

"Pesticide Risks to Wild Pollinators"

Workshop report

17 – 20 May 2010

Wageningen University & Research Centre

The Netherlands

Project: "Knowledge management of pesticide risks to wild pollinators for sustainable production of high-value crops in Brazil and Kenya" (BO-10-011-113)

1. Objectives

The workshop on Pesticide Risks to Wild Pollinators was organized from 17 to 20 May, 2010, at Wageningen University and Research Centre. The workshop was the first activity of a policy supporting project funded by the Dutch Ministry of Agriculture, Nature and Food Quality on "Knowledge management of pesticide risks to wild pollinators for sustainable production of high-value crops in Brazil and Kenya" (BO-10-011-113)

The project was initiated by Wageningen University and Research Centre at the request of the FAO Global Action on Pollination Services for Sustainable Agriculture, within the framework of the International Initiative for the Conservation and Sustainable Use of Pollinators (IPI) established under the Convention on Biological Diversity.

The main objectives of the workshop were:

- i.) to assess the state of the art in Kenya, Brazil and the Netherlands with respect to knowledge and research on pesticide risks to wild pollinators, in particular:
 - pesticide risk assessment approaches for pollinators,
 - pesticide toxicity testing for bees,
 - pesticide risk mitigation measures and approaches for bees;
- ii.) to identify gaps in knowledge and needs for further research and development; and
- iii.) to develop a work plan for research and policy development, both in the short-term (this project) and mid-term (for additional funding).

The programme of the workshop is provided in Annex 1.

2. Participants

The workshop was attended by the following participants:

Brazil: Leticia Altafin (Ministry of Agriculture, Livestock and Food Supply), Roberta Nocelli (Universidade Federal de São Carlos), Márcia Ribeiro (Embrapa Semiárido)

Kenya: Mary Gikungu (National Museums of Kenya), Muo Kasina (Kenya Agricultural Research Institute), Gladys Maina (Pest Control Products Board), Chris Odhiambo (National Museums of Kenya)

FAO: Barabara Gemmill-Herren (Plant Production and Protection Division)

Netherlands: Tjeerd Blacquière (Plant Research International/WUR), Bram Cornelissen (Plant Research International/WUR), Irene Koomen (Centre for development Innovation/WUR), Ivo Roessink (Alterra/WUR), Sjef van der Steen (Plant Research International/WUR), Harold van der Valk (Pesticide management consultant), Jacoba Wassenberg (Ctgb/Dutch Pesticide Registration Board)

Contact details of all participants are provided in Annex 2.

3. Background and state of the art

3.1 International background

Globally there are strong indications that bees and pollinators in general are declining.

Therefore, the Conference of Parties of the Convention on Biological Diversity (CBD), considering the recommendations of the Sao Paulo Declaration on Pollinators that address the issue of worldwide decline of pollinator diversity, established in 2000 an *International Initiative for the Conservation and Sustainable Use of Pollinators* (also called IPI). The IPI aims to promote coordinated action worldwide to:

- 1. Monitor pollinator decline, its causes and its impact on pollination services
- 2. Address the lack of taxonomic information on pollinators
- 3. Assess the economic value of pollination and the economic impact of the decline of pollination services
- 4. Promote the conservation and the restoration and sustainable use of pollinator diversity in agriculture and related ecosystems

The Initiative is facilitated and coordinated by FAO (see: www.internationalpollinatorsinitiative.org). FAO has also developed a general set of advice on the issue of protecting honey bees from pesticides.

Under UNEP-GEF (United Nations Environmental Programme – Global Environmental Facility), a project called the "Conservation and Management of Pollinators for Sustainable Agriculture, through an Ecosystem Approach" has been funded for the period 2009 – 2013, in which seven countries participate. The work programme contains a broad scope of activities related to pollinators and their protection.

Within the framework of the FAO coordination of IPI, a request for a pilot project on knowledge management of pesticide risks to wild pollinators for sustainable production of high-value crops in Brazil and Kenya was submitted by FAO to the Permanent Representation of the Netherlands to FAO. The pilot project was subsequently awarded by the Dutch Ministry of Agriculture, Nature and Food Quality.

Possible links between this pilot project and related activities were discussed, such as the STEP project (*Status and Trends of European Pollinators*) and the COLOSS network (*Prevention of Honeybee Colony Losses*).

3.2 State of the art in the participating countries

Each country presented the 'state of the art' with regards to wild pollinators and pesticide risks, touching on the following topics:

- identification of two pilot crops in each of the countries;
- identification of main pollinators;
- available knowledge on pollinator importance and ecology;
- identification of pest management approaches, and pesticides, being used in the pilot crops;
- identification of existing regulatory procedures relevant to pesticide impact on pollinators, in particular pesticide registration;
- identification of present risk mitigation measures being used to protect pollinators in the pilot crops.

3.2.1 Brazil

Brazil agriculture has greatly intensified over the last decades, and while the total cropping area has grown with 70%, pesticide use seeing a 700% increase.

The focal crops identified by Brazil for this pilot project are tomato and melon, as for both crops research on pollination is already ongoing through funding by the GEF programme and national funds. The general aim of the tomato work is conservation and management of crop pollinators in different landscape and agriculture management conditions (conventional and organic crops), mainly in crop areas in São Paulo, Minas Gerais, Rio de Janeiro and Goias states (tomatoes), and Pernambuco, Ceará and Rio Grande do Norte states (melon).

In tomato about 20 different genera of bee pollinators have been identified. Work is ongoing to deploy stingless bees as pollinators in tomatoes grown under cover. In tomato about 16 pesticides are registered, and the impression is that these are applied as cocktails as well as single use. With regards to effects of pesticide use in tomato there is ongoing work with the following aims:

- the establishment of sub lethal and lethal doses of new chemical substances to Africanized Apis mellifera and to stingless bees;
- identification of behavioural changes due to pesticides using parameters such as movement, spatial orientation, proboscis extension, etc.;
- morphological and physiological analysis in view to find cell molecular markers to identify the toxicity and healing process.

There is ongoing work through a project on evaluation of efficiency of the pollination services in the intensification of the melon production (*Cucumis melo* L. Curcubitaceae) in the Brazilian semi-arid zones. Melon appears mainly pollinated by honey bees. As for pesticide use, there are 29 active substances registered for use in melon. Even though wild pollinators do not appear to contribute much to pollination itself (which is ensured by honey bees), they do forage in the crop where pesticides are applied.

Pesticide registration is done at the national and the state level. Toxicity testing for bees is carried out according to the OECD guidelines on honey bees. Tests have to be carried out in Brazil itself. The Ministry of Environment (IBAMA) is in the process of publishing an environmental risk assessment guideline for pesticide registration purposes. It intends to consolidate environmental risk assessment and draw up a risk management plan. So far, pollinators other than honey bees have not been considered within the risk assessment. However, a legal resolution has been passed in Brazil for the protection of stingless bees.

Farmers in Brazil are generally not aware about the importance of pollination for the quality and quantity of their harvest, nor about the effects that pesticides may have on pollinators.

With regards to pesticide labelling, a hazard colour coding is used with the aim to protect the farmer. Little advice on reduction of environmental effects is included on the label. A recent study has shown that farmers have great problems understanding pesticide labels, and that these may not be an effective tool to transmit risk reduction measures.

3.2.2 Kenya

Smallholder farmers are the majority of producers within the Kenyan agricultural system. A wide variety of crops is produced, and where possible access to the (international) market is sought.

A study carried out in the Kakamega District in Western Kenya estimated that 40% of net production benefits could be attributed to pollination, with an estimated value US\$ 3.2 million. Honey bees contributed only 0.1% to this value; the rest was due to wild pollinators.

In different studies, sunflower seed setting increased by 53% when honey bees were present, while alfalfa seed production depends entirely on leafcutter bees.

Farmers in Kenya tend to seek quick-fix solutions to pest problems, and pesticides are often first choice. Farmers are risk-averse, and having small farm sizes are not willing to tolerate losses of any one crop. Calendar spraying and prophylactic pesticide treatments are often used, and IPM is still in its infancy in the country. Farmers generally do not have knowledge on the importance of bees and other pollinators for yield and quality of their crops.

Risk assessment of pesticides on honeybees is one of the dossier requirements for pesticide registration. Pesticide companies can however submit data of experiments which have been carried out outside Kenya, which are generally done with the European honey bee. A problem encountered in Kenya is that pollination is often important in minor crops, for which pesticide companies are not willing to collect data on risks to pollinators.

Mitigation measures are warnings on the label, timing of pesticide application and withdrawal of pesticides which have been proven to have negative side effects. One of the problems with protecting pollinators from pesticides is that pests often develop at flowering which is also a time that pollinators visit the crops. After registration no further monitoring takes place, although a monitoring protocol will be developed in the future within the GEF project.

As focal crops for this pilot project in Kenya, it was proposed to work on tomato, coffee, field beans or watermelon.

3.2.3 The Netherlands

In the Netherlands, pollination mainly takes place through honeybees and bumble bees. The role of wild pollinators is poorly documented, although there is some anecdotal evidence that pollination is improved in the presence of wild pollinators. As focal crops for the pilot project, fruit trees (top fruit), oilseed rape and field beans were suggested.

In fruit trees, pesticide risk mitigation measures consist of avoiding spraying during flowering and, if unavoidable, to use compounds which are non-hazardous to honeybees and bumble bees. After flowering, pesticides are applied irrespective of wild pollinators that might be present in the surrounding vegetation. In tomato, which is solely grown in greenhouses, pollination is exclusively carried out by indoor reared *Bombus terrestris* spp. Even though there is a rather long list of pesticides registered for use on tomatoes, farmers attempt to manage pest & diseases through biological control. Pesticides are used as a correction measure though.

Pollinators are protected through legislation whereby the assumption is that all pollinators are represented by the honeybee. The tiered system of pesticide risk assessment used in Europe was high lighted. In the new EU legislation (Regulation 1107/2009, effective from 14/06/2011) there is reference to honeybees but not to wild pollinators. However, the regulation stipulates in a general manner that plant protection products should have no unacceptable effects on non-target organisms, including their behaviour, and should not affect biodiversity and the ecosystem.

3.2.4 Conclusion on background and state of the art

The latest estimate of the total economic value of pollination worldwide amounts to € 153 billion, which represents 9.5% of the value of world agricultural production used for human food¹. There is mounting evidence that pollinator decline as observed all over the world may have significant adverse consequences on agricultural production. In addition, pollinator losses may lead to a reduction in (agricultural) biodiversity.

Gallai N, Salles J-M, Settele J & Vaissière BE (2009) Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological Economics* 68: 810-821

In Brazil, Kenya and the Netherlands, non-*Apis* bees contribute in varying degrees to pollination. In some countries and crops, wild bees are the principal pollinators. In other crops, even if honeybees are present, a diversity of pollinators may increase pollination rates.

There are presently only few studies which have assessed the effects of pesticides on non-Apis bees and the extent to which pollination by these groups can be affected is not clear.

The applicability to wild bees of pesticide risk assessment models that were developed for honey bees is not well known. Preliminary research indicates that there is no direct correlation between the two. Lethal effects of pesticides are much easier to determine and measure than sub-lethal effects, but the importance of the latter is acknowledged.

All presentations highlighted the lack of knowledge on the importance of pollination and the effects of pesticides on pollinators by scientists, regulators and policy makers, but also by farmers.

4. Problem definition

A session was dedicated to problem definition and defining objectives for future work. Through a problem tree analysis, the main problem was defined as the existence of lethal and sub-lethal effects of pesticides on wild pollinators leading to reduced ability of agroecosystems to sustain yields. Two main causes were identified: the misuse of pesticides and the lack of a valid risk analysis scheme for the effects of pesticides on wild (bee) pollinators. Annex 3 provides the more detailed problem analyses of the three sub-groups.

On the basis of this analysis the following objectives for future work were identified:

- 1. to develop a generic risk assessment model for (wild) bee pollinators:
 - a. LD₅₀ ring testing (see detailed work plan);
 - b. Determination of comparative toxicity through a species sensitivity distribution. Correlation between honey bee data and other bee data;
 - c. Quantification of exposure of wild bee pollinators to pesticides (underlying these studies are data on bee ecology within farming systems);
 - d. Development of a generic risk assessment model;
 - e. Validation of the chosen model.
- 2. to develop guidelines for mitigation measures based on expert judgement:
 - a. Verification of the applicability to wild pollinators of FAO and other guidelines for pesticide risk mitigation on honeybees;
 - b. Development of risk mitigation guidelines for the identified focal crops:
 - c. Integration of these guidelines into IPM projects/programmes.
- 3. to raise awareness of the negative effects that pesticides can have on wild pollinators:
 - a. Outreach to policy makers, farmers, industry and to a lesser extent the general public on the importance of pollination and the risks of pesticide use to pollinators
 - Show costs and benefits of reducing the negative effects of pesticide use on the wild pollinator populations (to be linked to ongoing economic assessments of the FAO-GEF project)

It was noted that the project focuses at first instance on lethal effects of pesticides. Sub-lethal effects may be addressed at a later stage in more detail because the methodology for

measuring these has as yet not been developed. It is suggested that a working group (to be formed) will keep a tab on sub-lethal effects.

5. Work plans

5.1 Short term work plan

It was decided that within the current project, which is funded in the BOCI programme of the Dutch Ministry of Agriculture, Nature and Food Quality (LNV), objective 1a could be covered.

For ease of testing and gain experience with the methods, social wild bees were chosen². The pesticides to be tested were selected by comparing the registered pesticides in the focal crops in each of the three countries (see annex 4). The following activities were identified to be carried out during the remainder of 2010:

- Produce a draft protocol for pesticide toxicity testing on non-Apis bees, including a
 recording format (protocol to be based on OECD guideline 214 & bumblebee guideline
 ICPBR Braunschweig). This activity will be initiated by Wageningen University and finetuned by the partners in Brazil and Kenya;
- Set up ring testing (contact application LD₅₀ test), including provision of material required to carry out the testing at the three sites (Netherlands (WUR), Brazil and Kenya);
- Jointly start the test in Brazil and Kenya (2 experts from WUR, 1 from Brazil and 1 from Kenya to be present to confirm and harmonize testing methodology);
- Data collection for 2-3 species at each of the sites and for each of the insecticides:
 - Brazil: Melipona scutellaris, Scaptotrigona postica, Trigona spinipes (all stingless bees), Apis mellifera (x scutellata hybrid: Africanized honeybee).). Xylocopa spp. could also be used.
 - Kenya: Apis mellifera scutellata (honeybee African subspecies), Meliponula sp. (stingless bee), Xylocopa rufa (carpenter bee)
 - Netherlands: Apis mellifera mellifera, Bombus terrestris, (Osmia rufa (only possible in spring).
- Data collection for 4 pesticides with different modes of action: dimethoate, indoxacarb, deltamethrin and imidacloprid (for each of the bee species);
- Elaborate species sensitivity distribution graphs for all species tested.
- Development of a full project proposal for a mid-term project.
- Concluding workshop with all three participating countries and FAO.

It should be noted that this type of research can be initiated and started in the present project, but will certainly require longer-term commitment to attain scientifically valid results. Partners in Brazil will contribute to these activities from national and possibly GEF generated funds. Partners in Kenya will attempt to generate agricultural research funds from KARI, but might need some additional support.

² altough *Xylocopa* spp. can show some degree of sociality, they cannot be considered social as honeybee and sb are.

5.2 Country specific mid term work plans

All three countries present and FAO underlined the need and commitment to further research into the effects of pesticides on wild pollinators and the development of effective risk reduction measures. As a start, each of the countries discussed elements for a work plan which can be further developed into a mid term project proposal, and used to source funding. Elements that were discussed in the country groups are summarized below.

5.2.1 Brazil

What we need to know and how?

- Cultures: melon and tomato
- LD₅₀
- Bee species for LD₅₀ tests:
 - Stingless bees: Melipona scutellaris, Scaptotrigona postica, Trigona spinipes. They
 are not potential pollinators for melon, but these are the bees we could work with
 (because of their breeding possibilities and nests availability, and large populations)
 - For tomato we are testing *M. scutellaris* in greenhouses (pollination efficiency);
 - Scaptotrigona will be the next;
 - Xylocopa spp: because it is a common species also in Brazil and we know how to breed them in hives;
 - Honeybee (Africanized): some studies already done -> Centro de Estudos de Insetos Sociais (Rio Claro) than can be used as basis.

Insecticides

- Imidacloprid, indoxicarb, deltamethrin, dimethoate;
- S. postica: Imidacloprid: is already being done;
- Honeybee: Imidacloprid and deltamethrin already done; dimethoate is being done;
- M. scutellaris and S. postica: fipronil LD_{50.}

LD50

- All the tests are being done according to the OECD protocol;
- Tests: contact, ingestion, application.

Identification in flower visitors

- Identification of residues at colony level on the bee products (honey, propolis, wax and pollen);
- When possible: identification of residues in the haemolymph of adults;
- Monitoring the residues on fruits (tomatoes, melon).

Mitigation

- To integrate representatives of farmers in projects: to bring their experiences and to learn the importance of pollinators and the risks of pesticides (and their residues) for humans, animals and pollinators;
- Capacity building of multipliers of the knowledge;
- To stimulate the Good Agriculture Practices (GAP) among the farmers;

- to do a national program of education of the GAP in all regions;
- Workshop of expertises through courses, talks, "field days", meetings, TVs (Globo Rural), videos, magazines, shows.

Public awareness

- To contact the Brazilian member of COLOSS in order to use the same methodology for registration of the events.
- To reinforce our researchers network on the issue.

Possible funding source the following were identified:

- CNPq
- MMA
- FAPESP

5.2.2 Kenya

Team

- GEF/UNEP/FAO GPP
- WUR
- Brazil
- Kenya
 - NMK
 - GEF GPP
 - PCPB
 - KARI

Objectives

- 1. Develop generic risk assessment (RA) model for bee pollinators;
- 2. Develop crop specific guidelines for mitigation measures;
- 3. Create awareness at different levels.

Activities objective 1

- LD₅₀ studies (Xylocopa flavorufa and Meliponula ferruginea)
 - Mechanistic approach
 - Empirical model
 - Contact/topical and oral (?)
- Quantify exposure studies in farmer fields
 - SSD
 - Exposure models
 - Validation studies
- Sub lethal effects
 - Bee behaviour, ecology, crops, farming systems

Activities objective 2

Selection of crops, pesticides and pollinators;

- Identification of risks of pesticides use and risks to pollinators;
- Expert forum meetings to deliberate pesticide risks and mitigation measures;
- Develop draft guidelines for pesticide mitigation measures;
- Stakeholder workshop to share draft guidelines, validate and seek dissemination pathways;
- Guideline production;
- Guideline dissemination.

Activities objective 3

- Sensitization meetings and workshops on pesticides and pollinators;
- Key technical meeting to communicate LD₅₀ results;
- Community workshops and trainings about pesticide use and risks and mitigations;
- Monitoring and evaluation of the guidelines.

5.2.3 The Netherlands

Time line (Year 1 & 2 are related to start of a full blown project)

2010 => LD 50 ring test => writing project proposal

Objective 1 - Risk assessment

- Year 1: Repeat LD₅₀ ring test
 - Collect crop field data on wild pollinators
 - Develop techniques for solitary bees
 - Expert meeting generic model
- Year 2: Continue LD₅₀ tests (other pesticides/species)
 - LD₅₀ test solitary bees
 - Quantification exposure studies
 - Develop generic model
 - Workshop to consolidate generic model
- Validation to be done in follow-up project
- Outputs objective 1:
 - Guidance documents
 - Testing protocol wild bees
 - Publications

Objective 2 – Mitigation measures

- Year 1: Expert meeting
 - Write guidelines on mitigation measures (apple, canola, field bean)
- Year 2: Trials to measure efficacy of mitigation measures
 - Write info green education network

Objective 3 – awareness building

- Target groups
 - Farmers
 - Policy makers
 - Pesticide producers
- Develop Guidance documents (no concrete ideas as yet)
- As possible funding source the following were identified:
 - NWO-WOTRO;
 - EU FP7 or INCO;
 - NEPAD/AGRA;
 - Private sector (food industry, pesticides industry, banks);
 - LNV/VROM BOCI;
 - NGO's Conservation International, WWF.

6. Presentation of work plan to Dutch stakeholders

At the end of the workshop, a presentation was given of its outcome and recommendations to a number of invited Dutch stakeholders.

Stakeholders present were: Suzanne Vermeulen (LNV), Pieter Oomen (chair ICPBR), Claudia Jilesen (Plant Protection Service), Jan Bouwman (Syngenta), Martien Beek (Beek Advisory Services, beekeeper), Niels Louwaars (WUR manager BOCI programme).

Tjeerd Blacquière (project leader Dutch team) presented the results of the workshop and the proposed work plan. The following comments and suggestions were made:

- Give importance to risk management and formulate recommendations to registrars;
- Do take the sub-lethal effects of pesticide into account in the project;
- Include the private sector in the awareness raising campaigns;
- Private sector, including pesticide industry should be involved in this work;
- Ensure that this research leads to practical application and does not only result in testing of lots of different species;
- In the proposal do show the urgency of this type of work, as awareness of this problem and its urgency is not (always) present with potential funding agencies.

Annex 1 – Workshop programme

Sunday, 16th May

Welcome drinks (hotel)

Monday, 17th May

- Opening, introduction participants
- Importance of this workshop in relation to the Global Pollinator Initiative, FAO
- State of the art, Brazil
- State of the art, Kenya
- State of the art, the Netherlands

Tuesday, 18th May

- Aim of the project; what is the main focus; which are related issues?
- Identification of knowledge gaps
- Definition of research/work needed to close identified knowledge gaps
- Break out in country groups to define country specific work plans
- Visit to ecotoxicology laboratories at Alterra
- Buffet

Wednesday, 19th May

- Break out in country groups to define country specific work plans (continued)
- Presentation of work plans; identification of commonalities
- Commitment, responsibilities, how to source funding, how forward
- Presentation of work plan and way forward to Dutch stakeholders
- Drinks

Thursday, 20th May

- Excursion to greenhouse with bumblebee pollination in Westland
- Canal trip and lunch in Amsterdam

Annex 2 – Participants

Brazil		
Leticia Altafin leticia.altafin@agricultura.gov.br	Ministry of Agriculture, Livestock and Food Supply, Esplanado dos Ministérios, Bloco D BRASILIA, DF Tel: +55-61-32182668 Fax: +55-61-32255341 Mobile: +55-61-81450494	Pesticide regulator, environmental aspects
Roberta C. F. Nocelli roberta@cca.ufscar.br or robertanocelli@terra.com.br	Universidade Federal de São Carlos Rodovia Anhanguera, Km 174 P.O. Box 153 Zip Code 135600-900 ARARAS, São Paulo State Tel: +55 19 35432595 Fax: +55 19 3543 2602 Mobile: +55 19 81775062	Co-project Coordinator Brazil Bee expert
Márcia de F. Ribeiro marcia.ribeiro@cpatsa.embrapa.br	Embrapa Semiárido BR 428, Km 152, Zona Rural - Caixa Postal 23 PETROLINA, PE Tel: +87 3862-1711 r. 161 Fax: +87 3862-1744 Mobile: +87 9936-0061	Sub-coordinator focus crop melon
FAO		
Barbara Gemmill-Herren Barbara.Herren@fao.org	FAO Viale delle Terme di Caracalla 00153 ROME ITALY Tel: +39 0657056838 Mobile: +39 3467614680	Coordinator GEF/UNEP/FAO Global Pollination Project
Kenya		
Mary Gikungu mgikungu@yahoo.com or mgikungu@museums.or.ke	National Museums of Kenya P .O. Box 40658-00100 NAIROBI Tel: +254 20 374 2161/4 Fax: +254 20 3741424 Mobile: +254 722624691 or +254 721791373	Head, Centre for Bee Biology and Pollination Ecology Pollination and wild bee expert

John Kasina Kenya Agricultural Research Institute Principal Research Scientist/Economic P.O. Box 14733-00800 Entomologist jkasina@yahoo.com or **NAIROBI** kasina.j@gmail.com Tel: +254 202392710 Fax: 254 204442926 Mobile: +254 723375984 Gladys N. Maina Pest Control Products Board Managing Director/Secretary P.O. Box 13794-00800 Westlands Pesticide Board pcpboard@todays.co.ke or **NAIROBI** md@pcpb.or.ke Tel: +254 20 4446115/4450242, Fax: +254 20 4449072 Mobile: +254 724 656 778 njeri_gladys@yahoo.com Chris Odhiambo National Museums of Kenya UNEP/GEF/FAO Project Manager PO Box 40658 codhiambo@mpala.org 00100 NAIROBI Tel:+254 20 374 2161/4 or 374 2131/4 ext. 2340 Fax: +254 20 3741424 Mobile: +254 722-397 762 The Netherlands Tjeerd Blacquière Wageningen University & Research Bee expert Centre Bees@WUR tjeerd.blacquiere@wur.nl Plant Research International P.O. Box 69 6700 AB WAGENINGEN Tel: +31-317-481330 Bram Cornelissen Wageningen University & Research Bee expert Centre Bees@WUR bram.cornelissen@wur.nl Plant Research International P.O. Box 69 6700 AB WAGENINGEN

Irene Koomen Wageningen University & Research Centre

irene.koomen@wur.nl Centre for Development Innovation

P.O. Box 88

6700 AB WAGENINGEN Tel: +31-317-482986 Mobile: +31-6-22341127

Tel: +31-317-481280

Capacity

development and IPM expert

Wageningen University & Research Pesticide risk Ivo Roessink Centre analysis expert Alterra ivo.roessink@wur.nl P.O. Box 47 6700 AA WAGENINGEN Tel: +31-317-481692 Sjef van der Steen Wageningen University & Research Bee & pesticide risk Centre analysis expert Bees@WUR sjef.vandersteen@wur.nl Plant Research International P.O. Box 69 6700 AB WAGENINGEN Tel:+31-317-481331 Harold van der Valk Vissersdijk 14 Consultant pesticide 4251 ED WERKENDAM management & harold.vandervalk@planet.nl Tel:+31-183-500410 policy Bee & pesticide risk Ctgb Jacoba Wassenberg analysis expert Board for the Authorization of Plant Protection Products and Biocides jacoba.wassenberg@ctgb.nl P.O. Box 217 6700 AE WAGENINGEN Tel: +31-317-471810

Annex 3 – Problem analyses (results from three sub groups)

Problem analysis Group 1 (Muo, Roberta, Barbara, Sjef)

Problem: Lack of knowledge how pesticides impact wild pollinators

Causes: Lack of knowledge of how to test impacts of pesticides on other species of

bees

No monitoring programmes after registration

Lack of knowledge of ecology, phenology of pollinator life history

Pollination not part of IPM

Effect: Pesticides impact the ability of agro-ecosystems to sustain yields by

impacting pollinators

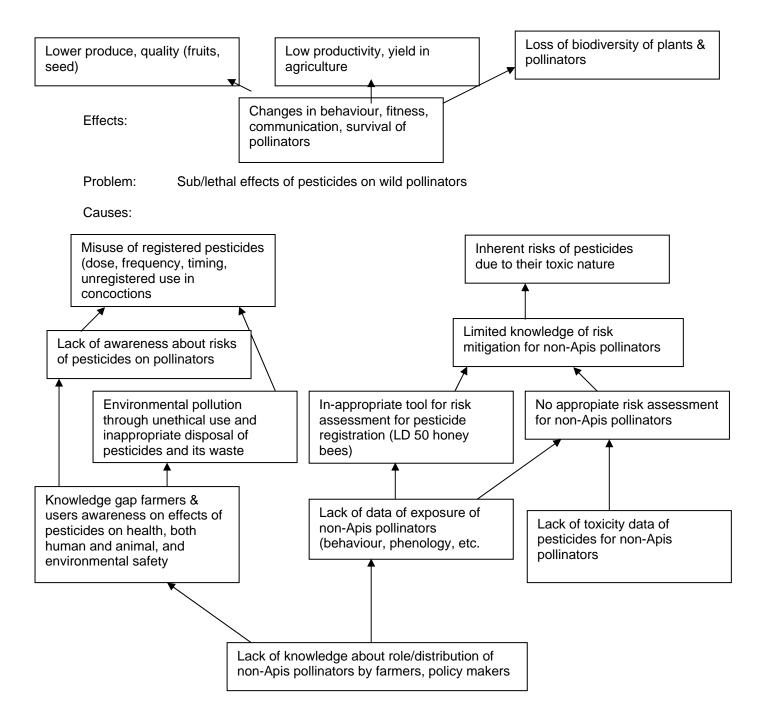
Comment: We believe that this is the effect but there is no evidence

Solutions: Comparative LD50 studies with Meliponini, *Xylocopa*, *Bombus* (short term)

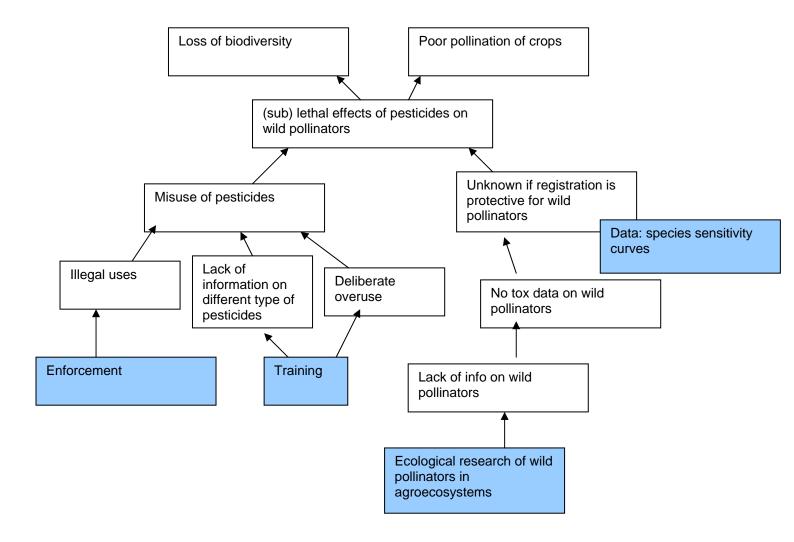
Comparative exposure levels in tomato in Brazil, Kenya & the NL (mid term)

Mitigation, farmer research (long term)

Problem analysis Group 2 (Gladys, Harold, Mary, Márcia)



Problem analysis Group 3 (Tjeerd, Leticia, Jacoba, Chris)



Blue = possible solutions