

Full Length Research Paper

Petiole anatomy of some species of Asteraceae in southwest Nigeria

AKINNUBI Funmilola Mabel*, AKINLOYE Akinwumi Johnson and
OLADIPO Olaniran Temitope

Department of Botany, Obafemi Awolowo University, Ile-Ife, Osun state, Nigeria.

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Petiole anatomy of 12 species of Asteraceae around Ile-Ife in South-Western Nigeria was described. Transverse section of the petiole (median) was cut at 20 μ using Reichert Sledge Microtome. The specimens were stained in 1% aqueous solution of Safranin O for 5 min, washed in three changes of water to remove excess stain and counterstained in 1% solution of Alcian blue for 5 min, and cleared in xylene. The section was mounted in DPX. The distinguishing characteristics of taxonomic value include, shapes of the petioles, variation in the number, arrangement and shapes of vascular bundles, types of trichomes.

Key words: Asteraceae, petiole, anatomy, taxonomic, trichomes.

INTRODUCTION

Asteraceae is a very large cosmopolitan family, highly advanced and easily recognized with worldwide distribution (Nielsen, 1965). It belongs to the sub-class Asteridae in the order Asterales (Ming, 1999). Asteraceae is the second largest family in the division Magnoliophyta with 1,100 genera and over 20,000 recognized species (Ming, 1999). The majority of Asteraceae species are herbaceous although an important component of the family consists of shrubs or even trees, many plants in the family Asteraceae are economically important as weeds, ornamentals, medicinal and green vegetables (Olorode, 1984).

Angiosperms are endowed with external morphological characters of significant taxonomic value which can be easily observed with the naked eye or with simple hand lens. Morphological attributes of vegetative organs have often constituted the mainstay of taxonomic studies in plants (Polhill, 1968; Pilbeam and Bell, 1979; Adedeji, 2005) and are very important in classification.

The use of anatomical methods in taxonomic investigations cannot be over emphasized. Although no character is absolutely immutable, some are more fixed than the others and it is on those that are less plastic that

the systematic anatomist rely because they are not really affected by environmental conditions (Barthlott, 1981); comparative plant epidermal studies have been found to be reliable in taxonomy and systematics (Stace, 1969; Ogunkunle and Oladele, 2000). Metcalfe and Chalk (1950, 1979), Naik and Nigrude (1981), Palmer and Tucker (1981), Adedeji (2004) and Adedeji and Illoh (2004) have all stressed the taxonomic importance of anatomical features which along with other characters are useful for identification and classification of plants.

The present study reports on the use of petiole anatomy in establishing the taxonomic relationships among ten species of Asteraceae.

MATERIALS AND METHODS

Transverse section (median) of the petiole of *Ageratum conyzoides* Linn., *Aspilia africana* (Pers) C.D Adams, *Bidens pilosa* Linn., *Chromolaena odorata* (Linn.) King & Robinson, *Crassocephalum crepidioides* Benth S. Moore, *Synedrella nodiflora* (Linn) Gaertn, *Tithonia diversifolia* (Hemsl) A. Gray, *Tridax procumbens* Linn. *Vernonia amygdalina* Del., *Vernonia cinerea* Linn were cut at 20 μ using Reichert sliding microtome. The sections were preserved

in 50% ethanol. The sections were stained in 1% aqueous solution of Safranin O for 5 min, washed in three changes of water to remove excess stain and counterstained in 1% solution of Alcian blue for 5 min. The sections were then washed in three changes of water and dehydrated by passing them through series of ethyl alcohol: 50, 70, 80, 90 and 100% with two changes in 100% alcohol to remove water molecules, (dehydration process) and excess stain (differentiation process). The dehydrated and differentiated sections were cleared in xylene and mounted in DPX. Photomicrographs of the petiole sections of the ten species were taken with Amscope digital camera attached to a light microscope. All microscopic measurements were made and expressed in micrometer.

RESULTS

***Ageratum conyzoides* Linn. (Plate 1A)**

Outline: Arc shape, adaxial side concave, abaxial surface convex. Epidermis: Uniseriate. Cortex: Compose of 1-2 layers of polygonal angular collenchyma cells and 11-14 layers of polygonal parenchyma cells. Vasculature: Vascular bundles, 3-5, bicollateral, arranged in form of an arc. Pith: Consists of thin walled parenchyma cells. Trichome type: Simple, uniseriate and multicellular.

***Aspilia africana* Pers. C.D. Adams (Plate 1B)**

Outline: Arc shape, concave on the adaxial surface, convex in the abaxial. Epidermis: Uniseriate. Cortex: Compose of 4 layers of polygonal angular collenchyma cells and 5 layers of thin-walled spherical shaped parenchyma cells. Vasculature: Vascular bundles, 4, consisting of 3 prominent bicollateral bundles alternating with a small one. Rib bundle is also present. Pith: Consist of thin walled parenchyma cells. Trichome types: Simple, uniseriate and multicellular.

***Bidens pilosa* Linn. (Plate 1C)**

Outline: Concave at the adaxial surface, convex at the abaxial. Epidermis: Uniseriate. Cortex: Compose of 2-3 layers of polygonal angular collenchyma cells and 5 layers of thin walled parenchyma cells. Vasculature: Vascular bundles, 2-4, amphicribal arranged in form of an arc. Pith: Thin walled parenchyma cells present. No trichome present.

***Chromolaena odorata* Linn. (Plate 1D)**

Outline: Boat shaped, slightly concave at the adaxial surface, convex on the abaxial surface. Epidermis: Uniseriate. Cortex: Compose of 2-3 layers of polygonal angular collenchyma cells and 4 layers of thin walled parenchyma cells. Vasculature: Vascular bundle, 3, arranged in form of an arc, amphicribal. Pith: Thin walled

parenchyma cells present. Trichome types: Simple, uniseriate multicellular.

***Crassocephalum crepidioides* (Benth) S. Moore. (Plate 1E)**

Outline: Concave on the adaxial surface, convex on the abaxial surface. Epidermis: Uniseriate. Cortex: Compose of 2-3 layers of polygonal angular collenchyma cells and 6-7 layers of thin walled parenchyma cells. Vasculature: Vascular bundles 3-5, amphicribal arranged in the form of an arc. Pith: Consist of thin walled parenchyma cells. No trichome present.

***Synedrella nodiflora* Benth. (Plate 2A)**

Outline: Arc shape, concave at the adaxial surface, abaxial surface is convex. Epidermis: Uniseriate. Cortex: Compose of 2-4 layers of polygonal angular collenchyma cells and 5-6 layers of parenchyma cells. Vasculature: Vascular bundles, 5-7, bicollateral. Pith: Consist of thin walled parenchyma cells. No trichome present.

***Tithonia diversifolia* Hemsl. A Gray (Plate 2B)**

Outline: Concave at the adaxial surface, abaxial surface is convex. Epidermis: Uniseriate. Cortex: Compose of 3 layers of polygonal angular collenchyma cells and 6 layers of thin walled parenchyma cells. Vasculature: Vascular bundles, 3-5, bicollateral arranged in the form of an arc. Pith: Thin walled parenchyma cells present. Trichome types: Simple, uniseriate and multicellular.

***Tridax procumbens* Linn. (Plate 2C)**

Outline: Boat shape, concave at the adaxial surface, abaxial surface is convex. Epidermis: Uniseriate. Cortex: Compose of 2-3 layers of polygonal angular collenchyma cells and 4-5 layers of thin walled parenchyma cells. Vasculature: Vascular bundles, 3, amphicribal arranged in form of an arc. Pith: Thin walled parenchyma cells present. Trichome types: Simple, uniseriate and multicellular.

***Vernonia amygdalina* Del. Cent. (Plate 2D)**

Outline: Slightly concave at the adaxial surface, abaxial surface is convex. Epidermis: Uniseriate. Cortex: Compose of 2-3 layers of polygonal angular collenchyma cells and 6-7 layers of polygonal parenchyma cells. Vasculature: Vascular bundles, 2-3, bicollateral. Pith: Thin walled parenchyma cells present. No trichome

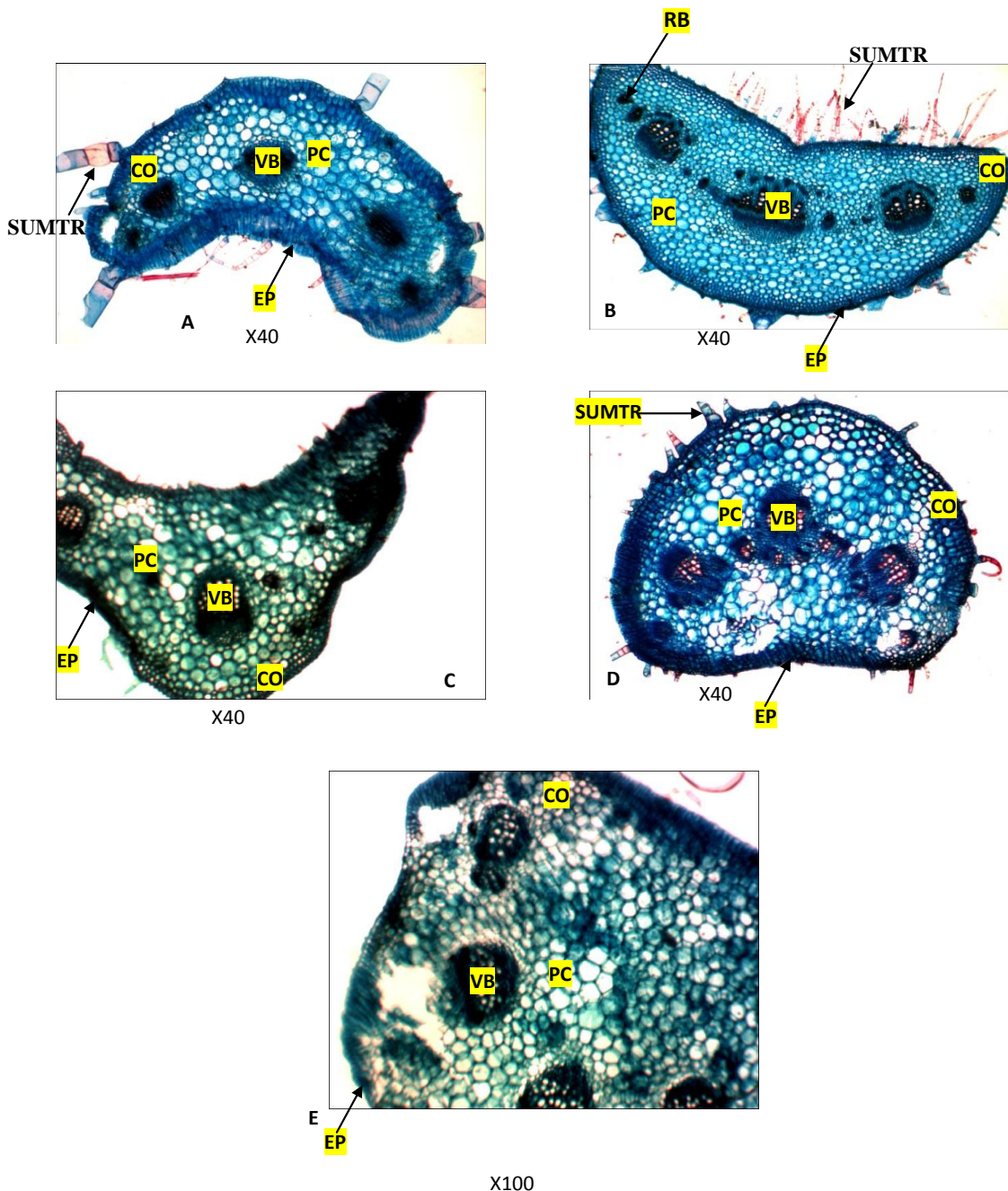


Plate 1. A- *Ageratum conyzoides*; B- *Aspilia africana*; C- *Bidens pilosa*; D- *Chromolaena odorata*; E- *Crassocephalum crepidioides*. BTR- Bicellular trichome; EP- epidermis; CO- collenchyma; PC- parenchyma; RB- rib bundle; SUMTR- simple uniseriate multicellular trichome; VB- vascular bundle.

present.

***Vernonia cinerea* Linn. (Plate 2E)**

Outline: Slightly concave at the adaxial surface, abaxial surface is convex. Epidermis: Uniseriate. Cortex: Compose of 1-2 layers of polygonal angular collenchyma cells and 5-7 layers of polygonal parenchyma cells.

Vasculature: Vascular bundles, 3, oval shaped, amphicribal. Pith: Thin walled parenchyma cells present.

DISCUSSION

The data recorded are useful to distinguish the taxa studied because each taxa showed unique anatomical characters which are diagnostic, for examples, the shape,

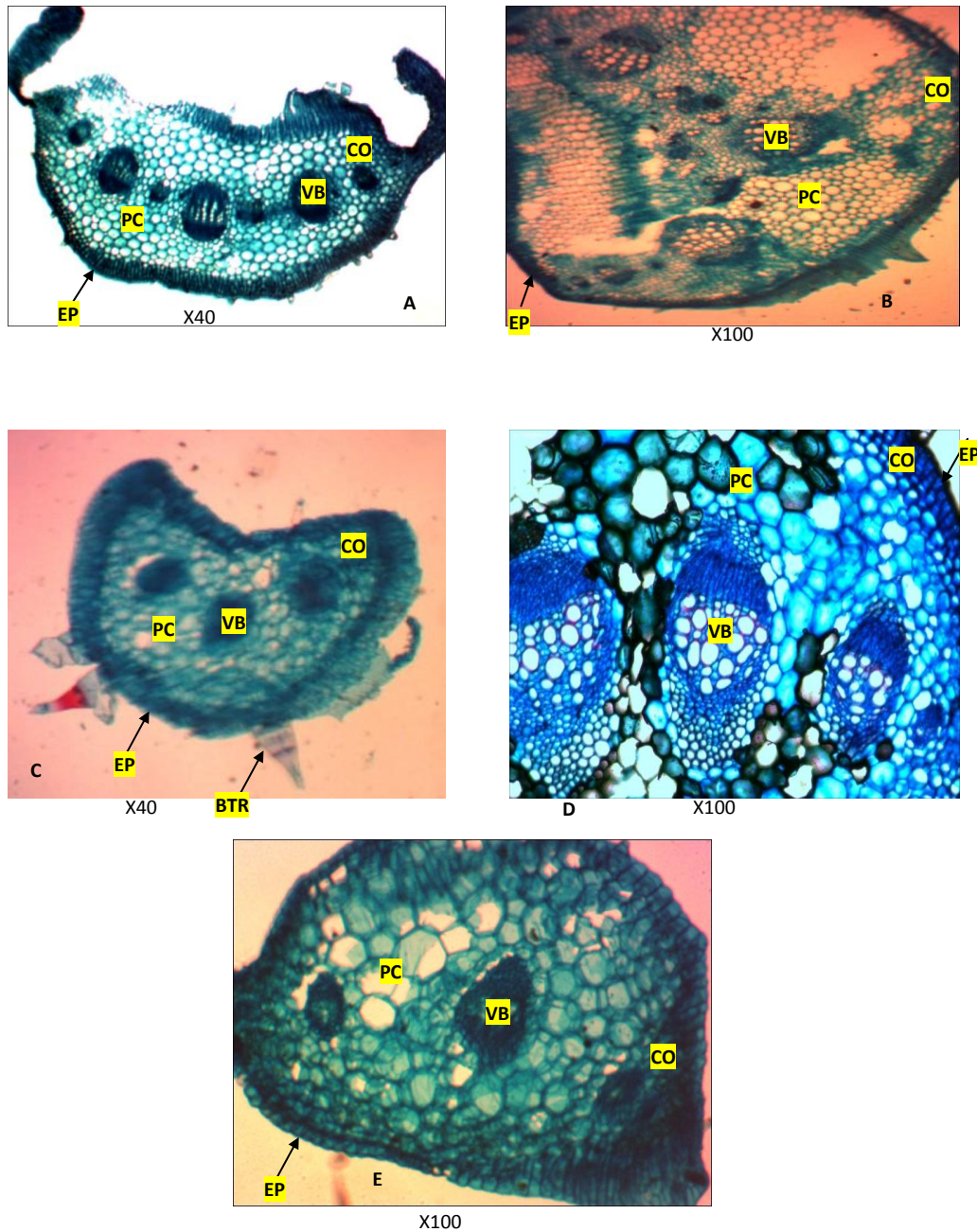


Plate 2. A- *Synedrella nodiflora*; B- *Tithonia diversifolia*; C- *Tridax procumbens*; D- *Vernonia amygdalina*; E- *Vernonia cinerea*. BTR- Bicellular trichome; EP- epidermis; CO- collenchyma; PC- parenchyma; RB- rib bundle; SUMTR- simple uniseriate multicellular trichome; VB- vascular bundle.

layers of their collenchyma and parenchyma cells, arrangements of vascular bundles and trichome distributions, even though overlaps were observed in some of the species. Many researchers have utilized anatomy for taxonomic consideration in many species of plants. These include the works of Naik and Nigrude (1981) on *Chlorophytum* Linn., Ogundipe and Olatunji (1991) on *Cochlospermum* Linn., Illoh (1995) on *Celosia* Linn., Adedeji (2004) on *Emilia* Cass. and Adedeji and Illoh (2004) on *Hibiscus* Lyndley Craven.

Anatomy of the transverse sections of the petiole of species studied reveals both intra and interspecific variations which are important in the classification and delimitation of the species. The pattern of distribution and composition of tissues are uniform in all the species studied with few exceptions, that is, the shape, layers of their collenchyma and parenchyma cells, arrangements of vascular bundles. However, the differences observed in the outline of the adaxial surface and the arrangement and types of vascular bundles can be used to separate

the genera of the family Asteraceae studied. Generally, the epidermis is adaxially concave, uniseriate and made up of angular collenchyma cells while polygonal cells are found in the cortex. These appear to be characteristic of the family. Anatomical distinctions occur in the vascular bundles of the species studied. The distinction in shape and type of vascular bundle in the species studied are of taxonomic value because it divided the species studied into two different groups, that is, amphicribal and bicollateral with differences in the number of bundles. Vascular bundles are either joined together or broken into two and are arranged in the form of an arc. Two major types of vascular bundles occur in the species studied: amphicribal and bicollateral bundles. These are useful in dividing the species studied into two groups. Amphicribal bundles are found in *B. pilosa*, *C. odorata*, *Crassocephalum crepidioides*, *S. nodiflora*, *T. procumbens* and *V. cinerea* while bicollateral bundles are found in *A. conyzoides*, *A. africana*, *T. diversifolia* and *V. amygdalina*. *A. conyzoides* and *T. diversifolia* are different from the other species studied, the vascular bundles are not joined (they are referred to as open); they possess 3-5 vascular bundles. The vascular bundles of *A. africana* with three prominent large vascular bundles alternate with small ones and possess rib bundles. These separate *A. africana* from other species. *S. nodiflora* is quite distinct from others because of numerous bundles.

The presence or absence of trichomes in the epidermis of the petioles of the species studied is taxonomically valuable. Based on the presence or absence of trichomes, the species studied can be grouped into two. Trichomes are found in *A. africana*, *A. conyzoides*, *C. odorata*, *T. diversifolia* and *T. procumbens*. Trichomes are absent in *B. pilosa*, *C. crepidioides*, *S. nodiflora*, *V. amygdalina* and *V. cinerea*. In species where trichomes are found they are simple uniseriate and multicellular.

Artificial key to the species of Asteraceae using anatomical characters

- 1a. Trichomes present, simple multicellular non glandular
 2a. Rib bundle present.....
A. africana
 2b. Rib bundle absent
 3a. Petiole outline boat shaped..... *C. odorata*
 3b. Petiole outline arc shaped
 4a. Cortex made up of 11-14 layers of polygonal parenchyma cells. *A. conyzoides*
 4b. Cortex made up of 4-6 layers of parenchyma cells
 5a. Vascular bundle amphicribal.....
T. procumbens
 5b. Vascular bundle bicollateral..... *T. diversifolia*
 1b. Trichomes absent

- 6a. Vascular bundle bicollateral
 7a. Outline slightly concave on adaxial..... *V. amygdalina*
 7b. Outline arc shaped on the adaxial surface..... *S. nodiflora*
 6b. Vascular bundle amphicribal
 8a. Vascular bundles 3.....
V. cinerea
 8b. Vascular bundles 2-5
 9a. 5 layers of parenchyma cells present in the pith..... *B. pilosa*
 9b. 6-7 layers of parenchyma cells on the pith..... *C. crepidioides*

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