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BIOCHEMICAL ESTIMATION OF SELECTIVE METABOLITES OF TWO PLANTS OF VERBENACEAE FAMILY

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Medicinal and aromatic plants are potential source of raw materials used for manufacture of drugs and perfumery products. Primary metabolites are directly involved in growth and development of plants. In the present investigation, various plant parts and calli of *Clerodendrum inerme* and *Clerodendrum phlomidis* wers evaluated for their biochemical estimation of primary metabolites *viz.,* total soluble sugar, starch, phenol, proteins and lipid using various methods. Both species of *Clerodendrum* varied in composition of their primary metabolites. Results showed that the maximum content of soluble sugar was found in leaves of *C. inerme* (69.8±0.83 mg/gdw), starch in leaves of *C. phlomidis*(47.2±0.48 mg/gdw), lipids in leaf part of *C. inerme* (55.0±0.67 mg/gdw), proteins in stem part of *C. inerme* (46.0±0.05 mg/gdw) and phenols in roots of *C. phlomidis* (47.2±0.48 mg/gdw). It further concludes that *C. inerme* and *C. phlomidis plant* parts are rich source of primary metabolites and can be used as raw material in industries.

Key words: *Clerodendrum inerme, Clerodendrum phlomidis,* metabolites, lipids,phenol, proteins, starch, sugar.

Medicinal and aromatic plants are potential source of raw materials used for manufacture of drugs and perfumery products. The use of plants as medicines antedates history. People in India and China are known to have used plants for their primary health care needs for over 5,000 years. The primary benefits of using plant-derived medicines are that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment (Bandow *et al.* 2003).

Clerodendrum inerme L., (Verbenaceae) commonly known as garden quinine is a perennial shrub found throughout India. Traditionally, whole plant parts of *C. inerme* are used as to treat coughs, scrofulous infection, venereal infection, skin diseases and Barberi diseases (Kirtikar and Basu 1991, Anonymous 1992). It is also used as febrifuge, vermifuge and antioxidant (Kanchanapoom *et al.* 2001). Aerial parts of *C. inerme* showed potent anti-viral activity against Hepatitis B virus (Mehdi *et al.* 1997).

Clerodendrum phlomidis, (Verbenaceae) commonly known as Agnimentha is a perennial shrub found throughout India. It is mostly used in India and Chinese system of medicines. Traditionally, *C. phlomidis is* used for the treatment of bronchitis, headache, weakness, drowsiness and digestive problems (Nadkarni 1976). A decoction of *C. phlomidis* leaf juice is used as inflammatory.

Primary metabolites, directly involved in growth and development of plants, *viz.,* amino acids, nucleotides and carbohydrates, have a key role in metabolic processes such as photosynthesis, respiration and nutrient assimilation. They are used as industrial raw material and food additives. Many plants such as *Nerium indicum, Gloriosa superba*, *Ricinus communis* and *Euphorbia hirta* have been evaluated for their composition of primary metabolites (Kumar and Vijayvergia 2007, Rishi and Sarin 2009, Vijayvergia *et al.* 2009).

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Table 1: Yield content (mg/gdw) of metabolites of *C. inerme* and *C. phlomidis*

Plant	Plant part	Metabolites (mg/gd.w)				
		Sugar	Starch	Lipids	Proteins	Phenols
C. inerme	Leaf	69.8±0.83	46.0±0.05	**55.0±0.67**	31.0±0.08	35.0±0.26
	Stem	49.7±0.40	43.3±0.37	38.6±0.04	**46.0±0.05**	38.6±0.40
	Root	38.6±0.40	22.1±0.87	21.8±0.32	26.3±0.20	31.0±0.08
	Calli	29.1±0.53	22.1±0.45	18.9±0.13	18.5±0.50	14.0±0.62
C. phlomidis	Leaf	57.2±0.53	**47.2±0.48**	50.0±0.21	28.3±0.16	29.1±0.53
	Stem	55.0±0.67	38.6±0.40	46.0±0.05	42.0±0.60	41.0±0.33
	Root	26.6±0.13	17.0±0.40	24.0±0.44	24.4±0.49	**43.3±0.37**
	Calli	22.0±0.60	10.2±0.22	18.5±0.50	12.6±0.20	17.0±0.18

Abbreviations: mg/gdw = mili gram per gram dry weight

In the present investigation, two plants of Verbenaceace family, *Clerodendrum inerme* and *Clerodendrum phlomidis are evaluated for their* biochemical estimation of some metabolites *viz.,* total soluble sugar, starch, phenol, proteins and lipids.

MATERIALS AND METHODS

Plants of C. inerme and *C. phlomidis were* collected from the campus of University of Rajasthan, Jaipur and Jhalana Hills, Jaipur, respectively. The plants were identified and voucher specimen of each of them was deposited to the Herbarium, Botany Department, University of Rajasthan, Jaipur (*C. inerme* RUBL NO.-20620 and *C. phlomidis* RUBL NO.-20646). The various plant parts (stem, leaves, and roots) of selected plants were separated, washed with running water to remove dust and shade dried.

The calli induced in *C. inerme* and *C. phlomidis* was also studied for the estimation of some metabolites. The calli of *C. inerme* and *C. phlomidis* is raised from leaf as explants on Murashige and Skoog's (1962) medium supplemented with varied concentrations of auxins and cytokinin. The calli is induced in *C. inerme* when *MS* medium supplemented with plant growth regulators NAA+Kn+2,4-D (1.5: 0.5: 1.0 mg/ml). The induction of calli in *C. phlomidis* takes place when MS medium supplemented with plant growth regulators NAA+BAP (0.5: 0.5 mg/ml).

The quantitative estimation of selective metabolites was carried out using different protocols. The powdered plant parts and calli of *C. inerme* and *C. phlomidis* was used for analysis of carbohydrate (Dubois *et al.* 1951), protein (Lowry *et al.* 1951), lipids (Jayaraman, 1981), starch (Dubois *et al.* 1951), phenol (Bray and Thorpe 1954). All experiments were repeated in triplicate and means (±SD) were calculated.

RESULTS AND DISCUSSION

Two plants of Verbenaceace family *viz., C. inerme* and *C. phlomidis* were evaluated quantitatively for the analysis of total soluble sugar, starch, phenol, proteins and lipids (Table 1). In present investigation, both species of *Clerodendrum* varied in composition of total soluble sugar, starch, phenol, proteins and lipids.

In the present study, maximum content of soluble sugar level was observed in leaves of *C. inerme* (69.8±0.83 mg/gdw) and minimum in calli of *C. phlomidis* (22.0±0.60 mg/gdw). Plant sugar can be used as artificial sweetener and they can even help in diabetes by supporting the body in its rebuilding (Freez 1998).

The highest content of starch was observed in leaf of *C. phlomidis* (47.2±0.48 mg/gdw) and lowest content in calli of *C. phlomidis (*10.2±0.22 mg/gdw). Starch is one of the most abundant metabolite in plants. The major sources of starch are wheat, potato and cassava mostly used as food (Tester and Karkalas 2001). Although, starch is also used in cosmetic formulation like face powder and in dusting preparations that use aerosol dispensing systems (Griffin and Wang 1983). Starch may also used as a substitute for petroleum based plastics (Schwach and Averous 2004).

The highest amount of lipids was observed in leaf part of *C. inerme* (55.0±0.67 mg/gdw). The calli of *C. inerme* and *C. phlomidis* have minimum amount of lipids 18.9±0.13 and18.5±0.50 mg/gdw, respectively. Lipids, a diverse group of primary metabolites, include reserve plant material such as fats, essential oils, waxes, terpenoids and oleoresin. Lipids are hydrophobic and a major component of cell membranes, which act as vital cellular messengers and serving as module to hormones and vitamins. With a strong foundation in research and development, plant lipids have developed products that work with diverse requirements, be it culinary, medicinal or cosmetics (Yadav and Tyagi 2006).

The maximum content of proteins was observed in stem part of *C. inerme* (46.0±0.05 mg/gdw). The calli of *C. phlomidis* have minimum amount of proteins, 18.5±0.50 mg/gdw. The presence of higher protein level in the plant points towards their possible increase in food value or that a protein based bioactive compound could also be isolated in future (Thomsen *et al.* 1991).

The highest content of phenols was observed in roots of *C. phlomidis* (47.2±0.48 mg/gdw) and lowest content in calli of *C. inermis (*14.0±0.62 mg/gdw). Phenols possess a number of biological activities such as antioxidant, antiseptic, disinfectant fungicide and pesticides. The higher amount of phenols is important in the regulation of plant growth, development and diseases resistance. Plant phenols may interfere with all stages of cancer process, potentially resulting in a reduction of cancer risk (Hollman 2001).

CONCLUSION

In the present investigation, the maximum content of soluble sugar was found to be observed in leaves of *C. inerme* (69.8±0.83 mg/gdw), starch in leaves of *C. phlomidis* (47.2±0.48 mg/gdw), lipids in leaf part of *C. inerme* (55.0±0.67 mg/gdw), proteins in stem part of *C. inerme* (46.0±0.05 mg/gdw) and phenols in roots of *C. phlomidis* (47.2±0.48 mg/gdw). It concludes that *C. inerme* and *C. phlomidis* plant parts are rich source of metabolites and can be used as raw material in industries.

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