

PHOTOPERIOD'S INFLUENCE ON VEGETATIVE GROWTH AND FLOWERING AT *TAGETES PATULA* AND *TAGETES TENUIFOLIA*

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Abstract: The effect of photoperiod upon the vegetative growth and flowering of *Tagetes patula* and *Tagetes tenuifolia*, was analysed.

Ornamental studied plants were cultivated in short-day conditions (in greenhouse, in winter) and long-day conditions (in field, in summer).

Plants obtained in short-day conditions had a more reduced vegetative growth, in comparison to plants cultivated in a long-day conditions.

Vegetative growth of plants cultivated in short-day conditions was different inhibited, according to the species.

Short-day conditions did not inhibit the flowering of *Tagetes patula* and *Tagetes tenuifolia* species.

The effect of photoperiod upon plants' vegetative growth and flowering, was studied. In short-day conditions vegetative growth and flowering was more reduced compared to long-day conditions.

Introduction

Plants' growth and flowering are influenced by internal factors, characteristic to each species and by external factors, such as: light, humidity, temperature, soil [8,20].

Concerning photoperiodism (daily period of light), plants can be classified in long-day plants, short-day plants and indifferente plants [3,4,8,20].

Tagetes patula and *Tagetes tenuifolia* species are known in literature [9,10,11,15,16] as long-day plants.

Tagetes patula and *T. tenuifolia* are ornamental plants, annually cultivated in „Alexandru Borza” Botanical Garden from Cluj-Napoca.

These two decorative species belong to **Asteraceae** family. There are annual herbaceous plants, which are characterized by a long-term flowering (July-October) [4,5,6,14,18].

Tagetes patula forms compact dwarf shrubs, up to 30-60 cm in height. The leaves, alternately or oppositely arranged, are lanceolated and pinnatisected. The flowers are grouped into a long pedunculated, solitary calathidia. The marginal ligulated flowers are yellowish with brown shades [5,6,14,15,16,17,21].

This decorative species is known in literature [5,6,7,14,19] as a medicinal herb. Its active elements have an antispasmodic and hypotensive action.

Tagetes tenuifolia (syn. *T. signata*) has 60-70 cm height. This species has little and numerous calathidia, with yellowish-gold marginal flowers [5,6,14,15,16,17,21].

Both of species multiply through seeds [5,6,14,17,18,21].

Materials and methods

During 1999 - 2001, the photoperiod influence on vegetative growth and flowering at *Tagetes patula* and *T. tenuifolia*, was studied.

The plants of *Tagetes patula* and *T. tenuifolia* were cultivated in short-days conditions (in greenhouse, in winter) and long-day conditions (in field, in summer).

For their cultivation we used seeds obtained from „Alexandru Borza” Botanical Garden.

In order to get plants in short-day conditions, we sowed them in wood boxes, in 01.10.2000. The preparation of the nutritive substrate was made accordingly to the data from literature [1,2,9,10,11,12,13].

After sowing, wood boxes were put in the greenhouse, where optimum conditions for plants' germination and growth (temperature 25°C, moderate moist), were assured.

We replicated the obtained plants in flower pots, in 25.10.2000. The preparation of the nutritive substrate (sand and garden soil mixture) from the pots was realized accordingly to the data from the literature [1,2,9,10,11,12,13].

For each studied species, 6 repetitions were performed. Periodically, we made observations upon the vegetative growth and flowering of cultivated plants in short-day conditions (in greenhouse, in winter).

In the ornamental sector of the Botanical Garden „Alexandru Borza” from Cluj-Napoca, *Tagetes patula* and *T. tenuifolia* are planted in beds (in field) in May.

In long-day conditions, the flowering of these plants begins in summer (July) and continues in autumn (October).

For each of the two studied species, we measured the height of mature plants cultivated in short-day (in greenhouse) and long-day conditions (in field).

Results and discussion

Data from literature [1,2,3,8,12,15,16,17] do not mention the influence of the short-day conditions on the vegetative growth and flowering of *Tagetes patula* and *T. tenuifolia*.

In our performed experiments, the germinative period (from the sowing to the plants coming up) was 7 days.

Plants obtained in short-day conditions were replicated in flower pots, in 25.10.2000. In the greenhouse, optimum conditions (temperature, moist and humidity, aeration etc.) for growing and development of plants, were assured.

Observations upon the cultivated plants' vegetative growth and flowering were made. The vegetative growth was appreciated according to plants' height (cm). We also observed the effect of short-day lighting upon flowering.

According to the phenophase, obtained results were registered at different dates.

Vegetative growth of *Tagetes patula* species was not inhibited in short-day conditions. In 30.10.2000, the height of the obtained plants was approximately 3 cm in all repetitions and in 20.02.2001, their height was almost 20 cm (Tab. 1, Fig. 1).

Plants of *Tagetes patula* began to flower in January, maximum flowering was recorded in the 20th of February (Tab. 1).

Plants obtained in short day conditions have smaller dimensions, as compared to those cultivated in field.

In the same experimental conditions (short-day, in greenhouse, in winter), *Tagetes tenuifolia* has a better vegetative growth than *Tagetes patula*.

Thus, in 30.10.2000, the height of *T. tenuifolia*'s plants was almost 5 cm in all repetitions, and in 20.02.2001, their height was approximately 26 cm (Tab. 2, Fig. 2).

This better vegetative growth is induced by species' characteristics.

In our experiments, vegetative growth and flowering in short-day conditions, as well as in long-day conditions, were compared.

To accomplish this, measurements of plants' height at their maturity (maximum flowering) were done. For each experimental variant 6 repetitions were made (Tab. 1 and 2).

In short-day conditions, vegetative growth of studied species (*Tagetes patula* and *T. tenuifolia*) is more reduced than in long-day conditions. The inhibition of vegetative growth depends on species characteristics, and it differs from one species to another (Tab. 3, Fig. 3).

Table 1: Vegetative growth and flowering of *Tagetes patula*, in short-day conditions (in greenhouse, in winter)

Repetition's no.	Date				
	Plants' height (cm)				
	30.10.2000	30.11.2000	28.12.2000	28.01.2001	20.02.2001
1	3,4	6,2	10,0	16,0*	20,0**
2	3,4	6,4	10,2	16,0*	20,0**
3	3,8	6,6	10,5	16,5*	20,5**
4	3,8	6,6	10,5	16,5*	20,5**
5	3,6	6,5	10,4	16,2*	20,2**
6	3,5	6,4	10,4	16,0*	20,0**
Mean	3,6	6,5	10,3	16,2	20,2

Legend: * - first inflorescence;
** - maximum flowering.

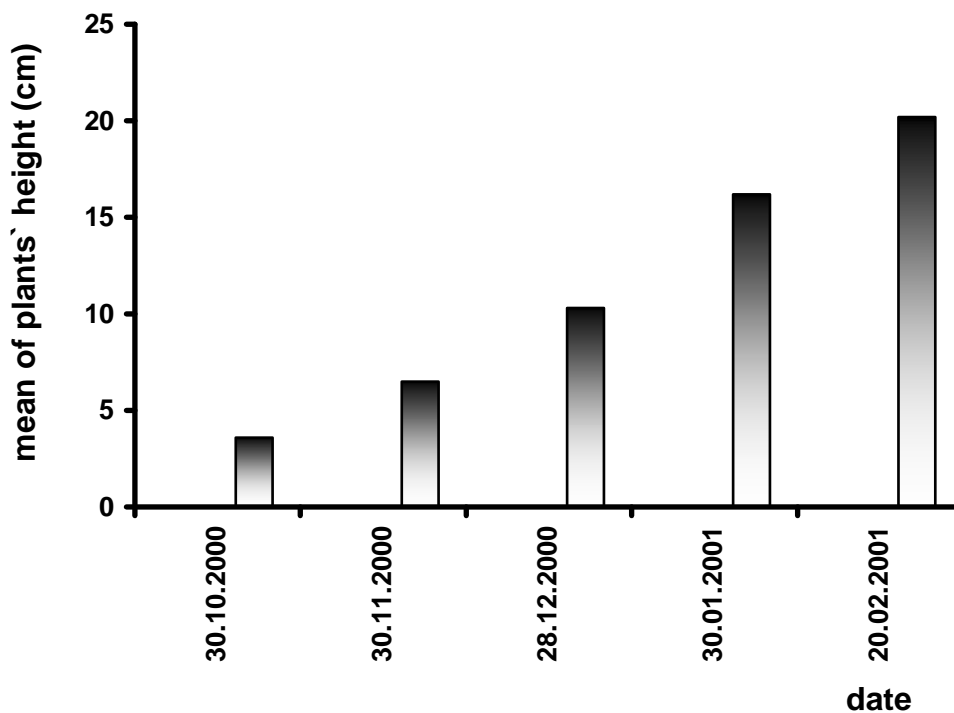


Fig. 1: Vegetative growth of *Tagetes patula*, in short-day conditions (in greenhouse, in winter).

Table 2: Vegetative growth and flowering of *Tagetes tenuifolia*, in short-day conditions (in greenhouse, in winter)

Repetition's no.	Date				
	Plants' height (cm)				
	30.10.2000	30.11.2000	28.12.2000	28.01.2001	20.02.2001
1	5,2	10,6	19,5	26,0*	26,3**
2	5,4	10,7	19,6	26,0*	26,5**
3	5,4	10,7	19,6	26,0*	26,5**
4	5,4	10,7	19,6	26,3*	26,6**
5	5,5	10,8	20,0	26,2*	26,5**
6	5,5	10,8	20,0	26,0*	26,5**
Mean	5,4	10,7	19,7	26,1	26,5

Legend: * - first inflorescence;
 ** - maximum flowering.

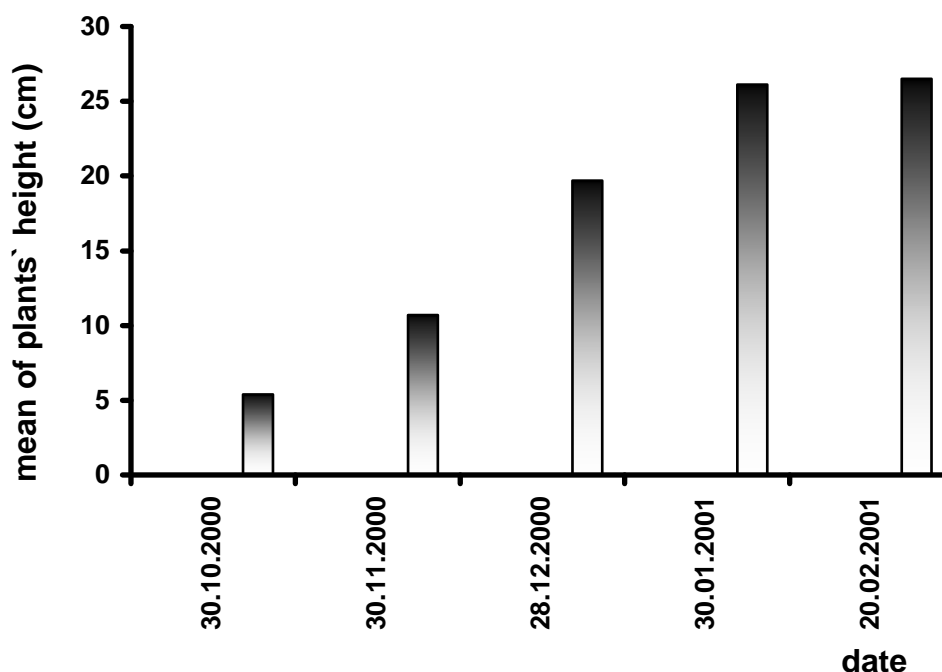


Fig. 2: Vegetative growth of *Tagetes tenuifolia*, in short-day conditions (in greenhouse, in winter).

Table 3: Photoperiod's influence on vegetative growth at *Tagetes patula* and *Tagetes tenuifolia*, in long-day conditions (A) and short-day conditions (B)

Crt. no.	Experimental variant	Plants' height at maturity (cm)		Vegetative growth's inhibition (%)
		A	B	
1	<i>Tagetes patula</i>	63,50	20,02	68,47
2	<i>Tagetes tenuifolia</i>	57,50	26,49	53,93

After approximately 110 days from sowing, plants of *Tagetes patula* and *T. tenuifolia* begun to flower (Tab. 1 and 2).

Our experimental results (Tab. 1 and 2) allowed us to appreciate that *Tagetes patula* and *T. tenuifolia* are indifferent species, concerning their requirements on photoperiod.

Plants obtained in short-day conditions form inflorescences.

We consider that these two ornamental species can be cultivated in short-day conditions, in order to be valorified into practice.

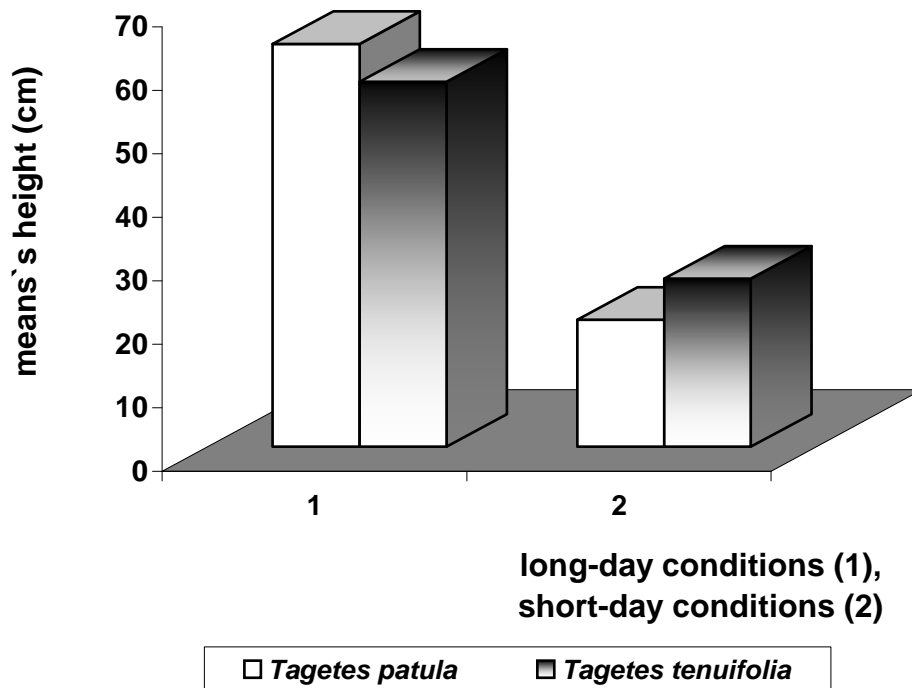


Fig. 3: Photoperiod's influence on vegetative growth at *Tagetes patula* and *Tagetes tenuifolia*, in long-day conditions and short-day conditions.

Conclusions

According to data from literature and experimental results, the following conclusions can be drawn:

- The vegetative growth of *Tagetes patula* and *T. tenuifolia* in short-day conditions, was different inhibited, depending on the species;
- Plants obtained in short-day conditions (in greenhouse, in winter) have a more reduced vegetative growth, compared to plants cultivated in long-day conditions (in field, in summer);
- The short-day conditions did not affect their flowering capacity;
- *Tagetes patula* and *T. tenuifolia* species can be successfully cultivated in short-day conditions, in order to be valorified into practice.

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INFLUENȚA FOTOPERIOADEI ASUPRA CREȘTERII VEGETATIVE ȘI ÎNFLORIRII LA *TAGETES PATULA* ȘI *TAGETES TENUIFOLIA*

(Rezumat)

În experimentele realizate, s-a studiat efectul fotoperioadei asupra creșterii vegetative și înfloririi la *Tagetes patula* și *Tagetes tenuifolia*. Cele două specii sunt frecvent cultivate ca plante ornamentale anuale.

Speciile studiate au fost cultivate în condiții de zi scurtă (iarna, în seră) și în condiții de zi lungă (vara, în câmp).

Plantele obținute în condiții de zi scurtă au o creștere vegetativă mult mai redusă, în comparație cu plantele cultivate în condiții de zi lungă.

La plantele obținute în condiții de zi scurtă, inhibarea creșterii vegetative este diferită fiind dependentă de specie.

Condițiile de zi scurtă nu au afectat capacitatea de înflorire a plantelor de *Tagetes patula* și *T. tenuifolia*.

Aceste specii pot fi cultivate în condiții de zi scurtă, pentru valorificare în practică.