

## PROTECTION POSSIBILITIES OF ORGANIC CROPS AGAINST INSECT PESTS IN THE EUROPEAN UNION

### Summary

Only products containing substances listed in the Regulations (EC) No 889/2008 and 354/2014 are permitted in the protection of organic crops from pests. Despite the common list of active substances and schemes of qualifying products for use in organic farming, availability of measures to protect organic farming in the Member States varies widely. Obtaining information concerning the list of plant protection products qualified for use in organic farming was possible only for 12 Member States. Among the countries, the biggest number of insecticides to protect organic crops has been approved in Italy, Germany and France. The lowest number has been noted in Slovakia and Poland. Italy has the broadest protection capacity for each group of organic farming: agricultural, vegetable, fruit and ornamental. Active substances most frequently registered in the products approved for use in organic farming are: microorganisms, natural pyrethrins, rapeseed and paraffin oils. Differences in the availability of ways to protect organic farming in the Member States hinder equal competition in the common market.

**Key words:** organic farming, plant protection, availability, insecticides, protection against pests, the European Union

## MOŻLIWOŚCI OCHRONY UPRAW EKOLOGICZNYCH PRZED SZKODNIKAMI W UNII EUROPEJSKIEJ

### Streszczenie

Do ochrony upraw ekologicznych przed szkodnikami dopuszczone są tylko środki zawierające substancje wymienione w Rozporządzeniach Komisji (WE) nr 889/2008 oraz 354/2014. Mimo wspólnej listy substancji aktywnych systemy kwalifikowania preparatów do stosowania w rolnictwie ekologicznym oraz dostępność środków do ochrony upraw ekologicznych w poszczególnych państwach członkowskich są bardzo zróżnicowane. Uzyskanie informacji dotyczących listy środków ochrony roślin zakwalifikowanych do stosowania w rolnictwie ekologicznym było możliwe tylko dla 12 państw członkowskich. Wśród tych państw najwięcej insektycydów do ochrony ekologicznych dopuszczonych jest we Włoszech, Niemczech oraz Francji. Najmniej na Słowacji oraz w Polsce. Włochy posiadają także najszersze możliwości ochrony dla każdej grupy upraw ekologicznych: rolniczych warzywniczych, sadowniczych i ozdobnych. Substancje aktywne najczęściej rejestrowane w środkach dopuszczonych do stosowania w rolnictwie ekologicznym to mikroorganizmy, naturalne pyretryny, olej rzepakowy i parafinowy. Różnice w dostępności możliwości ochrony upraw ekologicznych w poszczególnych państwach członkowskich utrudniają równorzędną konkurencję na wspólnym rynku.

**Słowa kluczowe:** rolnictwo ekologiczne, środki ochrony roślin, dostępność, insektycydy, ochrona przed szkodnikami szkodników, Unia Europejska

### 1. Background and purpose of the study

In 2013, the European Union had close to 260 thousand organic farms with a total acreage of over 9.5 million hectares [1, 2]. Many harmful organisms threaten organic crops, as well as other crops. Regulations allow for the use of certain plant protection products to reduce the number of these organisms. In organic farming only active substances listed in the Regulations (EC) No 889/2008 and 354/2014 can be used [3, 4]. These provisions are common across the European Union, but despite this the availability of plant protection products in the various Member States differs quite significantly [5, 6]. It results from the fact that individual Member States have different climatic conditions, different crops, and a separate system of qualification of plant protection products for use in organic farming.

The aim of the study was to compare the ability to protect organic crops from insect pests in the Member States of the European Union.

### 2. Material and methods

An overview of lists of products to protect organic farming in the European Union was carried out in 2015. For the analysis the lists of products approved for organic farming protection in 12 European Union Member States: Belgium, Croatia, Czech Republic, France, Germany, Great Britain, Hungary, Italy, Luxembourg, Poland, Slovakia and Sweden were used [7-19]. In the remaining 16 Member States either there were no official lists recorded of protection products designed for organic farming (Denmark, Estonia, Greece, the Netherlands, Ireland, Latvia and Romania), or obtaining information about such lists was very difficult (e.g. Spain and Portugal). Material for the study comes from the official websites dedicated to organic farming within the Member States. We analysed all the insecticides approved for use in organic farming. Based on the labels of the products, protected crop species were identified. The crops were then divided into four groups: agricultural, vegetable, fruit and ornamental.

### 3. Results and discussion

Collective data on active substances of insecticides approved for use in organic farming in the 12 analysed Member States is presented in Table 1.

The majority of insecticides approved for use in organic farming are in Italy (166) and Germany (111). The minority are in Slovakia (4) and Poland (8). The active substances contained in these plant protection products can be divided into several groups: micro-organisms (bacteria, viruses and fungi), substances of vegetable or animal origin, substances produced by microorganisms, substances used in traps and dispensers, other substances used in traditional ways and other substances unclassified to any of the preceding groups.

Sweden (42), Italy (42) and France (31) have the most insecticides containing microorganisms to protect organic crops. Slovakia (2), Luxembourg (2) and Poland (3) have the least. Among the substances of vegetable or animal origin, the regulations single out azadirachtin, orange oil, rapeseed oil, garlic extract, natural pyrethrins, and wax. The majority of the plant protection products in this group contains rapeseed oil and natural pyrethrins. Spinosad is the most popular substance produced by microorganisms and it is contained in a number of approved insecticides almost throughout the entire European Union. Pheromones and pyrethroids are among the group of substances used in traps and dispensers. Five countries have products containing pheromones that are used, among other purposes, to lure insects into traps. Among the group of pyrethroids, it is permitted to use only deltamethrin (insecticides in Croatia and Italy) and lambda-cyhalothrin (in Italy). Other substances used in organic farming include copper compounds (in the case of insecticides as an adjunct in mixtures with paraffin oil), sulphur (either alone or in a mixture with potassium salt as an adjunct), paraffin oil, potassium salt of fatty acids, calcium and soft soap. Kaolin, maltodextrin, crude oil and potassium bicarbonate belong to the group of other, unclassified substances.

Table 2 shows the number of insecticides depending on the extent of protected crop species. These species were divided into four groups according to the application. Among the agricultural species the plant protection product labelling showed: cotton, sugar and fodder beet, hop, clover, corn, alfalfa, field pea, leguminous field plant, rice, rape, sunflower, soya, sorgo, grass fodder, tobacco, cereals (wheat, barley, oat, rye) and potato. The most insecticides to protect crops can be found in Italy (90), and the least in Poland (2) and Slovakia (3).

Among the vegetable species protection included: aubergine, basil, beetroot leaves, broadbean, broccoli, cabbage turnip, Brussel sprout, beetroot, onion, horseradish, zucchini, salad chicory, radish, garlic, small onion bulb, pumpkin, endive, escarole, tarragon, bean, green beans, charlock, mushrooms, feathered, cauliflower, kohlrabi, common cabbage, Chinese cabbage, savoy cabbage, artichoke, cardamom, caraway, coriander, dill, fennel, garden lovage, sweet marjoram, carrot, common balm, mint, cucumber, oregano, pak choi, pepper, parsnip, patisona, pepino, parsley, tomato, leek, rhubarb, lamb's lettuce, rosemary, rucola, vegetable turnip, bitter cress and other sprouts, small radish, lettuce, celeriac, black salsify, eshalot, common sage, chive, garden asparagus, spinach, topinambur, thyme and pea. Most plant protection products

approved for the protection of vegetables can be found in Italy (92) and Germany (54), and the least in Poland (2) and Slovakia (3).

Among organic crops, orchard species occupy an important place, often mentioned in the labelling of the following plant protection products: citrus fruit (bergamot, lemon, grapefruit, clementine, lime, mandarin, orange, pomelo), berries (highbush blueberry, berry, blackberry, raspberry, tayberry, gooseberry, cranberry, currant), stone fruit (peach, sweet cherry, mirabelle, apricot, nectarine, plum, sour cherry), pome fruit (pear, apple, quince, *Chaenomeles*), actinidia, water-melon, cedar, olive, pomegranate, *Diospyros kaki*, cantaloupe, chestnut, kumquat, hazel, melon, almond tree, common medlar, walnut, stone pine, *Pouteria*, strawberry and grape. Italy (131) and Germany (79) dominate in terms of the number of insecticides for the protection of ecological orchards. Few products for this group of crops were recorded in Slovakia (1) and Poland (2). The group of ornamental plants grown organically includes most often trees and shrubs (poplar, oleander, rose, azalea, hortensia, rhodies) and conifer (spruce, larch, yew), flowering (chrysanthemum, carnation, begonia, pelargonium, gerbera), house plant (rubber plant, dracaena, philodendron, fern, mother-in-law's-tongue, spathe flower, dumbcane, flamingo flower, croton, *Bromelia*), balcony flowers, lawn and golf course, park and public gardens as well as greenhouses and nursery. 139 insecticides for protection of ornamental plants are authorised in Italy and 89 in Germany. Slovakia has only one and Poland 2. The labels often do not have any definite crop varieties, and they are described in very general terms, e.g. different kinds of vegetables, orchards, ornamental plants and flowers or agricultural plants. Such a system helps to expand the scope of application of the insecticides.

This analysis allowed for the conclusion that insecticides qualified for the protection of organic farming in the European Union contain very diverse active substances. Most products contain microorganisms, natural pyrethrins, rapeseed and paraffin oil. There are also registered products containing more than one active substance, e.g. azadirachtin + rapeseed oil (1 product), ethanol + tallow + rosin + hematite iron (III) + wax (1 product), ethoxylated fatty alcohols + lime + paraffin oil (1 product), fatty acids + potassium salt (8 products), paraffin oil + limestone (2 products), paraffin oil + copper compounds (2 products), paraffin oil + sulphur + copper oxychloride (1 product), rapeseed oil + pyrethrins (22 products), potassium + sulphur (2 products).

From the perspective of the entire European Union, protection of all economically important crop species is possible. However, you may notice clear differences in the availability of insecticides in different Member States. These differences are mainly due to climate conditions and typical crops. Most products can be found in countries with large areas of organic farming, but there are also exceptions such as Poland. Although it is ranked 5th in the European Union when it comes to the surface acreage of organic farming, it has only 8 registered insecticides. On the basis of the analysis of labels of the plant protection products approved for use in organic farming (the material is very comprehensive and is not presented in the tables) the following observations can be formulated in summarising the availability of plant protection products in the Member States:

Table 1. List of active substances in insecticides approved for use in organic farming in the European Union

Tab. 1 Lista substancji czynnych insektycydów dopuszczonych do stosowania w rolnictwie ekologicznym w Unii Europejskiej

Biologically active substances	Insecticides number											
	Belgium	Croatia	Czech Republic	France	Germany	Hungary	Italy	Luxembourg	Poland	Slovakia	Sweden	United Kingdom
Microorganisms (bacteria, viruses, fungi)*	13	6	4	32	12	17	42	2	3	2	42	7
Azadirachtin	1	-	1	-	4	-	9	1	-	1	-	-
Azadirachtin, rape seed oil	-	-	-	-	1	-	-	-	-	-	-	-
Deltamethrin	-	1	-	-	-	-	4	-	-	-	-	-
Ethanol, tallow, rosin, iron (III) oxide (hematite), wax	-	-	-	-	-	1	-	-	-	-	-	-
Ethoxylated fatty alcohols, calcium polysulfide, paraffin oil	-	-	-	-	-	1	-	-	-	-	-	-
Fatty acids	-	-	-	-	-	-	-	-	-	-	-	2
Fatty acids and unsaturated potassium salts	-	-	3	2	8	-	2	3	-	-	-	-
Garlic extract	-	-	-	-	-	-	-	-	-	-	-	2
Kaolin	-	-	-	7	-	-	-	-	-	-	-	-
Lambda-cyhalothrin	-	-	-	-	-	-	2	-	-	-	-	-
Maltodextrin	-	-	-	-	-	-	-	-	-	-	-	3
Orange oil	1	-	-	2	-	-	-	-	-	-	-	-
Paraffin oil	7	2	-	5	11	3	45	4	2	-	-	-
Paraffin oil, calcium	-	-	-	-	-	2	-	-	-	-	-	-
Paraffin oil, copper compounds	-	2	-	-	-	-	-	-	-	-	-	-
Paraffin oil, sulphur, copper oxychloride	-	-	-	-	-	1	-	-	-	-	-	-
Pheromone	6	-	4	-	5	-	-	2	1	-	-	-
Potassium hydrogen carbonate	1	-	-	-	-	-	3	-	1	-	-	-
Potassium salt	6	-	-	-	-	-	-	-	-	-	-	-
Potassium salt, sulphur	2	-	-	-	-	-	-	-	-	-	-	-
Pyrethrins	6	-	1	14	23	4	56	1	-	-	-	12
Rape seed oil	4	-	-	5	23	1	-	2	-	-	-	-
Rape seed oil, pyrethrins	2	-	3	2	16	-	-	-	-	-	1	-
Spinosad	4	2	8	5	3	2	3	1	1	1	1	-
Sulphur	1	-	-	-	5	-	-	-	-	-	-	-
Tall oil pitch	-	-	-	8	-	-	-	-	-	-	-	-
<b>TOTAL</b>	<b>54</b>	<b>13</b>	<b>24</b>	<b>82</b>	<b>111</b>	<b>32</b>	<b>166</b>	<b>16</b>	<b>8</b>	<b>4</b>	<b>44</b>	<b>26</b>

\* *Adoxophyes orana* Granulosis Virus, *Amblyseius andersoni*, *Amblyseius californicus*, *Amblyseius degenerans*, *Phytoseiulus macropilis*, *Phytoseiulus persimilis*, *Phytoseiulus sp.*, *Amblyseius cucumeris*, *Amblydromalus ibonicus*, *Phytoseiulus*, *Phytoseiulus robustulus*, *Hypoaspis aculeifer*, *Ampelomyces quisqualis*, *Aphidius colemani*, *Aphidius ervi*, *Aphidius aphidomyza*, *Aureobasidium pullulans* szczep DSM, *Bacillus firmus* szczep I-1582, *Bacillus thuringiensis*, *Bacillus thuringiensis* subsp. *auzawa*, *Bacillus thuringiensis* subsp. *kurstaki*, *Beauveria bassiana*, *Beauveria bassiana*, *Chrysoperla carnea*, *Coccophagus lycimnia*, *Coniothyrium minutum*, *Cyrtolaelaps montivivax*, *Adalia bipunctata*, *Delphastus catalinae*, *Cydia pomonella* Granulosis Virus, *Dacnusa sibirica*, *Diglyphus isaea*, *Encarsia citrina*, *Encarsia formosa*, *Ephestia kuehniella*, *Macrolophus pygmaeus*, *Orius laevigatus*, *Nesidiocoris tenuis*, *Eratmoceris eremicus*, *Trichogramma brassicae*, *Aphelinus abdominalis*, *Coccidoxenoides permixtus*, *Frankliniella thrips* vespiformis, *Gliocladium catenulatum* J 1446, *Helicoverpa armigera* Nucleopolyhedrovirus, *Heterorhabditis bacteriophora*, *Lecanicillium muscarium*, *Leptomastix dactylopii*, *Eretmocerus eremicus*, *Aphelinus abdominalis*, *Trichogramma achaeae*, *Macrolophus californicus*, *Metarhizium anisopliae*, *Microterys nietheri*, *Neoseiulus californicus*, *Neoseiulus cucumeris*, *Orius majusculus*, *Faeniliomyces fumosoroseus* var. *FE 9901*, *Faeniliomyces fumosoroseus* var. *Apoka*, *Faeniliomyces filicinus*, *Phasmarhabditis hermaphrodita*, *Steinernema feltiae*, *Pseudomonas chlororaphis* souche MIA 342, *Spodoptera litoralis* Nucleopolyhedrovirus, *Steinernema carpocapsae*, *Trichoderma asperellum*-TV1, *Trichoderma atroviride* 11237, *Trichoderma harzianum*, *Typhlodromips swirskii*

Source: own study / Źródło: opracowanie własne

1. In terms of availability of insecticides, the most favourable situation is in Italy and Sweden. In Italy, the range of registrations of various products recommended for use in organic farming covers all the major agricultural, vegetable, fruit and ornamental species. In Sweden there are fewer insecticides, but their labels have a vast scope of use (agricultural species, vegetable species, fruit trees, ornamental plants, varieties grown under cover); thanks to which, protection of the majority of crop species is possible.

2. In each of the remaining analysed countries there is a lack of insecticide protection for some applications:

- most countries, including Belgium, Luxembourg, Croatia, the Czech Republic, the Slovak Republic, Germany, Poland and the UK do not have the products to protect many agricultural species including cereals
- Croatia also lacks products to protect organically grown root vegetables, legumes, cucurbits and herbs.
- in the Czech Republic it is impossible to protect the majority of important species: vegetables (kohlrabi, broccoli, cauliflower, parsley, celery, garlic, herbs, spices) and fruit (pear, apricot, cherry, hazel, gooseberry, cranberry, blueberry).
- in the Slovak Republic there is a problem concerning the protection of celery, garlic, species of legumes, berries, walnut or hazelnut, perennials and ornamental shrubs and herbaceous species.
- in Poland there is a problem with the protection of some species of vegetables (peppers, cabbage, leafy and root species) and fruit (stone fruits, grapes)
- the UK does not have the plant protection products for sustaining ecological plantations of herbs, vegetables, onion and celery.
- Hungary lacks the plant protection products to protect species of root vegetable, eggplant, zucchini, species of legumes and leafy vegetables.

Gaps in the availability of insecticides that can be used in organic agriculture are a problem for farmers, as these conditions hinder ecological agricultural production and competition in the common market with farmers from other Member States.

#### 4. Conclusions

1. It can be noticed that there are significant differences in the availability of insecticides in different Member States. The biggest number of insecticides to protect organic crops is approved in Italy, Germany and France. The least in Slovakia and Poland. Italy has the broadest protection capacity for each group of organic farming: agricultural, vegetable, fruit and ornamental.

2. The number of available preparations is generally higher in countries with a greater area of organic farming. One exception is Poland, where despite a sizeable acreage of ecological farms, only 8 insecticides are available.

3. Insecticides qualified for the protection of organic farming in the European Union contain different active substances. Most plant protection products contain microorganisms, natural pyrethrins, rapeseed and paraffin oils. There are also registered formulations containing more than one active substance.

Table 2. Number of insecticides to protect individual crop groups in the European Union

Tab. 2. Liczba insektycydów dostępnych do ochrony poszczególnych grup upraw w Unii Europejskiej

Crops	Total number of approved insecticides*											
	Belgium	Croatia	Czech Republic	France	Germany	Hungary	Italy	Luxembourg	Poland	Slovakia	Sweden	United Kingdom
Agriculture crops	19	4	6	25	17	5	90	6	2	3	4	15
Vegetable plants	26	4	8	37	54	17	92	9	2	3	6	21
Fruit trees and shrubs	40	11	15	61	79	22	131	12	6	4	13	23
Ornamental plants	34	5	11	42	89	19	139	14	2	1	11	20

\* One product may be registered to protect more than one crop group

Source: own study / Źródło: opracowanie własne

4. Differences in the availability of ways to protect organic farming in the Member States hinder equal competition in the common market.

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