Chemical composition of moringa (Moringa oleifera Lam.) leaves from different germplasm

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Abstract

An investigation was carried out in moringa (Moringa oleifera Lam.) to study the extent of genetic variability on yield components and genetic diversity among 12 accessions based on biochemical parameters. The variability persist in the chemical constituents among the accessions may be due to the persistence of species difference and the prevalence of different agro-climatic conditions. The variation could be also being due to different age and growth phase of the plants. The highest vitamin C was recorded by PKM MO 2 (155.60 mg/100g). Among the genotypes, the highest crude fibre content was observed in PKM MO 1 (25.6 %). The magnesium content was highest in PKM MO 6 (0.86 %) followed by PKM MO 12 (0.86 %). Potassium content was recorded higher in genotype PKM MO 3 (3.86 %), followed by PKM MO 5 (3.20 %). The accessions PKM MO 7 followed by PKM MO 10 recorded the highest iron content. Thus, this study helped to identify agronomically superior and genetically diverse moringa germplasm accessions that can be utilized in moringa breeding for enhancement of leaf yield and quality.

Keywords: Moringa, vitamin C, protein, fibre, potassium and genetic diversity

Introduction

India is the largest producer of moringa with an annual production of about million tonnes of tender pods. In India, Andhra Pradesh leads in both area (18,000 ha) and production (7, 20,000 MT), followed by Karnataka (12,000 ha and 4, 56,000 MT). Tamil Nadu ranks third with an area of 8,000 ha and production of 2, 80,000 MT. Moringa oleifera is the most widely cultivated species of a monogenic family, the Moringaceae. This plant is native to the Indian subcontinent and has become naturalized in the tropical and subtropical areas around the world. It can grow well in the humid tropics or hot dry lands and can survive in less fertile soils (Anwar et al., 2005) [3]. It is a drought-tolerant, fast-growing and multi-purpose and one of the most useful trees due to its medicinal and nutritional properties in world and therefore described as a ‘miracle tree’ (Ashfaq et al., 2012) [4]. All parts of the Moringa tree are edible and have been consumed so long by humans. The leaves have an extremely high nutrient value. The leaves are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper (Jaffe, 1984) [9]. Vitamins like beta carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E also present in M. oleifera apart from 10 essential amino acids. In fact, moringa leaves is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 18 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 24 times more iron than spinach (Rockwood et al., 2013). The different parts of this plant have analgesic, diuretic, antihypertensive, antispasmodic, antitumor, antiulcer, cholesterol lowering effect, hepato protective, and hypoglycemic effect and also effective in skin and mucosal diseases (Guevara et al., 1999) [7]. Moringa tree is an effective remedy for malnutrition, especially among infants and nursing mothers. Village women of south western Senegal were trained in the preparation and use of Moringa leaf powder in foods for development of growth and improving overall health in children, pregnant women recovered from anaemia and had babies with higher birth weights and breast-feeding women increased their production of milk (Sambou Diatta 2002) [14].
Moringa seed oil, also known as Ben oil, is a sweet non sticking, non-drying oil with brilliant yellow colour. It is used as a lubricant for fine machinery such as time pieces because it has little tendency to deteriorate and become rancid and sticky (Ramachandran et al., 1980) [11]. It is also useful as vegetable cooking and frying oil. The oil is known for its capacity to absorb and retain volatile substances and is therefore valuable in the perfume industry for stabilizing scents. Considering the above fact, the present study is proposed with the following objectives: To characterize the genotypes based on their biochemical characteristics, to identify promising genotypes with high leaf yield and quality and to determine the level of variability existing among the genotypes.

Materials and Methods

Materials

Six moringa ecotypes (Block I) maintained in moringa genetic resources garden of Department of Vegetable Science, Horticultural College and Research Institute (HC&RI), Tamil Nadu Agricultural University, Periyakulam and another six moringa accessions (Block II) were collected from different districts of Tamil Nadu viz., Theni, Madurai, Karur, Dindigul, Tuticorin and Tirupur through limb cuttings and details of the genotypes used in the present study are listed below.

| Accesions No. | Name of the genotype and Characters | Place of collection |
|---------------|------------------------------------|---------------------|
| PKM MO 1      | Otu Karrumpu Murungai               | Kaveyamppatty-murungai |
| PKM MO 2      | Semmurmungai                       | Kamatchipuram -       |
| PKM MO 3      | PKM. 2                             | Periyakulam           |
| PKM MO 4      | Malaimurungai-29                   | Murugamalai -         |
| PKM MO 5      | Medium poded                       | Cholavanthan          |
| PKM MO 6      | Long poded                         | Warangal              |
| Check         | Nattumurungai -34                  | Kamatchipuram -       |

Table 2: Description of moringa genotypes (Block II)

| Accesions No. | Name of the genotypes and characters | Place of collection |
|---------------|--------------------------------------|---------------------|
| PKM MO 7      | Nool Murungai                        | Puthupai            |
| PKM MO 8      | Bitter Type                          | NBPUR               |
| PKM MO 9      | Yalpanam Murungai                    | Valliammalpuram     |
| PKM MO 10     | Nattu Murungai                       | Kadayachapuram      |
| PKM MO 11     | Vadippati Murungai                   | Kujilampaarai       |
| PKM MO 12     | Short Poded                          | Kadamaligundu       |

The above twelve genotypes along with check Nattumurungai (kamatchipuram) were taken for evaluation.

Observations recorded

In Block I and block II the observations were recorded in each moringa accessions.

Estimation of biochemical parameters

Estimation of Ascorbic acid

Ascorbic acid was estimated according to the procedure given by (A.O.A.C 1975) [1] and expressed as mg per 100g of fresh sample.

Estimation of Crude protein

Total nitrogen (%) = [(ml of standard acid x N of standard acid) - (ml of standard NaOH - C.F.) x N of standard NaOH] x 1.4007 /weight of sample (g). ·Correction factor (C.F.) = (Titre of standard NaOH against blank - ml of standard acid). Protein content was determined by multiplying total nitrogen value with 6.25 (A.O.A.C 1975) [1]. Protein (%) = Total Nitrogen (%) X 6.25

Estimation of Crude fibre

Crude fibre of dried leaf powder sample was estimated.

Estimation of Moisture Content (%)

The moisture content was determined by taking the weight of fresh leaves and it was dried in oven at to get weight of dry leaves. It was worked out and expressed in percentage.

Estimation of Ca and Mg content

The calcium and magnesium content of dried leaf powder sample was estimated as per the method described by (Jackson 1973) [8] an expressed in percentage (%).

Estimation of Potassium (K) Concentrations

The Flame Photometry method was used to determine the potassium concentrations. The digest was diluted and the potassium emissions measured in air- acetylene flame. A calibration curve of potassium emission against concentration was drawn and compared to that of a standard solution (A.O.A.C 1975) [1].

Determination of Micro nutrient

Determination of micro nutrient was done by dry ashing and atomic absorption spectrophotometer (AAS), according to (A.O.A.C 1975) [1]. The micro nutrient that was determined was iron.

Statistical analysis

Analysis of variance

Estimation of ANOVA using the mean values of all genotypes to find out the significance of genotypes effect was suggested by (Panse and Sukhatme 1985) [10].

Results and Discussion

Twelve accessions of moringa were evaluated for different morphological and biochemical characters. Observations on morphological, physiological and biochemical characters were studied. Biochemical traits viz., vitamin C (mg/100g), vitamin A (mg/100g), crude protein (%), crude fibre (%), calcium (%), magnesium (%), potassium (mg/100g), iron (ppm) were recorded. The per se performance plays an important criterion for discarding the undesirable types, which could be used for any selection programme, for crop improvement. This possesses a better scope of the germplasm to be employed as the potential source and also for selecting the high yielding accessions with all desirable attributes. The results of the present investigation in twelve moringa genotypes showed similarity with the findings of many workers in moringa (Resmi et al., 2006) [12], (Tak and Maurya 2015b) [17] and (Tak and Maurya 2015a) [16]. Analysis of different characters revealed that the mean square values among the accessions were positive for all the traits studied under the possibility of exploiting the variation for quality improvement programmes in moringa.

Vitamin C is essential micro-nutrient required for normal metabolic functions of human body, supplied by fruits and vegetables. According to US standards minimum of 60 mg of ascorbic acid is a daily requirement for human body (Ting 1980) [19]. Moringa is a good source of vitamin C yet its use as
The check nattumurungai (kamatchipuram) recorded 1.08% potassium content (Toma, 2016) [20]. The iron content ranged from 210 - 255 ppm. The accessions PKM MO 7 (254 ppm) followed by PKM MO 10 (250 ppm) recorded the highest iron content. The highest iron content was observed in PKM MO 7. The grand mean value was 234.65 ppm. The check nattumurungai (kamatchipuram) showed 241 ppm of iron content.

Conclusion

In the present trial, twelve divergent accessions of moringa have been evaluated. The accessions were studied such as crude protein (%), crude fibre (%), calcium (%), magnesium (%), potassium (%), Vitamin C (mg/100g), Vitamin A (mg/100g), iron (ppm) and the observation are recorded. The per se performance plays an important criterion for discarding the undesirable types, which could be used for any selection programme, for crop improvement. This possesses a better scope of the germplasm to be employed as the potential source and also for selecting the high yielding accessions with all desirable attributes. Analysis of different characters recognized that the mean square values among the accessions were positive for all the eight traits studied under the possibility of exploiting the variation for quality improvement programmes in moringa. Leaf yield was also noticed to be higher in genotypes rich in crude protein, calcium, magnesium and potassium. Based on per se performance of the genotypes regarding biochemical traits, the genotypes viz., PKM MO 2 (155.60 mg/100g), PKM MO 9 (145.61 mg/100g) and PKM MO 12 (140.56 mg/100g) revealed the higher vitamin C content, the genotypes viz., PKM MO 8 (33.40 %), PKM MO 4 (32.44 %) and PKM MO 10 (32.50 %) showed highest crude protein content, the genotypes viz., PKM MO 7 (254 ppm), PKM MO 10 (250 ppm) and PKM MO 12 (253 ppm) registered the higher iron content. These genotypes may be utilized for further studies in moringa.

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