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MORPHOLOGICAL AND BIOLOGICAL CHARACTERISTICS OF SPECIES FROM THE *AMARANTHUS* GENUS

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Abstract

Some morphological characteristics of Amaranth species were studied in 2011-2012. The seeds were collected from different agroecological zones of the country - Plovdiv, Sofia and Dobrich regions, from crops of sunflower and maize. Our research has shown that a large number of seeds in 1 g formed Amaranthus hybridus L. (2038), compared with Amaranthus blitoides L. (824). The mass of 1000 seed was higher in Amaranthus blitoides L. (1.47g). The phenological development of Amaranthus hybridus L. and Amaranthus blitoides L. was carried out. The main phenophase of weeds was observed. The study results show that for the whole growing season Amaranthus hybridus L. requires lower temperature sum (1308.0°C), compared with Amaranthus blitoides L. (1606.5°C).

Key words: *A. retroflexus L., A. blitoides L., morphological characteristics, phenological development.*

INTRODUCTION

The species of the *Amaranthus* genus have some biological and morphological characteristics, which together with their high ecological plasticity and adaptability and short life cycle make them particularly dangerous and competitive to crop plants. They form large seed generation with an extended germination period, and sometimes forms, resistant to some of the commonly used modern herbicides.

In the modern agriculture, the fight against the Amaranth species (*Amaranthus* spp.) is a topical issue and in order to be successful and expedient, it is recommended to study their morphological and bioecological characteristics.

MATERIALS AND METHODS

Material from the seeds of the two Amaranth species - *Amaranthus hybridus* L. and *Amaranthus blitoides* L., collected from different agroecological zones of the country - Plovdiv, Dobrich and Sofia regions from sunflower and maize crops have been used in the present study.

The absolute mass of the seeds from the Amaranth species has been determined (Zhalnov et al., 2001). The effective temperature sums for conducting the main phenophases in the weed development have also been determined using the formula (Gyurova and Peev, 1996):

$$\Sigma t=n(t-B), \text{ where}$$

Σt - the sum of the effective temperatures (°C);
n - number of days of a certain period (phase), number;
t - average temperature for the period (°C);
B - biological temperature minimum (°C).

The observations for the occurrence of the different pehonphases have been made in sunflower and maize crop stands, where permanent plots of 1 m2 have been marked and the growth of *Amaranthus hybridus* L. and *Amaranthus blitoides* L. has been studied.

RESULTS AND DISCUSSIONS

According to Dechkov (1979) in the analyses of soil samples in the country, the plow layer (0-25 cm) contains an average of 44 000 weed seeds are present per 1 m^2. The potential weed infestation with Amaranth species is the highest - 28 000 numbers per m^2, which represents 64% of the total quantity of weed seeds.

The number of seeds in 1 g and the absolute mass of the weed species *Amaranthus hybridus* L. and *Amaranthus blitoides* L. have been determined in laboratory conditions. The data is presented in Table 1.

From the carried out studies it was determined that a greater number of seeds in 1 g was formed in *Amaranthus hybridus* L. – 2038, unlike *Amaranthus blitoides* L. - 824. The mass of 1000 seeds has higher values for *Amaranthus blitoides* L. – 1.47 g.

Table 1. Number of seeds in 1 g and mass of 1000 seeds

Weed species	Number of seeds in 1 g	Mass of 1000 seeds (g)
Amaranthus hybridus L.	2038	0,64
Amaranthus blitoides L.	824	1,47

From the comparative analysis it can be noted that the seeds of *Amaranthus blitoides* L. are large, black, and shiny with a clearly marked edge on the periphery, while the seeds of *Amaranthus hybridus* L. are small, irregularly rounded and with a narrow edge on the periphery. Summarizing the obtained data on the impact of the agroclimatic indices on the phonological development of the two species, the following conclusion can be made:

Amaranthus hybridus L. has shorter vegetation period (120 days) and germinated at lower temperature (9.6^{o}C), while *Amaranthus blitoides* L. has a vegetation period of 153 days and germinates in spring at higher temperature (10.3^{o}C). Similar findings have also been made by Kostov (1999) and Kovachev (1967) (Table 2).

Throughout the vegetation period the hybrid Amaranth requires lower temperature sum (1308.0^{o}C) than the creeping Amaranth (1606.5^{o}C). Regarding the amount of precipitation *Amaranthus hybridus* L. is less demanding than *Amaranthus blitoides* L., respectively 209.4 mm and 245.2 mm (Table 2).

A significant difference between the two species regarding the different agroclimatic indices has been determined during the period first real leaf - weed flowering. This period is 13 days shorter for the hybrid Amaranth (duration of 30 days) and the temperature sum is significantly lower (with 199.2^{o}C).

The duration of the period flowering - seed ripening is shorter for the hybrid Amaranth (with 8 days). During this period for its development it requires higher average temperature (with 4.2^{o}C) and temperature sum (with 13.2^{o}C). The amount of precipitation is 15% lower (76.3 mm) in comparison with the creeping Amaranth (89.2 mm).

Table 2. Agroclimatic indices, affecting the phonological development of Amaranth species

Phenological development (period)	*Amaranthus blitoides L.*				*Amaranthus hybridus L.*			
	Period duration (days)	Average temperature (^{o}C)	Temperature sum (^{o}C)	Precipitation sum (mm)	Period duration (days)	Average temperature (^{o}C)	Temperature sum (^{o}C)	Precipitation sum (mm)
I period - from the sustainable transition of air temperature unitl germination	59	10.3	312.7	57.1	52	9.6	239.2	49.3
II period - germination – first real leaf	13	10.3	68.9	15.2	8	16.9	95.2	6.1
III period - first real leaf - flowering	43	19.4	619.2	83.7	30	19.0	420.0	77.7
IV period - flowering – seed ripening	38	19.1	535.8	89.2	30	23.3	549.0	76.3
V period - from the sustainable transition of the air temperature unitl seed ripiening	153	15.5	1606.5	245.2	120	15.9	1308.0	209.4

CONCLUSIONS

The carried out studies have found that a larger number of seeds in 1 g have been formed in *Amaranthus hybridus* L. – 2038, unlike *Amaranthus blitoides* L. – 824. The mass of 1000 seeds has higher values for *Amaranthus blitoides* L. – 1.47 g.

The phonological development of *Amaranthus hybridus* L. and *Amaranthus blitoides* L. has also been studied. The occurrence of the main phenophases of weed development has been determined. The study results show that for the whole vegetation period *Amaranthus hybridus* L. requires lower temperature sum (1308.0^{o}C) than *Amaranthus blitoides* L. (1606.5^{o}C).

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