



**MORPHOLOGICAL STUDY OF CYPSELAS IN 3 SPECIES OF THE TRIBE  
VERNONIEAE- ASTERACEAE**



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**Abstract**

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Among the 43 tribes of Asteraceae, Vernonieae of the plesiomorphic tribes. Present investigation has been carried out on the morphological characters of 3 species of the genus *Vernonia* Schreb., such as *Vernonia cinerea* Less., *Vernonia diffusa* Less., *Vernonia gracilis* Kunth. Of the tribe Vernonieae. This character plays a paramount role in isolation of taxa at the species level. Morphological features of the apical part, surface hairs, location of vascular trace, structure of carpodium and their cellular arrangement, pappus bristles of cypselas are taxonomically significant. An indented dichotomous key is provided on the basis of macro-morphological features of cypselas for identification of studied species.

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## INTRODUCTION

Vernonieae is a tribe of Asteraceae, contains 118 genera and more than 1,000 species. This tribe can be regarded as one of the most primitive tribe in the Asteraceae. This view supports with the opinion of Augier and Du Me'rac (1951) regarding its phylogenetic position in the Asteraceae. The tribe differs from Arctotideae and Moquinieae by the narrow styles and long sweeping hairs, from Cichorieae by the usual lack of milky sap and the usually actinomorphic corollas. Chemically, the genus *Vernonia* bears a unique constituent-vernolic acid (Harborne and Williams, 1977). Vernonieae are notable for the frequent extreme cymose forms of their inflorescences, involving seriate or scorpioid cymes. The Vernonieae is relatively more plesiomorphic than the 3 apomorphic tribes Eupatorieae, Senecioneae and Heliantheae of the subfamily Asteroideae (Bremer, 1987). Bremer (1996) has included it under subfamily Cichorioideae together with other 3 tribes in Vernonioid group which is characterized by their spiny pollen, long acute style branches and defetbn *jndhf* gene. Jansen and Stuessy (1980) have pointed out that the Liabeae should be

included within the Vernonieae, but the Liabeae has recognized as a distinct tribe from Senecioneae by Robinson (1983). Jones has mentioned that "the external features of cypselas including pappus under light microscope provide valuable information about the genus *Vernonia*". Similarly, structure of trichomes can be a diagnostic character in *Vernonia*. (Hunter and Austin, 1967; Urbatsch, 1972). The objective of the present study is to describe the detailed morphological structures of cypselas.

## MATERIALS AND METHOD

Mature cypselas of 2 species were procured from – **Royal Botanic garden, Kew, London** and one local specimen by the first author.

A few randomly selected dry cypselas from the procured mass were immersed in 1- 4 % NaOH solution for 2-3 days. After that, the cypselas were softened. The softened cypselas were stained in aqueous safranin solution (1%) and its different parts were dissected with the help of 2 sharp needles under dissecting microscope and stereo dissecting binocular microscope.

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## RESULTS

### *Vernonia cinerea* Less.

#### MORPHOLOGY (Fig. 1 A-H; 3 A-F)

Cypsela homomorphic, 2 mm - 2.5 mm X 0.5 mm excluding pappus, 6.0 mm X 0.5 mm including pappus, dull, dotted, tawny colour, linear, tapered at the base, rounded at the apex, cylindrical in cross sectional configuration. Ribs absent, surface papilose, rugose, containing tomentose hair, inflexed, densely distributed, nonglandular. Cypselar hair biserially forked type, tips of the body cells of hair situated in different plane. At the upper part of cypsela, stylopodium present; unenlarged, corona absent. At the basal region of cypsela, carpopodium present; wider than the base of cypsela, symmetric, circular, complete ring-like. Carpopodial cells with thick-walled, pitted, large, square, horizontally placed, arranged in single row, distinguishable from other cells of the cypsela. At the upper part of cypsela, pappus present; heteromorphic, ecoronate, arranged in two rows. Inner row made up of 23 barbelate pappus bristles, unequal in length, white in colour whereas outer row made up of 21 scaly pappus, unequally arranged, white in colour.

### *Vernonia diffusa* Less.

#### MORPHOLOGY (Fig. 2 A-J; 3 J-N)

Cypsela homomorphic, 3.2 mm X 0.7 mm excluding pappus, 9.0 mm-9.5 mm X 0.7 mm including pappus, dull, dotted, brownish yellow colour, oblong, tapered at base, rounded at the apex, cylindrical in cross sectional configuration, Ribs 16, prominent, surface papilose, rugose, containing pubescent hair, inflexed, sparsely distributed, nonglandular. Cypselar hair biserially forked type, tips of the body cells of hair situated in same plane. At the upper part of cypsela, stylopodium present; enlarged, corona absent. At the basal region of cypsela, carpopodium present; same as the base of cypsela, symmetric, cylindrical, complete ring-like, with a central depressed region. Carpopodial cells with thin-walled, nonpitted, large, square, carpopodial cells horizontally placed, arranged in single row, distinguishable from other cells of the cypsela. At the upper part of cypsela, pappus present; heteromorphic, ecoronate, arranged in two rows. Inner row made up of 36 barbelate pappus bristles, unequal in length, dull yellow in colour whereas outer row made up of 32 scaly pappus, unequally arranged, dull white in colour.

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***Vernonia gracilis* Kunth.**

**DISCUSSION AND CONCLUSION**

**MORPHOLOGY (Fig. 1 I-S, 3 G-I)**

Cypsela homomorphic, 1.5 mm X 1.0 mm excluding pappus, 5.0 mm-5.5 mm X 1.0 mm including pappus, dull, dotted, brownish yellow colour, oblong, tapered at base, rounded at the apex, cylindrical in cross sectional configuration, Ribs 11, prominent, surface, papilose, rugose, containing pubescent hair, inflexed, densely distributed, nonglandular. Cypselar hair biserially forked type, tips of the body cells of hair situated in different plane. At the upper part of cypsela, stylopodium present; unenlarged, corona absent. At the basal region of cypsela, carpodium present; wider than the base of cypsela, symmetric, circular, complete ring-like. Carpodial cells with thin-walled, nonpitted, large, square, carpodial cells horizontally placed, arranged in single row, distinguishable from other cells of the cypsela. At the upper part of cypsela, pappus present; heteromorphic, ecoronate, arranged in two rows. Inner row made up of 21 barbelate pappus bristles, equal in length, dull yellow in colour whereas outer row made up of 17 scaly pappus, unequally arranged, dull yellow in colour.

Three species of the genus *Veronica* have been studied morphologically. All the studied species exhibits homomorphism. Heteromorphism has also found to be reported in other species of this tribe (Jana and Mukherjee, 2012). Shape is more or less similar in the studied species. In all the studied species, cypsela oblong in shape, though shape is not an important character for characterization of taxa. Size is variable for all studied species. Among the studied cypselas, the smallest cypsela is found in case of *Vernonia gracilis* (1.5 mm X 1.0 mm excluding pappus, 5.0 mm-5.5 mm X 1.0 mm including pappus) and largest cypsela is found in case of *Vernonia diffusa* (3.2 mm X 0.7 mm excluding pappus, 9.0 mm-9.5 mm X 0.7 mm including pappus). Though, size is not an important taxonomic character. Colour of cypsela is variable and also depends on the maturity of cypselas. In *Vernonia cinerea* cypsela is with tawny coloured whereas in remaining 2 species, cypselas brownish yellow in colour. In all the studied species, cypselar wall remain addressed by twin hairs. Although, in some other species of this tribe, twin hair absent. At the upper portion of cypselas, pappus

present. In all the studied species, both barbelate and scaly type of pappus present. Pappus plays an important role in the dispersal of seed. Presence of only barbelate type of pappus bristles is reported by Jana and Mukherjee, (2012) in case of the species *Vernonia anthelmintica*, of this tribe. In all the studied species, pappus biserially arranged, but uniserially arranged pappus is found to be reported by Basak and Mukherjee (2003) in case of the species *V. blanda*, *V. saligna* of this tribe. At the basal region of cypselas, carpodium present. In all the studied species, carpodial cells arranged in single row, symmetric, complete ring like. Such type of carpodium has been reported by Mukherjee (1991). The value of cypselar characters can be employed for proper evaluation of taxa together with other characters from different taxonomic sources. In *Vernonia*, structure of stylopodium is not so much valuable for characterization of taxa. Among the studied species, in *V. ceneria*, stylopodiums

unenlarge and completely immersed in nectar. In *V. gracilis*, stylopodiums unenlarge. In *V. diffusa*, stylopodium enlarge and very prominent. The absent of stylopodium has been reported by Basak and Mukherjee (2003) in case of *V. Galamensis*. From the aforesaid discussion it may be concluded that diacritical features of cypselas are valuable for demarcation of taxa at or below infrageneric level.

#### KEY TO THE STUDIED SPECIES

- 1a. Stylopodium enlarge and prominent  
...*V. diffusa*
- 1b. Stylopodium unenlarge..... (2)
- 2a. Cypselas, linear in shape..... *V. ceneria*
- 2b. Cypselas, oblong in shape..... *V. gracilis*

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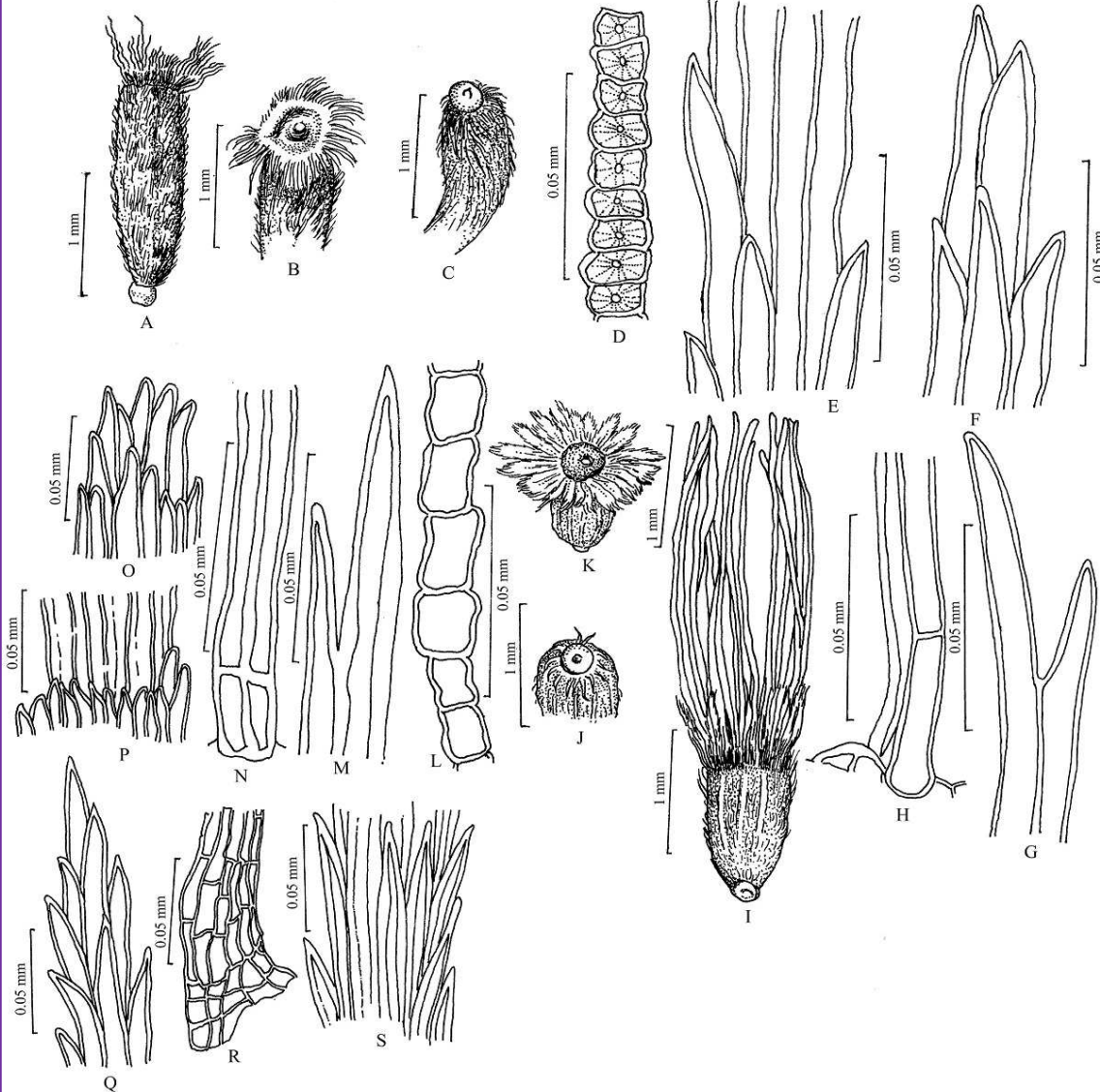


Fig.1 MORPHOLOGY OF CYPSELAS

A-H- *Vernonia cinerea*: A- cypsel, B- upper part of cypsel, C- lower part of cypsel, D- carpopodial cells, E- middle part of pappus bristles, F- upper part of pappus bristles, G- upper part of surface hair, H- lower part of surface hair; I-S- *Vernonia gracilis*: I- cypsel, J- lower part of cypsel, K- upper part of cypsel, L- carpopodial cells, M- upper part of surface hair, N- lower part of surface hair, O- upper part of pappus scales, P- lower part of pappus scales, Q- upper part of pappus bristles, R- lower part of pappus bristles, S- middle part of pappus bristles.

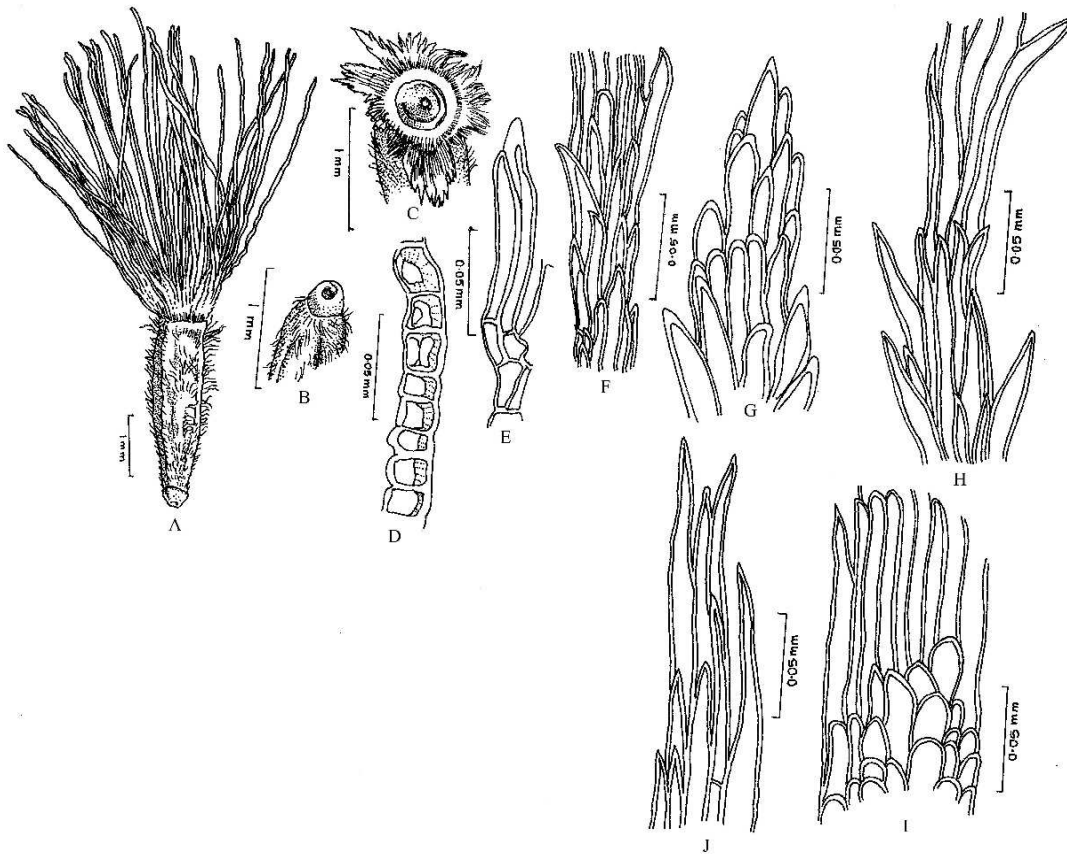


Fig.2 MORPHOLOGY OF CYPSELAS

A-H- *Vernonia diffusa*: A- cypselus, B- lower part of cypselus, C- upper part of cypselus, D- carpopedial cells, E- surface hair, F- lower part of pappus bristles, G- upper part of pappus bristles, H- middle part of pappus bristles, I- lower part of pappus scales, J- upper part of pappus scales.

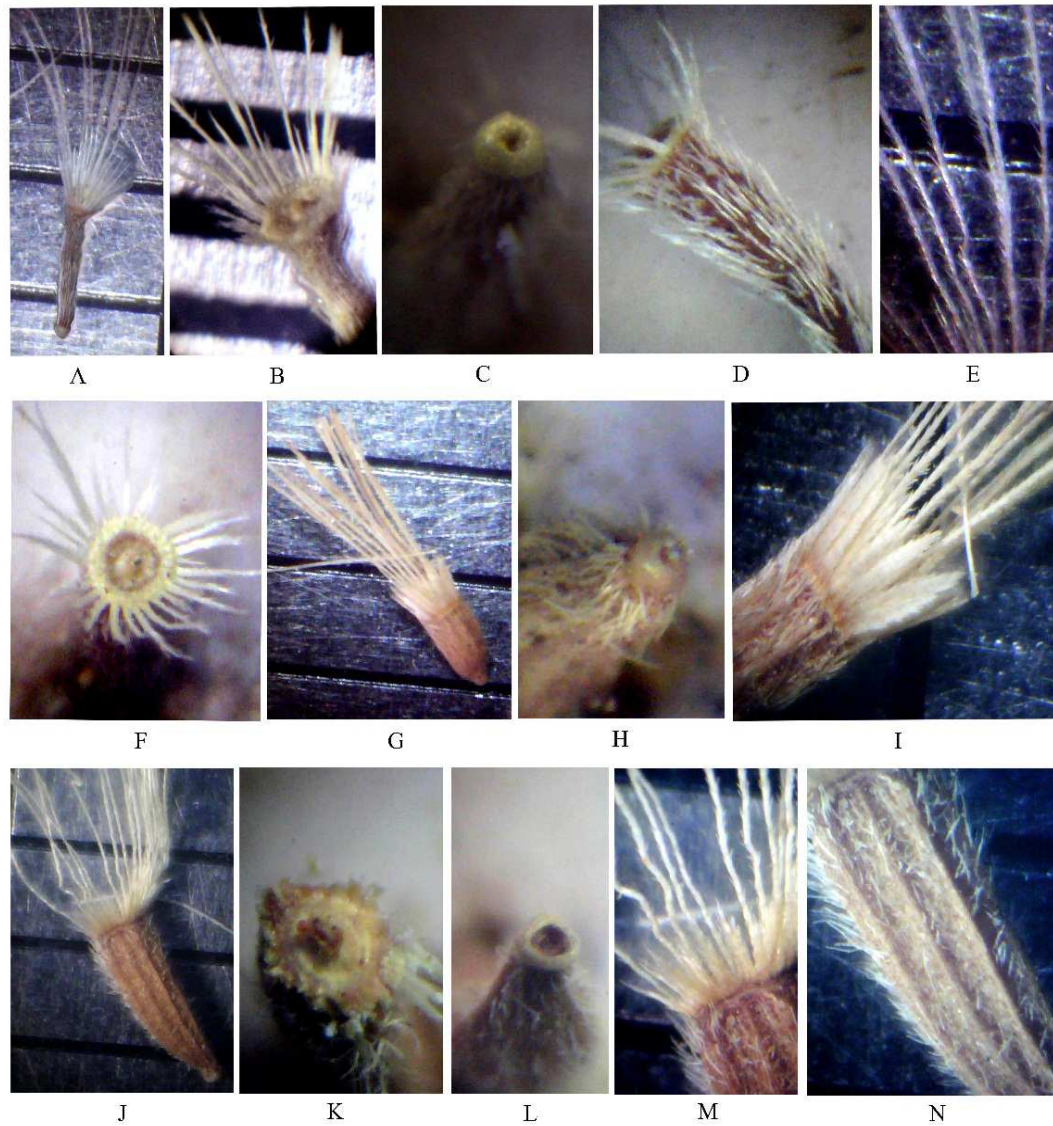


Fig.3 PHOTOGRAPH OF CYPSELAR PARTS

A-F- *Vernonia cinerea*: A- Cypselar part, B- Upper part of cypselar part, C- Lower part of cypselar part, D- Surface of cypselar part, E- Pappus bristles, F- Pappus scales; G-I- *Vernonia gracilis*: G- Cypselar part, H- Lower part of cypselar part, I- Upper part of cypselar part showing pappus bristles, pappus scales and surface of cypselar part; J-N- *Vernonia diffusa*: J- Cypselar part, K- Upper part of cypselar part, L- Lower part of cypselar part, M- Upper part of cypselar part showing pappus bristles and pappus scales, N- surface of cypselar part.



Table 1

Name of studied taxa and their source of origin

NAME OF TAXA	SOURCE OF ORIGIN
<i>Vernonia cinerea</i> Less.	Kalyani Township, Nadia
<i>Vernonia diffusa</i> Less.	Royal Botanic garden, Kew, London
<i>Vernonia gracilis</i> Kunth.	Royal Botanic garden, Kew, London

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