**Scholars Academic Journal of Pharmacy**
Abbreviated Key Title: Sch Acad J Pharm
ISSN 2347-9531 (Print) | ISSN 2320-4206 (Online)
Journal homepage: http://saspublisher.com/sajp/

OPEN ACCESS

Medical Biotechnology

# Effect of Season on UV Absorption Property of *Costus Speciosus* Leaves of Sikkim Himalayas

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**DOI:** 10.36347/sajp.2020.v09i01.004 | **Received:** 06.01.2020 | **Accepted:** 13.01.2020 | **Published:** 16.01.2020

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**Abstract** **Original Research Article**

*Costus speciosus* (*C. speciosus*), an edible leafy green, is known to possess a wide range of pharmacological properties. Recently we have shown UV absorption property of *C. speciosus* leaves of Sikkim Himalayas. Ethanol extract of *C. speciosus* leaves for 15 minutes at $40^0$C exerts maximum UV ray absorption property. It is known that pharmacological properties of medicinal plants are due to its secondary metabolite and amount of secondary metabolite varies with season. It is, therefore, thought worthwhile to study the seasonal effect on the UV absorption property of the *C. speciosus* leaves. Leaves of *C. speciosus* were collected in summer, winter, autumn and rainy seasons. Ethanol extracts of the leaves of different seasons were prepared separately. Extracts were allowed to absorb UV rays (wavelength range from 200 nm to 400 nm at 10 nm intervals) in a spectrophotometer to get absorption spectra. As polyphenols have relation with UV absorbing property amount of polyphenol in the leave extract was estimated. Results showed that ethanol extract of *C. speciosus* leaves of rainy season (June – August) had maximum UV absorbing property. Polyphenol content of the leaves was also high during rainy season. It is concluded that ethanol extract of *C. speciosus* leaves of rainy season may be used as anti solar agent in preparation of sun screen lotions.

**Keywords:** *Costus speciosus* leaves, UV absorbing property, seasonal effect, polyphenols, sun screen lotion.



## INTRODUCTION

Secondary metabolites of plants have no direct role in growth of the plant but are responsible to defend themselves against exogenous biotic / abiotic constraints. Different types of secondary metabolites present in plants are, terpenoids, phenols, alkaloids and sulphur containing compounds. These secondary metabolites are responsible for pharmacological activities of plants like anti diabetic, anti inflammatory, anti microbial, anti allergic, anti cancer, anti oxidant, anti gastric ulcer etc [1].

It is reported that amount of secondary metabolites present in plant varies with season. Influence of climate on secondary metabolites in medicinal plants was first studied by Fluck and Pharm [2]. Thereafter, many investigators have shown that accumulation of secondary metabolites in leaves, stem and roots of plants varies with season [3-7].

*C. speciosus (family,* Costaceae), found in tropical region of India along roadsides, streams and in wastelands, is an erect perennial herb [8]. It is edible leafy green. The plant is also found in moist tropical evergreen forests [9]. Known as keu in Bengali and Hindi the plant is used in traditional medicine as anthelmintic, expectorant purgative and stimulant. The plant is also used in the treatments of pneumonia, dropsy, jaundice, diarrhea, dysentery, dyspepsia, rheumatism, skin diseases, fever, bronchial asthma, urinary diseases, cough and cold, eye and ear infections as well as in snake bite cases [10].

*C. speciosus* showed many pharmacological properties like anti bacterial, anti fungal, anti-inflammatory, anti diabetic, anti oxidant, antipyretic, antifertility, antihelminthic, hepatopretective, hypolipidemic, anti cancer etc. The plant also possess anticholinesterase and adaptogenic activities [11, 12].

Recently we found anti solar activity of *C. speciosus* leaves of Sikkim Himalayas. Ethanol extract of *C. speciosus* leaves for 15 minutes at $40^0$C exerts maximum UV ray absorption property. Aim of the present work was to study the seasonal effect on the UV absorption property of the *C. speciosus* leaves. As there is a positive correlation between amount of phenolic compounds in plant's leaf and its UV absorption property [13], effort was also made to estimate amount of phenolic compounds in the *C. speciosus* leaves of different seasons.

## MATERIAL AND METHODS

### Plant Material

Leaves of *C. speciosus* were collected from the local market during autumn (September – November), winter (December – February), summer (March – May) and rainy season (June – August). Samples were authenticated by the taxonomist of the department of Botany of the University of North Bengal, Siliguri. A voucher specimen (No.SM-MB-011) was kept in the department of Medical Biotechnology, Sikkim Manipal Institute of Medical Sciences of Sikkim Manipal University, Gangtok, Sikkim, India for future reference.

**Fig-1: *Costus speciosus* leaves**

### Test Drug

Leaves of *C. speciosus* were washed thoroughly under tap followed by distilled water. Leaves were then shed dried and powered. The powder, used as test drug, was stored desiccated at 4 $^0$C until further use.

### Solvent extraction

Test drug (100g) of different seasons was extracted separately with 500 ml of ethanol in soxhlet at $40^0$C for 15 minutes. Earlier we found that these conditions are needed to get maximum UV absorption property of *C. speciosus* leaves. The extract was filtered and the filtrate was evaporated to dryness *in vacuo* with rotary evaporator at 40 – 50 $^0$C. This was applied separately for all extracts. Brown masses obtained.

### Anti solar activity

10 mg of this mass was dissolved in 100 ml distilled water. The solution was processed in a spectrophotometer for UV ray absorption at the range of 200-400 nm.

### Determination of total phenols content

Brown-yellow mass (20 mg) obtained in extraction process was mixed with 100 ml of distilled water. Solution was then filtered. Total phenols content of the filtrate was determined by the method of McDonald *et al.*, [14]. Each experiment was done for five times and mean value calculated.

### Chemicals

Chemicals required for the study were purchased from Merck, Germany and from Loba Chem. Lab, Himedia Lab, India.

## STATISTICAL ANALYSIS

All experiments were conducted for three times. Data were analyzed statistically by SPSS 20. The statistical significance between UV absorption spectra of different extracts was evaluated with Duncan's multiple range test (DMRT). 5% were considered to be statistically significant [15].

## RESULTS

UV absorption spectra of ethanol extract of *C. speciosus* leaves leaves during autumn, winter, summer and rainy season is represented in Figure-2. Ethanol extract of the plant leaves of autumn absorbs maximum UV ray at 200 nm (0.79). UV ray absorptions by the same extract at 250 nm, 300 nm, 350 nm and 400 nm were 0.71, 0.60, 0.48 and 0.40 respectively. Maximum UV absorption of ethanol extract of *C. speciosus* leaves of winter was found at 200 nm (0.85). At 250 nm, 300 nm, 350 nm and 400 nm wave lengths UV absorption were, however, 0.80, 0.67, 0.53 and 0.43 respectively. UV absorption spectra of ethanol extract of *C. speciosus* leaves of summer was found maximum at 200 nm (1.0). UV ray absorptions by the same extract at 250 nm, 300 nm, 350 nm and 400 nm were 0.89, 0.72, 0.59 and 0.48 respectively. Maximum UV absorption of ethanol extract of *C. speciosus* leaves of rainy season was found at 200 nm (1.5). At 250 nm, 300 nm, 350 nm and 400 nm wave lengths UV absorption were 0.98, 0.79, 0.64 and 0.55 respectively. Overall seasonal effect on UV radiation absorption by the ethanol extract of *C. speciosus* leaves at different wave lengths (200 – 400 nm) is presented in Figure-3.

Seasonal effect on amount of phenolic compounds in *C. speciosus* leaves is shown in Figure-4. *C. speciosus* leaves collected during rainy season had 69.3 mg phenolic compounds in 1 g dry wt of the leaves whereas *C. speciosus* leaves collected during autumn, winter and summer had 22.7 mg, 31.5 mg, 46.1 mg of phenolic compounds per g dry wt of the leaves respectively.

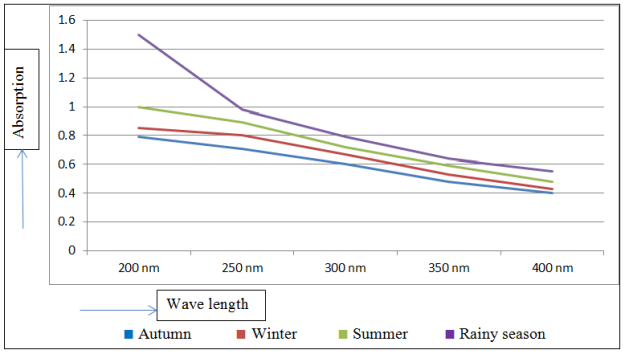


**Fig-2: UV radiation absorptions by the ethanol extracts of *C. speciosus* leaves during autumn, winter, summer and rainy season.**

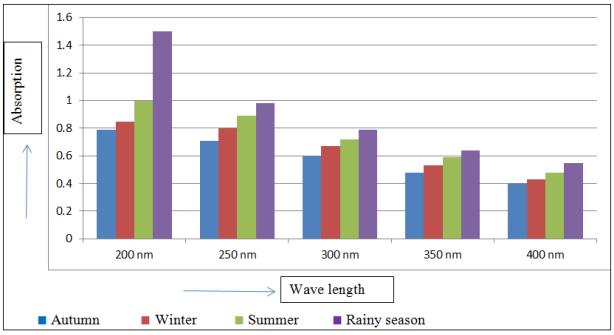


**Fig-3: Effect of season on UV radiation absorption at different wave lengths by the ethanol extract of *C. speciosus* leaves**

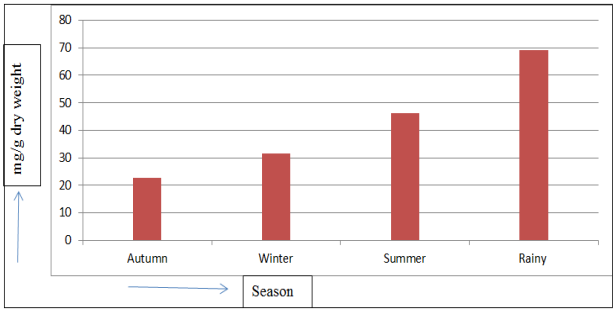


**Fig-4: Amount of phenolic compounds in *C. speciosus* leaves: Effect of season**

## DISCUSSION

It is known that biological activity of a plant is mediated through secondary metabolite. It is also known that concentration of secondary metabolite varies with season. Celiktas *et al.*, showed that antimicrobial activities of methanol extracts of *Rosmarinus Officinalis* was maximum during winter due to presence of high amount of essential oils in the plant [16]. That mineral nutrients and carbohydrates in walnut tree leaves were maximum in rainy season was the observation of Drossopoulos *et al.*, [17]. Hussain et al. showed that chemical composition, antioxidant and antimicrobial activities of basil (*Ocimum basilicum*) essential oils depends on season [18]. Coli *et al.* investigated seasonal variation in activity of pear thrips (*Thysanoptera: Thripidae*) within stands of sugar maple and noted maximum activity in autumn [19]. We also reported that antibacterial activity of leaves of *Murrya koenigii* (linn.) spreng wettst. Varies with season [20]. In the present work it was observed that UV absorption (200-400 nm) property of *C. speciosus* leaves was maximum in rainy season followed by summer, winter and autumn (Figure-3).

Ali. *et al* showed that there is a positive correlation between amount of phenolic compounds in plant's leaf and its UV absorption property [13]. We also reported that UV absorption property of *Murrya koenigii* (Linn) Spreng Wettst leaves was related with its polyphenol content [21]. More polyphenol content of the plant leaves absorbed more ultraviolet radiation. In the present study polyphenol content of of *C. speciosus* leaves of different seasons was estimated. Results showed that amount of polyphenol in the plant leaves was maximum in rainy season when the leaves had maximum UV ray absorption capacity (Figure-4). The present finding thus supports the earlier observations.

In human body ultraviolet radiation is responsible for cutaneous synthesis of vitamin – D. Vitamin - D is involved in formation of bones in humans. People who have low vitamin – D in body suffer from thinning or brittle bones, osteoporosis, anxiety or depression. But, at the same time ultraviolet radiation is bad for human body also. It has been reported that excess ultra violet ray can cause many detrimental effects including skin cancer and change in distribution and function of white blood cells thereby suppressing effect on the immune system in humans [22].

Under the circumstances there is continuous search for the sources which can absorb UV radiation from the environment thereby protecting humans. Medicinal plants were taken as the source and it was found out that many medicinal plants have ultra violet absorption property [23, 24].

In the present work we found UV ray absorption property of *C. speciosus* leaves of Sikkim Himalayas. Compound responsible for this property now needs isolation from the plant leaves. Presently work is going on in this direction in our laboratory.

## CONCLUSION

In this study we observed that ethanol extract of *C. speciosus* leaves of rainy season had maximum UV absorbing property. From this plant leaves active compound may be isolated which, in turn, can be used in preparation of sun screen lotions in future.

## ACKNOWLEDGEMENTS

Cooperation of taxonomists of the department of Botany, University of North Bengal, Siliguri, Dist. Darjeeling, West Bengal in identification of *C. speciosus* leaves is gratefully acknowledged.

**Conflict of interest**: Nil

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