Characterization of the flowering phenology of the world olive collection varieties in Morocco: towards selection of adapted varieties to global

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INTRODUCTION

The olive tree constitutes a remarkable species by its biological and ecological characteristics widely cultivated in many regions of the world, particularly in the Mediterranean area

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However, this crop is faced to climatic constraints in the current context of global warming, perturbing its biological, physiological and phenological development

INTRODUCTION

Air temperature, uncontrolled, is the most important abiotic factor affecting olive development

It mainly involved in the dormancy and flowering process during winter and spring respectively

In fact, the bud dormancy onset and its breaking date phase are strongly influenced by winter chill; while the flowering achievement is highly correlated to spring heat

INTRODUCTION

- In addition to the biennial bearing of olive, the annual temperature variations during these two periods seem to have significant negative consequence on the development cycle of tree production resulting in economic repercussions

- At phenological level, it was reported that increase of temperature during winter and spring induced flowering advance of olive cultivars in some Mediterranean areas such as Morocco, France, Spain, Italy and Tunisia

INTRODUCTION

Evolutionary flowering time change studies → Gained considerable attention in view of the current global climate change

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Ongoing climate variation can affect olive flowering time and ecological dynamics

OBJECTIVES

Flowering time is a key adaptive trait

We investigated Flowering time of **331 olive cultivars** in the **OWGB-M** Marrakech using BBCH scale

- Evaluate inter annual variation on flowering time and flowering period of **OWGB – Marrakech**
- Classify varieties of the **OWGB – Marrakech** collection depending on **Flowering time** and **Flowering duration**.

Materials & Methods

- Phenological observations were conducted out on 331 cultivated Olea europaea (L.) cultivars identified based on 554 accessions and originating from 14 Mediterranean countries. Each cultivar is represented by at least 3 trees.

Origine	Nombre d'accessions	Années de plantation
Italie	146	2003/2004
Espagne	89	2003/2004
Chypre	20	2004
Grèce	17	2003
Portugal	15	2003
France	13	2003
Tunisie	25	2005/2008/2011/2012
Maroc	38	2007/2008
Algérie	43	2008
Croatie	16	2008
Egypte	19	2008
Slovénie	9	2008
Syrie	65	2009
Liban	6	2009

Materials & Methods

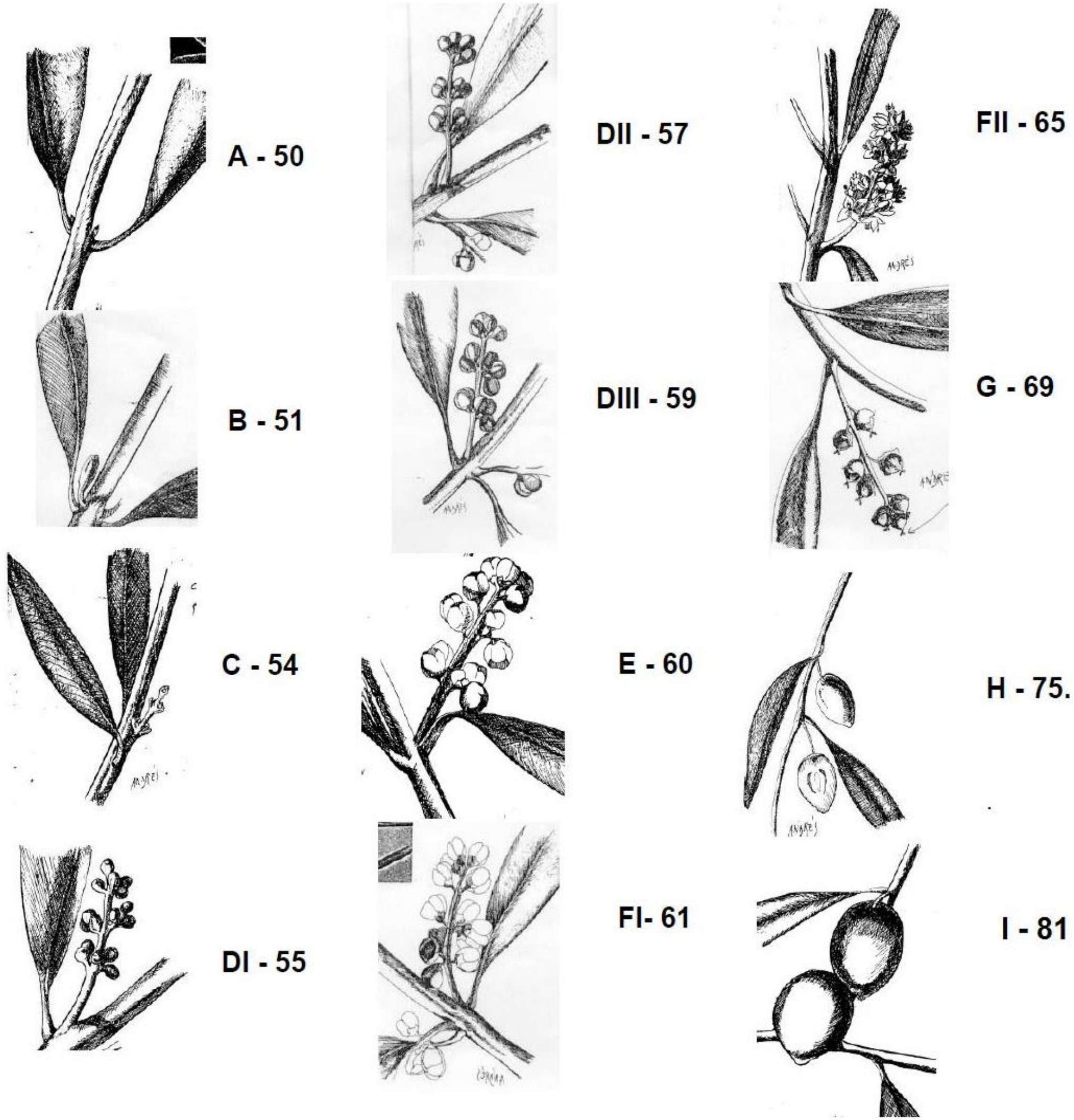
- According to the BBCH scale, phenological stages related to the olive inflorescence emergence and flowering were recorded over six years 2014-2019 overall the WOGBM.

- Observations were carried out every two or three days from the first February to the end of the flowering period to determine the date of inflorescence emergence stages (stage 51 to Stage 59) and flowering stages (stage 61, 65 and 69) according to the BBCH scale for olive tree (Meier, 2001).

- Phenological data have been converted according to their corresponding Julian days, starting from the first of January of each year (DOY: Day of the Year).

- All statistical data analyses were run in the R programming environment (R Development Core and Team, 2021; version R 3.6.3)

Phenological stages



Flowering stages

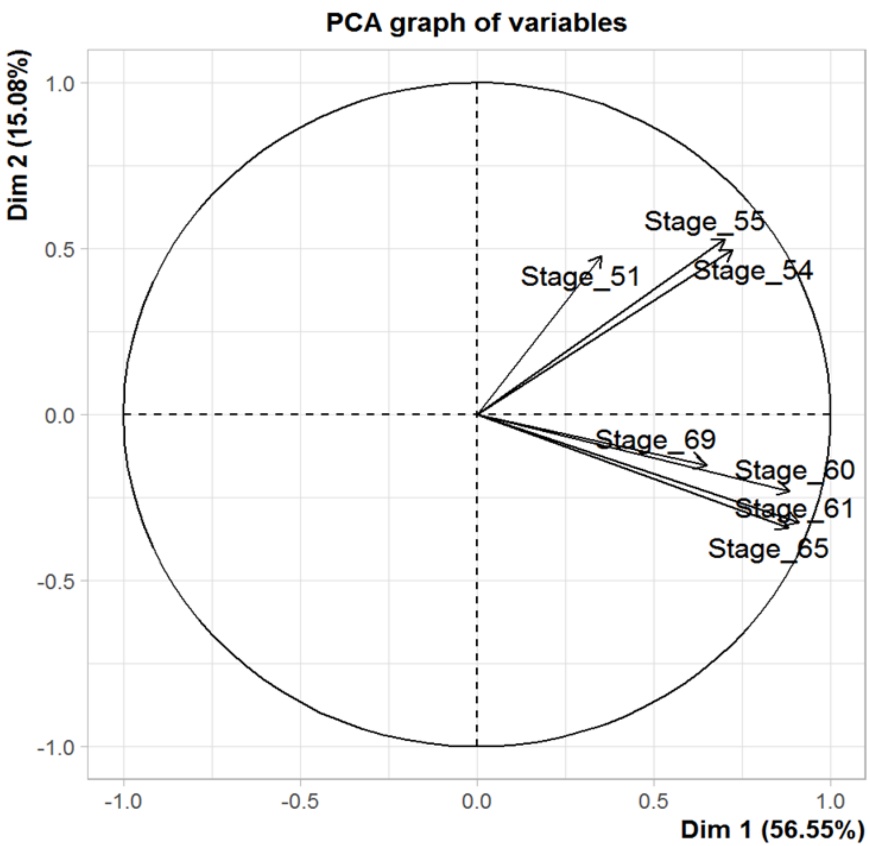
Stage 51

Stage 54

Stage 55

Flowering stages

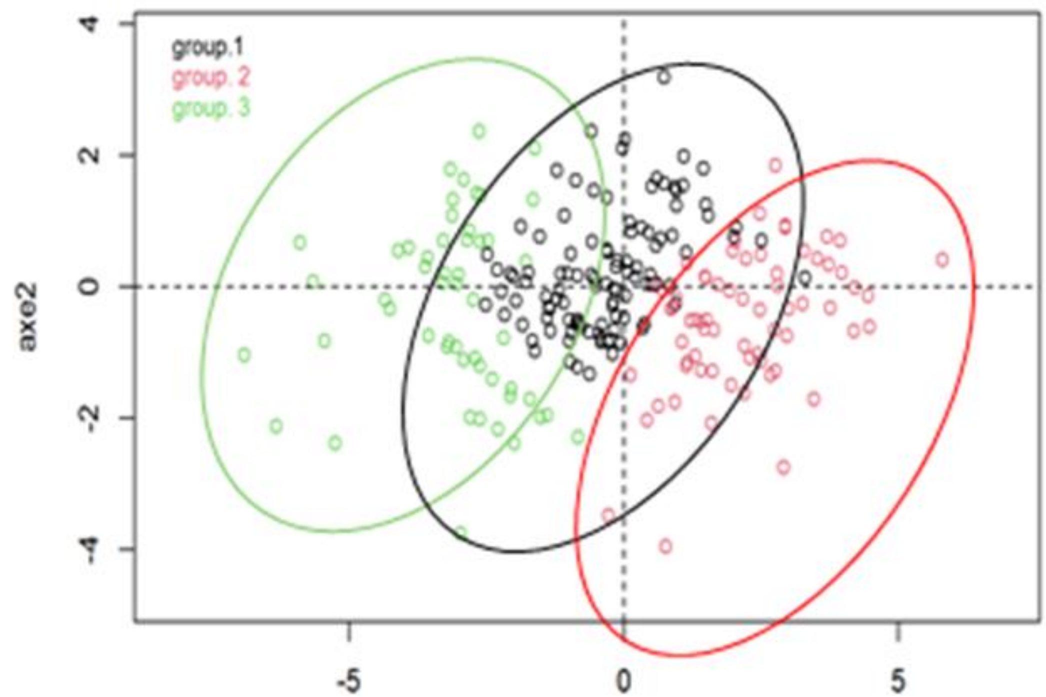
Results



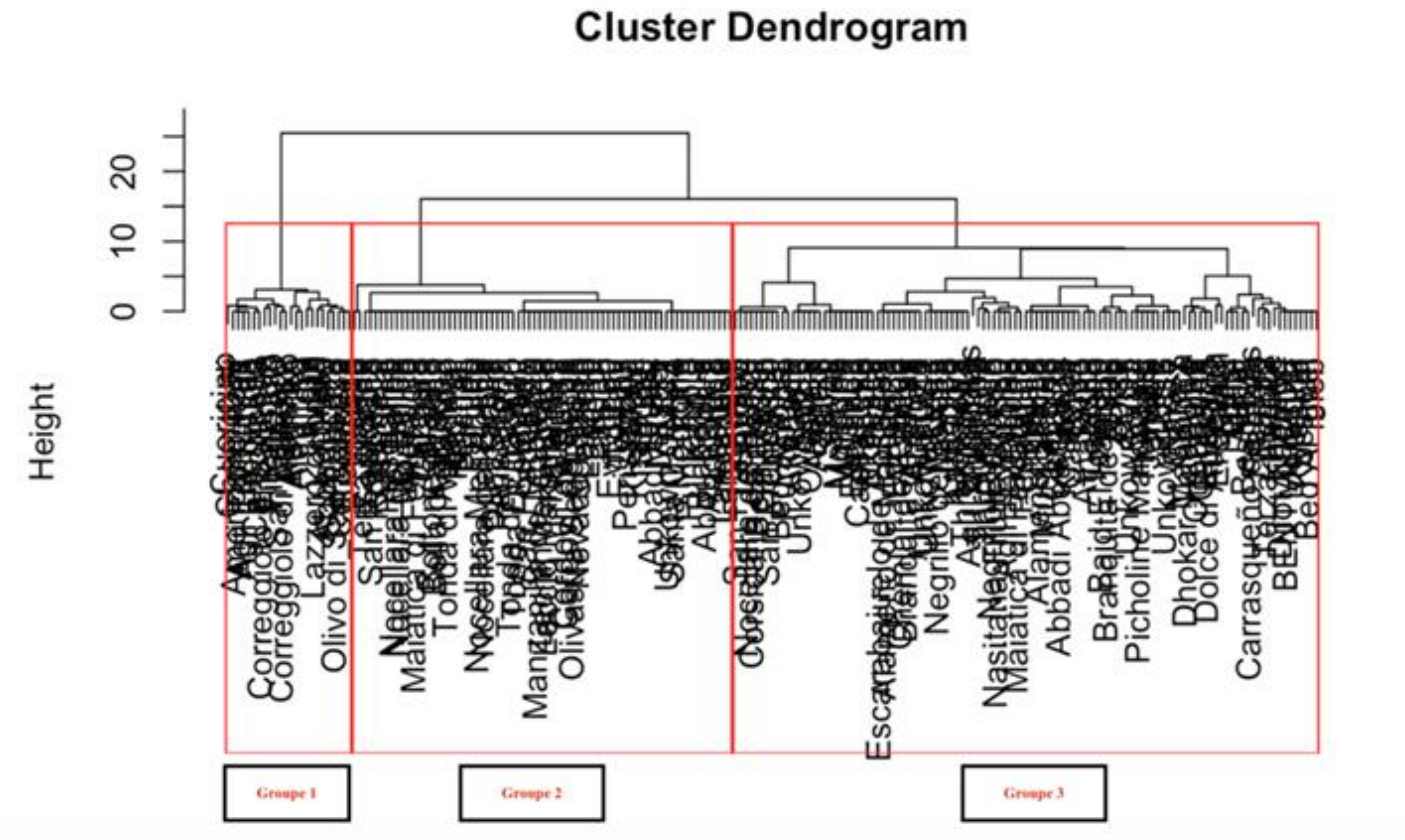
High correlation between flowering stages

Results

Principal components Analysis (PCA) of the phenotypic variability observed within the OWGB Marrakech collection



Results



Results

Three groups :

- Early flowering : Arbequine, Karolia, Lechin de Sevilla, Manzanilla de Sevilla, Hojiblanca…
- Intermediate flowering : Picholine marocaine, Picholine de Languedoc, Sigoise, Lucques; Koroneiki; Chemlal de Kabilye
- Late flowering : Picual, Leccino, Mastoidis Haouzia, Ottobratica, Chetoui …

Results

- Significant differences among cultivars were observed for all the evaluated flowering stage
- Higher values of flowering stage 51 phenological data were obtained for cultivars with supposed low Chilling requirement
- The budburst stage 51 is significantly negatively correlated to the flowering duration measured as the DOY (day of the year) difference between the beginning of flowering (stage 61) to the end of flowering (69).

Conclusion & Perspectives

- A wide range of variation was found in the WOGB Marrakech collection for all Phenological data

- Our results concerning flowering dates of the WOGBM cultivars showed an important significant year effect, followed by cultivar

- Flowering date for olive cultivars ranged over years between 91 DOY (April 1st) in the year 2019 to 150 DOY (May 30th) in the year 2016.

- Clustering of cultivars according to ward's method showed 3 groups : the early, intermediate and late flowering groups

Conclusion & Perspectives

- Stage 51 is a key stage of olive's trees flowering phenology, its early observation is correlated with long flowering period. Flowering period observations show correlation between a short flowering period and the increase of temperature expressed by the sum of degree-days.

Stage 51

- As the selection basis of adapted cultivars to global warming, our classification of olive Mediterranean genetic resources should be validated by further investigations, validating the statistical approach by the experimental one.

Thank you

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