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### **STANDARDIZING BEE SAMPLING: A SYSTEMATIC REVIEW OF PAN TRAPPING AND ASSOCIATED FLORAL SURVEYS**

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#### **ABSTRACT**

A number of methodological studies and conceptual frameworks offer guidance on bee sampling with pan traps (aka bee bowls, Moericke traps). Nevertheless, a large methodological variety persists in bee studies using pan traps. This lack of standardization complicates the comparison of sampling results among studies, and so it remains in question how floral abundance around pan traps affects the number of bees sampled.

We systematically reviewed all peer-reviewed studies, which used pan traps for bee collection, were published in English until spring 2022 and were listed in the Web of Science core collection. We extracted details of pan-trap characteristics and the methodology used to sample flower abundance and diversity around pan traps. We also obtained information on correlations between floral and bee abundance/diversity found in these studies.

Our systematic search yielded 369 references in total, yielding relevant 290 studies. Some methodological aspects such as trap color were often similar in the majority of studies; other aspects such as sampling duration, filling level or trap solution composition varied considerably. Few studies used floral abundance and/or diversity as an explanatory variable in their analyses. In comparison to botanical surveys, these studies often simplified floral sampling methods, probably due to time constraints and the need for synchronization with bee sampling. Correlations between floral abundance/diversity and bee abundance/diversity did not indicate an unambiguous relationship between pan trap results and surrounding floral context. The small pool of studies using floral context in their bee analyses indicates a great need for more research on this topic in the future, which should incorporate standardized methods.