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Salient features of *Berberis aristata* and *Berberis asiatica*: A comparative pharmacognostical study

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ABSTRACT

B.aristata (Berberidaceae), an important herbal drug of the Indian system of medicine, commonly known in vernacular as "Daruharidra", is used as stomachic, astringent, antiperiodic, antipyretic, antidiabetic, in the treatment of jaundice and eye infections. Due to its excessive harvesting by Pharmaceutical/Ayurvedic industries, a near scarcity of this plant material made another species of Berberis viz. B.asiatica to take its place and Industries/Ayurvedic physicians started using it as "Daruharidra" in place of B.aristata as its substitute. Although chemical and pharmacological work on both these plants is on record, yet no concrete work regarding the pharmacognostical work on either of them has been reported so far. All the parts of plant Root, stem and leaf of these plants are used in Ayurveda. The present work deals with pharmacognostical investigation of root, stem and leaf of both the plant species to find out their salient diagnostic features with a view to identify them from each other/other substitutes/adulterants (if any).

Keywords: *Berberis aristata*, *Berberis asiatica*, Pharmacognostical study.

INTRODUCTION

Berberis aristata DC Commonly known as "Daruharidra" in Sanskrit, is spinous shrub native to northern Himalaya region. The plant is widely distributed from Himalayas to Srilanka, Bhutan and Hilly areas of Nepal. It grows at the height of 2000-3000m especially in Kumaon and Chammba region of Himachal Pradesh. The plant is traditionally used in Ayurvedic medicines in the treatment of inflammation, wound healing, skin disease, menorrhagia, diarrhoea, jaundice and all affection of eyes. A very valuable Ayurvedic preparation "*Rasot''* is prepared from it [1]. Another species viz. *Berberis asiatica* Roxb is a very common substitute to "Daruharidra" that is *B. aristata* DC and widely used as anticancer, antidiabetic, spasmolytic, antipyretic, and antiseptic [2].

MATERIALS AND METHODS

Samples of the whole plants of *B.aristata* and *B.asiatica* were obtained from Bhimtal (Uttarakhand) and identified by Dr. Tirath kumar, Asst. Professor, Dept. of Pharmaceutical Science, Kumaon University, Bhimtal (Uttarakhand). Hand and microtome sections were taken, Stained and mounted as usual and the cell content and cell wall structure were studied according to the method described by Kay and Johansen [3,4]. Representative Sketches were made with the help of camera Lucida. Methods for determining the quantitative values were the same as described elsewhere [5]. For fluorescence analysis, the powder of the root, stem and leaf were examined under ultraviolet light [6].

Salient differentiating features

It is observed that the root of both the species show lots of similarities. The origination of cork cambium in the fifth to sixth layer of cortex of the young stem; the presence of 8-10 layers of cork; a wide secondary phloem region containing groups of phloem fibres in to which are merged stone cells and these groups are present in discontinuous rings; the phloem fibres are two types viz. pitted types and the other type without pits; are some of their common features. However, the differences between them are categorized as under:

Salient differentiating features of Root

S.no.	*B.aristata* (Root)	*B. asiatica* (Root)
1.	Secondary phloem fibres which do not show pits on their walls are longer (80-96-120-160×4-6-8µ)	They are relatively shorter in size (60-80-100×4-6-8µ)
2.	The fibres which show bordered pits on their walls are longer (60-80-88×8-10µ)	They are shorter (48-56-60×4-6-8µ)
3.	Stone cells have distinct verticle pits on their thick lignified walls and are more in number. The average number of stone cells/mg of dry root powder is 300 [7].	The shape and size of the stone cells is principally the same but lesser in number. The average number of stone cells/mg of dry root powder is 156 [8].
4.	The tracheidal fibres are longer (140-150-160×4-8-10µ)	They are shorter in dimension (80-88-92×4-6-8µ).
5.	In a root of about 5mm diameter, the number of medullary rays per mm arc at the cambial region is 4-5.	Their corresponding number in the same sized root is 5-7.
6.	In a root of about 5mm diameter, the wood bark ratio is approximately 2:1.	The same sized root has wood bark ratio as 1.5:1.
7.	Root powder mounted in nitrocellulose dissolved in amyl acetate and viewed under U.V light appears yellowish buff, but when 1N NaOH is mixed with above and again viewed in U.V light, the contents appear buff.	The powder similarly treated gave green fluorescence in both cases.

Likewise, the stem of both the species resembles each other in many of its macro & microscopic features. The presence in the young stem of unicellular non-lignified trichomes; the primary cortex being divided into three zones which includes external 3-4 layers of parenchymatous tanniferous cells followed by 4-6 layers of sclerenchymatous fibrous layer after which another 1-2 layered parenchyma; all of which exfoliate out after secondary growth has taken place; the origination of cork cambium arising in the second layer of cortical parenchyma encircling stele; are some of the common features of the stem of two species. However, the differentiating features between the stem of the two species are as under:

Salient differentiating features of Stem

S.no	*B.aristata* (Stem)	*B.asiatica* (Stem)
	Young stem	
1.	Epidermal trichomes are smaller (20-36-48×8-10µ).	Are larger (20-40-55-100×8-14µ).
2.	Tanniferous cortical cells are bigger in size (12-20-32-40×12-16-24-28µ).	Are smaller in size (8-12-16-20×8-10-16µ).
3.	The fibres constituting sclerenchymatous cortex are smaller in size (375-450-620-780×15-22-30-45µ).	Are bigger in size (495-900-1150-1500×15-24-36µ).
	Mature stem	
4.	The lignified phloem fibres are present in discontinuous concentric rings in the outer part of secondary phloem.	The phloem fibres are lesser in number and present in discrete small groups mostly in the outer part of secondary phloem.
5.	The stone cells are larger in size (12-18-25-40×10-15-20µ), their average number per mg of the dry bark is 224.	The stone cells are smaller in size (10-15-25×10-14-22µ) and lesser in number, their average number per mg of the dry bark is 108.
6.	Xylem fibres are smaller in length (180-260-570-630×20-22-37µ).	Xylem fibres are larger in length (375-500-675-975×10-18-24µ).
7.	In T.S., The vessels are seen to the concentrated in the inner and outer regions of the xylem.	The vessels are distributed uniformly in the xylem region.
8.	Vessels with spiral type of thickening are present along with these with bordered pits.	Vessels with spiral type of thickening are altogether absent.
9.	Fiber tracheids present .	Fiber tracheids absent.
10.	Xylem fibres are mostly concentrated in the lower part of xylem facing the region of pith and are present in the form of letter V.	Xylem fibres are distributed uniformly in xylem.
11.	The number of medullary rays per mm arc at the cambial region is 28-30.	Their number is 36-38.
12.	Wood bark ratio is 2:1.	Wood bark ratio is 1.5:1.
13.	Stem powder mounted in nitrocellulose under U.V light appears green.	Appears yellow.

Leaves of the two species resemble with each other in most of its external and internal features. The dorsiventral arrangement of the mesophyll with a three layered palisade zone on the upper side; the epidermis on both sides

being covered over by a thick furrowed cuticle; presence of anomocytic stomata on the lower epidermis only are some common features of the leaves of the two species. However, they differ in respect of:

Salient differentiating features of Leaf

S.no.	*B.aristata* (Leaf)	*B.asiatica* (Leaf)
1.	Lignified pericyclic fibres of the midrib appear to be longer (680-840-1240-1500×22-37-45µ).	Are comparatively shorter in size (630-900-1150-1290×22-30µ).
2.	Average Stomatal index, stomatal number, palisade ratio, vein islet number and vein termination number are 15-20; 350-380; 7-9; 120; 120 respectively.	They are 20-25; 490-510; 4-5; 120; 100 respectively.
3.	Leaf powder treated with 1N NaOH, dried and mounted in nitrocellulose appears green.	It appears yellowish brown.

RESULTS AND DISCUSSION

From the foregoing observation, the two species appear to resemble to a great extent in both its external morphology as well as its internal anatomy. Some work on the pharmacognosy of the root of both the species is on record [7,8]. The data reported by them is too scant and erroneous. They have reported the presence of pericyclic fibres and groups of stone cells as separate from each other but in fact, the fibres are actually phloem fibres and the stone cells are merged along with the group of phloem fibres. Further, these fibres have been reported to be of a single normal type but in fact two types viz. the normal type and the bordered pitted type of fibres are present. In the present work details of the pharmacognostical features including quantitative microscopical study using Lycopodium spore analysis [5], of both *B.aristata* and *B.asiatica* (Root, stem and leaf) has been studied and a comparison between their salient diagnostic features has been presented, so that the two species can be distinguished either from each other or from other substitutes or adulterants (if any).

CONCLUSION

The two species of Berberis; viz *B.aristata* and *B.asiatica*, though resembling each other in most of its external features have been worked out for their pharmacognostical characters using both microscopy and quantitative microscopy including Lycopodium spore analysis and differentiating characters of the two species in terms of their salient diagnostic features have been effectively brought out.

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