Research Article

CHARACTERIZATION OF AFRICAN MARIGOLD GENOTYPES USING BIOCHEMICAL PARAMETERS

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ABSTRACT

The experimental material consisted of 67 genotypes collected from different places of India and the experiment was conducted at Western block, Horticultural College and Research Institute, Periyakulam, during two seasons of August, 2013 to November, 2013 and December, 2013 to March, 2014 with 67 diverse genotypes and experiment was laid out under Randomized Block Design with three replications. The shelf life was highest (4.60 days) in AM-29 of *Tagetes erecta* recorded the maximum shelf life (5.00 days). The maximum carotenoid and xanthophyll content in *Tagetes erecta* was registered by AM-3 (0.95 mg/g and 146.60 g/kg respectively). The overall performance was found to be superior in AM-29 of *Tagetes erecta*.

INTRODUCTION

Marigold (*Tagetes erecta* L.) belongs to Asteraceae family and is a herbaceous plant with aromatic, pinnately divided leaves and is usually used as a bedding plant, cut flower and also as a coloring agent in poultry feed to obtain yellow egg yolks (Dole and Wilkins, 2005). Commercially, the flowers are exploited for their xanthophyll content which finds industrial application in several areas like preparation of natural dyes, essential oil, mosquito and nematode repellents and poultry industry etc. Xanthophylls (oxygenated carotenoids) are components with strong demand in international markets. They are used as additives for poultry (e.g. chicken), crustaceous (e.g. shrimp) and fish (e.g. salmon) feeds to provide bright colors in egg yolks, skin, and fatty tissues due to its pigmenting properties (Bernhard, Broz, Hengartner, Kreienbuhl and Schiedt, 1997; Bletner, Mitchell and Tugwell, 1966; Hencken, 1992; Levi, 2001). Despite the success of these innovative efforts, none of them reports xanthophylls production in quantity and quality comparable to processes that extract the xanthophylls from their natural source. One of these substrates is the marigold flowers (*Tagetes erecta*) considered as one of the richest natural sources of xanthophylls, mainly lutein (Ausich and Sanders, 1997; Levi, 2001). The pigment present in the flower significantly enhanced the intensity of the yellow colour of egg yolks and broiler skin. At present, in India, particularly in south India, private companies are undertaking contract farming of marigold involving 35,000 acres with more than 30,000 farmers across 4 states in India especially in Vidharbha region of Maharashtra for the extraction of xanthophyll pigment. Indian production of marigold accounts 360.10 MT. The leading states of marigold production are Tamil Nadu, Karnataka, Gujarat, Maharastra, Haryana, Andhra Pradesh, Orissa, Chattisgarh, Uttar Pradesh. Chandrasekhar *et al.* (2003). African marigold is used as a Poultry feed, intensifies colour of egg yolk & broiler skin. The recovery percentage 0.8–1.0%. The commercial production of *Tagetes erecta* for the synthesis of natural dye is done by the company AVT– Promotes SF and L-3 hybrids. Marigold of orange type has arich source of polysaccharide that includes galactose, glucose, arabinose. The lycopene present in marigold is also known to lower the risk of heart disease and prostrate cancer. The antioxidants present in marigolds are also known to protect the eyes from macular degeneration and cataracts.

MATERIALS AND METHODS

The fresh flower samples were collected, weighed and macerated in a homogenizer with 80% acetone. The extract was centrifuged at 3000 rpm for 15 minutes. After centrifuge, collect the supernatant and makeup the volume to 25 ml by using 80% acetone. The absorbance of extract

was read in a Spectrophotometer at 480 nm and 510 nm (Yoshida *et al*., 1971).

Carotenoid = 7.6 (OD at 480) – 1.49 (OD at 510)] × V/W × 1000 mg g^{-1}

Xanthophyll was estimated by AOAC method (Lawrence, 1990). The procedure in detail is as follows: Homogenize well, the dried petals into fine powder. Then accurately weigh 0.05 g of petal meal into 100 ml volumetric flask, pipette 30 ml extract into flask. Shake well for 10 - 15 minutes.

Hot saponification: Pipette 2 ml of 40 per cent methanolic KOH into flask. Shake for one min. Reflux the flask in a water bath at 56°C. Attach air condenser to prevent loss of solvent. Cool the sample. Keep it in dark for one hour then pipette 30 ml hexane into flask. Shake for one minute makeup the volume with 10 per cent sodium sulphate solution and shake vigorously for one minute. Keep in dark for one hour. Collect the upper phase in a 50 ml volumetric flask. Pipette 3 ml of upper phase into 100 ml volumetric flask and makeup the volume with hexane. Mix well (Plate-2) and measure absorbance at 474 nm. The total xanthophyll content in the sample was calculated by using the formula,

Total xanthophyll (g/kg petal meal) = A474*D/W x 236

Where,

A474 = Absorbance at 474nm;
W = weight of the sample (petal meal) in g;
D = Final dilution;
236 = Translation specific absorptivity for 1gm/litre.

RESULTS AND DISCUSSION

Quality parameters

The real worth of marigold for commercial value resides on its quality parameters such as carotenoid content, xanthophyll content and keeping quality of the genotypes under study. The shelf life of marigold is considered to be an important quality parameter for cut flower and loose flower industry. In this context, the shelf life decides the keeping quality of the flowers which is a rewarding trait for its commercial and consumer value. It was evident from the study that the genotype AM-29 of *Tagetes erecta* registered the maximum shelf life of 4.60 days. These findings are in agreement with the results of Gomathy (1996), Singh *et al.* (2006) in marigold; Bhattacharjee (1981a); Barooah *et al.* (2009); Wankhede *et al.* (2013) in gerbera; Rani *et al.* (2007) in gladiolus. The performance of the genotype AM-3 was overwhelming with richest amount of xanthophyll content (146.60 g/kg) which was closely followed by AM-15(146.53g/kg). It was interesting to note that the genotype AM-3 (0.95 mg/g) had the highest carotenoid content when compared to the other genotypes. The other genotypes that follow the genotype with the highest carotenoid content are AM-9 (0.85mg/g) and AM-8 (0.80 mg/g). The flower colour, which is a heritable character and such differences in the pigments might be due to gene action and can be used for varietal identification. The results are in concurrence with the findings of Wutiporn (1984); Kasemap *et al.* (1990); Gomathy (1996); Sowbhagya *et al.* (2004) in marigold; Kuehnle *et al.* (1997) in orchid.

Table 1. *Per se* performance of genotypes in *Tagetes erecta* L for qualitative parameters

Accession Number	Shelf life	Carotenoid content	Xanthophyll content
AM-1	3.58	0.49	101.10
AM-2	4.73	0.77	137.76
AM-3	5.94	0.96	147.25
AM-4	4.65	0.53	121.34
AM-5	5.08	0.76	128.71
AM-6	4.15	0.37	128.64
AM-7	5.38	0.74	106.30
AM-8	4.78	0.83	121.24
AM-9	3.70	0.84	142.78
AM-10	3.43	0.43	117.46
AM-11	3.64	0.77	114.49
AM-12	3.84	0.68	100.52
AM-13	4.22	0.48	120.015
AM-14	3.68	0.66	101.90
AM-15	5.79	0.66	146.31
AM-16	3.8	0.58	120.98
AM-17	4.30	0.58	102.10
AM-18	3.43	0.48	117.29
AM-19	5.84	0.54	147.48
AM-20	3.75	0.67	136.85
AM-21	3.14	0.64	127.36
AM-22	5.24	0.47	127.26
AM-23	5.43	0.33	119.88
AM-24	4.05	0.44	113.15
AM-25	4.67	0.68	138.19
AM-26	4.62	0.47	102.27
AM-27	4.48	0.76	138.09
AM-28	4.20	0.39	145.58
AM-29	6.22	0.56	104.73
AM-30	3.95	0.42	128.88
AM-31	3.5	0.47	112.035
MEAN	**4.42**	**0.598**	**123.210**
SEd	**0.01**	**0.011**	**1.542**
CD	**0.03**	**0.021**	**3.022**

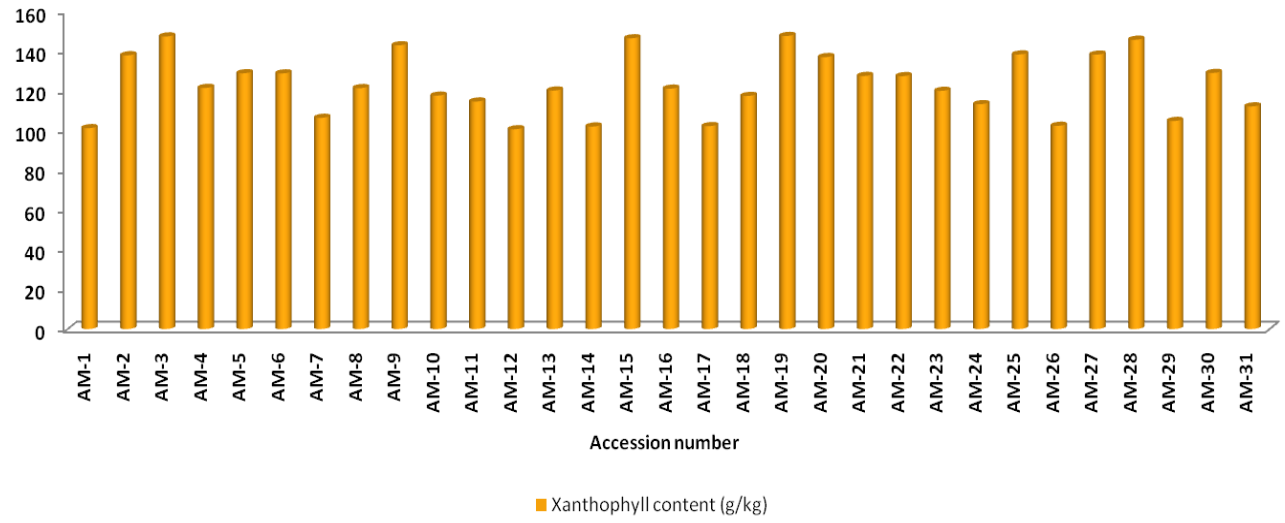

Fig. 1. *Per se* performance of *Tagetes erecta* for xanthophyll content

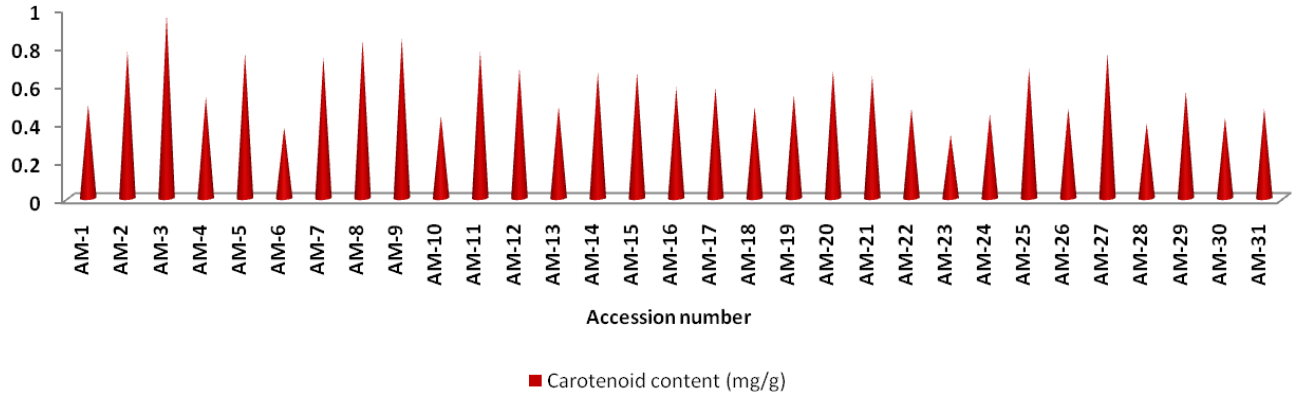

Fig. 2. *Per se* performance of *Tagetes erecta* for carotenoid content

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