

Insecticidal activity of a PPP as a criterion to trigger laboratory studies with non-*Apis* bees? Make a BeeCision!

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Introduction

Over the last six years, the effects of plant protection products (PPP) on pollinators such as honeybees have come increasingly to the attention of both scientists and the general public. In 2013, under the new EU Regulation 1107/2009, the European Food Safety Agency (EFSA) published a preliminary new guidance document (GD) on risk assessment for pollinators. In addition to assessments on honeybees, the new GD requires acute and chronic risk assessments for adult bumble bees and solitary bees as well as chronic risk assessment of bee larvae development (see Figure 1). After a strong debate about the feasibility of the new GD (very complex, highly conservative) and due to the lack of validated test guidelines (in particular for non-*Apis* bees), the EU Commission published a roadmap (SANCO/10606/2014) for the step-wise implementation of the GD. According to the roadmap, acute contact and oral toxicity tests for bumble bees and acute contact toxicity tests for solitary bees are requested from January 2015 from which the GD enters into force. Acute oral toxicity tests for solitary bees will be implemented by January 2017. After more than two years later, the chronic oral toxicity tests and larvae toxicity tests for non-*Apis* bees are expected to be implemented. In the absence of the requested data, risk assessments for these species are based on honeybee toxicity endpoints. However, non-*Apis* risk assessments based on honeybee data sets are very conservative. PPPs therefore frequently fail the initial screening step and higher tier testing is automatically triggered. To bridge the time until suitable testing guidelines are available, RIFCON suggests the use of the BeeCision to assess the risk posed by non-insecticidal PPPs to non-*Apis* bees.

Material & Methods

Risk assessment screening steps for 20 herbicides and 20 fungicides were conducted on honeybees, bumble bees and solitary bees according to the new EFSA Guidance Document (EFSA, 2013). Each substance is currently approved for use in Europe and acute honeybee toxicity endpoints were obtained from data sets available to the public (e.g. EFSA Conclusion). In addition, standard Tier I risk assessments on the non-target arthropods (NTA) *Aphidius rhopalosiph* and *Typhlodromus pyri* were conducted (according to Candolfi *et al.*, 2001) to identify potential insecticidal activity of the active substances and formulated products. A decision scheme (BeeCision) was developed in order to more realistically assess the risk posed by non-insecticidal PPPs to bumble bees and solitary bees (see Figure 2). BeeCision reinstates the 'insecticidal activity' approach originally suggested in a previous draft version of the EFSA GD and triggers further tests on non-*Apis* species only when potential insecticidal activity is clearly demonstrated by honeybee and NTA risk assessment.

Results

Table 1: Results of pollinator risk assessment and non-target arthropods

Active substance	NTA (Tier I)	Screening honeybee				Insecticidal activity? ^A	Screening bumble bee ^B	Screening solitary bee ^B
		Active substance		Formulation				
		Contact	Oral	Contact	Oral			
Herbicides								
Acetic Acid	x	x	x	x	x	Yes	x	x
2,4-D	✓	✓	✓	✓	✓	No	x	x
Thiencarbazon-methyl	✓	✓	✓	✓	✓	No	x	x
Aminopyralid	✓	✓	✓	✓	✓	Yes	x	x
Trinexapac-ethyl	x	✓	✓	✓	✓	Yes	x	x
Quizalofop-P-ethyl	x	✓	✓	✓	✓	Yes	x	x
Imazaquin	✓	✓	✓	✓	✓	No	x	x
S-abscisic acid	✓	✓	✓	✓	✓	No	x	x
Terbutylazine	✓	✓	x	✓	✓	Yes	x	x
Quinmerac	✓	✓	✓	✓	✓	No	x	x
Flurochloridone	✓	✓	✓	✓	✓	No	x	x
Pinoxaden	x	✓	✓	✓	✓	Yes	x	x
Metazachlor	✓	✓	✓	✓	✓	No	x	x
Metamitron	✓	✓	✓	✓	✓	No	x	x
Fluroxypyr	✓	✓	✓	✓	✓	No	x	x
Diflufenican	✓	✓	✓	✓	✓	No	x	x
Dicamba	x	✓	✓	✓	✓	Yes	x	x
Clopyralid	✓	✓	✓	✓	✓	No	x	x
Chloridazon	✓	✓	✓	✓	✓	No	x	x
Chlormequat	✓	✓	✓	✓	✓	No	x	x
Fungicides								
Amisulbrom	✓	✓	✓	✓	✓	No	x	x
Azoxystrobin	✓	✓	✓	✓	✓	No	x	x
Boscalid	✓	✓	✓	✓	✓	No	x	x
Penthiopyrad	x	✓	✓	✓	✓	Yes	x	x
Dithianon	✓	x	✓	✓	✓	Yes	x	x
Epoxiconazole	✓	✓	✓	✓	✓	No	x	x
Fenpropimorph	x	✓	✓	✓	✓	Yes	x	x
Fludioxonil	✓	✓	✓	✓	✓	No	x	x
Fluxapyroxad	x	✓	✓	✓	✓	Yes	x	x
Kresoxim-methyl	✓	✓	✓	✓	✓	No	x	x
Mandipropamid	✓	✓	✓	✓	✓	No	x	x
Metrafenone	✓	✓	✓	✓	✓	No	x	x
Tebuconazole	x	✓	✓	✓	✓	Yes	x	x
Cyflufenamid	✓	✓	✓	✓	✓	No	x	x
Fosetyl	✓	✓	✓	✓	✓	No	x	x
Triadimenol	✓	✓	✓	✓	✓	No	x	x
Cymoxanil	✓	✓	✓	✓	✓	No	x	x
Dimoxystrobin	✓	✓	✓	✓	✓	No	x	x
Prochloraz	x	✓	✓	✓	✓	Yes	x	x
Benalaxyl-M	✓	✓	✓	✓	✓	No	x	x

✓ Risk acceptable x Risk not acceptable NTA = Non-target arthropods ^A based on NTA risk assessment or honeybee screening step of active substance or formulation
^B Risk assessment based on honeybee toxicity endpoints including a safety factor of 10 (details are provided in EFSA (2013))

All the tested herbicides and fungicides failed the initial screening step for bumble bees and solitary bees whereas most of the non-insecticidal substances pose no risk to honeybees. Nevertheless, risk assessments conducted on non-target arthropods (*Aphidius rhopalosiph* and *Typhlodromus pyri*) suggested that many of the herbicides and fungicides have little or no insecticidal activity. In particular, risk assessments for 13 of the herbicides and 14 of the fungicides suggested that these compounds do not pose a risk to either the standard arthropod species or honeybees. This indicates a low risk to all insects including pollinators. This argumentation is supported by the fact that for most species (which passed the risk assessment) the toxicity endpoints are 'greater than' values (e.g. LC₅₀ oral > 100 µg a.s./bee for fludioxonil). The actual toxicity is therefore likely to be lower than predicted by the toxicity tests. According to RIFCON's newly developed decision scheme BeeCision, additional bumble bee and solitary bee studies would be needed for only 7 of the herbicides and 6 fungicides.

Conclusion

As long as the new Guidance Document on risk assessment for pollinators is not fully implemented (see European Commission, 2014) or no full data set is available, non-target arthropods could be used as indicators of insecticidal activity. The BeeCision scheme thus provides a useful strategy to conduct a more relevant risk assessment for honeybees and other pollinators. Once reliable data on the acute and chronic toxicity of pesticides other than insecticides are available, further evaluation of BeeCision will be needed before this tool can be integrated into risk assessment schemes for non-*Apis* species.

Literature

Candolfi *et al.* (2001) 'Guidance Document on regulatory testing procedures for plant protection products with non-target arthropods' From the workshop, European Standard Characteristics of Non-target Arthropod Regulatory Testing (ESCORT 2) 21-23 March 2000.
EFSA (2013) EFSA Guidance Document on the risk assessment of plant protection products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees). EFSA Journal 2013;11(7):3295,
European Commission (2014) Implementation plan for the EFSA Guidance Document on the Risk Assessment of Plant Protection Products on Bees (*Apis mellifera*, *Bombus* spp. and solitary bees) SANCO 10606/2014, 16 May 2014

Figure 1: Data requirements based on the new EFSA GD

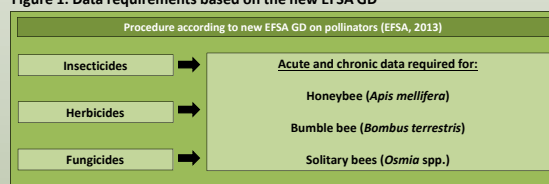


Figure 2: Proposed decision tree to evaluate the need for non-*Apis* toxicity tests

