Available online on www.ijppr.com
International Journal of Pharmacognosy and Phytochemical Research 2013; 5(3); 177-182

ISSN: 0975-4873

Research Article

Effect of Spacial and Temporal Variations in Cellular Characters and Chemical Contents in *Pseudarthria viscida* (l.)W. & Arn. – A Medicinal Plant

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ABSTRACT

Pseudartria viscida, a well known medicinal plant is widely used for the management of many diseases and ailments. Root of this plant is an important ingredient in more than 68 ayurvedic formulations. The present study deals with the existing major variation in anatomical, physico-chemical and phytochemical characters in *P.viscida* due to change in season and region. Phytochemical changes due to various seasons and different regions were also studied by performing HPTLC densitometric quantification of lupeol in methanol extract of roots. Microscopic variation observed in the quantity of cell inclusions such as starch and tannin, number of phloem fibers, and wall thickness of lignified cells. Physico-chemical parameters and HPTLC densitometric quantification also showed variation in the quantity of chemical constituents according to season and place of collection.

Key words: *Pseudarthria viscida*, seasonal variation, physico-chemical, phytochemical, lupeol.

INTRODUCTION

Active principals and other constituents of a number of medicinal plants are bound to fluctuate with season and variation in geographic conditions[1,2]. According to principles of western herbal medicine, therapeutic efficacy varies during different times or seasons of the year. The constituents and active principles vary quantitatively at different seasons of the year and the majority of plant materials are usually best collected during season when the herbs are at peak maturity and concentration[1]. In ancient ayurvedic texts, Charaka[3] mentioned timely collection of medicinal plant parts and specific seasons are mentioned for the collection of plants according to the part of plant which is used for the medicine preparation. *Ashtangahrdaya*[4], a classical Ayurveda text also mentioned the impact of season, altitude soil and period of harvesting on the availability of active principles in plants. It is self explanatory that ancient physicians were aware about relation between period of collection and distribution of active principles. In the present study, variation in histological and phytochemical characters of the medicinal plant *P. viscida* due to the variation in season and place of collection has been carried out.

MATERIALS AND METHODS

Plant materials: *P. viscida* is a viscid–pubescent semi-erect, under shrub with slender branches with rooting at nodes; leaves 3-foliate, alternate, stipulate; leaflets ovate, rhomboid and acute; lateral obliquely ovoid acute; flowers papilionaceous, small, pinkish white in long terminal branched racemes; fruit densely viscid, hairy, flat, linear oblong pods, seeds 4 to 6, compressed[5,6,7](Figure 1). In Kerala and Tamil Nadu the roots of this plant are used as *Salaparni*[5] and is an ingredient in more than 68 ayurvedic formulations.

Method of study: *P. viscida* being an annual plant roots were collected in various months/period of growth. Generally the plants of *P. viscida* start germination with the onset of monsoon and attain maturity by the month of December. Hence roots of plants were collected in each month from June onwards and in December plants were with fully matured seeds. Roots were also collected from various agro-climatic conditions like places of high, medium and low altitudes. Comparison of microscopic characters of the roots collected in various periods of growth was carried out by taking hand and microtome sections and staining with various histochemical stains as per standard procedures[8,9]. Histological characters like variation in the presence of lignin, variation in cell inclusions like starch, tannin, crystals etc. were observed. Phytochemical changes due to seasonal variation and geographical variation were studied by performing HPTLC densitometric quantification of lupeol in methanol extract of roots collected in various seasons and different places. Seasonal variation in physicochemical parameters such as moisture content, water and alcohol soluble extractive, total ash and acid insoluble ash was also determined and compared as per standard methods[9].

RESULT

Transverse section of the root is circular in outline, with outer cork region which becomes lenticellate and broken at places, a narrow bark and a wide central wood region.

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Figure 1**.** *Pseudarthria viscida* (L.) W. & A.
A. Habit; **B**. Fresh mature root.

Table 1. Variation in physicochemical parameters

Month	Moisture content %	Alcohol soluble extractive%	Water soluble extractive%	Ash value %	Acid insoluble ash%
June	10.95	2.95	5.05	6.99	0.78
August	8.97	4	6.25	7.00	0.79
October	8.7	5.3	10.86	7.25	0.80
November	7.5	6.67	14.11	7.33	0.81
December	5.7	7.56	14.95	7.48	0.82

Table 2. HPTLC densitometric quantification of lupeol in methanol extract of roots collected in various seasons/period of growth.

Month	% of Lupeol
June	0.0014
July	0.023
August	0.044
September	0.043
October	0.040
November	0.016
December	0.015

phloem and xylem is traversed with uni-biseriate medullary rays. The diagnostic feature of the mature root is the presence of tangentially running isolated or groups of larger cells filled with dark reddish brown depositions and small sized gelatinous fibers in the phloem region; prismatic crystals of calcium oxalate and starch grains are embedded in the parenchymatous cells throughout the section.

Variation in microscopic characters: Throughout the growth period and in all the seasons, the basic characters of cell inclusions like starch grains, tannin and prismatic crystals of calcium oxalate were same. Nature of cell type like xylem vessels, phloem fibres and xylem fibres and their pattern of arrangement were found to be same. Variation was seen in the quantity of cell inclusions and

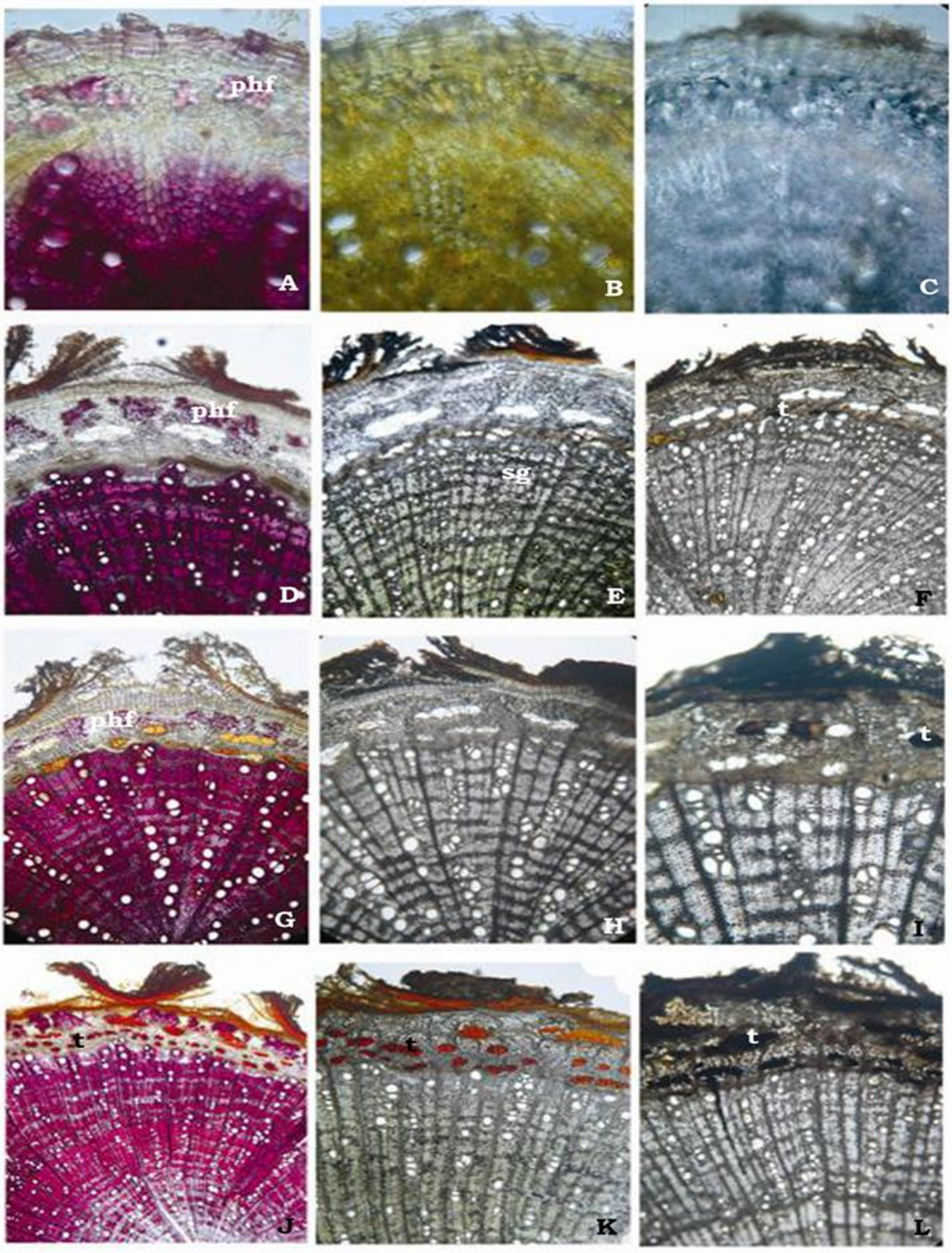


Figure 2. Seasonal/age variation in microscopic characters of *P. viscida* root. **A - C**. TS of root of young plants collected in June x 100; **D - F**. TS of root of plants collected in August (before flowering) x 100; **G - I**. TS of root of plant collected in October (with flowers and fruits) x 100; **J - L**. TS of root of plant with fully matured roots collected in December x 100. phf, phloem fibre; sg, starch grains; t, tannin.

amount of phloem fibres and xylem fibres and in the wall thickness of vessel elements. (Figure 2 A-L) In *P. viscida* variation was also seen in the quantity of tannin which is present in the cork cells, cortex, phloem region and in the medullary ray cells. As the plant is an annual, the season and age are interdependent. Not much variation was seen in the early 2 to 3 months. In these months the quantity of starch grains and tannin content were very less ie. a few starch grains are seen in the medullary rays, a few tannin content in the cortex and a few phloem fibres. Large cortical cells containing reddish brown depositions - a diagnostic character was not observed in these early stages (Figure 2 A-C). The growth of the plant is directly propotional to the amount of depositions and number of phloem fibres and quantity of starch grains (Figure 2 G-L).

Variation in physico-chemical parameters: Variation study in physicochemical parameters showed that as the season is going up from rainy to hot, moisture content decreases. All other parameters like alcohol and water extractive values and ash value increase with growth and season. The value of acid insoluble ash, showed more or less same in all the seasons (Table 1).

Variation in phytochemical constituents: HPTLC densitometric quantification of lupeol showed the presence of high percentage of lupeol content in the middle of the
growing period ie., in August. In this period the plant was in flowering stage and the concentration of lupeol was 0.044%. In December the lupeol content was 0.015%.

During this period the plant was in seed shedding stage. In the early period of growth (ie. In June) also the lupeol content was very low and it was 0.0014% (Figure 3. & Table 2).

Variation due to geographical conditions/ soil type: Roots were collected from places having different agroclimatic conditions ie from high altitude, medium altitude to plains. The soil type also varies from lateritic to sandy soil when coming from high altitude to low altitude. HPTLC densitometric quantification of lupeol in methanol extract of roots collected from various geographical conditions was carried out. The result showed that the quantity of lupeol was high (0.009%) in the roots collected from high altitude and lowest in the ones collected from the plains (Figure 4 & Table 3).

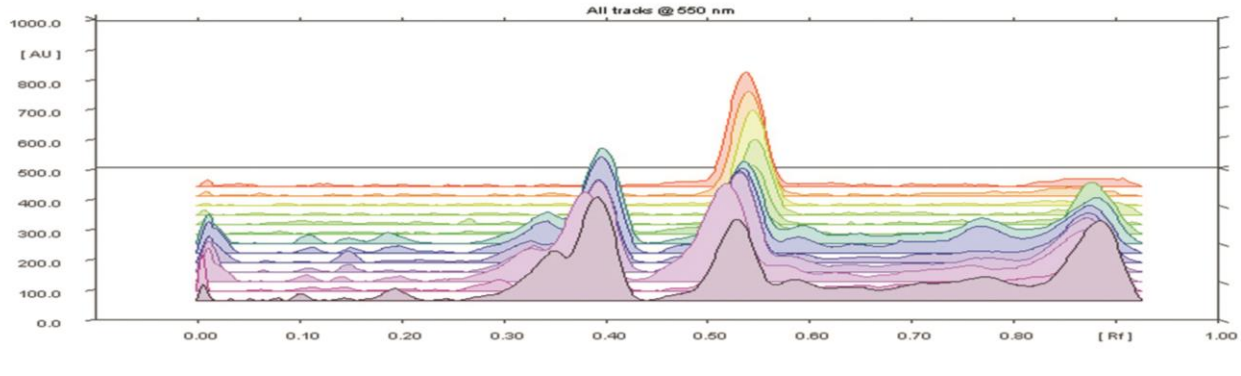
DICUSSION

From the study it is concluded that seasonal variation is

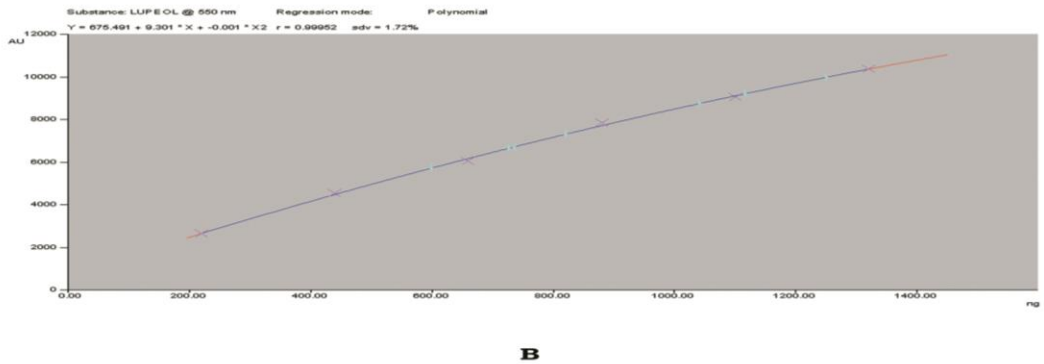
Table 3. HPTLC densitometric quantification of lupeol in methanol extract of roots collected from different geographical conditions.

Place of collection	% of Lupeol
I	0.006
II	0.009
III	0.004

I- Roots collected from low altitude;
II- Roots collected from high altitude
III- Roots collected from medium altitude



A



B

Figure 3. . HPTLC densitometric quantification of *P. viscida* root collected in various seasons using lupeol as standard A. HPTLC densitometric profile B. Calibration curve

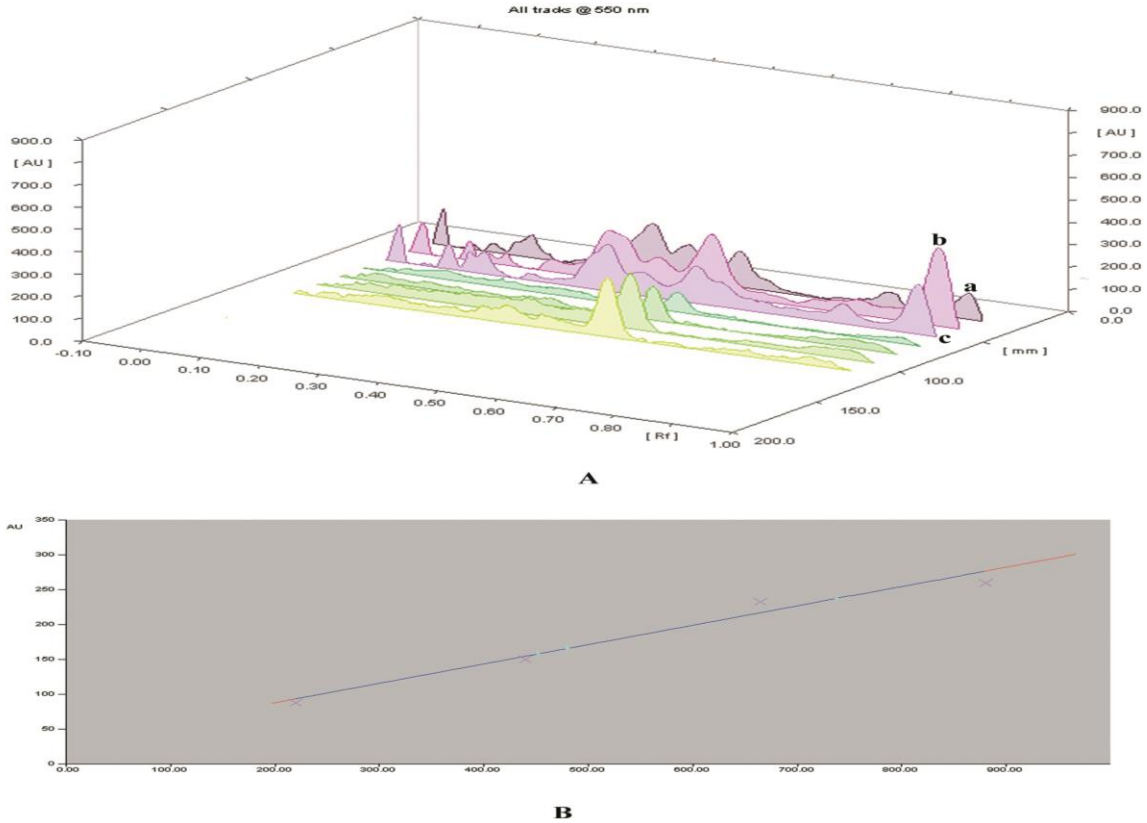


Figure 4. HPTLC densitometric quantification of lupeol in *P. viscida* root collected from different regions (a-low altitude; b-high altitude; c-medium altitude). A. HPTLC densitometric profile B. Calibration curve

associated with the vegetative and reproductive stages of the plant and it is in direct influence with the variation in chemical constituents of the plants quantitatively. In all the plants, the concentration of active principles is high in full bloom period and it is the best period for collection. Raja *et al*., reported that *Adhatoda* exhibited high percentage of vasicine content (3%) in March, when it was in full bloom and 1.4 % in September, when was in partial flowering. During the vegetative stage the plant contains very low concentration of vasicine content[10].

The geographical variation study revealed that the highest concentration of the lupeol (0.009%) was observed in plants collected from the high altitude area, the hilly areas and it is found to be superior to plants growing in other regions. In the classical text *Ashtagahridaya*[4] scholars have mentioned three types of habitats viz. *jangalam* (arid), anoopam (marshy) and *sadharanam* (normal) and it is insisted to collect plants from *jangalam* and *sadharanam*. Here the hilly areas can be equated with arid areas and so this opinion justifies the result of the variation due to soil type.

ACKNOWLEDGEMENT

Authors are very grateful to TATA Trusts, Mumbai for the financial assistance and Arya Vaidya Sala, Kottakkal for extending facilities for conducting the study. Authors are also thankful to Dr. Indira Balachandran, Project Director, Centre for Medicinal Plants Research, Arya Vaidya Sala, Kottakkal for extending support and encouragement for the study.

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