ORIGINAL ARTICLE

Morphological and Anatomical Studies of Stem of *Ageratum conyzoides*

Saurabh Satija[1], Saloni Kamboj[2], Jaspreet Kaur[1],Sanchit Mahajan[3], Neeta[4], Neha Sharma[1], Navneet Khurana[1], Manish Vyas[1], Meenu Mehta[1]*

[1]Department of Pharmaceutical Sciences, Lovely Professional University, Phagwara - 144 411, Punjab, India, [2]Department of Pharmaceutical Sciences, Guru Nanak Dev University, Amritsar – 143 001, Punjab, India, [3]Prime Healthcare, San Diego, California, USA, [4]Department of Pharmaceutical Sciences, Maharshi Dayanand University, Rohtak – 124 001, Haryana, India

Abstract

Context: *Ageratum conyzoides* Linn. (Asteraceae) is an important medicinal plant used in African traditional medicine for healing mental and infectious disorders. **Objective:** The objective of this work was to contribute to the pharmacobotanical standardization of *A. conyzoides*. **Materials and Methods:** Cross sections of the stem were obtained, by hand, for microscopic characterization of the stem. Powder microscopical characteristics were studied by microscope and scanning electron microscopy. Macroscopic characters and physiochemical standards of drug were also studied through standard methods mentioned in the WHO. **Results and Discussion:** Morphology of *A. conyzoides* showed that the outer surface of the stem was light green and inner surface was cream white in color, having slight bitter taste, and aromatic odor. Acicular calcium oxalate, sclerenchyma, thin long fibers, and hexagonal cork cells were observed in powder microscopy. Scanning electron microscopy showed the arrangement of vascular tissue in transverse section of the stem. **Conclusion:** These anatomical features are useful for the diagnosis of the species and provide support to their quality control.

Key words: Standardization, *Ageratum conyzoides*, Pharmacognostic, Microscopic, Morphological

INTRODUCTION

Asteraceae is a vast plant family that comprises roughly 1500 genera and 25,000 species in different habitats.[1] Members of family are mostly herbaceous plants, but some shrubs and climbers are also present. Vegetation of this family easy to distinguish as they have characteristic inflorescence.[2] Ageratum is one of the genera in the family[3] which is commonly known as "billygoat weed," "mentrasto," and "catinga-de-bode."[4] It is widely used as traditional remedy in several countries around the world. It is used as a purgative, febrifuge, anti-inflammatory, analgesic, anesthetic, and in the treatment of ulcers.[5]

Ageratum conyzoides is an annual branching herb grown in different western countries because of its wide adaptability,[6] superior reproductive potential, and allelopathy.[7] The plant contains variety of secondary metabolites which include alkaloids, tannins, coumarins, flavonoids, and mono- and sesquiterpenoids.[7-11] Some other properties of plant extract are also reported such as antibacterial activity,[12,13] antifungal activity,[14] healing,[15] and anticancer activity.[12] Studies show that antimicrobial activity of the plant is due to the presence of essential oil. The main constituents reported in essential oil the chromenes, precocene I and precocene II, and the sesquiterpenes caryophyllene, and germacrene-D.[16] As this plant had multifarious biological activities and used traditionally to treat various ailments, therefore, it must be authenticated and standardized to avoid any kind of adulteration. Taking in view its importance, this study was designed to evaluate pharmacognostic parameters and develop its monograph.

Address for correspondence:
Dr. Meenu Mehta, School of Pharmaceutical Sciences,
Lovely Professional University,
Phagwara – 144 411, Punjab, India.
Phone: +91-7988924829. E-mail: meenu18288@gmail.com

Received: 25-02-2018
Revised: 30-03-2018
Accepted: 14-04-2018

MATERIALS AND METHODS

Plant material

The dried plant of *A. conyzoides* was collected from Sri Venkateswara University Tirupati, Andhra Pradesh and authenticated by the Dr. K. Madhava Chetty, Assistant professor, Department of Botany; Sri Venkateswara University Tirupati. A voucher specimen was prepared and deposited in the herbarium, Guru Nanak Dev University, Amritsar, Punjab, under the collection number 993.

Pharmacognostic evaluation

Macroscopic characters

Morphological characteristics such as color, odor, and taste of the dried stems of *A. conyzoides* were observed with naked eye or with the aid of a magnifying lens.

Microscopic characters

Transverse sections of stems of *A. conyzoides* were cut and placed on glass slide. Few drops of chloral hydrate were added and just warmed it to obtain clear sections. Few drops of glycerin were added (mounting agent). Further staining of thin section was done by safranin dye or fast green for staining xylem and phloem cells, respectively, and visualized under scanning electron microscope (Zeiss Company. EVO/LS10).

Powder microscopic characters

Prepared glass slides were observed under the microscope (Magnus Ltd.). The powdered plant material was also treated with various reagents for the evaluation of microscopic features of the powdered plant material.

Physical Evaluation

Ash values

Ash values are helpful in determining the quality and purity of a crude drug, especially in the powdered form. The objective of ash values of vegetable drugs is to determine the inorganic matter present in the drug. On incineration, crude drugs normally leave an ash usually consisting of carbonates, phosphates, sulfates and silicates of sodium, potassium, calcium, and magnesium.[17]

Extractive values

The extracts obtained by exhausting crude drugs are indicative of approximate measures of their chemical constituents. Varieties of chemical compounds are available in crude drugs having variable properties. Various solvents are used for extraction of various chemical compounds in a particular amount.[18]

Loss on drying

The moisture content of a crude drug will be responsible for decomposition of crude drugs either producing chemical change or microbial growth. Hence, the moisture content of a drug should be determined and controlled. The moisture content is determined by heating a drug at 105°C in an oven to a constant weight.[19]

RESULTS AND DISCUSSION

Macroscopic characters

Standardization is an important step for authentication and identification of plants. Macroscopy of stem of *A. conyzoides* was carried out using naked eye and the characteristics observed are: stems are round shaped, hairy, and solid [Table 1].

Microscopic characters

Microscopic characters of transverse section of the stem were studied using scanning electron microscope, and the transverse section of stem showed the presence of cork cells and pith [Figure 1a], phloem and xylem vessels [Figure 1b], fiber [Figure 1c], and cork cells [Figure 1d].

Table 1: Organoleptic features of stem of *A. conyzoides*

Organoleptic Features	Dry stem
Color	Outer surface: Light green Inner surface: Creamish white
Odor	Aromatic
Taste	Slightly bitter
Shape	Hairy, cylindrical with enlarged nodes

A. conyzoides: Ageratum conyzoides

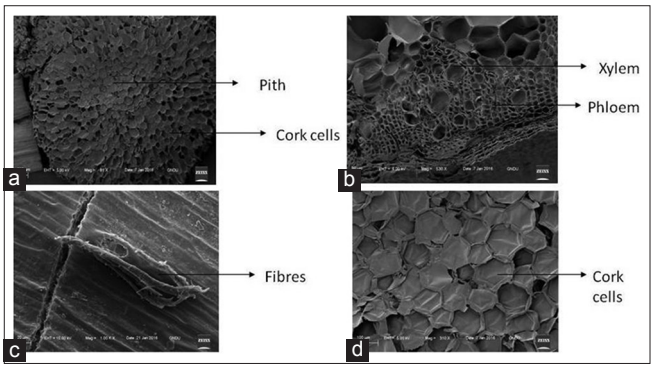

Figure 1: Scanning electron microscopy of the stem of *Ageratum conyzoides* (a) transverse section of the stem showed pith and cork cells (b) phloem and xylem vessels (c) fiber (d) cork cells

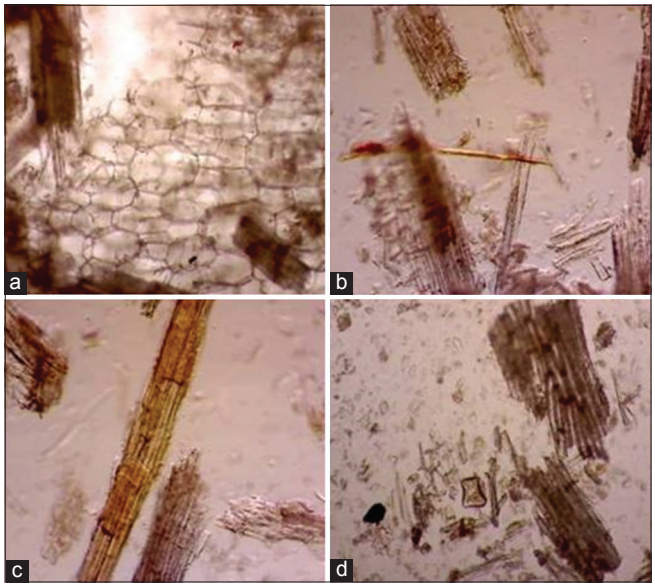

Figure 2: Powder microscopy of stem of *Ageratum conyzoides* showing (a) cork cells (b) fiber (c) sclerenchyma (d) calcium oxalate crystals

Table 2: Physical parameters of dried stems of *A. conyzoides* and their percentage yield

Physical parameter	% age yield w/w
Alcohol soluble extractive	5.52
Water-soluble extractive	11
Ether soluble extractive	2
Chloroform-soluble extractive	2.16
Total ash	9.75
Acid-insoluble ash	0.75
Water soluble ash	0.65
Loss on drying	6.03

Powder microscopy

Powder of *A. conyzoides* stem was studied using microscope under ×10 magnification. It revealed the presence of cork cells [Figure 2a], fiber [Figure 2b], calcium oxalate crystal [Figure 2c], and sclerenchyma [Figure 2d].

Physical parameters

Physicochemical study is an important part of the standardization of plant material. Ash value tests are useful for the determination of quality and purity of a crude drug.[20] Total ash gives idea about the inorganic matter present in plant material and acid insoluble ash tells about the silica present in the powdered plant. Results showed that the total ash value was 9.75%, acid insoluble ash was 0.75%, and water-insoluble ash was 0.65%. Extractive value was mainly used for the evaluation of crude drug, especially for the determination of the amount of the active constituents of crude drug. The ether soluble extractive value of *A. conyzoides* was 2%, chloroform soluble extractive value was 2.16%, alcohol soluble extractive value was 5.52, water-soluble extractive value was 11%, and loss on drying was 6.03%. The air-dried powdered stem of *A. conyzoides* was subjected to physical evaluation and the results obtained are shown in Table 2 given below.

The standardization process involves all the quality control parameters which are helpful in the authentication of plant material. All these parameters are necessary to ensure the quality and purity of a plant material and to supply medicinal plants of good quality having uniform efficacy.

CONCLUSION

All the above diagnostic macroscopic, microscopic features and pharmacognostic parameters could be a useful tool for the identification, authentication, and preparation of suitable monograph of *A. conyzoides*. This study would also helpful to check the adulteration of this important medicinal plant and is of much importance for further research on this plant.

REFERENCES

1. Souza VC, Lorenzi H. Systematic Botany: Illustrated Guide for Identification of Families of Native and Exotic Phanerogams in Brazil, Based on APG III. 3rd ed. Nova Odessa, Sao Paulo: Plantarum Institute; 2012. p. 768.
2. Venable DL, Levin DA. Morphological dispersal structures in relation to growth habit in the Compositae. Plant Syst Evol 1983;143:1-16.
3. Okunade AL. *Ageratum conyzoides* L. *Asteraceae*. Fitoterapia 2002;73:1-16.
4. Asicumpon. The Association for Scientific Identification, Conservation and Utilization of Medicinal Plants of Nigeria Checklist of Medicinal Plants of Nigeria and their uses. Abakpa-Enugu: Trinity-Biz Publishers; 2005.
5. Leitao F, Leitao SG, Fonseca-Kruel VS, Silva IM, Martins K. Medicinal plants traded in the open-air markets in the state of Rio de Janeiro, Brazil: An overview on their botanical diversity and toxicological potential. Rev Bras Pharmacogn 2014;24:225-47.
6. Kong C, Liang W, Hu F, Xu X, Wang P, Jiang Y, Xing B. Allelochemicals and their transformations in the *Ageratum conyzoides* intercropped citrus orchard soils. Plant Soil 2004;264:49-157.
7. Gonzalez AG, Aguiar ZE, Grillo TA, Luis JG, Rivera A, Calle J. Chromenes from *Ageratum conyzoides*. Phytochemistry 1991;30:1137-9.
8. Kasali AA, Winterhalter P, Adio AM, Knapp H, Bonnlander B. Chromenes in *Ageratum conyzoides*. Flavr Fragr J 2002;17:247-50.
9. Moreira MD, Picanc MC, Barbosa LCA, Guedes RN, Barros EC, Campos MR. Compounds from *Ageratum conyzoides*: Isolation, structural elucidation and

insecticidal activity. Pest Manag Sci 2007;63:615-21.
10. Nour AM, Khalid SA, Kaiser M, Brun R, Abdalla WE, Schmidt TJ, *et al*. The antiprotozoal activity of methylated flavonoids from *Ageratum conyzoides* L. J Ethnopharmacol 2010;129:127-30.
11. Bosi CF, Rosa DW, Grougnet R, Lemonakis N, Halabalaki M, Skaltsounis AL, *et al*. Pyrrolizidine alkaloids in medicinal tea of *Ageratum conyzoides*. Rev Bras Pharmacogn 2013;23:425-32.
12. Adetutu A, Morgan WA, Corcoran O, Chimezie F. Antibacterial activity and *in vitro* cytotoxicity of extracts and fractions of *Parkia biglobosa* (Jacq.) Benth. stem bark and *Ageratum conyzoides* Linn. leaves. Environ Toxicol Pharmacol 2012;34:478-83.
13. Odeleye OP, Oluyege JO, Aregbesola OA, Odeleye PO. Evaluation of preliminary phytochemical and antibacterial activity of *Ageratum conyzoides* (L.) on some clinical bacterial isolates. Int J Eng Sci 2014;3:1-5.
14. Morais WC, Lima MA, Zanuncio JC, Oliveira MA, Braganc MA, Serrao JE, *et al*. Extracts of *Ageratum conyzoides*, *Coriandrum sativum* and *Mentha piperita* inhibit the growth of the symbiotic fungus of leaf-cutting ants. Ind Crops Prod 2014;65:463-6.
15. Arulprakash K, Murugan R, Ponrasu T, Iyappan K, Gayathri VS, Suguna L. Efficacy of *Ageratum conyzoides* on tissue repair and collagen formation in rats. Clin Exp Dermatol 2012;37:418-24.
16. Liu XC, Liu ZL. Evaluation of larvicidal activity of the essential oil of *Ageratum conyzoides* L. Aerial parts and its major constituents against *Aedes albopictus*. J Entomol Zool Stud 2014;2:345-50.
17. Momin RK, Kadam VB. Determination of ash values of some medicinal plants of genus *Sesbania* of Marathwada region in Maharashtra. J Phytol 2011;3:52-4.
18. Joseph L, George M. Pharmacognostical profiling of *Geranium ocellatum* leaves. Int J Aromat Med Plants 2011;3:351-4.
19. WHO. Quality Control Methods for Medicinal Plant Material. Geneva, England: World Health Organization; 2010.
20. Kokate CK, Purohit AP, Gokhale SB. Analytical Pharmacognosy. 30th ed. Pune, India: Nirali Publication; 2005. p. 199.

Source of Support: Nil. **Conflict of Interest:** None declared.