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# MODELING GENETIC VARIATION FOR PHENOLOGICAL EVENTS IN *CORYLUS AVELLANA* L.

DE PACE C., CATARCIONE G., VITTORI D., RUGINI E.

Department of Science and Technologies for Agriculture, Forests, Nature, and Energy, University of Tuscia, Via S. Camillo de Lellis, 01100 Viterbo (Italy)

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Phenological events such as bud burst, flowering, fruit development and maturity, and leaf senescence have received increased interest in the light of global climate changes. As global warming progresses and varietal turnover is not adopted, climate effects on the plant's immediate environment followed by changes of the pace of several physiological processes and time occurrence of phenological stages in hazelnut orchards, are expected, mostly in the shortest and smallest geographical scales,

The three most important factors controlling phenology in tree species are the degree of fall-winter chilling, photoperiod (day length relative to night length), and temperature. In hazelnut , the time of occurrence of winter dormancy release leading to bud sprouting may be synchronized with seasonal changes in temperature as it was observed in the phylogenetically related hornbeam plants.

An observational study based on long-term data sets from field experiments using genetically differentiated materials (a full-sib progeny composed by 135 plants), provided data for modelling the phenotypic expression of bud-sprouting under local climate changes in order to gain insight on the genetic basis of that trait. The methodology can be expanded to cover a wider range of traits and environments.

The experiment was conducted at Viterbo over seven winter seasons, starting in 2004/2005. Time of budburst was defined as the day when at least one bud on 10 terminal 1-year old stems showed the first 1-2 mm of the new leaves.

Two groups of plants, one expressing the 'evergrowing' phenotype and the other the wild-type winter-dormancy phenotype, were steadily observed. The evergrowing plants produced new shoots in the middle of October of every year and, unless frost damage occurred in February, the shoots continued to grow up to the end of June when nuts ripen (it occurred only in 2007 and 2011). The proportion between the number of plants expressing the wild-type and the evergrowing phenotype, fitted a 3:1 ratio, suggesting a simple model (1 locus, two alleles) for the inheritance of the evergrowing phenotype. Homozygosity for the evergrowing allele cause interference with the response to the signal for leaf senescence and ceasing of growth. The group of plants expressing the wild type phenotype falled in two categories: one composed by 79 FS plants with budburst centerd on March 25$^{th}$, and the other composed by 40 plants with budburst on February14th. The proportion between the number of plants expressing the latest and earliest phenotype subgroups, fitted a 9:7 ratio, suggesting a simple genetic model for the inheritance of the earliest and latest phenotypes (2 loci, two alleles per locus with threshold expression). Graphical representation of the average budburst date for the 11 FS plants from each subgroup, revealed consistent phenotypic diversity over the 7 years, indicating a significant genetic divergence between the two subgroups. The year-to-year fluctuation of the average budburst date was closely associated (r=0.92) to the sum of chilling units (CU) occurring between October 18th and Dec. 20th . Using these information on the CU necessary to budburst it is possible to devise a predictive model for forecasting the date of budburst.