# “Pesticide Risks to Wild Pollinators”

23rd & 24th November 2010

Agricultural Information Resource Centre, KARI NARL Campus, Kenya

This workshop was the concluding meeting of the 2010 part of the project. It was organized to discuss:

(1) the first results on the agreed cooperative $LD_{50}$ testing of different bee species,
(2) international developments and other pollinator initiatives
(3) first draft of a report on Mitigation Measures
(4) the agenda and discussion themes of the Kenyan Stakeholders meeting of 25 November 2010 to be held in Thika
(5) some aspects of the plan for 2011 (as submitted to Dutch ministry of Economy, Agriculture and Innovation)

**Participants;**

Gladys Maina (PCPB), Muo Kasina (KARI), Mary Gikungu (National Museums of Kenya), Chris Odhiambo (National Museums of Kenya), Barbara Herren (FAO), Tjeerd Blacquiere (PRI-WUR), Sjef van der Steen (PRI-WUR), Ivo Roessink (Alterra-WUR), Irene Koomen (CDI-WUR), Pamela Kipyab (KARI), Nieke van Heesch (PRI-WUR), Paul Ngaruiya (PCPB), Maurice Wanyongo (PCPB).

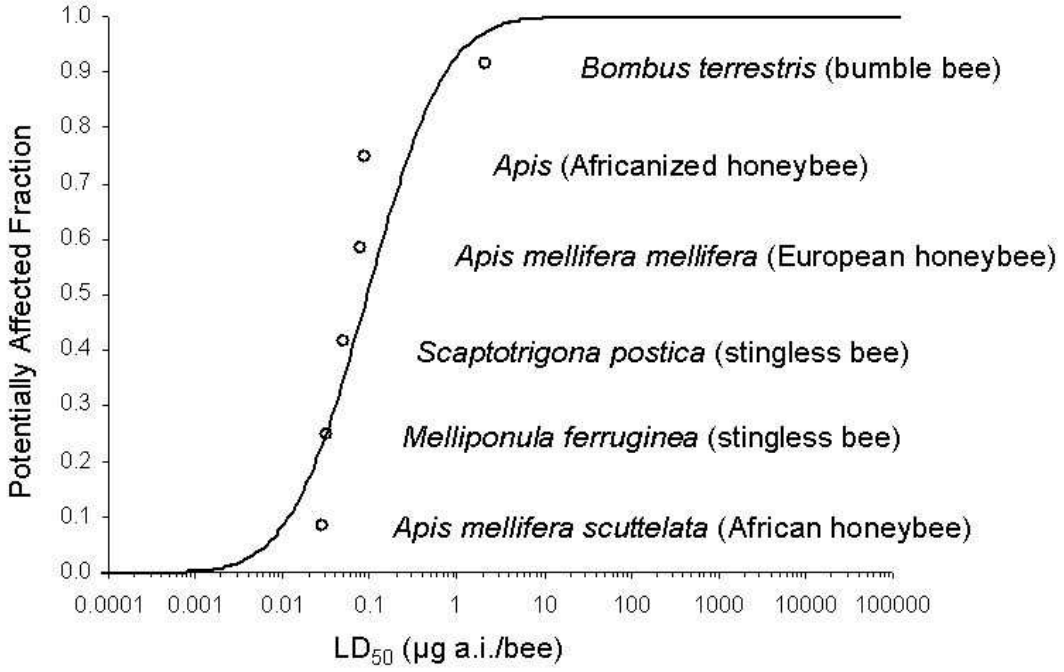
**Absent:** Due to problems with passports and obtaining visas both Roberta Nocelli and Marcia Ribeiro from Brazil were not able to attend the workshop.

**Opening**

Gladys Maina (PCPB) welcomed all participants and stressed the importance of approaching the issues under discussion both from the interest of *the benefits of pesticides to crop production* and from that of *the need to protect pollinators from the negative side effects of pesticides*.

## (1) Cooperative $LD_{50}$ testing of different bee species

The first results of the acute contact $LD_{50}$ of dimethoate 40% to (wild) pollinators were presented. The results were based upon tests carried out in the Netherlands, Brazil and Kenya, by partly the same team and by using the same cages, procedures (protocol) and chemicals, but applied to local bees. On each test location a comparison between (local) honey bees and a local wild bee was made. By compiling the data of all tests a first indication of the comparative sensitivities of these species to the first test chemical, dimethoate, could be obtained. *Bombus terrestris* (wild social bee, NL) was the least sensitive, followed by the Africanized honeybee (Brazil) and *Apis mellifera mellifera* (European black honey bee, Netherlands), then *Scaptotrigona postica* (eusocial stingless bee, Brazil), *Melliponula ferruginea* (eusocial stingless bee, Kenya) and finally *Apis mellifera scutellata* (African honey bee, Kenya) which was the most sensitive. (See graph: µg active ingredient (a.i.)/bee). Conclusion from this graph, *Apis mellifera mellifera* is not the most sensitive bee to dimethoate, but the sizes of the bees may also be important for the sensitivities. Moreover, the sensitivities of the species are in the same order, which might imply that not too big errors are made when only testing on honey bees. However, this is only for one chemical; other chemicals that operate through a different mechanism might well show quite different results.



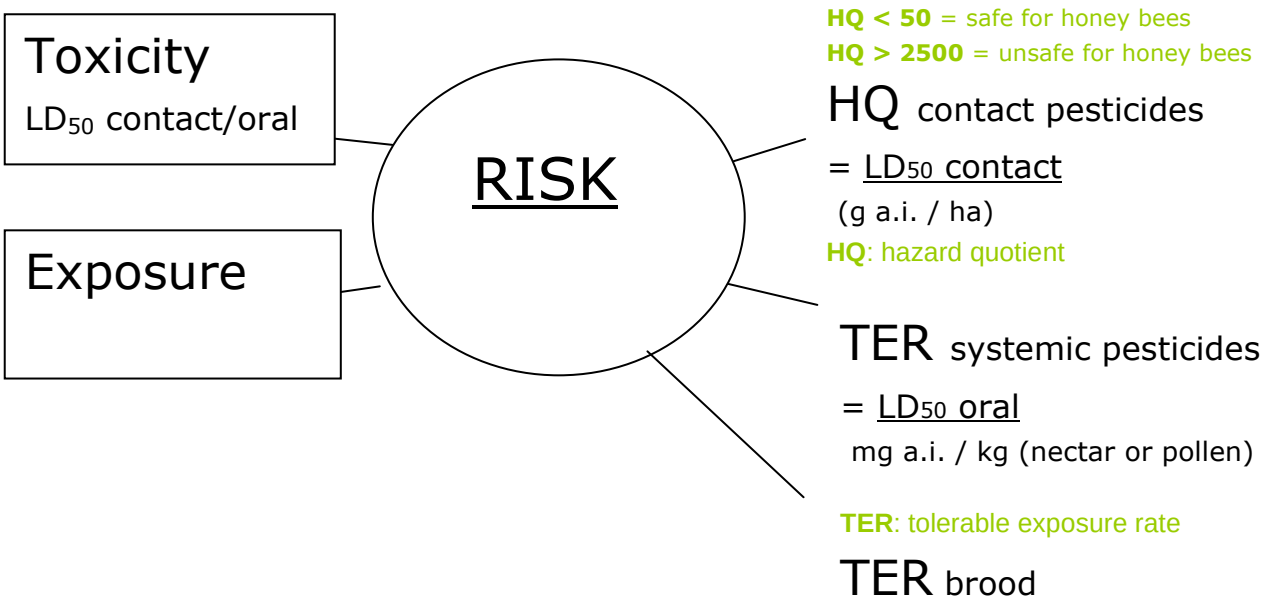

These results are the first comparative $LD_{50}$ data ever obtained from different bee species in one testing series. The results will now be further analyzed, including reference to be made to the different body weights of the different bees. A further remark is that so far no solitary bees have been tested yet, but only one social and five eusocial species. Therefore the first step will be to add a few solitary bees to the list, and test them for their acute toxicity $LD_{50}$ for dimethoate.

Dimethoate was chosen as the first chemical to test because it is the standard active ingredient that is used as a reference in all $LD_{50}$ tests, and because there is already a lot of

data known. Dimethoate is known to be very toxic, it is a high-risk pesticide, and used a lot in Africa and Brazil.
An important part of the research for 2011 is going to be the testing of the same species, again in one test series using another chemical with a different mode of action. Earlier we made a shortlist already: dimethoate, indoxacarb, deltamethrin and imidacloprid. It was agreed upon that the next tests will be carried out with the chemical Decis (active ingredient deltamethrin). This pesticide is widely used in all contributing countries and often debit to calamities.

**Discussion**
The data need to be looked at in the light of risk assessment (see the scheme below). Contact $LD_{50}$ figures are the first and most objective inputs to that. It will already be difficult to test all the chemicals in this ring test system because some (even in our shortlist) chemicals break down very easily. However, we need more data, since this kind of graph we produce becomes more valuable when it holds for more chemicals. But on the other hand if it does NOT hold for more chemicals that is important information, since in that case it might be necessary to test all chemicals with a series of pollinators.

General risk assessment method and model




In addition the oral toxicity is also important, which is already more difficult to assess and compare in a test with social and solitary bees. For instance when testing a systemic compound, which exposes a pollinator when it consumes nectar or pollen, it is difficult to relate $LD_{50}$ data to realistic exposures.

Although the sensitivities currently found are differing (which is not immediately concerning) there is another issue we need to address. The risk assessment for acute contact toxicity requires the toxicity (LD50 value), the exposure (use per ha) and the risk quotient (this was established at 50, see scheme). The latter figure is established empirically on a lot of European honeybee data and has no mechanistic background whatsoever. It is not clear if for other pollinators this 50 is relevant or that another value should be taken into consideration.

To tackle this problem we need to investigate the time that an individual bee is out of the hive, or for solitaries, in the field. This is the time the bee is potentially exposed to a chemical (which is a worst case assumption) and so we can assess the proper HQ for other pollinators as well. This will be presented in more detail by using a few schematics to properly discuss this in the draft document that Joseph Van der Steen and Ivo Roessink will produce in January 2011.
What is needed to make a risk assessment (example honey bee):

| *Apis mellifera* | *Apis mellifera* |
|---|---|
| o $LD_{50}$ contact | o $LD_{50}$ Oral |
| o Time out of hive | o Specific crop |
| | o Nectar and pollen |
| | o Brood care |

## Other issues

To finally assess the risks for a pollinator species it is important to include bee behaviour information. Depending on behaviour a bee might be more or less exposed. Coming to the field scale also another complicating factor was addressed: in the field bees are exposed to a mixture of chemicals which is very difficult to test.
It was also addressed that it might be interesting to test other *Apis mellifera sub*-species of East Africa, since there are four in Kenya alone.

## What is next? Agreements.

- Joseph van der Steen and Ivo Roessink will draft a concept note on the outcome of the discussion (send to everyone January 2011) and everybody will be invited to comment on that document. In essence it boils down to the facts that we would like to include two solitary bee species as well (*Megachile* sp. and *Osmia rufa*), and that Muo Kasina, Mary Gikungu, and Joseph van der Steen will take on this challenge.
- Another thing is that Joseph van der Steen and Ivo Roessink have submitted an abstract to the SETAC Europe meeting coming May in Milan regarding our project and that Roberta Nocelli, Muo Kasina and Mary Gikungu are co-authors.

## (2) Update on international developments and other pollinator initiatives

*(This was presented by Barbara Gemmill Herren, see also presentation for exact details.)*

**OECD** (working group on pesticides and pollinators)
October 2010 finalized work plan
April 2011 first phase of work plan, four themes in the work plan:
1 incident rapid alert system
2 research clearing house
3 toxicity study and exposure methods and
4 risk mitigation
Agreement: Irene will contact Susanne Sütterlin from the Dutch MoA who is a member of this working group. Issues to be discussed are awareness of our work and avoiding duplicating trials.

**ICPBR** Bee Protection Working Group
Next symposium autumn 2011 in Wageningen. We should at least present our data there.

**STEP** (Status and trends in European pollinators)
There will be a meeting in March.

**ALARM** (Assessing large scale risks to biodiversity with tested methods)

**SETAC** (Society of environmental toxicology and chemistry)
SETAC is a growing non-profit worldwide professional society where both research, industry and policy makers meet, also started an African branch three years ago.
Agreement: Ivo will send details of this to Gladys. SETAC publishes (very good) guidelines.
Meeting in Florida January 16$^{th}$ about pesticides and pollinators, if invited Ivo might attend and present the initial lab test results.
Very interesting society for this project!

**FAO** pesticide group, two interesting areas:
1 Pesticide stock management system.
2 Tools for decision making on pesticide registration (Guidelines). A pollinator model in such tool would be very positive.

**EPPO** – European and Mediterranean Plant Protection Organisation (falls under IPPC)
EPPO has issued a study on global climatic zones that can possibly be used for comparing risk assessment data on a zonal scale.
Agreement: Irene will contact EPPO to enquire if this study has been published already.

## (3) Mitigation measures

A discussion paper prepared by Harold & Irene was send out before the workshop listing all possible mitigation measures. References, mainly grey literature were listed as well. Most mitigation measures are generic, effectiveness of the listed measures, and especially effectiveness on other bees than honeybees is not always clear. One and all were asked to add to the list validating any measures where possible. Time during this workshop was too short to go into detail. Each of the participants in the project was asked, personnel or as a country team to provide additional information before the end of 2010. Irene will notify the Brazilian team of this so they can provide their input as well.

## (4) Discussion about the program of the stakeholder meeting on Thursday in Thika

The aim of the workshop is to:
1 Assess evidence of impacts of pesticides on pollinators
2 Present and evaluate the state of $LD_{50}$ data and their implications to wild pollinator management
3 Provide further information on the development of a generic model on pesticide risks to wild pollinators

Schedule:
9:00 Start
Speakers: Gladys Maina, Barbara Herren, PS ministry of Environment, PS ministry of Agriculture, Dr. Irunge (director of crop improvement), Dr Mbithi (Fresh produced export), Dr. Lusike Wasilwa, Dr. Mary Gikungu, Dr. Ngaruiya, Dr. Tjeerd Blacquière (presentation of LD50 results).
14:00 Discussion:

1 Pesticide risks to pollinators
2 Adequacy of honey bee as an indicator for other (wild) bees
3 Experiences in use of pesticides, their availability and impact on production costs

14:40 group presentations
16:30 Ending

## (5) Some aspects of the plan for 2011

### As a reminder: the agreed High value crops:

Brazil: tomato and watermelon
Kenya: tomato and watermelon (and coffee and field beans)
Netherlands: apple (honeybees) and tomato (bumble bees)

What are the most important pollinators (to study) with regard to these Focus crops (example):

| Crops | Insect |
|---|---|
| French Beans (Kenya) | *Apis mellifera* |
| | *Megachile* spp. |
| Watermelon (KE) | *Apis mellifera* |
| Tomato (Kenya) | *Xylocopa* |

**Agreements**

See the listed agreements elsewhere in the report.

For the long term a scheme is needed to put all the activities into context and design a long-term plan

It was suggested that in 2011 an expert meeting on the generic risk assessment model will be held, ideally tagged on to another meeting.

To bring the risk mitigation paper forward it was also suggested to organise a second expert meeting on this topic. Details how and what will need to be discussed when making detailed work planning for 2011.

# Annex 1: Stakeholder Workshop on Knowledge Management of the Effects of Pesticides to Wild Pollinators, 25th November 2010, Practical Training Centre, Thika

<insert programme>

Presentations from Break out groups

Group 1. How do you derive maximum benefit of pesticides without compromising on pollinators' safety?

Group 2. what are the knowledge management/ researchable areas in the interaction between pesticides and pollinators?

- Data on species (no) of pollinators
- Effects of behaviour
- Foraging behaviour
- Range of pesticide in use
- Preferred crops
- Effect of formulations
- Effects on brood/colony
- Misuse of pesticide
- Non-target organisms
- Residues in honey, wax, pollen
- Acaricides (used for livestock pests) effects in arid and semi arid lands (ASALs)
- Susceptibility of species
- Toxic plants?
- Diseases and parasites (i.e. fungal etc.)
- Same investigation for other pollinators.

Group 3. What are the practical mitigation measures to reduce risks of pesticides to pollinators?

- Effects on non-target organisms should be a requirement for the registration procedure and be relevant to the Kenyan situation
- Timing of spraying: related to flowering time, foraging behaviour.
  Must: understand the foraging behaviour of the important pollinators for specific crops
- Awareness raising => intensify the extension services
    - Pest recognition
    - Knowledge about pollinators
    - Which pesticides & mitigations measures
    - Crop knowledge
- Stress the importance of IPM, make it not the responsibility of farmers only
- Take agronomic practices (Good agricultural practice) into consideration when applying IPM
- Development of resistant (crop) varieties to reduce the need for pesticide application
- Use pollinators which have become resistant to commonly used pesticides (discussion/research area)

- Encourage areas which are set-aside as refuges for pollinators (as well as other beneficial insects)
    - Encourage hedge rows (small farms)
    - Set aside uncultivated land (large farms)
- Work needs to be done on species that do not harbour pests as well
- Use safe formulation of pesticides (i.e. powders are harmful to non-target organisms)
- Use selective pesticides
- Different mode of application of systemic pesticides like soil application rather then spraying (needs further discussion/research)
- When nothing else works use human hands as pollinators!

The meeting closed with commitment from various stakeholders to contribute to the work to be carried out in kind.

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## Annex 2: Visit to three small holder farmers Kiambu, nr. Kikuyu.

The group was accompanied by extension staff from the Ministry of Agriculture and Ministry of Livestock Development. Two of the farmers had recently started to produce among other crops, tomatoes in plastic tunnels. The beneficial contribution to pollination and crop yields through insect pollination was a revelation to both farmers. The discussion was about the negative effect of pesticides on pollinators, the fact that pollinators cannot enter the tunnels and methods for mechanical pollination. A third farmer produced tomatoes in the open, here also use of pesticides and importance of pollination was discussed.
The need for clear advice on the importance of pollinators and safe use of pesticides was discussed. Paul, with inputs from Muo and Irene, will write a first draft for tomatoes. PCPB will internally see how they can organise meetings to provide information for farmers/extension workers.

## Annex 3: Visit to a large scale fruit farmer (Kakuzi ltd.)

The farm is a large-scale farm, major crops are avocado, Eucalyptus (for poles) and recently macadamia trees are being planted. Bee hives are scattered around the farm at 3 hives per ha. This number has no scientific background but seems to work. The hives are owned by private beekeepers. They harvest the honey, part of their profits is used to provide more hives for the farm. It was discussed that macadamia will benefit more from bee pollination than avocado. Barbara indicated that a recently published study carried out in South Africa showed that pollination in avocado there was mainly done by flies. Barbara will send a copy of this publication to the farm managers.
Spraying at the farm was kept to a minimum, scouting is part of the routine. The farm is also one of the official test sites for new pesticides, presently they are testing pheromone traps against false codling moth, a pest that has become very important in avocado production there.
Even though this farm is very conscious about minimising pesticide use and creating an environment conducive for wildlife (birds, flowers etc.) they were not really aware of the effects of pesticides on pollinators. Similar to the visit the day before, also these farmers were very keen to learn.