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Evaluation of gaillardia (*Gaillardia pulchella* Foug.) genotypes for xanthophyll yield under Northern dry zone of Karnataka, India

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Abstract
The present study was conducted with an objective of "Evaluation of gaillardia genotypes for xanthophyll yield under Northern dry zone of Karnataka" from petals because these dietary xanthophylls are known to reduce the risks of age-related macular degeneration (AMD) and cataracts. Fifteen genotypes were studied *viz* UHSBGL-1, UHSBGL-2, UHSBGL-3, UHSBGL-4, UHSBGL-5, UHSBGL-6, UHSBGL-7, UHSBGL-8, UHSBGL-9, UHSBGL-10, UHSBGL-11, UHSBGL-12, UHSBGL-13, UHSBGL-14 and UHSBGL-15 which withstand typical environmental conditions of northern dry zone of Karnataka and the genotypes produced flowers that do not vary in color and were relatively unaffected by any pests and diseases. Xanthophyll was extracted from milled gaillardia petals using hexane method of extraction. However, overall high xanthophyll yield was obtain in genotype UHSBGL-5 (9.11g/kg) followed by UHSBGL-14 (6.11g/kg). These genotypes were found to be suitable to undergo further commercialization or subsequent processing and standardization of extraction procedure for economic, culinary and pharmaceutical benefits.

Keywords: Gaillardia (*Gaillardia pulchella* Foug.) genotypes, xanthophyll yield

Introduction
Gaillardia (*Gaillardia pulchella* Foug.) is commonly known as "Blanket Flower" because of its wide array of colours and patterns including Mexican blankets, gold tipped with russet-red centers but recent introductions have expanded the colour range. Gaillardia is also referred to as fire wheel or Indian blanket or brown eyed susan in European countries (Helen *et al*., 2007). It is called as "Galate hoovu" and "saventige" in vernacular language of Karnataka. It is one of the important hardiest annual flower crop which belongs to the family Asteraceae with the basic chromosomes number of x=18 and 2n=36 (Srivastava and Kandpal, 2006) [9]. It is native to Florida and western United States. The generic name of Gaillardia was proposed in honour of Gaillard de Marentonneau in 18th century, a French supporter of Botany (Bailey, 1929) [2].
It is a herbaceous annual or short-lived perennial growing up to a height of 30 to 150 cm. Out of twenty species available in the genus, only *Gaillardia pulchella* is annual and *Gaillardia aristata*, is a perennial one in cultivation (Anon., 1950) [1]. The flowers of gaillardia are small and numerous; born in solitary, usually showy heads which is known as capitalism with 4 to 6 cm in diameter. Individual flowers in a capitalism are called as florets which range from one to ten according to cultivars or genotypes. As a member of Asteraceae family it has both ray and disc florets which are pistillate and hermaphrodite in nature respectively. The flower has a long hairy stalk and single, semi double and double types with single or multicolored heads. The crop produces flowers in a wide range of colors such as yellow, orange, cream, scarlet, bronze, brick-red and red and can be grown all around the year.
Gaillardia is a potential flower crop that is gaining popularity throughout India on account of its easy cultivation and wide adaptability. Its habit of free and early flowering, bright shades of colors, shape and size with long blooming period has attracted the attention of flower growers. It has great demand for loose flowers, garlands, garden display and decorative purposes at various religious and social functions. It is grown in a herbaceous border and is also ideal as a filler for newly planted shrubberies. For landscaping purpose, it is grown in flower beds, borders and also as potted plants.

A part from its significance in commercial floriculture, it can be valued for multipurpose uses. Gaillardia flower can also be used as richest source of natural carotenoids and its carotenoid pigment namely xanthophyll (Naik *et al.*, 2005) [6]. Carotenoids have been reported to be beneficial in several aspects of human health such as supporting eye and skin, and reducing the failure of the eyesight due to age-related macular degeneration (AMD), coronary heart disease and cancer (Boonnoun *et al.*, 2012) [3]. Industrial use of carotenoids extracted from flowers is being used commercially in pharmaceuticals, food supplements, animal feed additives and as food colourant.

Basically, it is gaillardia flower petals which are significant source of the xanthophyll and have a much higher concentration of this pigment in comparison with other plant materials. Therefore, petals are used for extraction of xanthophylls.

Material and methods

The present investigation entitled "Evaluation of Gaillardia (*Gaillardia pulchella* Foug.) Genotypes for Xanthophyll Yield under Northern Dry Zone of Karnataka" was undertaken at Department of Floriculture and landscape, College of Horticulture, Bagalkot during the year 2017-18. The experiment was laid out in simple randomized block design with two replication and fifteen treatments. Forty-five days old seedlings were transplanted on the main field with a spacing of 30 X 45 cm. Flowers were harvested at peak flowering stage, petals were separated and used for xanthophyll yield estimation in each 15 genotypes using nexin method of extraction**.**

Analysis of xanthophyll was done using the freshly harvested flower petals as per the mentioned procedure. Fresh flowers (40g) were taken and cut into small pieces, were homogenised in a domestic mixer /grinder for 1-2 minutes, from this homogenised sample, 2g was transferred into a 100 ml amber coloured standard flask, 75-80ml of acetone was added and sonicated for 20minutes, Made up to the volume with acetone, 2ml of the solution was transferred into a 50ml standard flask and made up to the mark with Hexane. Absorbance was measured at 474nm using hexane as reference. Pratheesh *et al.* (2009) [7].

Total Xanthophylls (gm/kg) = A 474 x D x F / G x 2360

Where,

A 474 = Absorbance at 474 nm
F = Instrument derivation factor = 0.561/A474 (of working std. solution)
G = Weight of sample taken

Results

Results obtained on biochemical analysis of gaillardia for xanthophyll content in various genotypes of gaillardia are presented in Table-1.

Table 1: Xanthophyll content in flowers at peak flowering stage in various genotypes of gaillardia.

Genotypes	Xanthophyll (g/kg)
UHSBGL-1	1.19
UHSBGL-2	2.56
UHSBGL-3	1.88
UHSBGL-4	1.57
UHSBGL-5	9.11
UHSBGL-6	2.52
UHSBGL-7	3.55
UHSBGL-8	1.06
UHSBGL-9	2.44
UHSBGL-10	1.47
UHSBGL-11	4.96
UHSBGL-12	3.38
UHSBGL-13	4.66
UHSBGL-14	6.11
UHSBGL-15	2.49
S EM ±	0.27
CD (0.05)	0.85

UHSBGL* University of Horticultural Sciences Bagalkot Gaillardia Local

Xanthophyll content in flowers of various genotypes of gaillardia varied significantly among the genotypes, significantly maximum xanthophyll content was found in genotype UHSBGL-5 (9.11g/kg) followed by UHSBGL-14 (6.11g/kg) while least amount of xanthophyll was recorded in genotype UHSBGL-1 (1.19g/kg).

Discussion

The xanthophyll content in different gaillardia genotypes varied significantly. Among them genotype UHSBGL-5 is a yellow coloured pompon type of flower and produced more number of petals compared to other genotypes hence it may have given maximum xanthophyll yield, followed by UHSBGL-14. Whereas genotype UHSBGL-1 is orange yellow single whorl flower, this might be reason to produce least xanthophyll yield followed by UHSBGL-10 (Fig.1). Xanthophyll yield among the genotypes might have varied due to the genetic makeup and ability of genotype to produce pigments and it can also be attributed to the colour of flower and number of petals produced in a single flower by the different genotype. These results were supported by findings of Rao *et al*. (2005) [8], Kaul and Bedi (2006) [5], Pratheesh *et al.* (2009) [7] and Ahmad *et al.* (2011) in marigold.

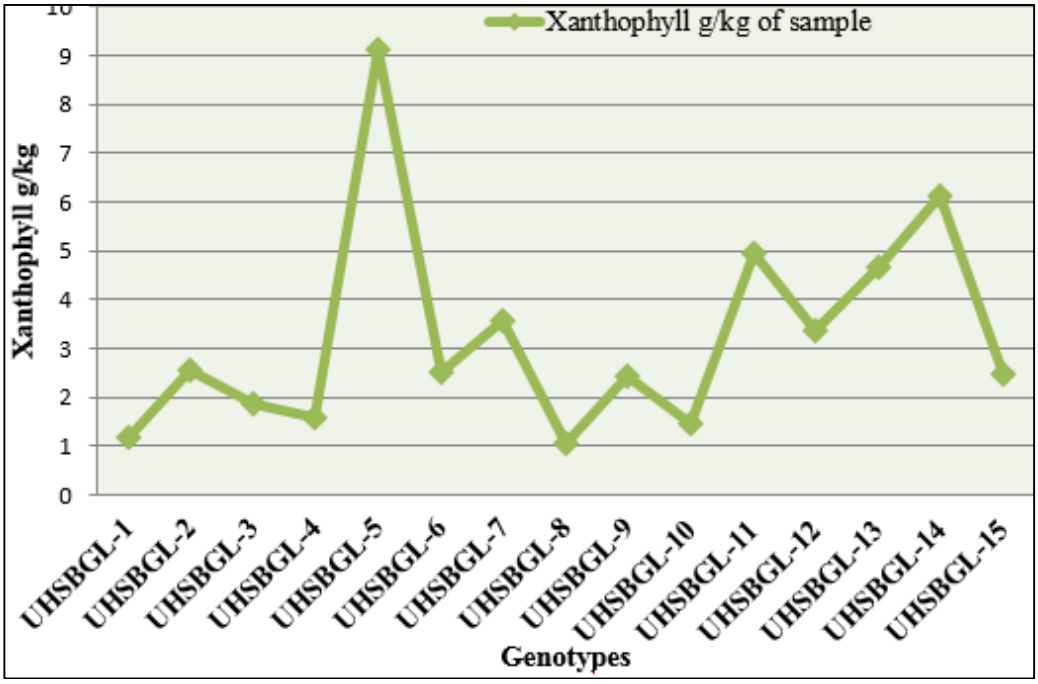

Fig 1: Xanthophyll content in flowers various genotypes of gaillardia.

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