

## PM 6/3 (5) Biological control agents safely used in the EPPO region

**Specific scope:** The purpose of this Standard is to provide a list of biological control agents (BCAs<sup>1</sup>) used in the EPPO region with no adverse effects or with acceptable adverse effects. This list is aimed to facilitate decision making on the import and release of BCAs within EPPO countries.

**Specific approval and amendments:** First approved in September 2001. Revisions 2–4 included amendments to the Appendices. Revision 5 approved in 2021–09. Revisions of the list are not subject to approval by the EPPO Council but are proposed by the joint EPPO/IOBC Panel on Biological Control Agents and approved by the EPPO Working Party for Phytosanitary Regulations.

Authors and contributors are given in the Acknowledgements section.

### 1 | INTRODUCTION

EPPO Standard PM 6/1 *First import of exotic biological control agents for research under contained conditions* (EPPO, 1999) provides guidelines to national authorities on the first import of non-indigenous BCAs for research under contained conditions. EPPO Standard PM 6/2 (3) *Import and release of non-indigenous biological control agents* (EPPO, 2014) provides guidelines to national authorities on the application procedures to release non-indigenous BCAs into the environment. This standard also includes the preparation of a dossier by the applicant for evaluation by the national competent authority. To help evaluate the information in the dossier, EPPO has developed a decision support scheme in Standard PM 6/4 *Decision support scheme for import and release of biological control agents of plant pests*. This scheme can be used by a national competent authority to assess whether to authorize the import and release of a non-indigenous BCA.

There is extensive knowledge and experience on the safety and practical use of introduced and indigenous BCAs in a number of EPPO countries. This knowledge and experience may be used to simplify procedures for approving the release of these BCAs in countries outside their current distribution. EPPO has therefore developed a list of BCAs used in the EPPO region to support EPPO member countries when making decisions concerning the release of BCAs. This list is updated annually. It is divided into three parts: commercially or officially used BCAs (Appendix 1), successfully established classical BCAs (Appendix 2) and BCAs formerly listed (in Appendices 1 or 2) but moved because they no longer meet the criteria for inclusion in the first two appendices (Appendix 3). The first two appendices constitute the EPPO Positive List. The addition of a BCA to the Positive List is made on the basis of current knowledge and expert judgement of the Joint EPPO/IOBC Panel on Biological Control Agents. The list is subject to regular review and may change based on new information whereby a listed BCA may no longer fulfil the criteria and is moved to Appendix 3.

Transfer of a BCA from the Positive List to Appendix 3 does not mean that it is not recommended for use but only that it should be assessed before release (e.g. using EPPO PM 6/4 *Decision support scheme for import and release of biological control agents of plant pests*).

### 2 | CRITERIA FOR ADDITION TO THE POSITIVE LIST

The Positive List specifies indigenous, introduced and established BCAs<sup>2</sup> which are recognized by the Joint EPPO/IOBC Panel on Biological Control Agents to have been used in several EPPO countries with no adverse effects, or with acceptable adverse effects, and approved by the EPPO Working Party for Phytosanitary Regulations. Other EPPO countries may therefore presume with some confidence that, in the absence of

<sup>1</sup>BCAs of invertebrate pests or of plants (weeds, parasitic and invasive plants) may be listed. Microorganisms used as plant protection products are not considered (since they are often covered by other regulations in EPPO countries, such as EU Regulation 1107/2009). However, microorganisms used for classical biological control may be included.

<sup>2</sup>In relation to ISPM No. 3, this means BCAs which either originate in the EPPO region (i.e. indigenous) or have been released into an ecosystem in the EPPO region where they did not exist previously (i.e. introduced) or are perpetuating themselves in the EPPO region after introduction for the foreseeable future (i.e. established).

unacceptable adverse effects, these BCAs can be introduced and used safely. They may, according to their judgement, dispense with, or simplify, the notification procedures proposed in EPPO Standards PM 6/1, PM 6/2 and PM 6/4. The list only deals with the safety aspects of the BCAs and does not consider their efficacy.

The BCAs are listed on the basis of expert evaluation of the available information. For BCAs to be added to the Positive List, there must either be an absence of reports of adverse effects or, when available reports exist, adverse effects are considered to be acceptable by the joint EPPO/IOBC Panel. BCAs must also meet the following criteria:

1. BCA for augmentative use which is (or has been) commercially available or officially used (Appendix 1)

AND either

- a. is indigenous<sup>3</sup> and widespread in part of, or the whole of, the EPPO region; or
- b. is established and widespread in part of, or the whole of, the EPPO region; or
- c. has been used for at least 5 years in at least 5 EPPO countries (exceptionally fewer, if relevant crops, target pests or plants are present in <5 countries);

OR

2. BCA for classical use which is found, at least 5 years after release, to be successfully established in part of, or the whole of, the EPPO region (Appendix 2).

The absence of a given organism from the Positive List may mean that it has not yet been studied by the joint EPPO/IOBC Panel or that it does not meet the criteria.

The following Standards are referred to:

**EPPO Standards PM 6: *Safe use of biological control***

EPPO (1999) PM 6/1 *First import of exotic biological control agents for research under contained conditions. EPPO Bulletin*, **29**, 271–272.

EPPO (2014) PM 6/2(3) *Import and release of non-indigenous biological control agents. EPPO Bulletin*, **44**, 320–329.

EPPO (2018) PM 6/4 *Decision-support scheme for import and release of biological control agents of plant pests. EPPO Bulletin*, **48**, 352–367.

## ACKNOWLEDGEMENTS

This Standard was revised by the joint EPPO/IOBC Panel on Biological Control Agents.

## APPENDICES

The lists which constitute the appendices are available via the web link [https://www.eppo.int/RESOURCES/eppo\\_standards/pm6\\_biocontrol](https://www.eppo.int/RESOURCES/eppo_standards/pm6_biocontrol).

### APPENDIX 1 – COMMERCIALLY OR OFFICIALLY USED BIOLOGICAL CONTROL AGENTS

Further details are given for each BCA, including its preferred scientific name, common synonyms, taxonomic classification, the pests against which it is mostly targeted, its origin and the date of first use as a commercial agent. In cases where information is not known a (?) is detailed. Countries where it is or has been used in the EPPO region are also listed on the basis of information provided by the companies and by some EPPO countries. This information may not have been available from all EPPO countries and may therefore be incomplete. Each agent has been used commercially at some time in the countries listed, but in some cases may no longer be commercially available or used there. Information is also given, when available, on the natural distribution of the agent in the EPPO region, whether it is used in the field and/or under protected conditions. Additional remarks are included when necessary.

### APPENDIX 2 – CLASSICAL BCAS SUCCESSFULLY ESTABLISHED IN THE EPPO REGION

Further details are given for each BCA, including its name, common synonyms, taxonomic classification, the pest(s) against which it has been released, date of first use, whether the BCA was introduced as single or multiple introductions and the origin of the collected material. Countries where the BCA has been introduced for classical biological control in the EPPO region are also listed. The presence of a BCA on the list means that it has been successfully established in at least one of the countries mentioned. The results of the introductions in target pest control, and results of introduction, in different countries are given, when available, as follows: [C] complete, [S] substantial, [P] partial, [E] established but not contributing to control or status unknown, [F] failed to become established, [N] no information on the outcome, [T] established but believed to have died out. Asterisks (\*) indicate cases where more than one BCA contributed to the result. In cases where information is not known a (?) is detailed. Information on countries and results of introductions are given on the basis of information provided by the BIOCAT database of CABI (data from the 1890s until 2010) and by some EPPO countries. Countries are, as far as possible, listed in the chronological order of introduction of the agent for classical biological control. The list of countries indicates to a certain degree the area in which each organism is present and

<sup>3</sup>Natural enemies released into areas where they are indigenous are considered inherently safe. Nevertheless, it is recognized that indigenous BCAs could have some 'transient adverse effects' if mass releases are used at the wrong time. This is not an obstacle for the inclusion of a BCA to the Positive List since no long-term consequences are expected.

established in the EPPO region, to the extent that each successful introduction can be presumed to have involved establishment. However, organisms may already be indigenous in some parts of the EPPO region, or have spread from countries where they were introduced, or indeed have disappeared from countries where they were once established, so the true distribution is uncertain in many cases. In some cases, a general statement can be made about the present distribution in the EPPO region and this has been added in italics at the end of the list of countries.

### **APPENDIX 3 – BIOLOGICAL CONTROL AGENTS FORMERLY LISTED IN APPENDICES 1 OR 2**

Species in Appendix 3 were listed in Appendices 1 or 2 but have been removed from one of these appendices. These species are not necessarily unsafe. Rather, they no longer fulfil all of the criteria to remain on the Positive List. The date of removal and a summary of the reasons for its removal from Appendix 1 or Appendix 2 are provided. Evidence for removal relating to adverse effects in one or more countries in the EPPO region are referenced.

## Appendices 1-3 (2021 version)

### APPENDIX I - Commercially used biological control agents

Further details are given for each BCA, including its preferred scientific name, common synonyms, taxonomic classification, the pests against which it is mostly targeted, its origin and the date of first use as a commercial agent. In cases where information is not known a (?) is detailed. Countries where it is or has been used in the EPPO region are also listed on the basis of information provided by the companies and by some EPPO countries. This information may not have been available from all EPPO countries and may therefore be incomplete. Each agent has been used commercially at some time in the countries listed, but in some cases may no longer be commercially available or used there. Information is also given, when available, on the natural distribution of the agent in the EPPO region, whether it is used in the field and/or under protected conditions. Additional remarks are included when necessary

#### **INSECTA**

##### **Coleoptera**

*Adalia bipunctata*  
*Aleochara bilineata*  
*Atheta coriaria*  
*Chilocorus baileyi*  
*Chilocorus bipustulatus*  
*Chilocorus circumdatus*  
*Chilocorus nigrita*  
*Coccinella septempunctata*  
*Cryptolaemus montrouzieri*  
*Delphastus catalinae*  
*Propylea quatuordecimpunctata*  
*Rhyzobius lophanthae*  
*Rodolia cardinalis*  
*Scymnus rubromaculatus*  
*Stethorus punctillum*

##### **Diptera**

*Aphidoletes aphidimyza*  
*Episyrphus balteatus*  
*Eupeodes corollae*  
*Feltiella acarisuga*  
*Sphaerophoria rueppellii*

##### **Hemiptera/Heteroptera**

*Anthocoris nemoralis*  
*Anthocoris nemorum*  
*Macrolophus pygmaeus*  
*Orius albidipennis*  
*Orius laevigatus*  
*Orius majusculus*  
*Picromerus bidens*  
*Podisus maculiventris*

##### **Hymenoptera**

*Acerophagus maculipennis*  
*Anagrus atomus*  
*Anagrus fusciventris*  
*Anagrus vladimiri*  
*Anastatus bifasciatus*  
*Aphelinus abdominalis*  
*Aphidius colemani*  
*Aphidius ervi*  
*Aphidius matricariae*  
*Aphytis diaspidis*  
*Aphytis holoxanthus*  
*Aphytis lingnanensis*

*Aphytis melinus*  
*Aprostocetus hagenowii*  
*Bracon hebetor*  
*Coccophagus lycimnia*  
*Coccophagus rusti*  
*Coccophagus scutellaris*  
*Compariella bifasciata*  
*Cotesia marginiventris*  
*Dacnusa sibirica*  
*Diglyphus isaea*  
*Encarsia citrina*  
*Encarsia formosa*  
*Encyrtus aurantii*  
*Encyrtus infelix*  
*Ephedrus cerasicola*  
*Eretmocerus eremicus*  
*Eretmocerus mundus*  
*Gyranusoidea litura*  
*Leptomastidea abnormis*  
*Leptomastix dactylopii*  
*Leptomastix epona*  
*Metaphycus flavus*  
*Metaphycus helvolus*  
*Metaphycus lounsburyi*  
*Metaphycus swirskii*  
*Microterys nietneri*  
*Opius pallipes*  
*Praon volucre*  
*Scutellista caerulea*  
*Tetracnemoidea peregrina*  
*Tetracnemoidea brevicornis*  
*Thripobius javae*  
*Trichogramma brassicae*  
*Trichogramma cacoeciae*  
*Trichogramma cordubensis*  
*Trichogramma dendrolimi*  
*Trichogramma evanescens*  
*Trichogramma pintoii*  
*Trichopria drosophilae*

##### **Neuroptera**

*Chrysoperla carnea*

##### **Thysanoptera**

*Frankliniopsis megalops*  
*Frankliniopsis vespiformis*  
*Karnyothrips melaleucus*

## ARACHNIDA

### Acarina

*Amblydromalus limonicus*  
*Amblyseius andersoni*  
*Amblyseius barkeri*  
*Amblyseius degenerans*  
*Amblyseius swirskii*  
*Cheyletus eruditus*  
*Euseius gallicus*  
*Hypoaspis aculeifer*  
*Macrocheles robustulus*  
*Metaseiulus occidentalis*  
*Neoseiulus californicus*  
*Neoseiulus cucumeris*  
*Phytoseiulus persimilis*

*Stratiolaelaps scimitus*  
*Transeius montdorensis*  
*Typhlodromus pyri*

### NEMATODA

*Heterorhabditis bacteriophora*  
*Heterorhabditis downesi*  
*Heterorhabditis megidis*  
*Phasmarhabditis hermaphrodita*  
*Steinernema carpocapsae*  
*Steinernema feltiae*  
*Steinernema glaseri*  
*Steinernema kraussei*

## Insecta, Coleoptera

### ***Adalia bipunctata***

Family	Coccinellidae
Main target pests	Aphididae
Original distribution	Palearctic (?)
Distribution in EPPO	Widespread
Date of first use	?
EPPO countries where used	Belgium, Denmark, Germany, Italy, Netherlands, Portugal, Switzerland
Use	Indoors

### ***Aleochara bilineata***

Family	Staphylinidae
Main target pests	<i>Delia antiqua</i> , <i>Delia radicum</i> (= <i>Delia brassicae</i> )
Original distribution	Northern and Middle Europe, Canada and USA
Distribution in EPPO	Widespread
Date of first use	1997 (in Netherlands)
EPPO countries where used	Netherlands, some other European countries
Use	Outdoors

### ***Atheta coriaria***

Synonyms	<i>Atheta brachelytra</i> , <i>Dalotia coriaria</i> , <i>Homalota coriaria</i>
Family	Staphylinidae
Original distribution	Europe, Northern Asia, North America, Oceania, widespread in EPPO region
Main target pests	Thripidae (thrips), Sciaridae (fungus gnats), Ephydriidae (shore flies)
Date of first use	2002 (Biobest)
EPPO countries where used	Belgium, France, Germany, Netherlands, Poland, Spain, Switzerland, United Kingdom
Use	Indoors

### ***Chilocorus baileyi***

Family	Coccinellidae
Main target pests	Diaspididae
Original distribution	Australia
Distribution in EPPO	Not established
Date of first use	1985
EPPO countries where used	Belgium, France, Netherlands
Use	Indoors

***Chilocorus bipustulatus***

Family	Coccinellidae
Main target pests	Diaspididae, Coccidae ( <i>Saissetia oleae</i> )
Original distribution	South Palaearctic
Distribution in EPPO	Widespread (South and Central)
Date of first use	1959
EPPO countries where used	Belgium, France, Greece, Israel, Italy, Netherlands, Turkey
Use	Outdoors/Indoors

***Chilocorus circumdatus***

Family	Coccinellidae
Main target pests	Diaspididae
Original distribution	S. E. Asia
Distribution in EPPO	Not established
Date of first use	1985
EPPO countries where used	Belgium, France, Netherlands
Use	Indoors

***Chilocorus nigrita***

Family	Coccinellidae
Main target pests	Diaspididae, Asterolecaniidae
Original distribution	S. Asia
Distribution in EPPO	Not established
Date of first use	1985
EPPO countries where used	Belgium, Denmark, France, Germany, Netherlands, UK
Use	Indoors

***Coccinella septempunctata***

Family	Coccinellidae
Main target pests	Aphididae
Original distribution	Palaearctic
Distribution in EPPO	Widespread
Date of first use	1980
EPPO countries where used	France, Germany, Portugal
Use	Outdoors

***Cryptolaemus montrouzieri***

Family	Coccinellidae
Main target pests	<i>Planococcus citri</i>
Original distribution	Australia
Distribution in EPPO	Mediterranean area
Date of first use	1985
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Jersey, Netherlands, Norway, Poland, Portugal, Russia, Slovakia, Spain, Sweden, Switzerland, Tunisia, UK
Use	Indoors/outdoors

***Delphastus catalinae***

Synonym	<i>Delphastus pusillae</i>
Family	Coccinellidae
Main target pests	Aleyrodidae ( <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> )
Original distribution	Nearctic/Neotropic
Distribution in EPPO	Not established
Date of first use	1993
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Jordan, Netherlands, Poland, Russia, Spain, Tunisia, UK (restricted under license)
Use	Indoors

***Propylea quatuordecimpunctata***

Synonyms	Propylaea 14-punctata, Calvia
Family	Coccinellidae
Main target pests	great variety of aphids belonging to the superfamily of Aphidoidea
Original distribution	Native to the Palearctic region and widely distributed in Europe, established in the Nearctic region.
Distribution in EPPO	Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Luxembourg, Macedonia, Malta, Moldova, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, the Netherlands, Turkey, Ukraine.
Date of first use	2018
EPPO countries where used	Belgium, Italy, Luxembourg, the Netherlands, Spain, UK and Benelux
Use	Indoors/outdoors

***Rhyzobius lophanthae***

Synonym	<i>Lindorus lophanthae</i>
Family	Coccinellidae
Main target pests	Diaspididae ( <i>Pseudolacaspis pentagona</i> ), <i>Quadraspidiotus perniciosus</i> , <i>Chrysomphalus dictyospermi</i> , <i>Parlatoria blanchardi</i>
Original distribution	Australia
Distribution in EPPO	Mediterranean, Russia
Date of first use	1980
EPPO countries where used	Belgium, Denmark, Germany, Greece, Israel, Italy, Netherlands, Portugal, Switzerland, Turkey
Use	Indoors

***Rodolia cardinalis***

Family	Coccinellidae
Main target pests	<i>Icerya purchasi</i>
Original distribution	Australia
Distribution in EPPO	Mediterranean, CIS
Date of first use	?1980s
EPPO countries where used	Belgium, Netherlands
Use	Indoors/outdoors

***Scymnus rubromaculatus***

Family	Coccinellidae
Main target pests	Aphididae
Original distribution	Central Europe
Distribution in EPPO	Finland, Estonia, Lithuania
Date of first use	1990
EPPO countries where used	Belgium, France, Netherlands, Portugal
Use	Indoors

***Stethorus punctillum***

Family	Coccinellidae
Main target pests	<i>Panonychus ulmi</i>
Original distribution	Palaeartic
Distribution in EPPO	Widespread
Date of first use	1995
EPPO countries where used	Belgium, France, Germany, Netherlands, Portugal, Spain, Sweden
Use	Indoors

**Insecta, Diptera*****Aphidoletes aphidimyza***

Family	Cecidomyiidae
Main target pests	Aphididae ( <i>Aphis gossypii</i> , <i>Myzus persicae</i> , <i>Macrosiphum</i> sp., <i>Aulacorthum</i> sp.)
Original distribution	Central Europe, Palaeartic
Distribution in EPPO	Widespread
Date of first use	1985
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jersey, Jordan, Lithuania, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Spain, Slovakia, Sweden, Switzerland, Tunisia, UK
Use	Indoors/outdoors

***Episyrphus balteatus***

Family	Syrphidae
Main target pests	Aphididae
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1995
EPPO countries where used	Belgium, Denmark, Germany, Italy, Netherlands, Portugal
Use	Indoors/outdoors

***Eupeodes corollae***

Synonyms	<i>Metasyrphus corollae</i> , <i>Syrphus corollae</i>
Family	Syrphidae
Main target pests	Aphididae
Original distribution	Palaeartic and southern Afrotropical regions
Distribution in EPPO	Widespread
Date of first use	2020
EPPO countries where used	Belgium, Latvia, the Netherlands, Spain, UK
Use	Indoors/outdoors

***Feltiella acarisuga***

Synonyms	<i>Feltiella tetranychii</i> , <i>Therodiplosis persicae</i>
----------	--



Family	Cecidomyiidae
Main target pests	<i>Tetranychus urticae</i> , <i>T. cinnabarinus</i>
Original distribution	W. Europe/Mediterranean
Distribution in EPPO	Widespread
Date of first use	1995
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Guernsey, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Spain, Sweden, Switzerland, UK
Use	Indoors

### ***Sphaerophoria rueppellii***

Synonyms	<i>Sphaerophoria flavicauda</i> , <i>Sphaerophoria nitidicollis</i>
Family	Syrphidae
Main target pests	Mainly Aphididae but also whiteflies, thrips and spider mites
Original distribution	Widely distributed in Palaearctic and Afrotropical regions
Distribution in EPPO	Mediterranean region
Date of first use	2012
EPPO countries where used	Spain
Use	Indoors/outdoors

## **Insecta, Hemiptera/Heteroptera**

### ***Anthocoris nemoralis***

Family	Anthocoridae
Main target pests	Psyllidae (orchards)
Original distribution	Palaearctic
Distribution in EPPO	Widespread
Date of first use	?
EPPO countries where used	Belgium, Denmark, Germany, Netherlands
Use	Outdoors

### ***Anthocoris nemorum***

Family	Anthocoridae
Main target pests	<i>Cacopsylla pyri</i> , thrips
Original distribution	Palaearctic
Distribution in EPPO	Widespread
Date of first use	1992
EPPO countries where used	Belgium, Denmark, France, Italy, Jersey, Netherlands, UK
Use	Outdoors

### ***Macrolophus pygmaeus***

Family	Miridae
Main target pests	Aleyrodidae
Original distribution	Palaearctic
Distribution in EPPO	Widespread
Date of first use	1990
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jordan, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey, UK (restricted under license)
Use	Indoors

Additional remark *Macrolophus pygmaeus* was previously included on the positive list under the name *Macrolophus melanotoma* (synonym: *Macrolophus caliginosus*), this error was found and corrected in 2009;

*Macrolophus pygmaeus* has been reported as damaging on cherry tomato

and on *Gerbera*. It is therefore not recommended for use on these crops. Caution is advised when using *M. pygmaeus* on any new crop, particularly ornamentals with a low threshold for cosmetic damage.

#### ***Orius albidipennis***

Family	Anthocoridae
Main target pests	Thrips
Original distribution	Mediterranean, palaeartic
Distribution in EPPO	Mediterranean
Date of first use	1991
EPPO countries where used	Belgium, France, Israel, Italy, Netherlands, Spain
Use	Indoors

#### ***Orius laevigatus***

Family	Anthocoridae
Main target pests	Thripidae ( <i>Frankliniella occidentalis</i> , <i>Thrips tabaci</i> )
Original distribution	Palaeartic (except north)
Distribution in EPPO	Widespread (except north)
Date of first use	1991
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jersey, Jordan, Lithuania, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Switzerland, Tunisia, UK
Use	Indoors

#### ***Orius majusculus***

Family	Anthocoridae
Main target pests	Thripidae ( <i>Frankliniella occidentalis</i> , <i>Thrips tabaci</i> )
Original distribution	Palaeartic
Distribution in EPPO	Widespread
Date of first use	1991
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Italy, Jersey, Lithuania, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, UK
Use	Indoors

#### ***Picromerus bidens***

Family	Pentatomidae
Main target pests	Lepidoptera
Original distribution	Palaeartic (also established in Nearctic)
Distribution in EPPO	Widespread
Date of first use	1990
EPPO countries where used	CIS countries, Germany, Poland, Russia
Use	Outdoors/indoors

#### ***Podisus maculiventris***

Family	Pentatomidae
Main target pests	Lepidoptera, <i>Leptinotarsa decemlineata</i>
Original distribution	North and South America
Distribution in EPPO	Not established
Date of first use	1996
EPPO countries where used	Belgium, Bulgaria, Denmark, Finland, France, Greece, Italy, Netherlands, Russia, Spain
Use	Indoors/outdoors

## **Insecta, Hymenoptera**

### ***Acerophagus maculipennis***

Synonym	<i>Pseudaphycus maculipennis</i> <sup>1</sup>
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	Palaeartic
Distribution in EPPO	Widespread (south)
Date of first use	1980
EPPO countries where used	Belgium, France, Germany, Netherlands, Spain
Use	Indoors

### ***Anagrus atomus***

Family	Mymaridae
Main target pests	Cicadellidae
Original distribution	Palaeartic
Distribution in EPPO	?
Date of first use	1994
EPPO countries where used	Belgium, France, Germany, Guernsey, Jersey, Netherlands, Spain, UK
Use	Indoors

### ***Anagyrus fusciventris***

Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	Australia
Distribution in EPPO	Not present
Date of first use	1990
EPPO countries where used	Belgium, Denmark, France, Germany, Netherlands, Spain
Use	Indoors

### ***Anagyrus vladimiri***

Synonym	<i>Anagyrus pseudococci</i> <sup>2</sup>
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	Mediterranean
Distribution in EPPO	Mediterranean
Date of first use	1995
EPPO countries where used	France, Czechia, Greece, Italy, Netherlands, Portugal, Spain
Use	Indoors/outdoors

### ***Anastatus bifasciatus***

Family	Eupelmidae
Main target pests	Heteroptera ( <i>Halyomorpha halys</i> )
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	2019
EPPO countries where used	Italy
Use	Outdoors

### ***Aphelinus abdominalis***

Family	Aphelinidae
--------	-------------

<sup>1</sup> The genus *Pseudaphycus* was synonymized with the genus *Acerophagus*: Trjapitzin VA (2008) A Review of Encyrtid Wasps (Hymenoptera, Chalcidoidea, Encyrtidae) of Macaronesia. *Entomological Review*, Vol. 88, No. 2, pp. 218–232.

<sup>2</sup> Andreason SA, Triapitsyn SV & Perring TM (2019) Untangling the *Anagyrus pseudococci* species complex (Hymenoptera: Encyrtidae), parasitoids of worldwide importance for biological control of mealybugs (Hemiptera: Pseudococcidae): Genetic data corroborates separation of two new, previously misidentified species. *Biological Control* **129**: 65-82.

Main target pests	Aphididae ( <i>Macrosiphum euphorbiae</i> , <i>Aulacorthum solani</i> )
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1992
EPPO countries where used	Austria, Belgium, Bulgaria, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Jersey, Jordan, Netherlands, Poland, Spain, Sweden, Switzerland, Tunisia, UK
Use	Indoors

#### ***Aphidius colemani***

Family	Braconidae
Main target pests	Aphididae ( <i>Aphis gossypii</i> , <i>Myzus persicae</i> , <i>M. nicotianae</i> )
Original distribution	North Africa, Middle East, India
Distribution in EPPO	Mediterranean area
Date of first use	1992
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jersey, Jordan, Lithuania, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey, UK
Use	Indoors

#### ***Aphidius ervi***

Family	Braconidae
Main target pests	<i>Aulacorthum solani</i> , <i>Macrosiphum euphorbiae</i>
Original distribution	Palearctic
Distribution in EPPO	Widespread
Date of first use	1995
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jersey, Lithuania, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, UK
Use	Indoors/outdoors

#### ***Aphidius matricariae***

Family	Braconidae
Main target pests	<i>Myzus persicae</i>
Original distribution	Holarctic
Distribution in EPPO	Widespread in temperate regions
Date of first use	1990
EPPO countries where used	Austria, Belgium, Germany, Guernsey, Jersey, Netherlands, Poland, Portugal, Slovakia, UK
Use	Indoors

#### ***Aphytis diaspidis***

Family	Aphelinidae
Main target pests	Diaspididae, <i>Quadraspidiotus perniciosus</i> , <i>Pseudaulacaspis pentagona</i>
Original distribution	California
Distribution in EPPO	Mediterranean
Date of first use	?
EPPO countries where used	Netherlands
Use	Indoors

#### ***Aphytis holoxanthus***

Family	Aphelinidae
Main target pests	Diaspididae
Original distribution	Asia
Distribution in EPPO	Mediterranean

Date of first use	1996
EPPO countries where used	Belgium, Czechia, France, Netherlands, Spain
Use	Indoors
<b><i>Aphytis lingnanensis</i></b>	
Family	Aphelinidae
Main target pests	<i>Aonidiella aurantii</i> , <i>Chrysomphalus dictyospermi</i>
Original distribution	Probably eastern Asia (widely established elsewhere)
Distribution in EPPO	Mediterranean
Date of first use	?
EPPO countries where used	Greece, Italy, Spain
Use	Indoors/outdoors
<b><i>Aphytis melinus</i></b>	
Family	Aphelinidae
Main target pests	<i>Aonidiella aurantii</i>
Original distribution	India/Pakistan
Distribution in EPPO	Mediterranean
Date of first use	1985
EPPO countries where used	Belgium, Czechia, Denmark, France, Greece, Italy, Portugal, Spain
Use	Outdoors/indoors
<b><i>Aprostocetus hagenowii</i></b>	
Synonyms	<i>Tetrastichus hagenowii</i> , <i>Tetrastichodes hagenowii</i>
Family	Eulophidae
Main target pests	Blattidae ( <i>Periplaneta</i> spp.)
Original distribution	?
Distribution in EPPO	Romania
Date of first use	1993
EPPO countries where used	Belgium, France, Germany, Netherlands, Spain
Use	Indoors
<b><i>Bracon hebetor</i></b>	
Synonyms	<i>Habrobracon hebetor</i>
Family	Braconidae
Main target pests	Lepidoptera (on stored products)
Original distribution	India, New England
Distribution in EPPO	Mediterranean area (mostly Eastern)
Date of first use	1980
EPPO countries where used	Many (including Germany, Portugal)
Use	Indoors
<b><i>Coccophagus lycimnia</i></b>	
Family	Aphelinidae
Main target pests	Coccidae
Original distribution	Cosmopolitan
Distribution in EPPO	Mediterranean
Date of first use	1988
EPPO countries where used	Belgium, Denmark, France, Germany, Netherlands, Portugal, Spain, Sweden
Use	Indoors
<b><i>Coccophagus rusti</i></b>	
Family	Aphelinidae
Main target pests	Coccidae
Original distribution	Cosmopolitan

Distribution in EPPO	Mediterranean
Date of first use	1988
EPPO countries where used	Belgium, France, Netherlands, Spain
Use	Indoors
<b><i>Coccophagus scutellaris</i></b>	
Family	Aphelinidae
Main target pests	Coccidae
Original distribution	Cosmopolitan
Distribution in EPPO	Widespread
Date of first use	1986
EPPO countries where used	Belgium, France, Netherlands, Portugal, Spain
Use	Indoors
<b><i>Comperiella bifasciata</i></b>	
Family	Encyrtidae
Main target pests	Diaspididae ( <i>Chrysomphalus aonidum</i> , <i>Aonidiella aurantii</i> )
Original distribution	?California/South China
Distribution in EPPO	Mediterranean
Date of first use	1985
EPPO countries where used	Belgium, Greece, Netherlands
Use	Indoors/outdoors
<b><i>Cotesia marginiventris</i></b>	
Synonyms	<i>Apanteles marginiventris</i>
Family	Braconidae
Main target pests	Lepidoptera (Noctuidae)
Original distribution	Americas
Distribution in EPPO	?
Date of first use	1993
EPPO countries where used	Belgium, France, Netherlands, Spain
Use	Indoors
<b><i>Dacnusa sibirica</i></b>	
Family	Braconidae
Main target pests	Agromyzidae ( <i>Liriomyza</i> spp.)
Original distribution	Palaearctic, Europe
Distribution in EPPO	Widespread, temperate regions
Date of first use	1981
EPPO countries where used	Austria, Belgium, Bulgaria, Czechia, Denmark, Finland, France, Germany, Guernsey, Italy, Jersey, Jordan, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, UK
Use	Indoors/outdoors (celery, lettuce)
<b><i>Diglyphus isaea</i></b>	
Family	Eulophidae
Main target pests	Agromyzidae ( <i>Liriomyza</i> spp.)
Original distribution	Palaearctic
Distribution in EPPO	Widespread
Date of first use	1984
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Hungary, Italy, Jordan, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey, UK
Use	Indoors/outdoors

***Encarsia citrina***

Family	Aphelinidae
Main target pests	Diaspididae
Original distribution	Cosmopolitan
Distribution in EPPO	Mediterranean
Date of first use	1984
EPPO countries where used	Belgium, France, Germany, Netherlands, Spain
Use	Indoors

***Encarsia formosa***

Family	Aphelinidae
Main target pests	Aleyrodidae ( <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> )
Original distribution	Southern nearctic
Distribution in EPPO	Widespread
Date of first use	1930
EPPO countries where used	Austria, Belgium, Bulgaria, Czechia, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Jordan, Lithuania, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey, UK
Use	Indoors

***Encyrtus aurantii***

Synonyms	<i>Encyrtus lecaniorum</i>
Family	Encyrtidae
Main target pests	Coccidae
Original distribution	Palaeartic
Distribution in EPPO	Widespread (south)
Date of first use	1980
EPPO countries where used	Belgium, France, Germany, Netherlands, Spain
Use	Indoors

***Encyrtus infelix***

Synonyms	<i>Eucomys tananarivensis</i>
Family	Encyrtidae
Main target pests	Coccidae
Original distribution	Afrotropical region
Distribution in EPPO	Israel
Date of first use	1992
EPPO countries where used	Belgium, Denmark, France, Netherlands, Spain
Use	Indoors

***Ephedrus cerasicola***

Family	Braconidae
Main target pests	<i>Aphis frangulae</i> , <i>A. gossypii</i> , <i>Aulacorthum circumflexum</i> , <i>Aulacorthum solani</i> , <i>Brachycaudus helichrysi</i> , <i>Capitophorus inulae</i> , <i>Cavariella aegopodii</i> , <i>Chaetosiphon fragaefolii</i> , <i>Cryptomyzus galeopsidis</i> , <i>Dysaphis apiifolia</i> , <i>Dysaphis sp.</i> , <i>Hyadaphis foeniculi</i> , <i>Hyperomyzus lactucae</i> , <i>Hyperomyzus sp.</i> , <i>Myzus ascalonicus</i> , <i>M. cerasi</i> , <i>M. ligustri</i> , <i>M. nicotinae</i> , <i>M. ornatus</i> , <i>M. persicae</i> , <i>Nasonovia ribisnigri</i> , <i>Nasonovia sp.</i> , <i>Ovatus crataegarius</i> , <i>Phorodon humili</i> , <i>Rhodobium porosum</i>
Original distribution	Naturally throughout Europe
Distribution in EPPO	Widespread
Date of first use	1999
EPPO countries where used	Belgium, Denmark, Finland, France, Germany, Netherlands, UK
Use	Indoors

***Eretmocerus eremicus***

Family	Aphelinidae
Main target pests	<i>Bemisia tabaci</i>
Original distribution	Southern nearctic
Distribution in EPPO	Mediterranean
Date of first use	1994
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Italy, Lithuania, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Switzerland, Tunisia, Turkey
Use	Indoors

***Eretmocerus mundus***

Family	Aphelinidae
Main target pests	<i>Bemisia tabaci</i>
Original distribution	South Europe
Distribution in EPPO	Mediterranean
Date of first use	1996
EPPO countries where used	Denmark, Germany, Italy, Netherlands, Portugal, Spain
Use	Indoors

***Gyranusoidea litura***

Family	Encyrtidae
Main target pests	<i>Pseudococcus longispinus</i>
Original distribution	Africa
Distribution in EPPO	France, Spain
Date of first use	1990
EPPO countries where used	Belgium, France, Netherlands
Use	Indoors

***Leptomastidea abnormis***

Synonym	<i>Leptomastix abnormis</i>
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	Palearctic
Distribution in EPPO	Widespread
Date of first use	1984
EPPO countries where used	Austria, Belgium, Denmark, Germany, Guernsey, Israel, Italy, Jersey, Netherlands, Spain, Switzerland, Turkey, UK
Use	Indoors

***Leptomastix dactylopii***

Family	Encyrtidae
Main target pests	<i>Planococcus citri</i>
Original distribution	Neotropic
Distribution in EPPO	Mediterranean area
Date of first use	1992
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Jersey, Netherlands, Norway, Poland, Portugal, Spain, UK
Use	Indoors/outdoors

***Leptomastix epona***

Family	Encyrtidae
Main target pests	Pseudococcidae, especially <i>Pseudococcus viburni</i>
Original distribution	Palearctic
Distribution in EPPO	Widespread (south)



Date of first use	1992
EPPO countries where used	Belgium, Denmark, France, Germany, Guernsey, Jersey, Netherlands, Spain, UK
Use	Indoors
<b><i>Metaphycus flavus</i></b>	
Family	Encyrtidae
Main target pests	Coccidae, <i>Saissetia oleae</i> , <i>Coccus hesperidum</i>
Original distribution	Nearctic
Established in EPPO	Yes
Distribution in EPPO	Mediterranean
Date of first use	1999
EPPO countries where used	Germany, Netherlands, Switzerland
Use	Indoors
<b><i>Metaphycus helvolus</i></b>	
Family	Encyrtidae
Main target pests	Coccidae ( <i>Saissetia oleae</i> <i>Coccus hesperidum</i> )
Original distribution	South Africa (also established in Nearctic)
Distribution in EPPO	Greece, Italy
Date of first use	1992
EPPO countries where used	Austria, Belgium, Denmark, France, Germany, Greece, Israel, Italy, Netherlands, Spain, Sweden, Switzerland
Use	Indoors/outdoors
<b><i>Metaphycus lounsburyi</i></b>	
Synonyms	<i>M. bartletti</i> , <i>M. anneckei</i> and <i>M. hagenowii</i> , also established in some Mediterranean countries, have been misidentified as <i>M. lounsburyi</i>
Family	Encyrtidae
Main target pests	Coccidae ( <i>Saissetia oleae</i> )
Original distribution	California, Australia, Hawaii, South Africa
Distribution in EPPO	Mediterranean
Date of first use	1997
EPPO countries where used	Denmark, France, Italy, Netherlands
Use	Indoors/outdoors
<b><i>Metaphycus swirskii</i></b>	
Family	Encyrtidae
Main target pests	Coccidae
Original distribution	East Africa?
Distribution in EPPO	France, Greece (Crete), Israel, Italy (probably more widely in Mediterranean region)
Date of first use	1992
EPPO countries where used	Belgium, France, Netherlands, Spain
Use	Indoors
<b><i>Microterys nietneri</i></b>	
Synonyms	<i>Microterys flavus</i>
Family	Encyrtidae
Main target pests	Coccidae ( <i>Saissetia oleae</i> )
Original distribution	California, Pakistan
Distribution in EPPO	Italy
Date of first use	1987
EPPO countries where used	Belgium, Denmark, France, Germany, Greece, Israel, Netherlands, Spain, former-Yugoslavia
Use	Indoors/outdoors

***Opius pallipes***

Family	Braconidae
Main target pests	<i>Liriomyza bryoniae</i>
Original distribution	Palearctic (?)
Distribution in EPPO	Widespread
Date of first use	1980
EPPO countries where used	Belgium, Czechia, Denmark, France, Germany, Greece, Guernsey, Jersey, Lithuania, Netherlands, Poland, Spain, UK
Use	Indoors

***Praon volucre***

Synonym	<i>Aphidius volucre</i>
Family	Braconidae
Main target pests	Aphididae
Original distribution	Palearctic
Distribution in EPPO	Widespread
Date of first use	?
EPPO countries where used	Belgium, Guernsey, Jersey, Netherlands, UK
Use	Indoors

***Scutellista caerulea***

Synonym	<i>Scutellista cyanea</i>
Family	Pteromalidae
Main target pests	Coccidae ( <i>Saissetia oleae</i> , <i>S. coffeae</i> , <i>Ceroplastes rusci</i> )
Original distribution	Africa
Distribution in EPPO	Mediterranean, CIS
Date of first use	1990
EPPO countries where used	Belgium, Denmark, France, Netherlands, Switzerland
Use	Indoors

***Tetracnemoidea peregrina***

Synonyms	<i>Hungariella peregrina</i>
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	North America
Distribution in EPPO	Israel
Date of first use	1992
EPPO countries where used	Belgium, France, Israel, Netherlands, Spain
Use	Indoors/outdoors

***Tetracnemoidea brevicornis***

Synonyms	<i>Hungariella pretiosa</i>
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	?
Distribution in EPPO	Italy
Date of first use	1992
EPPO countries where used	Belgium, France, Netherlands, Spain
Use	Indoors

***Thripobius javae***

Synonyms	<i>Thripobius semiluteus</i>
Family	Eulophidae
Main target pests	Thysanoptera ( <i>Heliothrips</i> spp.)
Original distribution	Tropical and subtropical areas of Africa, Asia and Australia

Distribution in EPPO	Israel
Date of first use	1995
EPPO countries where used	Belgium, Denmark, France, Germany, Netherlands
Use	Indoors
<b><i>Trichogramma brassicae</i></b>	
Synonyms	<i>Trichogramma maidis</i>
Family	Trichogrammatidae
Main target pests	Lepidoptera ( <i>Ostrinia nubilalis</i> )
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1980
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Italy, Jersey, Jordan, Netherlands, Slovakia, Spain, Switzerland, UK
Use	Outdoors/Indoors
<b><i>Trichogramma cacoeciae</i></b>	
Family	Trichogrammatidae
Main target pests	Lepidoptera
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1980
EPPO countries where used	Denmark, France, Germany, Hungary
Use	Outdoors
<b><i>Trichogramma cordubensis</i></b>	
Year of addition to the EPPO Positive List	2020
Family	Trichogrammatidae
Main target pests	Lepidoptera (e.g. <i>Cydalima perspectalis</i> , <i>Lobesia botrana</i> & <i>Eupoecilia ambiguella</i> )
Original distribution	Mediterranean (Algeria, Egypt, France, Iran, Morocco, Portugal, Spain)
Distribution in EPPO	Widespread
Date of first use	1980
EPPO countries where used	France
Use	Outdoors
<b><i>Trichogramma dendrolimi</i></b>	
Family	Trichogrammatidae
Main target pests	Lepidoptera
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1985
EPPO countries where used	Germany, Slovakia
Use	Outdoors
<b><i>Trichogramma evanescens</i></b>	
Family	Trichogrammatidae
Main target pests	Lepidoptera (including on stored products)
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1993
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Italy, Jersey, Jordan, Netherlands, Portugal, Slovakia, Spain, Tunisia, UK
Use	Indoors/outdoors

### ***Trichogramma pintoii***

Synonyms	<i>Trichogramma euproctidis</i>
Family	Trichogrammatidae
Original distribution	Palaeartic, Near East, Nearctic, Neotropical region; Oriental region, widespread in EPPO region
Main target pests	Mainly Lepidoptera species: <i>Ostrinia nubilalis</i> , <i>Helicoverpa armigera</i> , <i>Cydia nigricana</i> , <i>Cydia pomonella</i> , <i>Cydia funebrana</i> , <i>Plutella xylostella</i> , <i>Mamestra brassicae</i> , <i>Lacanobia oleracea</i>
Date of first use	2002 (Hungary)
EPPO countries where used	Belarus, Czech Republic, Hungary, Moldova, Poland, Russia, Slovakia, Ukraine, Uzbekistan
Use	Outdoors/Indoors

### ***Trichopria drosophilae***

Family	Diapriidae
Original distribution	Worldwide, mainly in tropical/Mediterranean/warmer temperate climatic areas. Indigenous in the EPPO region
Distribution in EPPO	France, Germany, Greece, Israel, Italy, Morocco, the Netherlands, Spain.
Main target pests	Pupal parasitoid of <i>Drosophila suzukii</i> , relatively specific parasitoid compared to other parasitoids of Diptera.
Date of first use	2015 (Italy)
EPPO countries where used	Italy (by 2015), Spain (2017) and Switzerland (2017)
Use	Outdoors/Indoors

## **Insecta, Neuroptera**

### ***Chrysoperla carnea***

Synonyms	<i>Chrysopa carnea</i>
Family	Chrysopidae
Main target pests	Aphididae etc.
Original distribution	Cosmopolitan
Distribution in EPPO	Widespread
Date of first use	1987
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, UK
Use	Indoors/outdoors

## **Insecta, Thysanoptera**

### ***Franklinothrips megalops***

Synonym	<i>Franklinothrips myrmicaeformis</i>
Family	Aeolothripidae
Main target pests	Thysanoptera
Original distribution	Africa, Israel, India
Distribution in EPPO	Israel, Tunisia
Date of first use	1992
EPPO countries where used	Belgium, France, Netherlands, Spain
Use	Indoors

### ***Franklinothrips vespiformis***

Family	Aeolothripidae
Main target pests	Thysanoptera
Original distribution	Asia
Distribution in EPPO	Israel, Portugal

Date of first use	1990
EPPO countries where used	Belgium, Denmark, France, Germany, Israel, Netherlands, Portugal, Sweden, Switzerland
Use	Indoors

#### ***Karnyothrips melaleucus***

Family	Phlaeothripidae
Main target pests	Coccidae, Diaspididae ( <i>Howardia biclavis</i> )
Original distribution	Pantropical
Distribution in EPPO	Portugal (Madeira)
Date of first use	1994
EPPO countries where used	Belgium, Denmark, France, Netherlands, Spain
Use	Indoors

#### **Arachnida, Acarina**

#### ***Amblydromalus limonicus***

Synonyms	<i>Amblyseius limonicus</i> , <i>Typhlodromus (Amblyseius) limonicus</i> , <i>Amblyseius (Typhlodromalus) limonicus</i> , <i>Typhlodromus limonicus</i> , <i>Amblyseius (Amblyseius) limonicus</i> , <i>Typhlodromalus limonicus</i> , <i>Typhlodromalus lailae</i>
Family	Phytoseiidae
Main target pests	Thrips and whiteflies (mainly <i>Bemisia tabaci</i> )
Original distribution	North, Central and South America, Hawaii, New Zealand and Australia
Distribution in EPPO	Established in north-east Spain
Date of first use	2010
EPPO countries where used	Austria, Belgium, Denmark, England, Finland, France, Germany, Ireland, the Netherlands, Poland, Russia, Sweden and Ukraine
Use	Indoors / Outdoors

#### ***Amblyseius andersoni***

Synonyms	<i>Typhlodromus andersoni</i>
Family	Phytoseiidae
Main target pests	<i>Tetranychus urticae</i> , <i>T. cinnabarinus</i> , <i>Panonychus ulmi</i> , <i>Aculops lycopersicae</i> , <i>Polyphagotarsonemus latus</i> , <i>Phytonemus pallidus</i>
Original distribution	Palaeartic and Nearctic
Distribution in EPPO	Widespread
Date of first use	2006 (by Syngenta)
EPPO countries where used	France, Guernsey, Italy, Netherlands, Poland, Spain, UK
Use	Indoors / Outdoors

#### ***Amblyseius barkeri***

Synonyms	<i>Amblyseius mckenziei</i> , <i>Neoseiulus barkeri</i>
Family	Phytoseiidae
Main target pests	Thysanoptera ( <i>Thrips tabaci</i> , <i>Frankliniella occidentalis</i> ), Tarsonemidae
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1981
EPPO countries where used	Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Slovakia, Switzerland
Use	Indoors

#### ***Amblyseius degenerans***

Synonym	<i>Iphiseius degenerans</i>
Family	Phytoseiidae
Main target pests	Thysanoptera
Original distribution	Africa/Mediterranean
Distribution in EPPO	Mediterranean

Date of first use	1993
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Jersey, Netherlands, Norway, Poland, Spain, Switzerland, Tunisia, Turkey, UK
Use	Indoors

#### ***Amblyseius swirskii***

Synonym	<i>Typhlodromips swirskii</i>
Family	Phytoseiidae
Original distribution	East of Mediterranean region, naturally occurs in Israel, Italy, Cyprus, Greece and Egypt, found there in various crops like apples, apricot, citrus, vegetables and cotton
Main target pests	<i>Bemisia tabaci</i> , <i>Trialeurodes vaporariorum</i> , <i>Frankliniella occidentalis</i>
Date of first use	2005 (Austria, Belgium, Finland, France, Germany, Greece, Hungary, Italy, Morocco, Netherlands, Poland and Turkey)
EPPO countries where used	Austria, Belarus, Belgium, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Italy, Jersey, Morocco, the Netherlands, Norway, Poland, Spain, Turkey, UK
Use	Indoors/outdoors

#### ***Cheyletus eruditus***

Family	Cheyletidae
Main target pests	Storage mites, spider (foliage) mites
Original distribution	Indigenous
Distribution in EPPO	Belgium, Netherlands
Date of first use	1985
EPPO countries where used	Belgium, Czechia, France, Germany, Netherlands
Use	Indoors
Additional remarks	Cases of allergic reactions to farmers have been reported

#### ***Euseius gallicus***

Family	Phytoseiidae
Main target pests	Whitefly (Aleyrodidae) and thrips (Thysanoptera)
Original distribution	Europe, Maritime and Mediterranean zones
Distribution in EPPO	Belgium, France, the Netherlands, Tunisia and Turkey
Date of first use	The Netherlands, 2010
EPPO countries where used	Belgium, France, Germany, the Netherlands, Poland and Ukraine
Use	Indoors

#### ***Hypoaspis aculeifer***

Synonyms	<i>Geolaelaps aculeifer</i>
Family	Laelapidae
Main target pests	Sciaridae, <i>Rhizoglyphus echinopus</i>
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1995
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Switzerland, UK
Use	Indoors

#### ***Macrocheles robustulus***

Synonyms	<i>Holostaspis subbadius</i> , <i>Macrocheles coprophila</i>
Family	Macrochelidae
Main target pests	Soil dwelling pests like thrips (pupae) and sciarids (larvae)

Original distribution	Cosmopolitan
Distribution in EPPO	Austria, Bulgaria, Czech Republic, Georgia, Germany, Greece, Hungary, Italy, Poland, Russia, Slovakia, Sweden and the UK
Date of first use	2010
EPPO countries where used	Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Poland, Russia, Spain, Sweden, the UK and Ukraine
Use	Indoors

### ***Metaseiulus occidentalis***

Synonyms	<i>Galendromus occidentalis</i> , <i>Typhlodromus occidentalis</i>
Family	Phytoseiidae
Main target pests	Tetranychidae
Original distribution	Nearctic
Distribution in EPPO	?
Date of first use	1991
EPPO countries where used	Denmark, France, Greece, Guernsey, Jersey, Netherlands, Poland, Spain, UK
Use	Indoors/outdoors

### ***Neoseiulus californicus* (non-diapausing strain only\*)**

Synonyms	<i>Amblyseius californicus</i> , <i>Typhlodromus californicus</i> , <i>Amblyseius mungeri</i> , <i>Typhlodromus mungeri</i> , <i>Amblyseius chilensis</i> , <i>Typhlodromus marinus</i>
Family	Phytoseiidae
Main target pests	Tetranychidae
Original distribution	Southern N. America/California, Mediterranean
Distribution in EPPO	?
Date of first use	1985
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Jersey, Malta, Netherlands, Poland, Portugal, Spain, Switzerland, Tunisia, UK (restricted under license)
Use	Indoors/outdoors

#### **\* References**

- Gotoh, T., T. Akizawa, M. Watanabe, A. Tsuchiya & S. Shimazaki, 2005. Cold hardiness of *Neoseiulus californicus* and *N. womersleyi*. J. Acarol. Soc. Jpn. 14(2): 93-103.
- Hart, A.J., J.S. Bale, A.G. Tullet, M.R. Worland and K.F.A. Walters, 2002. Effects of temperature on the establishment potential of the predatory mite *Amblyseius californicus* McGregor (Acari: Phytoseiidae) in the UK. J. Insect Physiology 48: 593-599.
- Houten, M. van, P.J.C. van Rijn, L.K. Tanigoshi, P. van Stratum & J. Bruin, 1995. Preselection of predatory mites to improve year-round biological control of western flower thrips in greenhouse crops. Ent. Exp. et Appl. 74: 225-234.
- Morewood, W.D., 1993. Diapause and cold hardiness of phytoseiid mites (Acarina: Phytoseiidae). Eur.J.Entomol.90: 3-10.

### ***Neoseiulus cucumeris***

Synonym	<i>Amblyseius cucumeris</i>
Family	Phytoseiidae
Main target pests	Thysanoptera ( <i>T. tabaci</i> , <i>F. occidentalis</i> )
Original distribution	Cosmopolitan
Distribution in EPPO	Widespread (not present in Sweden, Finland, Norway)
Date of first use	1985
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jersey, Jordan, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey, UK
Use	Indoors/outdoors

### ***Phytoseiulus persimilis***

Synonyms	<i>Phytoseiulus riegeli</i> , <i>Phytoseiulus tardi</i>
Family	Phytoseiidae
Main target pests	Tetranychidae ( <i>Tetranychus urticae</i> )
Original distribution	Mediterranean
Distribution in EPPO	Southern Europe
Date of first use	1968
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Italy, Jersey, Jordan, Lithuania, Malta, Morocco, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey, UK
Use	Indoors/outdoors

### ***Stratiolaelaps scimitus***

Synonyms	<i>Hypoaspis scimitus</i>
Taxonomic remark	The species has been previously used under the erroneous name <i>Stratiolaelaps miles</i> (= <i>Hypoaspis miles</i> = <i>Geolaelaps miles</i> )*
Family	Laelapidae
Main target pests	Sciaridae, <i>Rhizoglyphus echinopus</i>
Original distribution	Palearctic
Distribution in EPPO	Widespread
Date of first use	1994
EPPO countries where used	Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Jersey, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, UK
Use	Indoors

#### **\* References:**

Cabrera AR, Cloyd RA, Zaborski ER (2005) Development and reproduction of *Stratiolaelaps scimitus* (Acari: Laelapidae) with fungus gnat larvae (Diptera: Sciaridae), potworms (Oligochaeta: Enchytraeidae) or *Sancassania* aff. *sphaerogaster* (Acari: Acaridae) as the sole food source. *Experimental and Applied Acarology* **36**(1/2), 71-81.

Knapp M, Klapwijk J, October 2012 Information supporting the name change of commercially available *Hypoaspis miles* to *Stratiolaelaps scimitus*. KOPPERT Biological Systems.

Walter DE, Campbell NJH (2003) Exotic vs endemic biocontrol agents: would the real *Stratiolaelaps miles* (Berlese) (Acari: Mesostigmata: Laelapidae), please stand up? *Biological Control* **26**, 253-269.

Womersley H (1956) On some new Acarina-Mesostigmata from Australia, New Zealand and New Guinea. *Journal of the Linnean Society (Zoology)* **42**, 505-599.

### ***Transeius montdorensis***

Synonym	<i>Amblyseius montdorensis</i> , <i>Typhlodromips montdorensis</i>
Family	Phytoseiidae
Original distribution	Pacific Islands and western areas of the Australian mainland
Main target pests	Aleyrodidae ( <i>Trialeurodes</i> spp. and <i>Bemisia</i> spp.), thrips ( <i>Franklinella occidentalis</i> and <i>Thrips tabaci</i> ) and Eriophyidae ( <i>Aculops lycopersici</i> ), although to be used principally against <i>Frankliniella occidentalis</i>
Date of first use	2004
EPPO countries where used	Belgium, Denmark, Finland, France, Germany, Greece, the Netherlands, Poland, Romania, Spain and UK
Use	Indoors/outdoors

### ***Typhlodromus pyri***

Family	Phytoseiidae
Main target pests	<i>Panonychus ulmi</i> , <i>Tetranychus urticae</i> , <i>Eriophyes vitis</i> , <i>Epitrimerus vitis</i>
Original distribution	Europe/Nearctic
Distribution in EPPO	Widespread
Date of first use	1985



EPPO countries where used	Austria, Belgium, Czechia, Denmark, France, Germany, Hungary, Portugal, Slovakia
Use	Outdoors

## **Nematoda**

### ***Heterorhabditis bacteriophora***

Synonyms	<i>Heterorhabditis heliothidis</i>
Family	Heterorhabditidae
Main target pests	Vine weevils ( <i>Otiorhynchus</i> spp.)
Original distribution	South and central Europe/N. America
Distribution in EPPO	South and central Europe
Date of first use	1984
EPPO countries where used	Austria, Belgium, France, Germany, Italy, Netherlands, Slovenia, Switzerland
Use	Outdoors/?indoors

### ***Heterorhabditis downesi***

Synonyms	Irish type of <i>Heterorhabditis</i>
Family	Heterorhabditidae
Main target pests	Vine weevils ( <i>Otiorhynchus</i> spp.), <i>Phyllopertha horticola</i> , <i>Hoplia philanthus</i> , <i>Melolontha melolontha</i> , <i>Hylobius abietis</i>
Original distribution	Europe
Distribution in EPPO	Denmark, Germany, Hungary, Ireland, Italy, UK
Date of first use	2001
EPPO countries where used	Ireland, UK
Use	Outdoors/ ?indoors

### ***Heterorhabditis megidis***

Family	Heterorhabditidae
Main target pests	Vine weevils ( <i>Otiorhynchus</i> spp.)
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	1984
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Jersey, Netherlands, Norway, Poland, Slovakia, Spain, Sweden, Switzerland, Tunisia, UK
Use	Indoors/outdoors

### ***Phasmarhabditis hermaphrodita***

Family	Phasmarhabditidae
Main target pests	Slugs
Original distribution	Central Europe
Distribution in EPPO	Widespread (except in Northern countries)
Date of first use	1984
EPPO countries where used	Belgium, Denmark, France, Germany, Guernsey, Italy, Jersey, Netherlands, UK
Use	Indoors/outdoors

### ***Steinernema carpocapsae***

Synonyms	<i>Neoaplectana carpocapsae</i> , <i>N. feltiae</i>
Family	Steinernematidae

Main target pests	Vine weevils ( <i>Otiorhynchus</i> spp.), Sciaridae, soil-borne insects
Original distribution	Europe (Holarctic)
Distribution in EPPO	Widespread
Date of first use	1984
EPPO countries where used	Belgium, Denmark, France, Germany, Guernsey, Italy, Jersey, Netherlands, Portugal, Slovenia, Sweden, UK
Use	Indoors/outdoors

### ***Steinernema feltiae***

Synonyms	<i>Neoaplectana feltiae</i> , <i>N. bibionis</i> , <i>Steinernema bibionis</i> , <i>N. leucaniae</i>
Family	Steinernematidae
Main target pests	Melolonthidae, Sciaridae etc.
Original distribution	Europe (Holarctic)
Distribution in EPPO	Widespread
Date of first use	1984
EPPO countries where used	Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Guernsey, Ireland, Italy, Jersey, Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK
Use	Indoors/outdoors

### ***Steinernema glaseri***

Synonyms	<i>Neoaplectana glaseri</i>
Family	Steinernematidae
Main target pests	Soil insects, especially Coleoptera including Chrysomelidae, Curculionidae, Elateridae, Scarabaeidae, some Lepidoptera, Orthoptera etc.
Original distribution	Argentina, Brazil, China, Czech Republic, Palestine, Portugal, Republic of Korea, Slovak Republic, Spain, Switzerland, the USA
Distribution in EPPO	Czech Republic, Portugal, Slovak Republic, Spain, Switzerland
Date of first use	2004
EPPO countries where used	Netherlands, Belgium
Use	Indoors/outdoors

### ***Steinernema kraussei***

Family	Steinernematidae
Main target pests	<i>Otiorhynchus sulcatus</i>
Original distribution	Throughout Europe and North America
Distribution in EPPO	Widespread
Date of first use	2001 (in Ireland)
EPPO countries where used	Ireland, Norway, most of other European countries
Use	Indoors/outdoors

## Appendix II: Successfully established classical biological control agents

Further details are given for each BCA, including its name, common synonyms, taxonomic classification, the pest(s) against which it has been released, date of first use, whether the BCA was introduced as single or multiple introductions and the origin of the collected material. Countries where the BCA has been introduced for classical biological control in the EPPO region are also listed. The presence of a BCA on the list means that it has been successfully established in at least one of the countries mentioned. The results of the introductions in target pest control, and results of introduction, in different countries are given, when available, as follows: [C] complete, [S] substantial, [P] partial, [E] established but not contributing to control or status unknown, [F] failed to become established, [N] no information on the outcome, [T] established but believed to have died out. Asterisks (\*) indicate cases where more than one BCA contributed to the result. In cases where information is not known a (?) is detailed. Information on countries and results of introductions are given on the basis of information provided by the BIOCAT database of CABI (data from 1890s until 2010) and by some EPPO countries. Countries are, as far as possible, listed in the chronological order of introduction of the agent for classical biological control. The list of countries indicates to a certain degree the area in which each organism is present and established in the EPPO region, to the extent that each successful introduction can be presumed to have involved establishment. However, organisms may already be indigenous in some parts of the EPPO region, or have spread from countries where they were introduced, or indeed have disappeared from countries where they were once established, so the true distribution is uncertain in many cases. In some cases, a general statement can be made about the present distribution in the EPPO region and this has been added in italics at the end of the list of countries.

### INSECTA

#### Coleoptera

*Adalia bipunctata*

*Cryptolaemus montrouzieri*

*Rhizophagus grandis*

*Rhizobius forestieri*

*Rodolia cardinalis*

*Scymnus impexus*

*Scymnus reunioni*

*Serangium parcesetosum*

#### Diptera

*Cryptochetum iceryae*

#### Hymenoptera

*Ageniaspis citricola*

*Allotropa burrelli*

*Allotropa convexifrons*

*Amitus spiniferus*

*Anagyrus agraensis*

*Anagyrus fusciventris*

*Anaphes nitens*

*Aphelinus mali*

*Aphytis holoxanthus*

*Aphytis lepidosaphes*

*Aphytis lingnanensis*

*Aphytis melinus*

*Aphytis proclia*

*Clausenia purpurea*

*Comperiella bifasciata*

*Encarsia berleseii*

*Encarsia herndoni*

*Encarsia lahorensis*

*Encarsia perniciosi*

*Eretmocerus debachi*

*Metaphycus anneckeii*

*Metaphycus flavus*

*Metaphycus helvolus*

*Metaphycus lounsburyi*

*Metaphycus swirskii*

*Neodryinus typhlocybae*

*Neodusmetia sangwani*

*Ooencyrtus kuvanae*

*Pseudaphycus malinus*

*Psyllaephagus pilosus*

*Psytalia concolor*

*Pteroptrix orientalis*

*Pteroptrix smithi*

## **Insecta, Coleoptera**

### ***Adalia bipunctata***

Family	Coccinellidae
Target pest	<i>Toxoptera aurantii</i>
Date of first use	?
EPPO countries where introduced	Portugal (Azores) [S*] ( <i>Widespread in the EPPO region</i> )
Multiple/single introductions	Single
Origin of collected material	Portugal

### ***Cryptolaemus montrouzieri***

Family	Coccinellidae
Target pest	Pseudococcidae
Date of first use	1929
EPPO countries where introduced	Portugal [S] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	Australia
Target pest	<i>Planococcus citri</i>
Date of first use	1908-
EPPO countries where introduced	Italy [E; Sardegna P; Sicilia E], Israel [P], Portugal, Greece [F], Cyprus [T], France [P], Spain [P], former USSR (Georgia) [F?] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	Australia

### ***Rhizophagus grandis***

Family	Rhizophagidae
Target pest	<i>Dendroctonus micans</i>
Date of first use	1963-
EPPO countries where introduced	former USSR (Georgia) [S], UK [E], France [E] ( <i>Probably widespread in Central &amp; Eastern Europe</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	Belgium

### ***Rhyzobius forestieri***

Family	Coccinellidae
Target pest	<i>Saissetia oleae</i>
Date of first use	1980
EPPO countries where introduced	Italy [S], France [S], Greece [E], Cyprus [N], Israel [E]
Multiple/single introductions	Single
Origin of collected material	Australia

### ***Rodolia cardinalis***

Family	Coccinellidae
Target pest	<i>Icerya purchasi</i>
Date of first use	1897-
EPPO countries where introduced	Portugal [C], former USSR (Georgia) [C], Italy [S], former Yugoslavia [N], Israel [C*], France [C], Spain [C], Switzerland [F], Greece [S], Malta [C], Cyprus [S] ( <i>Mediterranean distribution, CIS</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	Australia

### ***Scymnus impexus***

Family	Coccinellidae
Target pests	<i>Adelges</i> spp.
Date of first use	1968

EPPO countries where introduced	Sweden [S], UK [N] ( <i>native in Europe</i> )
Multiple/single introductions	Single
Origin of collected material	Germany
<b><i>Scymnus reunioni</i></b>	
Synonym	<i>Nephus reunioni</i>
Family	Coccinellidae
Target pest	<i>Planococcus citri</i>
Date of first use	1967
EPPO countries where introduced	Israel [N], Italy (Sardegna) [P], former USSR (Georgia) [F?]
Multiple/single introductions	Single
Origin of collected material	India
<b><i>Serangium parcesetosum</i></b>	
Family	Coccinellidae
Target pest	<i>Dialeurodes citri</i>
Date of first use	1973
EPPO countries where introduced	former USSR [Georgia, C*; Azerbaijan, C*; Uzbekistan, F], France (Corse) [E], Israel, Turkey [S?]
Multiple/single introductions	Single
Origin of collected material	India, former USSR

## **Insecta, Diptera**

### ***Cryptochetum iceryae***

Family	Cryptochetidae
Target pest	<i>Icerya purchasi</i>
Date of first use	1987
EPPO countries where introduced	Israel [S]
Multiple/single introductions	Single
Origin of collected material	Australia

## **Insecta, Hymenoptera**

### ***Ageniaspis citricola***

Family	Encyrtidae
Target pest	<i>Phyllocnistis citrella</i>
Date of first use	1994-
EPPO countries where introduced	Israel, Morocco, Algeria, Tunisia, France, Greece, Cyprus, Spain [C], Italy (Sicilia); established only on Canary Islands where provides complete control of the target pest
Multiple/single introductions	Single, multiple
Origin of collected material	Thailand, Florida (USA)

### ***Allotropia burrelli***

Family	Platygasteridae
Target pest	<i>Pseudococcus comstocki</i>
Date of first use	1945
EPPO countries where introduced	former USSR [P*]
Multiple/single introductions	Single
Origin of collected material	Japan

<b><i>Allotropa convexifrons</i></b>	
Family	Platygasteridae
Target pest	<i>Pseudococcus comstocki</i>
Date of first use	1945
EPPO countries where introduced	former USSR [P*]
Multiple/single introductions	Single
Origin of collected material	Korea
<b><i>Amitus spiniferus</i></b>	
Family	Platygasteridae
Target pest	<i>Aleurothrixus floccosus</i>
Date of first use	1971-
EPPO countries where introduced	France [C*], Italy [S*]
Multiple/single introductions	Single
Origin of collected material	Central America
<b><i>Anagyrus agragensis</i></b>	
Family	Encyrtidae
Target pest	<i>Nipaecoccus viridis</i>
Date of first use	1984-
EPPO countries where introduced	Jordan [S?], Israel [S?]
Multiple/single introductions	Single
Origin of collected material	Guam
<b><i>Anagyrus fusciventris</i></b>	
Family	Encyrtidae
Target pests	Pseudococcidae ( <i>Pseudococcus longispinus</i> )
Date of first use	1972
EPPO countries where introduced	Israel [S]
Multiple/single introductions	Single
Origin of collected material	Australia
<b><i>Anaphes nitens</i></b>	
Family	Mymaridae
Target pest	<i>Gonipterus scutellatus</i>
Date of first use	1978
EPPO countries where introduced	Italy [C], France [P], Spain [S]
Multiple/single introductions	Single
Origin of collected material	Australia
<b><i>Aphelinus mali</i></b>	
Family	Aphelinidae
Target pest	<i>Eriosoma lanigerum</i>
Date of first use	1920-
EPPO countries where introduced	France [P], Hungary [S], Israel [P], Italy [S], Switzerland [S], former USSR (Azerbaijan) [C], Portugal [N], Belgium [C], Germany [P], UK [P], Slovenia, Malta, Netherlands [P], Spain [P], Poland [P], Sweden [P], Cyprus [C], Denmark [P] ( <i>Widespread in the EPPO region</i> )
Multiple/single introductions	Single
Origin of collected material	USA
<b><i>Aphytis holoxanthus</i></b>	
Family	Aphelinidae
Target pest	<i>Chrysomphalus aonidum</i>
Date of first use	1956

EPPO countries where introduced	Israel [C*] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	Hong Kong
<b><i>Aphytis lepidosaphes</i></b>	
Family	Aphelinidae
Target pest	<i>Cornuaspis beckii</i>
Date of first use	1956-
EPPO countries where introduced	Israel [C], Cyprus [N], France [N], Greece [S], Spain [S], Italy (Sicilia) [P]
Multiple/single introductions	Single
Origin of collected material	China
<b><i>Aphytis lingnanensis</i></b>	
Family	Aphelinidae
Target pest	<i>Aonidiella aurantii</i>
Date of first use	1960-
EPPO countries where introduced	Cyprus [P], Israel [E], Italy (Sicilia), Morocco [E], Spain [P] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	China
<b><i>Aphytis melinus</i></b>	
Family	Aphelinidae
Target pest	<i>Chrysomphalus dictyospermi</i>
Date of first use	1962-
EPPO countries where introduced	Greece [S; Kriti, C], Italy [C], Morocco [C], France (Corse) [P], Spain [P] ( <i>commercially available for inundative releases since 2008</i> ), former USSR (Georgia) [E?] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	?
Origin of collected material	India/Pakistan
Target pest	<i>Aonidiella aurantii</i>
Date of first use	1961-
EPPO countries where introduced	Cyprus [P], Israel [P], Italy (Sicilia) [P], Morocco [E] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	India/Pakistan
Target pest	<i>Aspidiotus nerii</i>
Date of first use	?
EPPO countries where introduced	Greece (Kriti) [P] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	India/Pakistan
<b><i>Aphytis proclia</i></b>	
Family	Aphelinidae
Target pest	<i>Pseudaulacaspis pentagona</i>
Date of first use	1924
EPPO countries where introduced	Italy [S] ( <i>Widespread in the EPPO region</i> )
Multiple/single introductions	Single
Origin of collected material	East Asia
<b><i>Clausenia purpurea</i></b>	
Family	Encyrtidae
Target pest	<i>Pseudococcus citriculus</i>
Date of first use	1940

EPPO countries where introduced	Israel [C]
Multiple/single introductions	Single
Origin of collected material	Japan
<b><i>Comperiella bifasciata</i></b>	
Family	Encyrtidae
Target pest	<i>Aonidiella aurantii</i>
Date of first use	1924-
EPPO countries where introduced	Israel [P*], Italy, France [N], Spain [P] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	South China
<b><i>Encarsia berleseii</i></b>	
Family	Aphelinidae
Target pest	<i>Pseudaulacaspis pentagona</i>
Date of first use	1906-
EPPO countries where introduced	Italy [C], Bulgaria [C], Switzerland [C], Spain [C], Austria [C], former USSR [C], France [P], Hungary, Slovenia
Multiple/single introductions	Single
Origin of collected material	Japan, East Asia
<b><i>Encarsia herdoni</i></b>	
Synonym	<i>Encarsia elongata</i>
Family	Aphelinidae
Target pest	<i>Lepidosaphes gloverii</i>
Date of first use	1979
EPPO countries where introduced	Spain [S]
Multiple/single introductions	Single
Origin of collected material	East Asia
<b><i>Encarsia lahorensis</i></b>	
Family	Aphelinidae
Target pest	<i>Dialeurodes citri</i>
Date of first use	1973-
EPPO countries where introduced	Italy [S; Sardegna, P; Sicilia, C], former USSR (Georgia) [C*], France [E], Turkey, Greece [S, E], Israel [C*]
Multiple/single introductions	Single, multiple
Origin of collected material	India, Pakistan
<b><i>Encarsia perniciosi</i></b>	
Family	Aphelinidae
Target pest	<i>Quadraspidotus perniciosus</i>
Date of first use	1932-
EPPO countries where introduced	Italy [P], former USSR [E], Germany [P], France [P], Bulgaria [C], former Czechoslovakia [E, N], Switzerland [P], former Yugoslavia [N], Austria [E], Greece [E], Spain [P] ( <i>Widespread in the EPPO region</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	China, Korea
<b><i>Eretmocerus debachi</i></b>	
Family	Aphelinidae
Target pest	<i>Parabemisia myricae</i>
Date of first use	1982-
EPPO countries where introduced	Israel [C], Turkey [C], Italy [S] ( <i>Mediterranean distribution?</i> )
Multiple/single introductions	Single



Origin of collected material	Japan, North America
<b><i>Metaphycus anneckeii</i></b>	
Family	Encyrtidae
Target pest	Saissetia oleae
Date of first use	?
EPPO countries where introduced	Greece [C], Israel [E], France [E], Italy [F]
Multiple/single introductions	Single
Origin of collected material	South Africa
<b><i>Metaphycus flavus</i></b>	
Family	Encyrtidae
Target pest	Coccus hesperidum
Date of first use	1959
EPPO countries where introduced	Italy [P], former USSR (Ukraine) [C] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	Morocco
<b><i>Metaphycus helvolus</i></b>	
Family	Encyrtidae
Target pest	Saissetia oleae
Date of first use	1960-
EPPO countries where introduced	Israel [E], France (Corse) [P*], Greece [C; Kriti, S], Italy [P], Spain [S], Cyprus [E], former USSR [F]
Multiple/single introductions	Single
Origin of collected material	South Africa
<b><i>Metaphycus lounsburyi</i></b>	
Family	Encyrtidae
Target pest(s)	Saissetia oleae
Date of first use	1973-
EPPO countries where introduced	France [P], Israel [C], Greece (Kriti) [P], Italy [E], Cyprus [S] ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single
Origin of collected material	South Africa
<b><i>Metaphycus swirskii</i></b>	
Family	Encyrtidae
Target pest	Saissetia oleae
Date of first use	1973
EPPO countries where introduced	Israel [E], France [E], Greece (Kriti) [P], Italy [P]
Multiple/single introductions	Single
Origin of collected material	Kenya
<b><i>Neodryinus typhlocybae</i></b>	
Family	Dryinidae
Target pest	Metcalfa pruinosa
Date of first use	1989-
EPPO countries where introduced	Italy, France, Slovenia, Switzerland
Multiple/single introductions	Single
Origin of collected material	USA
<b><i>Neodusmetia sangwani</i></b>	
Family	Encyrtidae
Target pest	Antonina graminis
Date of first use	1971
EPPO countries where introduced	Israel [S]

Multiple/single introductions	Single
Origin of collected material	South India
<b><i>Ooencyrtus kuvanae</i></b>	
Family	Encyrtidae
Target pest	Lymantria dispar
Date of first use	1922
EPPO countries where introduced	former Czechoslovakia [E], Spain [P], Morocco [E], Algeria [E], Portugal [E], former USSR (Kazakhstan, Moldova, Russia, Ukraine, Uzbekistan) [P]
Multiple/single introductions	Single
Origin of collected material	Japan
<b><i>Pseudaphycus malinus</i></b>	
Family	Encyrtidae
Target pest	Pseudococcus comstocki
Date of first use	1945
EPPO countries where introduced	former USSR [C]
Multiple/single introductions	Single
Origin of collected material	Korea
<b><i>Psyllaephagus pilosus</i></b>	
Family	Encyrtidae
Target pest	Ctenarytaina eucalypti
Date of first use	1994
EPPO countries where introduced	Ireland [S], France [S]
Multiple/single introductions	Single
Origin of collected material	Australia
<b><i>Psytalia concolor</i></b>	
Synonym	Opius concolor
Family	Braconidae
Target pest	Bactrocera oleae
Date of first use	1914-
EPPO countries where introduced	Italy [S], Greece [P], France [P], Spain [P], Portugal, former Yugoslavia [N]
Multiple/single introductions	Single
Origin of collected material	Libya, Tunisia
<b><i>Pteroptrix orientalis</i></b>	
Synonym	Archenomus orientalis
Family	Aphelinidae
Target pest	Pseudaulacaspis pentagona
Date of first use	1909
EPPO countries where introduced	Italy [S]
Multiple/single introductions	Single
Origin of collected material	Japan
<b><i>Pteroptrix smithi</i></b>	
Family	Aphelinidae
Target pest	Chrysomphalus aonidum
Date of first use	1956
EPPO countries where introduced	Israel [C*]
Multiple/single introductions	Single
Origin of collected material	Hong Kong

### Appendix III: List of biological control agents removed from Appendices I or II

Species in Appendix 3 were listed in Appendices 1 or 2 but have been removed from one of these appendices. These species are not necessarily unsafe. Rather, they no longer fulfil all of the criteria to remain on the Positive List. The date of removal and a summary of the reasons for its removal from Appendix 1 or Appendix 2 are provided. Evidence for removal relating to adverse effects in one or more countries in the EPPO region are referenced.

#### Formerly recommended as commercially used biological control agents

Insecta  
Hymenoptera  
- *Cales noacki*  
- *Lysiphlebus testaceipes*

#### Formerly recommended as successfully introduced classical biological control agents

Insecta  
Coleoptera  
- *Harmonia axyridis*  
Hymenoptera  
- *Cales noacki*  
- *Lysiphlebus testaceipes*

#### Insecta: Hymenoptera

##### *Cales noacki*

Family	Aphelinidae
Main target pest	<i>Aleurothrixus floccosus</i>
Date of first use	1970
EPPO countries where introduced	Spain [S], France [C], Italy [S], Morocco [C], Portugal [E], Tunisia [C], Malta, Greece ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	Chile
Date of removal from the list	2009-03-25/26, Joint EPPO/IOBC Meeting on Biological Control Agents, Engelberg (CH)
Summary of reasons	Commercial releases may lead to establishment in non-target habitats in certain areas. Outdoor releases have shown a wide host range that extends beyond the order Hemiptera and in some areas out competes indigenous natural enemies.

##### *Lysiphlebus testaceipes*

Family	Braconidae
Main target pest	Aphididae ( <i>Aphis gossypii</i> )
Original distribution	Nearctic, USA
Distribution in EPPO	Mediterranean countries (and possibly others)
Date of first use	1990
EPPO countries where used	Denmark, Germany (DE), Italy, Spain
Use	Indoors
Date of removal from the list	2008-03-26/28, Joint EPPO/IOBC Meeting on Biological Control Agents Wageningen (NL)
Summary of reasons	The species has a wide host range and shown non-target effects. In some areas it has spread into non-target habitats, where it has attacked non-target host species and replaced native primary parasitoid species (see references).  Lumbierres B., Starý P., Pons X., 2007. Seasonal parasitism of cereal aphids in a Mediterranean arable crop system. <i>Journal of Pest Science</i> , 80: 125-130.  Pons X., Lumbierres B., Starý P., 2004. Expansión de <i>Lysiphlebus testaceipes</i> (Cresson) (Hym., Braconidae, Aphidiinae) en el Noreste de

la Península Ibérica. Boletín de Sanidad Vegetal. Plagas, 30: 547-552.

Starý P., Lumbierres B., Pons, X., 2004. Opportunistic changes in the host range of *Lysiphlebus testaceipes* (Cr.), an exotic aphid parasitoid expanding in the Iberian Peninsula. Journal of Pest Science, 77: 139-144.

### **Insecta: Coleoptera**

#### ***Harmonia axyridis***

Family	Coccinellidae
Main target pest	<i>Toxoptera aurantii</i>
Date of first use	1964
EPPO countries where introduced	Portugal (Azores) [S*], Greece, former USSR [N], Ukraine, Tunisia, Italy
Multiple/single introductions	Single
Origin of collected material	East Asia
Date of removal from the list	2009-03-25/26, Joint EPPO/IOBC Meeting on Biological Control Agents, Engelberg (CH)
Summary of reasons	The species has a wide host range across many taxonomic groups with a strong capacity for natural spread. The species has become established in large areas of the EPPO region and is known to attack non-target prey, including some beneficial species. Based on releases elsewhere, replacement of native coccinellid species in the EPPO region could be expected.

### **Insecta: Hymenoptera**

#### ***Cales noacki***

Family	Aphelinidae
Main target pest	<i>Aleurothrixus floccosus</i>
Date of first use	1970
EPPO countries where introduced	Spain [S], France [C], Italy [S], Morocco [C], Portugal [E], Tunisia [C], Malta, Greece ( <i>Mediterranean distribution</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	Chile
Date of removal from the list	2009-03-25/26, Joint EPPO/IOBC Meeting on Biological Control Agents, Engelberg (CH)
Summary of reasons	Commercial releases may lead to establishment in non-target habitats in certain areas. Outdoor releases have shown a wide host range that extends beyond the order Hemiptera and in some areas out competes indigenous natural enemies.

#### ***Lysiphlebus testaceipes***

Family	Braconidae
Target pest	<i>Aphis citricola</i>
Date of first use	1973
EPPO countries where introduced	former Czechoslovakia, France (Corse) [P], Morocco [N] ( <i>Mediterranean countries and possibly others</i> )
Multiple/single introductions	Single, multiple
Origin of collected material	USA
Target pest	<i>Toxoptera aurantii</i>
Date of first use	1973
EPPO countries where introduced	France [S, P], Spain [P], Italy [E], Morocco [N] ( <i>Mediterranean</i> )

	<i>countries and possibly others)</i>
Multiple/single introductions	Single, multiple
Origin of collected material	USA
Date of removal from the list	2008-03-26/28, Joint EPPO/IOBC Meeting on Biological Control Agents Wageningen (NL)
Summary of reasons	<p>The species has a wide host range and shown non-target effects. In some areas it has spread into non-target habitats, where it has attacked non-target host species and replaced native primary parasitoid species (see references).</p> <p>Lumbierres B., Starý P., Pons X., 2007. Seasonal parasitism of cereal aphids in a Mediterranean arable crop system. <i>Journal of Pest Science</i>, 80: 125-130.</p> <p>Pons X., Lumbierres B., Starý P., 2004. Expansión de <i>Lysiphlebus testaceipes</i> (Cresson) (Hym., Braconidae, Aphidiinae) en el Noreste de la Península Ibérica. <i>Boletín de Sanidad Vegetal. Plagas</i>, 30: 547-552.</p> <p>Starý P., Lumbierres B., Pons, X., 2004. Opportunistic changes in the host range of <i>Lysiphlebus testaceipes</i> (Cr.), an exotic aphid parasitoid expanding in the Iberian Peninsula. <i>Journal of Pest Science</i>, 77: 139-144.</p>

---

Result of introduction when available: [C] complete, [S] substantial, [P] partial, [E] established but not contributing to control or status unknown, [F] failed to become established; [N] no information on the outcome; [T] established but believed to have died out. Asterisks (\*) indicate cases where more than one organism contributed to the result.