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Determination of growth habit in different safflower genotypes

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Abstract
In order to study the growth habits of different safflower genotypes, 200 varieties safflower were evaluated in summer , 2004-2005 in Karaj Iran.
Seeds were sown by hand on an inter-row spacing of 50cm and with 5cm intra-row spacing, each plot consisted of 3m rows in length. After emergence, manual thinning was used to obtain normal density. In this experiments, 70kg/ha of P2O5 as ammonium phosphate and 25kg/ha of nitrogen as urea were supplied prior to sowing and 30kg/ha of nitrogen as urea at the start of stem elongation. Weeds were controlled by manual weeding before stem elongation. Irrigation was used at 7 stages: After emergence, stem elongation, bud formation, beginning of the flowering, 50% of flowering, at the end of flowering and seed filling .During the growth period some important traits were recorded such as: dates of germination ,stem elongation, flowering time and maturity date.
The results showed that the genotypes can be classified in 4 different groups:

1. The genotypes that remain in rosette stage because of absence of cold condition called winter types.
2. The genotypes that pass the rosette stage and start bolting but no flower and no seed.
3. The genotypes that pass the rosette stage and start bolting and flowering but stay in the first stage of flowering.
4. The genotypes that pass the rosette, bolting, flowering and filling stages that called spring types.

Some important agronomic traits were recorded in group 4. It seems that the trait of growth habit in safflower can be controlled by many genes.

Key words: growth type- rosette- bolting- flowering- genotype

Intoduction

Safflower (*Carthamus tinctorius* L.) has been grown since ancient times (4500 BC) in Egypt, Morocco, China and India to obtain carthamin from the flowers, a dye that may be either yellow or red. India and Ethiopia are the countries with the longest tradition of growing safflower as an oil plant (Weiss, E.1983).
Iran is one of the richest germplasm sources of Safflower (*Carthamus tinctorius* L.). For instance, out of the 2042 safflower genotypes deposited at the Western Regional Plant Introduction Station, Pullman, WA, USA, 199 are from Iran (De Haro et al., 1991).
In Iran the area safflower cropped has increased over the last few years reaching about 7500 ha in 2008 whereas in 1997 it was 200-300 ha (Omidi, 2008).
In evaluation of exotic safflower genotypes (Omidi, 2005) concluded that some varieties able to toll very cold condition that classified as winter types.
Evaluation of Iranian native safflower (Omidi, 2000) demonstrated that there are differenc rosete behavior in safflower genotypes under study (long and short period).
Karapetian (2001) in crosses of 11 winter safflower varieties concluded rosete stage heritability is a polygenic trait. Yazdi-Samadi and Abd-Mishani (1989) grouped all 1618 Iranian and American safflower genotypes into 5 clusters according to their similarities and reported that the of lines from USA and Iran and other eastern countries were classified into same cluster, as they had similar genetic base.
The above results showed that different genotypes need different cold requirement. This study carried out to classification new safflower lines and cultivars in Iran.

Materials and methods

In jun 2005 Iranian and introduced safflower varieties and advanced lines were planted for study different growth habit in Karaj - Iran. Seeds were sown by hand on an inter-row spacing of 0.5m and with an intra-row spacing of 5 cm, each plot consisted of rows 3m long. After emergence, manual thinning was used to obtain normal density. For the experiment, 70kg/ha of P2O5 as ammonium phosphate and 25kg/ha of nitrogen as urea were supplied prior to sowing and 30kg/ha of nitrogen as urea at the start of stem elongation. Weeds were controlled by manual weeding before stem elongation. Irrigation was applied at 7 stages: After emergence, stem elongation, bud formation, beginning of flowering, 50% of flowering, finishing of flowering and seed filling. Data on yield per plant and yield components and other agronomic traits were recorded on plants randomly selected from the two middle rows in spring types.

Results and discussion:

The results showed that the genotypes can be classified in different groups:

1- The genotypes that remain in rosette stage because of absence of cold condition called winter types. Such as: padedeh, varamin295, zargan 279.

2- The genotypes that pass the rosette stage and start bolting but no flower and no seed such as: KW2, KW5.

3- - The genotypes that pass the rosette stage and start bolting and flowering but stay in the first stage of flowering, such as: Aceteria, mahali zanjan

4 - The genotypes that pass the rosette, bolting, flowering and filling stages that called spring types such as: Arak 2811, IL111, KH48154, Esfahan 28 and Esfahan 14

It looks that the traits of growth habit in safflower can be controlled by many genes. The range and mean of some important traits (group 4), are presented in table 1, Fig 1, 2, 3 and4.

Table1. Some agronomic traits of spring varieties:

Traits	Mean	Range	Traits	Mean	Range
Grain yield/plant (gr)	12.2	4-17	Days to flowering	69.1	60-70
Grain yield /plot(gr)	250.7	110-388	Days to 50% flowering	80.2	79-81
100.S.W.(gr)	33.3	24-39	Days to 100% flowering	91.2	88-93
No. Capitula	11	7-19	Days to maturity	122.1	119-130
No. seed / capitula	25.7	19-44	Oil %	27.7	21-33
No. Sub branches	9	4-11	Oil yield / plant (gr)	4.9	3.1-6.2
Height (cm)	75	56-99	Oil yield /plot (gr)	75.6	55-89

Fig. 1.Grain yield per plant (gr) treats of spring varieties

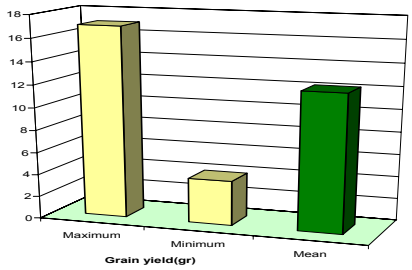


Fig. 2.Number of days flowering treats of spring varieties

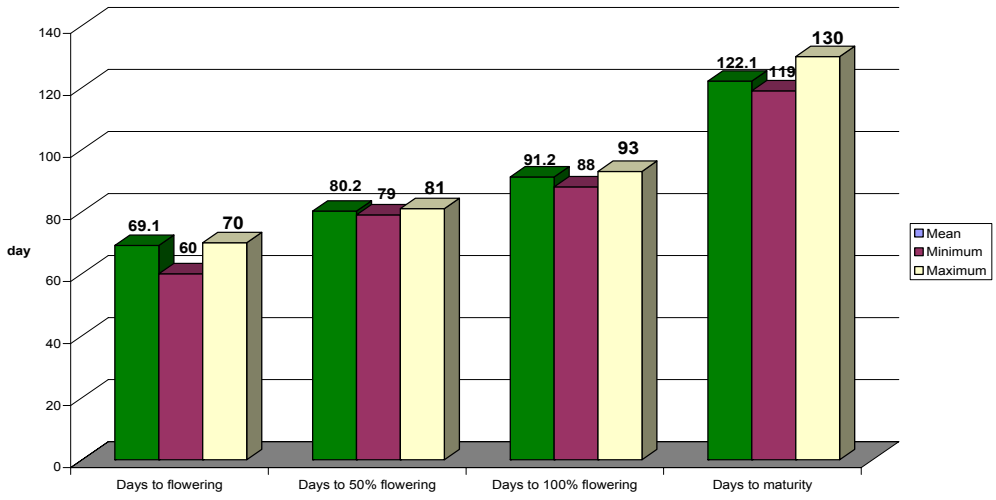


Fig. 3.Percent of oil seed traits of spring varieties

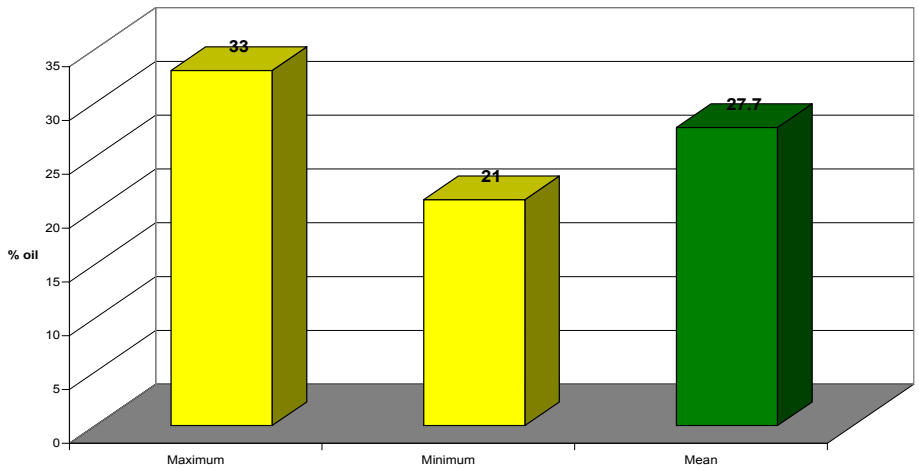
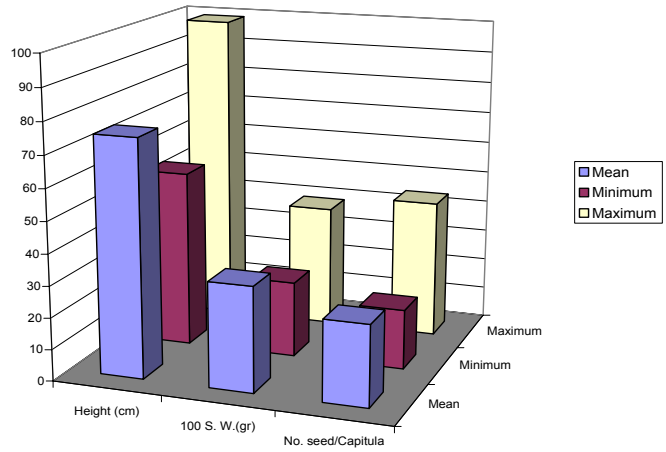


Fig. 4.Height, 100 seed weight and number of seed per capitula traits of spring varieties



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