

## Cypselar morpho-anatomy of *Calea cymosa* - tribe Neurolaeneae (Compositae)

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### Abstract

The present paper deals with the detailed morpho-anatomical features of cypsela of *Calea cymosa* of the tribe Neurolaeneae. Morphologically, special attention has been taken to the surface, pappus structure, stylopodium and carpodium. Anatomically, mesocarpic region is more interesting than other layer of pericarp. Mesocarp is made up of both parenchyma and sclerenchyma cells. In between this two cellular zones, phytomelanin layer exist; discontinuously arranged. Testa and endosperm layers are parenchymatous, uni-seriately arranged.

**Key words:** Cypselar morpho-anatomy; *Calea cymosa*; Neurolaeneae; Compositae.

The tribe Neurolaeneae has 5 genera and approximately 150 species<sup>12</sup>. The members of this tribe are commonly exist in Mexico, South America, Cuba etc. On the basis of molecular study, Panero and Funk<sup>18</sup>, had placed this group as a tribe of Heliantheae alliance sister to Bahieae, Chaenactideae and Tageteae. The members of this tribe, cypselas are generally obconical-obpyramidal in shape, black-brown in colour, surface may be glabrous or pubescent. The literatures regarding the cypselar features of this tribe are extremely limited. The aims of this study is to elaborate the detailed cypselar features of this tribe, with special reference to a single species (*Calea cymosa*).

Mature, identified, disease free cypsela of *Calea cymosa* Less. is procured from Swedish Museum of Natural History, Stockholm, Sweden, by the active contribution of Prof. (Dr.) Bartil Nordenstam, Emeritus professor.

For morphological observation, cypselas were immersed in 4% NaOH solution for clearing and were placed under simple dissecting microscope, to observe different morphological parts, such as surface hair, number of ribs on the surface, pappus structure, phytomelanin layer in the surface, stylopodium, carpodium etc. Finally, all the morphological parts were drawn by prism type of camera lucida.

For anatomical observation, good

cross sections have been taken through the middle part of mature cypsels, with the help of a sharp razor blade. Sections were immersed in 0.1 % aqueous saffarin solution for staining and finally placed under compound light microscope to observe different anatomical regions. Camera lucida drawings have been taken for the anatomical studies of pericarpic region.

SEM study has been taken, with the help of scanning electron microscope, available in Burdwan University, Burdwan (Hitach-500). For this purpose, five randomly selected dry, clean, mature cypsels were scanned, after gold coating, under a scanning electron microscope. Photographs were taken at different magnifications. The terminology adopted is mainly from Kynclova<sup>13</sup>, Barthlott<sup>1</sup> and Bremer<sup>3</sup>.

Micro- photographs have been taken, with the help of scanning microscope (SM-1500), available in Taxonomy and Biosystematics Laboratory, Department of Botany, University of Kalyani.

#### **Cypselar morphology (Fig. 1, Fig. 2)**

Cypselar homomorphic, 5.5 mm x 1 mm including pappus, 3 mm x 1 mm excluding pappus, black brown, oblanceolate, straight, upper part truncate, whereas; lower part tapered. Ellipsoidal in cross sectional configuration. Surface pubescent, containing papillate type of surface hair, tapering at the apex, expand at the base. At the upper portion of cypselar, stylopodium present; prominent, enlarged, partially immersed into the nectary. Pappus represented by scale like structure. At the basal region of cypselar, carpopodium present;

narrow than the base, pentangular. Carpopodial cells with thick walled, cubical, arranged in two rows.

#### **SEM study (Fig. 3)**

Within the surface, cells are homomorphic, rectangular, elongated in one direction, provided with straight-irregularly curved anticlinal wall, provided with a channel between the two cells. In the periclinal wall, cells may be concave, without any secondary structure. Pappus represented by scale like outgrowth. Stylopodium prominent, enlarge, pointed apex, expanded base, fully immersed into the nectary.

#### **Cypselar anatomy (Fig. 4)**

Cypselar elliptic in cross sectional configuration. Epicarp uni-seriate, parenchymatous. Internal to the epicarp, mesocarp present; made up of both parenchyma and sclerenchyma cells. In between this two zones, phytomelanin layer present; discontinuously arranged. Testal layer uniseriately arranged, parenchymatous. Endosperm uniseriately arranged, parenchymatous. Cotyledons are two in number, arranged at right angle to the axis of cypselar, containing 6 resin ducts (3 ducts in each cotyledon).

One species (*Calea cymosa*) of the tribe Neuroleae has been studied. General morphology of the cypselar is as follows: Ovoid in shape, straight in direction, upper part truncate where as lower part tapered. Surface is pubescent type, containing papillate type of hair. Surface hairs are distributed only through the ribs region. Jana and Mukherjee<sup>8</sup>, have noted that the surface of some species of Compositae have the different types of

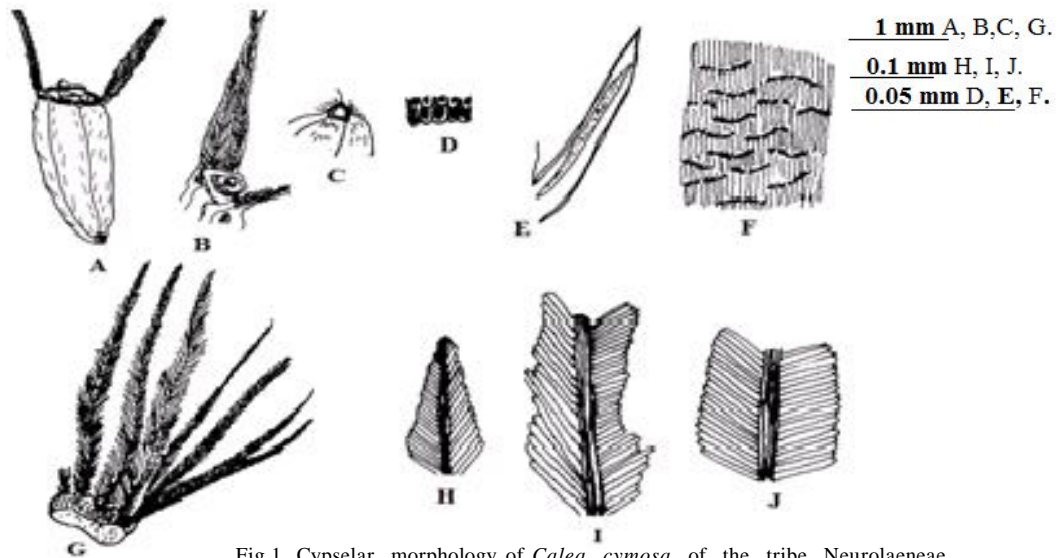


Fig.1. Cypselar morphology of *Calea cymosa* of the tribe Neurolaeneae  
A-J- *Calea cymosa* : A-Cypselum, B-Upper part of cypselum showing stylopodium, C-Lower part of cypselum showing carpodium, D-Carpodial cell, E-Surface hair, F-Surface showing phytomelanin deposition, G- Pappus, H-Upper part of pappus bristle, I-Middle part of pappus bristle, J-Lower part of pappus bristles

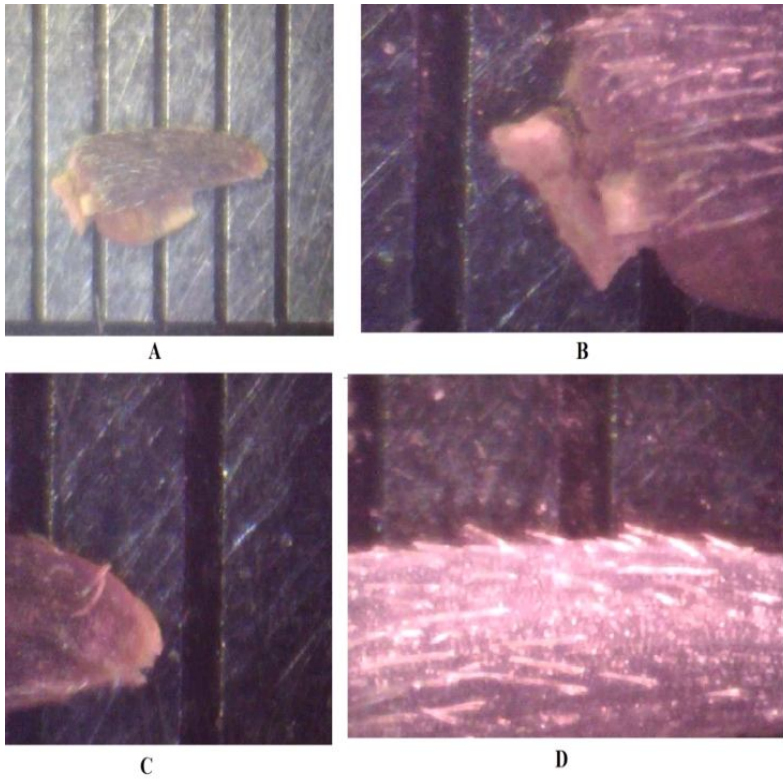
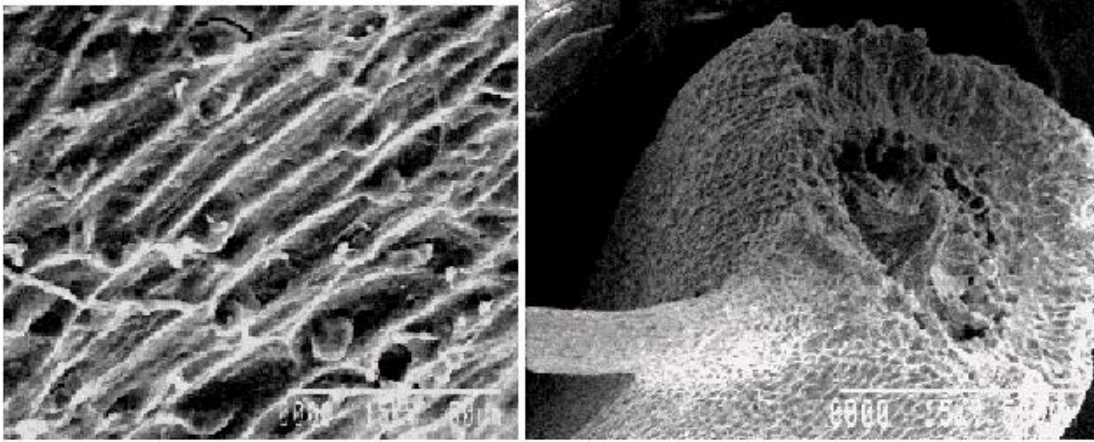


Fig.2. Camera photographs of studied cypselum of the tribe Neurolaeneae

A-D- *Calea cymosa*: A-Cypselum, B-Upper part showing stylopodium, C-Basal part showing carpodium, D-Surface showing surface hair.



**A** **B**  
Fig.3. SEM-Photographs of studied cypseli  
**A-B**— *Calea cymosa*: **A**-Surface, **B**-Upper part showing stylopodium

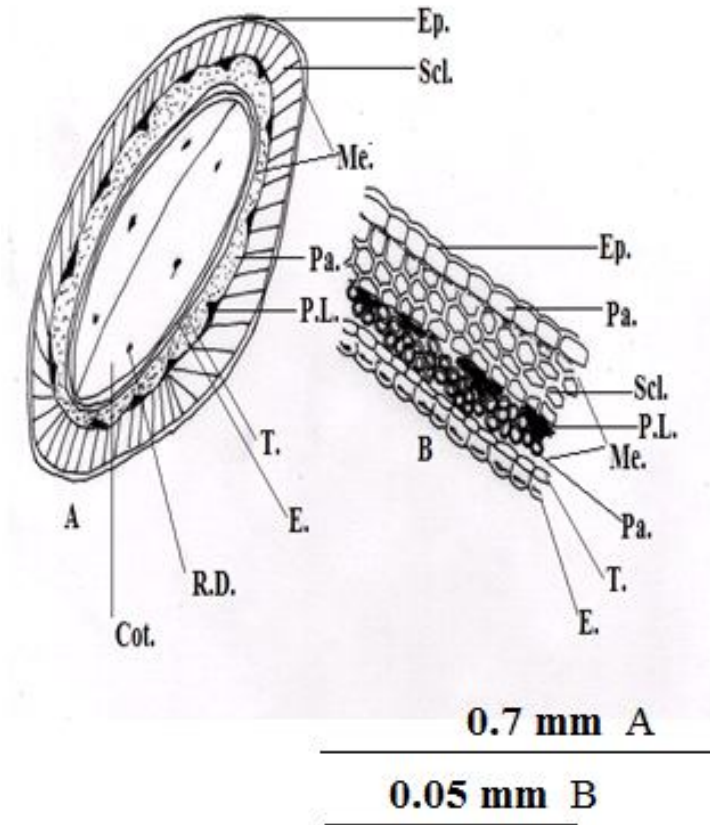


Fig.4. Cypselar anatomy of the studied species of the tribe Neurolaeneae

**A-B**-*Calea cymosa*:  
**A**-Diagrammatic view,  
**B**-Cellular view.

surface hairs, *i.e.* twin hair, papillate hair etc. At the upper portion of cypsela, stylopodium exists, which is enlarge, cylindric, partially immersed into the nectary. Actually, stylopodium is a modified style base. Mukherjee<sup>15</sup>, has published, regarding the stylopodial features of some species of Compositae and also had provide a detailed structure of stylopodium. Our observation regarding the stylopodial feature is exactly identical with the observation of Mukherjee<sup>15</sup>. At the upper portion of cypsela, scaly type of pappus is present. Singh *et al.*<sup>19</sup>, have done a work, regarding the achene morphology of some species of Compositae and have provided the information regarding the different types of pappus, such as paleaceous type, plumose type, simple hairy pappus etc. But, he has not reported regarding the scaly pappus. Jana and Mukherjee<sup>6</sup>, Mukherjee and Nordenstam<sup>16</sup>, have reported the different form of pappus, including the scaly pappus. So, our observation regarding the presence of scaly pappus in *Calea cymosa*, is clearly fits with the work of Jana and Mukherjee<sup>6</sup>, Mukherjee and Nordenstam<sup>16</sup>. At the basal region of cypsela, carpodium is present, which is pentangular in out line. Carpodial cells are thick walled, elongated, arranged in two rows. Carpodium is the basal meristematic tissue zone of cypsela. Its structure and cell distribution in different tires have a significant role for the characterization of taxa. Regarding the carpodial structure, Kynclova<sup>13</sup>, has mention this structure as peduncle. The distribution of carpodial cells are varies from taxon to taxon<sup>2</sup>.

The studied cypsela is elliptic in cross sectional configuration. Epicarp is made up of uniseriately arranged parenchyma cells, provided with cuticle. Internal to the epicarp,

mesocarp exists, which is divided into outer and inner mesocarp. Outer mesocarp is made up of pentangular, compactly arranged, sclerenchyma cells, whereas inner mesocarp is made up of parenchyma cells. Anatomical structure of cypselas are not well demonstrated in the past<sup>4</sup>. But it's potential usefulness has been recognized for some times. In our studied species, the mesocarpic region has a cellular variation. It is helpful for the separation of taxa among the different tribes, if we consider the separation of taxa on the basis of mesocarpic structure. In between the outer and inner mesocarpic region, phytomelanin layer, a black hard layer is formed, which is discontinuously arranged. Phytomelanin is a unique type of resinous substance and it is usually present in the members of the tribe Heliantheae<sup>11</sup>, Helenieae, Eupatorieae<sup>14</sup>, Perityleae<sup>9</sup>. So, on the basis of the phytomelanin deposition, the studied species is some how related with many tribes of Heliantheae allineae group<sup>12</sup>. Phytomelanin layer is may be either continuously arranged or discontinuously arranged. In our studied species, this layer is discontinuously arranged. Jana and Mukherjee<sup>7</sup>, have given a little information regarding the mode of arrangement of phytomelanin layer in Compositae. Internal to the mesocarpic region, testal layer is formed, which is uniseriate, parenchymatous. Jana and Mukherjee<sup>10</sup>, have worked on the detailed structure of testa and provide a classification on the basis of the 82 species. Internal to the testal layer, endosperm layer exists. This layer is uniseriate, parenchymatous. Cotyledons are two in number, arranged at right angle to the axis of cypselas. Each cotyledon has three resin ducts. The plane of arrangement of cotyledon is clearly fits with the observation of Pack<sup>17</sup>. On the basis of morpho-anatomical observation, it is obvious

that cypselar characters are identical with the Heliantheae alliance group as has been proposed by many author like Kadreit *et al.*,<sup>12</sup> Funk *et al.*,<sup>5</sup> particularly the distribution of black pigment, insoluble in water, acid and other substances.

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