Neonicotinoids - Overview of general considerations specific to Africa

Christian Pirk
Population in Africa

Data source: United Nations
More demand for pesticides and more demand for pollination/ honey bees
Pesticides South Africa

Over 105 neonicotinoid products

Insecticides South Africa

Over 130 imidaclorpid products
Neonicotinoids in honey

subsistence beekeeping/ harvesting in Africa
Food webs - Insects as human food in Southern Africa

Legislation for the Use of Insects as Food and Feed in the South African Context

Sallou Niassy, Sunday Ekesi, Sheryl L. Hendriks, and Anjanette Haller-Barker

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A. Halloran et al. (eds.), Edible Insects in Sustainable Food Systems,
https://doi.org/10.1007/978-3-319-74011-9_29

Fig. 2 Diversity and abundance of main groups of edible insects in southern Africa
Risk assessment data
From the EU and Australia

Lack of local RA studies

“Pesticide Act”
Act 36 of 1947
Effects of neonicotinoids on African bees

**Honey bee sensitivity to sucrose**

- In both cases, bees have reduced sucrose responses.
- Suggests bees cannot properly taste sugar, but can taste neonics.
- Bees encountering neonic treated crops for the first time may be biased regarding the actual quality of nectar, affecting foraging efficiency and overall pollination services.

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Additional effects of Thiamethoxam

- Combined effect of one neonicotinoid (THX) and nutrition on bees:
  - Sucrose sensitivity (nectar).
  - Survival & nutrition – balanced vs unbalanced diets.

Démares, F. et al. (2016) PLoS ONE 11(6)
**Additional effects of Thiamethoxam**

- Combined effect of one neonicotinoid (THX) and nutrition on bees:
  - Sucrose
  - Survi

![Graph showing the effect of sucrose concentrations on protein response rate and Thiamethoxam attenuation.](image)

*Démares, F. et al. (2016) PLoS ONE 11(6)*
THX - effect on thermoregulation

Biphasic effect of THX = impairs the ability to regulate body temperature

Effects of neonicotinoids on African bees

Pollinator studies

<table>
<thead>
<tr>
<th>Geographical region and sub-region (following FAO, &lt;www.fao.org&gt;)</th>
<th>Number of papers</th>
<th>Number of regions contributing to meta-analyses</th>
</tr>
</thead>
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<tr>
<td>South America</td>
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</table>

Table 2. The economic vulnerability to pollinator loss, as calculated by Gallai and colleagues (2009), is the ratio of the economic value of insect pollinators of the 100 most important commodity crops for human consumption to the total economic value of those crops. As in Gallai et al. (2009), regions with high vulnerability to pollinator loss (>10%) are highlighted in bold. The number of papers refers to data-sets used in the meta-analyses, after duplicates were removed, from each geographic region.

Web of Science Search “bees” & “neonicotinoid”

Urgent need for research in Africa

Economic and ecological implications of geographic bias in pollinator ecology in the light of pollinator declines

C. R. Archer, C. W. W. Pirk, L. G. Carvalheiro and S. W. Nicolson

Oikos 123: 401–407, 2014
doi: 10.1111/j.0030-1299.2013.01593.x
Biodiversity

Environmental Stratification
(Metzger et al 2013)
Pictures lacewings Neuroptera -
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conservation genetics specialist group (CGSG)) @ConGenAfrica
Pictures baboon spiders -
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Karoo Biogaps project
Prof C Sole (UP)
497 described species of dung beetles
In South Africa - very high endemic rate dung beetles & Neuroptera
Apis mellifera scutellata - South Africa To East Africa

Hepburn & Radloff 2000 - Genetics and Molecular Ecology
Locally adapted populations of Honey bees

Nigeria

Two distinct pheromone clusters
Two different sub-species?
Genetically different
(Rasolofoarivao et al 2015)

Madagascar

Genetic diversity
Is high in Africa

Nat Genet, 48, 1081-1088
Estimated 310 million colonies vs 11.5 million in Europe
South Africa over 10 million colonies

(Dietemann et al 2009)
Fundamental difference between Europe and Africa

Europe: 99% of bees Belong to somebody
Fundamental difference between Europe and Africa

Europe: 99% of bees Belong to somebody

You can move them
Fundamental difference between Europe and Africa
Fundamental difference between Europe and Africa
Fundamental difference between Europe and Africa
Fundamental difference between Europe and Africa

They can move

Africa: 95% of bees are wild
Fundamental difference between Europe and Africa

Wild honey bee population - exposed to pesticides
Fundamental difference between Europe and Africa

Pollinator populations - exposed to pesticides

- Carpenter bee
- Sweat bee / Solitary bee
- Leafcutter bee
- Stingless bees
Fundamental difference between Europe and Africa

Wild honey bee population - need to know densities
Fundamental difference between Europe and Africa

Wild honey bee population - harvest from the population

Are the bee population used in a sustainable way?
Fundamental difference between Europe and Africa

Wild honey bee population - harvest from the population

Some problems like overfishing in the oceans? Beekeepers “refills” boxes -> selection?
Fundamental difference between Europe and Africa

Wild honey bee population - need to know densities

Need for a comprehensive dataset on how many colonies and where they are
Climate change will make agriculture more challenging

Agriculture in Africa will become more intensive => more use of pesticides/neonicotinoids but also higher demand for the pollination services of honey bees.

Different economical realities/possibilities in different parts of Africa

Effects of neonicotinoids in light of diversity in floral and fauna
climatic diversity / gradients
biodiversity with a high level of endemism
growing human population
95% of honeybees are wild
biodiversity of insects is second to nothing in South Africa

Little is currently known about the pollinator populations, especially honey bees, and their sustainable use.
Work on Baboon spiders, Neuroptera and dung beetles thanks to Prof Catherine Sole (Systematic & Evolutionary Entomology (UP) & Invertebrate expert IUCN conservation genetics specialist group (CGSG)) @ConGenAfrica

SIRG
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Dr AA Yusuf
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Fiona Mumoki
Cathy Bester
SIRG extraordinary & former
Prof Robin Moritz
Prof Peter Neumann
Dr Vincent Dietemann
Dr Fabien Démares
Dr Simone Tosi