

Screening of Pesticides in Pollen Collected by Honey Bees

Results from three countries in the Northern Zone

CONCLUSIONS

- Insecticides posed the highest direct potential risk to bees
- Fungicides and herbicides were often detected and in highest concentrations
- The Risk index correlated positively with the proportion of crop pollen
- Analysis of pesticides in pollen collected by honey bees is a promising monitoring approach to support environmental risk assessments



Left: Pollen trap mounted at the entrance of a honey bee hive (photo Maj Rundlöf). Right: the collected pollen from four different honey bee colonies (photo Theresia Widhalm).

METHOD

- In total 6 sites in Lithuania, Norway and Sweden
- Sampling in 3-4 weeks in May-June 2024
- Pollen collected from honey bee colonies
- Pollen samples were analysed for 173 pesticides using LC-MS/MS and GC-MS
- Analysis of plant origin using image analysis and machine learning
- A Risk index was calculated by weighting the concentrations of each pesticide with its acute toxicity to honey bees (LD₅₀ mean of oral and apical) and summed per sample

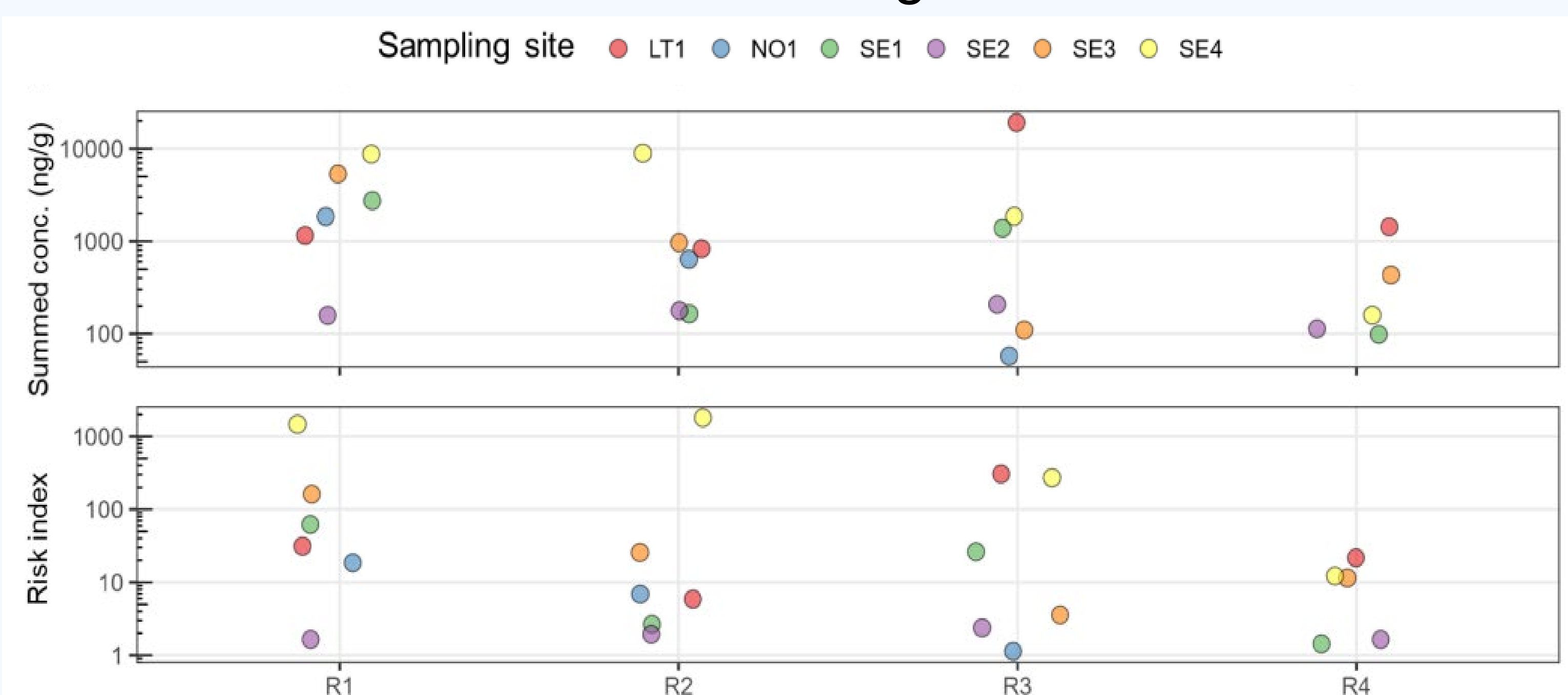
$$Risk\ index = \sum_{i=1}^n \frac{concentration\ substance\ (i)}{mean\ LD50\ substance\ (i)} \cdot \frac{ug}{bee}$$

REFERENCE

Rundlöf, M., Eriksson, E., Bergman, J., Erling, S., Jonsson, O., Ledesma, M., Blažytė-Čereškienė, L., Hatteland, B.A., Svensson, G.P., Weslien, K., Olsson, O., Gönczi, M. 2025. Screening of pesticides in pollen collected by honey bees in the Northern zone. CKB rapport 2025:1. SLU CKB, Uppsala.

RESULTS

- Summed concentrations and Risk index highest in early May (R1)
- No differences were found among countries



- The most common pollen types were **Brassicaceae** (e.g. oilseed rape) and **Rosaceae** (e.g. apple)
- Summed concentrations and Risk index correlated positively with the proportion of crop pollen in the sample

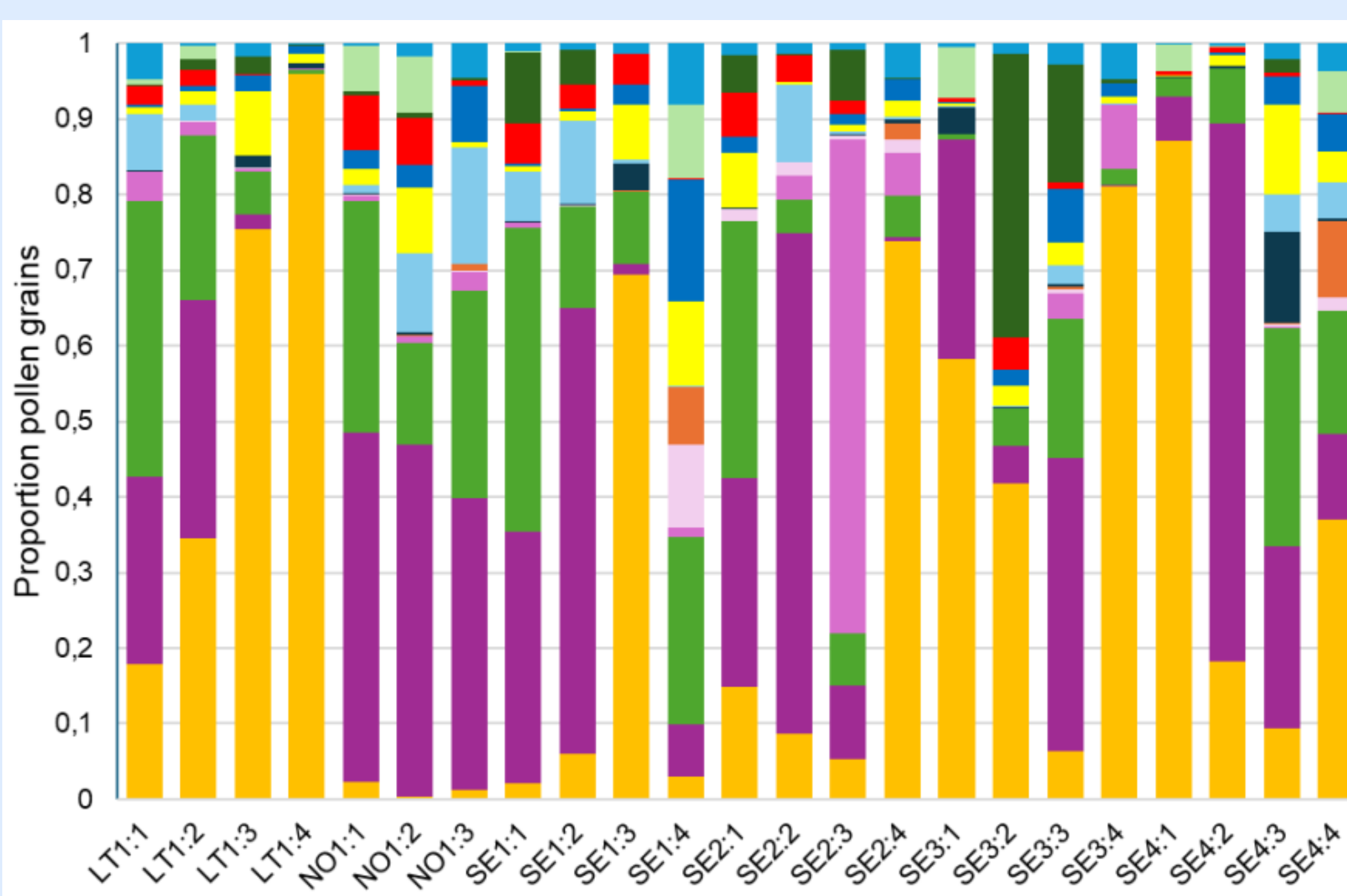


Photo: Jenny Svernäs-Gillner, SLU

Proportion of pollen grains in the honey bee collected pollen identified to different plant species or groups at the six sites in Lithuania (LT), Norway (NO) and Sweden (SE) over the 3-4 sampling rounds (consecutive weeks) at each site.

- Highest total risk:
 - Nr 1-2: insecticides, mainly driven by high toxicity
 - Nr 3-5: fungicides, mainly driven by high concentrations

Substances with highest Risk index over all samples. (F)= fungicide, (I)=insecticide, concentrations in ng/g.

Substance (type)	Detects	Risk sum	LD ₅₀ mean	LD ₅₀ contact	LD ₅₀ oral	Conc. sum	Conc. median	Conc. max
indoxacarb (I)	5	3402	0.156	0.08	0.232	531	38	270
acetamiprid (I)	22	415	11.3	8.09	14.53	4690	18	2000
captan (F)	16	133	150	200*	100*	20000	70.5	8500
boscalid (F)	9	67	183	200*	166*	12300	13	11000
azoxystrobin (F)	21	55	113	200*	25*	6170	1.5	6000
imidacloprid (I)	3	42	0.0424	0.081	0.0037	1.78	0.57	0.93
fluopyram (F)	19	39	101	100*	102.3*	3970	6.2	3600
pyrimethanil (F)	15	37	100	100*	100*	3740	18	1700
cyprodinil (F)	5	11	93.8	75*	112.5	1010	4.1	910
flonicamid (I)	4	7	80.3	100*	60.5*	560	106	330

*LD₅₀ based on limit test or doses that did not result in 50% mortality in the test population.



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