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Invasiveness of the exotic Acacia longifolia along a climatic gradient in the Mediterranean region: reasons and facts

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Acacia longifolia is one of the most aggressive invasive plant species in Portuguese sand dunes ecosystems. It exhibits a high resource allocation and a constant allocation pattern under different climatic conditions, following a water spender strategy. Indeed, physiological and phenological studies have an important role for the understanding of the response to climatic changes and resources availability fluctuations of invasive species concerns. Thus, the objective of this study is to understand the ecophysiological response of A. longifolia to different climatic conditions and understand how different climatic conditions can affect vegetative and reproductive investments of this invasive species.

Two plots were established in the northern (more mesic conditions) and in the southern (more xeric conditions) of Portugal. In each plot were performed leaf water potential and gas exchanges measurements in Acacia longifolia in three occasions: March, June and July. Additionally, stable isotopes analysis of leafs and phloem were also performed in the same three occasions. Phenological was monitored by measuring shoot elongation and by counting leaves, flowers and fruits. Then, a phenological diagram was elaborated.

The results pointed out for no difference in leaf water potential between north and south and also no difference in carbon isotopic signature of bulk leaf. While in the north the more drastic decrease in gas exchange occurred from June to July, in the south a greater decrease occur earlier, from March to July. In addition, plants in the north site had an averaged delay from 20 to 30 days in all phenophases. Significant differences between study sites appeared in the magnitude of growth and in the flowers and fruits production. In the northern A. longifolia showed higher reproductive investment and lower growth rate comparatively with southern forest.

In this work we presented evidence that indicated that under stressful climatic conditions, namely lower water availability, A. longifolia displayed limited carbon assimilation and inhibition effect on stomatal conductance; demonstrating that the carbon balance and water fluxes of A. longifolia were affected by water stress. Furthermore, the climatic differences between northern and southern locations of Portugal may be responsible for different patterns in carbon assimilation and stomatal conductance in A. longifolia. The present study suggests that higher air temperatures and irradiance may due an earlier display of phenological phases in the southern than in the northern plants. Phenological study provides further evidence of the trade-offs between reproductive and vegetative investment in A. longifolia under habitats with limited resources, namely dune ecosystems. These results are special important for understand of the factors that can determine the reproductive costs in A. longifolia, emphasizing a potential differences in the invasive pattern according to the climatic conditions. Moreover, this study may contribute for a future model that will account climate change scenarios and invasiveness patterns in the Mediterranean region.