

Selectivity list of plant protection products on beneficial arthropods in potato

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Abstract: Beneficial arthropods, as aphid predators and parasites, are the key of an effective aphid control in potato. However, these insects are exposed to plant protection products applied during the season, especially fungicides used to control the late blight and insecticides used to control aphids and the Colorado beetle. The conservation of natural enemies' population by the use of products that are selective for them is required in the context of IPM.

From 1996 to 2002, a research program has been initiated in order to develop tools to establish pesticide selectivity lists. These tools were first used to build pesticide selectivity list in Potato (2004) and field produced vegetables (2006). The list used in potato are based on ecotoxicology trials performed on the main aphid natural enemy found in potato in Belgium: the parasitic wasp *Aphidius rhopalosiphi* (De Stefani-Perez) (Hym.; Aphidiidae) and larvae of the predators *Adalia bipunctata* L. (Col.; Coccinellidae) and *Episyrphus balteatus* (Degeer) (Dipt.; Syrphidae). The results are crossed with the phenology of these beneficial to deliver a selectivity list easy to use to the farmers, with products rated from green (selective) to red (non-selective) by period of application.

The lists are diffused to the farmers yearly by the organisms in charge of the advisory systems and also used for several guidance document (IPM, specific labels, etc...). They are regularly update to include all changes in the list of product available, as compounds that are newly registered and old one that are removed. The last update (2012) is presented in this poster, with a short presentation of the methodology.

Key words: Selectivity list, Aphidiidae, ladybird, hoverfly, *Aphidius rhopalosiphi*, *Adalia bipunctata*, *Episyrphus balteatus*, potato, insecticide, fungicide, potato aphids, plant protection products

Introduction

Non selective pesticides are known to often increase pest problems instead of controlling them. The suppression of beneficial arthropods often lead to pest outbreaks and secondary pest development, (Ripper, 1956; Pimentel, 1961; Besemer, 1964; Adams & Drew, 1965; Nanne & Radcliffe, 1971; Vickerman & Sunderland, 1977; Brown, 1978; Shires, 1985; Sotherton *et al.*, 1987; Sotherton & Moreby, 1988; Borgemeister & Poehling, 1989; Croft & Slone, 1998, Lagnaoui & Radcliffe, 1998).

Aphids and Colorado beetle are the main insect pest problems encountered in ware potato in Belgium. If Colorado beetle can only be controlled by insecticides, aphids are most of the times regulated by natural enemies, as parasitic hymenoptera, mainly Aphidiidae and aphidophagous predators, as hoverflies, ladybirds and in a lesser extend lacewings (Jansen, 2002; Jansen & Warnier, 2004; Jansen, 2005). No insecticides are recommended in these situations and during the last 20 years, insecticides to control aphids were needed in potato on about 1 field out of 8.

In order to maintain this biological control, the use of PPP selective for beneficial arthropods was recommended. A first document called "selectivity list", that gave all relevant

info to the farmers was established in 2005 (Hautier *et al.*, 2006). These lists were updated every 2-3 years to add new registered compound or delete old product that were removed from the market. The lists updated in 2012 are presented below.

Material and methods

Selectivity were build on pesticides acute toxicity towards 3 selected natural enemies, considered as key beneficial arthropods for aphid control: a parasitic hymenoptera species (*Aphidius rhopalosiphi*) De Stefani-Perez (Hym.; Aphidiidae) a ladybird (*Adalia bipunctata* (L.) (Col.; Coccinellidae) and a syrphid [*Episyrphus balteatus* (De Geer) (Dipt.; Syrphidae)]. The hymenoptera was tested as adult and both predators as larvae. The products were first tested on glass plates and then, for product that were not harmless, on plants. According to the toxicity and the occurrence of these different beneficial groups observed in potatoes, the lists were established, rating products as harmless, slightly harmful, moderately harmful or harmful. The details of the test methods are given in a previous publication (Hautier *et al.*, 2006). Compared to the lists published in 2006, 5 new fungicides or fungicides associations (Azoxystrobin, Benthiavalicarb + Mancozeb, Boscalid + Pyraclostrobin, Fluopicolide + propamocarb, Mandipropamide) and 10 insecticides (Acetamiprid, Beta-cyfluthrin, Flonicamide, Natural pyrethrin extracts + PBO and + rapeseed oil, Rynaxypyr, Spinosad, Tau-fluvalinate, Thiacloprid and Thiametoxam) were added.

Results and discussion

The final results of the toxicity test and the rating for the different periods established on basis of the occurrence of the beneficial are listed in Table 1 (fungicides) and 2 (insecticides). These results are including both products previously tested and new products, indicated in bold.

Most of the fungicides used in potato were harmless for all beneficial tested and rated as harmless for all the growing season. The results obtained with insecticides were however more diversified with products belonging to the four categories. Several new compounds, including all neonicotinoid products (acetamiprid, Thiacloprid and Thiametoxam) were harmful at all periods, while other ones (e.g. Spinosad, Flonicamid, Rynaxypyr) were harmless, at least at one of the two main activity period of beneficial identified.

The consequence of these new records is that now harmless products are now available both for aphid (flonicamid, pymetrozine) and for Colorado beetle control (Spinosad, Rynaxypyr).

Conclusions

The results obtained in this study show that it is possible to control pest and disease with products that are selective towards the main aphid natural enemies, during all the periods where these beneficial insects are active in the field. Fungicide applications for late blight control are not a problem for selectivity and it is possible, by avoiding the use of several insecticides at specific periods, to maintain aphid natural enemy activity. These selectivity lists can help the farmers to choose the product to spray; and they can also complete the information given by potato advisory systems for aphid control.

Table 1. Selectivity lists of fungicides used in potato according to their toxicity towards main aphid natural enemies. 1 – Harmless, 2 – slightly harmful, 3 – moderately harmful, 4 – harmful, X – not registered at this period. New products are in bold.

	Periods			
	I (-10/06) No exposure	II (10-30/06) <i>Aphidius</i> tests	III (1-31/07) <i>Episyrphus</i> + <i>Adalia</i> tests	IV (1/08-..) No exposure
Azoxystrobine	1	1	1	1
Benalaxyl + Mancozeb	1	1	1	1
Benthiavdicarb + Mancozeb	1	1	1	1
Boscalid + Pyraclostrobine	1	1	1	1
Chlorothalonil	1	1	1	1
Chlorothalonil + Propamocarb	1	1	1	1
Copper hydroxide	1	1	1	1
Copper oxychlorid	1	1	1	1
Copper sulfate	1	1	1	1
Cyazofamide	1	1	1	1
Cymoxanil + Famoxadone	1	1	1	1
Cymoxanil + Mancozeb	1	1	1	1
Cymoxanil + Metiram	1	1	1	1
Cymoxanil + Propamocarb	1	1	1	1
Dimetomorph + Mancozeb	1	1	1	1
Fenamidone+ Mancozeb	1	X	1	1
Fluazinam	1	1	1	1
Fluopicolide + propamocarb	1	1	1	1
Mancozeb	1	1	1	1
Mancozeb + Zoxamide	1	1	1	1
Mandipropamid	1	1	1	1
Maneb	1	1	1	1
Metalaxyl-M + Fluazinam	X	1	1	X
Metalaxyl-M + Mancozeb	X	1	1	X

Table 2. Selectivity lists of insecticides used in potato according to their toxicity towards main aphid natural enemies. 1 – Harmless, 2 – slightly harmful, 3 – moderately harmful, 4 – harmful, X – not registered at this period. New products are in bold.

	Periods			
	I (-10/06) No exposure	II (10-30/06) <i>Aphidius</i> tests	III (1-31/07) <i>Episyrphus</i> + <i>Adalia</i> tests	IV (1/08-..) No exposure
Acetamiprid	-	4	3	-
Alpha-cypermethrin	-	2	2	-
Beta-cyfluthrin	-	2	4	-
Cypermethrin	-	1	4	-
Deltamethrin	-	3	4	-
Esfenvalerate	-	1	2	-
Flonicamide	-	1	1	-
Lambda-Cyhalothrin	-	1	2	-
Lambda-cyhalothrin + Pirimicarb	-	1	4	-
Pirimicarb	-	1	2	-
Pymetrozin	-	1	1	-
Pyrethrins (+ PBO)	-	4	3	-
Pyrethrins (+rapeseed oil)	-	4	3	-
Rynaxypyr	-	1	1	-
Spinosad	-	3	1	-
Tau-Fluvalinate	-	1	2	-
Thiacloprid	-	4	4	-
Thiametoxam	-	4	4	-
Zeta-cypermethrin	-	1	2	-

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