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The effect of summer shading on flower bud morphogenesis in apricot (*Prunus armeniaca* L.)

Research Article

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Abstract: The aim of this investigation was to assess whether imposed summer shading treatments in apricot (*Prunus armeniaca* L.) can affect the main phenological phases related to the floral morphogenesis (floral differentiation, xylogenesis), flower bud growth and quality in terms of bud capacity to set fruit. Experimental trials were carried out on fully-grown trees of 'San Castrese' and 'Stark Early Orange' cultivars characterized by different biological and agronomical traits to which shadings were imposed in July and August. Histological analysis was carried out from summer onwards in order to determine the evolution of floral bud differentiation, and the acropetal progression of primary xylem differentiation along the flower bud axis. Periodical recordings to evaluate the bud drop, blooming time, flowering and fruit set rates were performed also. These shade treatments determined a temporary shutdown of floral differentiation, slowed xylem progression up to the resumption of flower bud growth and a reduced entity of flowering and fruit set. These events were particularly marked in 'San Castrese' cultivar, which is well known for its adaptability to different climatic conditions. These findings suggest that adequate light penetration within the canopy during the summer season could be the determining factor when defining the qualitative traits of flower buds and their regular growth, and ultimately to obtain good and constant crops.

Keywords: *Floral differentiation • Xylem vessels • Bud growth • Bud drop • Fruit set*

1. Introduction

In apricot, as well as in other deciduous fruit species, floral bud initiation, differentiation and organogenesis take place during the summer season that precedes anthesis and are achieved by a variety of environmental as well as intrinsic cues [1]. The flower-bearing bud development is a process requiring the transformation of an undifferentiated meristematic apex into a structure carrying flowers throughout three main steps: *induction*, with production of a 'floral stimulus' in the leaves; *translocation* of the 'floral stimulus' towards the meristems; *evocation* throughout the involvement of molecular genetic mechanisms [2], followed by the floral morphogenesis. During these processes, a sequence of morphological and biochemical changes occur such as cell division, increased carbohydrate content and activity of some respiratory enzymes, protein and RNA synthesis [3,4]. Environmental factors (temperature, solar radiation, water availability), abiotic stresses occurring before and during the differentiation phase as well as certain cultural practices (*i.e.,* time and type of pruning, training system, fertilization, irrigation, chemical treatments) have been identified as important triggers that are able to modify the regularity of the floral differentiation phase [5-7]. In particular, it has been observed that different light levels available within the canopy throughout the growing season, and a lower interception of photosynthetically active radiation (PAR) such as that occurring at the base of the 'Y' training system, negatively affect the earliest floral morphogenesis phases [8]. These authors found

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