Vegetative Anatomy of *Galinsoga parviflora* Cav. (A Newly Recorded Genera in Jazan Region, KSA)

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Abstract:

*The present study examined the anatomical features of the stem and petiole besides measurements of the leaf epidermal cells and stomata of **Galinsoga parviflora Cav.** belonging to Asteraceae family which is regarded as a newly recorded genera in Jazan region, KSA. The stem had a primary structure. It has 11 closed collateral vascular bundles. The petiole is un-stratified with glabrous papillomatous cells with a laminar collenchyma composed of 2 cell layers. There are multiseriate non-glandular trichomes on the epidermis. Stomata are anisocytic which are surrounded by a girdle of three subsidiary cells. Stomata frequency was 20-24 and stomata index was 26.82.In general anatomical charecteristics are very important and could be used in diagnostic key of taxa at all taxonomic levels.*

Keywords: *Galinsoga*, anatomy, Jazan

Introduction

Galinsoga parviflora Cav. belongs to the family Astraceae. It occupies areas distributed by man in the new world and Europe and also have been introduced into Asia, Africa, Australia and other temperate and subtropical regions of the world **(Baker, 1965)**. The genus apparently is widely distributed in South and North America and native to Mexico where the greatest diversity and taxonomic complexity are found **(Judith, 1977 and Boulos, 2002).**

It is herb, up to 60 cm high with erect stem. Leaves are pale green, petiolate, opposite; lamina 3-veined and lanceolate to broadly ovate. Heads are radiate or discoid. Disc florets are yellow. It grows in sandy, loamy and clay soils **(Adnan *et al*., 2015).** The scarious fruits are probably adapted to dispersion along the water flows and riverine lands facilitating their expansion. It propagates by seeds producing many seeds which are dispersed by wind and germinate easily when they find some humidity **(Marchante *et al*., 2008)**.

It is reported from Yemen as a weed and a ruderal plant between altitudes of 1100-2900 m on escarpments and high plateau and areas where high rainfall is reported, particularly in the Ibb Province **(Wood, 1997).** This species has not been reported in any area of Jazan region before so it is regarded as a newly recorded genera in Jazan region particularly and in Saudi Arabia generally **(Adnan *et al*., 2015).**

Materials and Methods

Galinsoga parviflora was collected from an area in southwestern Jazan province, Kingdom of Saudi Arabia, located at (160 20' N, 420 45' E), altitude 2000 m, in the southern part (Jabal Fayfa) close to the mountains in Yemen. Plant specimens were identified at the herbarium of Science faculty – Jazan University **(Fig. 1)**. The meteorological data was obtained from the Presidency of Meteorology (PME) **(Table 1)**.

Meteorological parameters	January 2019	September 2019
average rainfall amount (mm)	12.7	7.7
average temperature (°C)	28	31
average wind speed (kmph)	17.3	15
average pressure (mb)	1015.4	1006.6
average cloud (%)	70	68
average humidity (%)	27	15
average UV index	7	7
average sun hours (hr.)	210	297
average sun days	17	22
average visibility (km)	9.9	9.9

Table (1) Meteorological parametes in Jan. and Sep. 2019 for Jazan region

The fourth node of the stem and the leaf petiole samples were sectioned using a razor blade and the thin slices obtained were kept in water before mounted onto a glass slide where some drops of absolute ethyl alcohol was added for tissue hardening and then 2 drops of Safranin and light green (1:1; v:v) solutions. Excess stain was washed off with water before a drop of glycerine was added. Slides were covered with cover slips and then ringed with nail lacquer to prevent dehydration. Slides were observed with an Olympus microscope and photographs were taken with a digitized camera (Nikkon) **(Kadiri A. and Ayodele A., 2010)**. The fresh middle third of leaves were plucked, washed and cleaned, nail varnish was applied to give a thicker surface on both the adaxial and abaxial surfaces and was left to dry for one hour. After drying, the impression left on the polish film produce an excellent detailed image of the epidermis and the surfaces were brought out with the aid of forceps and then placed on microscope slides. Iodine stain was used to detect the presence of stomata **(Johansen, 1940)**.The stained strips were mounted for examination by light microscopy and were prepared for photomicrography as described by **Aworinde & Ogundairo (2009)**.

The stomata index was estimated for the leaf surfaces using **Cutter (1978)** formula *i.e.* by expressing the number of stomata per unit area as a percentage of the total number of epidermal cells.

Stomata index (I) = S / E + S * 100
Where, I = Stomata index
S = number of stomata per unit area
E = number of epidermal cells per unit area.

The guard cell area was calculated by multiplying the length and width of guard cell by **Franco (1939)** constant.
Guard cell area = (length × width × k) μm^2
Where, Franco's constant (k) = 0.78524

The dimensions were measured using a light microscope. The ocular tube of the microscope was fitted with an ocular micrometer which was calibrated using a 2 mm range stage micrometer. This was done by aligning the zero marks of the stage micrometer with that of the ocular. The number of units of the ocular, which aligns with a given unit of the stage micrometer at 400x magnification, was noted. This was used as the conversion factor in the subsequent measurements. At 400x magnification:

44 units of the ocular = 0.15
1 unit of the ocular = 0.15 = 0.003 mm
Therefore, conversion factor at 400x magnification = 0.003mm **(Ajuziogu *et al.*, 2018)**.

Figure (1) Galinsoga parviflora the whole plant

Results and discussion

The morphological variation among the species of *Galinsoga parviflora* was previously mentioned by **(Adnan Al-Rehaily *et al*., 2015)**. The stem is circular shaped with six ribs. The epidermis is unilayered, rectangular cells which are covered by thin cuticle. Trichomes are hair-like appendages that develop from cells of the aerial epidermis and are produced by most plant species **(Werker, 2000)**. There are multiseriate non-glandular trichomes on the epidermis. Due to the desert nature of Jazan region, trichomes may also increase resistance to abiotic stress **(Amir *et al*., 2015)** which may increase tolerance to drought by reducing absorbance of solar radiation **(Ehrlinger, 1984; Choinski & Wise, 1999; Benz & Martin, 2006)(Fig. 2).**

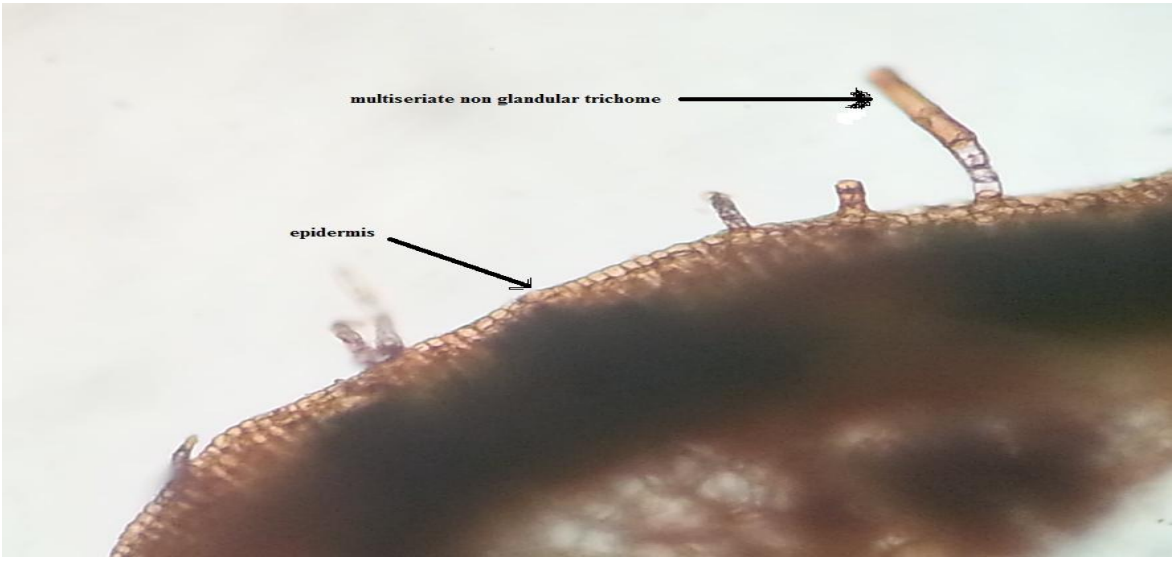

Figure (2) T.S. in the stem showing epidermis and trichomes (in 400x)

The number of collenchyma layers and position are taxonomic important tools **(Shaheen, 2007)**. At the corner of the stem, the external cortex is made up of 1–2 layers of very thin walls of parenchymatous cells; the inner cortex is formed by 5 - 6 very thick laminar collenchyma layers. The endodermis and pericycle are indistinguishable. The stem has 11 vascular bundles. Each one is bicollateral. The sieve elements of each vascular bundle are thin-walled, ovoid and triseriate of 5-6 celled in each one. They are arranged towards the pith where the outermost cells are large in size and the innermost ones are very small. The cambium is not distinguishable. Phloem is located on both sides of the xylem. The pith consists of large polyhedral parenchymatic cells which completely fill the middle of the stem **(Fig. 3).**

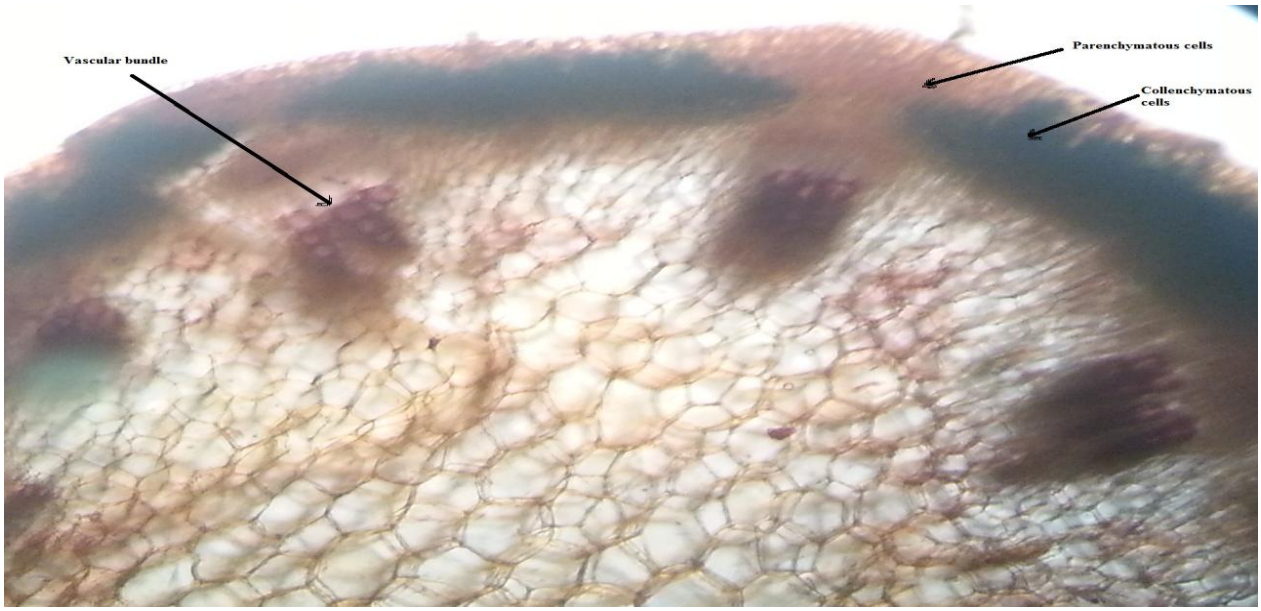

Figure (3) T. S. in the stem showing different types of cells and vascular bundles (in 400x)

The petiole is un-stratified with glabrous papillomatous cells with a laminar collenchyma composed of 2 cell layers. The mesophyll is composed of chlorenchymatous cells that can be arranged into 5-6 strata. The number of vascular bundles is a variable number of side vascular bundles which varied from 7 to 9. They are distributed in a single ring. The xylem is composed of large, thin wall, ovoid elements. The phloem is directed into the pith which has large parenchymatous cells **(Fig. 4)**.

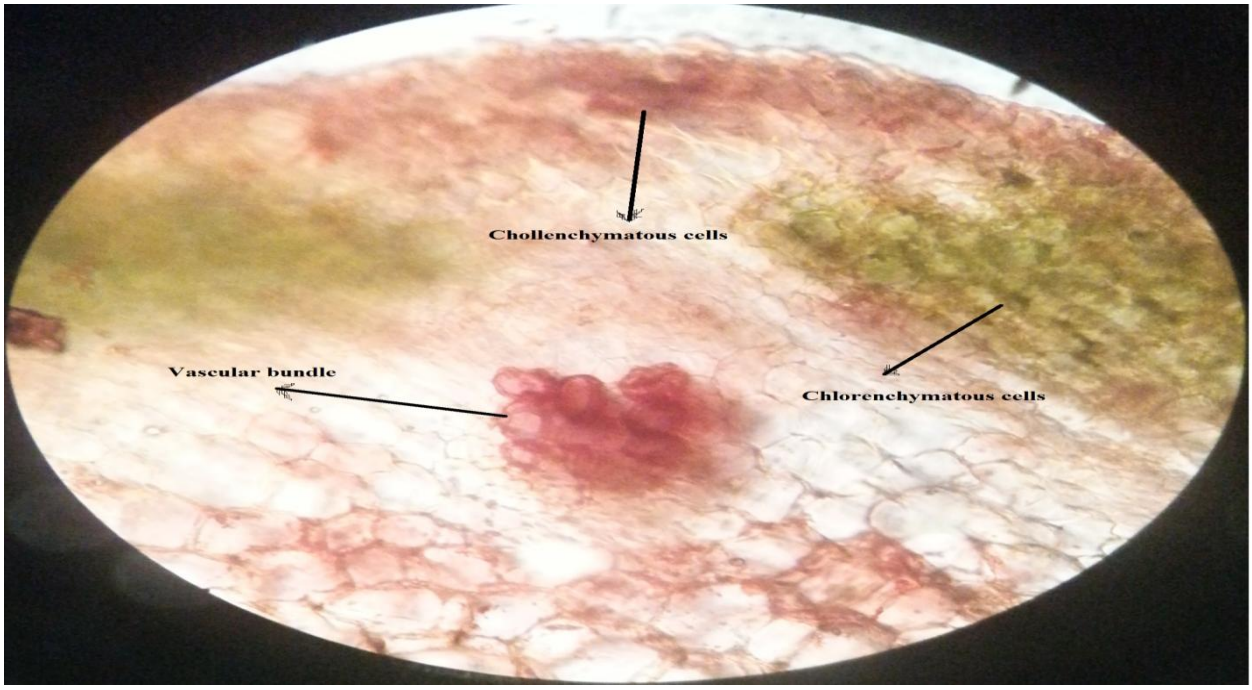

Figure (4) T. S. in the petiole showing different types of cells and vascular bundles (in 400x)

The epidermal cell is irregular and undulating and the anticlinal wall is thin and undulating similar to those reported in several desert plants **(Gibson, 1996)**.

Stomatal diversity is very useful for taxonomic hierarchy at all levels **(Ataslar, 2004)**. Stomata are anisocytic which are surrounded by a girdle of three subsidiary cells. There are many parameters which are obtained. First, stomata frequency was 20-24 and stomata index was 26.82 %. Finally, guard cell measures was 2.62 x 1.31 µm and guard cell area was 2.7 μm^2 **(Fig. 5)**.

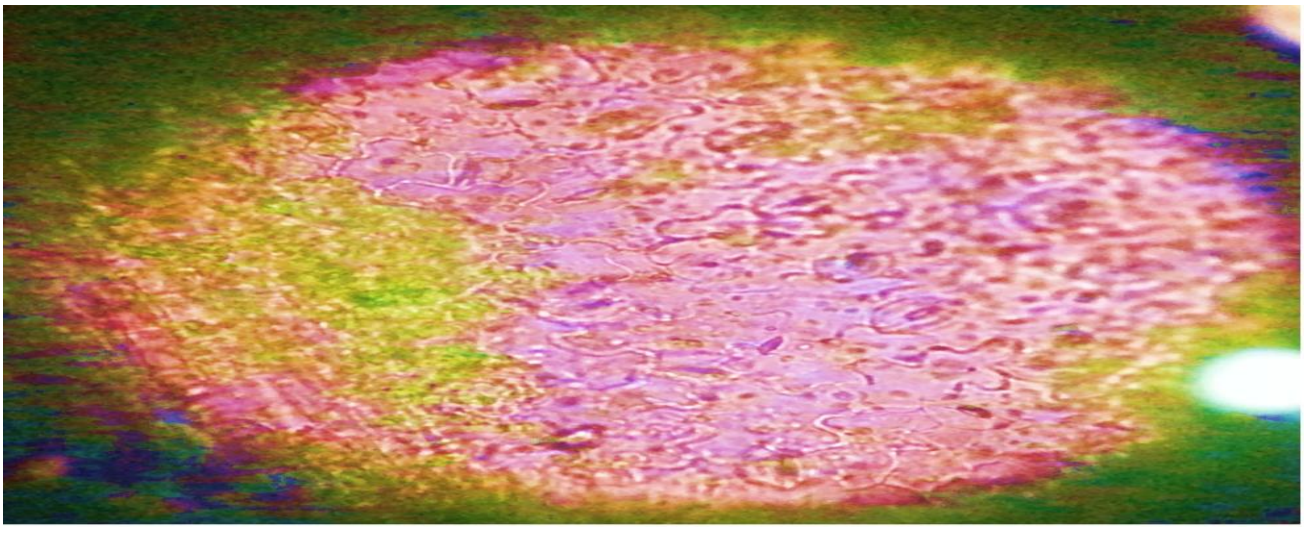

Figure (5) Epidermal cells and stomata (in 400x)

Conclusion

In general anatomical characteristics are regarded as very important diagnostic keys of taxa at all taxonomic levels.The anatomical features of *Galinsoga parviflora* can help in future for more taxonomic details for determining either the inter-phytorelation and intra-phytorelation within *Galinsoga* sp. and Asteraceae family. The mechanical tissue which present in the stem and less in the petiole besides multiseriate non-glandular trichomes may illustrate the adapted features towards the xerophytic habitat.

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