

Contributions of Malaise traps to the EU Pollinator Monitoring Scheme (EUPoMS)

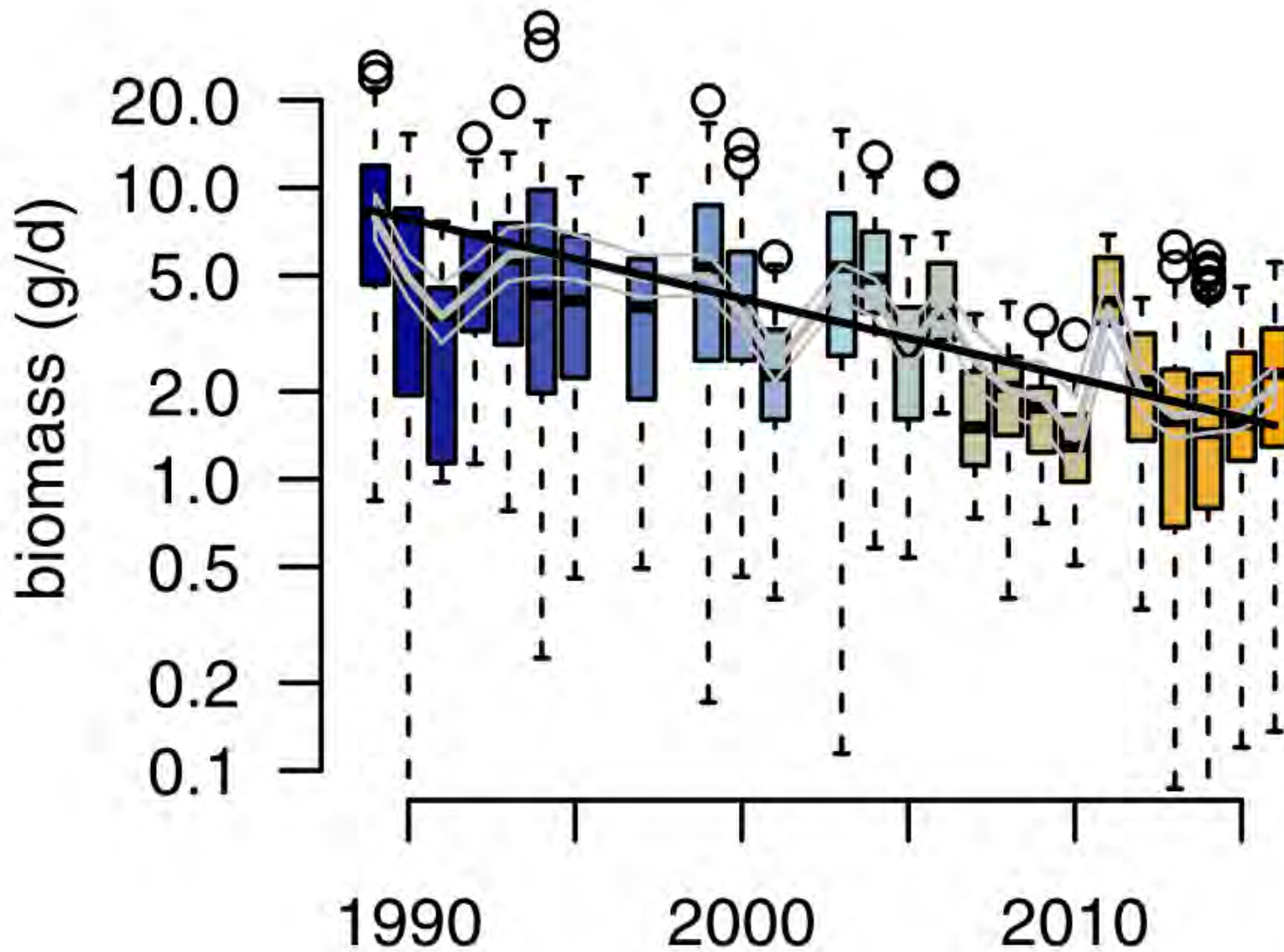
James Sinclair, Mark Frenzel, and Peter Haase



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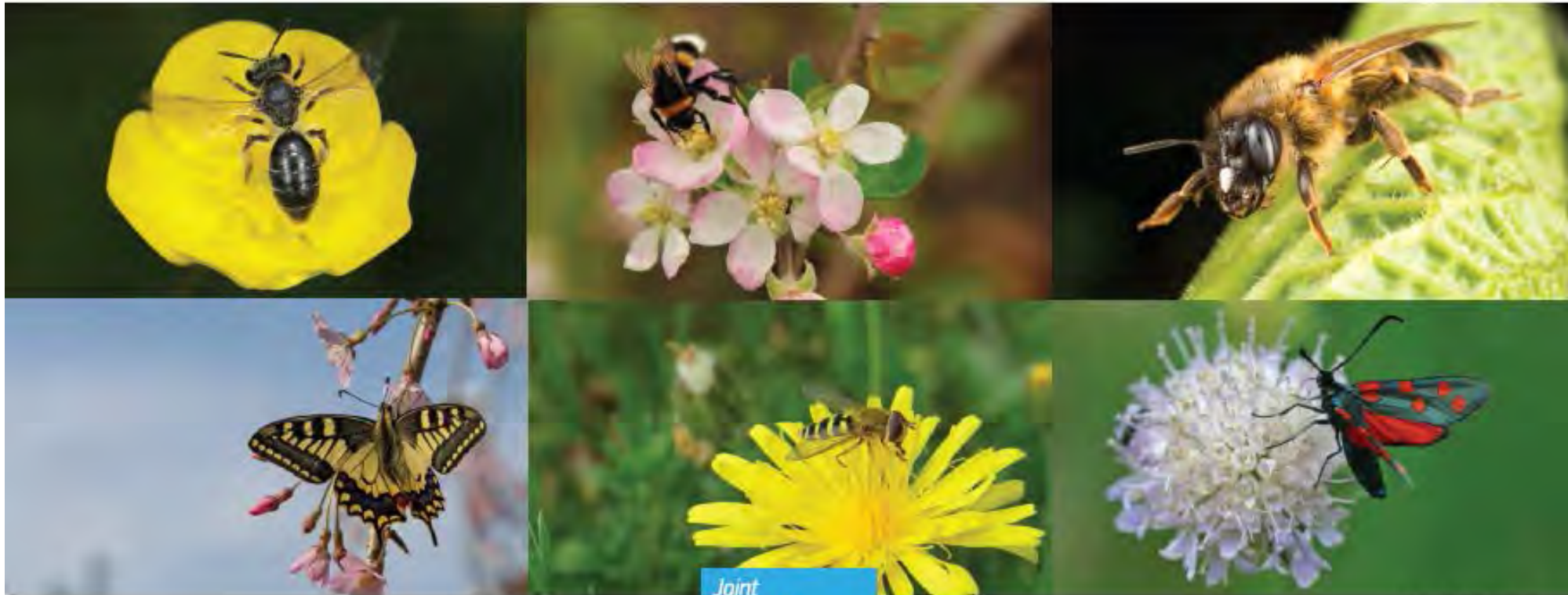
Reported declines in insects



Proposal for an EU Pollinator Monitoring Scheme

Simon G. Potts, Jens Dauber, Axel Hochkirch, Bas Oteman, David B. Roy, Karin Ahn , Koos Biesmeijer, Tom D. Breeze, Claire Carvell, Catarina Ferreira,  na FitzPatrick, Nick J.B. Isaac, Mikko Kuussaari, Toshko Ljubomirov, Joachim Maes, Hien Ngo, Adara Pardo, Chiara Polce, Marino Quaranta, Josef Settele, Martin Sorg, Constanti Stefanescu, Ante Vujic

2021





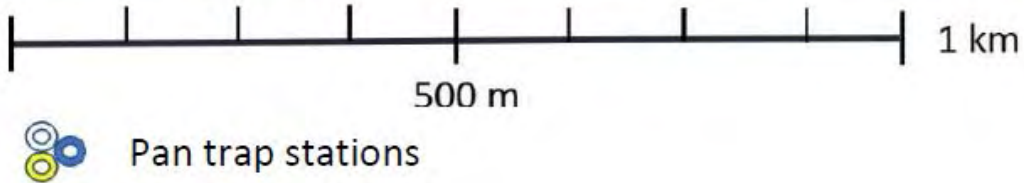
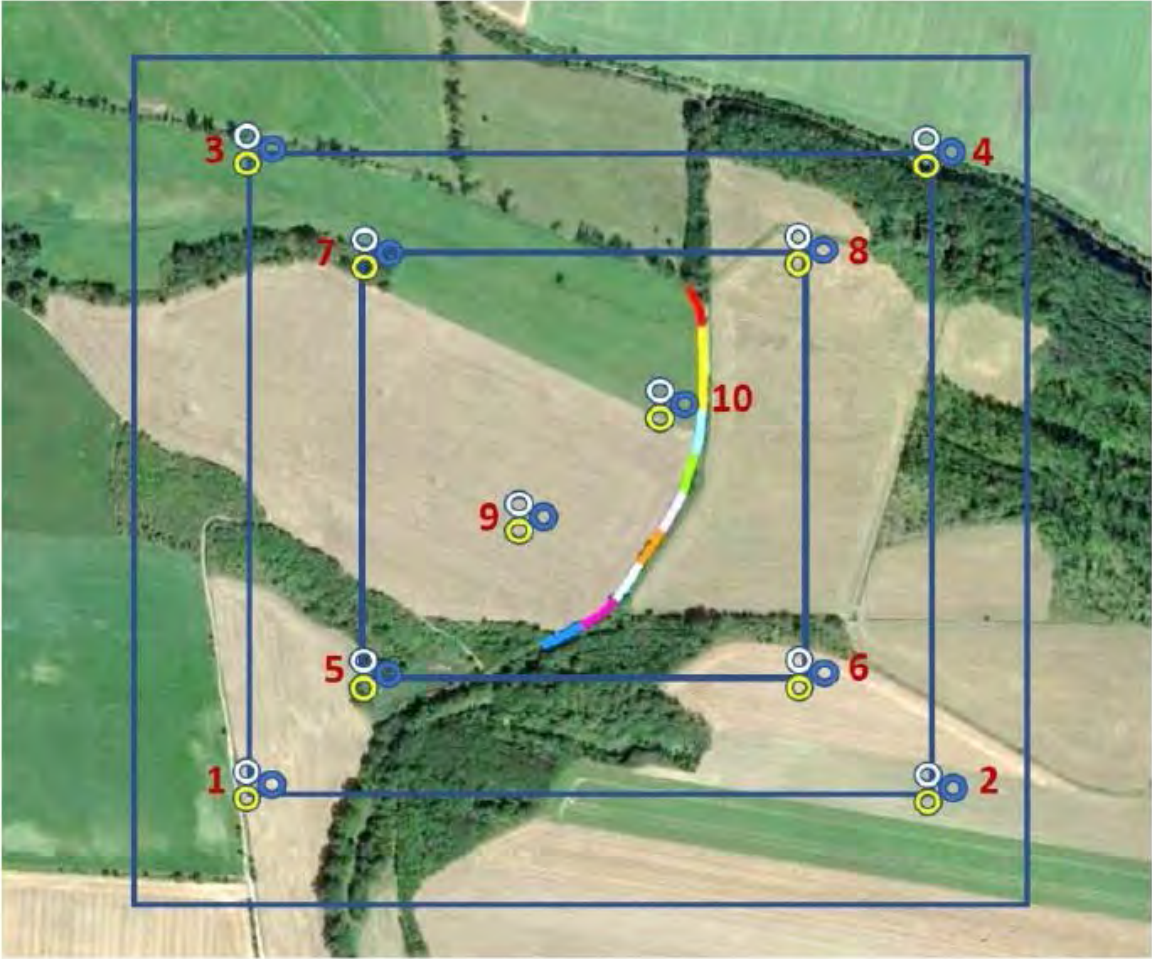
SPRING (Strengthening Pollinator Recovery through INdicators and monitorinG)

Objectives

- Expand the European Butterfly Monitoring Scheme (eBMS)
- Build up the capacity of citizen science networks on pollinators across Europe
- Organize advanced taxonomic training
- Monitor rare and threatened species
- Monitor moths
- **Pilot a Minimum Viable Scheme (MVS) for wild bees, butterflies and hoverflies**

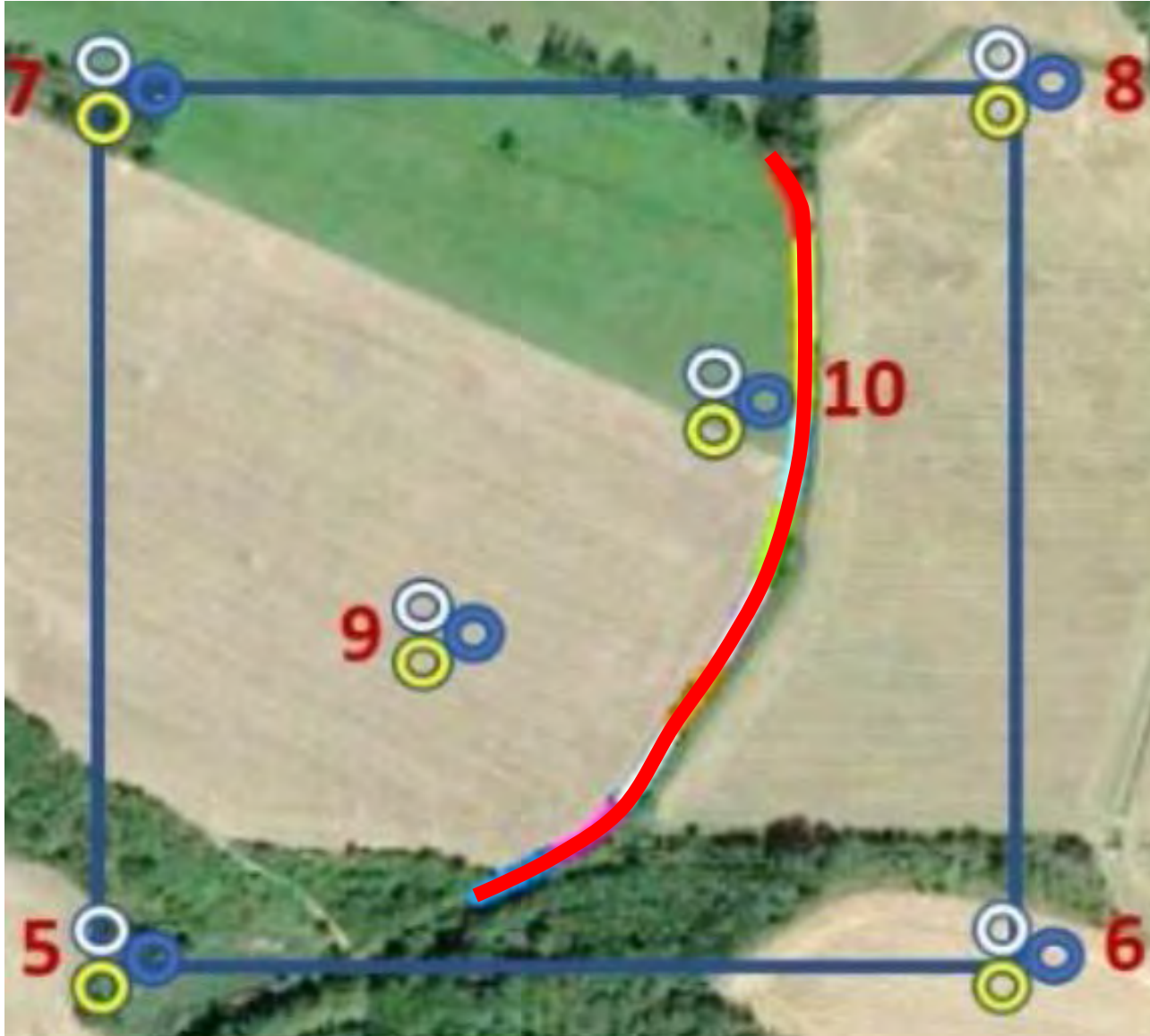
Task 3: Minimum Viable Scheme (MVS)

Pan traps



Task 3: Minimum Viable Scheme (MVS)

Transect walks



BEES
Honeybees
Bumblebees
Group A: Ginger
Group B: Black-red
Group C: all-dark
Group D: yellow-black-white
Group E: yellow-black-red
Large bees (> 10mm)
Small bees (3-10mm)
Wasp or blood bees
HOVERFLIES
Group 1: large, robust hoverflies (Tribes: Eristalini & Volucellini)
Group 2: distinctly <i>bumblebee-like</i> hoverflies
Group 3: distinctly <i>wasp-like</i> hoverflies
Group 4: hoverflies with black-and-yellow stripes of spots (Core: subfamily Syrphinae)
Group 5: other hoverflies

Task 3: Minimum Viable Scheme (MVS)

Weaknesses

- Missing information on other pollinators (beetles, wasps, other flies, etc.)
- Missing information on non-pollinating insects
- Taxonomic information can be biased and coarse (e.g., morpho-groups)
- Short, weather-dependent sampling window
 - Pan traps: 6 months, sampling 1 day per month, traps out for 6h
 - Transects: 1x 30min walk for butterflies, 1x 30min walk for bees/hoverflies

Question

What other sampling methods can be feasibly combined with the MVS to capture a wider variety of insects?

- Needs to be suitable for non-experts
- Costs must be low
- Needs to provide a substantial addition to the MVS to warrant extra effort

Task 4: Testing complementary modules

Task 4.2: Malaise traps



Bulk sample processing via DNA metabarcoding

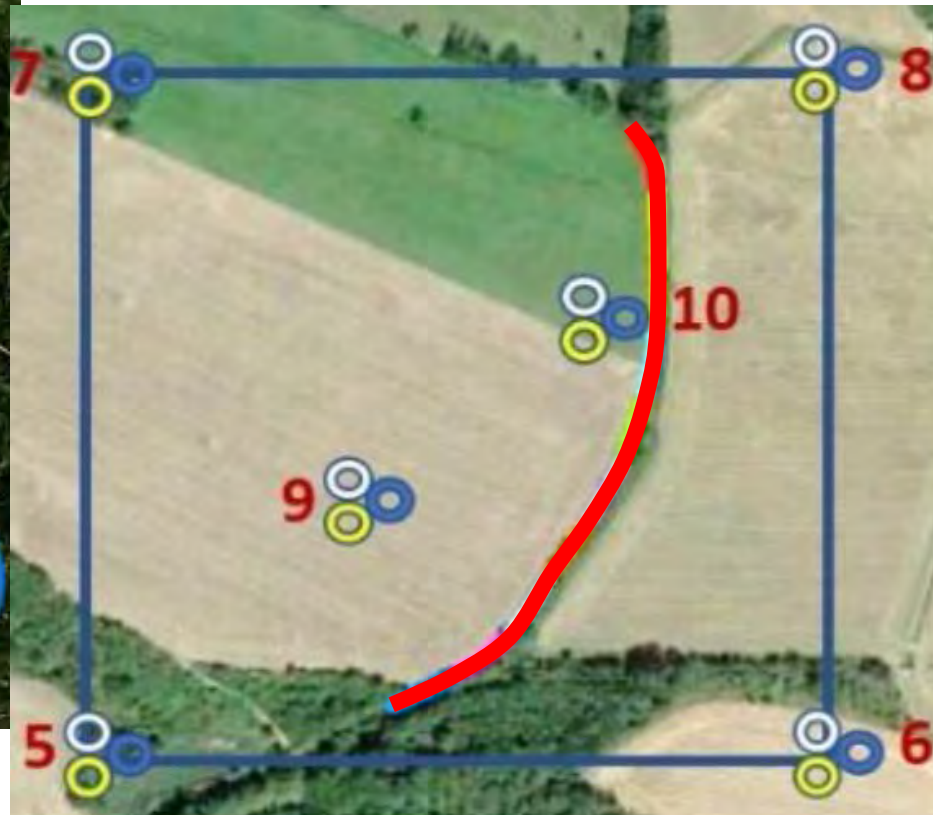


Malaise traps

- Missing information on other pollinators (beetles, wasps, other flies, etc.)
- Missing information on non-pollinating insects
 - Collect any passing flying insect
- Taxonomic information can be coarse (e.g., morpho-groups)
 - Molecular methods allow for lower-level IDs
- Short, weather-dependent sampling window
 - Constant sampling across 14-day intervals

Question

Can Malaise traps be feasibly combined with the MVS to capture a wider variety of insects?



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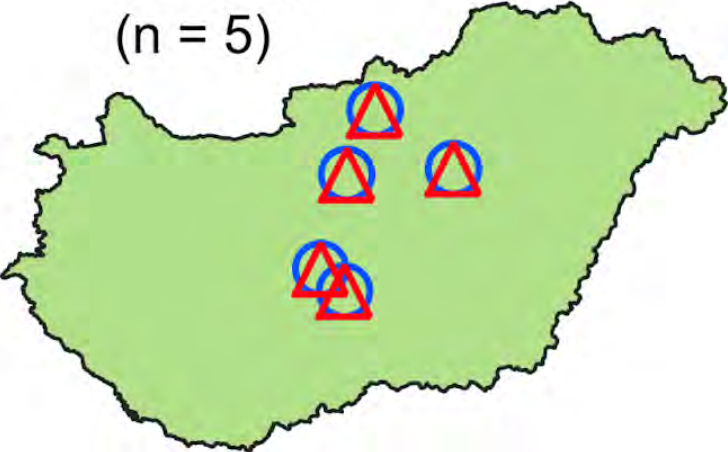
- Needs to be suitable for non-experts
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Methods

Germany
(n = 13)



Hungary
(n = 5)



Lesbos, Greece
(n = 2)



- - MVS site
- △ - Malaise trap site

Trap types in SPRING

Bug dorm

400€, 1.98m²



Entomol. Society Krefeld

400€, 1.89m²



LTER-D

100€, 1.16m²



Question

Can Malaise traps be feasibly combined with the MVS to capture a wider variety of insects?

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- Costs must be low ?
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Metabarcoding



Trapped



Preserved



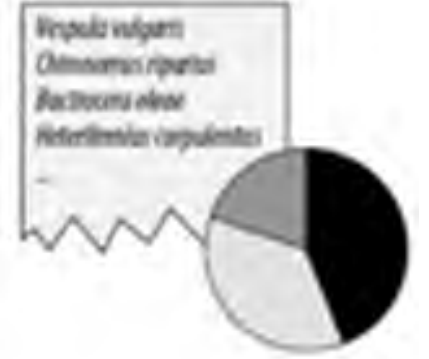
Homogenized



DNA extraction
& PCR



Sequencing



Matched

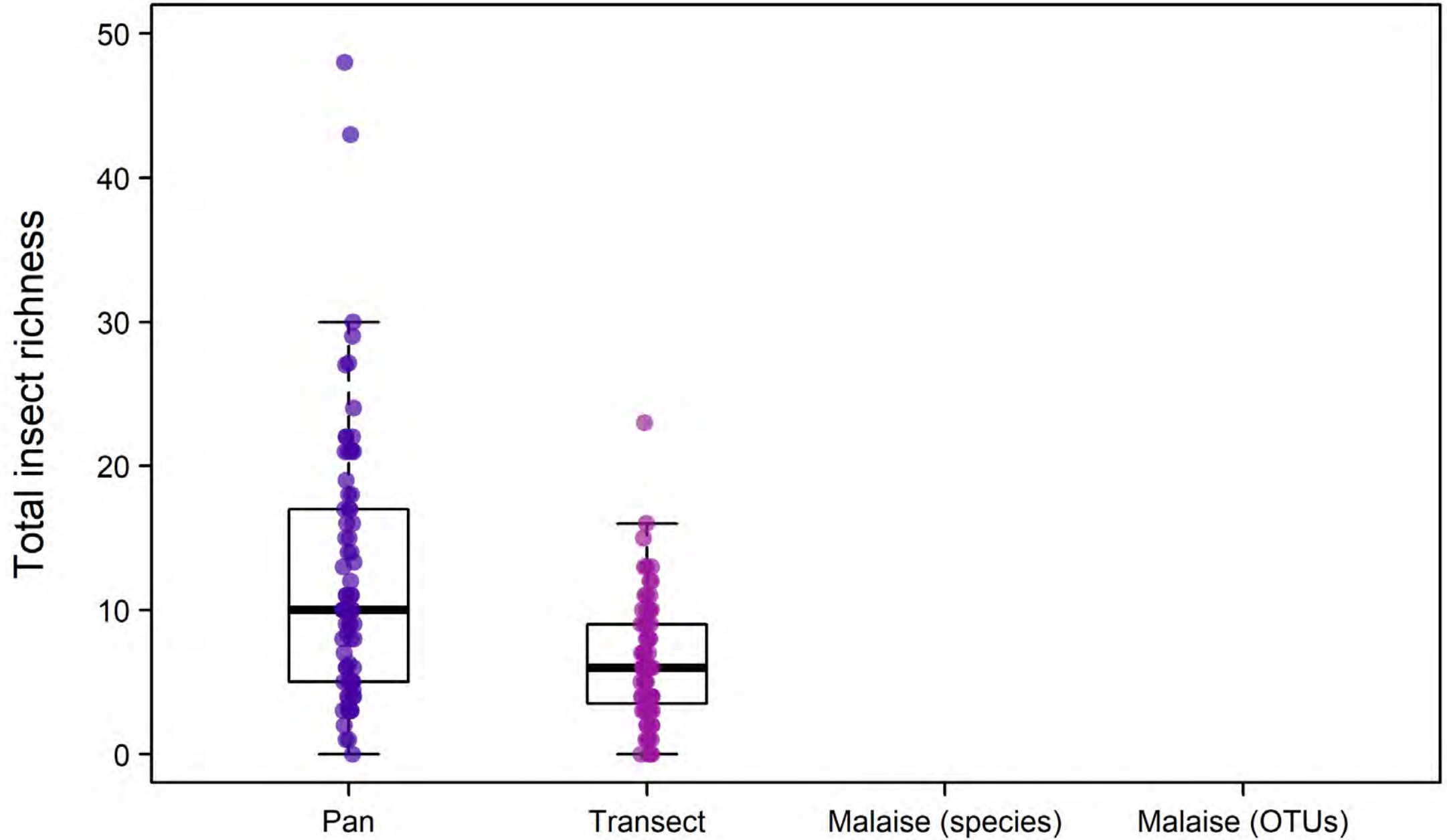
< 50€ per sample
about 3 weeks / 1000 samples

Question

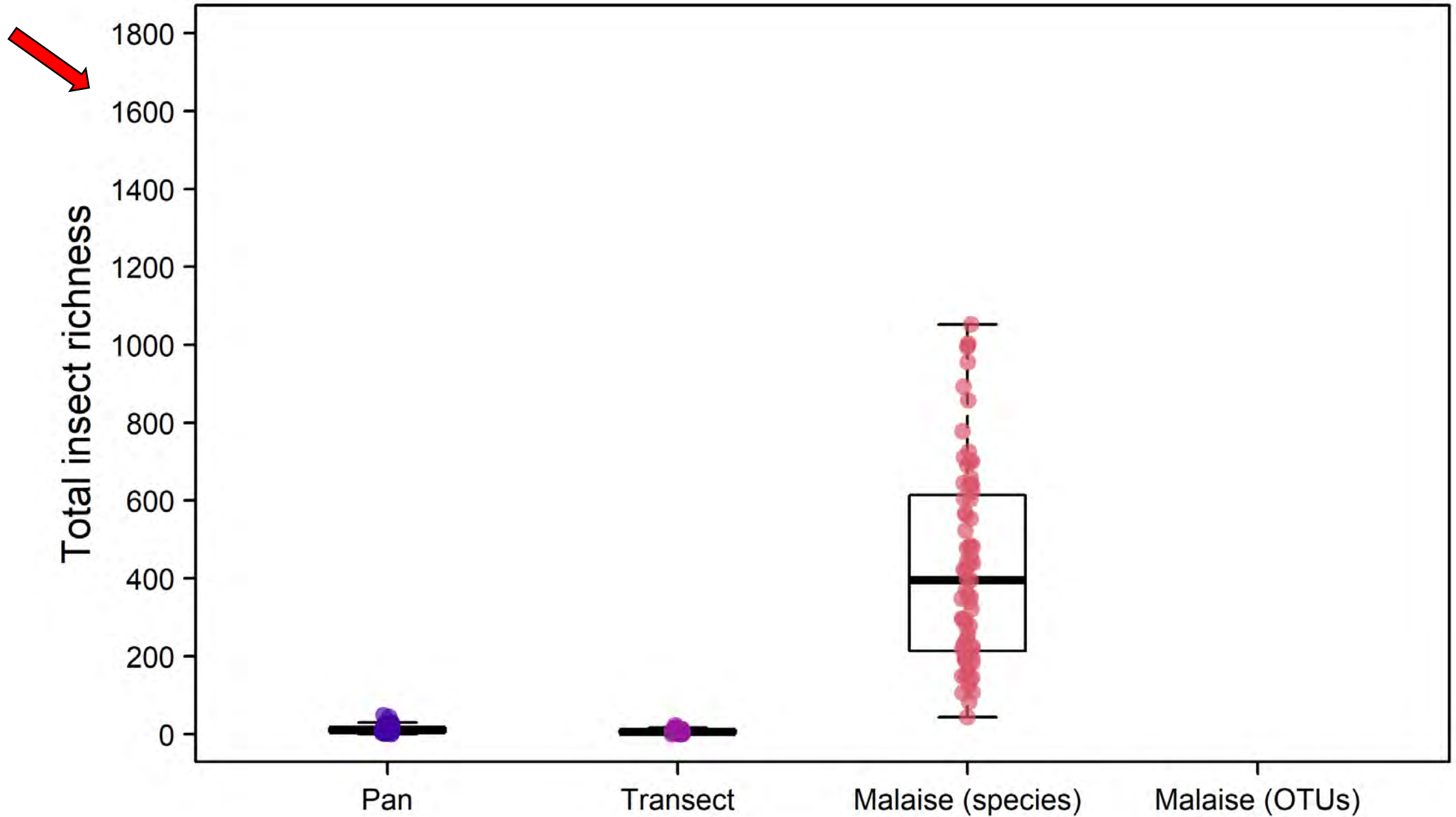
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Results – Total taxa



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Adelidae

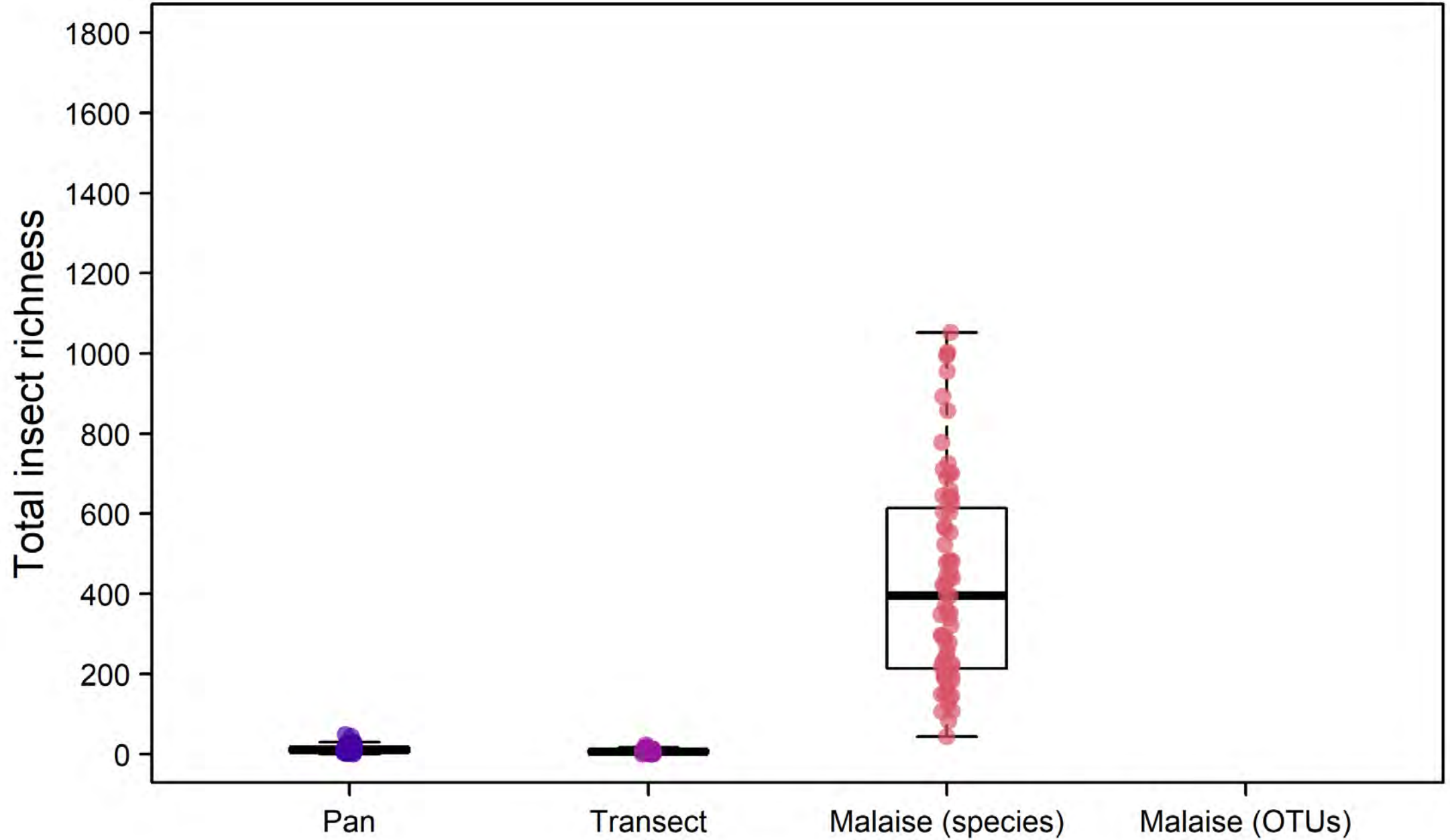
18 OTUs

15 species-level IDs

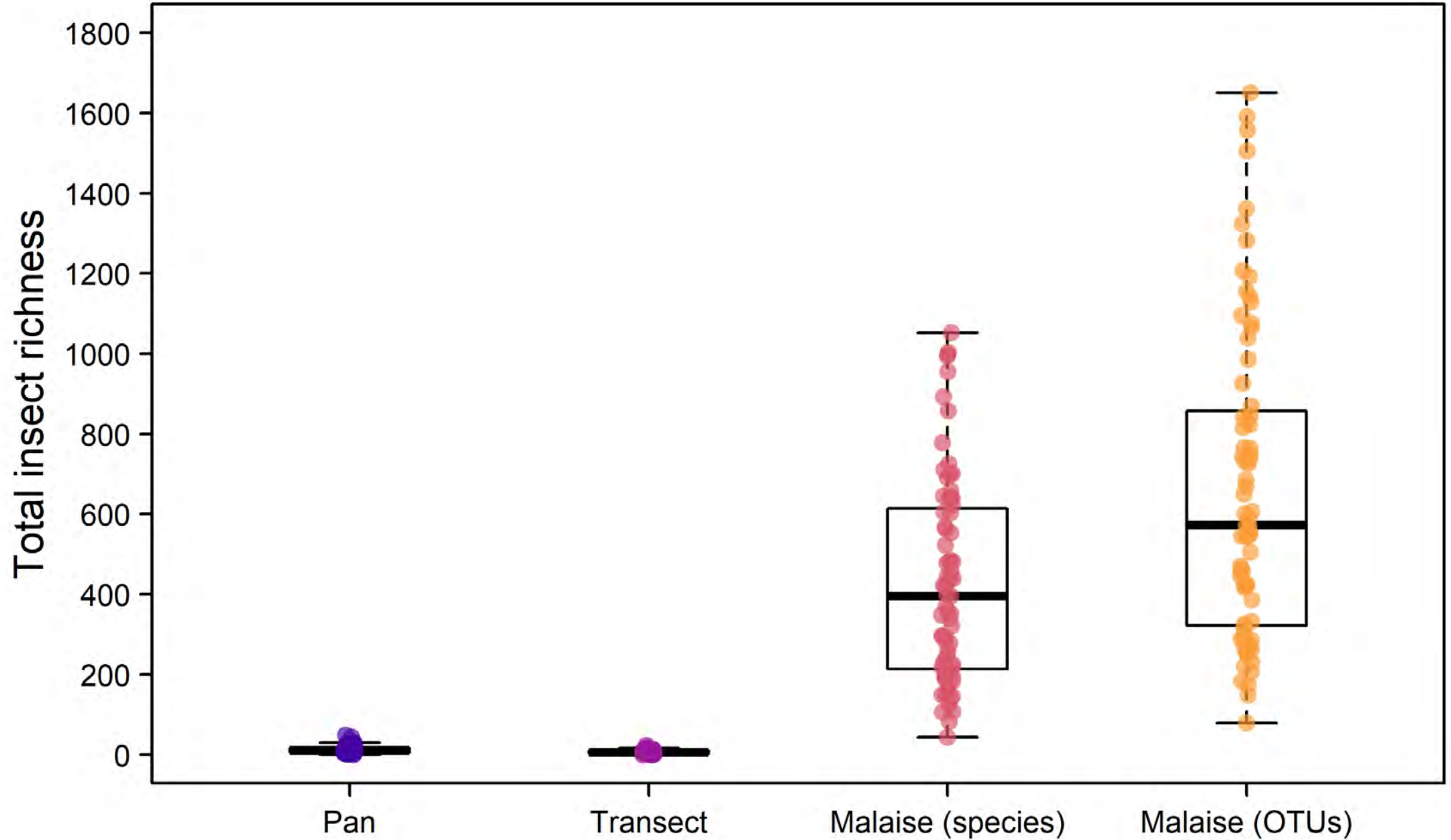
**$18 * 0.933 =$
16.8 species**

ID	Phylum	Class	Order	Family	Genus	Species
OTU_2996	Arthropoda	Insecta	Lepidoptera	Adelidae	Nematopogon	adansoniella
OTU_15251	Arthropoda	Insecta	Lepidoptera	Adelidae	Nemophora	associatella
OTU_65092	Arthropoda	Insecta	Lepidoptera	Adelidae	Adela	croesella
OTU_9145	Arthropoda	Insecta	Lepidoptera	Adelidae	Adela	croesella
OTU_19292	Arthropoda	Insecta	Lepidoptera	Adelidae	Adela	cuprella
OTU_75452	Arthropoda	Insecta	Lepidoptera	Adelidae	Nemophora	degeerella
OTU_2567	Arthropoda	Insecta	Lepidoptera	Adelidae	Cauchas	fibulella
OTU_5056	Arthropoda	Insecta	Lepidoptera	Adelidae	Nematopogon	metaxella
OTU_7414	Arthropoda	Insecta	Lepidoptera	Adelidae	Nematopogon	pilella
OTU_929	Arthropoda	Insecta	Lepidoptera	Adelidae	Adela	reaumurella
OTU_7068	Arthropoda	Insecta	Lepidoptera	Adelidae	Nematopogon	robertella
OTU_14099	Arthropoda	Insecta	Lepidoptera	Adelidae	Cauchas	rufifrontella
OTU_1994	Arthropoda	Insecta	Lepidoptera	Adelidae	Cauchas	rufimitrella
OTU_2917	Arthropoda	Insecta	Lepidoptera	Adelidae	Nematopogon	schwarziellus
OTU_361	Arthropoda	Insecta	Lepidoptera	Adelidae	Nematopogon	swammerdamella

Results – Total taxa

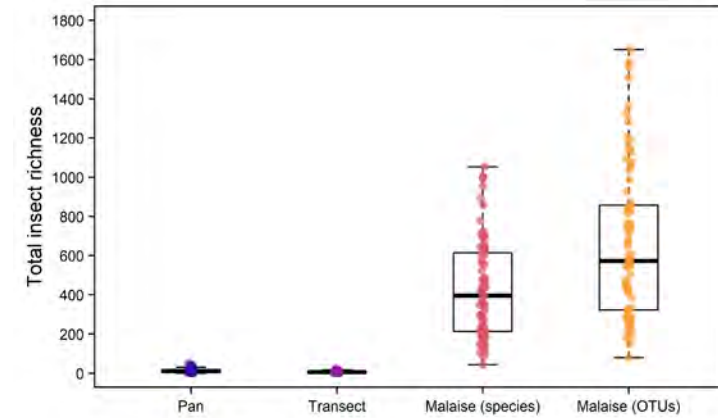


Results – Total taxa

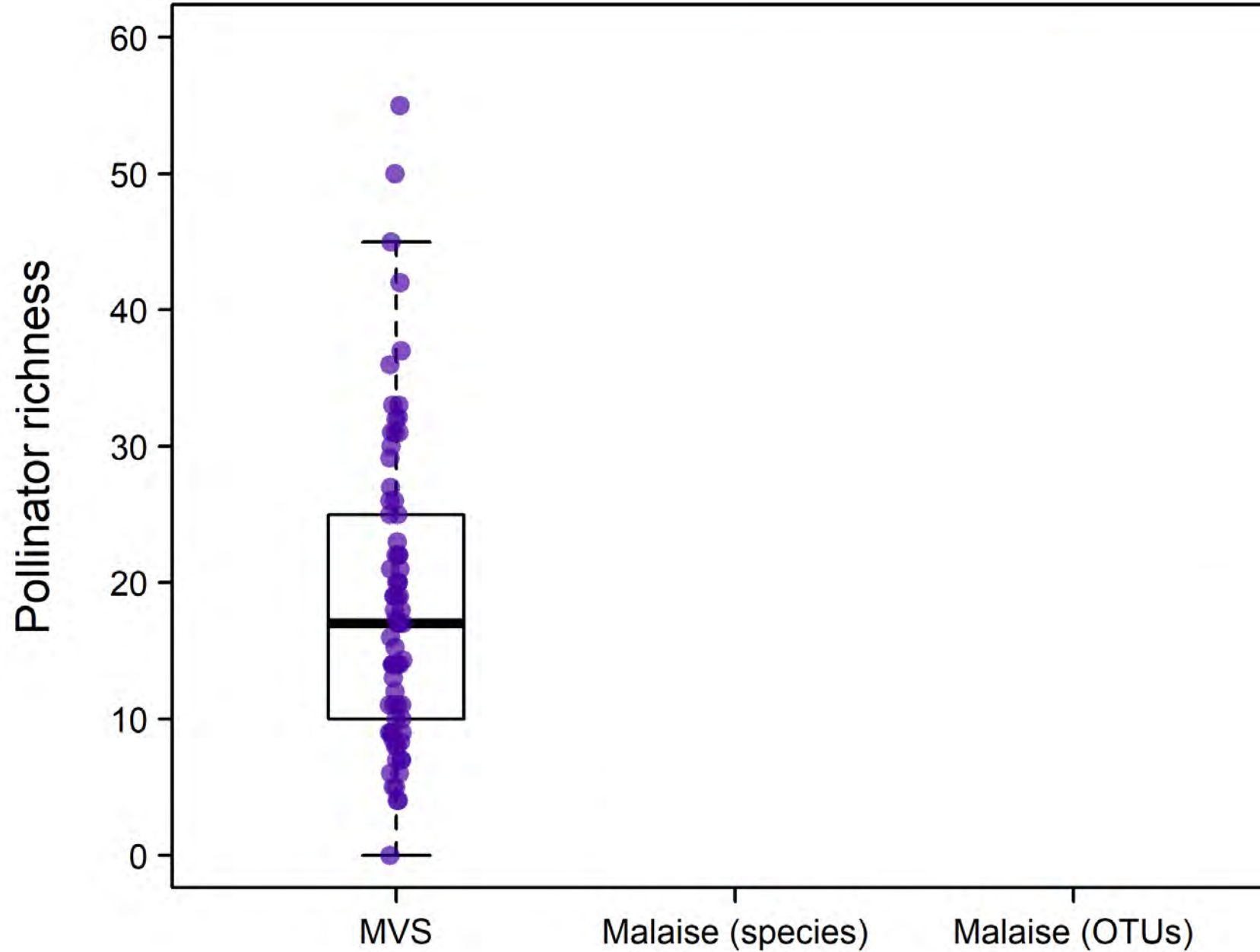


Summary

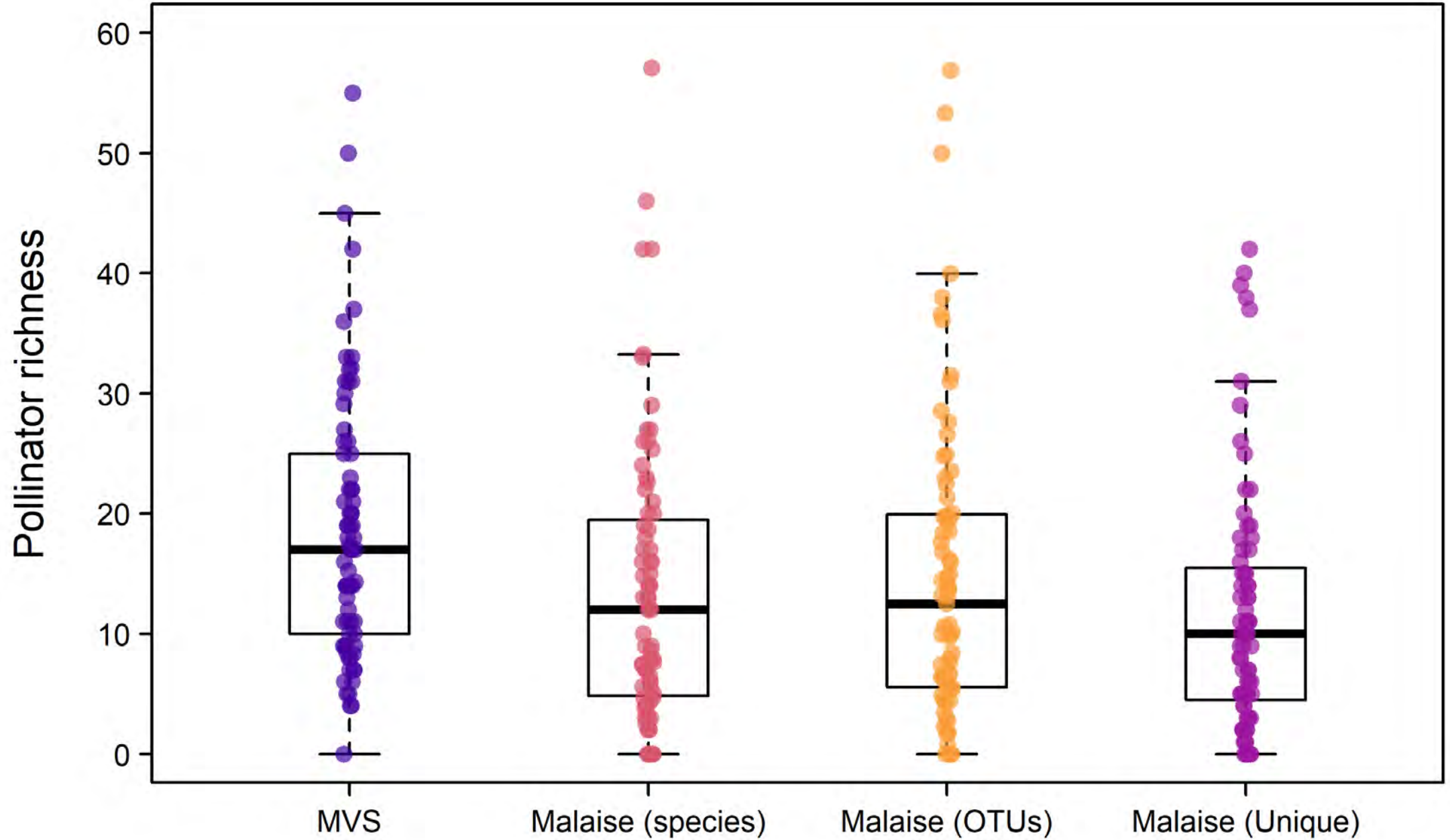
Malaise traps capture about 10x more insects, particularly when estimating species from OTUs



Results – Pollinators only



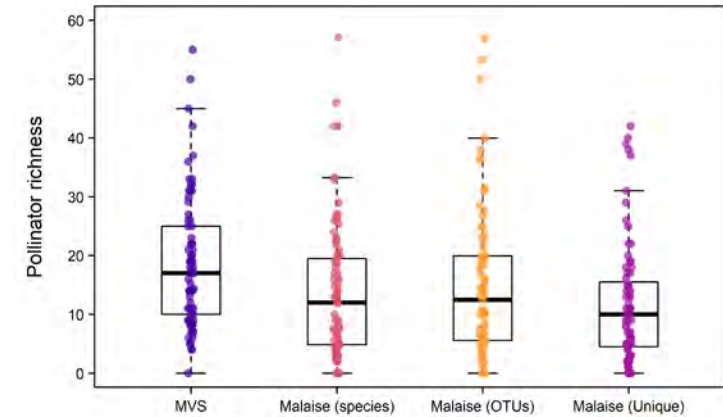
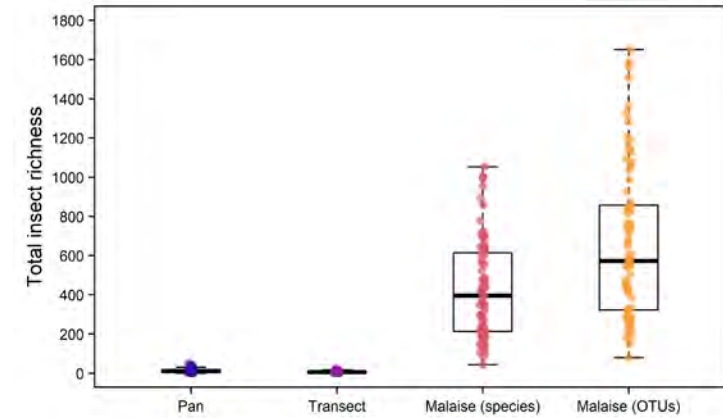
Results – Pollinators only



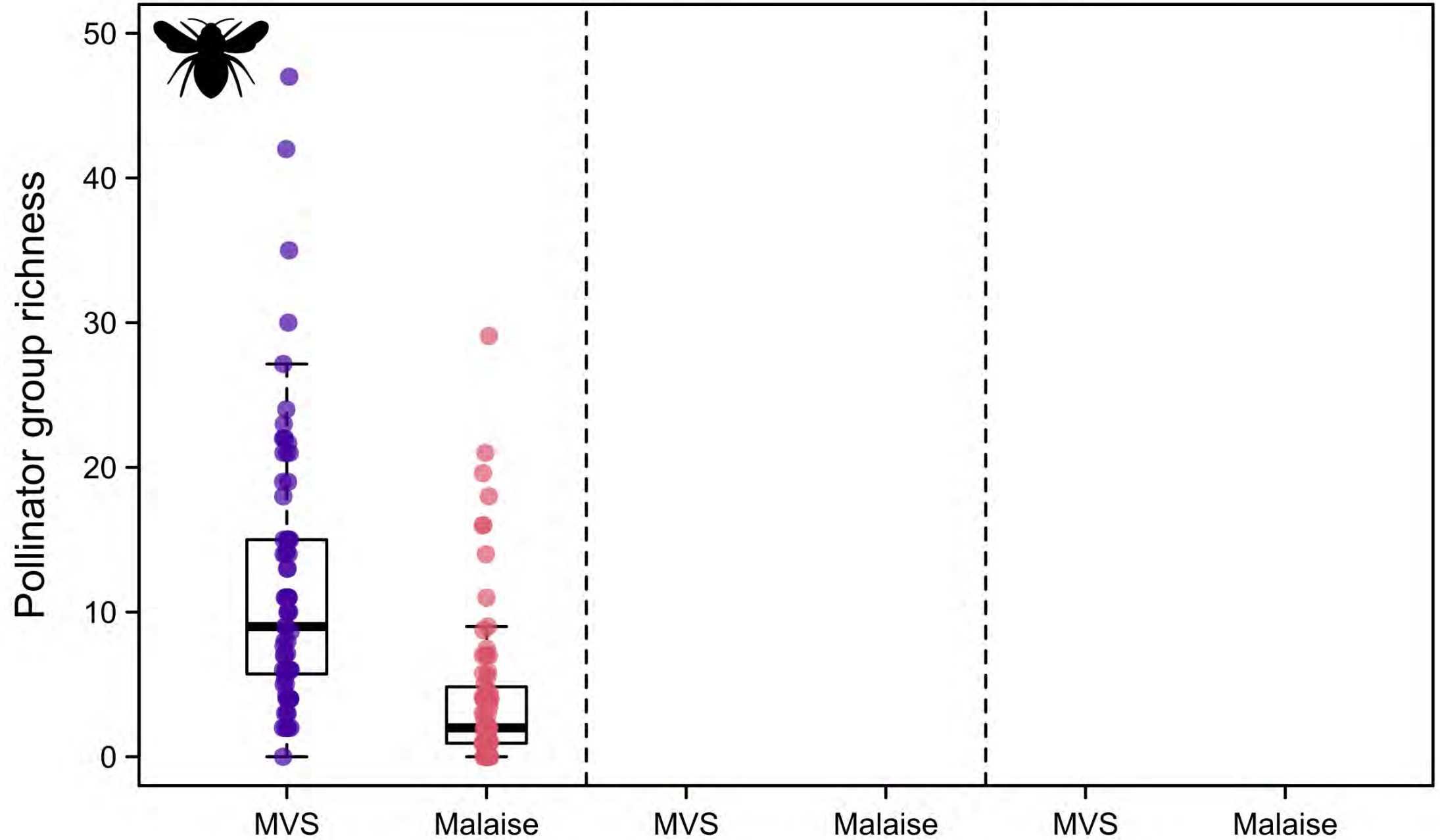
Summary

Malaise traps capture about 10x more insects, particularly when estimating species from OTUs

MVS does a better job with pollinators, but Malaise traps also contribute unique pollinator information



Results – Pollinator groups

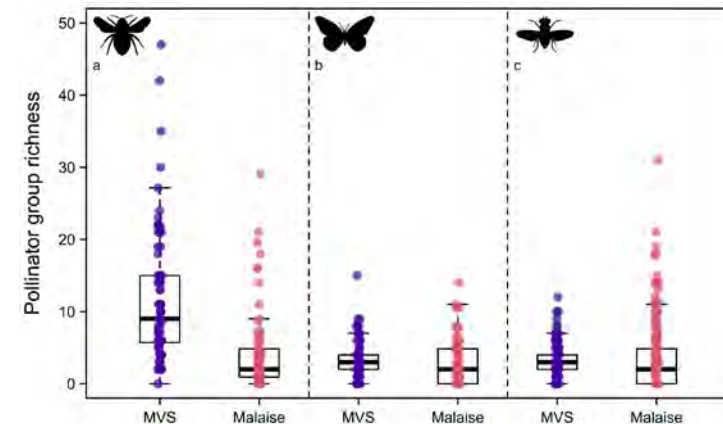
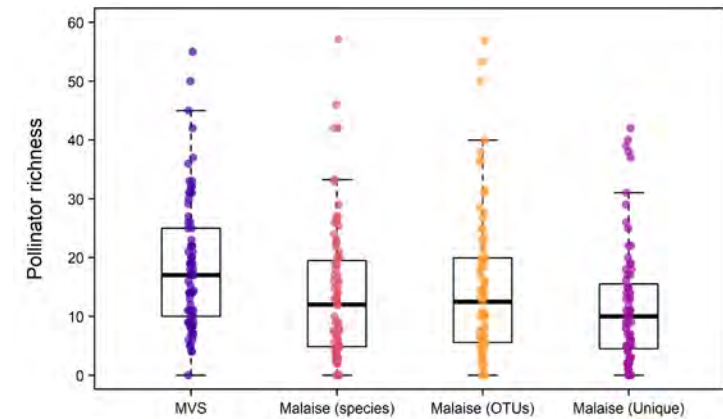
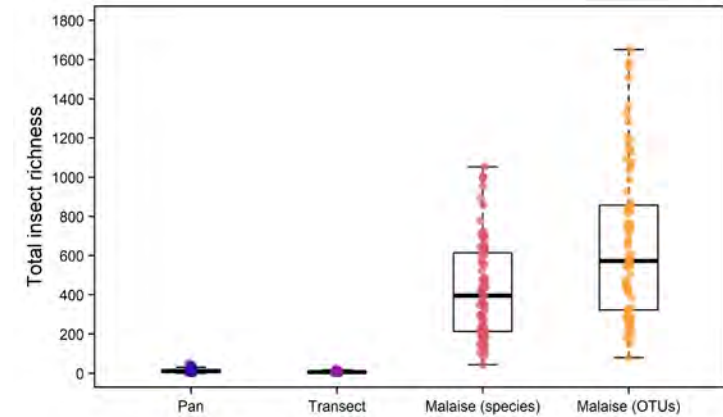


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Higher number of pollinators in MVS primarily driven by bees



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- Costs must be low ✓
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Weaknesses

- Limited to presence/absence (for now)
 - Species losses only register when the species is gone
- Sample is destroyed
 - DNA can be stored but specimen cannot be re-examined nor vouchered
- Dependent on reference libraries
 - Problem will diminish as libraries expand
- Metabarcoding expertise and some additional sampling effort/cost

Questions?



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