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Assessment of physiological and biochemical comparison in three common garden plants: *Allium sativum* L., *Coriandrum sativum* L., *Coleus amboinicus* Lour

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Abstract
There are many commercial crops that are major backbone of agricultural industries. Among them many are famous for their aroma and flavor which enhance the taste of foods, beverages and drugs. Three common plants viz. *Allium sativum* L., *Coriandrum sativum* L., *Coleus amboinicus* Lour. have been used in this study that are famous for their aroma and medicinal properties. The chlorophylls and antioxidant properties of selected plants were measure; all the selected plants found better in various properties. As for protein, phenolics and DPPH *C. amboinicus*, *C. sativum* and *A. sativum* were better identified respectively. Overall the selected plants are better for antioxidant properties hence; they could be used regularly as spices or medicinally for managing various deficiencies in the body.

Keywords: Antioxidants, aroma, food, protein, phenol, spice

Introduction
Spices are major and important commercial crop, that are backbone of agricultural industry due to their used for imparting flavor, aroma and piquancy to the food items. These are strongly flavored or aromatic substance of vegetable origin mostly obtained from tropical plants that are mostly used for seasoning and flavouring thus, enhancing the taste of foods, beverages and drugs. India plays significant role in the global spice market which is also known as land of spices [1-3]. According to Bureau of Indian Standards, India has 63 spices are widely grown throughout the country in this regards India is the largest producer, consumer and exporter of spices in world with 46% share [4, 5]. Along with flavour, spices are important medicinally; uses of spices are important for prevention of various serious ailments such as hypertension and infection [3]. Spices derived from different plant parts or entire plant that can be used often dried or processed forms that having flavouring, preservating and antiseptic properties due to the presence of volatile or essential oils. Due to their variations in flavour and pungency with antioxidant properties they are used in different medicines that promote various industries as perfumery, soaps, incense, dyes, etc. The functional properties of spices as antioxidants, preservatives, anti-microbial, antibiotic and medicinal have been well recognized [6]. Current study focus on the highly used three important spices plant namely *Allium sativum* L., *Coriandrum sativum* L., *Coleus amboinicus* Lour. *A. sativum*, originated from central Asia is one of the most important and daily uses spice in Indian continent which used as spice and flavoring agent for foods. It has good potential to kill or inhibit bacteria, fungi; prevent blood clotting and contain anti-tumor properties along with boost the immune system and reducing total cholesterol and blood pressure [7]. *C. sativum* originated from near east is another daily uses spice used by Indians having corindrol; a chief constituent of coriander oil. The seeds having anti-cholesterol properties [8] and are used in the preparation of many house hold medicines to cure cold, fever, nausea and stomach disorders [9]. The third selected plant *C. amboinicus* is used to spice dishes containing tomato sauces [10, 11] having medicinal properties due to its aromatic and pungency including antimutagenic, antitumorigenic, antigenotoxic effects and antimicrobial activities [10, 12-15]. On the bases of above important properties these plant have been evaluated for their physiological and biochemical properties.

Materials and Methods

Allium sativum L., *Coriandrum sativum* L. and *Coleus amboinicus* Lour. have been selected on the basis of availability, seasonality, multiple uses and their demand that were collected from Kamal Nursery near Rajpur road, Dehradun, Uttarakhand (India). The plants were assessed by their fresh leaves for chlorophyll contents by the extraction procedure of Hiscox and Israelsham [16] than *Chl*. a, *Chl*. b and Total chlorophyll (*Chl*. a+b) estimated according to the formula given by Arnon [17]; carotenoid contents were measured according to the method of Kirk and Allen [18] by the given formula-

$$C = \frac{D \times V \times F \times 10}{2500}$$

[C = total volume of carotenoid (mg), D = absorbance at 450 nm, V = volume of the original extract in ml, F = Dilution factor and 2500 = extinction coefficient of the pigment].

Biochemically the plants were assessed for total proteins estimation by Bradford [19] method using Coomassie Brilliant Blue G-250 binding dye and bovine serum albumin (BSA) standard. Diphenyl picryl hydrazyl (DPPH) free radical scavenging activity estimated by the method of Singh *et al*. [20] and the total phenolic contents measured by Singleton and Rossi [21] method by using various concentrations of gallic acid and quantification was done on the basis of a standard curve with gallic acid equivalent. Whole experiment was done in laboratory conditions with three replicates (n = 3) of each treatments statistical analysis of mean values ± SE that were subjected to one factorial analysis of variance (ANOVA).

Results and Discussions

In the observations of chlorophylls; *C. sativum* performed better in all the platform of chlorophylls followed by *C. amboinicus* and *A. sativum*. In case of carotenoid *A. sativum* performed better contents as compared with *C. sativum* and *C. amboinicus*. Biochemically DPPH, phenolic and total protein were analyzed. In case of total protein analysis, maximum 4.58 fold protein measured in *C. amboinicus* followed by *C. sativum* (2.87 fold) as compared with *A. sativum* (Table 1). Phenolic and DPPH activities recorded in various concentrations (20, 40, 60, 80 and 100µg/ml). For total phenol observations *C. sativum* having maximum phenolic activity in all concentrations as compared with *A. sativum* and *C. amboinicus* (Fig. 1, Table 1). Similarly, maximum DPPH radical scavenging activity was recorded in *A. sativum* in various concentrations followed by *C. sativum* and *C. amboinicus* (Fig. 2, Table 1). *C. sativum*, *A. sativum* and *C. amboinicus* having good dietary antioxidant activities. *C. sativum* performed better chlorophylls and carotenoid contents as compare with *A. sativum* and *C. amboinicus* because of higher amount of above ground biomass that having higher photosynthetic activities while *A. sativum* with only leafy aboveground biomass; *C. amboinicus* has succulent and less chlorophyllous above ground biomass which have less photosynthetic activities. Cholorophylls having antioxidant compound that reduce the blood sugar, intoxification, indigestion and lowering the allergens [22] on the other hand carotenoids protect the cells from oxidative damage [23, 24]. *A. sativum* has been used as a remedy and health-promoter for 5,000 years which contains organosulfur compounds that has lipid-lowering, antithrombotic, anti-blood coagulation, anti-hypertension, anticancer, antioxidant and antimicrobial properties [25]. *A. sativum* having good quantity of phenolic compounds that possesses potential health promoting effects and source of natural antioxidants [26, 27]. The plant parts of *C. sativum* are rich with aromatic flavour that have been commonly used in cooking systems and herbal remedies for alleviate spasms, gastric complaints, bronchitis, gout and giddiness [28]. Similar results on phenolic compounds and DPPH activities earlier mentioned in various plant parts of *C. sativum* [29, 30]. The phenolic compounds are very important secondary metabolites in plants that having a wide and complex array of phytochemicals which showed various physiological effects *viz*. antioxidant, antimicrobial, antiviral and anti-inflammatory activities along these them able to delay lipid oxidation in foods and biological membranes has provoked research into food science and biomedicine [31,32]. Nutshell, this study shows the presence of well-known antioxidants in the selected plants.

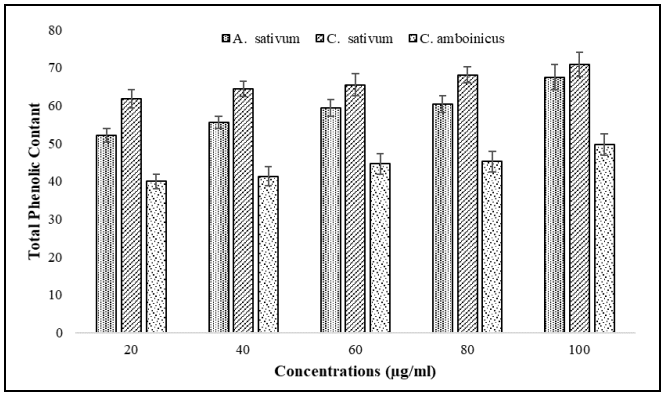

Fig 1: Total phenolic contents with various concentrations (µg/ml) in selected spice plants

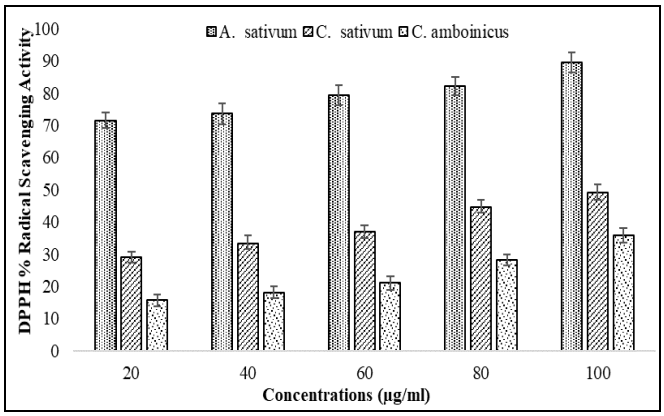

Fig 2: DPPH% radical scavenging activity with various concentrations (µg/ml) in selected spice plants

Table 1: Comparative analysis of some physiological and biochemical parameters of selected plant species

Plant species	Chlorophyll (mg g^{-1} fr. wt.)			Carotenoid (mg g^{-1} fr. wt.)	Total protein (mg g^{-1} fr. wt.)	DPPH (% radical scavenging activity)	Total Phenol (µg/mgGAE)
	Chl. a	*Chl*. b	Total *Chl*.				
Allium sativum	0.76±0.12	0.14±0.01	0.89±0.26	13.48±1.24	02.53±0.69	89.57±3.13	67.52±3.28
Coriandrum sativum	1.70±0.33	0.52±0.13	2.27±0.31	08.78±0.56	07.25±0.83	49.21±2.34	70.82±3.24
Coleus amboinicus	0.63±0.19	0.51±0.18	1.14±0.28	05.97±0.98	11.60±1.79	35.76±2.29	49.66±2.81

Conclusion

All the selected plants performed better for different activities, overall for protein *C. amboinicus*, for phenolics *C. sativum* and for DPPH *A. sativum* shows better antioxidant activity.

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