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GROWTH AND FLOWERING OF TWO *LEUZEA* SPECIES

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S u m m a r y

The experiment was carried out in 2004-2006 at the Experimental Farm of the Department of Vegetable and Medicinal Plants Cultivation, University of Agriculture in Lublin. The study was aimed at the evaluation of growth and development of two leuzea species: *Leuzea carthamoides* DC and *Leuzea centauroides* L. cultivated under Polish climatic conditions. Observations were made upon annual, biennial, triennial, and quadrennial plants. The leuzea plantation was set from seedlings produced in a greenhouse. *Leuzea carthamoides* DC plants were higher and produced more leaves. *Leuzea carthamoides* DC and *Leuzea centauroides* L. plants formed inflorescence stems and bloomed in the second year of cultivation. Inflorescence stems in *Leuzea carthamoides* DC are single, while those in *Leuzea centauroides* L. are branched. *Leuzea carthamoides* DC plants form larger heads compared to *Leuzea centauroides* L.

Key words: *Leuzea sp*., growth, flowering

INTRODUCTION

Leuzea carthamoides DC is a perennial from the Asteraceae family. In its wild form, it can be found in Siberia, middle Asia and northern Mongolia. It finds the best conditions for growing in mountains at the height above 1500 meters. For many years, it has been cultivated near Moscow, Nowosybirsk, in Romania, Slovakia, and even Poland (N i e d w o r o k and J a n k o w s k a , 1997). It is characterized by a straight stem, empty inside. It forms abundant clusters consisting of many stems 50-180 cm high (C i c i n , 1962; S t r z e l e c k a and K o w a l s k i , 2000). The species blooms at the beginning of its second vegetation cycle in July and August in natural habitat (C i c i n , 1962; Č i k o v and Ł a p t i e v , 1987; G r o c h o w s k i , 1990; S t r z e l e c k a and K o w a l s k i , 2000). Flowers are violet or violet-purple (C i c i n , 1962; Č i k o v and Ł a p t i e v , 1987). Rhizomes with numerous roots are the underground organ which is pharmaceutical raw material (S t r z e l e c k a and K o w a l s k i , 2000). The rhizomes have an immunostimulating, anti-depressive, and anti-tumor action. Its fruit – achene – is a source of biologically active substances, namely ecdysteroids and sterols (G e s z p r y c h and W ę g l a r z , 2002).

Leuzea centauroides L. is a perennial of up to 100 cm in height and with purple flowers (T u t i n et al. 1976). There is no data on that species in available literature references.

The present paper is aimed at the evaluation of growth and flowering of two leuzea species: *Leuzea carthamoides* DC and *Leuzea centauroides* L. cultivated under Polish climate conditions.

MATERIALS AND METHODS

The experiments were carried out in 2004-2006 at the Experimental Farm of the Department of Vegetable and Medicinal Plants Cultivation, University of Agriculture in Lublin. The studies were conducted using two leuzea species: *Leuzea carthamoides* DC and *Leuzea centauroides* L.

Seeds originated from the Botanical Garden of Maria Skłodowska-Curie University in Lublin. They were sown individually into pots filled with peat substrate. The first emergence was observed after 5 days. The seedlings were planted in a plot (40 × 40 cm spacing) in mid-May. The experiment was performed in 4 replications, with 30 plants in each. The plot area was 4.8 m^2. Weed control and soil opening were made manually.

The study consisted of two experiments:

Experiment 1. Annual plants were observed. Weekly observations of plant height (length of leaf rosette) and number of leaves were made during vegetation period.

Experiment 2. That part related to biennial, triennial, and quaternal plants. *Leuzea carthamoides* DC began its vegetation two or three weeks before *Leuzea centauroides* L. (Tab. 1). The height of inflorescence shoot was assessed at full bloom stage. In the generative stage, the total number of anthodium per plant and the diameter of blooming anthodium were determined. In *Leuzea centauroides* L., the mean number of heads per single shoot was also evaluated. The obtained results were statistically processed by means of variance analysis for *k*-fold cross classification.

Table 1
Dates of vegetation beginning for *Leuzea carthamoides* DC and *Leuzea centauroides* L.

Year	Plant species	Date
2004	Second year of cultivation: *Leuzea carthamoides* DC *Leuzea centauroides* L.	 31.03 16.04
2005	Third year of cultivation: *Leuzea carthamoides* DC *Leuzea centauroides* L.	 8.04 29.04
2006	Fourth year of cultivation: *Leuzea carthamoides* DC *Leuzea centauroides* L.	 12.04 5.05

RESULTS

The studied leuzea species differed from each other with respect to their height (Fig. 1). A week after planting (24 May), the mean height of *Leuzea centauroides* L. was 10.4 cm, while *Leuzea carthamoides* DC 13.6 cm. For the whole vegetation period, *Leuzea centauroides* L. plants were shorter than *Leuzea carthamoides* DC plants, and that tendency persisted till the end of vegetation. At the end of September, *Leuzea carthamoides* DC plants were taller than *Leuzea centauroides* L. ones by 8.8 cm, on average.

On the basis of field observations it was also found that *Leuzea centauroides* L. formed fewer leaves in the first vegetation year (Fig. 2). The mean number of leaves after seedling planting was 4.5 per plant, which was similar to that in *Leuzea carthamoides* DC (4.9 per plant). In autumn, a much larger number of leaves was recorded in *Leuzea carthamoides* DC than *Leuzea centauroides* L. (25.4 and 16.3 per plant, respectively).

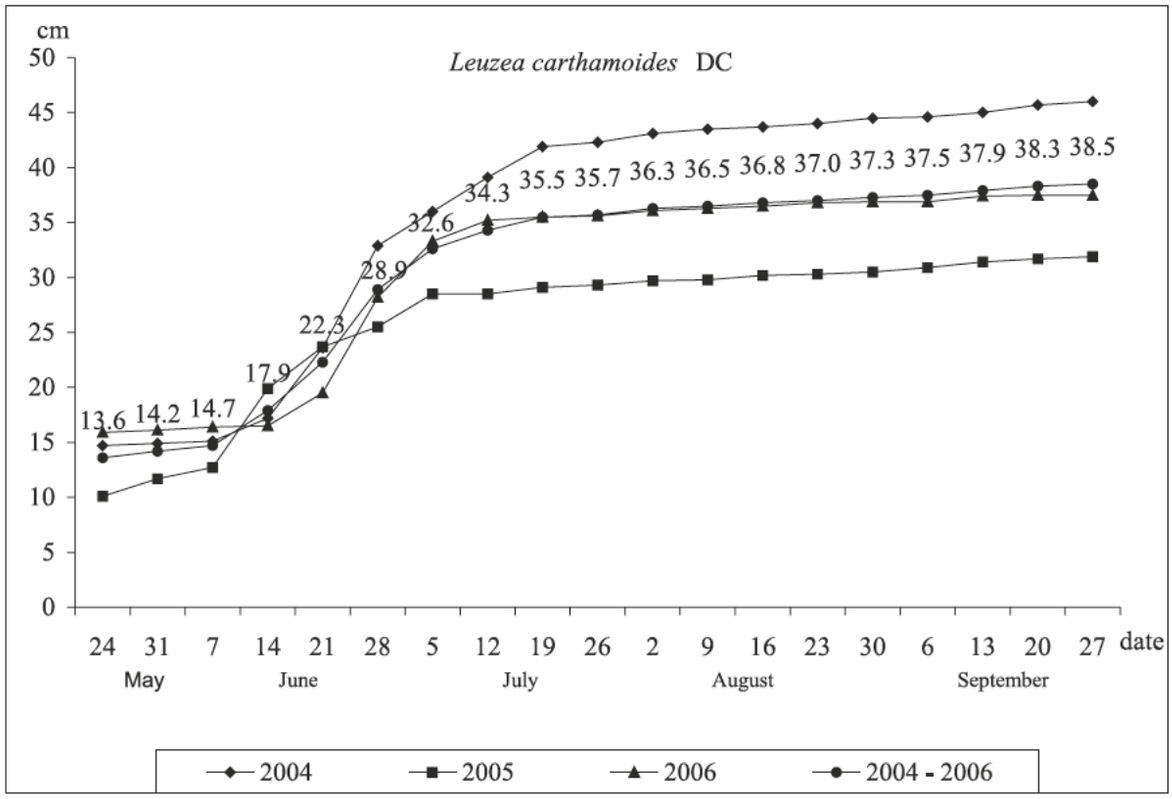
Leuzea plants differed with respect to the inflorescence stem height (Tab. 2). In *Leuzea carthamoides* DC, the average height of inflorescence stem was 127.0 cm, which was significantly higher than in *Leuzea centauroides* L. (99.8 cm). The studies revealed that *Leuzea carthamoides* DC formed a significantly larger anthodium with the mean diameter of 5.8 cm. The diameter of *Leuzea centauroides* L. anthodium was 4.5 cm (Tab. 2).

Plants of *Leuzea carthamoides* DC produce single flower stems ended with a head (anthodium). Observations indicated that the number of flower heads per single stem could be 2.5 for *Leuzea centauroides* L., on average (Tab. 2).

Table 2
Comparison of selected features of leuzea.

Plant species	Age of plant (in years)	Year	Height of inflorescence stem (cm)	Number of anthodium per plant	Diameter of anthodium (cm)	Number of anthodium per single stem
Leuzea carthamoides DC	two three four	2004 2005 2006	134.6 c 130.7 bc 115.7 abc	4.3 ab 3.2 a 2.9 a	5.4 abc 6.3 c 5.8 bc	– – –
		$\overline{X}$	127.0 b	3.5 a	5.8 b	–
Leuzea centauroides L.	two three four	2004 2005 2006	112.6 abc 99.6 abc 87.1 a	5.5 bc 5.1 abc 7.0 c	4.9 abc 3.7 a 4.8 abc	2.1 a 3.3 b 2.2 a
		$\overline{X}$	99.8 a	5.9 a	4.5 a	2.5

Means with different letters are significantly different



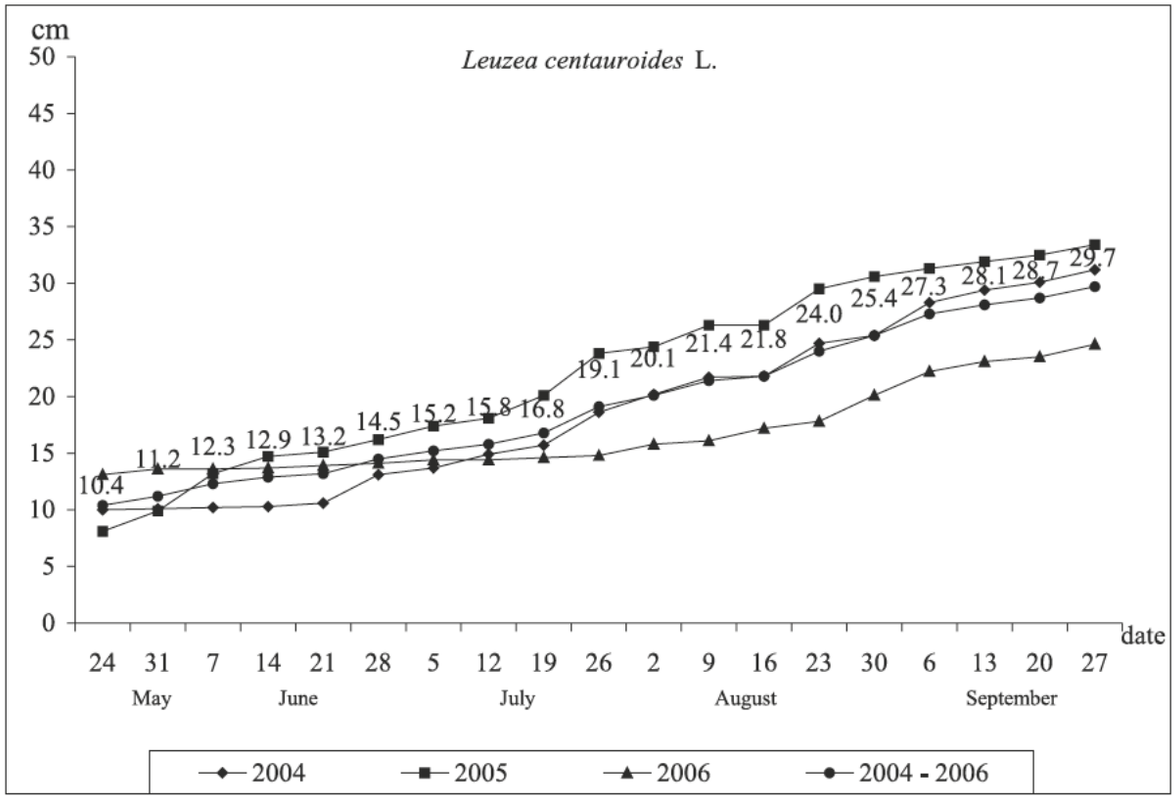


Fig. 1. Height of *Leuzea carthamoides* DC and *Leuzea centauroides* L. plants in the first year of cultivation.

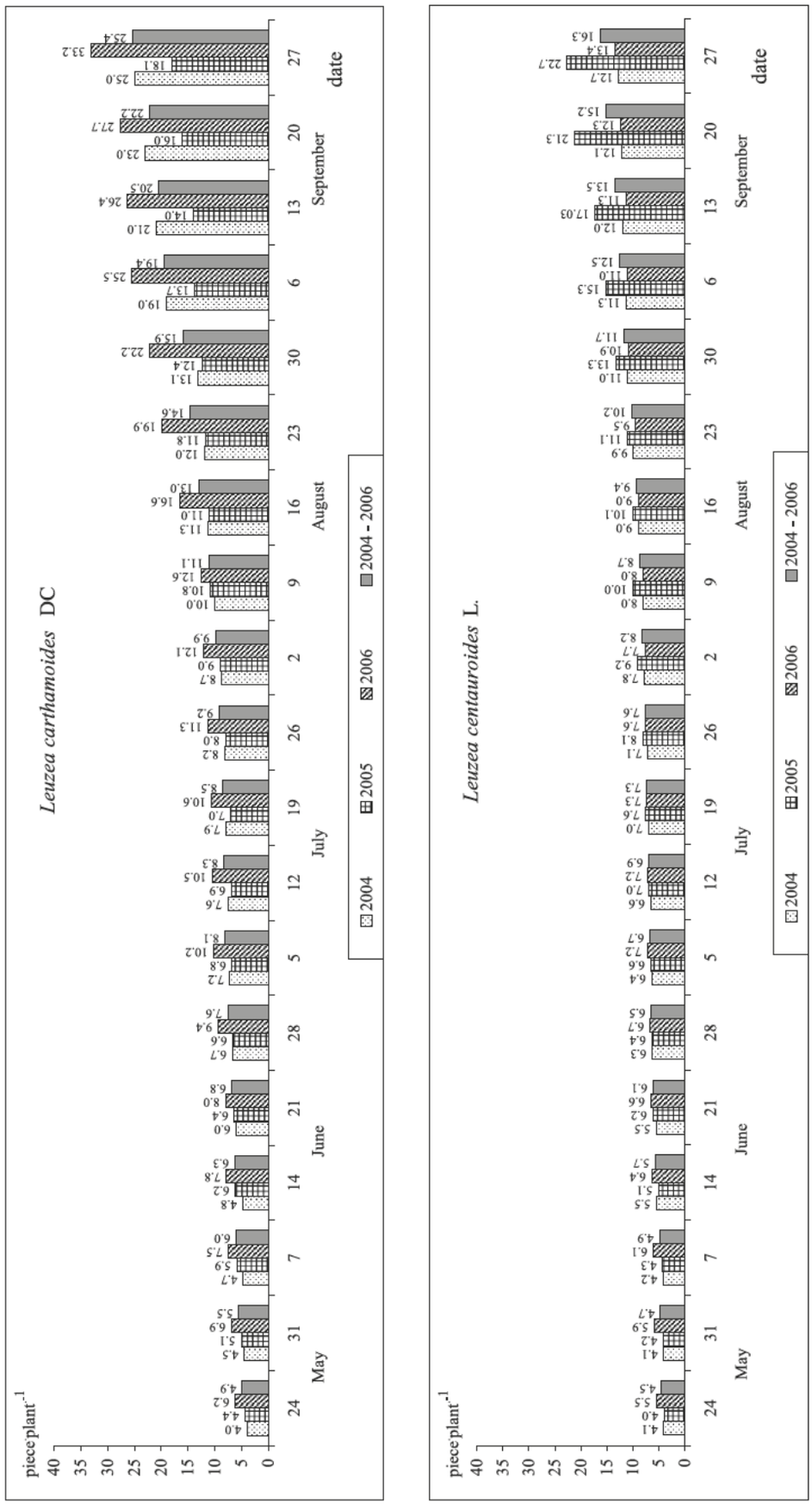


Fig. 2. Number of leaves in *Leuzea carthamoides* DC and *Leuzea centauroides* L. in the first year of cultivation.

DISCUSSION

Leuzea carthamoides DC and *Leuzea centauroides* L. are species that are little known in domestic and foreign literature. There is little information on their growth and development, as well as their requirements.

In the present experiments, the first emergence was observed after 5 days. Cicin (1962) found that these plants germinated after 4-9 days under laboratory conditions at 20-30°C, and after 9-20 days on the field (Sarwa, 1992; Niedworok and Jankowska, 1997).

According to Grochowski (1990), *Leuzea carthamoides* DC plants begin vegetation in March. In our study, only biennial plants of *Leuzea carthamoides* DC began vegetation in March (31 March), triennial and quadrennial ones – in April. *Leuzea centauroides* L. begins vegetation by about 2-3 weeks later.

Cicin (1962), Čikov and Łaptiev (1987), Strzelecka and Kowalski (2000), and Sarwa (2001) found that *Leuzea carthamoides* DC reached 50-180 cm of height. In the present study, that species grew up to 127.0 cm of height and *Leuzea centauroides* L. to 99.8 cm.

According to Grochowski (1990), Niedworok and Jankowska (1997) and Strzelecka and Kowalski (2000), *Leuzea carthamoides* DC plants bloomed from the second vegetation cycle. In the present experiments, no studied plant produced inflorescence stems in the first year of cultivation.

CONCLUSIONS

1. In the first year of vegetation, *Leuzea carthamoides* DC plants are higher and form more leaves.

2. Leuzea carthamoides DC and *Leuzea centauroides* L. plants produce inflorescence stems and bloom in the second year of cultivation.

3. Inflorescence stems in *Leuzea carthamoides* DC are single and ended with an anthodium, while in *Leuzea centauroides* L. stems are branched.

4. Leuzea carthamoides DC plants produce higher inflorescence stems and larger heads than *Leuzea centauroides* L.

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Wzrost i kwitnienie dwóch gatunków szczodraka

Streszczenie

Doświadczenie przeprowadzono w latach 2004–2006 w Gospodarstwie Doświadczalnym Katedry Warzywnictwa i Roślin Leczniczych AR w Lublinie. Celem badań była ocena wzrostu i kwitnienia dwóch gatunków szczodraka: *Leuzea carthamoides* DC i *Leuzea centauroides* L., uprawianych w warunkach klimatycznych Polski. Obserwacjom poddano rośliny jednoroczne, dwu-, trzy- i czteroletnie. Plantację szczodraka założono z rozsady wyprodukowanej w szklarni. Rośliny *Leuzea carthamoides* DC były wyższe i wykształciły więcej liści. Rośliny *Leuzea carthamoides* DC oraz *Leuzea centauroides* L. wytworzyły pędy kwiatostanowe i zakwitły w drugim roku uprawy. Pędy kwiatostanowe *Leuzea carthamoides* DC są pojedyncze, zaś u *Leuzea centauroides* L. rozgałęziają się. Rośliny *Leuzea carthamoides* DC wykształcają większe koszyczki niż *Leuzea centauroides* L.