



# PHENOLOGICAL DEVELOPMENT OF SUNFLOWER HYBRIDS GROWN UNDER CONTRASTING AGROECOLOGICAL CONDITIONS

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The experiment was set up using a block method in 4 replications after a wheat predecessor in the fields of two different ecological regions – Thrace (Plovdiv region) and Dobrudja (Dobrich region), Bulgaria. Six sunflower hybrids were studied – P64LP170, bred in Corteva, USA as a standart, and Bulgarian hybrids Dalena, Deveda, Enigma, Krasela and Sunny, breded at the Dobruja Agricultural Institute - General Toshevo. For the purpose of the study, the occurrence of the main phenological phases have been recorded: sowing (V0), germination (VE), second pair of leaves (V2), the fourth pair of leaves (V4), budding (R1),beginning of flowering (R5), end of flowering (R6) and ripening(R9). Of primary importance for the development of sunflower is the duration of the interphase periods, which is a consequence of the meteorological conditions of the year and the region and of the genotypic differences between individual sunflower hybrids. The interphase period sowing-germination has a very different duration in the two regions in the first year. The reason for the long germination period in Southern Bulgaria is the low temperatures in March. The remaining interphase periods do not differ significantly between the two regions, nor between the hybrids. In the second year of the study, the interphase periods did not differ significantly, both between the two regions and between the hybrids until the moment of the latter.

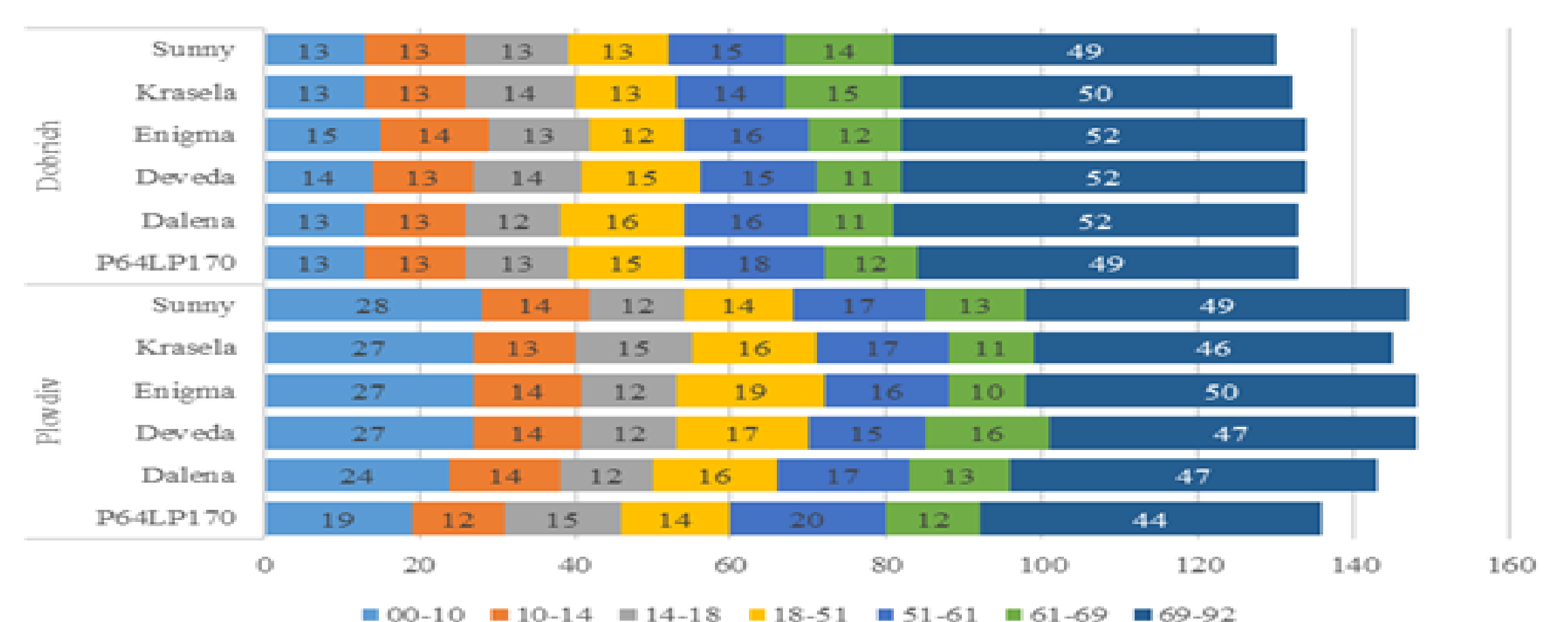
## • Introduction

- Sunflower (*Helianthus annuus* L.) is an annual plant. Its botanical name *Helianthus* comes from the Greek words helios (sun) and anthos (flower). It is a diploid species ( $2n = 34$ ) that belongs to the suborder *Helianthineae*, section *Helianthea*, subfamily *Asteroideae*, and family *Compositae* (*Asteraceae*) (PANERO and FUNK, 2002). The genus *Helianthus* originated in the temperate steppe of North America and contains 14 annual and 37 perennial species (SCHILLING, 2006). Soon after the discovery of America, Spanish explorers brought the sunflower to Europe, to the botanical gardens in Madrid. This most likely happened during the Spanish expedition in 1510 (PUTT, 1997). The first published record of the sunflower appears in 1568 by the Belgian Rembert Dodoens, one of the famous herbalists of the era. After its introduction to Europe, the sunflower was used only as an ornamental plant for more than two centuries (GARAPOVA and KIRCHEV, 2021).
- The first attempt to use the sunflower as an oil crop was the registration of a patent for extracting oil from sunflower seeds for industrial use in 1716 in England. Sunflower is now one of the four most important oilseed crops in the world (along with palm, soybean and rapeseed) and one of the two most important oilseed crops in Europe, along with rapeseed. In contrast to other vegetable oils, about 90% of the total sunflower oil production is used for human consumption and only 10% is used for industrial purposes. It is grown on 25.56 million hectares, with an annual global production of about 40.64 million tonnes of seeds (U.S. DEPARTMENT OF AGRICULTURE, 2013), with a slight upward trend in both production area and seed production due to increasing seed yield per unit area (KAYA et al., 2012). The largest sunflower producers in the world are Russia with 7.20 million ha and Ukraine with 5.80 million ha. These two countries provide more than 50% of the total global sunflower production (JOCIC et al., 2015).

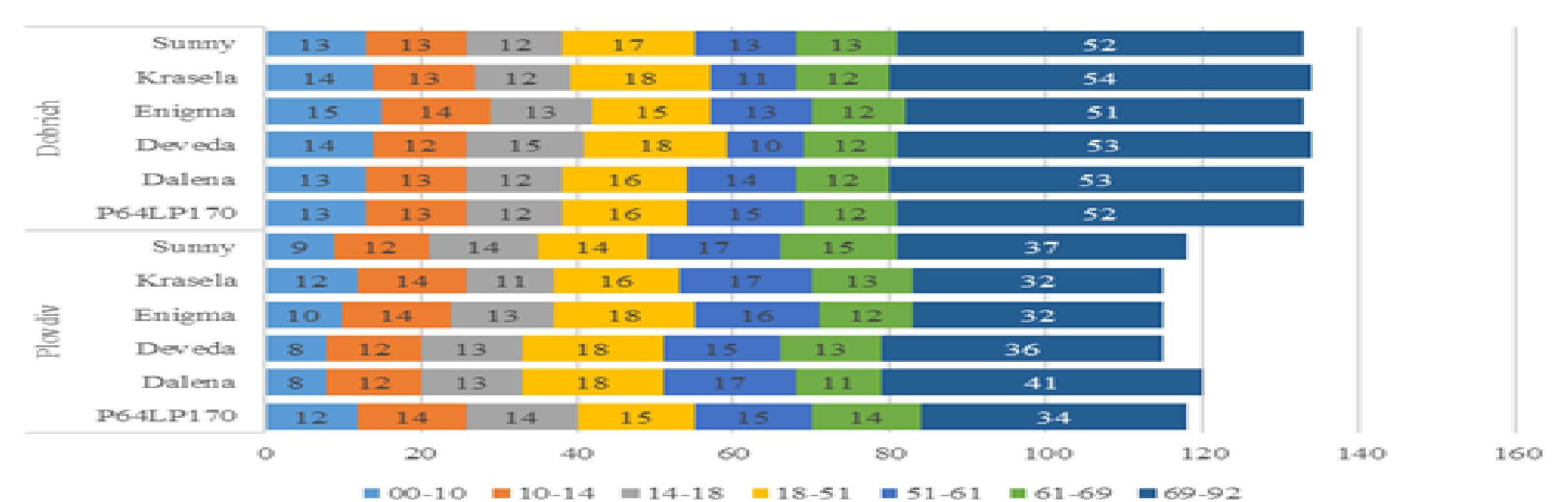
## • Material and method

- The experiment was set up using a block method in 4 replications after a wheat predecessor in the fields of two different ecological regions – Thrace (Plovdiv region) and Dobrudja (Dobrich region), Bulgaria. Six sunflower hybrids were studied – P64LP170, breded in Corteva, USA as a standart, and Bulgarian hybrids Dalena, Deveda, Enigma, Krasela and Sunny, breded at the Dobruja Agricultural Institute - General Toshevo.
- For the purpose of the study, the occurrence of the main phenological phases have been recorded according to Schneiter & Miller scale (SCHNEITER and MILLER, 1981): sowing (V0), germination (VE), second pair of leaves (V2), the fourth pair of leaves (V4), budding (R1),beginning of flowering (R5), end of flowering (R6) and ripening(R9). Depending on the dates of the phenological phases, the duration of the interphase periods is calculated.
- The meteorological conditions during the two years, as well as the long-term averages in both study areas, are described in another of our studies (TANCHEV and GEORGIEV, 2025).

## • Results and discussions



• Figure 1. Duration of interphase periods – 2023



• Figure 2. Duration of interphase periods - 2024

## • Conclusions

- Each of the phenological phases occurs to a different extent earlier in the Plovdiv region than in the Dobrich region, which is completely explainable, as a result of the later warming in Northern Bulgaria than in Southern Bulgaria. Of primary importance for the development of sunflower is the duration of the interphase periods, which is a consequence of the meteorological conditions of the year and the region and of the genotypic differences between individual sunflower hybrids. The interphase period sowing-germination has a very different duration in the two regions in the first year. The reason for the long germination period in Southern Bulgaria is the low temperatures in March. The remaining interphase periods do not differ significantly between the two regions, nor between the hybrids. In the second year of the study, the interphase periods did not differ significantly, both between the two regions and between the hybrids until the moment of the latter.