

Austrian Beekeeper Citizens Science Survey, the Financial Burden to Fight *Varroa Destructor* [in progress]

Hannes Oberreiter University Graz, Institut of Biology



Introduction

My master thesis deals with beekeeping in Austria and the expenses involved in the use of medication against the parasitic mite *Varroa destructor*. In the foreground of the work is an exploratory analysis of citizen science survey data from the years 2018/19 and 2019/20 which is done yearly in Austria since 2008 by the University of Graz [3].

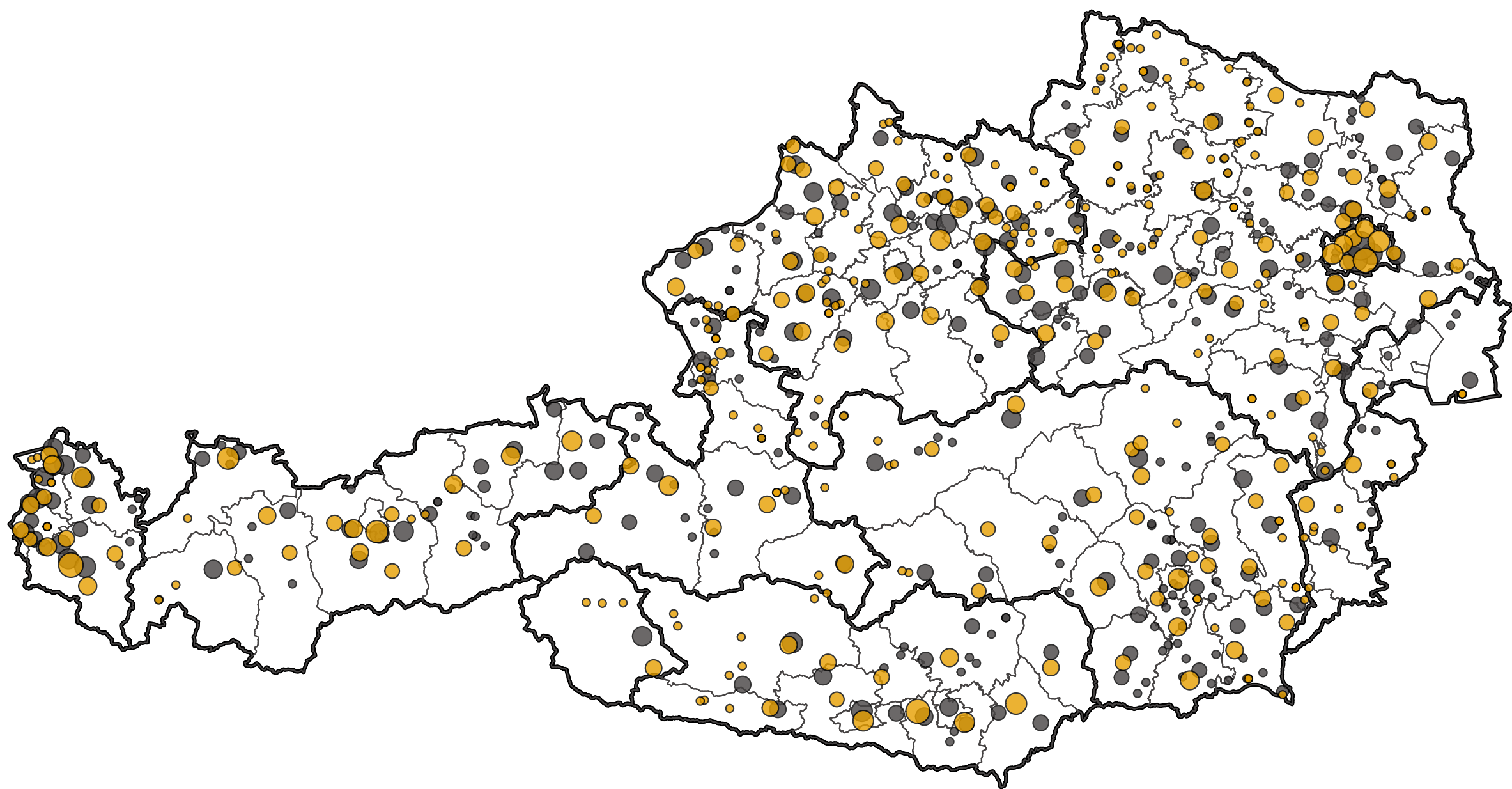


- analysis of the economic burden of beekeepers to fight the introduced aggressor *Varroa destructor*
- dimensions of the Austrian treatment agent market
- hypothesis about loss and expenses correlation

Material and Methods

The survey consisted of questions from the international COLOSS questionnaire [4] and some additional questions which were only present in the Austrian survey. Our main interest in this study are the surveyed questions about the “Estimated expenses of treatment against Varroa Mites per colony”.

- citizen science survey
- data of two years and more than 2.000 responses
- open source and fully reproducible code as goal



Survey • 2018/19 • 2019/20 Beekeeper (n) • 1 • 10 • 14 • 29

Figure (1): The approximate location of the main winter apiary showed a nationwide coverage all over Austria from the 2019/20 survey. Shapefiles, “Creative Commons”: <https://www.data.gv.at/>

Preemptive Conclusion

With our first data exploration we can already see different expenses for different operation size groups. Our estimates, which were calculated beforehand, are in range with the survey expenses. It seems the question in the survey was not clear, as many participants did answer complete expenses and not per colony. Further data cleanup and also comparison of treatment combinations needs to be done.

- estimates are in line with survey
- significant lower expenses per colony for bigger beekeeping operations
- further analysis in progress

References

1. Dahle, B. The Role of *Varroa Destructor* for Honey Bee Colony Losses in Norway. *Apicultural Research* **49** (2010).
2. Rosenkranz, P. et al. Biology and Control of *Varroa Destructor*. *Invertebrate Pathology* **103** (2010).
3. Brodschneider, R. et al. Fünf Jahre Untersuchung des Bienensterbens in Österreich. *Entomologica Austriaca* (2013).
4. Van der Zee, R. et al. Standard Survey Methods for Estimating Colony Losses and Explanatory Risk Factors in *Apis Mellifera*. *Apicultural Research* **52** (2013).
5. Moosbeckhofer, R. et al. *Varroa-Bekämpfung Einfach-Sicher-Erfolgreich. 2 Völlig Neu Bearbeitete Auflage*. 2015.
6. Ramsey, S. D. et al. *Varroa Destructor* Feeds Primarily on Honey Bee Fat Body Tissue and Not Hemolymph. *National Academy o. S.* **116** (2019).
7. Noël, A. et al. *Varroa Destructor. E.T. in Life Sciences 4* (eds Scott-Brown, A. et al.) (2020).
8. Oberreiter, H. et al. Austrian COLOSS Survey of Honey Bee Colony Winter Losses 2018/19 and Analysis of Hive Management Practices. *Diversity* **12** (2020).

(Info Box) Varroa Mite

- most important bee pest worldwide, in Austria since the 1980s
- mainly in the brood and there preferable in the drone brood [2]
- feeds primarily on the fat body of larvae and adult bees, which are used as phoretic transport medium [6]
- great influence on the overwintering success of bee colonies [1]
- vector for other pathogens, such as viruses [2, 7]
- in Austria most beekeepers use a combination of organic acids to treat their colonies against the Varroa mite [5, 8]

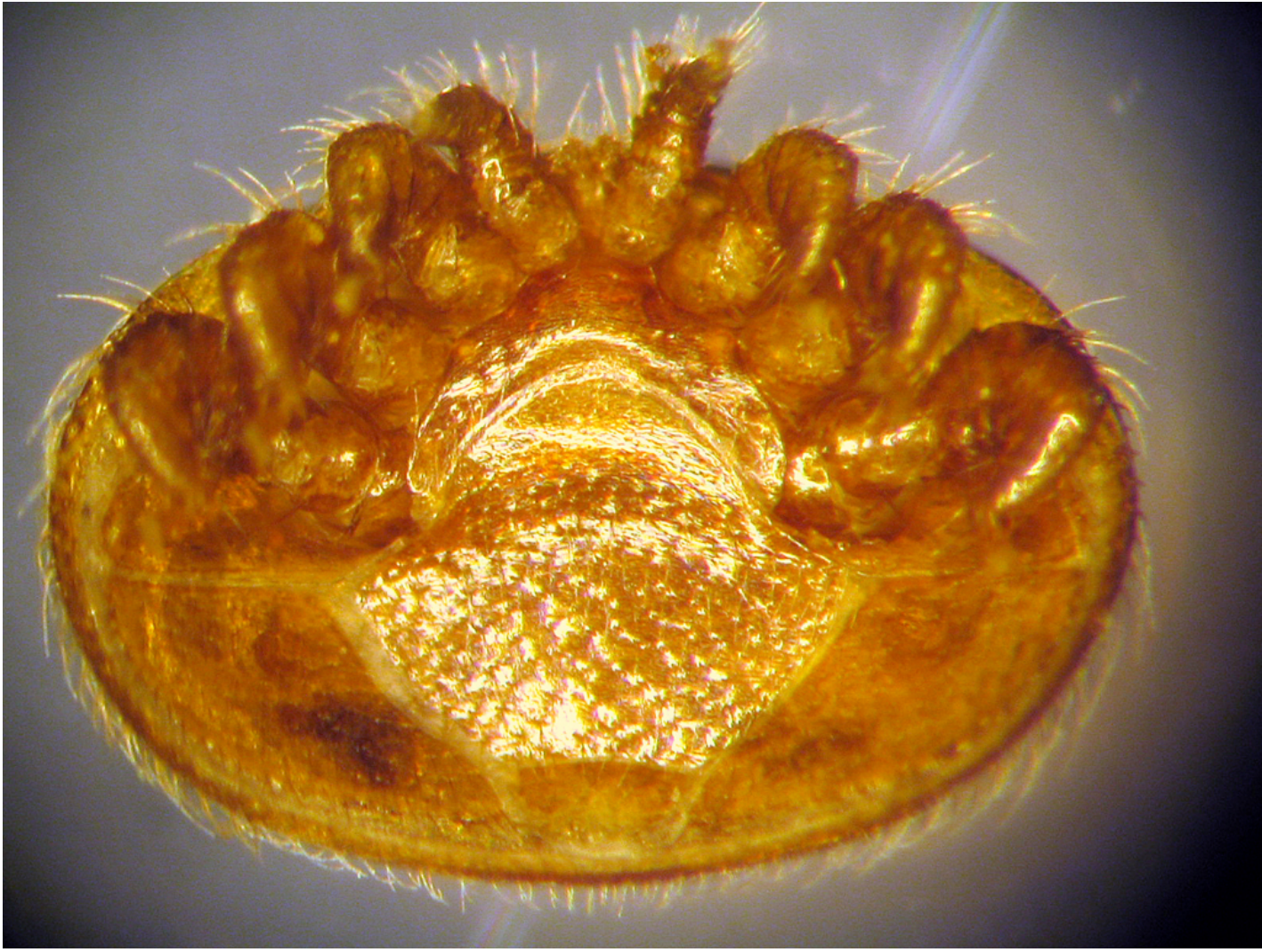


Figure (2): Varroa mites are mainly found in the brood and there preferable in the drone brood [2]. Photo © Hannes Oberreiter (left), dava123 from iNaturalist.org (right)

Preemptive Results

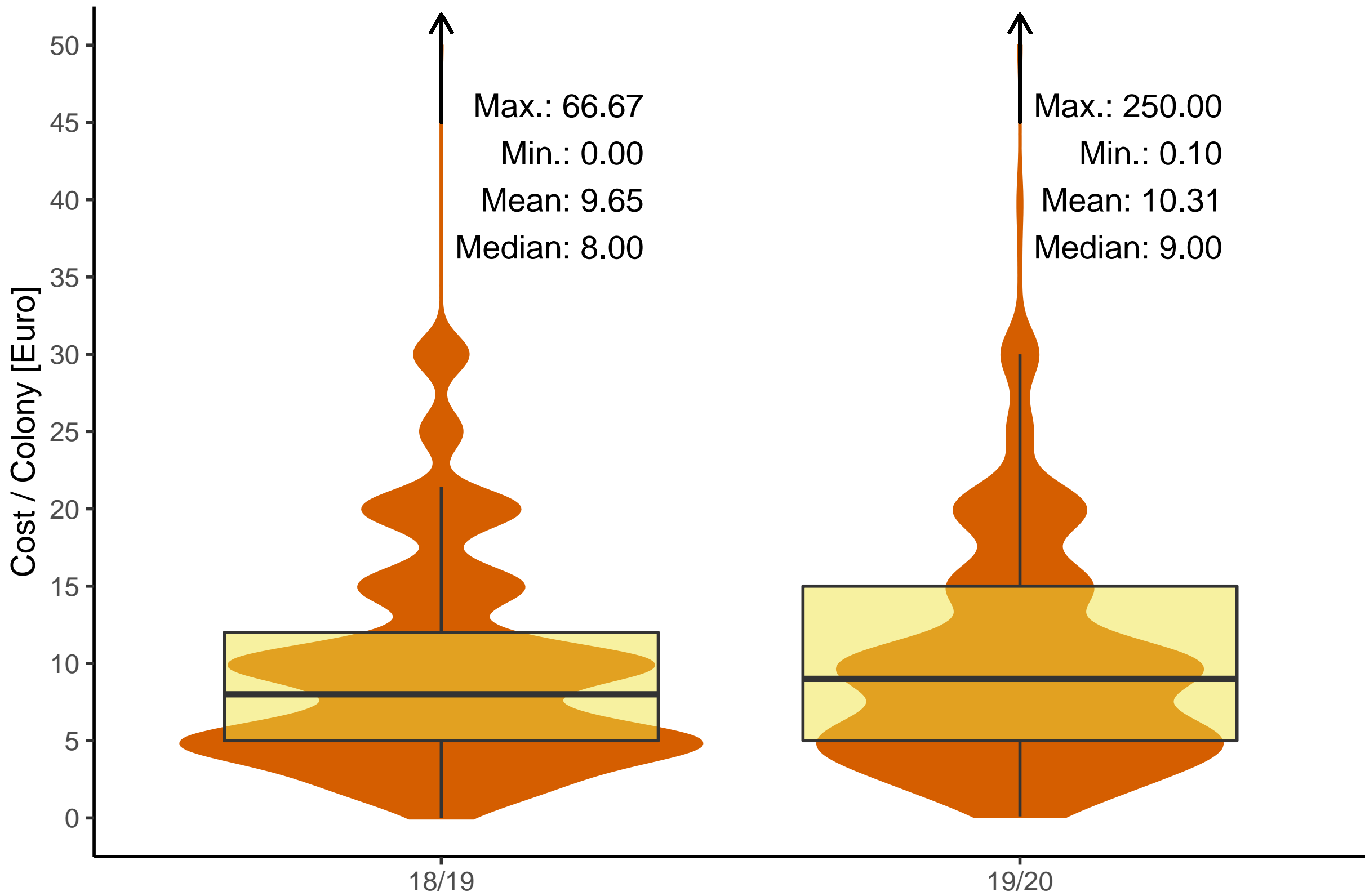


Figure (3): Distribution of expenses as violin plot in combination with a boxplot. Maximum values are cutoff.

Table (1): Descriptive statistics of expenses per colony in comparison to our own estimation of expenses, in Euro. Both survey years together.

Type	Minimum	1. Quantile	Median	Mean	3. Quantile	Maximum
Survey	0.00	5.00	8.33	9.98	12.50	250.00
Estimated	0.00	8.05	10.65	12.18	14.02	167.32

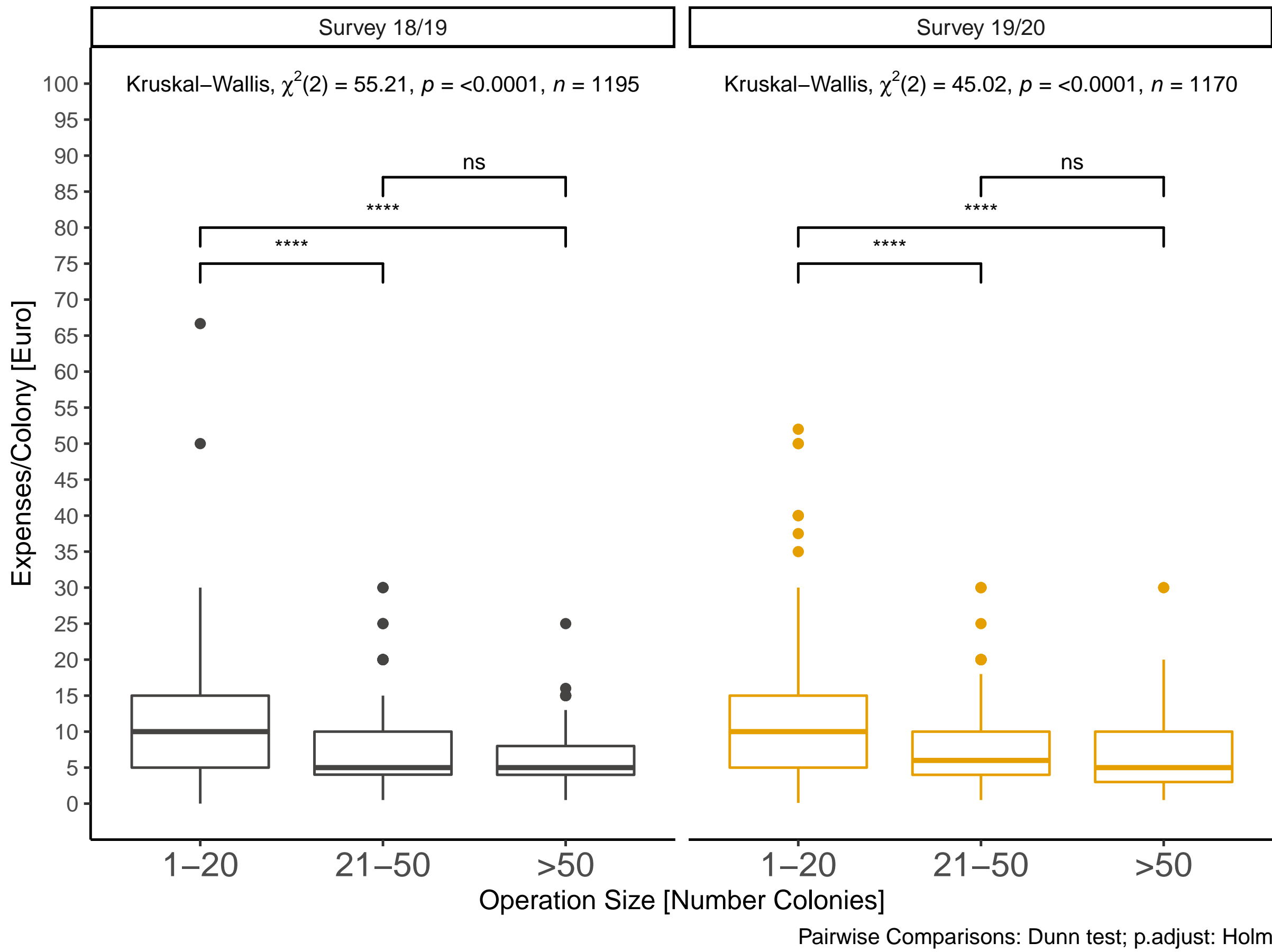


Figure (4): To compare different operation size groups, we used the number of hives wintered from the survey to group the beekeepers in their respective operation size groups. Stars (*) above groups indicate statistically significant different groups.