



Trap nests for Hymenoptera: past, present, and future of a standardized sampling method in (tropical) ecology

1. Background & Aim

Trap nests are an elegant way to attract and collect cavity-nesting bees and wasps, including their natural enemies. Dating back to Jean-Henri Fabre [1], the method has been popular among biologists. Originally mostly applied to unravel natural history [2], a large body of literature has accumulated, and trap nests have helped to discover new species [3] and to investigate habitat change [4,5]. We synthesize this literature with a focus on tropical localities. We also identify promising future directions and advise on common problems encountered with trap nests in the tropics.

3. Future perspectives

Trap nests have huge potential for use in tropical ecology. There are vast areas with little or no trap nest research. Due to the easy use and manageable but representative species diversity, this sampling method is particularly suitable under field conditions for engaging local assistants. As a permanent sampling method that also allows assessing resource use and trophic interactions, trap nests are promising but underutilized tools for habitat evaluation [4,5] and long term monitoring of changing environments – pressing issues in ecology, both, in the tropics and elsewhere.

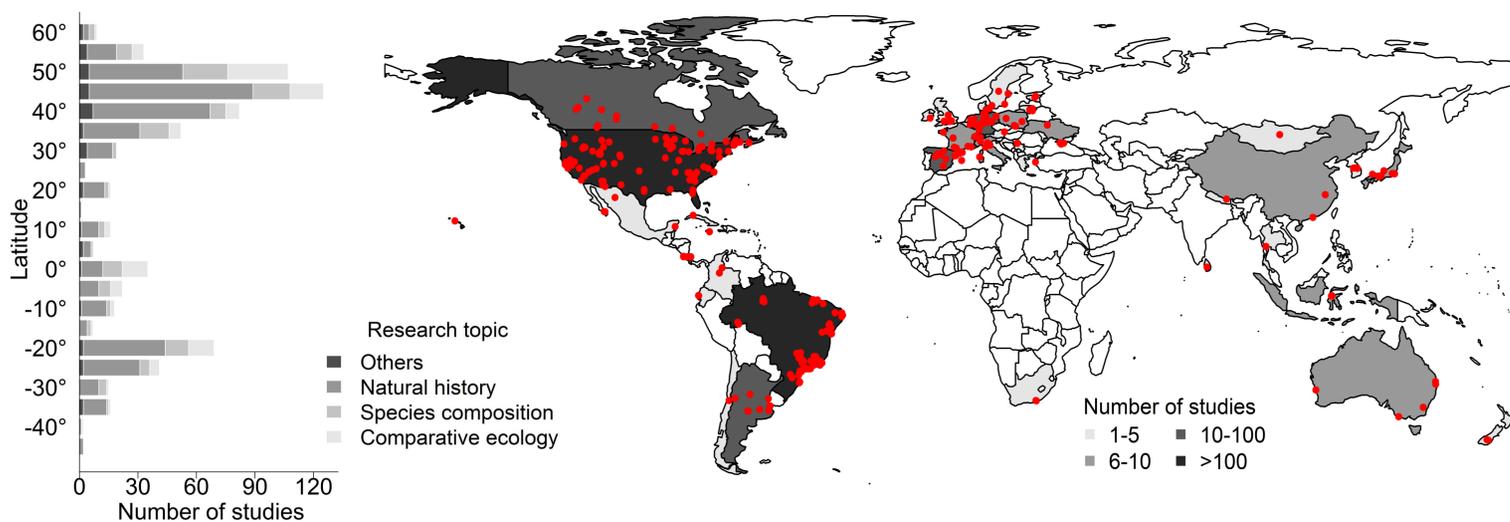


Fig. 1: Geographic spread and research topics of all trap nest studies found in the literature. Over 25% of studies were each conducted in the US and Brazil. There is a strong bias towards temperate regions. Studies from the tropics are rare, particularly in Africa and Asia. Most research focused on natural history (e.g. food objects, nesting biology). The relative contribution of individual research topics was independent from latitude.

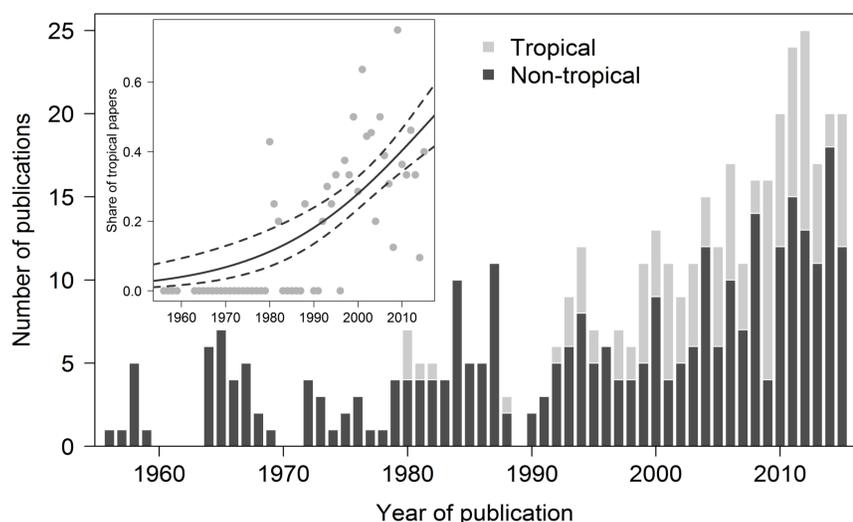


Fig. 2: Absolute numbers of trap nest papers from tropical and non-tropical regions increased over time as did the relative share of tropical papers (inset).

2. Literature review

- ISI Web of Science™, full 'all databases' in January 2017
- Keywords: trap nest*/nesting shelter* AND insect*/ wasp*/ bee*/Hymenoptera*/parasitoid*/trophic interaction*
- 472 papers (1956-2015): 126 tropical (23.5° N – 23.5° S)
- Extraction of spatial information and research topic

4. Successful use in the tropics

Problem	Solution
• Ant infestation	Sticky resin (e.g. tanglefoot)
• Molding	Fungicide (e.g. tebuconazol)
• Bird predation	Wire mesh
• Water accumulation	Drain slots

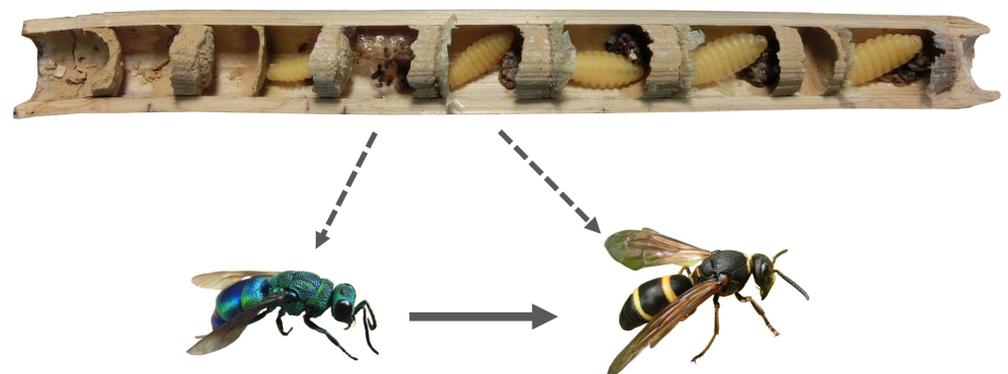


Fig. 3: Trap nests collect representative subsets [6] of the total Hymenoptera community by mimicking natural nesting opportunities. They allow detailed study of natural history and quantification of trophic interactions. The example shows (top) an opened reed internode containing a nest of the (right) caterpillar-hunting wasp *Anterhynchium flavomarginatum*, which was parasitized by the (left) cuckoo wasp *Chrysis principalis* (note the different larvae).

Acknowledgements & References

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[1] Fabre (1914) Dodd, Mead and Company. New York.

[2] Krombein (1967) Smithsonian Press. Washington DC.

[3] Staab et al. (2014) *PLOS ONE* 9:e101592.

[4] Tylianakis et al. (2007) *Nature* 445:202-205.

[5] Staab et al. (2016) *Proc R Soc B* 283:20160275.

[6] Tscharrntke et al. (1998) *J Appl Ecol* 35:708-719.

