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Citizen Science and Pollination Research: Lessons Learned from a Research Collaboration in Community Gardens in Berlin and Munich

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Urban community gardeners create important habitats for pollinators in cities through their gardening practices. In a collaborative research project in 33 community gardens in Berlin and Munich, we examined the link between pollination and garden features under real-life conditions. We aimed to collaboratively develop insect conservation interventions to enhance pollinator diversity and harvest success simultaneously. Most citizen science participants consistently conducted fruit production measurements of their study plants. Nevertheless, the data showed a trade-off between a protocol designed to interfere as least as possible with the gardener's routine and the data's fit for purpose regarding the research question. Our main lessons learned were (1) to invest in establishing and maintaining a good relationship with participants and (2) to develop hypotheses and methods in close collaboration with participants. We believe it is crucial to foster the integration of different perspectives and knowledge in order to realize the potential of citizen science in pollinator research.

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1. Introduction

Urban community gardens serve as important habitats for wild bees and other insects in the city [1], while being actively managed by the community gardeners and their practices. As such, these gardens may reduce the overall negative effects of urban areas on the biomass of flying insects [2]. In the context of biodiversity loss, citizen science (CS) is also seen as a method to create awareness and conservation action [3]. Acknowledging this, we developed a research project with a CS component to further explore the link between garden management, pollinator diversity and pollination as a collaborative effort between urban community gardeners and scientists. As part of our CS research, we decided to study the link between fruit development and pollinator diversity, as we believed harvest success to be a motivation for the engagement of gardeners in urban pollinator conservation [4]. Here we reflect on our CS research approach to share lessons learned.

2. Methods

In 2020 and 2021, we worked together with overall 33 community gardens in Berlin and Munich, Germany. The gardeners observed their crops throughout the growing season by documenting the number of buds, flowers, fruits and harvested fruits every three to seven days. We wanted gardeners to have freedom in certain decisions, in order to increase their autonomy and motivation in the CS research. Thus, we designed a protocol in which gardeners could select different crops (i.e. tomato, pepper, strawberry, cucumber, pumpkin or zucchini) to be consistently monitored. They could also independently decide when to start their observations. At the same time, we visited the gardens several times per summer and collected data on pollinator and plant diversity, additional garden environmental features (e.g., temperature, canopy cover, flower abundance) and urban landscape context.

3. Results

In total, 74 citizen scientists from 23 of the 33 community gardens in Berlin and Munich examined 154 plants. Most gardeners decided to study tomato plants (n=52). Overall, at least ten datasets were created for each crop from the selection and in addition one physalis plant was examined. The average investigation period was 72 days. Of these study plants, 64 did not produce any harvestable yield during the observation period and 17 of them did not produce any fruit at all. We first performed a preliminary screening of the data, which led to the exclusion of 64 datasets due to the following reasons: (a) errors & missing data, e.g. the measurement started with plants already bearing fruits, no flowers were documented, missing or wrong data points etc. (n=34); (b) less than three replicates (i.e. individual study plants) per garden (n=24); (c) observation period under three measurements (n=4) or (d) wrong or unknown crop (n=2).

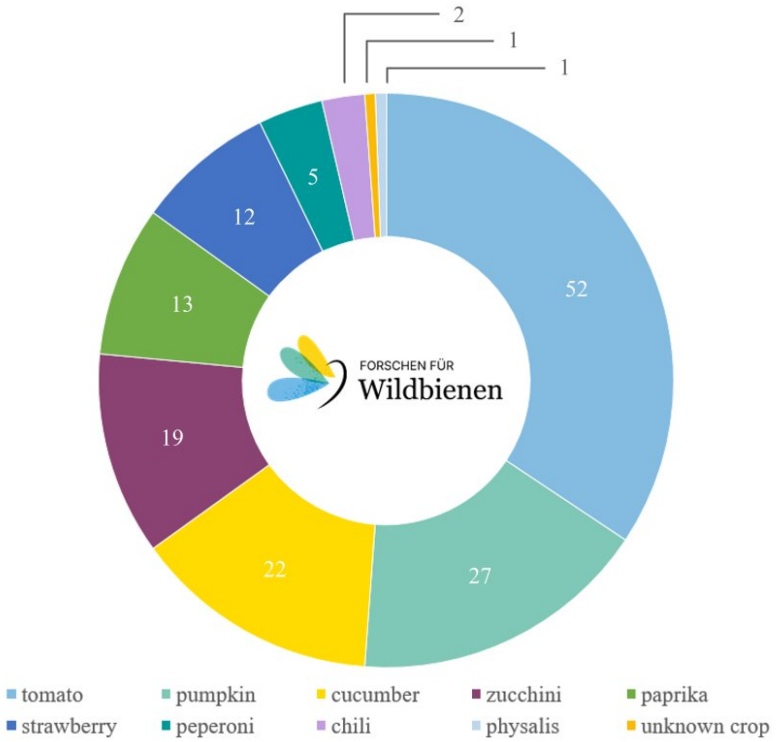

Figure 1: Number of examined plants by crop type (total=154).

4. Lessons learned

4.1 CS under real-life conditions requires long-term engagement

The first lesson that we have learned from our CS work is that long-term engagement particularly through good relationships with gardeners is key for CS research success. For example, our preliminary results show a high rate of study plants with pest infestation or diseases, which possibly harmed the plants growth or its fruit development. This makes it necessary to collect long-term data, as one year can be particularly bad for certain crops. In other large-scale CS pollination research, participants cultivated plants from provided seeds and under standardized conditions in order to prevent biases such as a high plant mortality [5]. Authors recommended controlling this even more by using standardized pre-grown plants. In our research, we refrained from using pre-grown seedlings in order to obtain real-life conditions. We found interest in pollinators, interest in the overall project and contribution to something meaningful as nature conservation the most frequent self-reported motivation for participation [6]. Therefore, an essential part of CS under real-life conditions is frequent communication about project progress and research results, especially transparency about how scientific results are produced and timelines to publication.

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4.2 Understanding participants interest in pollinators is crucial

Our study has shown a challenging trade-off between motivating participation, retaining engagement and the data quality in regard to our research [7]. While participants conducted consistent measurements, in some cases protocol specifications such as plant selection (e.g. dataset on a physalis plant) were not followed or measurements were started in a late stage of the study plant's development. In addition, some gardeners continued to nurture and examine sick and even dead study plants throughout the growing season. We believe both to be connected to the gardeners' high level of commitment to CS research and the accessibility of the project due to adapting the protocol to gardeners' practice. Moreover, addressing gardeners' interest in pollinators, pollinator research and conservation in our engagement strategy generated effective triggers and motivated people to participate [6]. Overall, we critically reflect on our original assumption that possible benefits of pollinator conservation for harvest success could further incentivize pollinator-friendly gardening measures in urban community gardens. Additional comments from participants on their data indicated that in urban community gardens harvest is often taken by visitors. Thus, we realized even though harvest success might still be important, personal nature experience and enhancing nature connectedness in a space like community gardens [8] might be incentive enough to engage in pollinator conservation. In the future, we will develop and reflect on research questions more in collaboration with gardeners using workshops and structured discussions from the beginning of the project.

5. Conclusion

Working together with gardeners provided an opportunity to reflect on scientific methods and assumptions. We therefore argue that research questions and methods need to adapt more to CS instead of using CS to repeat traditional experimental designs. Citizen scientists should not only be trained to execute better scientific work, but we should much more recognize its potential to reflect on how to better connect the different bodies of knowledge - the participants' expertise and our scientific knowledge and practices. We therefore see the next step of our project in the discussion of the research results towards the collaborative development and implementation of evidence-based and practice-oriented insect conservation interventions.

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