Original Research Article

Diversity of trichomes in Calliandra haematocephala Hassk. (Caesalpinioideae DC., Fabaceae Lindl.)

ABSTRACT

Objective: High structural diversity of trichomes in the members of family Fabaceae Lindl. has been a subject of study from decades. The present study was aimed to study structural diversity of trichomes in Power Puff Tree (*Calliandra haematocephala,* Caesalpinioideae, Fabaceae) a pan-tropical ornamental tree

Methods: Plant specimens were collected from the campus of Govind Ballabh Pant University of Agriculture and Technology Pantnagar (India) during the year 2020. Plant species was identified with the help of relevant Floras. Fresh plant material was used for vestiture and trichome study under light microscope using standard anatomical procedures. Illustrations of trichomes were drawn by using prism type camera lucida and photographs were taken at different magnifications. Standard terminology of trichomes (Payne, 1978) was adopted to describe different structural types.

Results: Nine different types of glandular and non-glandular trichomes were recorded in *Calliandra haematocephala* Hassk. Four different vestiture types were recorded on the surfaces of studied parts. Trichomes were found present in all vegetative parts and some reproductive parts *viz*; peduncle, bracts, bracteole, petals while other reproductive parts like sepals, filaments, anther, ovary, style and stigma were found completely glabrous.

Keywords: **Keywords: *Calliandra*; *Trichomes*; *Vestiture*; *Glandular*; *Nonglandular*.**

1. INTRODUCTION

A well established term in botanical literature 'trichome' refers to a kind of epidermal outgrowth or appendages of a plant surface which are of diverse form, structure and function (1). Trichomes may occur on all parts of a plant, either they persist throughout the life of an organ, or they are ephemeral. Trichome types have been successfully used in the classification of genera and even of species in certain families and in the recognition of interspecific hybrids (2,3,4). Trichomes are micromorphological characters which can be used to identify plant species when the plant lacks its floral structures (5,6). *Calliandra haematocephala* Hassk. is a

member of genus *Calliandra* belonging to subfamily Caesalpinioideae DC. of the family Fabaceae. *Calliandra haematocephala* is a 1-3 meters high evergreen, shrub, with spreading and pendulous branches, forming a dense round head. Leaves are alternate, stipulate, petiolate, compound and bipinnate. Flowers are sessile and arranged in small, dense flower heads, watermelon pink with numerous silky stamens, fruit is a compressed legume (7) (Figure.1). Various pharmacological properties of leaves have been reported in *Calliandra haematocephala* such as analgesic, anticonvulsant, antipyretic, anti-ulcer and antioxidant (8, 9). Leaf extracts of *Calliandra haematocephala* have antiviral activity against RV infection *in-vitro* (9). Leaves of *Calliandra haematocephala* have been found to be a novel source of the synthesis of zinc oxide nanoparticles and to detect the presence of hydrogen peroxide in various samples (10). Though, several macromorphological and pharmacological studies has been conducted for *Calliandra haematocephala,* detailed information of micromorphological characters like surface indumentum and trichome morphology is not well investigated. Present study was conducted to explore the structural diversity and distribution of trichomes, and vestiture types on the surfaces of all vegetative as well as reproductive parts to fill the void in information regarding micromorphology of *Calliandra haematocephala*.

Figure- 1. *Calliandra haematocephala* Hassk.

2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

Plant specimens were collected from campus of Govind Ballabh Pant University of Agriculture and Technology Pantnagar (India). Processing of plant specimens was done following standard taxonomic procedures (11). Plant species was identified with the help of relevant Floras and herbarium consultations at the herbaria of Botanical Survey of India, Northern Regional Center, Dehradun (BSD) and Forest Research Institute, Dehradun (DD). Voucher specimens were deposited in the herbarium of Department of Biological Sciences, Govind Ballabh Pant University of Agriculture and Technology Pantnagar, Uttarakhand, India. Fresh plants materials were used for vestiure and trichome study. Epidermal surfaces of each and every part were gently peeled off using razor blade. Peels were washed carefully and stained with aqueous safranin for 2-4 minutes. Stained epidermal peels were mounted in glycerine, covered and sealed with transparent nail polish to prevent dehydration. Prepared slides were examined under the light microscope in 4x, 10x, 40x, 100x objective and photomicrographs were obtained using Olympus MLX-B Plus microscope fitted with cell phone camera. Exact illustrations of trichome morphology were drawn by using prism type camera lucida at 10x magnification of objective lens. Trichomes were measured after appropriate calibrations using stage and ocular micrometer. For the description of vestiture, arrangement, position of trichomes on plant surfaces, shape and size standard taxonomic terminology given by Beentje (2010) and Payne (1978) with some required modifications was used.

3. RESULTS AND DISCUSSION

Nine different types of trichomes were recorded- I) Glandular, multicellular, biseriate, colleter (MCO) which are 75-90 µm long, porrect, straight and recorded on peduncle and margin of petal (Figure-2.G1,G2,G3; Figure-3.A). II) Glandular, multicellular, uniseriate, brevicollate trichomes (MBR) which are 45-60 µm long, appressed, straight and recorded only on peduncle (Figure-2. J1, J2; Figure-3. B). III) Non-glandular, unicellular, uniseriate, attenuate trichomes(UAT) which are 75-600 µm long, straight and recorded on stem, leaflet margin (porrect), stipule, petiole, petiolule, rachis, abaxial surface of leaflet (spreading), adaxial surface of leaflet and bracteole (appressed) (Figure-2. A1, A2; Figure-3.C). IV) Non-glandular, unicellular, uniseriate, simple-acuminate (UAU) trichomes which are 120-225 µm long, straight and recorded on abaxial surface of leaflet (porrect), bracts and peduncle (oriented in different directions) (Figure-2.B1,B2; Figure-3. E). V) Non-glandular, unicellular, uniseriate, simple-muticose (UMU) trichomes which are 150-420 µm long, appressed and recorded only on peduncle (Figure-2. H1). VI) Non-glandular, multicellular, uniseriate, simple-subulate trichomes (MSU) which are 75-420 µm long, straight and recorded on peduncle (appressed) and abaxial surface and margin of petal (porrect) (Figure-2. C1,C2; Figure-3.D). VII) Non-glandular, multicellular, uniseriate, acuminate with cushion

trichomes (MCA) which are 480-600 µm long, arcuate, oriented in different directions and recorded only on peduncle (Figure-2.D1, D2; Figure-3.F). VIII) Non-glandular, unicellular, uniseriate, stalked-muticose trichomes (USM) which are 150-270 µm long, straight, appressed and recorded on peduncle (Figure-2. F1; Figure-3.G). IX) Non-glandular, unicellular, uniseriate, stalked-acuminate trichomes(USA) which are 180-270 µm long, tortuous, ascending and recorded on peduncle and bracts (Figure- 2. E1, E2; Figure-3.H).

Present study shows all vegetative and some reproductive parts of *Calliandra haematocephala* bear one or more different types of glandular and non-glandular trichomes (Figure 2 & 3). Two types of trichomes are glandular while seven types of trichomes are no-glandular in nature. Glandular trichomes were restricted to peduncle and petal margin in distribution but non-glandular trichomes were more common and recorded on most of the surfaces. Stem of *Calliandra haematocephala* bear only one type of trichomes (non-glandular, attenuate type) which were also recorded on other studied parts but their orientation on stem was porrect and the vestiture formed by such type of trichomes on surface was puberulent. The vestiture type recorded on both the surfaces of leaflets (pinna) was puberulent which do not show any taxonomic significance but two surfaces of leaflet can be differentiated on the basis of trichome observation as abaxial surface of leaflets has two different types of non-glandular trichomes with different orientations and adaxial surface of leaflets has only one type of trichome and their orientation was appressed. Rachis also bears same type of trichomes with similar orientation but forming lanate type of vestiture on surface. Eight types of trichomes were found present forming strigose type of vestiture on the surface of peduncle. The orientation of all types of trichomes on peduncle was found different. Along the margins and abaxial surface of petals show presence of glandular (colleters) and non-glandular (simple subulate) type of trichomes. Table-1 shows vestiture and trichome types on studied plant parts. El-Mary *et al*. (2003) have also reported non-glandular, unicellular tricomes and stalked glandular trichomes on stem and leaves of *Calliandra haematocephala* cultivated in Egypt. The present study, however, could not confirm the presence of glandular trichomes on leaves and petiole as these were recorded on only peduncle and petal margins. The complete structural diversity of trichomes (nine types) as observed in present work was not observed and reported by El-Mary *et al*. (2003). Shaheen *et al*. (2020) have also studies leaves of 30 Fabaceae species from Pakistan which included *Calliandra bella* but the authors surprisingly realized very little variations in trichomes reporting generally non-glandular trichomes which are multicellular, uniseriate, unbranched, with bulbous base and pointed tips.

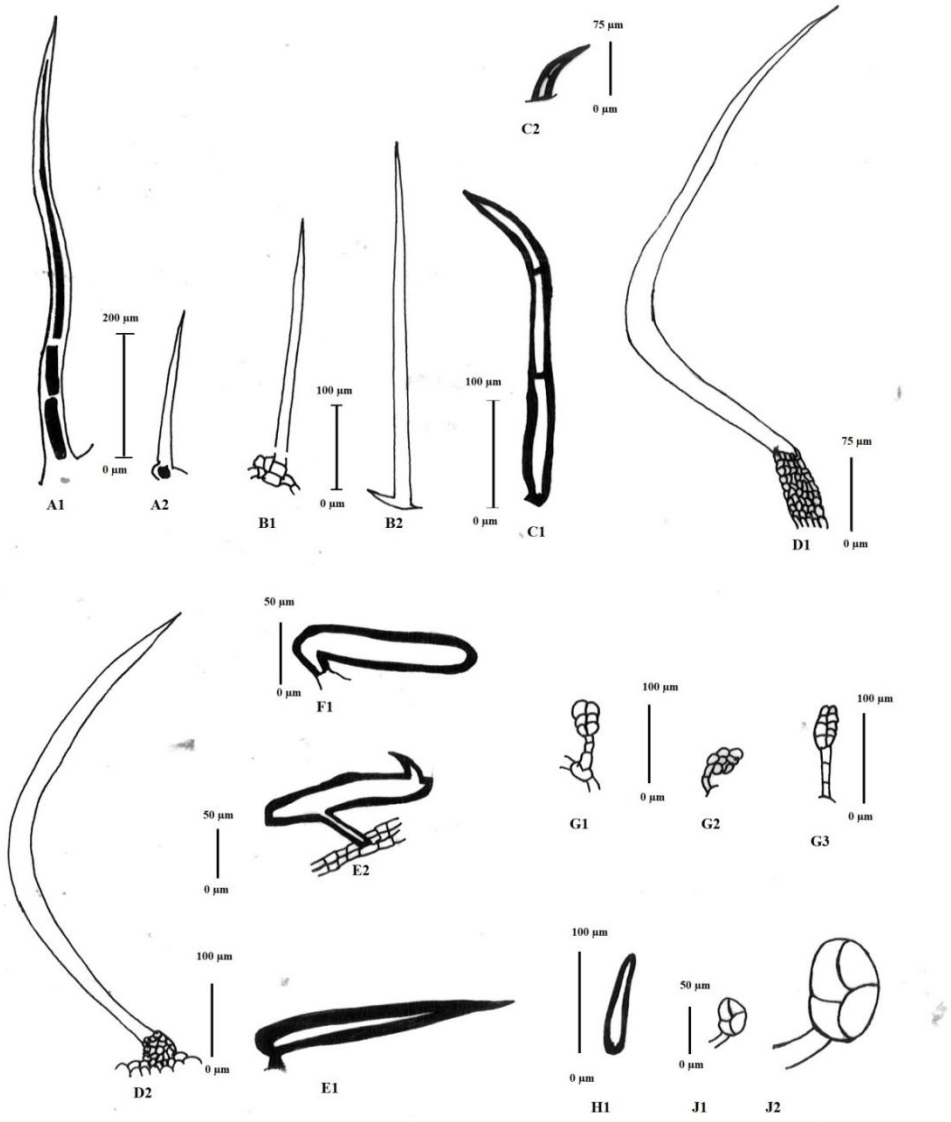

Figure-2. Structural diversity of trichomes in *Calliandra haematocephala*. A1, A2: Non-glandular, unicellular, uniseriate, attenuate; B1, B2: Non-glandular, unicellular, uniseriate, simple-acuminate; C1, C2: Non-glandular, multicelluar, uniseriate simple-subulate; D1, D2: Non-glandular, multicellular, uniseriate, acuminate with cushion; E1, E2: Non-glandular, unicellular, uniseriate, stalked, acuminate; F1: Non-glandular, unicellular, uniseriate, stalked, muticose; G1, G2, G3: Glandular, multicellular, biseriate, colleters; H1: Non-glandular, unicellular, uniseriate, simple-muticose; J1, J2: Glandular, multicellular, uniseriate, brevicollate.

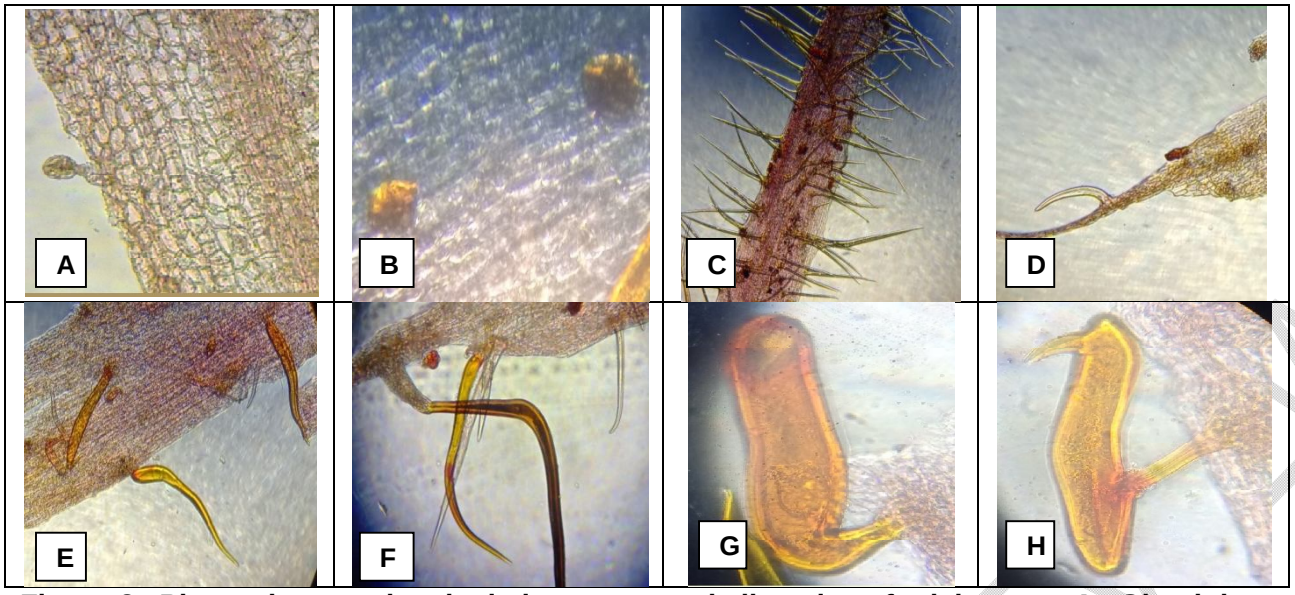

Figure-3. Photomicrographs depicting structural diversity of trichomes. A: Glandular, multicellular, biseriate, colleters; B: Glandular, multicellular, uniseriate, brevicollate; C: Non-glandular, unicellular, uniseriate, attenuate; D: Non-glandular, multicelluar, uniseriate, simple- subulate; E: Non-glandular, unicellular, uniseriate, simple-acuminate; F: Non-glandular, multicellular, uniseriate, acuminate with cushion; G:- Non-glandular, unicellular, uniseriate, stalked- muticose; H- Non-glandular, unicellular, uniseriate, stalked-acuminate.

Table 1. Vestiture type and types of trichomes in different studied parts.

Plant part	Vestiture type	Types of trichomes
Stem	Puberulent	Type-III
Stipule	Puberulent	Type-III
Petiole	Puberulent	Type-III
Petiolule	Puberulent	Type-III
Leaflet (Abaxial surface)	Puberulent	Type-III, IV
Leaflet (Adaxial surface)	Puberulent	Type-III
Leaflet (Margin)	Evenly distributed	Type-III
Rachis	Lanate	Type-III
Peduncle	Strigose	Type-I, II, IV,V,VI, VII, VIII, IX
Bracts	Puberulent	Type-III, IV, IX
Bracteole	Strigose	Type-III
Sepal (Abaxial surface)	Glabrous	
Petal (Abaxial surface and margin)	Puberulous & Puberulent	Type-I,VI
Filaments	Glabrous	
Anther	Glabrous	
Ovary	Glabrous	
Style	Glabrous	
Stigma	Glabrous	

4. CONCLUSION

The present study revealed the presence of nine different types of glandular (two types) and non-glandular (seven types) trichomes in *Calliandra haematocephala*. Peduncle was the part showing maximum structural diversity of trichomes by bearing eight different types of trichomes on its surface while filaments, anthers, ovary, style and stigma were completely glabrous. These micromorphological characters and vestiture types observed on the surfaces of different plant parts are diagnostic to distinguish and separate the species even when they are sterile or fragmentary.

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