolla yellow, largest petal distinctly bilobed. Fertile stamens 6; 2 longer with hooked connective and dialated filament; 4 shorter without produced connective and simple filament; 4 staminodes. Ovary densely hairy; style short, curved; stigma capitate; pod pubescent, slender, flattened. many seeded (Figs A-F)
Cassia hirsuta Linn.

Macromorphology (Figs. A-F)

A. Habit sketch.
B. Single flower.
C. C\”, C\”\”. stamens.
D. Staminode.
E. Gynoecium.
F. T. S. Ovary.

Micromorphology (Figs. 1 - 11)

T. S. Root 1. Diagrammatic sketch.
2. Sector magnified.
T. S. Stem 3. Diagrammatic sketch.
4. Sector magnified.
Leaf T. S. petiole 5. Diagrammatic sketch.
Lamina 7. Upper epidermis.
8. Lower epidermis.
9. Stoma in V. S.
10. V. S. Lamina.
12. Simple hairs.
Cassia hirsuta Linn.
Occurrence - Rare; along the road sides and interior to Chikhaldara - Semadoh.
Firs. & Frts. - June - December.
Exsiccate - PYB . 338.

Micromorphology

Root (Fig 1 &2).

Triarch ;pith absent. Secondary growth normal. Cork Cambium originates in the inner cortex. Secondary cortex with numerous stone cells. At places outer phloem cells also become stone cells.

Stem (Figs. 3 & 4)

With distinct ridges and furrows. Epidermis thickly cutinized, followed by 3-4 layered colenchymatous hypodermis below the ridges; innermost layer with heavy deposition of secondary wall material, cells simulating the stone cells (Cells do not take safranin stain). Cortex few layered, parenchymatous, containing abundant chloroplasts. Endodermis ill-defined. Pericycle sclerenchymatous, broader opposite the vascular bundles. Vascular bundles conjoint collateral open, arranged in a ring. Pith large, parenchymatous, cells containing sphaeraphides.

Leaf (Figs. 5-12)

Petiole pentangular with two short wings on the upper side. Epidermis thickly cutinized, followed by 3-4 layered chlorenchymatous cortex, interrupted by single layered colenchymatous hypodermis. Vasculature forms a discontinuous ring interrupted by parenchyma at two places at the base of petiole; higher above two distinct arches are found one on the lower side and one on the upper side. Vascular bundles conjoint, collateral, open; with some secondary growth at the basal region of petiole. Lamina amphistomatous. Epidermis cutinized, cells bluntly angular; stomata numerous, more in lower epidermis; paracytic; in transverse section guard cells with
cuticular horns. Mesophyll with single layered palisade and 3-4 layered spongy parenchyma. Midrib with an arch of vasculature surrounded by sclerenchymatous sheath. Ground tissue parenchymatous, cells on dorsal side chlorenchymatous continuous with mesophyll tissue of lamina.

**Trichomes** (Fig. 12)

All parts densely hairy. Hairs simple, multicellular uniseriate.

**Chemistry**

Total ten amino acids present. They are Glutamic acid, Glycine, L-Tyrosine, DL-Alanine, Proline, DL-Valine, Isoleucine, Valine, unp4 & unp5.

Alkaloids, Flavonoids, Pyrogallol and Steroids present.

Ash contains Sulfur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**

- Root powder made into paste and applied over skin affections and in leucoderma.
- Young leaves eaten as vegetable in rheumatism

**Recorded uses**

- Leaves are crushed in pig oil to make a paste, which is rubbed on the body of newly born child suffering from fever. The dust of the baked fruits are taken as a beverage (Ref. 121)
CUCURBITACEAE Juss.


Macromorphology

Slender, small, monoecious tuberous climbers, growing to 5-7 ft. stem slender, grooved. Leaves almost entire cordate at base, palmately lobed, upper ones obscurely three lobed. Male flowers solitary, axillary, peduncled; peduncle 5-8 cm. long with wide orbicular, spatheceous bract present at apex, enclosing the flower upto the calyx tube. Calyx lobes acute with slender mucrona; sepals 5, 0.8 x 4 cm. free up to the base; hairy, acute, mucronate. Corolla of 5 petals; petals free, yellow, 2 x 0.7 - 0.8 cm, exerting out of spatheceous bract. Stamens 3, inserted on the corolla tube, one, one-celled and other two, two-celled; anthers cohering to each other; filaments free, connective broad. Female flowers in cymose clusters, observed only as small buds, do not grow further. No fruit produced (Figs A-C).

Occurrence

Rare. Collected only from Vairat plateau which represents highest point in Melghat.

Flrs.

September - November.

Exsiccata

VDD.201.

Micromorphology

Root

Large starchy tubers.

Stem (Figs. 1-6).

Pentangular with five ridges and five furrows. Epidermis cutinized and cuticularized. Stomata of two types present; a) in level with the other epidermal cells and b) elevated on a crest formed by one or two epidermal cells; guard cells of
**Momordica balsamina L.**

**Macromorphology (Figs. A-C)**

A. Habit sketch
B. Floral bud with spathecion bracts
C. L. S. flower (male)

**Micromorphology (Figs. 1-13)**

T. S. Stem
1. Diagrammatic sketch.
2. Sector magnified showing V. B. below the ridge.
3. V. B. below the furrow.
4. Sphaeraphides in intercellular spaces.
5. Simple and elevated stoma on epidermis.
6. Glandular trichome

T. S. petiole
7. Diagrammatic sketch.
8. Sector magnified.

Lamina
10. Lower epidermis.
11. Single stoma in V. S.
12. V. S. Lamina.
Momordica balsamina L.
former overlapping each other literally closing the stoma, those of later type leaving an opening. Few glandular trichomes present; each with a single stalk and a unicellular glandular head. Hypodermis collenchymatous, completely filling the ridges. Cortex few layered, collenchymatous. Endodermis distinct, cells amyliferous. Pericycle forming a sclerenchymatous ring. Vascular bundles conjoint, bicalcarlate, open; only outer combium distinct. Vascular bundle below one of the furrows-where ridges are quite close - ill developed, consisting only of phloem. Pith large, parenchymatous, containing numerous sphaeraphides and some square crystals. Sphaeraphides interestingly are noted in the small intercellular spaces also.

**Leaf** (Figs. 7-13).

**Petiole** angular, deeply grooved from above. Epidermis cutinized and cuticularied; followed by 2-3 layered collenchymatous hypodermis below the angles; single layered elsewhere. Ground tissue parenchymatous. Vascular bundles arranged to form deep ‘C’ shaped arc with one vascular bundle in the ridge of dorsal side. Many sphaeraphides and square crystals present in the ground tissue. **Lamina** amphistomatous. Upper epidermal cells some what angular, with paired cystoliths scattered; lower shallowly sinuate. Stomata more frequent in lower epidermis. Guard cells overlapping each other in v. s., almost closing the stomatal opening. **Midrib** with 1-2 layered collenchymatous hypodermis and parenchymatous ground tissue. Vasculature in the form of bicalcarlate shallow arc.

**Chemistry**

Total nine amino acids present. They are L-Tyrosine, Serine, Glutamic acid, Methionine, Isoleucine and DL-2 amino n-butyric acid, up 7, up4 and unp5.  
Alkaloids, Favonoids (Flavonols & Flavanones) and steroids present. 
Ash contains Sulphur, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use** - Tuber powder given females to induce fertility
Recorded uses - Plants are emetic, useful in chapped hands, burns, and haemorrhoids etc. Young shoots and leaves used as vegetables.

BEGONIACEAE C. A. Agardh


Macromorphology

Small, herbaceous, 1-4 leaved plants; root subtuberous stems usually red, smooth slender. Leaves 2-8 x 2-5 cm. with few stout hairs above; petiole of the radical leaves 2-5 in long, those of cauline 1.5 – 6 cm. long, usually red with a few scattered hairs; stipules triangular, acute. Flowers pale pink, beautifully marked with glistening dots when fresh, in few flowered cymes, unisexual. Sepals 2 in male flowers; stamens many, monadelphous; anthers yellow. Female flowers with 5 - segments of perianth, soon become larger than male flowers. Styles 3, connate; stigmas reniform. Capsules membranous, crowned by the accrescent perianth, 3-winged, ciliate tipped with glandular black dots; 2-celled. Seeds minute, ellipsoid (Figs A-D).

Occurrence - Occasional on humus rich, wet vertical cliffs, along the streams and river banks and in valley bottoms.

Flrs. & Frts. - September - October.

Exsiccate - VDD 8
Begonia crenata  Dryand.

Macromorphology (Figs. A-D)

A. Habit sketch 
B. Single male flower 
C. Single female flower 
D. T. S. Ovary 

Micromorphology (Fig.1-10)

T. S. Tuber :  2. Diagrammatic sketch. 
T. S. Stem :  3. Diagrammatic sketch. 
              4. Sector magnified. 
Leaf  5. Upper epidermis. 
     6. Lower epidermis 
     7. Lamina V. S. 
     8. Midrib V. S. 
     9. Simple trichome on leaf. 
    10. Glandular trichome on leaf.
Begonia crenata  Dryand.
Micromorphology

Root (Fig. 1)
Diarch; pith absent. Epiblema cells thin walled; root hairs many; cortex 3-4 layered, thin-walled cells containing large starch grains. Endodermis and pericycle thin-walled. Secondary growth absent.

Stem (Figs. 2-4)
Underground stem tuberous; tubers moniliform. Outermost 2-3 layers of cork followed by large parenchymatous storage tissue storing starch. Stele displaced to one side. Aerial stem cylindrical. Epidermis cutinized and cuticularized, followed by 2-3 layers of collenchymatous hypodermis. Cortex 3-4 layered, cells becoming larger towards the center; sphaeraphides present. Endodermis heterogeneous, cells parenchymatous as well as sclerenchymatous. Pericycle single layered, parenchymatous, thin walled. Vascular bundles conjoint, collateral, cambium becoming distinct only at some places. Pith large, parenchymatous with patches of thick walled cells interspersed, sphaeraphides present. Secondary growth absent.

Leaf (Fig 5-10)
Hypostomatous. Cells of upper epidermis slightly sinuous, those of lower epidermis deeply sinuate; in v. s. upper epidermal cells larger than lower ones. Stomata with 3-subsiadiary cells; cells may be unequal or in anisocytic as may not be as in anomocytic type. In v. s. of guard cells show cuticular horns or ledge forming a stomatal cavity. Both the glandular and nonglandular trichomes present. Glandular trichomes with single stalk cell and unicellular glandular head. Simple trichomes 3-4 celled, uniseriate, basal cell long, terminal ending in a sharp bristle like cell. Mesophyll differentiated into single layer of short palisade cells and two layered spongy parenchyma with large sub-stomatal chambers. Midrib with parenchymatous ground tissue having many sphaeraphides. Palisade layer of mesophyll continues below the upper epidermis. Vasculature in the basal part of leaf in the form of a ring of conjoint, collateral vascular
bundles; higher above vascular bundles on adaxial side gradually disappear leaving a shallow 'C' shaped arch of vasculature on abaxial side.

Chemistry

Total amino acids present eight. They are Aspartic acid, L-Tyrosine, Threonine, DL-Alanine, L-Cystine, L-Methionine, Isoleucine and is up 8.

Alkaloids, Flavonoids, Phenolics (Catechol & Hydroquinone) and Steroids present.

Ash contains Sulfur, Calcium, Magnesium, Iron, chlorine, and phosphorus.

Local use - Leaf juice taken internally to cure acidity.

Recorded uses - Plant is haemostatic and useful in wounds and ulcers.

SOLANACEAE Juss.


(V. Pandhari ringani, Safed ringani)

Macromorphology

Large shrubs, 8-12 ft. high, densely covered with stellate hairs; stem and petioles prickly, few may be present on midrib on the underside of leaf. Leaves ovate-lanceolate, 20 x 10 cm. base oblique – cordate; Inflorescence adnate, cymes helicoid, arranged in corymbose fashion. Flowers white, 1.5 - 2 cm. Calyx 5 - lobed, green. Corolla rotate; tube very short; petals 5, white. Stamens 5 in the corolla throat; filaments short, 0.1 cm; anthers oblong, connivent in a short cone, dehiscence terminal, by pores. Ovary 2 - celled but at maturity
Solanum torvum Swartz.

Macromorphology (Figs. A - G)

A. Habit sketch
B. Single flower
C. L. S. flower
D. Single stamen
E. Gynoecium
F. Fruit
G. T. S. Ovary

Micromorphology (Figs 1-12)

T. S. Root
1. Diagrammatic sketch.
T. S. Stem
2. Diagrammatic sketch.
3. Sector magnified.
T. S. petiole
4. Diagrammatic sketch.
5. Sector magnified.
Lamina
6. Upper epidermis.
7. Lower epidermis.
8. Stoma in V. S.
9. V. S. Lamina.
T. S. Midrib
10. Sector magnified.
Trichomes
12. Stellate hair.
Solanum torvum Swartz.
becoming 4 - celled, covered by gland tipped hairs, stigma capitate. Berry globose, glabrous, yellow when ripe (Figs A-F).

**Occurrence** - Rare, on Chikhaldara plateau especially on Gavilgarh and around.

**Flrs. & Frt.** - September - January

**Exsiccate** - PYB 216a

**Micromorphology**

**Root** (Fig. 1).


**Stem** (Figs. 2 & 3).

Epidermis cuticularized, followed by single layer of parenchymatous hypodermis. Cells of epidermis and that of hypodermis containing chloroplasts; however, chloroplasts are more abundant in hypodermis, followed by broad zone of collenchymatous outer cortex. Inner cortex parenchymatous, few layered, some of the cells of inner cortex full of starch grains. Endodermis and pericycle not distinct. Vascular bundles conjoint, bicollateral, open, arranged in a ring. Pith large; cells contains starch grains. Secondary growth normal. Peripheral cells of inner and outer phloem lateron get converted into stone cells.
Leaf (Figs. 4-12).

**Petiole** cylindrical, dorsal side somewhat flattened. Epidermis with numerous stellate hairs and few short stalked glands; followed by single layered chlorenchyma. Ground tissue differentiated into outer collenchymatous and inner parenchymatous zone. Many cells of parenchymatous zone filled with starch grains. Vasculature in the form of shallow and two small vascular bundles on dorsal side below the outer cortex. Vascular strand bicollateral. Many cells of phloem contain starch. **Lamina** hypostomatous, cells of upper epidermis polygonal, those of lower epidermis, shallowly sinuate or bluntly angled. Stomata anomocytic, numerous in lower epidermis, occasionally one or the other stoma may be seen on the upper epidermis. In v. s. guard cells show outer and inner ledges forming front and back cavity leading to the substomatal chamber. Mesophyll differentiated into single layered palisade; cells of palisade narrow, long, almost occupying half the thickness of lamina. Spongy tissue 4-5 layered; cells loosely arranged, enclosing large intercellular spaces. **Midrib** with single layered chlorenchymatous hypodermis followed by few layers of thick-walled cells. Ground tissue parenchymatous. Vasculature in the form of a bicollateral crescent shaped arc.

**Trichomes**

Stellate hairs with long multicellular stalk form a dense tomentum. Few glandular hairs interspersed between stellate hairs. Glands shortly stalked with multicellular head.

**Chemistry**

Total eight amino acids present. They are L-Tyrosine, Threonine, DL-Alanine, Proline, Valine, Isoleucine; up 3 and unp 5.

Alkaloids, Flavonoids (Flavonols & Flavanones), Phenolics (Catechol) and Steroids present.

Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.
Local use

- Plant powder or ash given with honey to cure asthma and cough.

Recorded uses

- Plants are digestive, diuretic, sedative, and tonic. Root decoction useful in postnatal blood discharge; root paste useful in rhagades. Leaf paste applied on snakebite, haemostatic, dog-bites. Fruit decoction in spleen enlargement, cough, liver enlargement and boils (Ref 12, 25, 29, 31, 78, 139, 218, 239)

ACANTHACEAE JUSS.


*(V. Kadu Chirayata, Kalmegh.)*

Macromorphology

Erect, branched, glabrous herbs, 30-70 cm tall, stem 4-angled. Leaves lanceolate, 1.5 - 5.5 x 3.3 - 2 cm, opposite, entire, undulate, acute, dark green, glabrous. Inflorescence branched, terminal, unilateral. Flowers bilabiate, white with purple strong lines on inner side; bracteate; bracts linear-lanceolate, 0.15-0.2 cm long; sepals linear - lanceolate, glandular pubescent. Corolla white with pink throat, 7-9 cm long, glandular pubescent from outside; lobes linear oblong, 0.2 - 0.25 cm long, sub-obtuse. Stamens 2; anthers bearded at base, placed at two levels; filaments hairy throughout. Ovary glabrous; style slightly pubescent; stigma simple, flat. Capsules 1.5 - 2 cm long, linear oblong, acute at both ends, apiculate, hairy; hairs glandular. Seeds numerous, rugosely pitted, glabrous, yellow-brown (Figs A-G).

Occurrence

- Rare, on hilly slopes around Chikhaldara and Makhala plateau.

Flrs. & Frts.

- December - February

Exsiccata

- PYB & VDD. 345.
Andrographis paniculata (Burm. f.) Wall. Ex. Nees.

Macromorphology (Figs. A - G)

A. Habit sketch
B. Single flower
C. L. S. flower
D. Single stamen
E. Ovary
F. T. S. Ovary
G. Capsule

Micromorphology (Figs. 1-8)

T. S. Root 1. Diagrammatic sketch
T. S. Stem 2. Diagrammatic sketch
3. Sector magnified
Leaf 4. Upper epidermis
5. Lower epidermis
6. Single stoma in V. S.
7. V. S. lamina
8. V. S. Midrib
Andrographis paniculata (Burm. f.) Wall. Ex. Nees.
Micromorphology

Root (Fig. 1).


Stem (Figs 2 & 3)

Quadrangular; angles produced in short wings. Epidermis with cystoliths and few stomata; cells cutinized and cuticularized. Collenchymatous hypodermis filling the wings; elsewhere absent. Cortex chlorenchymatous: the hypodermal layer clearly differentiated into palisade like cells; rest of the cells isodiametric, thin walled, loosely arranged. Endodermis distinct, cells barred shaped. Pericycle parenchymatous with stone cells. Stele, a continuous cylinder with vessel below the ridges or at angles in between thick walled conjunctive tissue present. Secondary growth normal. Water storage tracheids scattered in pith cork superficial.

Leaf (Figs. 4-8)

Lamina hypostomatous. Cells of upper epidermis angular; those of lower epidermis slightly sinuous; stomata dicytic, one of the subsidiary cells conspicuously smaller than the other. Cystoliths distributed in both the epidermis. Mesophyll differentiated into palisade and spongy parenchyma; palisade cells narrow, columnar; spongy tissue 3-4 layered, cells enclosing large air spaces; substomatal chambers large. Midrib with ridges, ground tissue in ridges slightly thickwalled than rest of elsewhere. Vasculature a crescent shaped bundle enclosed in parenchymatous sheath. Chlorenchymatous tissue of lamina continuous over the vascular bundle below upper epidermis.

Chemistry

Total amino acids present seven. Aspartic acid, L-Tyrosine, Glutamic acid, DL-Alanine, Proline, Valine and Iso-leucine.

Alkaloids, Flavonols, Iridoids Phenolics(Catechol) and Steroids present.
Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**  - Decoction of plant for fever and acidity. Plant powder with honey or milk for diabetes.

**Recorded use**  - A widely known medicinal herb. Root and dry stem on dyspepsia and influenza. Decoction of root and leaves used as febrifuge, anthelmintic, antipyretic, purgative and stomachic. Whole plant or leaf powder on snake bite, filaria, leprosy, leucoderma and scabies. Leaf juice on malarial and liver complaints.(Ref: 23, 29, 31, 36, 66, 78, 97, 121, 134, 163, 173, 197, 203, 238).

**ORCHIDACEAE A.L. Juss.**


(K. Bansingada)

**Macromorphology**

Plant tuberous; tubers obconical, snail shell like with oblique, annular rings on surface; in long chains. Leaf and scape appears seperately. Leaves 2.5, elliptic - lanceolate, aerial axis, a pseudostem, formed of leaf bases; Lower 4-5 leaves sheathlike, closely clasping the petiole of laminar leaves; laminar leaves 25 x 6-8 cm, plicate. Scapes with broad, loose ochreate sheaths; flowers 3-5, racemosely placed terminally. Floral bracts linear, equalling the sepals; sepals 3, subequal, elliptic, 5-7 nerved; lateral sepals 1.2 x 0.3 cm, dorsal 1 x 0.3 cm, acute. Petals yellow, lip with faint purple tinge, 1.2 x 0.6 cm with small basal inflaxed lobe’s embracing lateral petals, 1.3 x 0.6 cm. Column with foot; sides slightly winged with obtuse apex, thus appearing deeply grooved; pollinia 2, with elastic caudicles, attached to rostellum, globose. Capsule 1-1-5 inches, narrow, loosely twisted (Figs A-D).
Eulophia pratensis Lindl.

**Macromorphology (Figs. A-D)**

A. Habit sketch  
B. Flowering scape  
C. Single flower  
D. Pollinia

**Micromorphology (Figs. 1-8)**

T. S. Root 1. Diagrammatic sketch  
2. Sector magnified  
T. S. Tuber 3. Diagrammatic sketch  
Leaf 4. Upper epidermis  
5. Lower epidermis  
6. Single stoma in V. S.  
V. S. Lamina 7. Sector magnified  
V. S. Midrib 8. Sector magnified
Eulophia pratensis Lindl.
Occurrence - Frequent in core area of Tiger Project. Melghat, between Chikhaldara - Semadoh, along moist, humus rich slopes.

Flrs. & Frts. - July - August

Exsiccate - PYB & VDD. 310

Micromorphology

Root (Figs. 1 & 2).

Polyarch; pith large. Xylem elements few, phloem surrounded by sclerenchymatous sheath. Velamen many layered, inner most layer with dense granular contents. Endodermis single layered, cells large; thin walled. Cortex parenchymatous, many layered, young cortical cells contain microbial colonies; in old root, colonies absent but cells contain bundles of raphides. Endodermis with passage cells opposite the xylem; thick-walled cells opposite the phloem.

Tuber (Fig. 3)

Conical in shape with distinct nodes and internodes. Epidermis with thin cuticle. Ground tissue parenchymatous, enclosing large air chambers. Vascular bundles scattered; conjoint, collateral; phloem capped by sclerenchyma.

Leaf (Figs. 4-8)

Lamina hypostomatous, Epidermis thickly cutinized and cuticularized. Cells of upper epidermis angular, those of lower epidermis also angular but much smaller than the cells of upper epidermis. Stomata numerous in lower epidermis, no subsidiary cells differentiated. In v. s. guard cells show formation of cuticular ledge enclosing a small stomatal cavity. Mesophyll homogeneous; cells loosely placed, enclosing large air spaces. Midrib with thickly cuticularized epidermis followed by 1-2 layered chlorenchymatous hypodermis; below it is a narrow zone of sclerenchyma. Vascular bundles few, abutting the sclerenchyma. A crescent shaped sclerenchymatous patch present immediately below the upper epidermis.
Chemistry

Total amino acids seven. They are DL- Alanine, Valine, Isoleucine, Tyrosine, up 8, unp 8 & unp 5.
Alkaloids, Flavonoids (flavonols), Phenolics (Pyrogallol) and Steroids present.
Ash contains Sulphur, Calcium, Magnesium, Iron Chlorine, Phosphorus and Sodium.

Local use - Tuber powder given with the tubers of Chlorophyllum tuberosum and Curculigo orchioides in milk for general weakness, impotency etc.

Recorded uses - Nil.


Macromorphology

Erect perennial herbs with 1-2, fusiform, white root-tubers. Leaf solitary, radical, broadly ovate or suborbicular, 4-6 cm long and nearly as broad, cordate at base, acute apiculate; sheaths very short. Flowers in 1-4 flowered, lax racemes; scapes 8-20 cm tall, covered with 1 or 2 Sheaths; bracts ovate, 1-1.2 cm long, acuminate; pedicel with ovary 4-5 cm long. Lateral sepals obliquely ovate, 1 x 0.5 cm, acute, 7-nerved. dorsal sepal ovate, 0.8 x 0.5 m, obtuse, apiculate. Petals white, 2-partite: segments unequal, upper one ovate - orbicular, 0.5 – 0.6 x 0.5 cm, lower filiform, 1 x 0.5 cm long. Lip 1-1.2 cm long, 3-partite, the segments filiform to lanceolate. Spur 2 cm long, curved, clavate at the tip. Capsules oblong, 2-3 cm long, ribbed. Seeds numerous (Figs A-G).
Habenaria grandifloriformis Blatt & Me. Cann.

Micromorphology (Figs. A - G)

A. Habit sketch
B. Single flower
C. Single flower
D. Flower parts dissected
E. Pollinia
F. L. S. Ovary
G. T. S. Ovary

Micromorphology (Figs. 1-12)

T. S. Tuber 2. Diagrammatic.
               3. Sector magnified.
T. S. Leaf base 4. Diagrammatic sketch
Lamina 6. Upper epidermis
         7. Lower epidermis
         8. V. S. Stoma
         9. V. S. Lamina through midrib
        10. V. S. Lamina
T. S. Scape 11. Diagrammatic sketch.
         12. Sector magnified.
Habenaria grandifloriformis Blatt. & Mc. Cann.
Contd. ~
Occurrence - Frequent at several spots on plateau and open grasslands at higher elevations in Chikaldara and Dhakna ranges.

Flrs. & Frts. - July - August.
Exsiccata - VDD 306

Micromorphology

Root (Fig.1)

6-7 arch; pith small. Epiblema cells thin walled, much irregular in shape; root hairs many. Cortex 6-8 layered; parenchymatous, thin walled; cells isodiametric, enclosing air spaces. Endodermis and pericycle ill defined.

Tuber (Figs 2&3)

Epidermis thin walled with unicellular and multicellular, uniseriate trichomes. In the subepidermal region cork cambium produces 2-3 layers of cork. The layer next to the cork consist of distinct, barrel shaped cells resembling exodermis. Cortex many layered; cells parenchymatous, thin- walled, compactly placed. Many cortical cells show presence of microbial colonies and bundles of raphides. Stelar region marked by ill defined endodermis and pericycle. Vascular elements few, at places only one or two vessel elements get differentiated along with few, small, thin-walled cells - probably phloem cells. Pith large.

Leaf (Figs. 4-10)

Leaf base tubular, both the outer and inner epidermis thin walled. Ground tissue parenchymatous, cells isodiametric, loosely placed. Vascular bundles arranged in single series, embedded in ground tissue. One side of tube bulged forming a rib that continues as midrib in the lamina. 2-3 vascular bundles with 2 xylem poles and a patch of phloem i.e. roughly amphixylic in nature. Lamina hypostomatous. Cells of upper epidermis polygonal, those of lower epidermis bluntly angled with numerous stomata; subsidiary cells not differentiated. In v. s. cells of upper epidermis extend vertically down wards
occupying more than half the thickness of lamina. Guard cells with outer ledge, enclosing small stomatal cavity leading to large substomatal chamber. Mesophyll though not differentiated into palisade and spongy parenchyma, 2-3 layers below upper epidermis consist of more compactly placed, isodiametric cells, densely filled with chloroplasts, rest of the layers of mesophyll consist of loosely placed, isodiametric or horizontally stretched cells with few chloroplasts or without. Midrib structurally not different from rest of the lamina, except for the fact that it produces a small bulge on underside of leaf and has a prominent vascular bundle.

**Scape** (Figs. 11 & 12).


**Chemistry**

Total amino acids eight. They are Aspartic acid, DL-Alanine, Proline, Valine, Isoleucine, up6, unp4 & unp5.

Alkaloids, Flavonoids, Phenolics (Catechol) and steroids present.

Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**  -  Tuber powder with milk given in general debility.

**Recorded uses**  -  Nil.

Macromorphology

Tuberous annuals; tubers 1.5 - 2 cm in diam.; subglobose, white. Leaf petiolate, 9 - 12 x 3 - 11 cm, cordate, broadly ovate to almost orbicular, acute, acuminate, nerves up to 20, plicate. Flowers not seen. Only vegetative specimens collected (Fig A).

Occurrence - Rare. Semadoh in core area of Tiger Project, Melghat, in valleys along Khamla road
Season - July - August
Exsiccate - PYB 299.

Micromorphology

Root (Fig. 1)
Pentarch; pith comparatively large. Epiblema cells large, cortex parenchymatous, few layered, cells large with small intercellular spaces. Endodermis and pericycle not differentiated.

Tuber (Fig. 2)
Epidermis without cuticle, with unicellular trichomes; gets easily peeled off. Ground tissue parenchymatous, cells isodiametric to polygonal, thin walled, with small intercellular spaces. Vascular bundles small, few, scattered.

Stem (Figs. 3 & 4)
Cylindrical. Epidermis single layered without cuticle; becoming dark brown with age; getting easily peeled off. Ground tissue parenchymatous, cells thin-walled, enclosing small intercellular spaces. Cortical zone out side the vascular region
Nervilia aragoana Gaud.

Macromorphology (Fig. A)

A. Habit sketch

Micromorphology (Figs. 1-12)

T. S. Root
1. Sector magnified.

T. S. Tuber
2. Diagrammatic sketch.

T. S. Stem
3. Diagrammatic; underground.
4. Sector magnified.

T. S. Petiole
5. Diagrammatic sketch.
6. Sector magnified showing peripheral V. B.
7. Showing central V. B.

Lamina
8. Upper epidermis.
9. Lower epidermis.
10. Stoma in V. S.
11. V. S. Lamina
12. V. S. Midrib
Nervilia aragoana Gaud.
contains microbial colonies. Vascular bundles small, few, scattered in the inner region of ground tissue.

**Leaf** (Fig 5-12)

*Petiole* with ridges and deeply furrowed on one side. Epidermis with cuticle. Cuticle thick over the ridges, thin elsewhere. Ground tissue parenchymatous. Vascular bundles forming a ring in hypodermal region, scattered in the inner ground tissue. Outer vascular bundles each placed below the ridge and having a sclerenchymatous cap opposite the phloem. Vascular bundles of inner ground tissue without sclerenchymatous cap. **Lamina** hypostomatous. Cells of upper epidermis polygonal, those of lower epidermis bluntly angled. Stomata numerous, tetracytic. In v. s. guard cells horned, enclosing a small stomatal cavity. Mesophyll differentiated into single layered palisade consisting of squarish to elongated cells. Spongy tissue 2-3 layered, enclosing large sub stomatal chambers. **Midrib** and even smaller veins show prominent hornlike wings, filled with parenchyma. Ground tissue chlorenchymatous. Vascular bundles small, embedded in chlorenchymatous tissue.

**Chemistry**

Total amino acids eight. They are Glutamic acid, DL-Alanine, Citruline, Valine, Isoleucine, Aspartic acid, and unp 2 & unp 5.

Alkaloids, Flavonoids (Flavonols) Phenolics (Pyrogallol) and steroids present.

Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**

- Fresh tubers boiled and eaten. It is believed that, it reduces appetite / hunger.

Tuber powder with milk and sugar if taken internally, increases sexual passion, also increases lactation in females and spermcount in males.
Recorded uses - The plant is bitter, acrid, cooling, galactagogue, diuretic and tonic. Tubers hot, bitter and astringent. It overcomes dysuria, colic, urinary calculi, cough, asthma, vomiting, epilepsy, diarrhoea, diabetes, cyalactia, mental instability, haemoptysis.(Ref. 211, 238)

ZINGIBERACEAE


(V. Jangli adrak, K. Bhunka)

Macromorphology

Perennial, erect herbs, 2-3m. tall; root stock creeping, tuberous; stems more or less woody at base, twisted, mostly unbranched. Leaves 15 - 3.0 x 7.5 cm, subsessile, oblong or oblanceolate - oblong, acute or acuminate, often cuspidate, glabrous above, silky pubescent beneath, base rounded; alternate, spirally arranged. Flowers large, white; in dense cone like spikes. Bracts deep - crimson red. Capsules trigonous globose, 2 cm in diam., red. Seeds black, aril white (Figs A-E).

Occurrence - Common in Semadoh, Harisal, Kolkaz, Tarubandha ranges in deep valleys and moist shaddy slopes, along streams and river banks.

Flrs. & Frts. - October - November

Exsiccata - VDD 303. Photograph

Micromorphology

Root (Fig.1)

Polyach; pith small, cells becoming thick walled in the later stages. Epiblema
Costus speciosus (Koening ex. Retz.) Sm.

Macromorphology (Fig. A - E)

A. Habit sketch
B. Inflorescence
C. Single flower
D. Single stamen
E. T. S. Ovary

Micromorphology (Figs. 1-14)

T. S. Root
1. Sector magnified

T. S. Rhizome
2. Diagrammatic sketch
3. Single vascular bundle showing origin of perivascular cambium

T. S. Stem
4. Diagrammatic sketch
5. Sector magnified showing peripheral part
6. Single central vascular bundle

Leaf
7. Upper epidermis
8. Lower epidermis
9. Single stoma on lower epidermis magnified
10. V. S. Single stoma
11. V. S. Lamina

V. S. Midrib
12. Diagrammatic sketch
13. Sector magnified
14. Trichome on Leaf
Costus speciosus (Koening ex. Retz.) Sm.
with many unicellular hairs, even in older roots, hairs survive. Cortex differentiated in two zones. Outer zone 5-6 layered, cells polygonal, compactly placed, thick-walled, enclosing intercellular spaces. Endodermis distinct with casparian strips, followed by thin walled pericycle. In old roots, cork cambium differentiates just below the outer cortex, producing secondary parenchyma to the inner side and thick walled cork tissue to the outer side.

**Rhizome (Figs 2 & 3)**

Cork superficial, few layered. Cork cambium producing cork to outer side and secondary ground tissue to the inner side. Ground tissue parenchymatous; several cells containing brownish substance present in ground tissue. Vascular bundles scattered in ground tissue; bundles hadrocentric. A distinct cambium originates deep in the ground tissue producing secondary parenchyma forming vascular bundles to the inner side. Vascular bundles both outer to the cambium and inner ones develop a concentric cambium in the outer layers of bundles producing large secondary parenchyma, storing starch. Thus each vascular bundle gets surrounded by starch storing parenchyma.

**Stem (Figs. 4 & 6)**

Cylindrical. Epidermal cells small, thickly cutinized and cuticularized. Ground tissue parenchymatous divided into two distinct zones by a ring of sclerenchyma. Vascular bundles scattered; few in the outer zone, numerous in inner zone, some embedded in sclerenchymatous ring. Bundles hadrocentric; each consisting of single vessel and a patch of phloem surrounding the vessel. A sclerenchymatous sheath or cap is associated with each vascular bundle.

**Leaf (Figs. 7-14)**

*Lamina* amphistomatous; stomatal frequency greater on lower surface; cells angular in outline. Stomata with subsidiary cells, roughly in two cycles; inner cycle of 4 cells, 2 on each side, parallel to guard cells and outer cycle of 4 cells, two lateral and two anteroposterior. Unicellular, simple, short trichomes present on lower epidermis.
Mesophyll with hypodermis below both the epidermis. Cells of upper epidermis large; those of lower much smaller. Palisade two layered; the layer immediately below hypodermis consists of longer cells, second layer of shorter cells. Spongy tissue 2-3 layered; cell isodiametric, loosely arranged. Veinlets embeded in mesophyll. Cuboidal crystals present in the cells of upper epidermis and hypodermis. **Midrib** large. Ground tissue parenchymatous. One or two layers of chllorenchymatous mesophyll are continuous on adaxial side of midrib, separated from epidermis by few layers of parenchyma. Some vascular bundles are present in a series, abutting the chllorenchymatous zone. Some vascular bundles scattered in the abaxial ground tissue. Bundles hadrocentric, surrounded by sclerenchymatous, multilayered sheath. Cuboidal crystals present in the cells of adaxial ground tissue. Unicellular trichomes present on lower epidermis.

**Chemistry**

Total amino acids six. They are Aspartic acid, DL-Alanine, Lysine - monohydrochloride, DL-2-amino-n-butyric acid up5 & unp8.

Flavonoids (Flavonols), Iridoids and steroids present in roots.

Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine and Phosphorus.

**Local use**

- Rhizome juice mixed with honey is given in whooping cough.
- Rhizome paste applied externally in tonsilitis.

**Recorded uses**

- The rhizome is bitter, astringent, acrid, cooling, purgative, aphrodisiac, anthelmintic, depurative, febrifuge, expectorant, cardiac tonic and tonic; useful in burning sensation, flatulence, constipation, helminthiasis, leprosy, skin diseases, fever, hiccough, asthma, bronchitis, inflammations, anemia, diabetes, oedema, piles, stomach ache, fore head ache, bloody urine, fish poisoning, spermarrhoes, rheumatism, antidote to snake poison. Leaves made into paste and applied over blisters due to fire, young stem and leaves also used as vegetable. (Ref. 2, 23, 29, 36, 85, 94, 107, 132, 135, 149, 159, 188, 210, 212, 218, 238)
HYPOXIDACEAE R. Br.


(V. Kalimusali)

**Macromorphology**

Small perennial herbs with stout, elongate, cylindric root stock upto 30 cm long. Leaves radical, sessile or narrowed into short or long petioles, linear - lanceolate, 15 - 100 x 1.5 - 4.5 cm, plicate, acuminate; sheaths 5 - 10 cm long, membranous. Flowers distichous, on a short, clavate, flattened scape; the lowest flower in the raceme bisexual, upper ones male; bracts lanceolate, 1.5 - 4 cm long, acuminate. Perianth yellow; segments elliptic - oblong, united to a short tube, ciliate at apex, otherwise glabrous. Stamens 6, shorter than the perianth segments. Ovary densely hairy; stigmas 3. Capsules oblong, 10-12 mm long, hairy. Seeds black, ovoid with an appendage above the funicle, vertically striated (Figs A-F).

**Occurrence**

- Fairly common throughout, on open grasslands, mud flats along stream and river margins.

**Flrs. & Frts.**

- June - September

**Exsiccata**

- VDD 10

**Micromorphology**

**Root** (Figs 1 & 2)

Hexarch; pith small, thick-walled. Epiblema gets peeled off very early. Hypodermal and subhypodermal layer become thick-walled and serves as rhizodermis. Cortex parenchymatous multilayered; outer 8-10 layers of contractile parenchyma, followed by tangentially streached, irregularly arranged inner cortex. Endodermis thick-walled; pericycle thin walled.
*Curculigo orchioides* Gaertn.

**Macromorphology (Figs. A - F)**

A. Habit sketch  
B. Single flower  
C. L. S. Flower  
D. Single stamen  
E. Gynoecium  
F. T. S. Ovary

**Micromorphology (Figs. 1 - 14)**

T. S. Root  
1. Sector magnified.  
2. Stelar region magnified.  
T. S. Stem  
3. Diagrammatic sketch.  
4. Sector magnified.  
T. S. petiole  
5. Diagrammatic sketch.  
6. Sector magnified showing peripheral V. B.  
7. Medullary V. B.  
Lamina  
8. Upper epidermis.  
9. Lower epidermis.  
10. Single stoma in V. S.  
11. V. S. Lamina near midrib with lateral vein.  
12. V. S. Lamina through midrib  
13. V. S. part of Lamina with close plications.  
14. V. S. Lamina, much away from midrib.
Curculigo orchioides Gaertn.
Stem (Figs. 3 & 4)

Cylindrical, underground. Outermost zone of 2-3 layers of thick-walled cork-like cells. Ground tissue parenchymatous, many layered; cells thin walled, full of starch; enclosing small intercellular spaces and large raphide containing pockets. Vascular bundles scattered; leptocentric or amphivasal.

Leaf (Figs. 5-14)

Base forming a pseudoaxis. In t. s. each leaf base deeply ‘U’ shaped. Epidermis single layered; cutinized and cuticularized; ground tissue parenchymatous. Cells thin-walled with small intercellular spaces. Bundles of raphides scattered in ground tissue. Vascular bundles of two distinct sizes; larger ones hypodermal in position and smaller ones deeply embedded in the ground tissue. Hypodermal bundles with prominent sclerenchymatous cap; smaller bundles with a narrow sclerenchymatous sheath.

Lamina plicate; more so in the middle expanded region. From the base to the middle part and from center to the margin, anatomy varies. Amphistomatous. Epidermal cells, angular stomata of upper epidermis with distinct lateral, subsidiary cells, while those in the lower epidermis irregularly tetracytic. In v. s. guard cells show outer and inner ledges forming front and back stomatal cavities opening into large substomatal chamber. In the basal part of leaf, lamina is not plicate; mesophyll homogeneous; cells isodiametric, Vein bundles capped by hypodermal, sclerenchymatous patch on both sides. Higher above lamina plicate; folded along the veins alternately. Vein bundles with conspicuous sclerenchymatous patch opposite the phloem. Upper epidermal cells large, balloon like resembling bulliform cells of Graminae folding takes place along these cells. Gradually away from the central vein folds become less conspicuous. Mesophyll in the region of folding, 2-3 layered; epidermis in this region being of exceptionally large cells. Gradually away from the center, mesophyll shows differentiation into single layered palisade and spongy tissue. Raphide containing pockets scattered in the mesophyll throughout.
Chemistry

Total amino acids present ten. They are Tyrosine, Threonine, DL-Alanine, Lysine monohydrochloride, L – Cystine, Ornithine - mono - hydrochloride. Arginine, DL- Dopa, Isoleucine and imp 2
Alkaloids, Flavonols, Steroids and Phenolics(Catechol) present.
Ash contains Calcium, Sulphur, Iron, Chlorine and Phosphorus.

Local use - Fresh tuber applied on wounds in the form of thin film to for quick healing.
Fresh tuber paste applied over snake - bite directly to stop the spread of poison in the body. Tuber powder is aphrodisiac.

Recorded uses - The tubers are sweet, cooling, bitter, emollient, diuretic, aphrodisiac, depurative, alterant, antidote, appetiser, carminative, viriligenic, antipyretic, abortifacent, expectorant and is useful in leucoderma, haemorrhoids, pruritus, skin diseases, asthma bronchitis, jaundice, diarrhoea, cuts, wounds, dyspepsia, colic, ophthalmia, lumbago, gonorrhoea, improvement of complexion, general debility, impotency, urinary diseases, menorrhagia, piles, bone cracks, nightfalls, spleen enlargement, snake-bite, back ache, scorpion sting, abortion, epilepsy (Ref. 2, 36, 66, 84, 104, 121, 132, 135, 136, 137, 149, 175, 177, 188, 203, 211, 219, 222, 231, 238)
TACCACEAE Dumort.


**Macromorphology**

Perennial herbs with subterranean, depressed-globose, 5-10 cm in diam. white brownish corm. Leaf solitary, on 30-90 cm long petiole; blade circular in outline, 3 - partial, 30-90 cm across; segments divided into linear - lanceolate lobes. Flowers long pedicelled, drooping, 12-15 cm across, at the end of 60-100 cm long, terete, green or brown-mottled scape. Involucral bracts 6-12, oblong-lanceolate, acuminate, white with purple stripes; bracteoles much longer than the bracts. Perianth sub-globose, 1-1.5 cm long, greenish yellow; lobes connivent, with purple margin. Stamens 6, included. Ovary 3-gonous, 1-locular. Fruit globose 3 x 2 cm, yellow, 6 - ribbed. Seeds many, angular (Figs A-F).

**Occurrence**

- On shaded moist mud flas, in Koktu valley, Dhakana range.

**Flrs. & Frts.**

- July - October.

**Exsiccate**

- PYB 9

**Micromorphology**

**Root** (Fig. 1)

Polyarch; pith small; conjunctive tissue lignified. Water storage tracheids present in associations with the large vessels, also scattered in the pith and conjunctive tissue. Epiblema thin walled with unicellular hairs. One or two hypodermal layer become thick-walled to serve as rhizodermis after epiblema gets peeled off. Cortex parenchymatous including few large air spaces in the outer region and few smaller in the inner region.
Tacca leontopetaloides (L.) O. Kitz.

Macromorphology (Figs. A - D)
A. Habit sketch.  
B. Bud & Single flower.  
C. Stamen.  
D. Gynoecium  
E. L. S. Ovary

Micromorphology (Figs.1-12)
T. S. Root  
1. Sector magnified
T. S. Petiole  
2. Diagrammatic sketch  
3. Sector magnified showing peripheral V. B.  
4. Central V. B.  
Lamina  
5. Upper epidermis.  
7. Lower epidermis showing twin stomata.  
8. Single stoma in V. S.  
9. V. S. Lamina.
T. S. Midrib  
10. Diagrammatic sketch.  
11. Diagrammatic sketch of lateral vein.  
12. Sector magnified.
Tacca leontopetaloides (L.) O. Kitz.
Leaf (Figs. 2-12)

**Petiole** cylindrical, thick. Epidermis cutinized and cuticularized. Cortex parenchymatous; cells thin walled; delimited from ground tissue by a ring of sclerenchyma. Vascular bundles scattered. Peripheral abutting the sclerenchyma, thus forming a ring. Sclerenchymatous patch broader opposite the vascular bundles, gradually cells around the vasculature become lignified, so that vascular bundle gets sheathed by sclerenchyma. Center hollow. Peripheral bundles larger than the inner ones. **Lamina** hypostomatos; cells of epidermis shallowly sinuate; those of lower epidermis smaller than the upper ones, with numerous anomocytic stomata; at places twin-stomata are seen. In v. s. guard cells with sharp outer ledges forming a stomatal cavity. Mesophyll differentiated into two layered palisade consisting of short, compactly placed cells, with dense chloroplast, spongy parenchyma 3-4 layerd, loosely placed with intercellular spaces. **Midrib** striate with hollow center at the basal part of lamina. Ground tissue parenchymatous. Vascular bundles arranged in a ring around a central hollow; higher above ground tissue is without hollow, only two vascular bundles.

**Chemistry**

Total amino acids present twelve. They are Aspartic acid, Glycine, DL-Alanine, Lysine mono - hydro chloride, L-Hystine, Proline, DL- Methionine, DL-Valine and Isoleucine, and unp2, unp3 and unp7.

Alkaloids, Flavonoid (Flavonols), Iridoids, Phenolics (Catechol) and Steroids present.

Ash contains Calcium, Sulphur, Iron, Chlorin, Phosphorus and sodium.

**Local use**

- Tubers are kept in houses and tuber powder given internally as antidote to snake poison.

**Recorded uses**

- Root bitter, rubificient and useful in dysentery, leprosy, stomach disorders. Tubers boiled and eaten. (24, 132, 188, 239)
DIOSCOREACEAE. R. Br.


**Macromorphology**

Perennial climbing shrubs, unarmed. Rhizomes small, bearing tubers at the end of fleshy roots; tubers 1-3, small, subfusiform. Leaves simple, 7.5-13.0 x 2-9 cm, usually ovate or ovate-oblong; base deeply cordate or sagittate, lower often alternate, upper usually opposite, 5-nerved. Flowers greenish white in axils. Male flowers in panicles; spikes 2-5-4.0 cm long; female flowers usually in solitary 5.5-12.0 cm long spikes. Capsules 1-5-2.0 x 1.1 - 3.0 cm, obovate with retuse apex, stipe short, wings evenly rounded. Seeds with reddish - brown wings all around (Fig A).

**Occurrence**

- Fairly common in Melghat.

**Flrs. & Frts.**

- September - December.

**Exsiccata**

- VDD 120

**Micromorphology**

**Root** (Fig. 1)

Polyarch, pith small, cell thick-walled. Few large metaxylem vessels show transverse separation. Each phloem patch is associated with water canal, present towards the pith side. Epiblema with unicellular hairs; in old roots, epiblema gets peeled off and 2-3 outermost layers of cortex, become thick - walled and protective; these cells are polygonal without intercellular spaces. Cortex parenchymatous, cells thin-walled, isodiametric with small intercellular spaces. Cortex parenchymatous, cells thin-walled, isodiametric with small intercellular spaces.
Dioscorea belophylla (Prain) Haines.

Macromorphology (Fig. A)

A. Habit sketch

Micromorphology (Figs. 1-13)

T. S. Root
1. Sector magnified

T. S. Tuber
2. Diagrammatic sketch

T. S. Stem
3. Diagrammatic sketch
4. Sector magnified showing type I bundle
5. Sector magnified showing type II & type III bundles

T. S. Petiole
6. Diagrammatic sketch
7. Sector magnified

Lamina
8. Upper epidermis
9. Lower epidermis
10. Stoma in V. S.
11. Gland on epidermis
12. V. S. Lamina, sector magnified
13. V. S. Midrib, sector magnified
Dioscorea helophylloa (Prain) Haines.
Rhizome (Fig. 2)

Outermost cork many layered. Ground tissue large, parenchymatous, containing starch grains, many cells containing dark brown content, scattered in ground tissue. Vascular strands comparatively fewer in numbers, scattered, with two xylem poles and few phloem patches. Each vascular bundle towards its outer side was observed to develop meristematic parenchyma. It must be adding the secondary storage parenchyma.

Stem (Figs. 3-5)

Epidermis cutinized and cuticularized; cells small, followed by 2-3 layers of collenchymatous hypodermis. Cortex few layered, parenchymatous, cells containing few chloroplasts and some cells with dark brown content. Endodermis distinct followed by sclerenchymatous pericycle. Vascular bundles of three types observed:

Type I - Abutting the pericycle, conical in shape, each bundle consist of two phloem patches, associated with small water canals and followed by vessel elements; again there is a patch of phloem with water canals and narrow end on cone consisting of protoxylem elements.

Type II - Bundles abutting the pericycle roughly horizontally elliptic in shape. Each bundle consists of a patch of phloem associated with water canal. Vessel elements arranged in roughly ‘U’ shaped, connecting the phloem patch.

Type III - Bundles may be in the close association of type II, seperated by only single layer of parenchyma or may be clearly seperated by the narrow zone of parenchyma, but always lying in line with type II bundle. Each bundle consists two patches of phloem associated with water canal. These two patches may sometimes be large and confluent. It is followed by a large water canal, vessel elements and two more phloem patches along with water canals flanking the xylem elements.
In old stem no cambium was observed; however, the lignification of conjunctive tissue is to great extent, even water canals become thick-walled. Water storage tracheids are associated with water canals and also metaxylem elements.

Leaf (Figs. 6-13).

Petiole pentangular with flat adaxial side. Epidermis is followed by few layers of collenchymatous hypodermis at angles. Cortex parenchymatous, 3-4 layered, followed by a distinct endodermoid and sclerenchymatous pericycle like layer. Vascular bundles 6, arranged in a ring. Each vascular bundle consist of a patch of xylem element, flanked on both sides of phloem. Vascular bundles below the abaxial angle clearly formed by the fusion of two. Inner ground tissue parenchymatous. At the base of lamina, vasculature is in the form of bundles arranged in a single series to form an arc. Endodermoid layer and pericycle absent. Lamina hypostomatous. Cells of epidermis sinuous. Multicellular glands with short stalk scattered in the epidermis. Lower epidermis with numerous stomata; stomata anomocytic, most of them with three subsidiary cells; one of the three subsidiary cells mostly smaller than the other two. Stomata in v. s. shows outer ledge and stomatal cavity. Mesophyll differentiated into palisade and spongy parenchyma. Palisade apperanthy two layered, however, cells immediately below the upper epidermis somewhat elongated, palisade like. Cells of second layer, squarish to isodiametric. Spongy tissue 3-4 layered; many mesophyll cells contain dark brown substance. Midrib with parenchymatous ground tissue. Vascular bundle single, large, with 4 protoxylem poles and 5-phloem patches flanking each metaxylem poles.

Chemistry

Total amino acids present seven. They are Serine, DL- Alanine, Valine, DL-Valine Isoleucine, up5 & unp 5.

Alkaloids, Flavonoids, Iridoids, Phenolics and Steroids present.

Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, phosphorus and Sodium.
Local use - Tuber powder given in heat problems. Tuber poultice applied on whitlow.

Recorded uses - Tubers roasted and eaten (Ref. 112, 210)

LILIACEAE.


(V. & K. Jangli lasan, Lasani)

Macromorphology

Erect herbs, 7 - 20 cm tall; underground tuber subglobose, 1-2 cm in diam. Leaves few, sessile, linear, grasslike, 8-15 cm long, 0.5-0.6 cm wide, sheathing at base, acute or acuminate. Flowers few in terminal erect racemes; bracts linear, the lower leafy; pedicels 1-2.5 cm long. Perianth segments distinct, narrow, acute, spreading. Segments 3-4 mm long; filaments flattened. Ovary oblong; style 3, recurved capsules oblong-ellipsoid, 10-15 x 6-7 mm, 3- grooved, obtuse. Seeds many, ellipsoid or subglobose, 2 mm in diam; brown (Figs A-F).

Occurrence - Not common. On moist hillslopes and plateau among grasses.

Flrs. & Frts. - September - October.

Exsiccata - VDD 202

Micromorphology

Root (Fig 1)

Polyarch; pith small. Epiblema followed by parenchymatous cortex; cells thin walled, enclosing large air chambers. Endodermis and pericycle thin walled.
Iphigenia indica (L.) A. Gray.

Macromorphology (Figs. A-F)

A. Habit sketch
B. Single flower
C. Flower (Perianth removed)
D. Single Stamen
E. T. S. Ovary
F. Fruit

Micromorphology (Figs. 1-13)

T. S. Root 1. Sector magnified
T. S. Tuber 2. Diagrammatic sketch
            3. Sector magnified
T. S. Stem  4. Diagrammatic just above the node
            5. Sector magnified just above the node
            6. Little below the node showing formation of
               leaf sheath tube of next node
Leaf base tube 7. Diagrammatic sketch
1. Sector magnified
Lamina    9. Upper epidermis
          10. Lower epidermis
          11. Single stoma in V. S.
          12. V. S. lamina
          13. V. S. Midrib
Iphigenia indica (L.) A. Gray.
**Tuber** (Figs. 2 & 3)

Small, ellipsoidal. Epidermis single layered, non cutinized. Hypodermal layer with dark brownish cell contents. Ground tissue parenchymatous, cells thin walled, isodiametric, compactly placed, full with starch. Vascular bundles scattered; conjoint, collateral; larger ones amphiphloic.

**Stem** (Figs. 4 - 6).

Cylindrical. Just above the node, nearly for 1/3 of the internodal part, ochreate leaf base is inseperably fused with the stem. Higher above in the internode, leaf base tube separates from the stem. Epidermis thick-walled; followed by 3-4 layered parenchymatous hypodermis. Hypodermis with vascular bundles following a ring. Following the hypodermis is 3-4 layered zone of thick walled cells. Vascular bundles present in a ring abutting thick-walled zone. Medullary parenchyma without vascular strands. Vascular bundles amphiphloic, outer hypodermal region with vascular bundles higher above at next node gradually forms large air chambers. The region is infact the leaf base sheath of next node.

**Leaf** (Figs. 7 - 13)

**Base** tubular. Outer epidermis thickly cutinized and cuticularized. Ground tissue with few layered hypodermal chlorenchymatous zone and large air chambers, limited by thin-walled, single layered inner epidermis. Vascular bundles amphiphloic, embedded in Chlorenchymatous hypodermis. Vascular bundles with associated parenchyma form partition walls of air chambers. **Lamina** amphistomatous. Epidermal cells elongated, cylinder like, parallel to the surface of lamina. Stomata without subsidiany cells. In v. s. guard cells with cuticular ledge forming a stomatal cavity. Mesophyll homogenous, consisting of all isodiametric cells near the midrib, away from it becomes differentiated into two layers of cells appearing palisade like; however, these cells are short and not columnar. Spongy tissue with large air space. **Midvein** with chlorenchymatous ground tissue and single vascular bundle embedded in it. In midrib region, cells of upper epidermis are too large than the cells of lower epidermis. Lateral veins embedded in mesophyll with a parenchymatous bundle sheath.
Chemistry

Total amino acids present eight. They are Glutamic acid, Tyrosine, DL-Alanine, Histidine, D-Methionine and Valine, unp 2 & unp 4.
Alkaloids, Flavonoids (Flavonols), Phenolics (Catechol) and Steroids present.
Ash contains Sulphur, Calcium, Magnesium, Iron Chlorine and Phosphorus.

Local use
- Oil extracted from bulbs is used as pain reliever especially in migraine.
- Oil given to smell after snake bite to avoid sleep.
- Oil applied over snake bite.

Recorded uses
- Bulbs are used for colic and headache in parts of Bihar (Ref 31).

COMMELINACEAE R. Br.

(V. Ghodighas K. Color)

Macromorphology

Perennial herbs, 28 - 50 cm high. Leaves cauline, sessile or subsessile, 9 -17 x 3.5 - 7.0 cm, lanceolate or elliptic, subacuminate, unequal sided, the lower often smaller. Spathes pedunculate, 1.5 - 2.5 x 0.9 - 1.5 cm, broadly ovate-turbinate, apex acute, base truncate, rounded or subcordate, margins hirsute. Flowers white. Capsules 0.5 x 0.5 cm, obcordate, laterally flattened. Seeds filling the loculus, the inner face of the seed flat, outer one convex. (Figs - A 4 B)

Occurrence
- Not common. In Dhargad, Koktu, Gullarghat, Narnala localities along stream margins.
Commelina suffruticosa Blume.

Macromorphology (Fig. A - B)

A. Habit sketch
B. Single flower

Micromorphology (Figs. 1-14)

T. S. Root
1. Sector magnified
T. S. Stem
2. Diagrammatic sketch
3. Sector magnified showing peripheral bundles
4. Single central vascular bundle
Leaf base
5. Tube, diagrammatic sketch
6. Sector magnified
Lamina
7. Upper epidermis
8. Lower epidermis
9. Single stoma in V. S.
10. V. S. Lamina
V. S. Midrib
11. Sector magnified
12. V. S. Lateral veins
13. Simple trichome on Leaf
Commelina suffruticosa Blume
Frs. & Frts. - July - October
Exsiccate - VDD 9.

Micromorphology

Root (Fig. 1)
Polyarch; pith small. Epiblema gets peeled off very early. One of the hypodermal layer become thick- walled and serves as rhizodermis. Outer cortex 2-3 layered, cells parenchymatous, compactly placed. Inner cortex many layered, cells thin - walled with small intercellular spaces. Endodermis with casparian stripes. Pericycle thin walled. In old roots, wherever rhizodermis gets damaged, wound healing cork can be seen.

Stem (Figs. 2 - 4).
Stem roughly semicircular in outline. Epidermal cells small. Thickly cutinized and cuticularized. Hypodermis, discontinuous, 3-4 layered, interrupted by chlorenchyma, at places. Cortex parenchymatous, cells chlorenchymatous; enclosing large air chambers. Endodermis ill-defined followed by 1-2 layered thick-walled pericycle; at places pericyclic layers absent. Vascular bundles at periphery forming a ring. Bundles scattered in ground tissue, consist of water canal and few phloem cells only. The structure over all simulates that of dicot stem. Because of aerenchyma ground tissue gests clearly distinguished into cortex and stele; inner most layer of cortex appearing like endodermis and thick-walled narrow zone appearing like paricycle. Ring of peripheral bundles further adds the similarity.

Leaf (Figs. 5 - 12)
Base sheathing; sheath parenchymatous: ground tissue enclosing large air chambers. Vascular bundles arranged in a single ring. Bundles conjoint, collateral, surrounded by compact parenchyma. Lamina amphistomatous. Cells, of upper epidermis angular. Stomata with two subsidiary cells parallel to guard cells; few. Cells of lower epidermis larger than the upper. Stomata many, each surrounded by 6 subsidiary cells, arranged in two cycles: inner cycle of two subsidiary cells, parallel to
guard cells, outer cycle of four cells, two parallel to guard cells and two at right angles. In v. s. each guard cell with erect ledge. Large, rod shaped crystals present in lower epidermis. Mesophyll differentiated into single layer of long palisade cells occupying more than 1/2 of the extent of mesophyll tissue and two layered spongy parenchyma consisting of horizontally oriented, compactly placed parenchymatous cells with large substomatal chambers. Midrib with 2 layered collenchymatous hypodermis and parenchymatous ground tissue. Vascular bundle single. Chlorenchyma of mesophyll continuing over the vascular bundle. Minor veinlets embedded in mesophyll. Epidermal cells at the position of veinlets conspicuously smaller than elsewhere.

**Trichomes** (Fig. 14)

Unicellular with acute endings, present all over the plant body.

**Chemistry**

Total amino acids present eight. They are Aspartic acid, Proline, DL-2-amino-n-butyr acid, Methionine, Isoleucine, up 5 & unp 4.

Alkaloids, Flavonoids (Flavonols), Iridoids. Phenolics (Catechol) and Steroids present.

Ash contains, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**

- Root paste given orally as well as applied over snake - bite. Root powder given in piles, fistula and red - discharge in women.

**Recorded uses**

- *Plant paste applied over wounds and sores menorrhagia* (Ref 31, 238).
Sauromatum venosum (Ait.) Schott
Inflorescence

Sauromatum venosum (Ait.) Schott
Fruit

Amorphophallus bulbifer Blume
Fruiting

Amorphophallus spp.
Fruiting

Amorphophallus bulbifer Blume

Arisaema murayii (Graham) Hook.

Theriophonum minutum Willd.
ARACEAE

Amorphophallus bulbifer  Blume. Hook f. Fl. Brit. India 6:515. 1893; Sharma,
(V. Jangli Surankand)

Macromorphology

Plants cormose; corms large, 15-20 cm. high and 25-30 cm in diam. some what
irregular in shape with warts. Roots thick as well as thin; secondary thin roots profuse,
concentric wrinkles present on the roots. Leaf single, growing upto 5 ft. high, pedisect; petiole
dark green with vertical long pale green streaks; leaf first divided into three main rachii and
each further dichotomously. A bulbil develops at first trichotomy and further dichotomy of
pale green at young stage and brownish black at maturity (Fig A).

Occurrence

- Most common at Chikhaldara plateau along moist slopes as
  well as forest undergrowth

Flrs. & Frts.

- June-September

Exsiccata

- PYB & VDD 234.

Micromorphology

Root (Fig.1)

Polyarch; pith small. Epiblema persists for long time. Outer cortex 3-4 layered;
cells small, compactly arranged. Middle cortex 3-5 layered, made up of contractile
parenchyma. Inner cortex parenchymatous, 4-5 layered. Inner three layers of
tangentially stretched cells, arranged in concentric layers. Endodermis and pericycle
both of thin walled cells.
Amorphophallus bulbifer  Blume

Macromorphology (Fig. A)

A. Habit sketch.

Micromorphology (Figs. 1-12)

T. S. Root  1. Sector magnified
T. S. petiole  2. Diagrammatic sketch
            3. Sector magnified showing peripheral
            4. Central V. B.
            5. Air chambers
            6. Single stoma on petiole
Lamina       7. Upper epidermis
            8. Lower epidermis
            9. V. S. lamina
T. S. Midrib 10. Diagrammatic sketch
            11. Sector magnified showing peripheral V. B.
            12. Central medullary V. B.
Amorphophallus bulbifer  Blume
Leaf (Figs. 2-12)

Petiole thick, cylindrical. Epidermal cells cutinized; cuticle producing prominent pegs. Few stomata present in epidermis. Stomata cyclic; guard cell surrounded by five subsidiary cells, forming a circle. Ground tissue parenchymatous, with large air chambers. Several sclerenchymatous patches present in hypodermal region. Vascular bundles scattered; peripheral ones abutting the sclerenchymatous patches forming a ring. Vascular bundles consisting of a patch of phloem, one or two tracheary elements and a large water canal. Lamina hypostomatous. Cells of upper epidermis angular; those of lower epidermis slightly sinuous with numerous stomata. Subsidiary cells not sharply differentiated; however cells lateral to guard cells some what distinct from rest of the cells-stomata appearing paracytic-,subsidiary cells slightly elevated. Mesophyll differentiated into single layered palisade and spongy tissue consisting of irregularly shaped cells enclosing large air spaces. Some cells of palisade contain large sphaeraphides while some of the spongy tissue contain bundles of raphides. Midrib with parenchymatous ground tissue enclosing large air chambers. Large sclerenchymatous patches present in the hypodermal region; epidermal cells opposite the sclerenchymatous patch much larger than elsewhere. Vascular bundles scattered, peripheral ones may be abutting the sclerenchymatous patch or much separated from. Peripheral bundles are larger than inner ones. Water canal may be absent from the peripheral bundle.

Chemistry

Total amino acids eleven present. They are Glutamic acid, Tyrosine, Serine, Glycine, DL-Methionine, DL Valine, Isoleucine, L-leucine, up1, unp 1 and unp 2.

Alkaloids, Flavonoids(Flavonols), Phenolics (Catechol & Hydroquinone) and Steroids present.

Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

Local use - Corm powder with honey taken internally to cure deodenal ulcers, intestinal ulcers and blood cancer.

Recorded uses - Nil
Amorphophallus spp. (A. commutatus ?)
(K. Narak kand, Narkya)

Macromorphology

Plants cormose; corms 15 x 10-12 cm across. Leaf single; petioles 1-5 ft., stout, streaked with pale green and dark brown; leaf primarily divided into three pinnæ and each further divides dichotomously; leaf segments long, narrow, 13 x 2 cm or so. Spadix sessile intensely foul smelling (Inflorescence personally not seen by author). Fruit, bright red berries on a long peduncle.

Occurrence
- Not common. On Chikhaldara and vairat plateau on hilly moist slopes.
Flrs. & Frts.
- February - March
Exsiccata
- Photograph

Micromorphology

Root (Fig 1)
Polyarch; pith small. Epiblema persists for a long time, followed by 3-4 layers of compact parenchyma forming outer cortex; following the outer cortex are 3-5 layers of contractile parenchyma. Inner cortex consist of squarish or tangentially stretched parenchymatous cells arranged in concentric, radial files. Endodermis thick walled and pericycle thin walled; cells opposite the phloem larger than the cells opposite the xylem.

Leaf (Figs. 2-12)
Petiole thick, cylindrical. Epidermis thickly cutinized; cuticle forming short pegs. Few stomata present. Ground tissue parenchymatous enclosing large air chambers. Sclerenchymatous patches present in hypodermal region. Vascular bundles scattered; peripheral ones abutting the sclerenchymatous patches, forming a ring, smaller than the scattered bundles. Each bundle consist of a patch of phloem; xylem consisting of 1 or 2
Amorphophallus spp.

Macromorphology (Fig. A)

A. Habit sketch

Micromorphology (Figs. 1-12)

T. S. Root
1. Sector magnified

T. S. Petiole
2. Diagrammatic sketch
3. Stomata on petiole
4. Air chambers
5. Sector magnified showing peripheral V. B.
6. Showing central V. B.

Lamina
7. Upper epidermis with cuticular striations
8. Lower epidermis
9. Single stoma in V. S.
10. V. S. Lamina

V. S. Midrib
11. Diagrammatic sketch
12. Sector magnified
Amorphophallus spp.
tracheary elements and a large water canal. **Lamina** hypostomatous. Cells of upper epidermis hexagonal, with prominent cuticular striations. Cells of lower epidermis bluntly angled without cuticular striations. Stomata numerous, flanked by two subsidiary cells, parallel to the guard cells i.e. paracytic. Mesophyll differentiated into single layered palisade consisting of long narrow cells and spongy parenchyma; consisting of irregular cells enclosing large air spaces. Some of the palisade cells containing sphaeraphides; while some of the spongy cells contain bundles of raphides. **Midrib** with parenchymatous ground tissue enclosing large air chambers. Sclerenchymatous patches present in hypodermal region. Vascular bundles few, scattered; peripheral ones abutting the sclerenchymatous patches.

**Chemistry**

Total eight amino acids present. They are Aspartic acid, L-tyrosine, DL-Alanine, Methionine, Isoleucine, Nor-leucine, up1, and unp2

Alkaloids, Flavonoids (Flavonols), Phenolics (Naphthol) and Steroids present.

Ash contains Sulphur, Calcium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**

- Corm juice or paste used against snake - bite.

- Corm paste applied over affected part in fistula & piles. Dry powder with honey also recommended for ascites.

- Corm powder with honey & Ghee given in cancer.

**Recorded uses**

- Nil

(V. Sanp kand K. Khandar, Bhasamkand)

Macromorphology

Perennial, cormose, scapigerous herbs; coms with root fiber from the upper side. Leaf solitary, peltate, divided to the base into 5-10, ovate - lanceolate, acuminate segments; 7.5 - 15.0 x 2.5 - 5.0 cm. petioles 25 - 30 cm long, green. Peduncles as long as petioles. Spathes striate, green at base, forming a tube for more than 1/3 its length. Spadix narrowed from base upwards. Male flowers scattered with a few neuters above them. Ovaries numerous, crowded, bright red when ripe, variously compressed (Fig A).

Occurrence

Occasional throughout, however, abundant at certain spots in Chikhaldara, Tarobandha, Dhakna, Semadoh ranges, Kotku valley etc on moist shady slopes.

Frs. & Frts.

August - September.

Exsiccata

VDD 302

Micromorphology

Root (Fig.1)

Polyarch; pith absent. Centre of root occupid by one large metaxylem element. Outside phloem, some small air chambers present. Epiblema persists for a long time. 3-5 layered cork like tissue produced in hypodermal region, followed by cortical parenchyma. Inner cortex consists of concentrically arranged layers of tangentially stretched, rectangular, perenchymatous cells. Endodermis thick-walled; pericycle thin-walled.
Arisaema murrayi (Graham) Hook.

Macromorphology (Fig. A)
A. Habit sketch

Micromorphology (Figs. 1-12)

| T. S. Root          | 1. Sector magnified |
| T. S. petiole       | 2. Diagrammatic sketch. |
|                     | 3. Stomata on petiole epidermis. |
|                     | 4. Sector magnified. |
|                     | 5. Central V. B. |
| Lamina              | 6. Upper epidermis. |
|                     | 7. Lower epidermis. |
|                     | 8. Single stoma in V. S. |
|                     | 9. V. S. Lamina. |
| T. S. Midrib        | 10. Diagrammatic sketch. |
|                     | 11. Peripheral V. B. |
|                     | 12. Medullary V. B. |
Arisaema murrayi (Graham) Hook.
**Leaf** (Figs 2-12)

**Petiole** thick, cylindrical. Epidermis with stomata; subsidiary cells 4, arranged to form a circle around the guard cell. Epidermal cells thickly cutinized and cuticularized; followed by 2-3 layered collenchymatous hypodermis. Ground tissue parenchymatous; sclerenchymatous patches present just below the hypodermis. Vascular bundles scattered; peripheral ones abutting the sclerenchymatous patches. Each vascular bundle consists of one or two tracheary elements, 1 or 2 large water canals and a patch of phloem. Bundles towards centre are larger than peripheral bundles. Old petiole develops many layered cork. **Lamina** hypostomatous; cells of upper epidermis hexagonal, those of lower epidermis bluntly angled, much smaller than the cells of upper epidermis, with numerous stomata. Guard cells with two subsidiary cells. Stomata paracytic mesophyll differentiated into single layered palisade, consisting of narrow elongated cells and spongy parenchyma with irregular cells enclosing large air spaces; some cells of mesophyll contain raphides. **Midrib** large; ground tissue parenchymatous with sclerenchymatous hypodermal patches. Vascular bundles scattered; peripheral ones abutting the sclerenchymatous patch. Each bundle consists of 1 or 2 vessel elements, one or two water canals and a patch of phloem. Peripheral bundles smaller than the scattered ones.

**Chemistry**

Total amino acids present nine. They are Aspartic acid, Glutam acid, DL-Alanine, L-Leucine, Valine, Isoleucine, up2, unp 2 & unp 3.

Alkaloids, Flavonoids, phenolics (pyrrolol) and steroids present.

Ash contains Suphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

**Local use**

- Corm paste boiled in Sesame oil. This oil given for massage in rheumatism.
- Corm powder with honey and ghee given to cure bleeding piles.
- Corm paste used to stop bleeding from freshly cut wounds.

**Recorded uses**

- Nil

Macromorphology

Plants cormose; corms large, 4-7 x 10-15 cm. Leaf solitary, pedisect, segments 7-15, variable, 5.0 - 38 x 2.5 - 7.5 cm, elliptic, acute, deepgreen, acuminate; midrib and veins impressed above, the lower part of midrib often spotted. Petiole stout, 30-50 cm long; green, spotted densely with reddish, fine dots. Spathe 20 – 45 cm. long; tube subglobose; limb linear-lanceolate, with dark purple spots, margin purple & wavy. Spadix much shorter than spathe; appendix long (As corm grows older in florescences and produced). Male inflorescence 0.5 cm long and about 1 cm above the female. Anthers densely packed. Female inflorescence 1-1.5 cm. long. Neuters between male and female in florescence. Fruit globose, berries red (Figs A-F).

Occurrence
- Occasional, but common at Chikhaldara plateau.

Flrs. & Frts.
- March - May

Exsiccata
- VDD 289.

Micromorphology

Root (Fig.1)

Hexarch; pith absent. Epiblema gets soon replaced by one of the hypodermal layers that becomes thick-walled. Outer cortex consists of 3-4 layers of contractile parenchyma. Inner cortex 5-6 layered, cells arranged in regular concentric layers, gradually becoming smaller and smaller towards the endodermis. Endodermis with casparian stripes. Wound healing cork producing secondary cortex can be seen at places in the region of hypodermis. This develops in response to damage caused to root surface.
Sauromatum venosum (Ait.) Schott.

Macromorphology (Figs. A-F)

A. Habit sketch
B. Spadix
C. Spadix cut open
D. L. S. Fruit
E. Ovary; T. S. Ovary
F. Seed

Micromorphology (Figs. 1-12)

T. S. Root: 1. Sector magnified
T. S. Petiole 2. Diagrammatic sketch
3. Sector magnified showing peripheral V. B.
4. Central V. B.
Lamina 5. Upper epidermis
6. Upper epidermis showing single stoma
7. Lower epidermis
8. V. S. Lamina
9. Single stoma in V. S.
V. S. Midrib 10. Diagrammatic sketch
11. Sector magnified showing peripheral V. B.
12. Showing central V. B.
Sauromatum venosum (Ait.) Schott.
Leaf (Figs. 2-12)

Petiole thick, cylindrical. Epidermis cutinized and cuticularised, followed by parenchymatous ground tissue. Large sclerenchymatous patches present in the outer cortex. Peripheral vascular bundles abutting the sclerenchymatous patches, thus, forming a ring. Each bundle consists of a comparatively larger patch of phloem, xylem with two tracheary elements and a large water canal. Several vascular bundles remained scattered in the ground tissue; bundles; comparatively larger than peripheral ones. Lamina hypostomatous. Cells of upper epidermis hexagonal just one or the other stoma scattered here & there; subsidiary cells not differentiated. Cells of lower epidermis bluntly angled; stomata numerous; guard cells flanked by two subsidiary cells parallel to the guard cells i.e. paracytic; however, differentiation of subsidiary cells not sharp. Mesophyll differentiated into single layered palisade and a spongy tissue made up of several irregularly shaped parenchymatous cells enclosing large air spaces. Midrib large, ground tissue parenchymatous with large sclerenchymatous patches in the hypodermal region. Vascular bundles scattered; peripheral ones abutting the sclerenchymatous patches. Peripheral bundles consist of a large patch of phloem and single tracheary element and large water canal. Scattered bundles consists of 5-6 vessel elements and a patch of phloem, no water canal present.

Chemistry

Total amino acids present eleven. They are Aspartic acid, Glutamic acid, Threonine, Lycine mono- hydrochloride, Methionine, Isoleucine. up 6, unp2, unp3 and unp7.

Alkaloids, Flavonoids (Flavonols), Phenolics (Pyrogallol) and Steroids present.
Ash contains Sulphur, Calcium, Magnesium, Iron, Chlorine, Phosphorus and Sodium.

Local use - Corm powder given with honey and ghee to cure tuberculosis. bleeding piles and blood cancer. Fresh corm or petiole juice applied external on scorpion sting.

Recorded uses - Nil.
   *(K. Tangya, Doda)*

**Macromorphology**

Plants cormose; corm spherical, old corms are discarded. Leaves simple, petiolate, entire, obtuse, younger leaves sagittate, narrow, middle part of lamina, 17 x 1 cm; lateral lobes 8 x 5 cm; petiole 7 cm long. Inflorescence staked. Spathe leafy, yellow green, darker at the base and fades towards apex, 11-12 x 4.5 cm; margin dentate; dark brown to purplish. Inflorescence axis 6.5 x 5.7 cm. with creamish appendage. Male and female flowers distant, the male with small subulate neuters above and long, narrow neuters below. The females at the base of spadix, 3-6 in number, in single series; ovaries conical, slightly notched at base, sessile, single celled; ovules pendulous and basal; stigma pulvinate, discoid, with reddish brown spots. Berries not seen *(Figs A-D).*

**Occurrence**

- Rare. Only at Kolkaz, along moist slopes. shady localities.

**Flrs.**

- August - September

**Exsiccata**

- PYB & VDD 279

**Micromorphology**

**Root** *(Fig.1)*

Tetrach; pith absent, centre only with single metaxylem element present. Epiblema single layered, gets soon replaced by underlying thick walled hypodermal layer. Rhizodermis followed by 2-3 layers of somewhat thick-walled compactly placed cells. Cells of middle cortex consisting of contractile parenchyma inner cortex 5-6 layered, parenchymatous, tangentially stretched, becoming gradually smaller towards the stele; concentrically arranged. Endodermis thick-walled; pericycle thin-walled.
**Theriophonum minutum** Willd.

**Macromorphology (Figs. A - D)**

A. Habit sketch  
B. Spadix cut open  
C. Single anther  
D. Ovary

**Micromorphology (Figs. 1-13)**

- T. S. Root  
  1. Sector magnified
- T. S. Petiole  
  2. Diagrammatic sketch  
  3. Sector magnified showing peripheral bundle  
  4. Single medullary bundle
- Lamina  
  5. Upper epidermis  
  6. Lower epidermis  
  7. Stoma in V. S.  
  8. V. S. Lamina
- T. S. Midrib  
  9. Diagrammatic sketch  
  10. Sector magnified showing abaxial V. B.
- T. S. Scape  
  11. Diagrammatic sketch  
  12. Sector magnified showing peripheral bundle  
  13. Medullary bundle
Theriophonum minutum Willd.
Leaf (Figs. 2-10)

**Petiole** cylindrical with numerous, small, ridges & furrows. Epidermis thinlycuticularized. Below the ridges, following the epidermis are large sclerenchymatous patches. In furrows, hypodermis parenchymatous with numerous chloroplasts. Peripheral vascular bundles opposite the sclerenchymatous patches forming a ring. Few Vascular bundles scattered in ground tissue. Each vascular bundle consist of xylem with one or two tracheary elements, a water canal and a patch of phloem. Water canal is produced by disintegration of vessel elements. Ground tissue parenchymatous, enclosing few large air canals. Bundles of raphides present.

**Lamina** amphistomatous; cells angular. Stomata though not distinctly, roughly paracytic, more frequent in lower epidermis. In v. s. horns of guard cells form a distinct cavity leading to substomatal chamber. Mesophyll differentiated in single layered palisade and 3-4 layered spongy parenchyma. Raphides present in spongy as well as palisade cells.

**Midrib** with few sclerenchymatous hypodermal patches on the lower side. Vascular bundles of abaxial side abutting the sclerenchymatous patches. Few vascular bundles scattered in parenchymatous ground tissue.

Scape (Figs 11-13)

Cylindrical with ridges and furrows. Ground tissue parenchymatous with sclerenchymatous hypodermal patches below the ridges. Peripheral vascular bundles abutting the sclerenchyma. Numerous small vascular bundles scattered in ground tissue.

**Chemistry**

Total seven amino acids present. They are Glutamic acid, Serine, DL-Alanine, Lycine mono-hydrochloride, DL-Methionine and Isoleucine and unp2

Alkaloids, Flavonoids phenolics (Catechol) and Steroids present.

Ash contains Calcium, Sulfur, Magnesium, Iron Chlorine and Phosphorus.

**Local use** - Tuber powder with honey given for small intestinal ulcers and stomach aches.

**Recorded uses** - Nil
DISCUSSION

Some twenty plants were selected for pharmacognosic studies randomly i.e. not selecting the plants used for any one purpose or belonging to any one family. However, the plants selected, mostly are little known for medicinal value and out of twenty, fourteen belong to monocot group about which both anatomical and chemical information available is either nil or scanty. Especially the study of free amino acids and ash contents is a positive addition to known chemistry.

For monocotyledons Dalhgren et. al. (1985) was consulted, for anatomical information of dicotyledons Metcalf & Chalk’s (1972) work was consulted. In most of the cases the generalizations made by authorities at family level or generic stand true. Of course generic and specific variations do occur, which can be said as diagnostic.

\[ \text{Oxalis latifolia H.B. & K. differs from the Oxalis species studied earlier in absence of contractile roots, rubiaceous stomata and transparent crystals. The cells containing some brown substance and presence of same substance in lycigenous canal in bulblets is in confirmation with the oil cells noted earlier. Chemistry of the species has been worked out for the first time. Oxalis corniculata is reported to have malic acid, tartaric acid and citric acid (Chatterjee & Pakrashi 1991-95). O. latifolia is also sour in taste like O. corniculata. It is therefore possible that tartaric acid and citric acid is also present in the species along with other substance analysed here.} \]

\[ \text{Cassia hirsuta L. anatomically differs from other Caesalpinioideae in formation of deep seated cork, presence of stomata in upper epidermis and absence of epidermal pappilae. Glands or glandular hairs noted for other species of Cassia are absent. Cassia hirsuta is noted as medicinal plant for the first time in literature though many species of Cassia like C. absus L., C. alata L, C. senna L. var. senna Brenan., C. fistula L., C. occidentalis L. C. sophora L. and C.} \]
*toras* are well known medicinal herbs. Chemistry of these species is also known in quite detail, however, for *C. hirsuta* no chemical information is available.

*Momordica balsamina* L. becomes distinct by virtue of absence of water containing hairs, previously recorded for *Momordica* species and presence of sphaeraphides and cuboidal crystals. Stomata raised on distinct epidermal projections and overlapping guard cells is an interesting feature of the species. This must be helping the plant to restrict the entry of pathogens through the stomata. The species is a little known ethnomedicine.

*Begonia crenata* Dryand. differs in many respects from the species studied earlier for their anatomy. Crystals and cystoliths in the form of octahedra and quadric prisms absent; but sphaeraphides are present which are not noted for any of the species previously. Water storage hypodermis absent. Hydathodes are present at tip of leaf teeth, associated with vein endings. Most of the Begoniaceae show characteristic type of hairs. However, trichomes of the present species are not so.

*Solanum torvum* Swartz is characteristic in not having peltate hairs - so characteristic for *Solanum*. Stellate hairs present; however, they are different from both the pellate and stellate hairs already noted in the presence of central cell. Calcium oxalate crystals or crystal sand widely distributed in family is absent from the present species. Instead, several cells contain some black substance easily diffusing in the preservative medium; whose nature is not known. *S. torvum* is an established herbal medicine. Chemistry of plant is known to much extent. However no information about the ash contents and free amino acids is available.

Anatomy of *Andrographis paniculata* (Burm. f.) Wall. Ex. Nees. is in confirmation with the earlier studies. Stomata though dicytic are characteristic in the sense that one of the guard cells is conspicuously smaller in size. Bundles of acicular fibres peculiar to the family are absent from the species. It is well known and established medicinal herb. Chemistry is known but not in details. Ash analysis has revealed the presence of S, Ca, Mg, Fe and P in addition to Na, K and Cl recorded earlier (Nadkarni 1995).
Comparatively much less information about the anatomy and chemistry of monocots was available.

All the three members of Orchidaceae studied here are terrestrial and form distinct underground tubers. In Habenaria grandifloriformis Blatt, there is root tuber while in Eulophia pratensis Lindl. and Nervilia aragoana Gaud. they are stem tubers. Multilayered velamen is known commonly from aerial roots of epiphytes, however, E. pratensis though a terrestrial form shows presence of velamen like tissue. Velamen cells usually show scalariform thickening, however, no such thickening was found in velamen like tissue of Eulophia. The tissue appears to be intermediate between true velamen and cortex of the other members. Presence of microbial colonies is noted here in the tubers of Eulophia and Habenaria. They were noted in the underground part of stem and not in the root of Nervilia. Vasculature in the species studied is mostly of few trachydiary elements only. This may be because, the members are small herbs, living for short period of monsoon only. Any type of crystals are absent. However, variously shaped silica bodies enclosed in special cells called stegmata and raphides are reported by earlier authors for the family Orchidaceae (Solereder & Meyer 1930; Moller and Rasmussen 1984). Though anomocytic and paracytic stomata are common for the family, N. aragoana shows tetracytic stomata. It also differs in having a mesophyll with distinct palisade, while the other two members possess homogenous mesophyll. Leaf of H. grandifloriformis is peculiar in the sense that cells of upper epidermis are extended vertically, so as to occupy more than half the thickness of lamina. Very little is known about orchid chemistry. The data generated here, therefore, is addition to the information about Orchidaceae. N. aragoana is a little known medicinal plant while E. pratensis and H. grandifloriformis are not the known medicinal plants. However, H. susannae (L.) R.Br. is used by the tribals of Chhota Nagpur as medicinal and E. nuda Lindl. And E. campestris Wall. are also known medicinal species.

Little is known about the anatomy of Costaceae, mostly included in Zingiberaceae. The undulate cylinder of fiber present is aerial stem, gradually becomes parenchymatous, below in the rhizome. It is in the parenchymatous zone that the cambium producing secondary parenchyma and vascular bundles originates. The fibrous cylinder therefore probably is pericyclic in nature. Origin of perivascular concentric cambium producing
large amount of storage parenchyma is characteristic to the species. Large cuboidal oxalate crystals present. *Costus speciosus* (Koen. ex. Retz.) Sm. is well known medicinal plant, commercially exploited for its diosgenin content, used in the preparation of contraceptive pills. Chemistry has been worked out in quite details. However, there is no reference to amino acidal profile and ash contents.

Uniseriate, branched or multicellular hairs are recorded in the leaves of *Curculigo* species. However, present species shows absence of hairs. Leaf anatomy much specialized; varying in the same leaf from center to margin. Chemistry known to some extent. Flavone glycoside present in the plant is powerful uterine stimulant. (Chopra et. al. 1956).

Taccaceae is a unigeneric family. Cells containing bundles of rephides concentrated around the veins are noted for the genus, however the *Tacca leontopetaloides* (L.) O. Ktze. shows absence of crystals from all parts of the body. Peculiar trichomes consisting of a short row of cells bearing a multicellular body on which is another cells row at apex, are reported to be present on both sides of leaf. Leaves of *T. leontopetaloides* are perfectly glabrous. Stomata anomocytic thus differing from the Chinese species having axillocytic stomata (Ling Ping 1981). It is a little known medicinal plant. Chemistry almost unknown. Tubers, which are very rich in starch, are noted to contain ceryl alcohol and a bitter principle. The bitterness is probably because of the alkaloids detected in present studies.

Anatomy of Discoreaceae is very interesting, but comparatively little known especially for Indian species. Vasculature much complex. In tuber, vascular bundles amphiphloic while in stem three types of bundles present as noted by Ayensu (1970). Water pores noted for other species absent. Multicellular bulb-like glands present on lower surface of leaf are in confirmation with Ayensu (1970), though glands are said to be absent by Dalhgren (1985). Disocoreas have been studied extensively for their chemistry. No Indian species contains Diosgenin in the amount so as to exploit commercially. However, tubers of most of the species form supplementary diet of tribals of many areas. The poisonous alkaloid, Dioscorine is removed by boiling the tubers or by keeping thin slices in running water for 24 – 28 hours.
Both the anatomy and chemistry of Liliaceae is little known. Steroidal saponins are reported from several genera. *Iphigenia indica* (L.) A. Gray, also shows presence of alkaloids. Apart from Melghat it is used in some parts of Bihar only as medicinal herb.

Presence of raphide sacs in continuous series is a common feature of the family Commelinaceae. Raphide canals are absent from *Commelina suffruticosa* Blume. However, rod shaped silica crystals are present in the epidermal cells. Though alkaloids are stated to be absent from Commelinaceae, the present species gave positive test for alkaloids. Martinez (1981) and Stirton and Harborne (1980) have studied flavonoids and anthocyanins. Various species of *Commelina* like *C. benghalensis*, *C. diffusa*, *C. paludosa*, *C. undulata* are also medicinal. *C. suffruticosa* is little known for its medicinal value.

All the members of Araceae studied here are belong to subfamily Aroideae. All are rhizomatous members with single large aerial leaf with long petiole. Contractile roots having contractile parenchyma present in all species. Wound cambium producing cork is produced in most of the species. This feature has been earlier noted by Reyneke and Schijff (1974) in roots of *Eucomis* of Liliaceae. Hypodermal sclerenchymatous patches noted in petioles of genera studied are not noted either by French and Tomlinson (1983) or Mayo et. al. (1997). Though association of laticifers with vascular bundles is reported previously; in the present members the associated canals appear to be of two types; at least morphologically. Canals associated with phloem are different from those associated with xylem. Thus here both the laticifers and water canals may be present. Solereder and Meyer (1928) described the palisade as consisting of short, wide and armed cells. On the contrary palisade of the members studied consists of narrow, elongated, compactly placed, unarmed cells. It appears that Araceae show varied anatomy. Areccae is known to have oxalate crystals, saponins, phenolics, cyanogenic glycosides and polyhydroxy alkaloids. All the members test positively for alkaloids, steroids and phenolics. Medicinal use of members is restricted to the tribal of Melghat only; thus forming a unique feature of Korku medicine.
Amino acids occur in plants both in free state and as the basic units of proteins and other metabolites. Protein amino acids number 24 while non-protein ones are more than 200; however non protein amino acids are of very restricted occurrence. Fleshy organs of plants are the principal sites for the accumulation of free amino acids (Evans 1997). Many of the members studied have fleshy perennating underground organs and therefore are comparatively rich in free amino acids (Table I, II, III).

_Tacca leontoptaloides_ shows presence of maximum numbers of free amino acids i.e. twelve. The minimum i.e. six amino acids are detected from rhizomes of _Costus specious_ which is some what contrary to the above made statement. However, it is possible though the number of amino acids is less, the concentration of the acids may be more in the tissue. (Quantitative analysis of amino acids needs to be done for the members). Of the 23 protein amino acids, Isoleucine is present in 18 members (90%), DL- Alanine in 14 (70%), Aspartic acid and L-Tyrosine in 11 (55%) and Valine in 10 (50%) members studied. Alanine is derived from pyruvate and forms Valine with members studied. Alanine is derived from pyruvate and forms Valine with α-ketoisovaleric acid and with acetate after decarboxylation forms Leucine. Some of the species are characterized by presence of amino acids restricted to them only. Thus Ornithine monohydrochloride and Arginine present in _C. orchioides_ only and Tryptophan being present in _Oxalis latifolia_.

The species except one i.e. _Costus speciosus_ tested positively for alkaloids. Amino acids, Arginin, Proline and Ornithine are of importance, as in some plants, they are precursors of certain alkaloids. Proline is found in six members, ornithine and argenine in one each. There is possibility to get alkaloids in these members derived from above said amino acids. Lysine is also the precursor of some alkaloids found in _Nicotiana lupinus_ and _Punica_. Some amino acids reacting with ninhydrin to give purple colour could not fit in the Rf patten of standard protein amino acid. They are noted as unknown protein amino acids (up 1,2,....). Possibly they are amides or other derivatives of protein amino acids. Those reacting with ninhydrine to produce the colour other than purple or blue are non-protein amino acids. Since so many non-protein amino acids exist and no standards were available they were noted as unknown non-protein amino acids (unp 1,2,3,.....). From the colour resonces and Rf values 9
### Table I

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Table Showing Protein Amino Acidal Profile

(Serial numbers of Amino acids are as per the list on next page.)

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*Rf* in PhW/BAW  
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*RF in PhW/BAW

Table Showing Unknown Protein Amino Acidal Profile
such non–protein amino acids have been detected from the plants studied. Some 30 years ago non-protein amino acids were considered as oddities of plant biosynthesis. Now they constitute a group receiving, increasing attention because of their possible physiological and ecological significance. Many of the non-protein amino acids provide plant protection from insects.

**Alkaloids** is the very important group of bioactive compound. It is from those plants, containing alkaloids that large number of drugs are derived. The group however is very varied one. Upto 1989 more than 10,000 alkaloids were known. Today the figure might have progressed much ahead. It was not possible to identify the type of alkaloid present since it needs a very sound theoretical and practical knowledge of biochemistry. Here the study was restricted only upto the detection of presence or absence of alkaloid in the plant material (Table IV). Out of twenty species studied nineteen responded positively to all the four tests. Alkaloids are often toxic to man and many have dramatic physiological activity. The activity ranges from narcotic – central nervous system stimulant – Anaesthetic – Anticancer.

**Steroids** occur as steroidal saponins steroids associate with saponins steroidal alkaloids and other phytosterols like stigmasterol and sitosterol. Steroidal saponins are reported from Dioscoreaceae, Amaryllidaceae, Liliaceae and Leguminosae. Steroidal alkaloids are reported from dicot families. Steroidal saponins are of great pharmaceutical importance because of their relationships to compounds such as sex hormones, cortisones, diuretic steroids, vitamin D. and cardiac glycosides. Steroids are also known for their lypolytic activity. All members tested positive for unsaturated steroidal nucleus and except two (Arisaema murayii and Habenaria grandifloriformis) for saturated steroidal nucleus (Table IV).

**Phenols** are important constituents of some medicinal plants. These are eight Phenolic classes of pharmaceutical interest; Of these simple phenolic compounds, anthraquinones, flavones & flavonoids are tested in the species. Flavonoids are known to act as antirheumatic and simple phenols are known as vermicide, sedative and in some cases as flavouring agents. Catechol and pyrogallol are common phenolic constituents of the members studied (Table V). Napthol was found to be present only in Amorphophallus sp. Hydroquinone noted in Begonia crenata and Amorphophallus bulbifer. In both the members it is present in
### TABLE IV

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Table Showing Test for Alkaloids, Steroids and Iridoids

Concentration of compound is denoted by (++++) Strong, (+++) Moderate, (+) Weak and (-) absent
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Table Showing Test For Flavonoids, Simple Phenolics and Anthraquinones

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<th>Colour with Excess FeCl₃</th>
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<td>Orange red</td>
<td>(Combination of Yellow Red)</td>
<td>Catechol &amp; Hydroquinone</td>
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<td>Pyrogallol &amp; Catechol</td>
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<td>Pyrogallol</td>
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### TABLE VII

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Table Showing Elements From Acid Soluble Ash Fraction.

Concentration of compound is denoted by (+++ ) Strong, (++ ) Moderate, (+) Weak and (-) absent.
Curculigo and Andrographis show absence of flavonoids show absence of flavonoids. Anthraquinones are uniformly absent from all the members studied.

Iridoids are monoterpene lactones. Many medicinal plants contain iridoides but then exact action on human body is not known. Dahlgren(1981) noted presence of iridoides exclusively for some dicot orders. Present investigation shows presence of acubins in five members out of which four belong to monocotyledons. Out of four, one is Costus speciosus exhibiting strong positive reaction for acubins. This is somewhat surprising result or we can say much is yet to be known about plant chemistry. (Table IV).

Ash was analysed for seven elements. Except sodium, all other elements were found to be present in moderate to high concentrations. Andrographis paniculata is the only member exhibiting high concentration of sodium. Sodium chloride is antiseptic, antiperoidic, anthelmintic and deobstruent. Sulphur acts as laxative, alterative, diuretic and insecticide. Magnesium and Iron when present in the form of silicate are nerve tonic, deobstruent and astringent. They are also useful in the treating diarrhoea in children and in profuse or troublesome and painful menstruation. Iron when present in the form of oxide is useful in hemorrhages. It is used in several medicines for relieving bleeding from internal organs. Externally calcium popularly used in the form of lime water is a well known remedy for inflammatory swelling. Many type of ulcers improve under the use of lime water as a local application, also useful in treating poisoning by mineral acids. Several salts of lime are used in Ayurvedic medicine. Shankh Bhasma is most popularly used. Lime is useful internally in dispepsia, enlarged spleen and other enlargements in abdomen. (Table V).