The assessment of pesticide risk to bees: the work of the ICPBR 'Bee Protection Group'

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Abstract

The 10th Symposium of the International Commission for Plant-Bee Relationships (ICPBR) Bee Protection Group was held on 8-10 October 2008 in Bucharest, Romania. A major part of this meeting was given over to a revision of the EPPO guideline 170 and the associated risk assessment scheme, which forms the basis of regulatory evaluations for the effects of pesticides on honey bees in the EU. While the current EU risk assessment scheme is considered to be robust and effective, such revisions are considered appropriate as part of an ongoing process of review and appropriate development. The revision process was based on reports presented by three working groups that had been set up at the 9th Symposium of the Bee Protection Group (York, UK; 2005). The three groups had addressed the following issues: (1) higher tier testing (cage and field trials); (2) the risk to bees from the use of plant protection products through seed coating and soil applications (systemic effects); (3) the risk to honey bee brood (including *in vitro* larval testing methodology). These proceedings present the current proposals for the revised EPPO honeybee testing guidelines and risk assessment scheme. These will be subject to a final review before being submitted to EPPO and also to EFSA for consideration as part of the revision of the Terrestrial Ecotoxicology Guidance Document.

Keywords: risk assessment, honey bees, guidelines, revision

Introduction

The 10th Symposium of the International Commission for Plant-Bee Relationships (ICPBR) Bee Protection Group was held on 8-10 October 2008 in Bucharest, Romania. This group is the European expert forum addressing the risk of pesticides to bees, representing academia, regulators and industry. There were about 80 delegates from 15 European countries present at the meeting. A number of papers were presented, addressing a range of issues including test methodology, honey bee poisoning incidents and monitoring schemes, the risk to bees from insecticidal seed treatments and bumble bees. In particular, a major part of the meeting was given over to a revision of the European Plant Protection Organisation (EPPO) honey bee test guidelines and risk assessment scheme. This paper provides a brief introduction to the Bee Protection Group and provides the background to the work that was done in relation to the assessment of pesticide risk to honey bees.

EU Regulatory Risk Assessment

The ICPBR Bee Protection Group provides the technical input to the EPPO 170 guideline[1] and associated risk assessment scheme[2]. This in turn currently forms the basis of regulatory evaluations for the effects of pesticides on honey bees in the EU[3]. In addition, more recently, the EPPO 170 guideline has formed the basis of the OECD laboratory test guidelines for acute contact and oral toxicity to honey bees (OECD Guidelines Nos. 213 and 214 [4,5]).

The approach to honey bee risk assessment that has been developed has proved to be robust and effective but at the same time it is recognised that a continuing process of refinement and development is appropriate to ensure that the guidance is clear and responds to any concerns identified during use. Accordingly, a review was carried out in 1999 at the 7th symposium in Avignon, France[6] and this resulted in the current versions of the EPPO guideline 170 and the associated risk assessment scheme[1,2]. More recently, EPPO had asked the ICPBR Bee Protection Group to undertake a similar exercise at the 10th symposium in Bucharest.

Honey bee risk assessment scheme

Honey bees have been the subject of regulatory data requirements at the national level in the EU for more than 50 years. Initially, the assessment comprised toxicity classifications based on laboratory generated data but it soon became clear that in many cases this was not a good indicator of effects seen in the field. This resulted in the development of the hazard quotient, one of the first occasions there had been a consideration of the relationship between toxicity, as measured in simple laboratory assays, and exposure under field conditions[7]. This was subsequently incorporated into a sequential testing scheme [8] that forms the basis of the current approach to risk assessment for honey bees and other non-target groups.

The sequential risk assessment scheme incorporates different levels of testing into a stepwise procedure. This starts in the laboratory with the simple acute contact and oral toxicity tests and where appropriate is followed by testing with increasing levels of realism and complexity i.e. semi-field (cage) tests and full field studies. The assessment of the data produced by this testing is risk based and at Tier 1 this involves the use of the hazard quotient, the ratio between the application rate and the toxicity (LD_{50}) value. Based on a comparison of HQ values with the known risk to bees for registered compounds in the Netherlands, a threshold value was set at 50[8]. Below this level it is considered that there will be an acceptable risk to bees i.e. there will be no effects when plant protection products containing a particular compound are used under field conditions. HQ values greater than 50 indicate that there is a potential risk and that the significance of this cannot be ascertained without additional, higher tier data. This threshold value of 50 has been validated using incident scheme data from a number of EU countries and has been shown to provide an appropriate level of protection[9].

The higher tier testing incorporates increasing levels of realistic exposure into the testing. Thus, at the semi-field level free-flying colonies of bees are confined in mesh covered cages over plots of the test crop that is treated in a manner reflecting normal agricultural practice. In full field studies, honeybee colonies are placed adjacent to large plots of a test crop e.g. a standard attractive crop such as *Phacelia* or the crop relevant to the intended use of the plant protection product. In both cases, a range of assessments are carried out including mortality, behaviour of the bees on the crop (foraging activity) and at the hive and the health of the colony (including brood assessments). This more complex data set is inevitably difficult to interpret in terms of considering the significance of any effects seen as well as assessing the overall impact on colony performance and thus requires a degree of expert judgement.

In addition to the core scheme as outlined above, a number of additional aspects can be taken into account in the current honeybee risk assessment scheme. Thus, it may be appropriate to consider the duration of any residual toxicity e.g. when considering safe intervals before exposing colonies to treated crops. However, although test methodology is available none has been validated for regulatory use and at the last guideline revision[6] it was agreed that this should only be an optional requirement. Specific effects may be identified in the initial testing and investigated further e.g. repellency and synergism. Particular attention is paid to compounds with insect growth regulatory activity, with a specific test method available for assessing effects on bee brood[10]. In the final assessment, it may be necessary to impose risk mitigation measures to demonstrate acceptability and while general guidance is given on this, it is recognised that this must be implemented at the national level taking into account local conditions, agricultural practices etc.

Revision process

The Bee Protection Group is keen to promote national incident schemes and one reason for this is that they can identify issues arising from actual use that may require further consideration within the risk assessment process. While the current EU risk assessment scheme is considered to be robust and effective it is also recognised that a continuous process of review and appropriate development is necessary. This needs to be done in a considered way with the development of a consensus view amongst the expert representatives within the group. This allows any new information to be evaluated and its significance in relation to the risk for honeybees assessed. This is the approach that has been adopted by the Bee Protection Group in both the previous revision in 1999 and has been used in the current revision requested by EPPO.

The current revision process was based on reports presented by three working groups that had been set up at the previous meeting of the Bee Protection Group (in 2005 at the Central Science Laboratory, UK)[11]. These working groups are used to address in detail specific issues identified at the main meetings and then report back at the next symposium in order that their proposals can be discussed and a consensus view obtained. In this case the three groups had addressed: (1) higher tier testing (cage and field trials); (2) the risk to bees from the use of plant protection products through seed coating and soil applications (systemic effects); (3) the risk to honey bee brood (including *in vitro* larval testing methodology).

1. Concerns had been raised that systemic activity is not adequately addressed by the conventional regulatory risk assessment for foliar applied pesticides. This relates to the exposure of bees from soil-applied pesticides (seed treatments, etc) that move through a plant into flowers, nectaries and aphid honeydew. While this issue is considered to some extent within the current EU risk assessment scheme, it was considered that its potential significance might require a separate-harmonised risk assessment scheme. This would comprise a similar sequential or step-wise design that would identify the circumstances in which information on systemic activity is required and determine how it should be used within an assessment of risk, including identifying appropriate trigger values for higher tier assessment.

2. Currently, EU regulatory requirements for honey bee brood are addressed by the acute toxicity testing in adults together with the initial risk assessment using the hazard quotient. Where higher tier testing is triggered, brood effects are taken into account according to the semi-field and field test guidelines. Only in the case of insect growth regulatory compounds (IGRs) are there specific testing requirements, which currently follow the EPPO guideline[10]. However, this methodology has never been validated and there have been reported problems with its reproducibility. A new *in vitro* test is being developed[12], which assesses toxicity to bee brood primarily via the oral route of exposure. Consideration has been given to incorporating the toxicity data produced into the risk assessment scheme, taking into account brood exposure and again identifying appropriate trigger values for higher tier assessment.

3. In addition, a working group was set up to review the current guidance for higher tier testing i.e. semi-field (cage) test and full field studies. The aim of the EPPO 170 test guideline is to provide sufficient guidance to allow the studies to be conducted without being too prescriptive. It was considered that this should be looked at again in the light of experience obtained with the working of this guideline over many years. In particular, it was recognised that developments in the other working groups highlighted the fact that higher tier testing might be triggered via a number of different routes e.g. adult toxicity, brood effects, systemic activity etc. Accordingly, it is important that the guidance is sufficiently detailed and flexible to address the different emphasis that each requires.

After receiving presentations from the working groups, a plenary session of the 10th Symposium discussed the proposals in detail in order that the consensus view of the meeting could be obtained. The resultant reports of the working groups are presented in this volume[13, 14, 15]. This will now be taken forward into specific proposals for revised test and risk assessment guidelines by the EPPO honey bee sub-group during 2009.

Conclusions

This paper presents the current situation with regards to the proposed revision of the honeybee testing guidelines and risk assessment scheme. However, it was agreed at the 10th Symposium that revised versions of the Bee Protection Group's proposals, incorporating the comments received at the meeting as appropriate, would be circulated to all delegates for a final review. The Bee Protection Group proposal for the revision of the honey bee test guidelines and risk assessment scheme will then be submitted to EPPO during 2009. They will also be sent to the European Food Standards Agency (EFSA) for consideration as part of the revision of the Terrestrial Ecotoxicology Guidance Document.

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