

Study on Morphological and Anatomical Characters of Two Species of Asteraceae Found in Mandalay Region

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Abstract

The morphological and anatomical study on some medicinal plants of the species of *Eclipta alba* (L.) Hassk, and *Wedelia calendulacea* Less. belongs to the Asteraceae family. Anatomical studies on transverse sections of leaf (midribs and petioles), stem and root were conducted at Department of Botany, Yadanabon University. The free hand transverse sections stained with safranin were used in this study. In transverse section of stem, epidermis, hypodermis, endodermis, vascular bundle and pit characters were observed. The vascular bundles were conjoint collateral open type and xylem arrangement showed endarch. In root section, epidermis, cortex (large region), endodermis, vascular bundle and pit characters were observed. The vascular bundle was collateral open type and xylem arrangement showed exarch. In leaf section, Anomocytic stomata type at a large quantity in the abaxial surface more than in the adaxial surface with a cuticle layer. Non-glandular multicellular type of trichomes of leaf and stem were observed in immature stages of plants. The type of stomata, trichome, vascular bundle and the secretory structure of stem and leaf can be identified anatomical characters for taxonomic systematic studies of family Asteraceae.

Keyword: Stomata, Trichome, Epidermis, Vascular bundle

Introduction

Asteraceae (Compositae) is an advanced and botanically highly specialized family of dicotyledons representing mainly herbaceous plants. The Asteraceae family consists of approximately 25000 species (Barroso, 1986) included in over 1100 genera. These species frequently present herbaceous habits, although arboreous and valuable herbaceous habits also occur (Cronquist, 1981). Because of this variety of habits, the family presents various anatomical structures and in some cases ecological specialization may occur (Metcalf and Chalk, 1950). Secretory structures are of great taxonomical interest and their restricted distribution has an important diagnosis value (Metcalf and Chalk, 1950; Fahn, 1979). Frequently, in Asteraceae, they occupy distinct positions in different organs of the plant occurring in all, some or in only one organ (Solereeder, 1908).

Eclipta alba (L.) Hassk. has been traditionally used to check hair loss and stimulate hair growth. *Eclipta alba* (L.) Hassk. (Fam: Compositae) is a small-branched annual herb with white

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flower heads inhabiting tropical and subtropical regions of the world. The extracted juice if taken internally and applied to the scalp blackens the hair (Chopra et al., 1955; Kritikar and Basu, 1975). *Eclipta alba* (L.) Hassk. has been reported in various polyherbal formulation for hair growth promotion. *Wedelia calendulacea* (L.) Less. have the potency of specificity to serve as desirable medicinal food especially for control of various inflammatory activity relative to human health (Baishiyou, 1993; Cheol, 2004; Lee, 1995, 2001, 2004; Shin, 2006; Xiulan, 1997).

The aims of this research are to describe the morphological characters of *Eclipta alba* (L.) Hassk. and *Wedelia calendulacea* Less. of Asteraceae family and to know anatomical characters of stem, leaf and root of *Eclipta alba* (L.) Hassk. and *Wedelia calendulacea* (L.) Less.

Materials and Methods

In this research, the specimens were collected in Maha Aung Myae Township, 2019, October. After the collection, the vegetative and floral parts of fresh specimens were studied and recorded for taxonomic description. The stem, root and leaves were separated and washed them through running tap water. Free hand transverse sections were prepared from fresh samples. The anatomical studies, free-hand sections of the fresh specimens were cut by using a razor blade to obtain thin sections. For preparation of stem and root sections, the parts of stems and roots are sliced into thin transverse sections by hand and all slices were immersed into water containing petridish. Before the microscopic examination, some of the thin slices were cleared by chloral hydrate solution on a glass slide and stained with 1% (w/v) safranin solution for 5 minutes and rinsed with distilled water for 3 minutes in several times to remove excess of stain safranin solution, and add dilute glycerine solution and mounted with a clean cover slip, finally examine under a light microscope. And then, photomicrograph under light microscope with digital camera.

Results

Morphological Characters of *Eclipta alba* (L.) Hassk.

Family	-	Asteraceae
Common name	-	Kyeikhaman
Flowering period	-	January–October

Perennial herbs; stem terete, solid, rotting at the lower joints, strigose. Leaves simple, opposite and decussate, exstipulate, sessile; blades linear, oblong-lanceolate to lanceolate, cuneate at the base, spinulose-serrate along the margin, acute to acuminate at the apex, strigose on both surfaces. Inflorescences terminal or axillary heads, solitary or paired, white, many flowered,

heterogamous; peduncles strigose; involucre bracts, free, unequal, oblong to oblong-lanceolate, acute at the tip, ciliate along the margin, glabrous within, persistent; receptacle convex, palea linear, pale green, persistent. Ray-florets white, pistillate, numerous, uniseriate, zygomorphic; pappus reduced, membranous, white or pale green, persistent. Corolla white, liguliform, membranous; tube slender, limbs linear, obtuse or rounded at the apex, entire along the margin. Ovary pale green, inferior, oblong, laterally compressed, glabrous, unilocular with solitary basal ovule; style long, translucent; stigma recurved, papillose. Disk-florets white, numerous, bisexual, actinomorphic. Pappus reduced, membranous, white or pale green, persistent. Corolla white, funnelform, obtuse at the apex, entire along the margin. Stamens 4, epipetalous, inserted; filaments long, adnate to the below of corolla-tube, translucent; anthers black, dithecous, introrse, dehiscent longitudinally. Ovary as in ray floret. Fruits simple, indehiscent, achenial, oblong or obovate, Seeds non endospermic.

(Table 1, Figure 1).

Morphological Characters of *Wedelia calendulacea* (L.) Less.

Family	-	Asteraceae
Common name	-	Negya-gale
Flowering period	-	throughout the year

Perennial herbs, stem procumbent or ascending, frequently rooting at the nodes, glabrous. Leaves simple, opposite and decussate, exstipulate, subsessile; blade oblanceolate, trinerved, attenuate and subpetiolate at the base, flat or apiculate at the base, flat or apiculate at the apex, shortly appressed hispid on both surfaces. Inflorescences terminal solitary heads, heterogamous; peduncles long, strigose to sericeous. Involucre bracts seriate, entire along the margin, acute or obtuse at the apex, strigose outside and glabrous inside, inner ones lanceolate, scarious more or less ciliate along the margin, acute at the tips and hairy outside; receptacle convex; palea scarious, oblong-lanceolate. Ray-florets head, pistillate; pappus scales basally united into an irregularly toothed cup, persistent; corolla yellow, the limb be toothed, glabrous; ovary cuneate, glandular; style cylindrical, stylar arms linear. Disk-florets bisexual; pappus scales basally united into an irregularly toothed cup; corolla yellow, tubular, the lobes ovate with acute tips, the lobes ovate with acute tips; stamens 5, syngenesious; filaments long, anthers long, entire at the base; ovary inferior, 1-loculed and 1 basal-ovule, laterally compressed; style cylindrical, stylar arms linear, hairy. Fruits simple, indehiscent, achenes, dark brown, rugulose, glabrous. Seeds non-endospermic (Table 1, Figure 1).

**Anatomical Characters of *Eclipta alba* (L.) Hassk. and
Wedelia calendulacea (L.) Less.**

Dermal tissue system was composed of epidermal cells, stomata and trichomes. In leaf section, anomocytic stomata type at a large quantity in the abaxial surface more than in the adaxial surface with a cuticle layer. In transverse section of midrib of *Eclipta alba* present the secretory ducts and the midrib is elevated but relatively flat at the apex. *Eclipta alba* (L.) Hassk has three separate vascular bundles and 5–7 layers of parenchymatous cells in both lower and upper epidermis. In transverse section of midrib *Wedelia calendulacea* (L.) Less. the secretory ducts present and the midrib is flattened at the apex. *Wedelia calendulacea* (L.) Less. has four separate vascular bundles with 5–6 layers and 5–7 layers of parenchymatous cells in upper and lower epidermis. The resin ducts which are usually located near the side of vascular bundles in the midrib. In transverse section, the petioles studied are shallowed crescent shape in outline, concave at the adaxial sides and shallowed lobes at abaxial sides (Table 1, Figure 2, 3).

In cross section of stem, *Eclipta alba* (L.) ground tissue system was composed of cortex, endodermis, pericycle and pith. Cortex composed of outer collenchymatous and inner parenchymatous cells; collenchymatous cells 5 to 8-layered, inner parenchymatous cells 3 to 5-layered. In cross section of stem, *Wedelia calendulacea* (L.) Less. ground tissue system was composed of cortex, endodermis, pericycle and pith. Cortex composed of outer collenchymatous and inner parenchymatous cells; collenchymatous cells 4 to 6-layered, inner parenchymatous cells 3 to 5-layered, the cells oval or rounded, thin-walled, pericycle below the endodermis, the cells polygonal; pith parenchymatous, polygonal or rounded, intercellular spaces present. In cross section of *Eclipta alba* (L.) Hassk. and *Wedelia calendulacea* (L.) Less., the stem was circular shape in outline. The vascular bundle were conjoint collateral open type. The protoxylem lies towards the centre and metaxylem lies towards the periphery of the organ; the xylem arrangement showed endarch. It was observed that the stem of *Wedelia calendulacea* (L.) Less. has resin ducts in the cortex and pith. In addition to resin ducts, the secretory cells can be found in the stem of *Eclipta alba* (L.) Hassk. Non-glandular multicellular trichomes were found in both species of lower and upper epidermis (Table 1, Figure 2, 3).

In cross section of *Eclipta alba* (L.) and Hassk. *Wedelia calendulacea* (L.) Less., the root was circular shape in outline. The vascular bundle was conjoint collateral open type. The protoxylem lies towards the periphery and metaxylem lies towards the centre of the organ; the xylem arrangement showed exarch. It was observed that the stem of *Wedelia calendulacea* (L.) Less. has

resin ducts in the cortex and pit. In addition to resin ducts, the secretory cells can be found in the stem of *Eclipta alba* (L.) Hassk. (Table 1, Figure 2, 3).

Table 1. Summary of macroscopic and microscopic characteristics observed for stem root and leaf tissue of *Eclipta alba* (L.) Hassk. and *Wedelia calendulacea* (L.) Less.

Species		
Characteristics	<i>Eclipta alba</i> (L.) Hassk.	<i>Wedelia calendulacea</i> (L.) Less.
Hair type on leaf blade	appressed pilose	pubescent
Leaf shape	linear-oblong	oblong
Stomata type	Anomocytic	Anomocytic
Glandular trichomes	present	present
Number of ray floret	30-40	20-25
Stem shape	circular	circular
Number of vascular bundles in stem	15-20	12-17
Secretory/ resin ducts	present	present

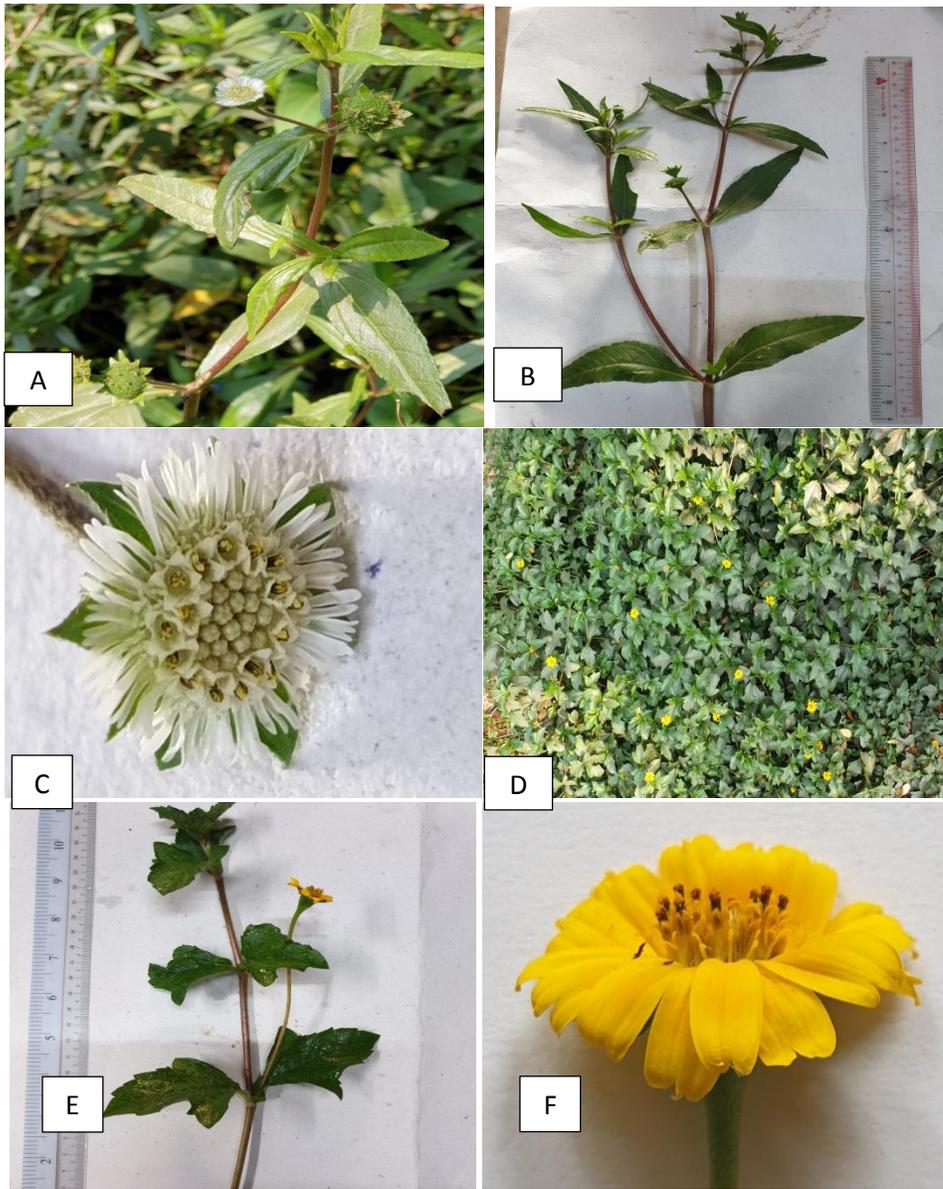


Figure (1) Morphological Characters

Eclipta alba (L.) Hassk.

Wedelia calendulacea (L.) Less.

A. Habitat

D. Habitat

B. Habit

E. Habit

C. Inflorescence

F. Inflorescence

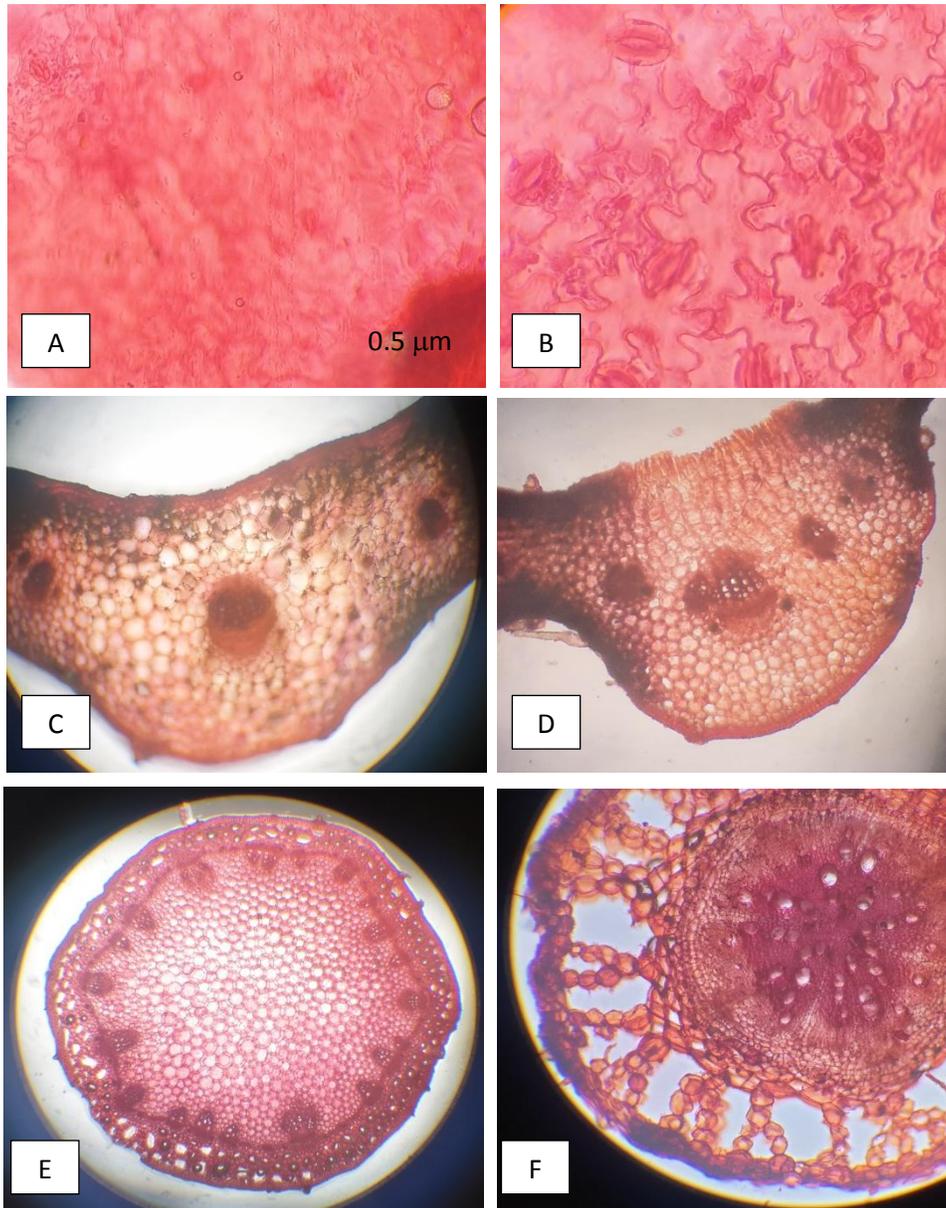


Figure (2) Transverse section of *Eclipta alba* (L.) Hassk.

A. Stomata on adaxial surface of leaf D. Midrib

B. Stomata on abaxial surface of leaf E. Stem

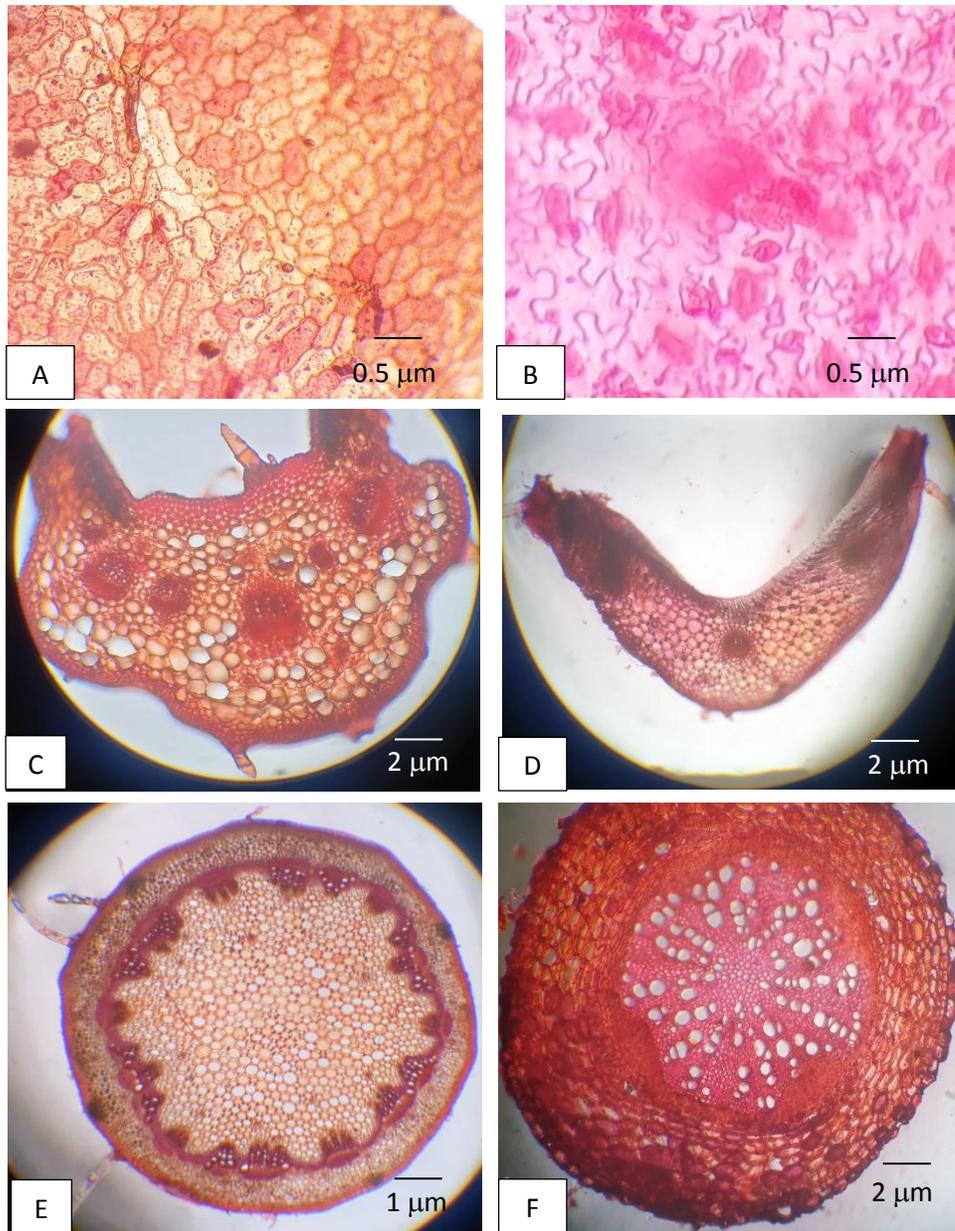


Figure (3) Transverse section of *Wedelia calendulacea* Less.

- | | |
|---------------------------------------|-----------|
| A. Stomata on adaxial surface of leaf | D. Midrib |
| B. Stomata on abaxial surface of leaf | E. Stem |

Discussion and Conclusion

Eclipta alba (L.) Hassk commonly known as False Daisy is a plant belonging to the family Asteraceae. Anatomical Characters of *Eclipta alba* (L.) Hassk. and *Wedelia calendulacea* (L.) Less. it was found that the spongy parenchyma region was made up to parenchymateous cells which were round or oval in shape and were loosely arranged which shows the presence of intercellular spaces. The midrib region reveals the presence of 2-3 layers of compactly arranged cells of collenchyma just between the two layers of epidermis. A well developed vascular bundle was found to be embedded within the midrib region. Both species show the presence of Anomocytic stomata type. It also shows presence of unicellular covering trichomes (Table 1, Figure 2, 3). Trichomes help to reduce water loss and also to reduce the rate of transpiration (Bendre and Kumar, 1997). The stomata control rates of photosynthesis and transpiration by plants and since photosynthesis is a major factor in determining rates of dry matter accumulation, stomata are of prime importance in any consideration of factors decontrolling crop yield (Rahman, 2009). The transpiration stream may also facilitate uptake and transport of salts necessary for nutrition of the plant (Rahman, 2009). They are also widely used in other aspects of taxonomy and have been largely applied to the elucidation of 'phylogenetic' relationships (Davis and Heywood, 1963). It shows following parts as epidermis, cortex, vascular bundle covered with pericyclic fibers and pith. The epidermis is single layered, quadrangular cells. The cortex shows presence of many layers of thin walled cellulose parenchyma and vacuoles. Below cortex lignified pericyclic fibers are present; they cover the vascular bundle so also called as strengthening cells. Below this a well developed vascular bundle is present. Innermost layer of pith consists of large, thin walled, big rounded cells (Table 1, Figure 2, 3).

In both species, secretory structures are of great taxonomical interest and their restricted distribution has an important diagnostic value (Metcalf and Chalk, 1950; Fahn, 1979; Castro *et al.*, 1997; Solereder, 1908). Also, difference in vascular bundle types and presence of secretory cell in the phloem varied from species to species (Makbul *et al.*, 2011). In addition the differences in the midrib shape could be used to classify some members of this family (Noorbakhsh *et al.*, 2008). The glandular trichomes in *Eclipta alba* (L.) Hassk. and *Wedelia calendulacea* (L.) Less. also help the diagnosis of Asteraceae species. Castro *et al.* (1997) presented a description of some types of trichomes occurring in some genera of Asteraceae and used them to elaborate an identification key. Therefore anatomical characters are provided to differentiate plant species. So its values are important for plant classification.

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