

Guttation and the risk for honey bee colonies (*Apis mellifera* L.): a worst case semi-field scenario in maize with special consideration of impact on bee brood and brood development

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Material and methods

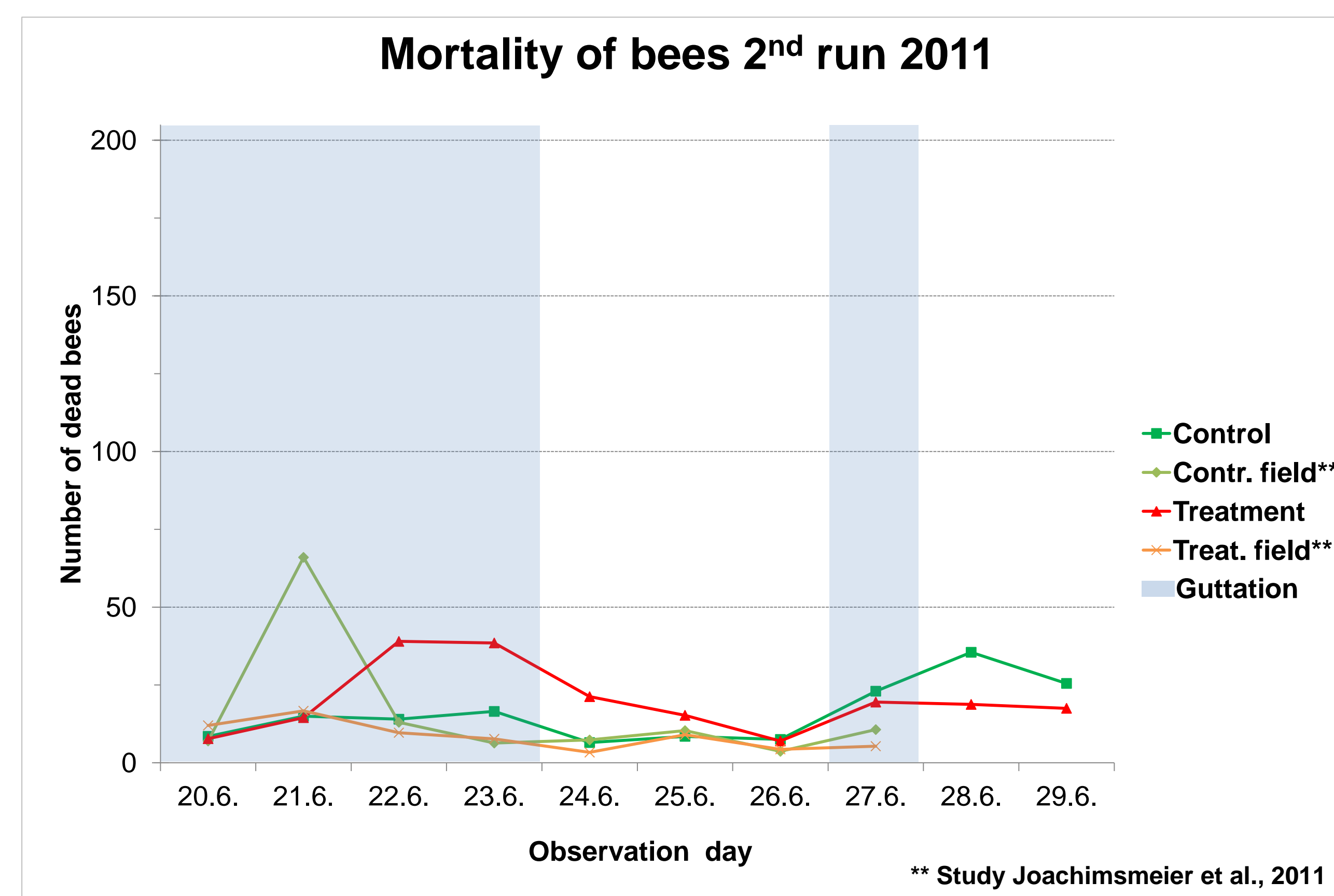
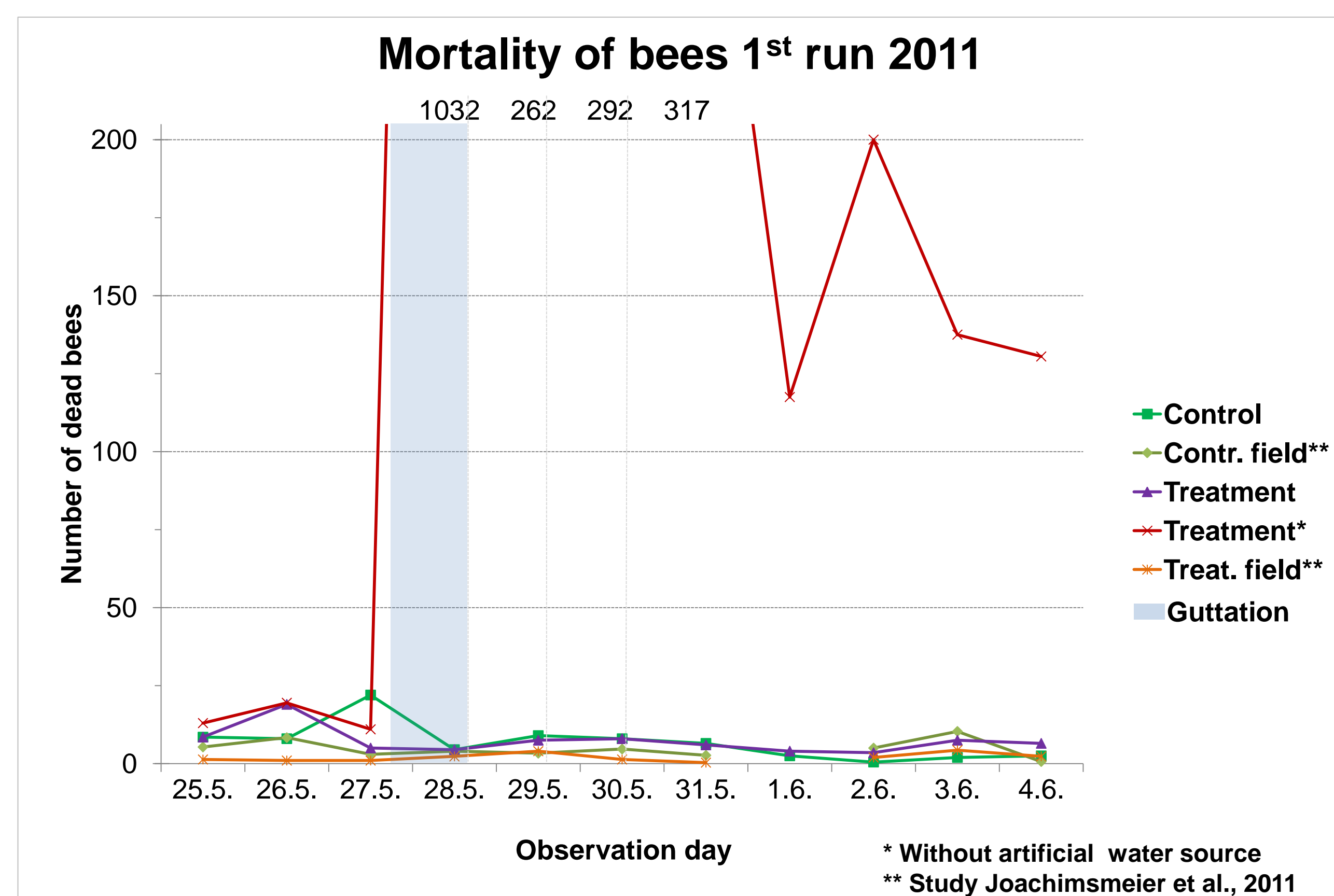
The study was performed under semi-field conditions in Lucklum (Braunschweig, north Germany), in treated (a.s. Clothianidin, Poncho Pro[®], 1.25 mg/kernel) and untreated maize. The tents (4 treatment and 2 control) had an area of 96m² (16 x 6m) each and were covered with a gauze permeable for wind and rain but impenetrable for bees. The study was repeated twice, in the first run (BBCH 13-15) with two variants, one with and one without artificial water source containing uncontaminated tap water, one control for each variants. In the second run (BBCH 15-19) all variants had an artificial water source. Bee colonies used were of similar size with approximately 10.000 bees, (one-room, "Zander"), had an oviparous one year old queen bee and contained sufficient nectar and pollen stores in the hives and were allowed to forage on additional sugar feeding paste and pollen sources in the tents. The mortality of bees was assessed in dead bee traps, on the linen sheets in the crop. The flight activity and behavior of bees at the entrance and in three flight squares were determined once daily. The observation time in the tents were 11 (1st run) and 10 (2nd run) days, the observation of brood development for 100 brood cells per hive was conducted nearly for four weeks following the protocol of Schur et al.(2003). Over the whole study the occurrence of guttation was documented.

The first run of the study

The study was performed in six flight tents in corn (BBCH 13-15) with one bee hive per tent. Two treatment tents with and two without artificial water source containing uncontaminated tap water, one control for each variants in the untreated field side.

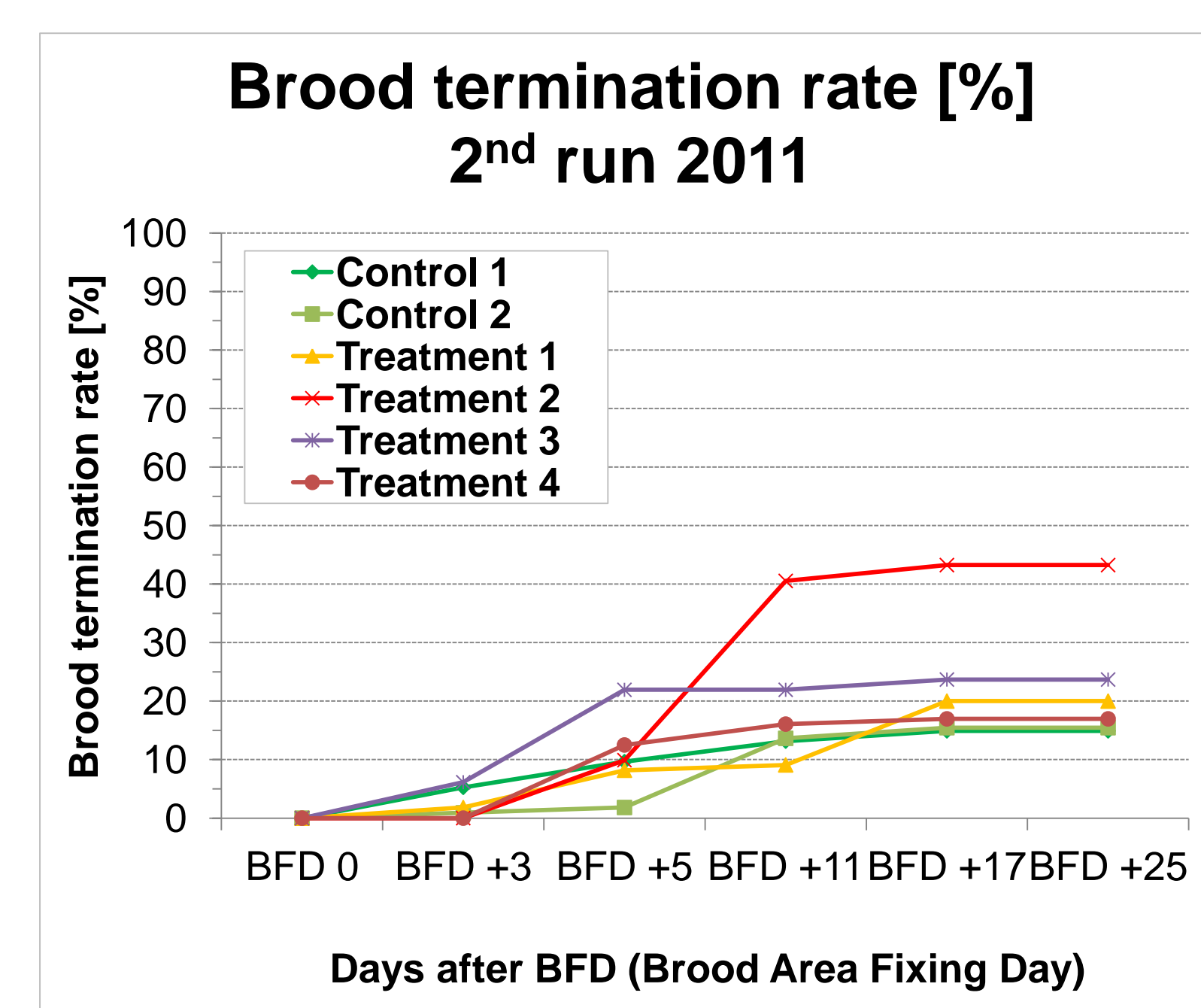
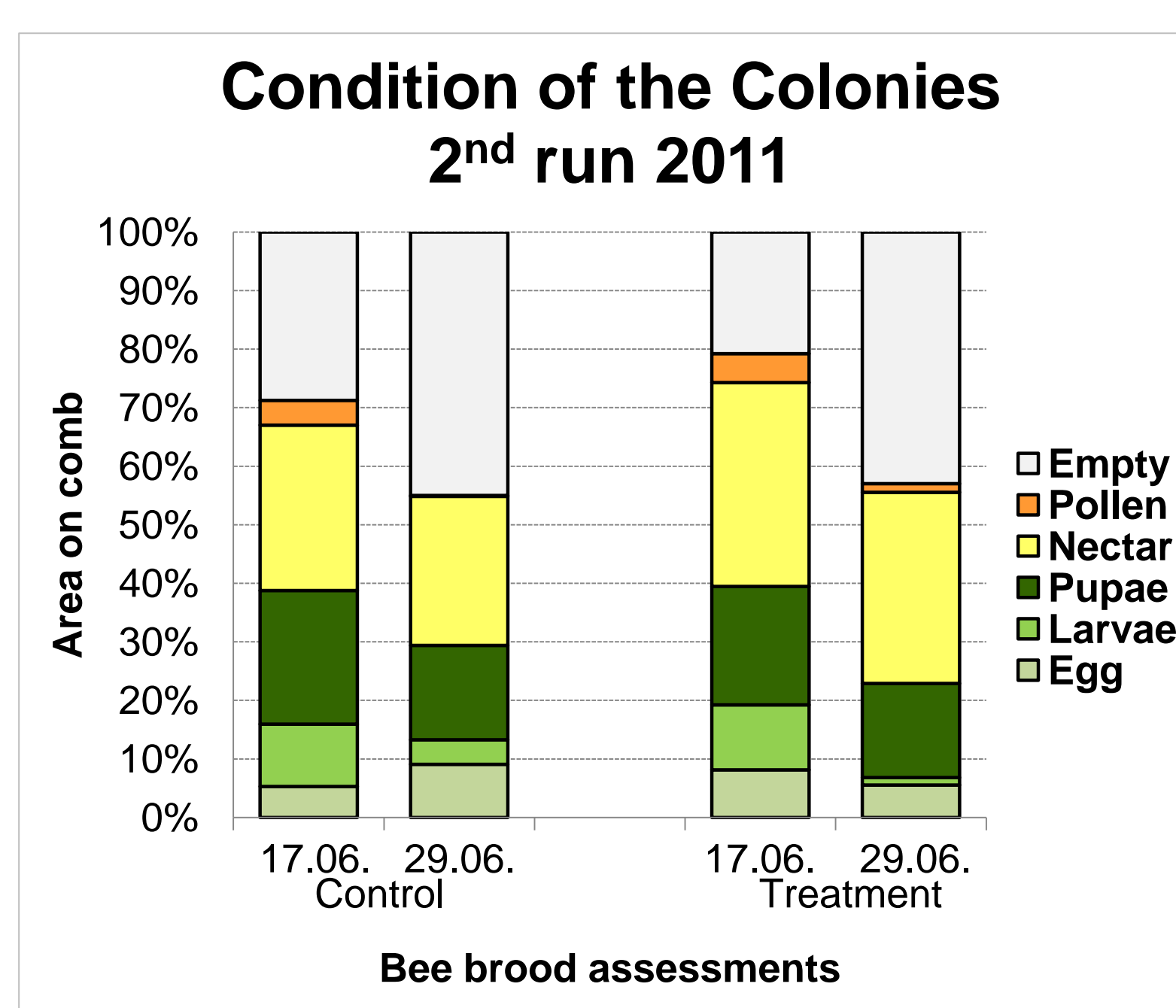
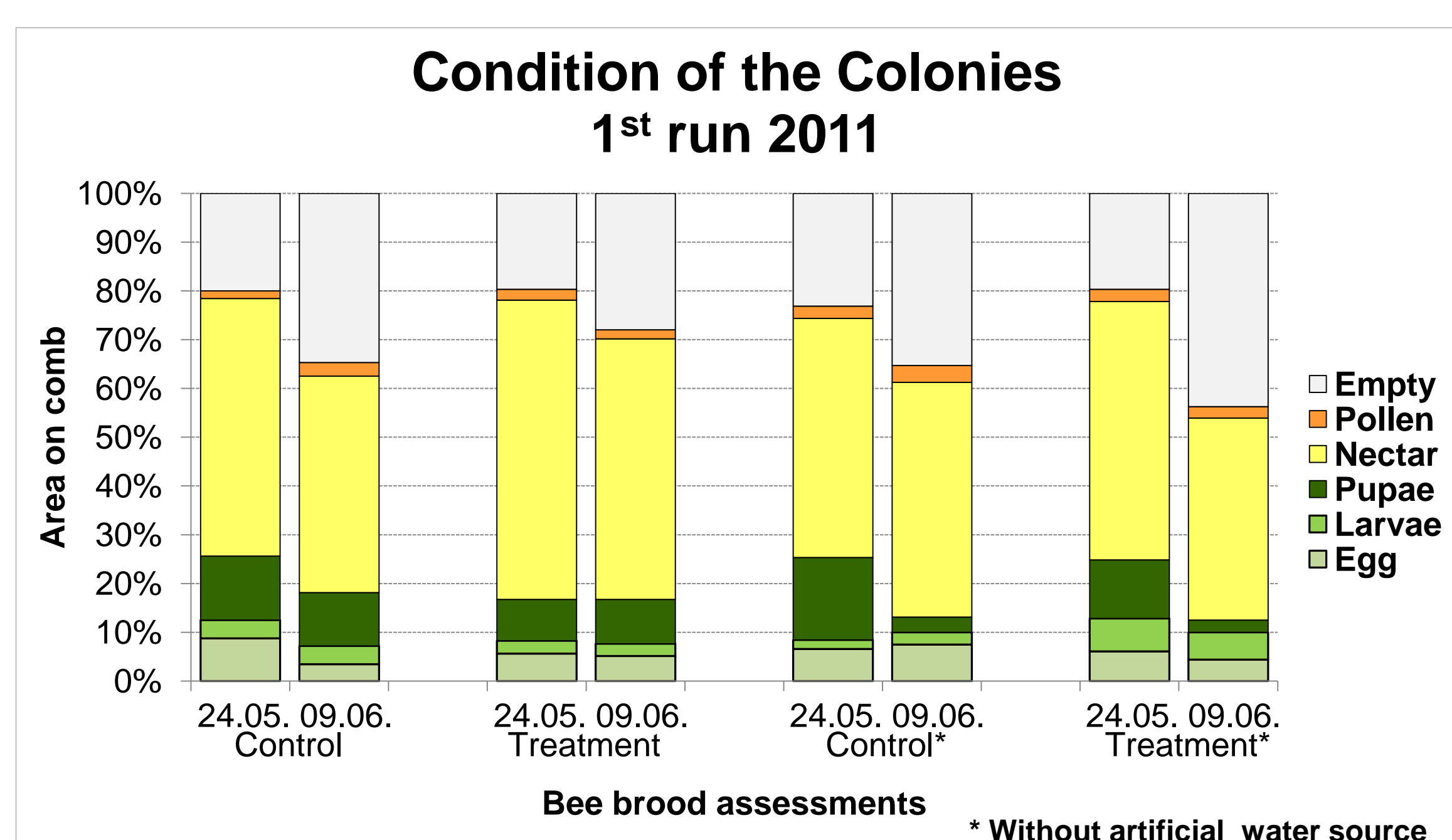
The second run of the study

The study was also performed in six flight tents but in bigger corn (BBCH 15-19) with also one bee hive per tent. The four treatment tents are similar with artificial water source with uncontaminated tap water. The conditions of the control tents are the same in the untreated area.



Mortality of Bees

Due to the weather conditions in the first repetition guttation occurred only once, which caused a high mortality of more than 1.000 bees/hive and day in the waterless variant. In the second run guttation of the corn occurred on 5 of 10 days. The mortality in treated and control variants was on a similar level and within normal range. Both runs exposed a normal mortality in the control and treated variants with additional water supply over the whole exposure time, same in the field study (poster Joachimsmeier et al., 2011).



Condition of the Colonies

The condition of the colonies was checked once before and one time after the exposure period. At the start the colonies showed an equal distribution of the different brood stages and the total covered area was also on a similar level in the six colonies. On second date in the first run the area covered with capped cells of the waterless variation were decreased compared to the other variants. In second run the effects of the conditions of the colonies are equal in all variants and in an normal range.

Brood development

Because of the termination rate ranged up to 100% in both control variants of the first run, the results can not be evaluated. The control mortality could be explained by weather conditions. In all variants of the second run, most marked eggs reached the expected stages up to last BFD. The termination rate under 30% is in normal range.

Conclusion

In the first run of the study, in the artificial extreme situation without any additional water supplies a high impact on adult mortality and also on the brood development was observed (can not be evaluated, because of high termination rate in the control variants), indicating the sensitivity of the test system but representing a unrealistic worst case scenario. In variants with treated maize and additional water supply, no effects on adult mortality and Brood were observed. The results of the second run are also with no effects on adult mortality or brood development. The comparison of a parallel open field study with same conditions (poster Joachimsmeier et al., 2011), also confirmed the results of no effects on mortality.