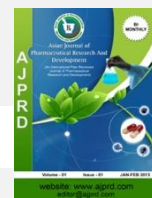


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Research Article

PRESENCE OR ABSENCE OF STONE CELLS IN THE ROOTS OF INDIAN ACONITES: AN AID TO IDENTIFICATION OF SPECIES

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ABSTRACT

The species of the genus *Aconitum* are commonly and collectively called Aconites in trade. Aconites are known to people since antiquity as deadly poisonous plants. They are being used world-wide either as an arrow poison to kill the wild animals illegally or to heal human beings legally. After detoxification of the roots of Aconites using conventional methods, they are being used in different traditional systems of medicine such as Chinese, Japanese, Nepalese, Ayurveda, Siddha, Unani and Tibetan, in addition to tribal and folk medicines. The roots of Aconites are highly exploited from wild sources and are traded illegally. Identification of traded roots of Aconites is a difficult task. To overcome this botanical problem, anatomical characters may be used. Sclereids, particularly brachysclereids are popularly known as stone cells because of their hardness. Stone cells protect other cells/tissues of the plants or plant parts. Since the presence of stone cells in plants is considered as one of the constant characters (marker characters), which may be very well utilized for identification or authentication of tuberous roots of Aconites. The present study highlights the presence or absence of stone cells (brachysclereids) in the tuberous storage roots of Indian Aconites as an aid for the identification or authentication at species level.

Keywords: *Aconitum*, Aconites, Stone cells, Sclereids, Brachysclereids, Identification.



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INTRODUCTION

The herbaceous genus *Aconitum* L. belongs to the family Ranunculaceae. It comprises of about 400 species world-wide [4]. In India, it is represented by 27 species, and distributed in the alpine and subalpine regions of Himalayas. In trade, the roots of the the genus *Aconitum* are commonly called Aconites [6,8].As the roots of Aconites are deadly poisonous, paste made from crude roots has been used as arrow poison since antiquity. Consumption of crude tuberous roots of Aconites is fatal, as they directly act on the central nervous system of our body. Prior to the use of the crude roots of Aconites in medicine, they are processed using traditional methods. Aconite roots have been used in both traditional as well as modern systems of medicine, in addition to folk and tribal medicines.

Aconites can be used to treat hundreds of common diseases and disorders in general. However, in particular, they can be used to treat two main painful medical conditions, viz., Arthritis and Neuralgia [1,9,10]. Taxonomists generally depend on morphological features of leaves, flowers and fruits to identify the Indian aconites. Since the market samples consist of only crude/raw roots, identification of species using morphological characters is difficult, but they could be identified through anatomical characters. Anatomical characters are of great value in establishing botanical identity and also to check adulteration of crude drugs that are common in crude drug trade. The constant and unique anatomical characters that are found in certain plants/plant parts can be used as marker characters to delimit the individual species from its allied species [5].

Generally, roots of flowering plants are not distinguished into mother roots or daughter roots. However, most of the Aconites possess a pair of tuberous roots and are called mother root and daughter root by traders and researchers. Further, the tuberous roots of Aconites exhibit anomalous anatomical characters, which can be used for the identification of the species.

The three basic types of tissues in plants, viz., dermal, vascular and ground tissues are arranged in a specific pattern and they vary from species to species. These structural variations are utilized by the anatomists for the identification/authentication of plants/plant parts that are traded in their crude form. In addition to these, three usual basic tissues, certain unusual structures are also seen in some of the plants/plant parts, which make those plants/plant groups unique anatomically. One such unique structural feature is the presence of stone cells in the roots of Aconites. These structures could be very well used for the identification/authentication of crude roots of Aconites at species level.

Sclerenchyma cells are one of the important supporting tissues in plants. Sclereids are one of the derivatives or modifications of the sclerenchyma cells that give strength to some of the plant parts. Sclereids are common in fruits, seeds and also in leaves. Sclereids vary widely in shape, size and wall characteristics. Sclereids are categorized into four types, viz., brachysclereids (stone cells), macrosclereids (elongated rod-like cells), osteosclereids (bone-shaped cells) and astrosclereids (star-shaped cells). Brachysclereids (stone cells) are short, roughly isodiametric, resembling parenchyma cells in shape, widely distributed in cortex, phloem, pith of stems and in the flesh of fruits [2].

MATERIALS AND METHODS

The plant materials (roots) required for the present study were collected from different parts of Indian region of Himalayas by undertaking field tours, which were identified by consulting national and state floras and also by comparing with the authentic specimens deposited in different recognized Indian herbaria, viz., Central National Herbarium, Botanical Survey of India, Howrah (CAL); Botanical Survey of India, Dehra Dun (BSD); Botanical Survey of India, Gangtok (BSHC); National Botanical Research Institute, Lucknow (LWG) and University of Kashmir, Srinagar (KASH). The voucher herbarium specimens are deposited at CAL and the crude roots of Aconites are deposited in the Crude Drug Museum (CDM) of Pharmacognosy Unit, Botanical Survey of India, Howrah.

Customary procedure of microtomy was employed for studying the anatomical features of Aconites [3,7]. Trinocular compound microscope (Olympus CX41 microscope) was used to study anatomical features of

roots of Indian Aconites. For normal structural observations, bright field was used, and for the study of lignified cells, especially stone cells, polarized light filters was employed.

RESULTS AND DISCUSSION

In Indian Aconites, the stone cells are mostly present and rarely absent in the mother tuberous roots, meanwhile they are mostly absent and rarely present in the daughter roots. Therefore, the mother roots of Aconites were taken up for the present study. Based on the presence or absence of sclereids (stone cells) in the tuberous roots of Aconites, they may be categorized into three different types/groups, viz., stone cells present outer to the endodermis, stone cells present both inner and outer to the endodermis and absence of stone cells. These structural variations can be used for the identification of traded crude/raw roots of Aconites.

The genus *Aconitum* (Aconites) is one of the important medicinal plant groups, which is enlisted in the 'Negative List of Exports' in 1998 by the Government of India, to regulate its trade/export on one hand and on the other hand, to check illegal trade of Indian Aconites collected from wild sources.

BOTANICAL IDENTIFICATION OF INDIAN ACONITES USING STONE CELLS

An outline of the anatomical characters of Indian Aconites including stone cells has been given [11]. For easy understanding of the readers, the author has categorized structural features of stone cells (brachysclereids) into three different types based on their arrangement, as detailed below.

Presence of Stone cells outer to the Endodermis

The following taxa, viz., *Aconitum arunii*, *A. balfourii*, *A. heterophylloides* var. *heterophylloides*, *A. heterophylloides* var. *leucanthum*, *A. nagarum* and *A. spicatum* are placed under this category (Table 1; Plate 1).

Presence of Stone cells both outer and inner to the Endodermis

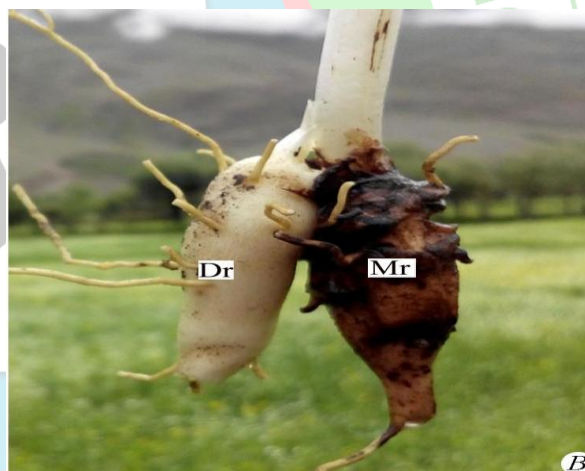
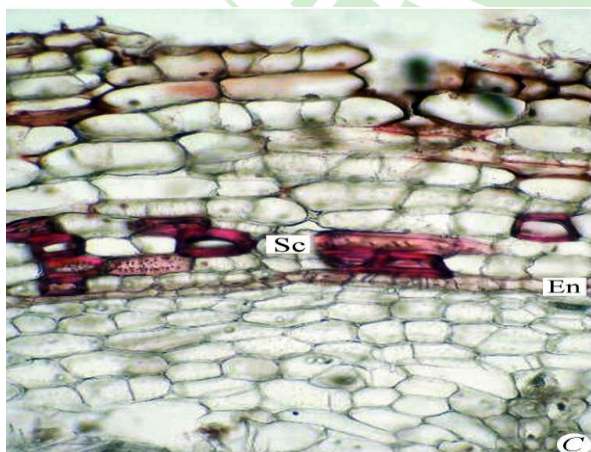
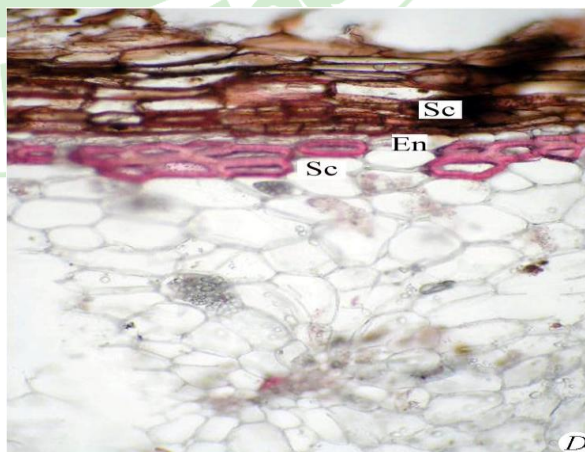
Under this category, *Aconitum deinorrhizum*, *A. laciniatum* and *A. violaceum* var. *robustum* are placed (Table 1; Plate 1).

Absence of stone cells both outer and inner to the Endodermis

The following species, viz., *Aconitum assamicum*, *A. bisma*, *A. chasmanthum*, *A. ferox*, *A. heterophyllum*, *A. hookeri*, *A. laeve*, *A. rotundifolium* and *A. violaceum* var. *violaceum* are placed under this category (Table 1)

Table: 1. Presence or absence of stone cells in the mother roots of Indian Aconites

Name of the Species	Presence of Stone cells		Absence of Stone cells
	outside endodermis	outside and inside endodermis	outside and inside endodermis
<i>Aconitum arunii</i>	✓		
<i>A. assamicum</i>			✓
<i>A. balfouri</i>	✓		
<i>A. bisma</i>			✓
<i>A. chasmanthum</i>			✓
<i>A. deinorrhizum</i>		✓	
<i>A. ferox</i>			✓
<i>A. heterophylloides</i> var. <i>heterophylloides</i>	✓		
<i>A. heterophylloides</i> var. <i>leucanthum</i>	✓		
<i>A. heterophyllum</i>			✓
<i>A. hookeri</i>			✓
<i>A. laciniatum</i>		✓	
<i>A. leave</i>			✓
<i>A. nagarum</i>	✓		
<i>A. rotundifolium</i>			✓
<i>A. spicatum</i>	✓		
<i>A. violaceum</i> var. <i>robustum</i>		✓	
<i>A. violaceum</i> var. <i>violaceum</i>			✓

Plate – 1 Presence or absence of stone cells in the mother roots of Aconites.**A.** *Aconitum ferox* in their habitat,**B.** *Aconitum heterophyllum* - mother and daughter roots**C.** *Aconitum heterophylloides* - stone cells seen outer to the endodermis**D.** *Aconitum laciniatum* - stone cells seen both outer and inner to the endodermis

Abbreviation : (Dr - Daughter root, Mr - Mother root, En - Endodermis, Sc - Stone cells)

CONCLUSION

Identification or authentication of medicinal plants (vegetable crude drugs) is considered very much important as they are used in the preparation of different types of medicine to save human lives. If anything goes wrong, the entire system will go wrong, it may be even fatal at times. Anatomical characters can be used to establish correct botanical identity of crude/raw drugs. Further, they are simple, time-saving, cost-effective and reliable. The tuberous roots of Indian Aconites exhibit distinguishing anatomical characters, including presence or absence of stone cells (brachysclereids), which can be

used as a tool for the identification or authentication of each and every species of *Aconitum* from its closely related species and also to detect possible adulterants and substitutes that are common in commerce (crude drug trade).

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