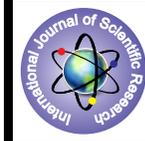


Effect of Environmental Conditions on the Vitamin C and Essential Oil Content of *Adhatoda Vasica* Growing in the Various Regions of Kerala and Maharashtra



Botany

KEYWORDS : Vitamin C, essential oil, *Adhatoda vasica*, antioxidant, Ayurvedic medicines, environmental condition.

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ABSTRACT

Adhatoda vasica (*vasaka*) is a common plant used for upper respiratory tract infections, bronchitis and as an expectorant. The leaves of *Adhatoda vasica* (*vasaka*) are important drugs of Ayurveda, prescribed as an expectorant. *Adhatoda vasica* is known to contain vitamin C and essential oil which is responsible for its antioxidant properties. In the present work plants of *Adhatoda vasica* were collected from various regions of Kerala and Maharashtra during summer and winter seasons and they were analyzed for Vitamin C content and essential oils. It was observed that in the plants of *Adhatoda vasica*, the vitamin C content and essential oil was found to be maximum in plants collected from Kerala compared to Maharashtra. Both Vitamin C content and essential oil was found to be maximum in the plants of *Adhatoda* collected from both Maharashtra and Kerala during the winter season.

Introduction:

Adhatoda vasica, one of the Indian species of Family Acanthaceae is well known for its pharmacological activities. Several alkaloids of *Adhatoda vasica* were found to possess anti-spasmodic properties.

Adhatoda vasica Nees is well-known in Ayurvedic and Unani medicine. It has been used for the treatment of various diseases and disorders, particularly for the respiratory tract ailments. Many studies have been conducted on this plant and some of the reported activities of the plant include anti-diabetic, anti-inflammation, anti-allergic, anti-tussive, anti-ulcer, antioxidant, anti-genotoxicity, anti-tubercular, abortifacient, radioprotective, bronchodilator and hepato-protective studies of the chronic toxicity of some compounds of *Adhatoda vasica* Nees. The plant lives for multiple seasons and retains its leaves throughout the year (G. Abhyankar, V.D. Reddy, 2007). Herbal medicines are currently in demand and their popularity is increasing day by day. India is a vast repository of medicinal plants that are used in traditional medical treatments. (Chopra *et.al*, 1956) medicinal plants play an important role in the development of potent therapeutic agents. The basic use of plants in medicine will continue in future as a source of therapeutic agents and as raw material based for the extraction of semi synthetic chemical compounds such as cosmetics perfumes and food industries, recently even developed countries are using medicinal systems that involve the use of herbal drugs and remedies.

The present day information about the chemical properties is based on various studies that have been done in different parts of the world and it is likely that the chemical constituents may be varying due to edaphic and geographic factors. Hence it was thought necessary to study if there were any variation in the amount of Vitamin C and essential oil present in the plants growing in different regions of India affecting their medicinal properties.

Material and Methods:

Adhatoda vasica Nees. one of the most commonly used important medicinal plants was selected for the study. They were collected from five different regions of Maharashtra and Kerala during the summer and winter season and analysed for Vitamin C content and essential oil.

Vitamin C estimation

Vitamin C content was estimated by the following method:

Stock Standard Solution – 100mg ascorbic acid was dissolved in 100ml of 4% oxalic acid solution in a standard flask.

Working Standard – 10ml of stock solution was diluted to 100ml with 4% oxalic acid.

5ml of working standard solution was taken into a 100ml conical flask. Added 10ml of 4% oxalic acid and titrated against the standardized 2,6-dichloro phenol indo phenol dye solution (v_1 ml). End point is appearance of pink colour which persists for a few minutes.

0.5gm of leaf sample was extracted in 4% oxalic acid and made up the volume to 100ml and centrifuged. 5ml of this supernatant was taken in a conical flask, added 10ml 4% oxalic acid and titrated against the standardized 2,6-dichloro phenol indo phenol dye solution (v_2 ml).

Amount of ascorbic acid mg/g sample:

$$= \frac{0.5\text{mg} \times v_2 \text{ ml} \times 100\text{ml}}{v_1 \text{ ml} \quad 5\text{ml} \quad \text{wt. of sample}}$$

ii] Essential Oil Content

Essential oil content was estimated from the dry powder using Soxhlet extraction method with Hexane as the solvent for extraction in mg/gm.

Observations:

It was observed that in *Adhatoda vasica*, Nees plants collected from Kerala, maximum amount of Vitamin C was observed in the plants collected from Trivandrum during the winter season (Table 1). Whereas, minimum amount of Vitamin C content was observed in the plants collected from Kottayam during summer season (Table 1)

However, it was observed that in all the plants of *Adhatoda vasica*, Nees collected from Kerala during the winter season showed a higher level of Vitamin C as compared to plants of *Adhatoda vasica*, Nees collected during summer season (Table 1) in *Adhatoda vasica*, Nees plants collected from Maharashtra, maximum amount of Vitamin C content was observed in plants collected from Nashik in winter season i.e. 48mg/gm of plant material. While minimum amount of Vitamin C content was observed in plants collected from Mumbai, i.e. 16mg/gm of plant material (Table 2)

Comparatively, more amount of Vitamin C was observed in winter season than in summer season in the plants of Adha-

toda vasica, Nees collected from Maharashtra (Table 2)

It was observed that in *Adhatoda vasica*, Nees plants collected from Kerala, maximum amount of Essential oils was observed in the plants collected from Cochin during the winter season i.e. 0.44gms/1 gm of plant material. Whereas, minimum amount of Vitamin C content was observed in the plants collected from Kottayam during summer season i.e. 0.17gms/1 gm of plant material (Table 3)

In all the plants of *Adhatoda vasica*, Nees collected from Kerala during the winter season showed a higher level of Essential oil content as compared to the plants of *Adhatoda vasica*, Nees collected during summer season (Table 3)

It was seen that, from all the *Adhatoda vasica*, Nees plants collected from Maharashtra, maximum amount of Essential oil content was observed in plants collected from Mumbai in winter season i.e. 0.49gms/1 gm of plant material. While minimum amount of Essential oil content was observed in plants collected from Thane in summer season, i.e. 0.17gms/1 gm of plant material (Table 4)

It was observed that from all the plants of *Adhatoda vasica*, Nees collected from Maharashtra during the winter season showed a higher level of Essential oil content as compared to the plants of *Adhatoda vasica*, Nees collected during summer season (Table 4)

Table 1: Effect of environmental conditions of various places of Kerala on Vitamin C content (mg/gm) of Adhatoda vasica, Nees

Sites	Summer season	Winter season
Trichur	24±0.12	32±0.17
Cochin	36±0.41	40±0.27
Trivandrum	48±0.23	48±0.83
Calicut	40±0.17	44±0.24
Kottayam	20±0.08	24±0.17

Values given are mean ± SD

Effect of environmental conditions of various places of Kerala on Vitamin C content (mg/gm) of Adhatoda vasica, Nees

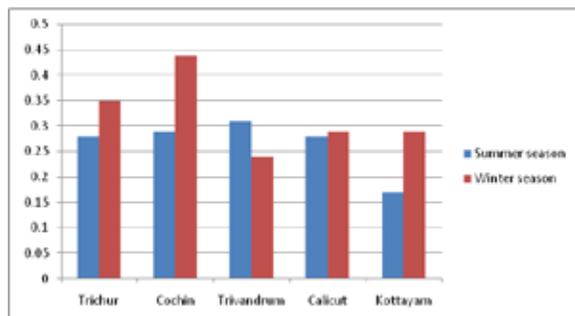


Table 2: Effect of environmental conditions of various places of Maharashtra on Vitamin C content (mg/gm) of Adhatoda vasica, Nees

Sites	Summer season	Winter season
Aurangabad	40±0.41	44±0.47
Jalgaon	40±0.27	44±0.47
Nashik	44±0.28	48±0.41
Thane	32±0.17	40±0.07
Mumbai	16±0.48	24±0.12

*Values given are mean ± SD

Effect of environmental conditions of various places of Maharashtra on Vitamin C content (mg/gm) of Adhatoda vasica, Nees

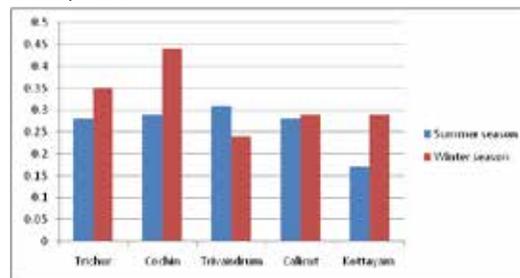


Table 3: Effect of environmental conditions of various places of Kerala on Essential oil content of Adhatoda vasica, L.

Sites	Summer season	Winter season
Trichur	0.28±0.47	0.35±0.12
Cochin	0.29±0.48	0.44±0.47
Trivandrum	0.31±0.41	0.24±0.49
Calicut	0.28±0.07	0.29±0.58
Kottayam	0.17±0.08	0.29±0.18

*Values given are mean ± SD

Effect of environmental conditions of various places of Maharashtra on Essential oil content of Adhatoda vasica, L.

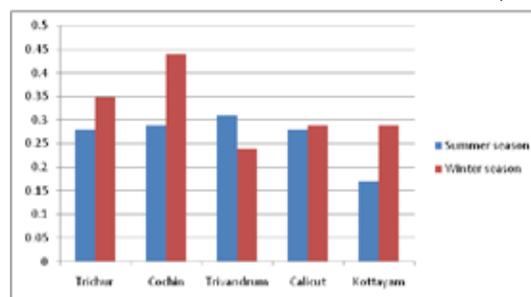
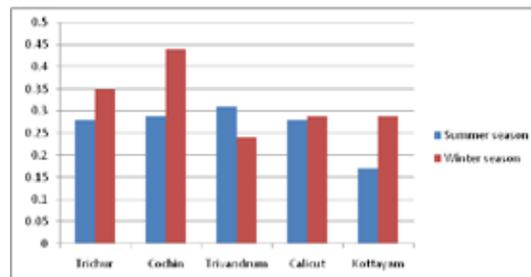


Table 4: Effect of environmental conditions of various places of Maharashtra on Essential oil content of Adhatoda vasica, Nees

Sites	Summer season	Winter season
Aurangabad	0.45±0.45	0.48±0.45
Jalgaon	0.45±0.45	0.48±0.45
Nashik	0.36±0.27	0.45±0.07
Thane	0.17±1.07	0.18±0.17
Mumbai	0.25±0.17	0.49±0.87

*Values given are mean ± SD

Effect of environmental conditions of various places of Maharashtra on Essential oil content of Adhatoda vasica, Nees



Result and Discussions:-

Although essential oils have been used therapeutically for centuries, there is little published research on many of them. However, this is beginning to change as more scientific studies on essential oils are conducted around the world. The chemistry of essential oils is influenced by the local geography and weather conditions, as well as the season and time of day when the plants are harvested, how they are processed, and how they are packaged and stored. Each plant is unique in its chemistry so essential oils are never exactly the same.

There was variation in the Essential oil content in the plants of *Adhatoda vasica* Nees collected during summer and winter seasons. The variation was also noticed in the essential oil content of the plants collected from the various regions of Maharashtra and Kerala. It was observed that a slight increase in the essential oil content was observed during the winter season(December-January).

In the present investigation, the essential oil was extracted after the leaves were dried in the oven at 50°C. The method of drying had a significant effect on the essential oil content of *C. Citrates*(A.R. Mohamed Hanaa et al,2012). The essential oil content obtained from dry leaves was more pure since the moisture content was reduced to a large extent. Hence, in the present investigation, the essential oil was extracted from dry plant material.

Alizadeh et al (2010) have reported that the yield of plant material, essential oil composition and secondary metabolites in medicinal and aromatic plants are strongly influenced by harvest time, ecological and climatic conditions, ontogenetical variation and other environmental factors such as soil type and nutrition (Alizadeh et al., 2010 and 2011; Cabo et al., 1982; Ozguven and Tansi, 1998; Stutte, 2006). Knowledge

of the factors that influence on yield and essential oil composition in medicinal plants is insufficient, and these factors seems to play an important role in drug yield and essential oil composition in medicinal and aromatic plants. Hence in the present investigation, the essential oil yield of two most commonly used medicinal and aromatic plants are analysed.

In the present work it was observed that the Vitamin C content in the plants collected from different places was more during the winter season as compared to the Vitamin C content of the plants collected during the summer season(Table 1,2,3 and 4). Carol Reiss in 1993 has reported higher Vitamin C content in cabbage placed in cold water as compared to the Vitamin C content of cabbage placed in boiling water. He stated that when cabbage was placed in cold water, and the temperature was slowly raised, the total amount of Vitamin C decreased as the temperature rises. Hence in the present investigation also, the vitamin C content was found to be more during winter season when the temperature is much lower.

Conclusion

From the present investigation, it can be concluded that *Adhatoda vasica* Nees plants collected from Kerala are medicinally more useful as the Essential oil and Vitamin C content of both these plants collected from Kerala were found to be maximum especially during the winter season probably due to the environmental conditions in this region which is conducive for it.

Hence *Adhatoda vasica* Nees growing in these regions should be selected for medicinal preparations for best results.

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