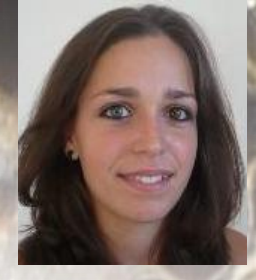


# COMPARISON OF IBERIAN HONEY BEE COLONY VARIABLES CONTINUOUSLY MONITORED WITH THERMO-HYGRO-BUTTONS AND ELECTRONIC SCALES SET UP IN TWO LATITUDINAL EXTREMES OF PORTUGAL



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## INTRODUCTION

Honey bee colony data collected continuously together with climate data are of great importance because they provide the opportunity to understand colony phenology. Continuous monitoring of honey bee colonies initiated long time ago with Gates (1914) and Hambleton (1925), when they assessed weather effects on hive weight using mechanical scales. Currently, the study of colony dynamics has been intensified with development of new technologies such as electronic scales, hygro-buttons, thermo-buttons, and computer-assisted digital image analysis of brood combs. Studies of colony dynamics are of great interest in Portugal because of large climatic (and flora) differences between the two latitudinal extremes and because of distinct genetic backgrounds of the native subspecies, *Apis mellifera iberiensis* (Pinto et al. 2013).

## GOAL

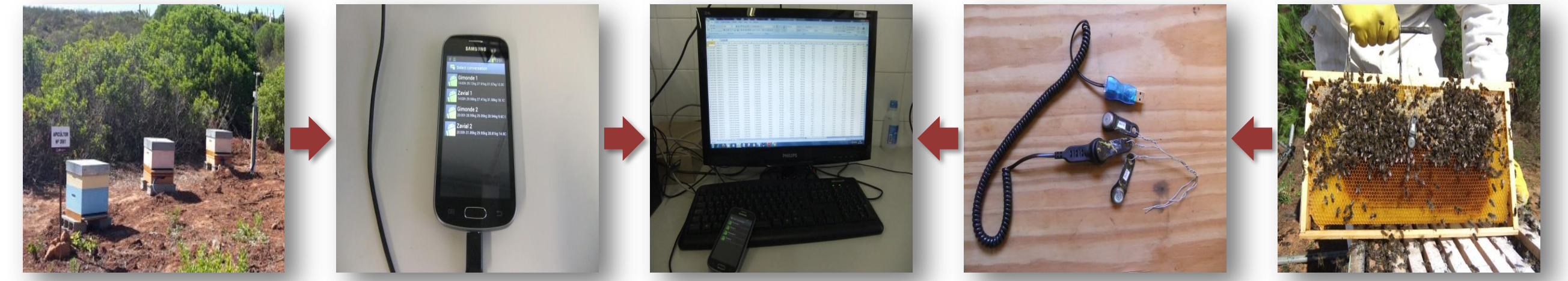
To study the temporal dynamics of colony weight and nest temperature of 2 colonies, located in two latitudinal extremes of Portugal.

## METHODS

The apiaries were set up in Gimonde (North of Portugal) and Zavial (South of Portugal, Figure 2). An anemometer, a rain sensor, and a hygro-thermo button were set up in each apiary. Automatic scales and 3 hygro-thermo buttons were set up in 1 hive in each apiary. The data from the scales and the hygro-thermo buttons (set in the external combs, positions A and C, and in the central comb, position B) were collected every 6 and 1 hour, respectively. The combs were photographed monthly and the queen status was assessed (Figure 1).

Presence	Queen				
	Virgin Queen (VQ)	Mated Queen (MQ)	Year	Painted (P)	Painted today (PT)
1- Inferred					
2- Observed					
3- Non-existent					

Figure 1 - Queen code, automatic weather station, automated scales and thermo-hygro buttons.



## RESULTS AND DISCUSSION

Temperature, rainfall and windspeed values were considerably different between the two latitudinal extremes of Portugal (Gimonde and Zavial, Figure 2).

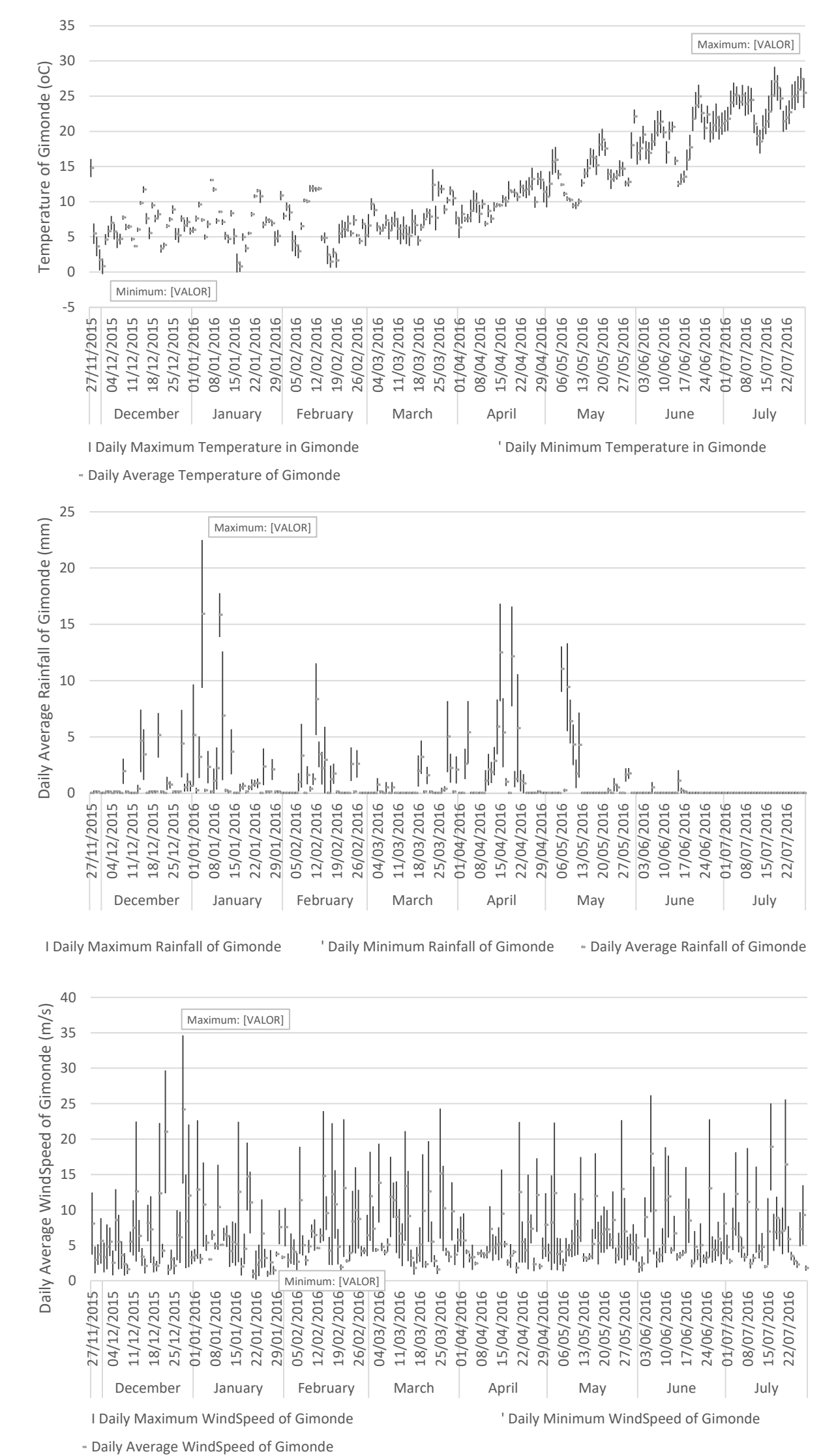
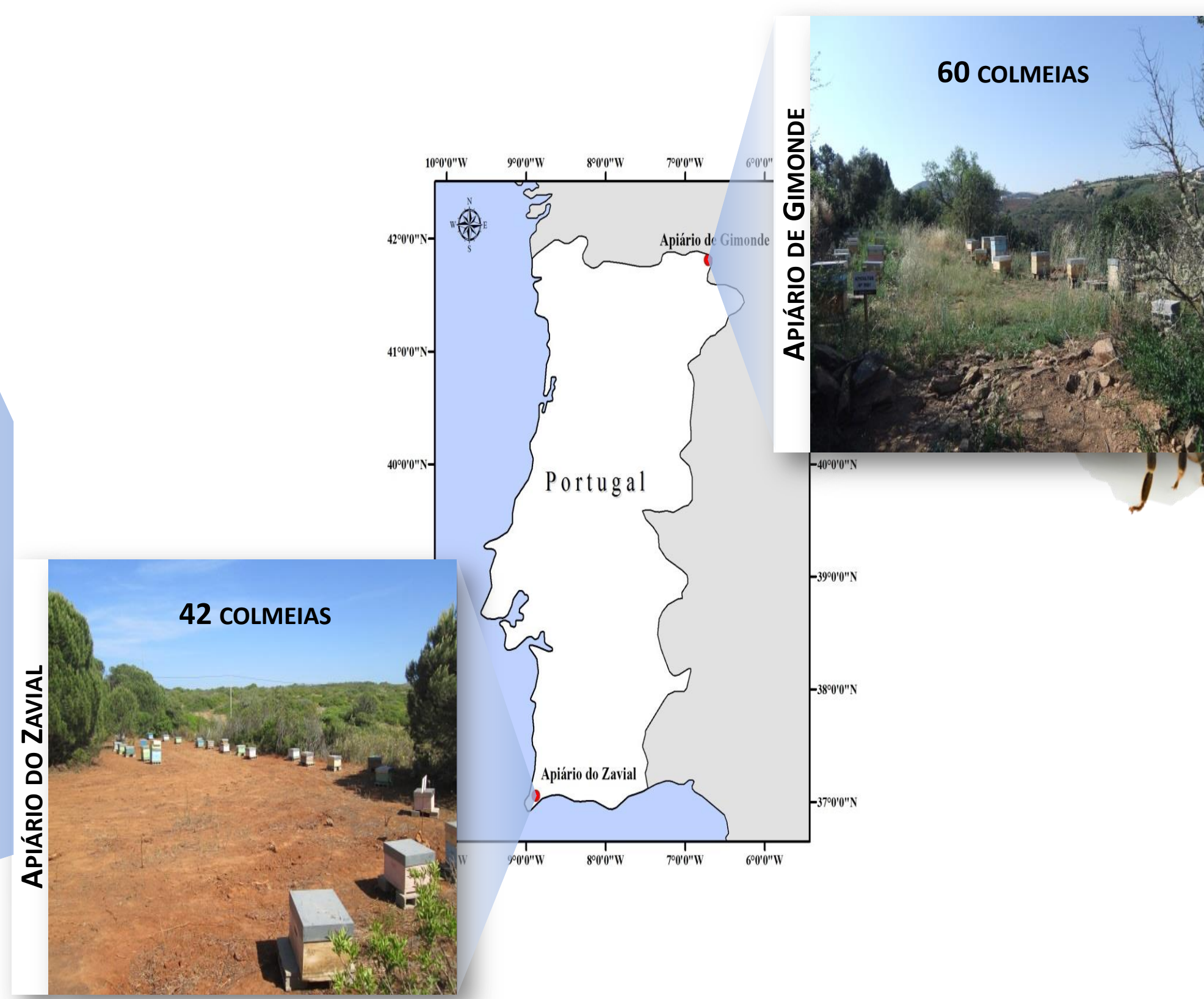
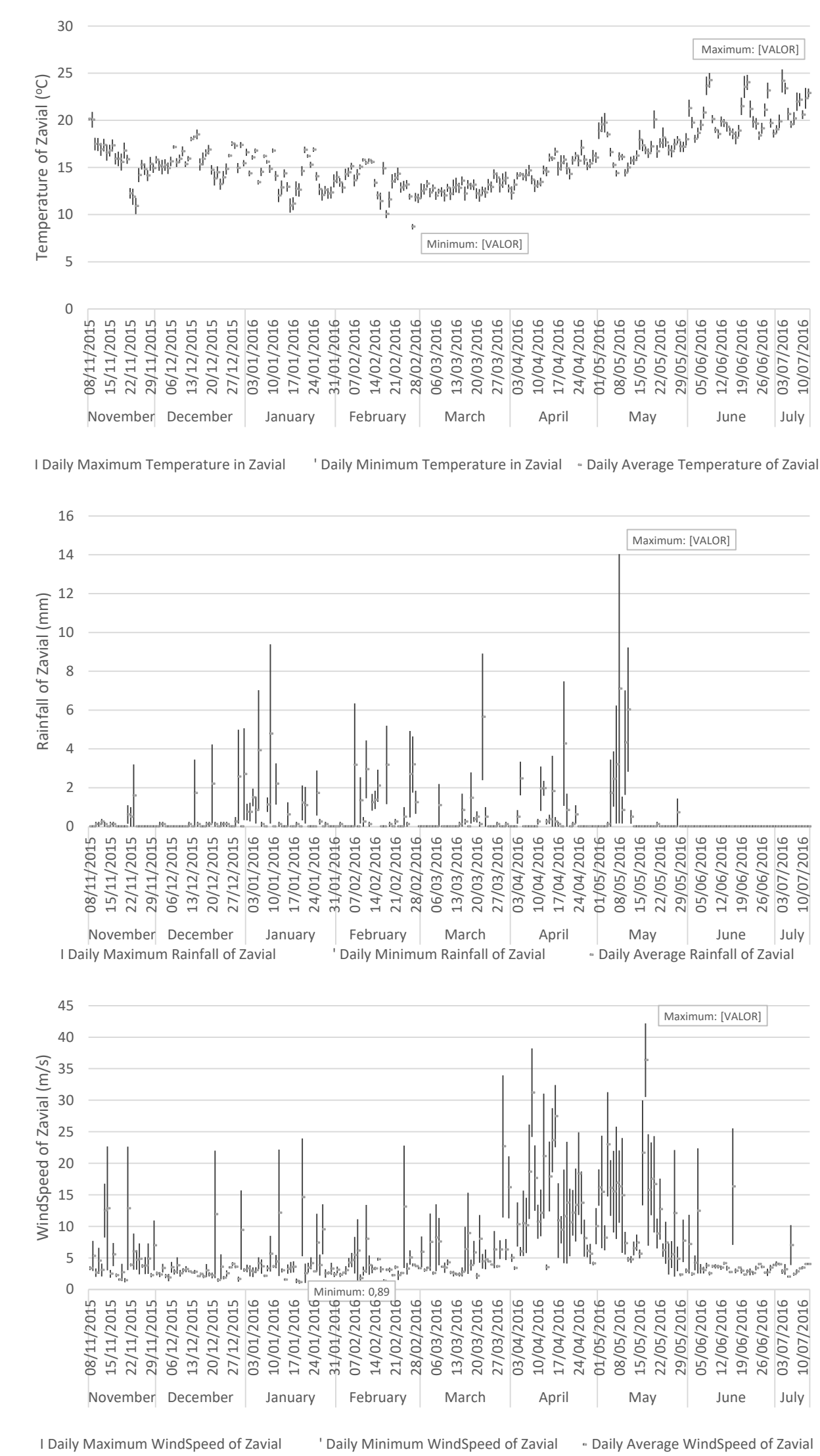


Figure 2 - Daily temperature, rainfall, and windspeed (maximum, minimum and average) in Gimonde and Zavial were collected from November of 2015 to July of 2016.

## GIMONDE

- The hygro-thermo button located in the hive's central comb set up in Gimonde, named BL2G\_B, fluctuates between 32-35°C, reflecting the presence of brood. However, in the period of 03/01/2016 - 23/01/2016, 03/03/2016 - 12/03/2016 and 18/03/2016 - 19/03/2016 the temperature in the central comb dropped below 32°C due to low environmental temperatures of winter in Gimonde. This may indicate a non-laying queen, or broodless state in this hive space.
- The hygro-thermo buttons located in the hive's external combs, named BL2G\_A and BL2G\_C, were generally correlated with environmental temperatures, except when the brood expanded to the external combs. The BL2G\_A indicates the presence of brood in the period 22/06/2016 - 28/07/2016, and the BL2G\_C in the periods 17/07/2016 - 20/07/2016 and 24/07/2016 - 28/07/2016.
- The weight decreased until 02/05/2016, indicating food consumption. After 05/03/2016 the weight increased steadily, coincidental with the onset of the flowering season, reflecting an increasing of food reserves and brood. During the nectar flow, the hive's weight increased with increasing of environmental temperature.

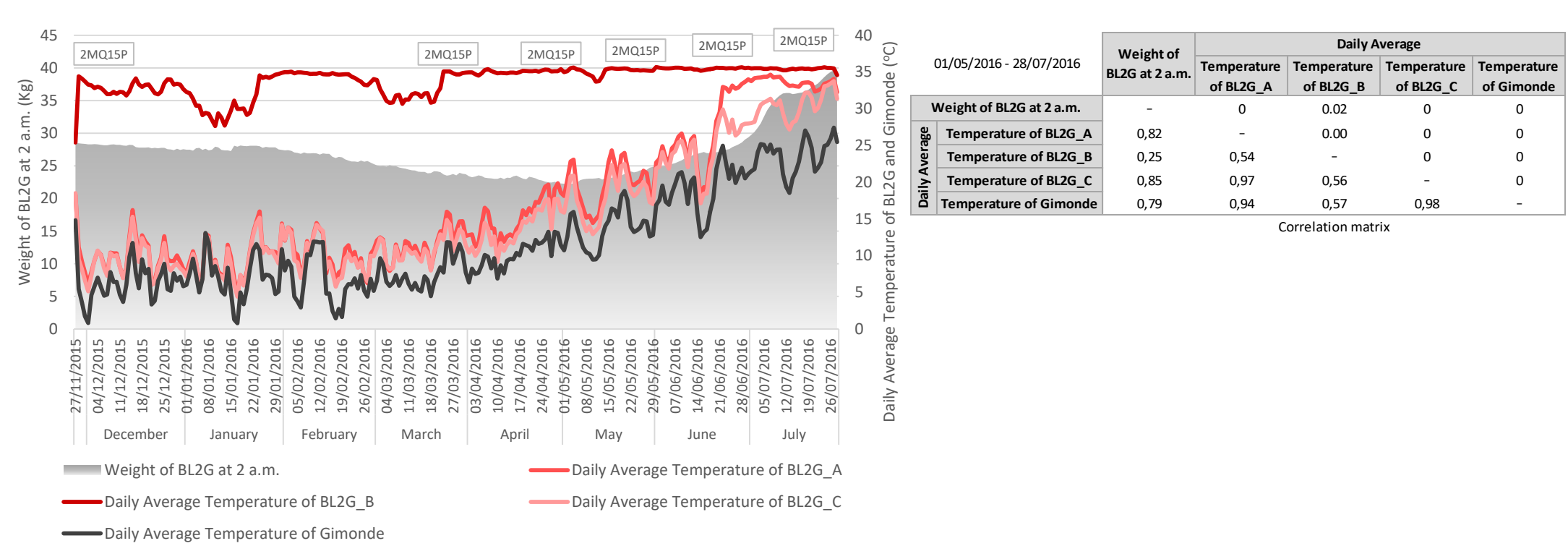


Figure 3 - Weight of BL2G hive at 2 a.m. Daily average temperature in comb positions BL2G\_A, B and C. Environmental temperatures and their correlation with the flowering period in Gimonde.



## ZAVIAL

- The hygro-thermo button placed in the hive's central comb, named BL2Z, varied between 32-35°C in the period of 10/11/2015 to 21/06/2016, indicating the presence of brood.
- The hygro-thermo buttons placed in the hive's external combs, BL2Z\_A and BL2Z\_C, were significantly correlated with environmental temperature, except when the brood expanded to their position. The BL2Z\_A indicates the presence of brood in the period 18/03/2016 - 22/04/2016, and the BL2Z\_C in the periods of 09/03/2016 - 21/04/2016, 16/05/2016 - 21/06/2016 and 03/07/2016 - 09/07/2016.
- In the period 01/03/2016 - 17/04/2016, the hive's weight increased 103,913g/day, however on 14/04/2016 the colony swarmed, decreasing 610g. We observed virgins queens and swarm queen cells on 16/04/2016. During the period of 18/04/2016 - 30/04/2016 there was a decreasing of weight, possibly due to reduced brood.
- The temperature decreased below 32°C, as detected by BL2Z\_A and BL2Z\_C on 23/04/2016 and 22/04/2016, respectively, supporting the swarming event and absence of a mated queen. From 16/05/2016 on the BL2Z\_C detected again temperatures compatible with the presence of brood, indicating the presence of a mated queen. Those temperatures are maintained until 21/06/2016.
- During the period of 22/06/2016 - 12/07/2016 the BL2Z\_B detect temperatures below 32°C, indicating absence of brood, consistent with the queenlessness status observed on 11/07/2016.
- In the period 03/07/2016 - 09/07/2016 the BL2Z\_C detected temperatures between 32-33°C that could be explained by the presence of brood. This result was observed in the field on 11/07/2016.
- During the nectar season, the hive's weight increased significantly with increasing of environmental temperature.

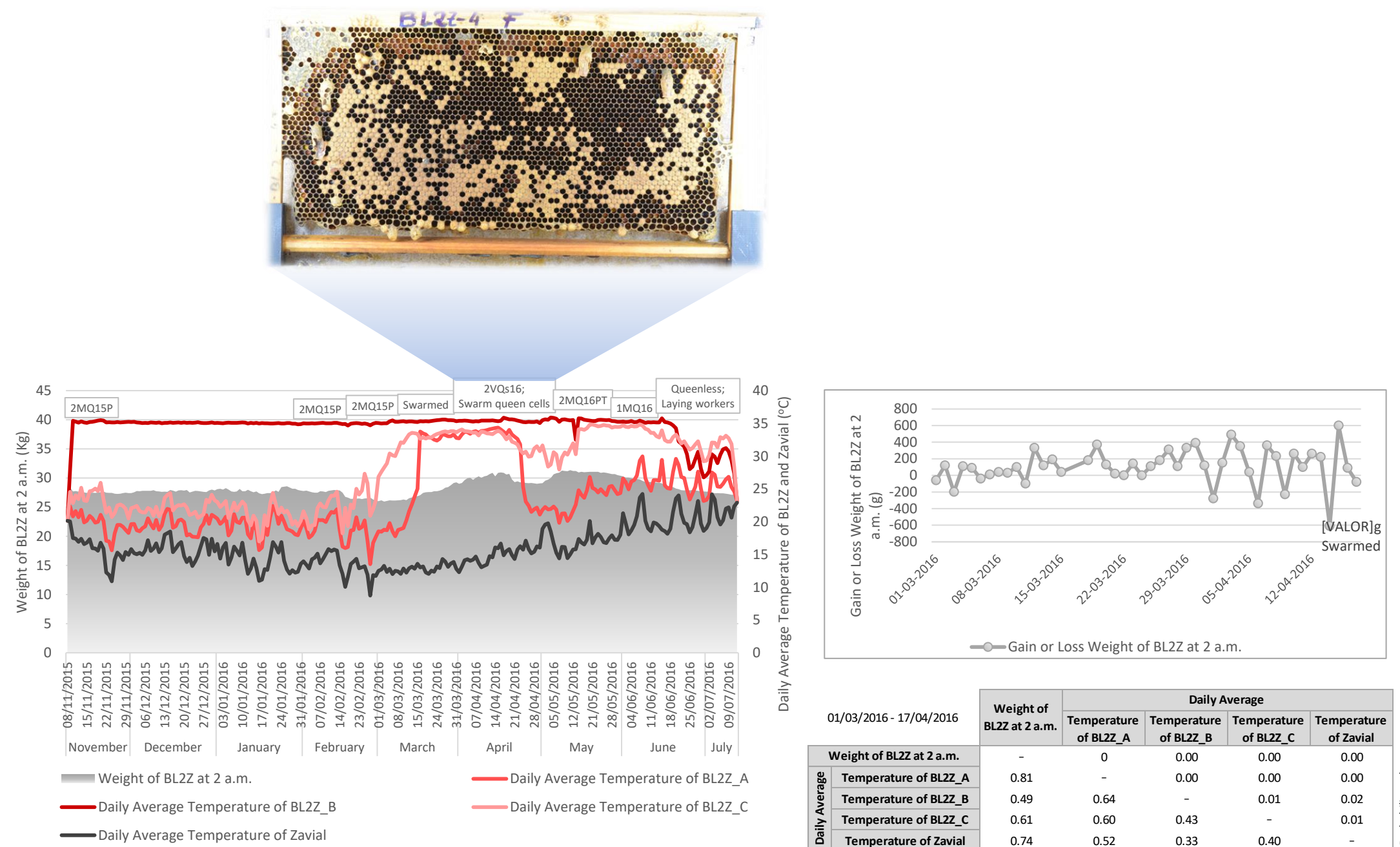


Figure 3 - Weight of BL2Z hive at 2 a.m. Daily average temperature in comb positions BL2Z\_A, B and C. Environmental temperatures and their correlation with the flowering period in Zavial.

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