Remotely controlled bee wintering building for Precision Beekeeping (Apiculture)

Aleksejs Zacepins, Egils Stalidzans, Jurijs Meitalovs
Latvia University of Agriculture, Faculty of Information Technologies

INTRODUCTION:

European honeybee (Apis mellifera L.) has adapted to survive cold winters in northern climate. Nevertheless success of wintering depends on different biological and physical factors. In cold climates the passive wintering takes 4-6 months and that is very important part of the annual cycle where beekeeping technologies can be improved to reduce significant losses of bee colonies during winter. The losses caused by environmental conditions can be reduced ensuring close to optimal conditions for bee colonies in a controlled bee wintering building. Duration of broodless period is one of biological factors which influence quality of wintering. Brood rearing through winter or too short broodless period during wintering can result in starvation because of too high food consumption rate and overburden of intestine part with residues which can cause rise of intestine diseases.

BEE WINTERING BUILDING:

Traditionally beekeepers are used to keep colonies outside during the winter time but bees can also be placed in a special wintering building (see Fig.1) to save physiological resources of bees and honey compared with outdoor wintered bees.

A building for indoor wintering of up to 100-150 honeybee colonies is built in Jelgava (Latvia). The wintering building (floor 6,25m x 4,00m, height 2,4m) was equipped according to the instructions of Fingler and Small (1982) from Manitoba (Canada) to enable temperature control in the building.

To observe individual bee colonies a temperature sensor network (see Fig.2) is introduced to measure the temperature of each hive above the upper hive body.

Fig.1. Exterior view of wintering building

Fig.2. Interior view of wintering building

The described system is used in Jelgava, Latvia in winters 2010-2013 for experimental purposes wintering indoors about 20 bee colonies and 10 bee colonies were wintered outdoors for comparison of wintering results. The temperature in the wintering building was kept at +3…+6ºC ensuring high survival rate of bee colonies.

PRECISION BEEKEEPING (APICULTURE):

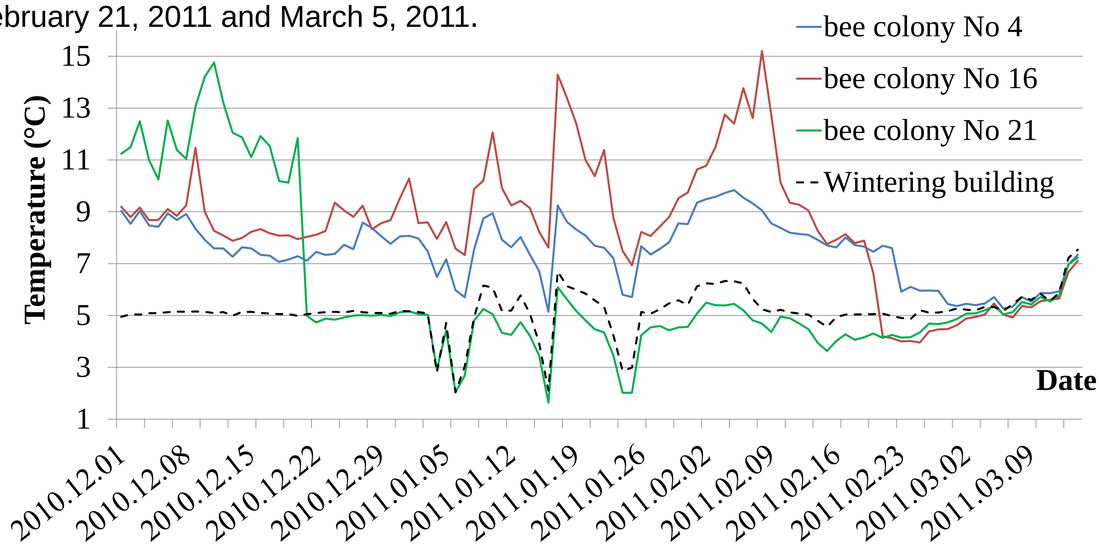
Precision Beekeeping (Apiculture) is an apiary management strategy based on the monitoring of individual bee colonies to minimize resource consumption and maximize the productivity of bees.

Precision Beekeeping (PB) like PA can be considered as a three-phase cycle including 1) data collection, 2) data analysis and 3) application.

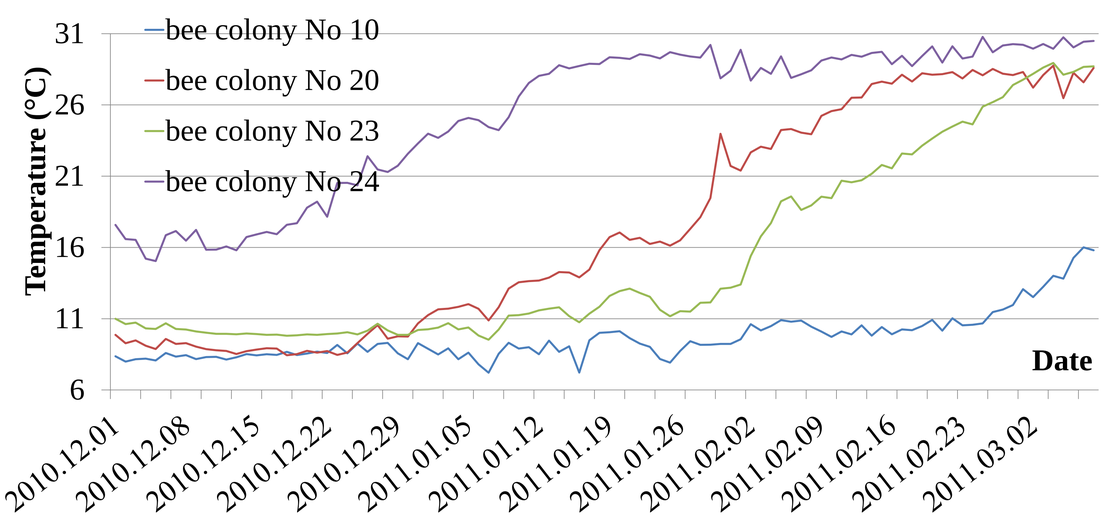
The future perspectives of PB are strengthened by an European project within ERA-net ICT-Agri with topic “Application of Information Technologies in Precision Apiculture (ITAPIC)” where scientists from Latvia, Denmark, Germany and Turkey are participating. It is planned to analyse applicability of temperature, sound and video measurements and develop decision support systems for Precision Beekeeping approach (**www.itapic.eu**).

TEMPERATURE DYNAMICS OF THE BEE COLONIES:

Identification of **the bee colony death** by produced bee warmth (2010-2011 wintering period). Bee colonies No 21, 16 and 4 are dead respectively on December 21, 2010, February 21, 2011 and March 5, 2011.



Identification of the **bee colony brood rearing process** by stable increase in colony temperature (2010-2011 wintering period). Bee colonies No 10, 20, 23 and 24 begin linear increase of the temperature respectively on December 13, 2010, December 23, 2010, January 22, 2011 and February 22, 2011.



PUBLICATIONS:

Zacepins, A. (2012) Application of bee hive temperature measurements for recognition of bee colony state. In: *Proceedings of the 5th International Scientific Conference “Applied Information and Communication Technologies” (AICT 2012)*, Jelgava, Latvia, p. 216–221.

Zacepins, A., Karasha, T. (2012) Web based system for the bee colony remote monitoring. In: *Proceedings of the 6th International Conference “Applied Information and Communication Technologies” (AICT 2012)*, Tbilisi, Georgia, p. 155–158.

Zacepins, A., Stalidzans, E. (2012) Architecture of automatized control system for honey bee indoor wintering process monitoring and control. In: *Proceedings of the 13th International Carpathian Control Conference (ICCC 2012)*, Podbanske, Slovakia, p. 772–775.

Zacepins, A., Stalidzans, E., Meitalovs, J. (2012) Application of information technologies in precision apiculture. In: *Proceedings of the 13th International Conference on Precision Agriculture (ICPA 2012)*, Indianapolis, USA.

Zacepins, A., Stalidzans, E. (2013) Information processing for remote recognition of the state of bee colonies and apiaries in precision beekeeping (apiculture). *Biosystems and Information Technology*, Vol. 2(1), p. 6–10.

ITAPIC Application of Information Technologies in Precision Apiculture
SEVENTH FRAMEWORK PROGRAMME
ICT AGRI era-net