

***Insect life traits are key factors in mercury accumulation and transfer within the
terrestrial food web***

*Yung Loïc^Δ, Coralie Bertheau^Δ, David Cazaux[□], Nicole Regier[†], Vera I. Slaveykova[†],
Michel Chalot^Δ*

^Δ UMR CNRS 6249 Chrono-environnement, Université Bourgogne Franche-Comte, F-25200
Montbéliard, France

[□] INOVYN France, 39500 Tavaux, France

[†] Environmental Biogeochemistry and Ecotoxicology, Department F.-A. Forel for
Environmental and Aquatic Sciences, Earth and Environmental Sciences, Faculty of Sciences,
University of Geneva, 1211 Geneva, Switzerland

KEYWORDS: Bioaccumulation, Terrestrial Food web, Insects, Mercury accumulation, Nettle

SUMMARY OF CONTENT

N° of SI page: 4

N° of SI table: 1

N° of SI figure: 1

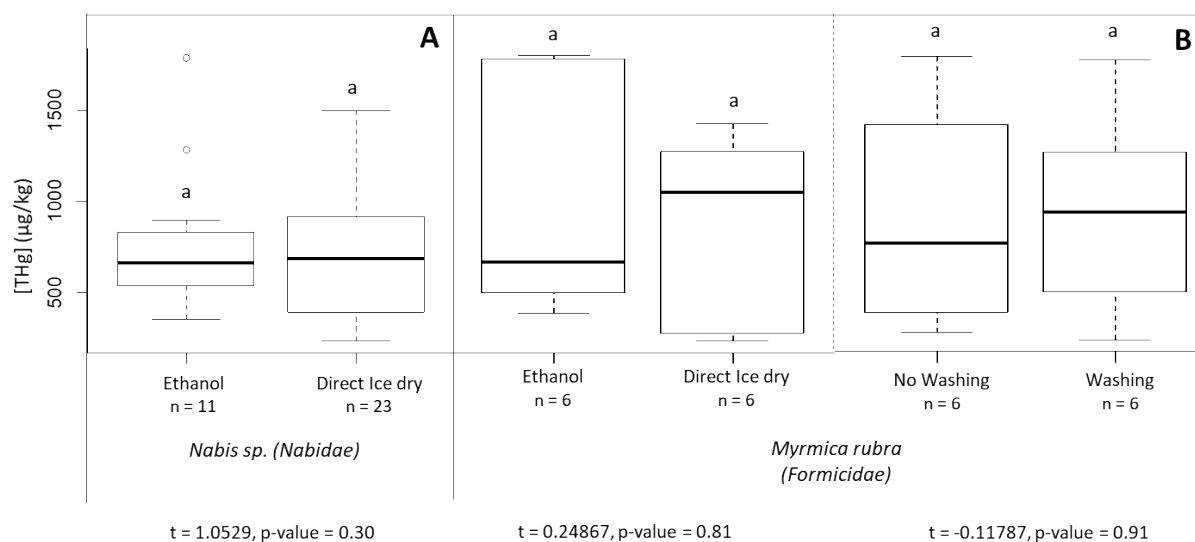


Figure S1. Result from a preliminary tests consisting in the evaluation of the influence of insect conservation methods on the THg concentrations measured in *Nabis sp.* (A) and *Myrmica rubra* (B) conserved in ethanol or directly ice-dried after the collection. Letters indicate results from welch Two sample t-test.

The influence of insect conservation methods on the THg concentrations measured was tested on two insect species: *Nabis sp.* and *Myrmica rubra* conserved in ethanol after the collection (n = 11 and n = 6, respectively) or directly freeze-dried (n = 23 and n = 6, respectively). Statistical analysis (Supplemental figure 1) showed no significant difference between the two conservation methods for the THg concentrations in the two studied insects (t = 1.0529, p-value = 0.30 for *Nabis sp.* and t = 0.24867, P = 0.81 for *Myrmica rubra*).

Table S1. Ecological characteristics of each targeted taxa, including their link with nettle, habitat, trophic guild in the nettle-based food web, feeding guild and dietary range according to the literature

Targeted insects		Habitat	Trophic guild	Feeding guild	Dietary range	Reference
Nettle-related insects						
<i>Aphid</i>						
Aphididae	<i>Microlophium carnosum</i>	plant - nettle	herbivorous	sap-sucking	specialist	Baverstock et al. 2011
<i>Leafhoppers</i>						
Cicadellidae	<i>Eupteryx urticae</i>	plant - nettle	herbivorous	sap-sucking	specialist	Stiling, 1980
<i>Ladybird beetle</i>						
Coccinellidae	<i>Coccinella septempunctata</i> <i>Harmonia axyridis</i>	plant - nettle	predator I	soft-body predator (aphididae)	specialist	Gurney et Hussey, 1970 Koch, 2003
<i>Weevil</i>						
Curculionidae	<i>Nedyus quadrimaculatus</i> <i>Taenapion urticarium</i>	plant - nettle	herbivorous	leaf-miner	specialist	Hoffman, 1958
<i>Caterpillar</i>						
Lepidoptera	ND (larvae)	plant - nettle (& other)	herbivorous	leaf-miner	ND	
<i>Plant bug</i>						
Miridae	<i>Liocoris tripustulatus</i> <i>Deraeocoris ruber</i>	plant - nettle plant - nettle	herbivorous predator I	sap-sucking soft-body predator (aphididae)	specialist specialist	Wheeler, 2001
<i>Damsel bug</i>						
Nabidae	<i>Himacerus mirmicoides</i> <i>Nabis rugosus</i> <i>Nabis sp.</i>	plant - nettle	predator II	insect predator	generalist	Lattin, 1989
<i>Seed bug</i>						
Rhyparochromidae	<i>Scolopostethus affinis</i>	plant - nettle	herbivorous	sap-sucking	specialist	Eyles, 1964
Nettle-unrelated insects						
<i>Spittlebugs</i>						
Aphrophoridae	<i>Aphrophora alni</i>	plant - <i>Salicaceous</i>	herbivorous	sap-sucking	specialist	Weaver and King, 1954
<i>Flea-beetle</i>						
Chrysomelidae	<i>Crepidodera sp.</i>	larvae : forest floor adult : plant - <i>Salicaceous</i>	herbivorous	larvae : root feeder adult : leaf miner	specialist	Urban, 2014
<i>Chironomids</i>						
Chironomidae	<i>Chironomus sp.</i>	larvae : sediments underwater adult : ND	ND	larvae : filter feeder adult : ND	ND	Amitage et al., 2012
<i>Weevil (I)</i>						
Curculionidae	<i>Phyllobius sp.</i>	larvae : soil adult : plant - nettle	herbivorous	larvae : root feeder adult : leaf miner	NA	Ioannisiani et al., 1970
<i>Wireworm / Click beetle</i>						
Elateridae	<i>Agriotes sp.</i>	larvae : soil adult : plant <i>Salicaceous</i>	herbivorous	larvae : root feeder adult : leaf miner	generalist	Evans, 1944
<i>Red fire ant</i>						
Formicidae	<i>Myrmica rubra</i>	soil, plant	ND	arthropods predator	generalist	Brian, 1973
<i>Scorpion-fly</i>						
Panorpidae	<i>Panorpa vulgaris</i> <i>Panorpa germanica</i>	larvae : litter, soil adult : terrestrial biota	ND	arthropod scavenger	generalist	Byers and Thornhill, 1983
<i>Green shield bug</i>						
Pentatomidae	<i>Palomena prasina</i>	plant - <i>Salicaceous</i>	herbivorous	sap-sucking	specialist	Javahery, 1967
<i>Marsh fly</i>						
Sciomyzidae	<i>Trypetoptera punctulata</i>	larvae : snail adult : terrestrial habitat	ND	larvae : snail parasitoid adult : scavenger	NA	Barker et al., 2004

Table S2. Mean MeHg concentrations ($\mu\text{g}/\text{kg}$ dry wt.) and the MeHg fraction as a percentage of the THg concentration, for soil and nettles (*Urtica dioica*) and for all the investigated insect taxa from the experimental site.

Samples	#	Mean MeHg ($\mu\text{g}/\text{kg}$)	Mean %MeHg
Soil	4	1.8	0.0
<i>Urtica dioica</i>	3	0.3	1.2
Aphididae	1	2.6	25.5
Chironomidae	6	187.5	36.2
Coccinellidae	3	13.5	36.9
Cicadellidae	3	22.2	41.7
Elateridae	4	3581.5	74.2
Formicidae	12	571.8	54.5
Lepidoptera	3	2.4	5.6
Nabidae	7	431.9	65.2
Panorpidae	5	357.1	29.0

- Baverstock, J.; Porcel, M.; Clark, S. J.; Copeland, J. E.; Pell, J. K. Potential value of the fibre nettle *Urtica dioica* as a resource for the nettle aphid *Microlophium carnosum* and its insect and fungal natural enemies. *BioControl* **2011**, 56 (2), 215–223. <https://doi.org/10.1007/s10526-010-9330-x>.
- Stiling, P. D. Host plant specificity, oviposition behaviour and egg parasitism in some leafhoppers of the genus *Eupteryx* (Hemiptera: Cicadellidae). *Ecol. Entomol.* **1980**, 5 (1), 79–85. <https://doi.org/10.1111/j.1365-2311.1980.tb01125.x>.
- Gurney, B.; Hussey, N. W. Evaluation of some coccinellid species for the biological control of aphids in protected cropping. *Ann. Appl. Biol.* **1970**, 65 (3), 451–458. <https://doi.org/10.1111/j.1744-7348.1970.tb05513.x>.
- Hoffman, A. Coléoptères Curculionidés; Faune de France; Fédération française des sociétés de sciences naturelles: Paris, **1954**.
- Koch, R. L. The multicolored asian lady beetle, *Harmonia axyridis*: a review of its biology, uses in biological control, and non-target impacts. *J. Insect Sci.* **2003**, 3 (32), 1–16. <https://doi.org/10.1673/031.003.3201>.
- Wheeler, A. G. *Biology of the plant bugs (Hemiptera: Miridae): pests, predators, opportunists*; Cornell University Press, 2001.
- Lattin, J. D. Bionomics of the Nabidae. *Annu. Rev. Entomol.* **1989**, 34 (1), 383–400.
- Eyles, A. C. Feeding habits of some Rhyparochrominae (Heteroptera: Lygaeidae) with particular reference to the value of natural foods. *Trans. R. Entomol. Soc. Lond.* **1964**, 116 (5), 89–114. <https://doi.org/10.1111/j.1365-2311.1964.tb00826.x>.
- Weaver, C. R.; King, D. R. Meadow spittlebug, *Philaenus leucophthalmus* (L.). **1954**.
- Urban, J. Occurrence, bionomics and harmfulness of *Crepidodera aurea* (Geoffr.) (Coleoptera, Alticidae). *Acta Univ. Agric. Silv. Mendel. Brun.* **2014**, 59 (5), 279–308.
- Armitage, P. D.; Pinder, L. C.; Cranston, P. S. *The Chironomidae: biology and ecology of non-biting midges*; Springer Science & Business Media, 2012.
- Ioannisiani, T. G.; Biro, A. V.; Lavrova, N. K. Data on the biology of weevils of the genus *Phyllobius* (Coleoptera, Curculionidae). *Zool. Zhurnal* **1970**, 49 (3), 384–389.
- Evans, A. C. Observations on the biology and physiology of wireworms of the genus *Agriotes* Esch. *Ann. Appl. Biol.* **1944**, 31 (3), 235–250. <https://doi.org/10.1111/j.1744-7348.1944.tb06733.x>.
- Brian, M. V. Feeding and growth in the ant *Myrmica*. *J. Anim. Ecol.* **1973**, 42 (1), 37–53. <https://doi.org/10.2307/3405>.
- Byers, G. W.; Thornhill, R. Biology of the Mecoptera. *Annu. Rev. Entomol.* **1983**, 28 (1), 203–228. <https://doi.org/10.1146/annurev.en.28.010183.001223>.
- Javahery, M. The biology of some Pentatomoidea and their egg-parasites. **1967**.
- Barker, G. M.; Knutson, L.; Vala, J. C.; Coupland, J. B.; Barnes, J. K. Overview of the biology of marsh flies (Diptera: Sciomyzidae), with special reference to predators and parasitoids of terrestrial gastropods. In *Natural enemies of terrestrial molluscs*; Barker, G. M., Ed.; CABI: Wallingford, 2004; pp 159–225. <https://doi.org/10.1079/9780851993195.0159>.