The Bioscan 5 (3) : 403-405, 2010
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES

QUANTIFICATION OF PRIMARY METABOLITES OF *MORINGA OLEIFERA* LAM

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KEY WORDS
Moringa oleifera
Primary metabolites
Lipids, Phenol
Starch
Proteins

Received on :
19.05.2010
Accepted on :
29.07.2010

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ABSTRACT
Since time immemorial, man has used various plant parts in the treatment and prevention of various ailments. These plants provide biologically active metabolites and lead structures whose activities can be enhanced by manipulation through combinations with chemicals and synthetic chemistry. These metabolites can be exploited in the field of new drugs research and for the development of modified derivatives with enhanced activity and reduced toxicity. In the present investigation, various plant parts (leaves, stems, roots and pods) of *Moringa oleifera* was evaluated for their biochemical estimation of primary metabolites *viz.,* total soluble sugar, starch, phenol, protein and lipid. The plant parts varied in composition of their primary metabolites. Results showed that the maximum content of soluble sugar (57.2±0.53 mg/gdw) and phenols (41.0±0.33 mg/gdw) were found in stem part, starch (42.0±0.60 mg/gdw) and lipid (46.0±0.05 mg/gdw) in leaf part and proteins in pods (41.0±0.30 mg/gdw) of *M.oleifera*. It further concludes that *Moringa oleifera* plant parts are rich source of primary metabolites and can be used as raw material in industries.

INTRODUCTION

Medicinal plants are globally priced for their medicinal, flavouring and aromatic qualities for centuries. In India, drugs of herbal origin have been used in traditional systems of medicines such as *Unani* and *Ayurveda* since ancient times (Magner, 1992). The metabolites of plant are commercially important and find its use as raw material for various scientific investigations and in number of pharmaceutical compounds. In recent times, the blind dependence on synthetic drugs is surpassed over to the fact that the herbal drugs are cost-effective, easily available and most importantly, with negligible side effects (Newman *et al.,* 2000).

Moringa oleifera Lam commonly known as Drumstick tree, is a small deciduous tree cultivated in tropical regions of all over the world. It is used as tonic, diuretic condiments, anti-pyretic and for the treatment of rheumatism (Kirtikar and Basu, 1980). The plant was reported to contain various amino acids, fatty acids and vitamins. The coagulant of the seeds could be used for wastewater treatment (Berger *et al.,* 1984). The leaves of *M. oleifera* are used to treat scurvy and catarrhal affection (Caceres *et al*., 1991; Sabale *et al*., 2008).

Primary metabolites directly involved in growth and development of plants. Primary metabolites *viz*., chlorophyll, 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). The present study was conducted to investigate biochemical estimation of primary metabolites *viz.,* total soluble sugar, starch, phenol, proteins and lipids of *Moringa oleifera*.

MATERIALS AND METHODS

Plants parts (stem, leaves, roots and pods) of *Moringa oleifera* were collected from the campus of University of Rajasthan, Jaipur (26.92°NL-75.82°EL). The plants were identified and a voucher specimen was deposited to the Herbarium, Botany Department, University of Rajasthan, Jaipur (RUBL NO: - 26025). The various plant materials were separately washed with running water to remove dust, shade dried and powdered with motar and pestle.

The quantitative estimation of primary metabolites was carried out using different protocols. The powdered plant parts *viz,* leaves, stems, roots and pods of *M. oleifera* was used for analysis of carbohydrate (Dubois *et al.,* 1956), protein (Lowry *et al.,* 1951), lipids (Jayaraman, 1981), starch (Dubois *et al.*, 1956) and phenol (Bray and Thorpe, 1954) respectively. All experiments were repeated in triplicate and means (±SD) were calculated.

RESULTS AND DISCUSSION

In the present investigation, *M. oleifera* was evaluated quantitatively for the analysis of total soluble sugar, starch, phenol, protein and lipid (Table 1). The various plant parts

(leaf, stem, root and pod) of *M. oleifera* varied in composition of primary metabolites studied. Maximum content of soluble sugar level was observed in stem of *M. oleifera* (57.2 ± 0.53 mg/gdw) and minimum in roots (26.0 ± 0.13 mg/gdw) (Table 1 and Fig.1). Previously, higher content of sugar (126mg/gdw) was reported in leaves of *M.indica* (Vijayvergia and Shekhawat, 2009). Plant sugars can be used as artificial sweetener and they can even help in diabetes by supporting the body in its rebuilding (Freeze, 1998). An antitumor polysaccharide was obtained from *Melia azadirachta* (Terumocrap, 1985).

The highest content of starch was observed in leaf (42.0 ± 0.460 mg/gdw) and lowest content in pods (10.2 ± 0.22 mg/gdw) (Table 1and Fig.2). In the observations made by Vijayvergia and Shekhawat (2009) starch was higher in stems of *M.indica* (54 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 be used as a substitute for petroleum based plastics (Schwach and Averous, 2004).

The amount of lipids was highest in the leaf part of *M. oleifera* (46.0 ± 0.05 mg/gdw). The pods of *M. oleifera* had minimum amount of lipids (22.1 ± 0.45 mg/gdw) (Table 1 and Fig.3). Higher content of lipid was reported in roots of *E.alba* (42 mg/gdw) and *C.quadrangularis* (39 mg/gdw) respectively (Viyay and Vijayvergia, 2007). 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

Table 1: Yield content (mg/gdw) of primary metabolites of *M. oleifera*

Plant part	Primary metabolites (mg/gdw) Sugar	Starch	Lipids	Proteins	Phenols
Leaf	50.0 ± 0.21	42.0 ± 0.60	46.0 ± 0.05	28.3 ± 0.16	31.0 ± 0.08
Stem	57.2 ± 0.53	38.6 ± 0.40	31.0 ± 0.05	35.0 ± 0.26	41.0 ± 0.33
Roots	26.6 ± 0.13	14.0 ± 0.62	24.0 ± 0.44	18.9 ± 0.13	38.6 ± 0.40
Pods	29.1 ± 0.53	10.2 ± 0.22	22.1 ± 0.45	41.0 ± 0.30	17.0 ± 0.18

Abbreviations: mg/gdw = mili gram per dry weight

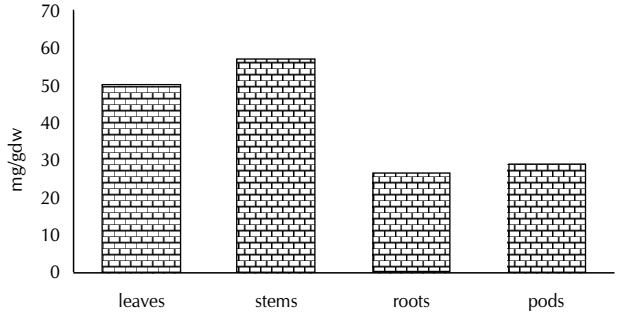

Figure 1: Yield content of sugar from various parts of *M. oleifera*

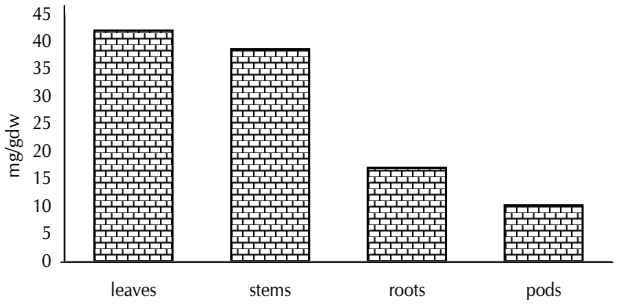

Figure 2: Yield content of starch from various parts of *M. oleifera*

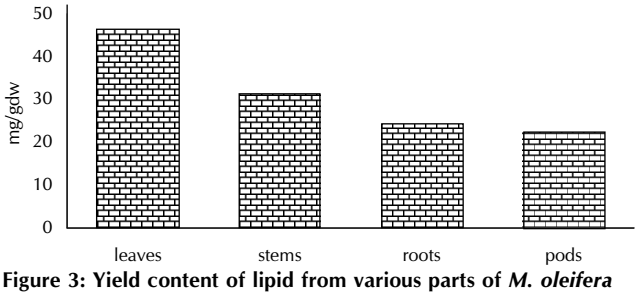

Figure 3: Yield content of lipid from various parts of *M. oleifera*

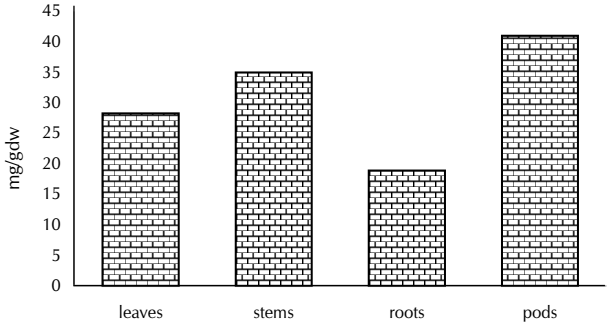

Figure 4: Yield content of protein from various parts of *M. oleifera*

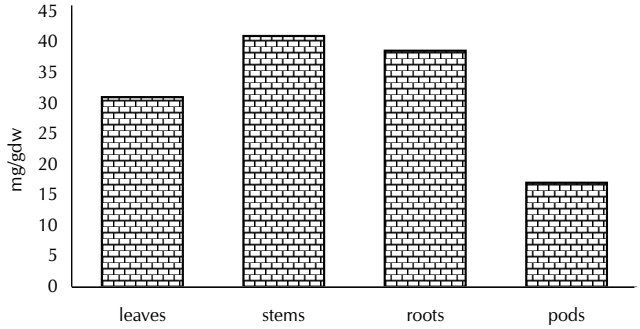

Figure 5: Yield content of phenol from various parts of *M. oleifera*

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 pods of *M. oleifera* (41.0 ± 0.30 mg/gdw). The roots of *M. oleifera* have minimum amount of proteins (18.9 ± 0.13 mg/gdw) (Table 1; Fig.4). In similar studies carried out, protein content was

maximum (64 mg/gdw) in leaves of *M.indica* (Vijayvergia and Shekhawat, 2009),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 amount of phenols was observed in stem of *M. oleifera* (41.0 $\pm$ 0.40 mg/gdw) and lowest content in pods (17.0 $\pm$ 0.18 mg/gdw) (Table 1 and Fig.5). In earlier studies done by Vijayvergia and Viyay (2007), phenols were higher (45 mg/gdw) in roots of *B.aegyptiaca*. 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).

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