

Seasonal variations in physicochemical profiles of *Guduchi Satva* (starchy substance from *Tinospora cordifolia* [Willd.] Miers)

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ABSTRACT

Guduchi Satva (GS), the starchy material extracted from the *Guduchi* stem is well-known Ayurvedic single drug formulation having a wide range of therapeutic utility. Species of the plant, stem size, collection time, season and maturity of the plant may affect the yield and physico-chemical profile of GS. However, published data on such variations is lacking. Considering this, present study is planned to screen seasonal variations in physico-chemical profile of GS. 18 batches of GS were prepared in six different seasons (3 batches in each season) and findings were systematically recorded. The obtained *Satva* was further subjected to relevant physico-chemical parameters. Principal component analysis method was adopted to analyze variations. Maximum yield of *Satva* was obtained in *Shishira Ritu* (January-February) while the minimum in *Grishma* (May-June). Variation in taste and color was found in *Satva* prepared in *Varsha Ritu*. All functional groups were found to be same in each season. Total alkaloidal contents found bit higher in *Varsha* and *Vasanta*. More residual x-variance in alcohol soluble extract and more leverage were observed in water soluble extract due to impact of seasonal spells.

Key words: *Guduchi*, *Ritu*, *Satva*, season, *Tinospora cordifolia*

INTRODUCTION

Tinospora cordifolia (Willd.) Miers, commonly known as *Guduchi* is one of the highly valued vine useful in a wide range of diseases. *Satva* is aqueous extractable starchy substance collected from herbal drug.^[1] *Guduchi Satva* (GS) is commonly used and prescribed Ayurvedic medicine in *Daba* (burning sensation), *Pitta* predominant disorders.^[2] Its method of preparation has been mentioned initially in *Yoga Ratnakara* followed by *Rasa Yoga Sagara*, *Siddha Yoga*

Sangraba, *Bhavprakashya*, etc.; however, no text emphasizes on the impact of the season on quantitative and qualitative aspects of *Satva*.

Earlier attempts in GS preparation reported quantitative variation in yield.^[3] These variations may be due to differences in the species, stem size, collection time, season and maturity of the plant. Timely collection of different parts of plants for medicinal purposes are also stressed by *Charaka* and *Sushruta*.^[4,5] It can be understood that ancient physicians were aware of association of time of collection with distribution of active constituents in various plant parts. Thus, despite of incredibly complex relationship between the phyto-constituent level in plant and season, present study is executed to revalidate the classical concept and comprehend the effect of different seasons on physico-chemical profile of GS in a different season.

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MATERIALS AND METHODS

Material collection and authentication

Fresh *Guduchi* stems creeping on *Neem* (*Azadirachta indica*) tree were collected [Figure 1] and authenticated at Pharmacognosy laboratory as *T. cordifolia*. *Guduchi* associated with *Neem* is believed to be best as the synergy between these plants enhances its efficacy.^[6] Medium size



Figure 1: *Guduchi* collected from natural habitat with *Neem* tree

stem from the same plant with uniform maturity was selected for study, as it is reported to yield more *Satva*.^[3]

Method of preparation

A total of 18 batches of *Satva* (3 in each season) were prepared. The division of seasons is enlisted in Table 1. 1 kg fresh *Guduchi* stem was collected and washed with water. Stems were chopped (1.5-2 inches), pounded to get homogeneous bolus and mixed with 6 parts of potable water in a stainless steel vessel and kept undisturbed for soaking (12 h). The mass was vigorously macerated manually (1 h) and filtered slowly through a clean four folded cotton cloth. The liquid was kept undisturbed for 4 h. The supernatant liquid was decanted carefully and heavy starchy, sticky layer of sediment settled at the bottom was removed, air dried and stored in airtight glass jars. Similar procedure was followed in each season for remaining batches [Figure 2].

Physico-chemical screening

A total of 18 samples prepared in six seasons were subjected to Organoleptic and physicochemical analysis such as pH value, loss on drying (LOD) at 110°C, ash value and extractives such as water soluble and methanol soluble extracts,^[7] phyto-chemical screening^[8] and total alkaloids.^[9] Average value for consecutive three batches prepared in one season was calculated and compiled in Table 2.

Rasanirdharana pariksha (taste assessment test)

Classical texts mentioned the taste of GS as *svadu* (sweet),^[10] but recent scholars explain it as slight bitter.^[11] Action of any *Dravya* (drug) is based primarily on its *Rasa* (taste).^[12] Thus, a need was felt to ascertain the *Rasa* of GS by adopting classical methods. Hence, *Rasanirdharana* of GS was done by preparing a special proforma.^[13] A total of 30 healthy volunteers with a age range of 21-25 years old were selected and *Rasanirdharana pariksha* was performed 2-3 h after lunch. At 20 min prior to the test volunteers

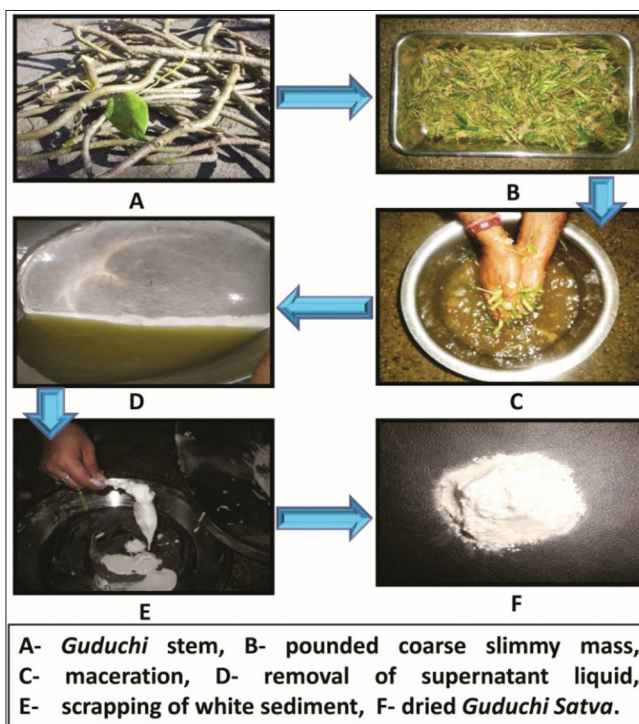


Figure 2: Unit operating procedure of preparation of *Guduchi Satva*

Table 1: Division of seasons

Indian season	Season (<i>Ritu</i>)	
	Gregorian tropical months	Hindu lunar months
<i>Shishira</i>	January-February (late winter)	<i>Magha-Falguna</i>
<i>Vasanta</i>	March-April (spring)	<i>Chaitra-Vaishakha</i>
<i>Greeshma</i>	May-June (summer)	<i>Jyeshtha-Ashada</i>
<i>Varsha</i>	July-August (rainy season)	<i>Shravan-Bhadrapada</i>
<i>Sharad</i>	September-October (autumn)	<i>Ashwina-Kartika</i>
<i>Hemanta</i>	November-December (early winter)	<i>Margshirsha-Pausha</i>

were asked to wash mouth with plenty of distilled water. Equal quantity of samples were blinded and placed on the anterior surface of the tongue. The volunteers were requested to perceive and record the taste.

RESULTS AND DISCUSSION

The whole plant is used medicinally; however, GS is said to be prepared from its stem.^[11] The yield of GS is found to be more in January-February (*Shishira*); whereas it was least in May-June (*Grishma*). This may be due to impact of different seasons on cellular proliferation and plant maturity. Maximum metabolic activity of the starch grains in cellular constituents occurs after preliminary development; during which the percentage of starch also increases. Thus, it infers that full maturation of starch grain

occurs in *Shishira Ritu*, which resulted into maximum yield. Details of GS preparation are placed in Table 2.

Organoleptic characters of samples are listed at Table 2. Color variation was found among the samples. In July-August (*Varsha Ritu*) *Satva* was Greenish white in color, slight bitter in taste with specific smell of *Guduchi Svarasa* (juice), which may be due to enhancement of cellular activities and bitter phyto-constituents of the plant.^[14,15] In rest of the five seasons, it was found tasteless and without specific smell. The observed characters were different from other seasons.

All functional groups were found to be same in each season. Alkaloids, carbohydrates and starch were present while glycosides, tannins, saponins, flavanoids, phenols, proteins and steroids were absent. Percentage of total alkaloid contents were found to be bit higher in *Varsha* and *Vasanta* [Table 2]. *Charaka* advocate collecting stems in *Varsha* and *Vasanta Ritu*.^[4] However for extraction of GS from stem, specific season has not been mentioned. The present research findings are partially consistent to the above mentioned *Ritu* as far as collection season of stem, yield of *Satva* and total alkaloidal contents are concerned. Extensive quantitative analytical study may elaborate changes in percentage of chemical constituents of *Satva* prepared in different seasons.

Regional and seasonal or climatic variations are reported in number of medicinal plants.^[16] Season also had its impact on quantity and/or quality of active principles and secondary metabolites in medicinal plants.^[17,18] Plant circadian rhythms tells the plant what season it is and accordingly levels of

phyto-hormones (physiological intercellular messengers) changes over the lifespan of a plant, which are responsible for cellular/enzymatic activities, cell constituent level and plant growth.^[19,20]

Table 2 shows variations in physico-chemical parameters among the samples. Principal component analysis (PCA) was adopted to analyze the variations. PCA is the most widely used multivariate analysis technique for transforming the original measurement variables into new variables called principal components (PCs). Each PC is a linear combination of the original measurement variables. Often, only two or three PCs are necessary to explain all of the information present in the data. By plotting the data in a coordinate system defined by the two or three largest PCs, it is possible to identify key relationships in the data, that is, find similarities and differences among objects in a data set. Figure 3a depicts more residual x-variance in alcohol soluble extract (ASE) and more leverage observed in water soluble extract (WSE), whereas less leverage and variation is observed in LOD and pH values. Figure 3b shows PC1 contributes in explaining data among *Grishma*, *Sharad* and *Varsha Ritu* whereas PC2 explains *Shishira*, *Vasanta* and *Hemanta Ritu*. Figure 3c shows meager variations in ash value, pH and LOD than ASE and WSE values. Hence, impact of periodicity of season on extractive principles of GS has been confirmed. It signifies that, collection of herb in different times may influence expression of its pharmacological and clinical actions.

Study limitations and future directions

The present study is preliminary attempt to find thoroughly the facts or confirmation of Ayurvedic Principles. The

Table 2: Average results of GS in different seasons

Parameters	Season					
	<i>Shishira</i>	<i>Vasanta</i>	<i>Grishma</i>	<i>Varsha</i>	<i>Sharad</i>	<i>Hemanta</i>
Pharmaceutical						
Fresh <i>Guduchi</i> stem (kg)	1	1	1	1	1	1
Quantity of potable water (L)	6	6	6	6	6	6
Total yield (g)	37.8	29.3	22.3	23.3	30.8	34.0
% yield	3.78	2.93	2.23	2.33	3.08	3.40
Organoleptic						
Colour	Clear white	Pale white	Pale white	Greenish white	Greyish white	Clear white
Smell	Not specific	Not specific	Not specific	Slight bitter	Not specific	Not specific
Taste	Tasteless	Tasteless	Tasteless	Slight bitter	Tasteless	Tasteless
Touch	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Appearance	Powder	Powder	Powder	Powder	Powder	Powder
Physico-chemical parameters						
pH value	5.06	5.06	5.05	5.07	5.06	5.05
Loss on drying at 110°C (% w/w)	6.30	6.13	6.12	6.50	6.30	6.30
Ash value (% w/w)	0.65	0.64	0.65	0.70	0.65	0.64
Water soluble extract (% w/w)	22.49	23.03	22.09	24.00	22.50	23.80
Alcohol soluble extract (% w/w)	14.0	14.29	14.86	16.00	15.07	14.60
Total alkaloid content (%)	0.32	0.34	0.30	0.33	0.32	0.31

GS=*Guduchi Satva*

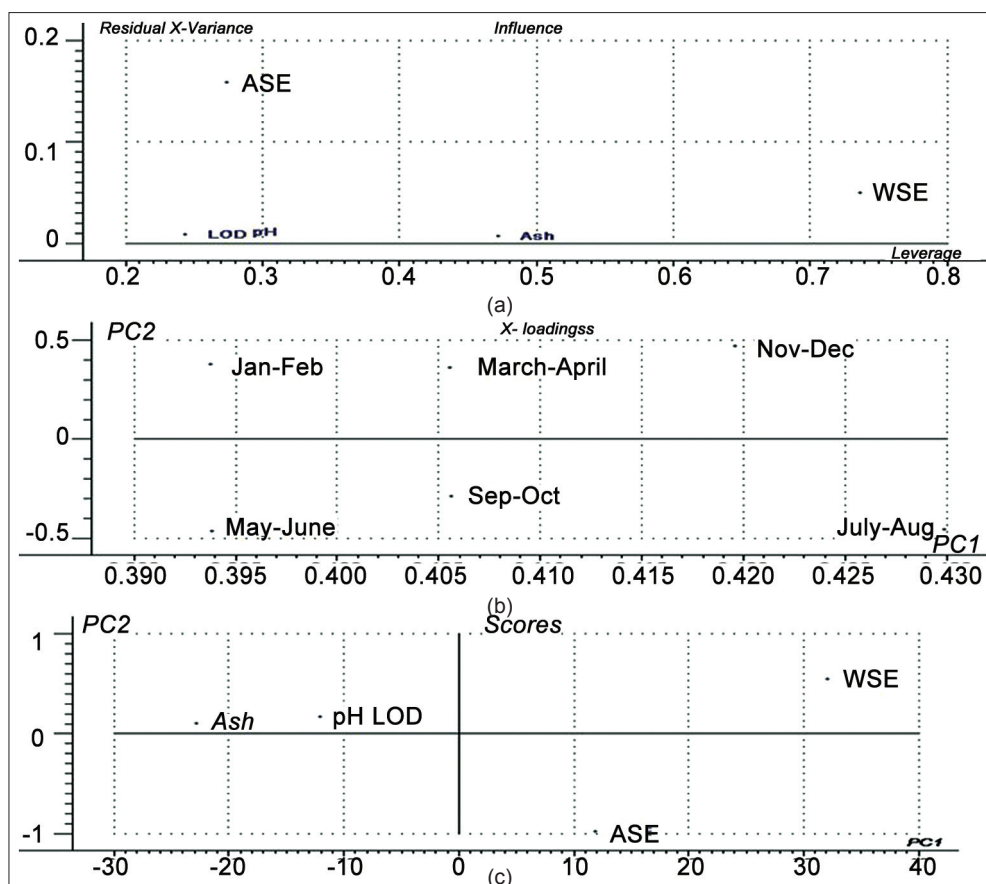


Figure 3: Scoring and plotting graphs showing principal component analysis of *Guduchi Satva*

phytochemical screening reported in present study is only qualitative; more extensive works on quantification of chemical constituents and secondary metabolites are needed. To establish a concrete conclusion about seasonal variations in physico chemical profiles, highly sophisticated analytical studies are required for extensive exploration of phytoconstituent pockets of this medicinal dosage form. This may bring physicians nearer in achieving specific anticipated desirable action by clearing them what season to opt for drug collection and preparation of *Satva*.

CONCLUSION

Yield of GS depends upon season of collection of *Guduchi* and manufacture. Maximum yield of *Satva* was obtained in *Shishira Ritu* while minimum in *Grishma*, therefore *Shishira Ritu* should be utilized by manufacturers for maximum yield. Total alkaloidal contents found to be bit higher in *Varsha* and *Vasanta*, thus consistent with *Charaka's* claim to collect stems in these *Ritus*. More variation in extractive principles due to seasonal impact is also established thus supports classical statement for timely collection of different parts of plants. The current observations reveal seasonal variations in physico-chemical profiles of *Satva*.

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