Biomonitoring of agroforestry systems - application of smart beehives

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INTRODUCTION

Nowdays' environmental interest is greatly focused on evaluation of the effects of anthropogenic pollutions. Finding the appropriate and representative indicators, which are able to reveal interactions between the pollution and the environmental elements is the key issue of our research. Besides the conventional environmental examinations investigation of different organisms and their produced materials is a novel, progressive point of view.

AIMS&SCOPE

Honey bees (*Apis mellifera*) play by pollination of plants. Furthermore they produce various products with high economic value. Understanding their communication, following their life cycle and measuring their collected products provide valuable information regarding to environmental status. Due to these benefits our aims are to establish the basic parameters and the methodology for an environmental biomonitoring system for environmental review of shelterbelt system based on bee families.

RESULTS

🐝 **Pollen** samples proved the best in indication of **soil pollution**

🐝 **Contaminations** (organic and inorganic) from the **atmosphere** are accumulated in **propolis** samples

🐝 **Ratio of elemental content** of beekeeping products from different areas refers their **transport route**

🐝 Detectable **PAH components**: naphthalene, acenapthalene, fluorene, pyrene, anthracene, fluorathene, phenanthrene

🐝 Annual **total PAH** concentration in propolis samples varied: **1.75-2.70 ngg^{-1}**

🐝 Temperature sensors in beehives can **indicate** the **end** and the **start of brood period** (Fig. 2.)

🐝 **Elemental results** from pollen samples: **Ca/Mg**~1.0-1.5, **K/Na** ~ 40-60, **Zn/Fe** ~ 1.0 (pollen seems to be a proper Zn source)

MATERIAL AND METHODS

On the one hand smart beehives were setting into pilot agroforestry areas (optimised for beekeeping). Beehives are equipped with different sensors, in order to measure outside and inside the temperature, humidity and CO_2, VOC concentration. Data are transferred into server periodically by mobile network, which provides possibility to follow life activities of bee families. Solar panels are responsible for electricity supply.

On the other hand analysing beekeeping products: honey, propolis, wax, pollen allows an indication method of various anthropogenic pollution impacts. Novel protocol was developed for analysis of PAH - PolyAromatic Hydrocarbons applying by analytical technique of GC-MS TQ 8040 (Shimadzu Co.) Inorganic elements were detected by iCAP 6300 Duo ICP-OES (Thermo Fisher Scientific Inc.)
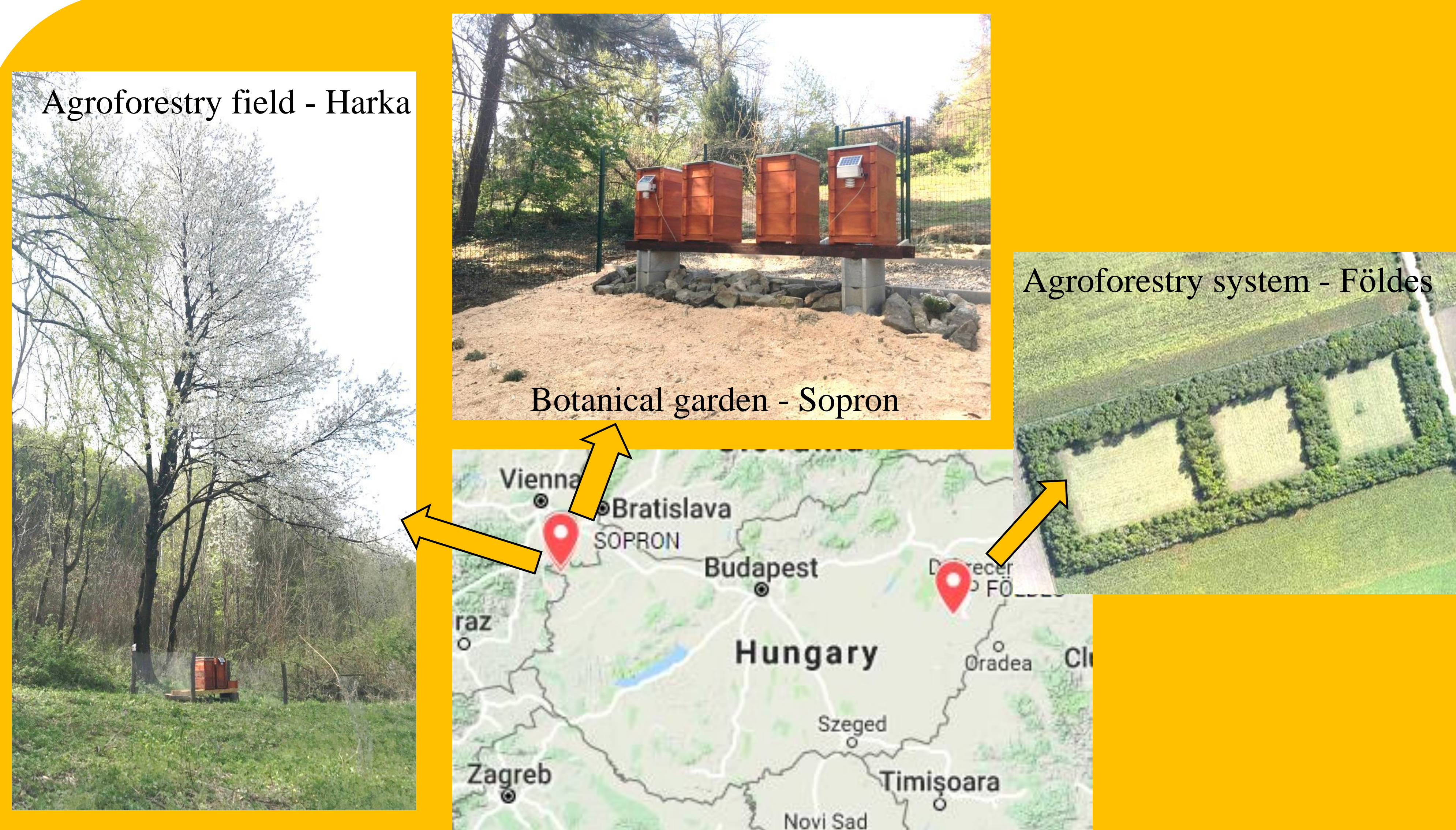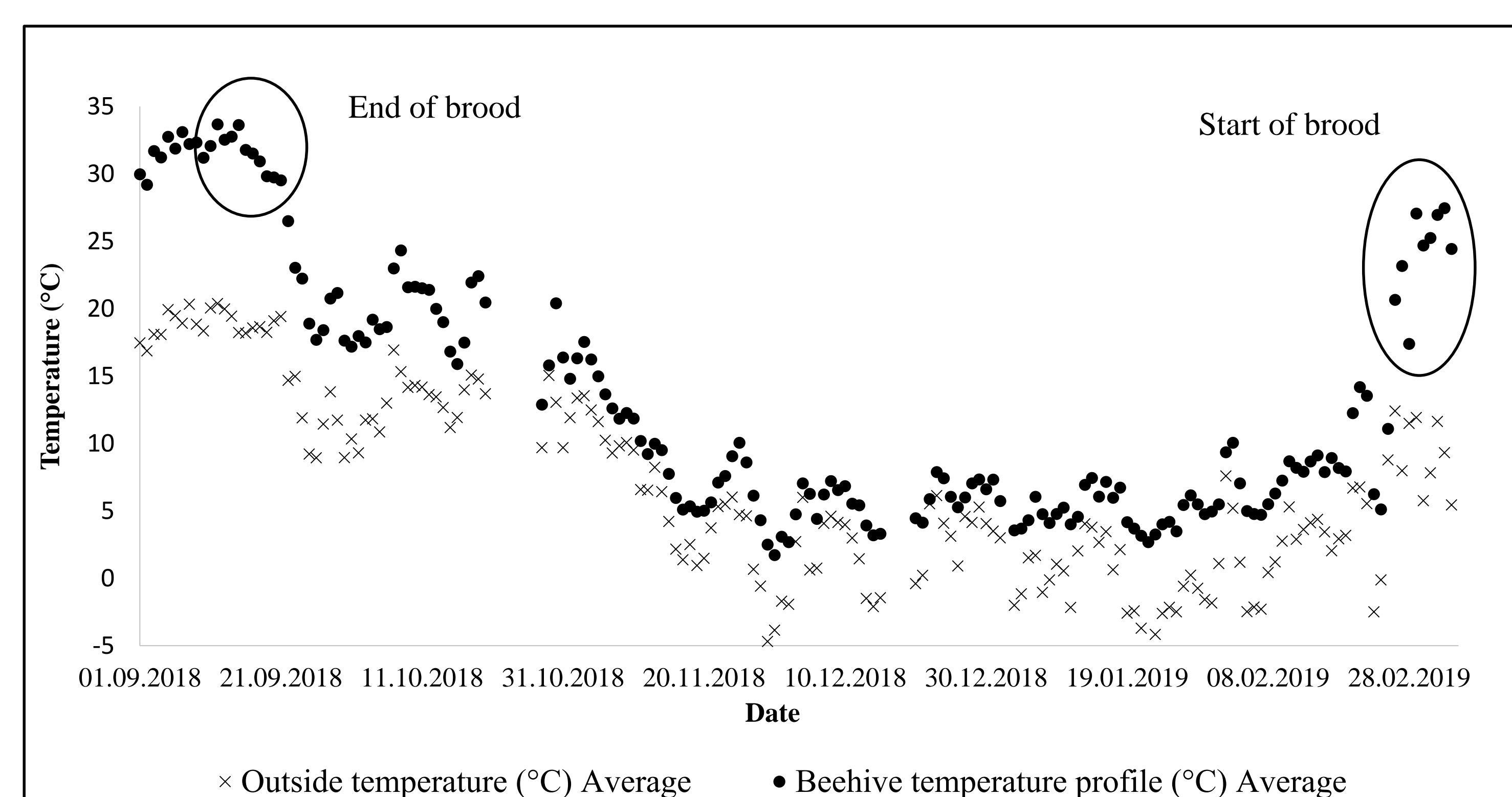

Figure 1. Pilot areas

Figure 2. Alteration of daily outside and beehive temperature

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