



STUDY OF MEMBERS OF DIFFERENT TRIBES OF FAMILY ASTERACEAE WITH REFERENCE TO STEM ANATOMY

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ABSTRACT:

Asteraceae is one of the widest family in Angiosperms having significant economic values, such as production of oil, ornamental plant, secondary metabolites, etc. In family Asteraceae about 1,535 genera distributed in 13 tribes. The current work aims at studying the differences in stem anatomy and floral characters of these tribes. In the present study sixteen species belonging to ten tribes were documented, The Heliantheae, one of the tribes' in this family is more dominant in Nagpur region, and in the present study six genera were recorded. This was followed by two genera in Cichorieae, and one genus each in the tribes Anthemideae, Astereae, Echinopeae, Eupatorieae, Gnaphalieae, Inuleae, Mutisieae and Vernonieae. Detailed study of the arrangement of vascular bundles and type of trichomes found on the stem was studied using free hand-sections. For the floral characters, ray floret, disk floret, shape of receptacle and the type of capitulum inflorescence was studied. An attempt was made for the development of a taxonomical key based on stem anatomical features highlighting the differences in the tribes. Microphotography of the floral components and anatomical study of the stem of these plants, revealed characters which are utilized for creating a key for various tribes based on morphology as well as anatomical characters.

Key words: - Asteraceae, tribes, Heliantheae, stem anatomy, capitulum, key

INTRODUCTION:

The family Asteraceae also called the Compositae has been considered to be a unified evolutionary by all botanists. This family is one of the largest of the eudicots with over 32,000 species and at least 1,900 genera in 13 subfamilies (The Plant List, 2013). Members of the family Asteraceae can be found all over the world. These plants have evolved many adaptations to withstand harsh environment as well as more moderate climates. Many plants in the family Asteraceae are economically important as weed, ornamentals, medicinal and green vegetables are poisonous plants. Commercially the flowers of this family are very famous of their colorful florets. A wide range of horticultural species are grown in home garden or national garden plots. The Asteraceae feature extensively in gardens distributed throughout the world as ornamental. A wide range of horticultural species is grown both

under grass, and as herbaceous garden plants throughout the world. About half the species of Asteraceae are native to the Old World and half to the New World.

TRIBE is a taxonomic group that is a subdivision of a subfamily

The Asteraceae consist of 1528 genera and 22,750 species. The Asteraceae has recently been classified into at least ten subfamilies and members of the family have a worldwide distributed. (Ngu Wah Win, 2018)

This family includes tribes - *Vernonieae*, *Eupatorieae*, *Asteroideae*, *Inuloideae*, *Helianthoideae*, *Antemideae*, *Senecioideae*, *Calendulaceae*, *Cynaroideae*, *Mutisiaceae*, and *Cichoriaceae*. (Hooker, 1881) As per Cronquist (1981), in Asteraceae 13 tribes found. In best-known family of flowering plants, the Asteraceae may be organized into 3 subfamilies: (1) the

Brandesiodieae with a single tribe, (2) the *Cichorioideae* with 6 tribes, and (3) the *Asteroideae* with 7 tribes. (Heywood *et al.*1978). Family of Asteraceae is common at temperate region, In India, Asteraceae is dominant towards Himalayan regions, nearly 955 taxa are found, (72.67%) with about 202 taxa of which are endemic to the India. The chief center of diversity of the Indian Asteraceae is due to conducive temperature and altitudes, habitats distributed from the cold deserts of Ladakh to forests of north-east India.

The works were carried out in Nagpur region were detailed study of the arrangement of vascular bundles and type of trichomes found on the stem was studied by taking free hand-sections. For the floral characters, ray floret, disk floret, shape of receptacle and the type of capitulum inflorescence was studied. An attempt was made for the development of a key based on stem anatomical features highlighting the differences in the tribes. Microphotography of the floral components and anatomical study of the stem of these plants, revealed characters which can be utilized for creating a key for various tribes based on morphology as well as anatomical characters.

MATERIAL & METHODS

The species belonging to different tribes of Asteraceae were collected from Nagpur region. Field notes were made of precise location and of habitat of that plants type. They were record and take photographs in the field. After the collection, the vegetative and floral parts of fresh specimens were studied for taxonomic characters; some of collected specimens were dried and pressed to prepared herbarium sheet.

The collected specimens were preserving for further anatomical study. For anatomical study, the fresh and preserve specimens were examining by preparing free-hand section for microscopic study of stem. These sections were stained with

double staining technique and observed under microscope for anatomical characters.

On the basis of anatomical character bracketed key prepared.

Observations and Results

The works were carried out in Nagpur region were detailed study of the arrangement of vascular bundles and type of trichomes found on the stem was studied for the following tribes given in the table no. 1. & table No. 2 shows important character identified along with anatomical feature in front of respective names of the plant studied.

RESULT & DISCUSSION

The works were carried out in Nagpur region were detailed study of the arrangement of vascular bundles and type of trichomes found on the stem was studied for the following tribes given in the table no. 1. & table No. 2 shows important character identified along with anatomical feature in front of respective names of the plant studied.

3.1. KEY TO ANATOMICAL CHARECTERS OF TRIBES OF DIFFERENT GANERA FROM ASTERACEAE

1. Secretary canal
.....*Cosmos sulphureus* Tribe
HELIANTHEAE
1. Secretary canal absent
..... (2)
2. Epidermis with Bitrunket trichomes
.....*Vernonia cineria* Tribe
VERNONIEAE
2. Epidermis with other trichomes
..... (3)
3. Long blunt trichome
.....*Gerbera jamesonii* Tribe
MUTISIEAE
3. Long pointed trichome
.....
..... (4)
4. Epidermis spiny
.....*Ageratum conyzoides* Tribe
EUPATORIEAE

4. Epidermis non spiny
..... (5)
5. Biseriate multicellular trichome
..... ***Echinops echinatus* Tribe**
ECHINOPEAE
5. Uniseriate multicellular trichome
..... (6)
6. Secretory trichome
..... ***Blumea lacera* Tribe**
INULEAE
6. Non secretory trichome
..... (7)
7. Small and big vascular bundle alternate
..... ***Solidago canadensis* Tribe**
ASTEREA
7. Same sized vascular bundle
..... (8)
8. Pericycle oval rounded
..... ***Launaea procumbens* Tribe**
CICHORIEAE
8. Pericycle non oval
..... (9)
9. Secondary growth shown
..... ***Chrysanthemum sp* Tribe**
ANTHEMIDEAE
9. Many seriate vessels
..... ***Gnomophilum palustre* Tribe**
GNAPHALIEAE
- 3.2. KEY TO ANATOMICAL CHARACTERS
DIFFENT GENERA**
1. Stem cylindrical..... (4)
1. Stem angular..... (2)
2. Cortex with secretory canal
Cosmos sulphureus
2. Cortex without secretory canal..... (3)
3. Epidermis with blunt trichome
Parthenium hysterophorus
3. Epidermis with trunket trichome.....
Vernonia cineria
3. Epidermis without trichome.....
Sonchus oleraceus
4. Spiny cuticle..... ***Ageratum conyzoides***
4. No spiny cuticle..... (5)
5. Bisereate multicellular trichome.....
Echinops echinatus
5. Unisereate multicellular trichome and others..... (6)
6. Arenchymatous

- cortex..... ***Eclipta alba***
6. Non Arenchymatous cortex..... (7)
7. Secretory trichome..... (8)
7. Non secretory trichome..... (9)
8. Small and big vascular bundle alternate.....
Solidago canadensis
8. Small and big vascular bundle alternate with conical V.B.....
Gerbera jamesonii
8. Same size V. B.
Blumea lacera
9. Pericycle hemispherical, sub rounded.....
Xanthium indicum
9. Pericycle non hemispherical..... (10)
10. Pericycle oval or rounded.....
Launaea procumbens
10. Pericycle non oval or non rounded..... (11)
11. Long elongated tapering trichome (12)
11. Non elongated tapering trichome (13)
12. Secondary growth
Chrysanthemum sp.
12. Non secondary growth
Synedrella nodiflora
13. Many seriate vessels
Gnomophilum palustre
13. Big vessels
Tridax procumbens

Conclusion

Morphological details of 16 species carried out belonging to 10 tribes. Tribe HELIANTHEAE is common in Nagpur region, 6 species were collected and described.

On the bases of anatomical characters different tribes can be distinguish, for example, Anatomical characters of tribes and genera is given in the Table No. 3. Thus anatomical features can be included for identification of different tribes in Asteraceae.

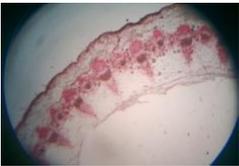
Looking to the diversity of family Asteraceae more detailed work is required.

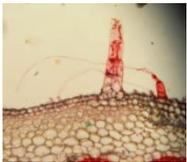
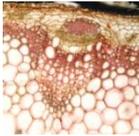
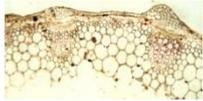
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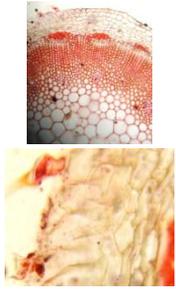
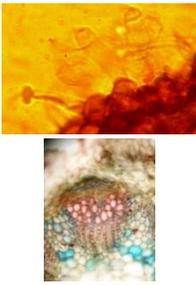
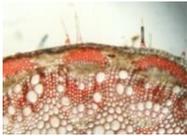
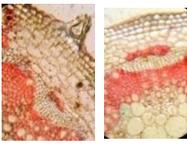
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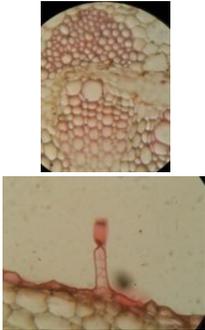
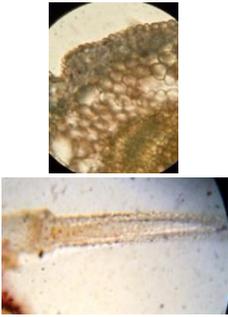
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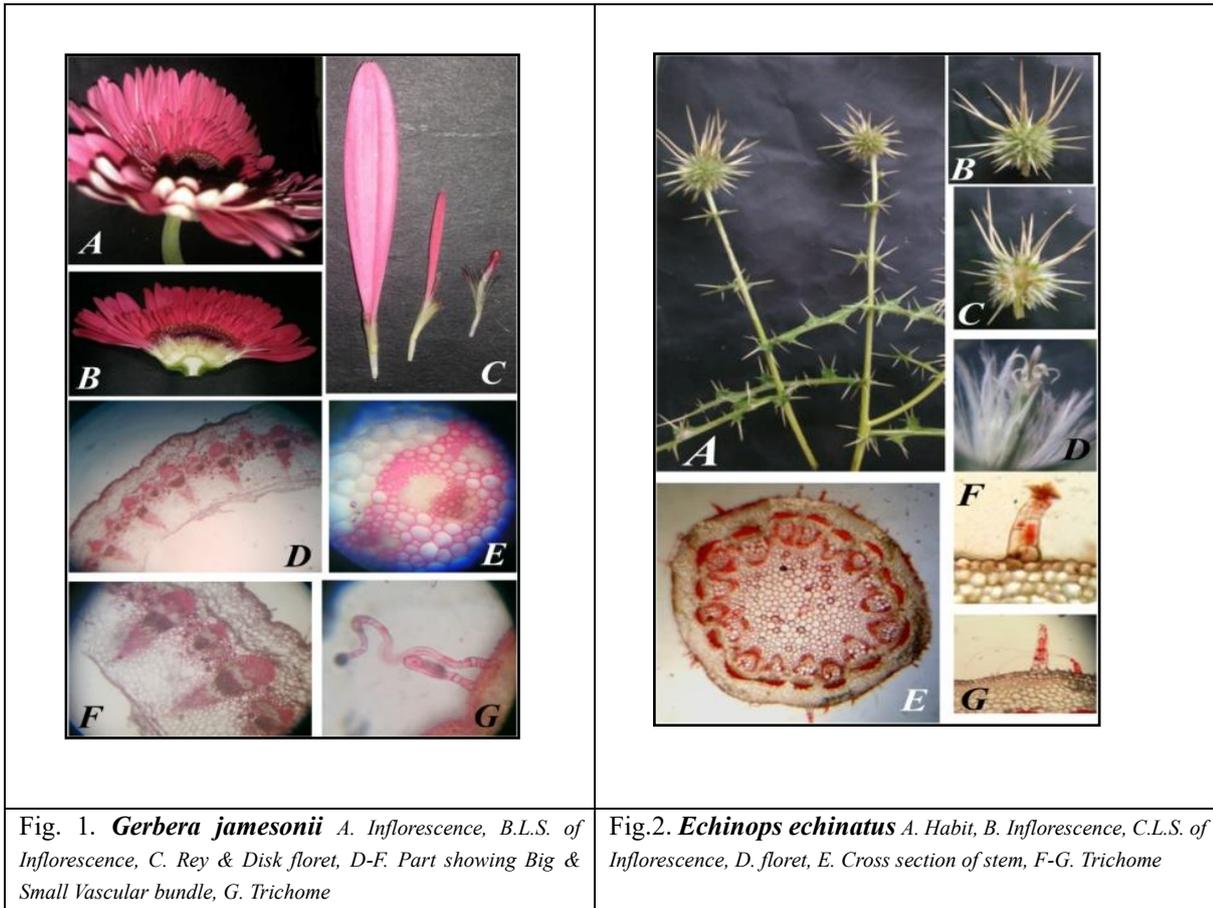
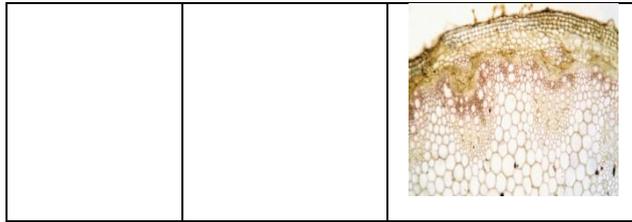
Sr. No.	Name of plant genera studied	Name of tribes studied
1	<i>Gerbera jamesonii</i>	MUTISIEAE
2	<i>Echinops echinatus</i>	ECHINOPEAE
3	<i>Launaea procumbens</i>	CICHORIEAE
4	<i>Sonchus oleraceus</i>	CICHORIEAE
5	<i>Vernonia cineria</i>	VERNONIEAE
6	<i>Solidago canadensis</i>	ASTEREAE
7	<i>Chrysanthemum sp.</i>	ANTHEMIDEAE
8	<i>Gnomophilum palustre</i>	GNAPHALIEAE
9	<i>Blumea lacera</i>	INULEAE
10	<i>Cosmos sulphureus</i>	HELIANTHEAE
11	<i>Synedrella nodiflora</i>	HELIANTHEAE
12	<i>Tridax procumbens</i>	HELIANTHEAE
13	<i>Xanthium indicum</i>	HELIANTHEAE
14	<i>Eclipta alba</i>	HELIANTHEAE
15	<i>Parthenium hysterophorus</i>	HELIANTHEAE
16	<i>Ageratum conyzoides</i>	EUPATORIEAE

Name of Tribe& Plant	Characters	Photos
<i>Gerbera jamesonii</i> MUTISIEAE	Long blunt trichome. Alternet vascular bundle. Vascular bundle conical	
		

<p><i>Echinops echinatus</i> ECHINOPEAE</p>	<p>Two type of trichome Long tapering & Biseriate multicellular trichome.</p>	
<p><i>Launaea procumbens</i> CICHORIEAE</p>	<p>Small and big vascular bundle alternate. Pericycle is oval in shaped.</p>	 
<p><i>Sonchus oleraceus</i> CICHORIEAE</p>	<p>Shows angular margin. Vessels in a column.</p>	 
<p><i>Vernonia cineria</i> VERNONIEAE</p>	<p>Hairy epidermis Bitrunket trichome</p>	 
<p><i>Solidago canadensis</i> ASTEREAE</p>	<p>Vascular bundle big & small alternate Long uniseriate glandular hair.</p>	 

<p><i>Chrysanthemum</i> sp. ANTHEMIDEAE E</p>	<p>Secondary growth Pointed trichome Pericycle in patches</p>	
<p><i>Gnomophilum</i> <i>palustre</i> GNAPHALIEAE</p>	<p>Many hairs on epidermis Many uniseriate vessels</p>	
<p><i>Blumea lacera</i> INULEAE</p>	<p>Same size vascular bundle Scattered vessels along periphery</p>	
<p><i>Cosmos sulphureus</i> HELIANTHEAE</p>	<p>Secretory canal Triangular vascular bundle</p>	
<p><i>Synedrella nodiflora</i> HELIANTHEAE</p>	<p>Small pointed trichome Phloem move towards in side</p>	
<p><i>Tridax procumbens</i> HELIANTHEAE</p>	<p>Small Pericycle Big vessels</p>	

<p><i>Xanthium indicum</i> <i>HELIANTHEAE</i></p>	<p>Hemispherical Pericycle Uniseriate multicellular trichome</p>	
<p><i>Eclipta alba</i> <i>HELIANTHEAE</i></p>	<p>Arenchymatous cortex Spiny trichome</p>	
<p><i>Parthenium hysterophorus</i> <i>HELIANTHEAE</i></p>	<p>Pericycle continues Blunt trichome</p>	
<p><i>Ageratum conyzoides</i> <i>EUPATORIEAE</i></p>	<p>Alternet vascular bundle Round Pericycle</p>	



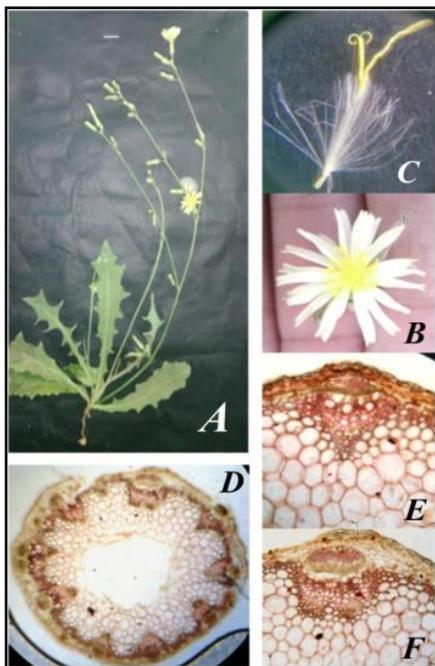


Fig.3. *Launaea procumbens* A.Habit,B.Inflorescence,C.floret,D. Cross section of stem, E & F. Vascular bundle And arrangement of Pericycle

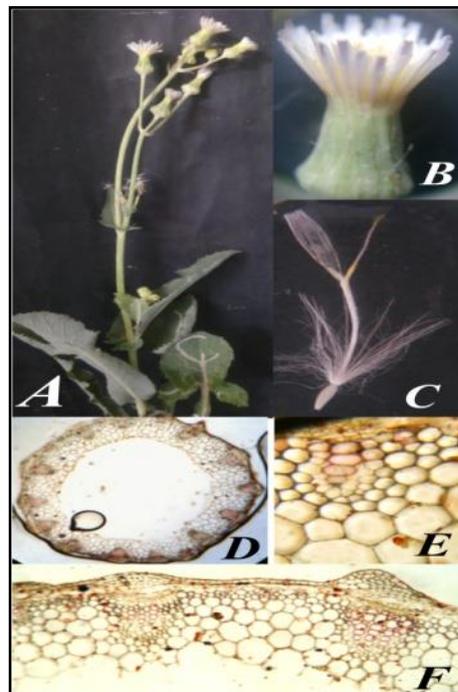


Fig.4. *Sonchus oleraceus* A.Habit,B.Inflorescence,C.floret,D. Cross section of stem, E & F. Vascular bundle And arrangement of Pericycle

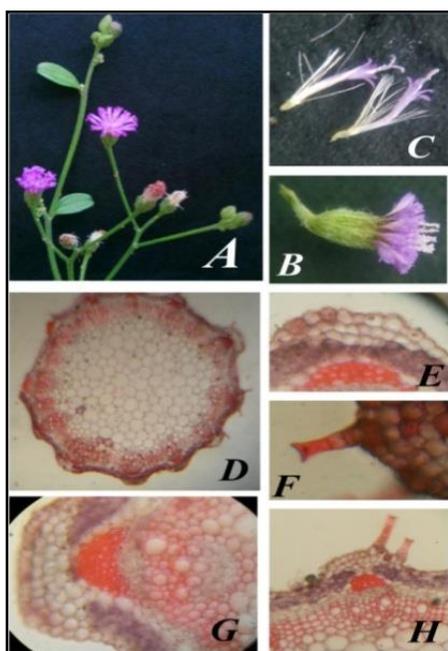


Fig.5. *Vernonia cineria* A.Habit,B.Inflorescence,C.floret,D. Cross section of stem, E. Epidermis with minute hairs, F. Bitrunket Trichome, G. Vascular bundle with Pericycle, H. Trichome with Vascular bundle

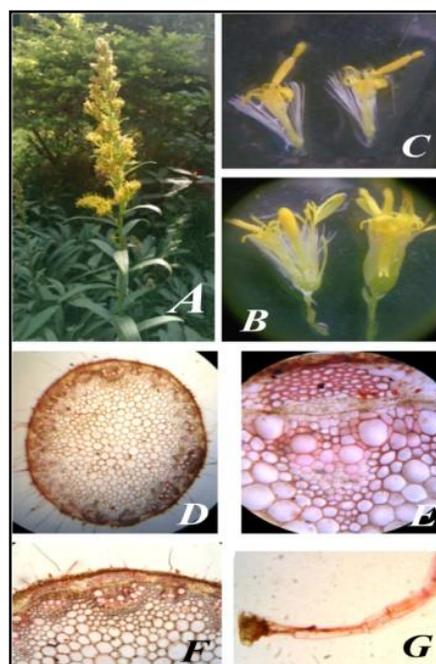


Fig.6. *Solidago canadensis* A.Habit,B.Inflorescence,C.floret,D. Cross section of stem, E. Structure of Vascular bundle, F .part showing arrangement of vascular bundle, G. Glandular Trichome

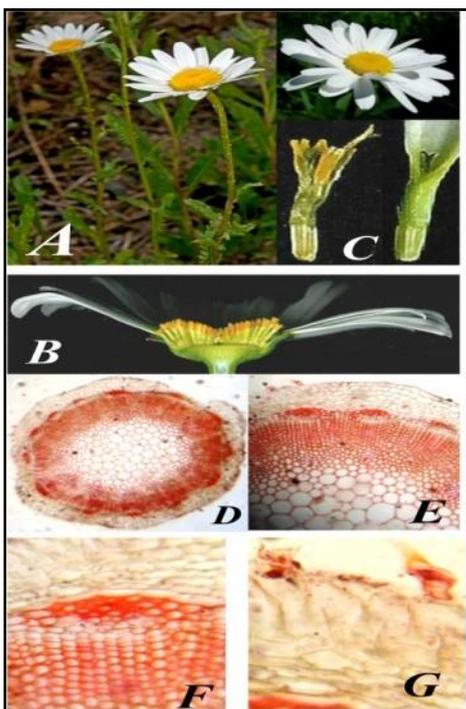


Fig.7. *Chrysanthemum* sp.

A.Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Arrangement of vascular bundles, F. Structure of vascular bundle, G. Cortex tissue

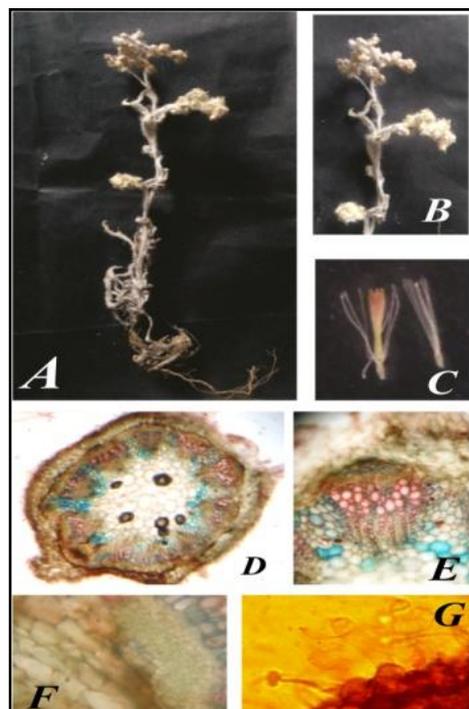


Fig.8. *Gnomophilum palustre*

A.Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Structure of vascular bundle, F. Structure of pericycle, G. Woolly trichomes

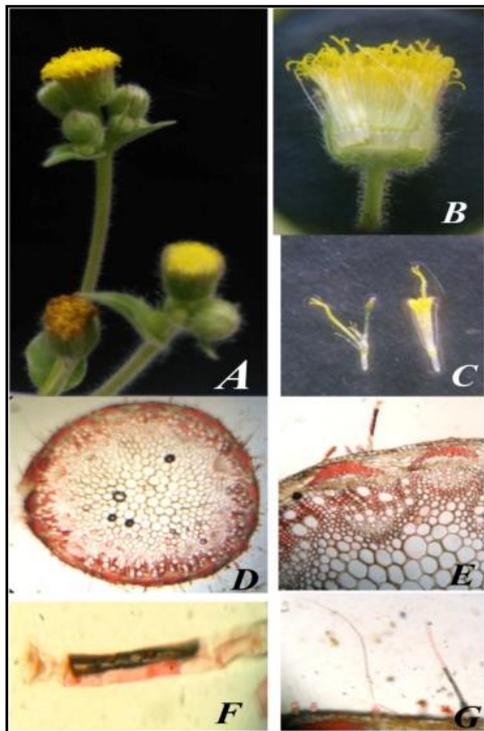


Fig.9. *Blumea lacera*
A. Habit, B. L.S. of Inflorescence, C. floret, D. Cross section of stem, E. Arrangement of vascular bundles, F. Structure of Glandular trichome, G. Tapering trichome

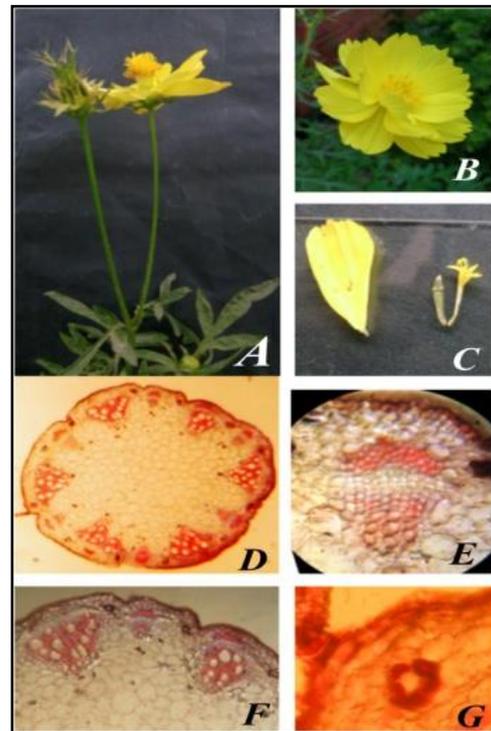


Fig.10. *Cosmos sulphureus* A. Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Structure of vascular bundle, F. Arrangement of vascular bundles, G. Cortex showing canal

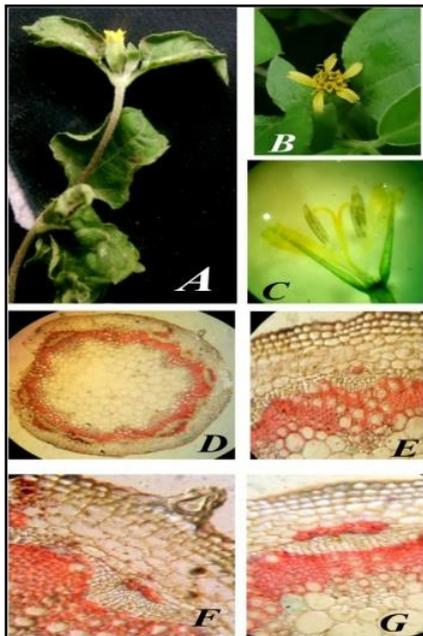


Fig.11. *Synedrella nodiflora*
A. Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Vascular bundles, F. Small trichome with cortex and Pericycle, G. Structure of Pericycle

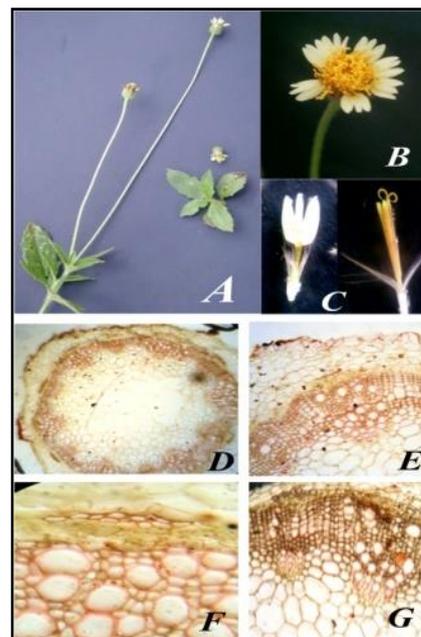


Fig.12. *Tridax procumbens*
A. Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Cortex & vascular structure, F. Structure of Pericycle and xylem vessels, G. Arrangement of vascular bundles.

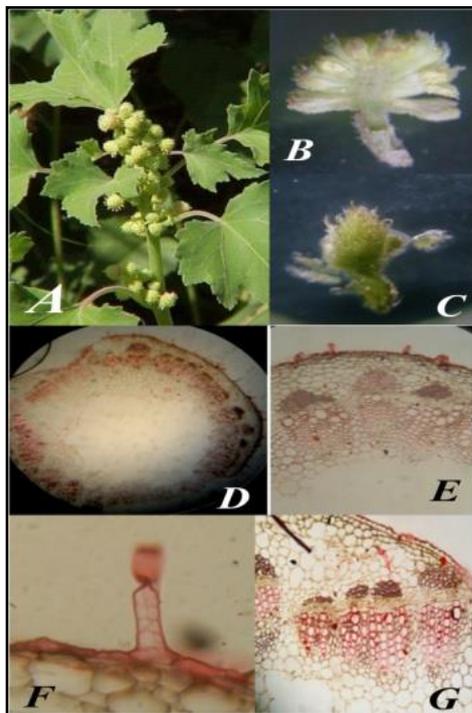


Fig.13. *Xanthium indicum*
 A. Habit, B. Male Inflorescence, C. Female floret, D. Cross section of stem, E. Arrangement of vascular, F. Trichome, G. Structure of vascular bundle

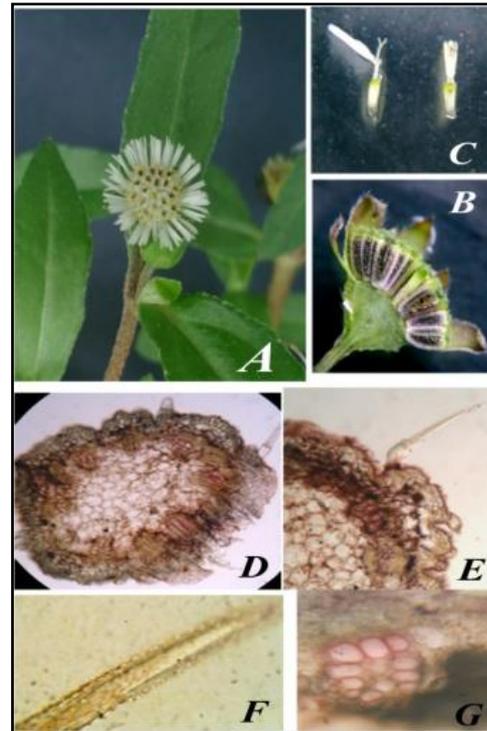


Fig.14. *Eclipta alba*
 A. Habit, B.L.S. of Inflorescence, C. Ray & Disk floret, D. Cross section of stem, E. Cortex with Arenchymatous cell and trichome structure, F. Structure of trichome, G. Vascular bundles.

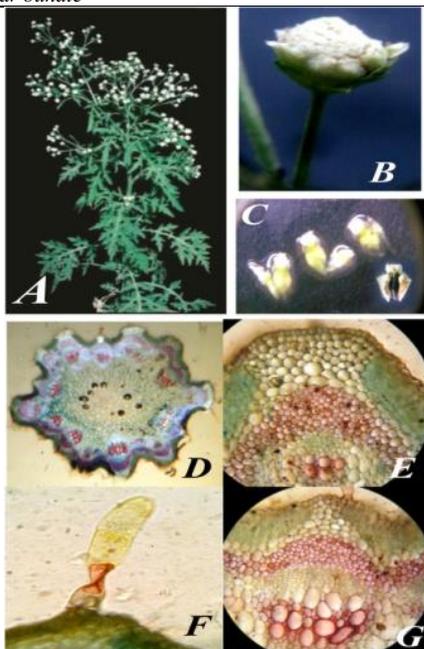


Fig.15. *Parthenium hysterophorus*
 A. Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Cortex & vascular structure, F. Structure of Trichome, G. Vascular Bundle

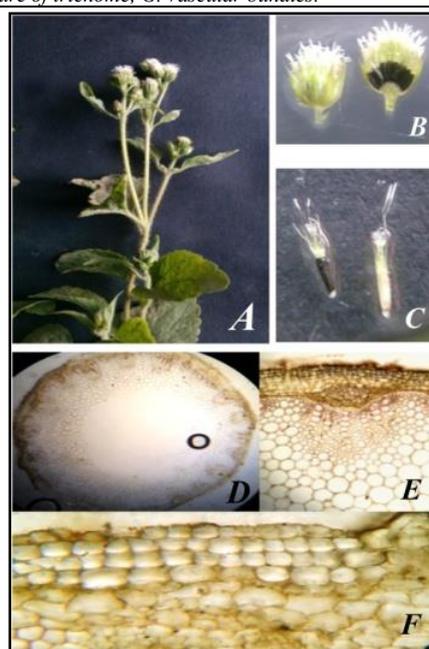


Fig.16. *Ageratum conyzoides*
 A. Habit, B. Inflorescence, C. floret, D. Cross section of stem, E. Cortex & vascular structure, F. Structure of multilayered epidermis