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SAFE USE OF BIOLOGICAL CONTROL

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[1]) 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[2] 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

[1]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.

[2]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[3] 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.

[3]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.

APPENDICES

The lists which constitute the appendices are available via the web link 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

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.

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ADDENDUM

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

During their meeting in 2023 the Joint EPPO/IOBC Panel on biological control agents agreed that the definition of Castella et al. (2022): *native species (also called indigenous) species, meaning that they originate from and have evolved in a local area over a long period of time* is the most suitable definition for this Panel to use. Therefore the following footnote should be added to the scope of the Standard PM 6/3 (5) Biological control agents safely used in the EPPO region (EPPO, 2021).

*For this Standard, the definition of native/indigenous follows that of Castella et al. (2022) *native species (also called indigenous) species, meaning that they originate from and have evolved in a local area over a long period of time*.

REFERENCES

Castella C, Orsat C, Marcdargent M, Malausa T, Desneux N, De Clercq P, Pappas M, Stenberg JA, Roques N (2022). *Study on the Union's situation and options regarding invertebrate biological control agents for the use in plant health and plant protection*. European Commission, DG SANTE.

EPPO (2021). PM 6/3 (5) Biological control agents safely used in the EPPO region *EPPO Bulletin* 51, 452-454.

Appendices 1-3 (2024 version)

APPENDIX I - 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.

INSECTA

Coleoptera

Adalia bipunctata
Aleochara bilineata
Atheta coriaria
Chilocorus baileyi
Chilocorus bipustulatus
Chilocorus circumdatus
Chilocorus nigrita
Coccinella septempunctata
Cryptolaemus montrouzieri
Delphastus catalinae
Exochomus quadripustulatus
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
Anagyrus fusciventris
Anagyrus 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 pintoi
Trichopria drosophilae
Trissolcus basalis

Neuroptera

Chrysoperla carnea
Micromus angulatus

Thysanoptera

Franklinothrips megalops

Franklinothrips 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
Pronematus ubiquitus
Stratiolaelaps scimitus
Transeius montdorensis
Typhlodromus pyri

NEMATODA
Heterorhabditis bacteriophora
Heterorhabditis downesi
Heterorhabditis megidis
Phasmarhabditis californica
Phasmarhabditis hermaphrodita
Steinernema carpocapsae
Steinernema feltiae
Steinernema glaseri
Steinernema kraussei

Insecta, Coleoptera

Adalia bipunctata	
Family	Coccinellidae
Main target pests	Aphididae
Original distribution	Palaearctic (?)
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	*Delia antiqua, Delia radicum (= Delia brassicae)*
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	*Atheta brachelytra, Dalotia coriaria, Homalota coriaria*
Family	Staphylinidae
Original distribution	Europe, Northern Asia, North America, Oceania, widespread in EPPO region
Main target pests	Thripidae (thrips), Sciaridae (fungus gnats), Ephydridae (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 (*Saissetia oleae*)
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	*Planococcus citri*
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	*Delphastus pusillae*
Family	Coccinellidae
Main target pests	Aleyrodidae (*Trialeurodes vaporariorum, Bemisia tabaci*)
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
Exochomus quadripustulatus	
Synonym	-
Family	Coccinellidae
Main target pests	Hemiptera (*Pulvinaria, Saissetia oleae*, *Ceroplastes*, *Sphaerolecanium* and *Coccus*)
Original distribution	Europe, and throughout Paleartic region
Distribution in EPPO	Widespread
Date of first use	1975
EPPO countries where used	Germany, Greece,
Use	Outdoors/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	*Lindorus lophanthae*
Family	Coccinellidae
Main target pests	Diaspididae (*Pseudolacaspis pentagona*), *Quadraspidiotus perniciosus, Chrysomphalus dictyospermi, Parlatoria blanchardi*
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	*Icerya purchasi*
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	*Panonychus ulmi*
Original distribution	Palaearctic
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 (*Aphis gossypii, Myzus persicae, Macrosiphum* sp., *Aulacorthum* sp.)
Original distribution	Central Europe, Palaearctic
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	*Metasyrphus corollae*, *Syrphus corollae*
Family	Syrphidae
Main target pests	Aphididae
Original distribution	Palaearctic 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	*Feltiella tetranychi, Therodiplosis persicae*
Family	Cecidomyiidae
Main target pests	*Tetranychus urticae, T. cinnabarinus*
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	*Sphaerophoria flavicauda*, *Sphaerophoria nitidicollis*
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	France, 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	*Cacopsylla pyri*, 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, palaearctic
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 (*Frankliniella occidentalis, Thrips tabac*i)
Original distribution	Palaearctic (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 (*Frankliniella occidentalis, Thrips tabac*i)
Original distribution	Palaearctic
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	Palaearctic (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, *Leptinotarsa decemlineata*
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	*Pseudaphycus maculipennis*[1]
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	Palaearctic
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	Palaearctic
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	Erroneous: *Anagyrus pseudococci*[2]
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 (*Halyomorpha halys*)
Original distribution	Europe
Distribution in EPPO	Widespread
Date of first use	2019
EPPO countries where used	Italy
Use	Outdoors
Aphelinus abdominalis	
Family	Aphelinidae

[1] 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.*

[2] 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 (*Macrosiphum euphorbiae, Aulacorthum solani*)
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 (*Aphis gossypii, Myzus persicae, M. nicotianae*)
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	*Aulacorthum solani, Macrosiphum euphorbiae*
Original distribution	Palaearctic
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	*Myzus persicae*
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, *Quadraspidiotus perniciosus, Pseudaulacaspis pentagona*
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
Aphytis lingnanensis	
Family	Aphelinidae
Main target pests	*Aonidiella aurantii, Chrysomphalus dictyospermi*
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
Aphytis melinus	
Family	Aphelinidae
Main target pests	*Aonidiella aurantii*
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
Aprostocetus hagenowii	
Synonyms	*Tetrastichus hagenowii, Tetrastichodes hagenowii*
Family	Eulophidae
Main target pests	Blattidae (*Periplaneta* spp.)
Original distribution	?
Distribution in EPPO	Romania
Date of first use	1993
EPPO countries where used	Belgium, France, Germany, Netherlands, Spain
Use	Indoors
Bracon hebetor	
Synonyms	*Habrobracon hebetor*
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
Coccophagus lycimnia	
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
Coccophagus rusti	
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
Coccophagus scutellaris	
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
Comperiella bifasciata	
Family	Encyrtidae
Main target pests	Diaspididae (*Chrysomphalus aonidum, Aonidiella aurantii*)
Original distribution	?California/South China
Distribution in EPPO	Mediterranean
Date of first use	1985
EPPO countries where used	Belgium, Greece, Netherlands
Use	Indoors/outdoors
Cotesia marginiventris	
Synonyms	*Apanteles marginiventris*
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
Dacnusa sibirica	
Family	Braconidae
Main target pests	Agromyzidae (*Liriomyza* spp.)
Original distribution	Palearctic, 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)
Diglyphus isaea	
Family	Eulophidae
Main target pests	Agromyzidae (*Liriomyza* 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 (*Trialeurodes vaporariorum, Bemisia tabaci*)
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	*Encyrtus lecaniorum*
Family	Encyrtidae
Main target pests	Coccidae
Original distribution	Palaearctic
Distribution in EPPO	Widespread (south)
Date of first use	1980
EPPO countries where used	Belgium, France, Germany, Netherlands, Spain
Use	Indoors
Encyrtus infelix	
Synonyms	*Eucomys tananarivensis*
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	*Aphis frangulae, A. gossypii, Aulacorthum circumflexum, Aulacorthum solani, Brachycaudus helichrysi, Capitophorus inulae, Cavariella aegopodii, Chaetosiphon fragaefolii, Cryptomyzus galeopsidis, Dysaphis apiifolia, Dysaphis sp., Hyadaphis foeniculi, Hyperomyzus lactucae, Hyperomyzus sp., Myzus ascalonicus, M. cerasi, M. ligustri, M. nicotinae, M. ornatus, M. persicae, Nasonovia ribisnigri, Nasonovia sp., Ovatus crataegarius, Phorodon humili, Rhodobium porosum*
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	*Bemisia tabaci*
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	*Bemisia tabaci*
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	*Pseudococcus longispinus*
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	*Leptomastix abnormis*
Family	Encyrtidae
Main target pests	Pseudococcidae
Original distribution	Palaearctic
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	*Planococcus citri*
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 *Pseudococcus viburni*
Original distribution	Palaearctic
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
Metaphycus flavus	
Family	Encyrtidae
Main target pests	Coccidae, *Saissetia oleae, Coccus hesperidum*
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
Metaphycus helvolus	
Family	Encyrtidae
Main target pests	Coccidae (*Saissetia oleae Coccus hesperidum*)
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
Metaphycus lounsburyi	
Synonyms	*M. bartletti, M. anneckei* and *M. hagenowii,* also established in some Mediterranean countries, have been misidentified as *M. lounsburyi*
Family	Encyrtidae
Main target pests	Coccidae (*Saissetia oleae*)
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
Metaphycus swirskii	
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
Microterys nietneri	
Synonyms	*Microterys flavus*
Family	Encyrtidae
Main target pests	Coccidae (*Saissetia oleae*)
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	*Liriomyza bryoniae*
Original distribution	Palaearctic (?)
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	*Aphidius volucre*
Family	Braconidae
Main target pests	Aphididae
Original distribution	Palaearctic
Distribution in EPPO	Widespread
Date of first use	?
EPPO countries where used	Belgium, Guernsey, Jersey, Netherlands, UK
Use	Indoors
Scutellista caerulea	
Synonym	*Scutellista cyanea*
Family	Pteromalidae
Main target pests	Coccidae (*Saissetia oleae, S. coffeae, Ceroplastes rusci*)
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	*Hungariella peregrina*
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	*Hungariella pretiosa*
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	*Thripobius semiluteus*
Family	Eulophidae
Main target pests	Thysanoptera (*Heliothrips* 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
Trichogramma brassicae	
Synonyms	*Trichogramma maidis*
Family	Trichogrammatidae
Main target pests	Lepidoptera (*Ostrinia nubilalis*)
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
Trichogramma cacoeciae	
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
Trichogramma cordubensis	
Year of addition to the EPPO Positive List	2020
Family	Trichogrammatidae
Main target pests	Lepidoptera (e.g. *Cydalima perspectalis*, *Lobesia botrana* & *Eupoecilia ambiguella*)
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
Trichogramma dendrolimi	
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
Trichogramma evanescens	
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 pintoi	
Synonyms	*Trichogramma euproctidis*

Family	Trichogrammatidae
Original distribution	Palaearctic, Near East, Nearctic, Neotropical region; Oriental region, widespread in EPPO region
Main target pests	Mainly Lepidoptera species: *Ostrinia nubilalis, Helicoverpa armigera, Cydia nigricana, Cydia pomonella, Cydia funebrana, Plutella xylostella, Mamestra brassicae, Lacanobia oleracea*
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 Drosophila suzukii, 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
Trissolcus basalis	
Family	Scelionidae
Original distribution	Worldwide
Distribution in EPPO	Cyprus, France, Georgia, Hungary, Israel, Italy, Jordan, Montenegro, Morocco, Portugal, Spain, Turkey
Main target pests	*Nezara viridula*
Date of first use	2018 Spain (since 1930s as a classical BCA globally)
EPPO countries where used	France (2018) Spain (2017)
Use	Outdoors/Indoors

Insecta, Neuroptera

Chrysoperla carnea	
Synonyms	*Chrysopa carnea*
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
Micromus angulatus	
Synonyms	*Eumicromus angulatus*, *Hemerobius angulatus*, *Hemerobius hopii*
Family	Hemerobiidae
Main target pests	Aphididae etc.
Original distribution	Cosmopolitan
Distribution in EPPO	Widespread (Holarctic)
Date of first use	2021
EPPO countries where used	Belgium, Germany, Russian Federation, UK
Use	Indoors/outdoors

Insecta, Thysanoptera

Franklinothrips megalops	
Synonym	*Franklinothrips myrmicaeformis*
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 (*Howardia biclavis*)
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	*Amblyseius limonicus, Typhlodromus (Amblyseius) limonicus, Amblyseius (Typhlodromalus) limonicus, Typhlodromus limonicus, Amblyseius (Amblyseius) limonicus, Typhlodromalus limonicus*, *Typhlodromalus lailae*
Family	Phytoseiidae
Main target pests	Thrips and whiteflies (mainly *Bemisia tabaci*)
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	*Typhlodromus andersoni*
Family	Phytoseiidae
Main target pests	*Tetranychus urticae, T. cinnabarinus, Panonychus ulmi, Aculops lycopersicae, Polyphagotarsonemus latus, Phytonemus pallidus*
Original distribution	Palaearctic 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	*Amblyseius mckenziei, Neoseiulus barkeri*
Family	Phytoseiidae
Main target pests	Thysanoptera (*Thrips tabaci, Frankliniella occidentalis*), 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	*Iphiseius degenerans*
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	*Typhlodromips swirskii*
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	*Bemisia tabaci, Trialeurodes vaporariorum, Frankliniella occidentalis*
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	Belgum, 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	*Geolaelaps aculeifer*
Family	Laelapidae
Main target pests	Sciaridae, *Rhizoglyphus echinopus*
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	*Holostaspis subbadius, Macrocheles coprophila*
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	*Galendromus occidentalis, Typhlodromus occidentalis*
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	*Amblyseius californicus, Typhlodromus californicus, Amblyseius mungeri, Typhlodromus mungeri, Amblyseius chilensis, Typhlodromus marinus*
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

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Neoseiulus cucumeris	
Synonym	*Amblyseius cucumeris*
Family	Phytoseiidae
Main target pests	Thysanoptera (*T. tabaci, F. occidentalis*)
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	
Synonym	*Phytoseiulus riegeli, Phytoseiulus tardi*
Family	Phytoseiidae
Main target pests	Tetranychidae (*Tetranychus urticae*)
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
Pronematus ubiquitus	
Synonyms	*Tydeus ubiquitus*
Family	Iolinidae
Main target pests	*Aculops lycopersici, Tetranychus urticae, Acalitus essigi, Aculops cannibicola*
Original distribution	Cosmopolitan
Distribution in EPPO	Widespread
Date of first use	2021
EPPO countries where used	Belgium, Germany, Greece, Netherlands, Spain
Use	Indoors/outdoors
Stratiolaelaps scimitus	
Synonyms	*Hypoaspis scimitus*
Taxonomic remark	The species has been previously used under the erroneous name *Stratiolaelaps miles (=Hypoaspis miles = Geolaelaps miles*)*****
Family	Laelapidae
Main target pests	Sciaridae, *Rhizoglyphus echinopus*
Original distribution	Palaearctic
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. s*phaerogaster* (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	*Amblyseius montdorensis, Typhlodromips montdorensis*
Family	Phytoseiidae
Original distribution	Pacific Islands and western areas of the Australian mainland
Main target pests	Aleyrodidae (Trialeurodes spp. and Bemisia spp.), thrips (*Frankinella occidentalis* and *Thrips tabaci*) and Eriophyidae (*Aculops lycopersici*), although to be used principally against *Frankiniella occidentalis*
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	*Panonychus ulmi, Tetranychus urticae, Eriophyes vitis, Epitrimerus vitis*
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	*Heterorhabditis heliothidis*
Family	Heterorhabditidae
Main target pests	Vine weevils (*Otiorhynchus* 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 *Heterorhabditis*
Family	Heterorhabditidae
Main target pests	Vine weevils (*Otiorhynchus* spp.), *Phyllopertha horticola, Hoplia philanthus, Melolontha melolontha, Hylobius abietis*
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 (*Otiorhynchus* 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 californica	
Family	Rhabditidae
Main target pests	Slugs : *Arion distinctus, Arion hortensis, Deroceras invadens, Deroceras reticulatum, Arion lusitanicus, Arion rufus, Arion vulgaris, Deroceras laeve, Lehmannia valentiana and Milax gagates*
Original distribution	Widespread : Europe, North America, New Zealand
Distribution in EPPO	Widespread
Date of first use	2020
EPPO countries where used	Belgium, Germany, Netherlands, UK
Use	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	*Neoaplectana carpocapsae, N. feltiae*
Family	Steinernematidae
Main target pests	Vine weevils (*Otiorhynchus* 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	*Neoaplectana feltiae, N. bibionis, Steinernema bibionis, N. leucaniae*
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	*Neoaplectana glaseri*
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	*Otiorhynchus sulcatus*
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 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 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
Rhyzobius 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 berlesei
Encarsia herndoni
Encarsia lahorensis
Encarsia perniciosi
Eretmocerus debachi
Metaphycus anneckei
Metaphycus flavus
Metaphycus helvolus
Metaphycus lounsburyi
Metaphycus swirskii
Neodryinus typhlocybae
Neodusmetia sangwani
Ooencyrtus kuvanae
Pseudaphycus malinus
Psyllaephagus pilosus
Psyttalia concolor
Pteroptrix orientalis
Pteroptrix smithi
Tamarixia dryi

Insecta, Coleoptera

Adalia bipunctata	
Family	Coccinellidae
Target pest	*Toxoptera aurantii*
Date of first use	?
EPPO countries where introduced	Portugal (Azores) [S*] *(Widespread in the EPPO region)*
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] *(Mediterranean distribution)*
Multiple/single introductions	Single
Origin of collected material	Australia
Target pest	*Planococcus citri*
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?] *(Mediterranean distribution)*
Multiple/single introductions	Single, multiple
Origin of collected material	Australia
Rhizophagus grandis	
Family	Rhizophagidae
Target pest	*Dendroctonus micans*
Date of first use	1963-
EPPO countries where introduced	former USSR (Georgia) [S], UK [E], France [E] *(Probably widespread in Central & Eastern Europe)*
Multiple/single introductions	Single, multiple
Origin of collected material	Belgium
Rhyzobius forestieri	
Family	Coccinellidae
Target pest	*Saissetia oleae*
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	*Icerya purchasi*
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] *(Mediterranean distribution, CIS)*
Multiple/single introductions	Single, multiple
Origin of collected material	Australia
Scymnus impexus	
Family	Coccinellidae
Target pests	*Adelges* spp.
Date of first use	1968

EPPO countries where introduced	Sweden [S], UK [N] *(native in Europe)*
Multiple/single introductions	Single
Origin of collected material	Germany
Synonym	*Nephus reunioni*
Family	Coccinellidae
Target pest	*Planococcus citri*
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
Serangium parcesetosum	
Family	Coccinellidae
Target pest	*Dialeurodes citri*
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	*Icerya purchasi*
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	*Phyllocnistis citrella*
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)
Allotropa burrelli	
Family	Platygasteridae
Target pest	*Pseudococcus comstocki*
Date of first use	1945
EPPO countries where introduced	former USSR [P*]
Multiple/single introductions	Single
Origin of collected material	Japan
Allotropa convexifrons	

Family	Platygasteridae
Target pest	*Pseudococcus comstocki*
Date of first use	1945
EPPO countries where introduced	former USSR [P*]
Multiple/single introductions	Single
Origin of collected material	Korea
Amitus spiniferus	
Family	Platygasteridae
Target pest	*Aleurothrixus floccosus*
Date of first use	1971-
EPPO countries where introduced	France [C*], Italy [S*]
Multiple/single introductions	Single
Origin of collected material	Central America
Anagyrus agraensis	
Family	Encyrtidae
Target pest	*Nipaecoccus viridis*
Date of first use	1984-
EPPO countries where introduced	Jordan [S?], Israel [S?]
Multiple/single introductions	Single
Origin of collected material	Guam
Anagyrus fusciventris	
Family	Encyrtidae
Target pests	Pseudococcidae (*Pseudococcus longispinus*)
Date of first use	1972
EPPO countries where introduced	Israel [S]
Multiple/single introductions	Single
Origin of collected material	Australia
Anaphes nitens	
Family	Mymaridae
Target pest	*Gonipterus scutellatus*
Date of first use	1978
EPPO countries where introduced	Italy [C], France [P], Spain [S]
Multiple/single introductions	Single
Origin of collected material	Australia
Aphelinus mali	
Family	Aphelinidae
Target pest	*Eriosoma lanigerum*
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] *(Widespread in the EPPO region)*
Multiple/single introductions	Single
Origin of collected material	USA
Aphytis holoxanthus	
Family	Aphelinidae
Target pest	*Chrysomphalus aonidum*
Date of first use	1956
EPPO countries where introduced	Israel [C*] *(Mediterranean distribution)*

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

Multiple/single introductions	Single
Origin of collected material	Japan
Comperiella bifasciata	
Family	Encyrtidae
Target pest	*Aonidiella aurantii*
Date of first use	1924-
EPPO countries where introduced	Israel [P*], Italy, France [N], Spain [P] *(Mediterranean distribution)*
Multiple/single introductions	Single
Origin of collected material	South China
Encarsia berlesei	
Family	Aphelinidae
Target pest	Pseudaulacaspis pentagona
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
Encarsia herndoni	
Synonym	Encarsia elongata
Family	Aphelinidae
Target pest	Lepidosaphes gloverii
Date of first use	1979
EPPO countries where introduced	Spain [S]
Multiple/single introductions	Single
Origin of collected material	East Asia
Encarsia lahorensis	
Family	Aphelinidae
Target pest	Dialeurodes citri
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
Encarsia perniciosi	
Family	Aphelinidae
Target pest	Quadraspidiotus perniciosus
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] *(Widespread in the EPPO region)*
Multiple/single introductions	Single, multiple
Origin of collected material	China, Korea
Eretmocerus debachi	
Family	Aphelinidae
Target pest	Parabemisia myricae
Date of first use	1982-
EPPO countries where introduced	Israel [C], Turkey [C], Italy [S] *(Mediterranean distribution?)*
Multiple/single introductions	Single
Origin of collected material	Japan, North America

Metaphycus anneckei	
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
Metaphycus flavus	
Family	Encyrtidae
Target pest	Coccus hesperidum
Date of first use	1959
EPPO countries where introduced	Italy [P], former USSR (Ukraine) [C] *(Mediterranean distribution)*
Multiple/single introductions	Single
Origin of collected material	Morocco
Metaphycus helvolus	
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
Metaphycus lounsburyi	
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] *(Mediterranean distribution)*
Multiple/single introductions	Single
Origin of collected material	South Africa
Metaphycus swirskii	
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
Neodryinus typhlocybae	
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
Neodusmetia sangwani	
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
Ooencyrtus kuvanae	
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
Pseudaphycus malinus	
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
Psyllaephagus pilosus	
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
Psyttalia concolor	
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
Pteroptrix orientalis	
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
Pteroptrix smithi	
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
Tamarixia dryi	

Family	Eulophidae
Target pest	*Trioza erytreae*
Date of first use	2019
EPPO countries where introduced	Portugal [S], Spain (mainland and Azores) [S]
Multiple/single introductions	Multiple
Origin of collected material	South Africa

Appendix 3: 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	*Aleurothrixus floccosus*
Date of first use	1970
EPPO countries where introduced	Spain [S], France [C], Italy [S], Morocco [C], Portugal [E], Tunisia [C], Malta, Greece (*Mediterranean distribution*)
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 (*Aphis gossypii*)
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. Journal of Pest Science, 80: 125-130. Pons X., Lumbierres B., Starý P., 2004. Expansión de *Lysiphlebus testaceipes* (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	*Toxoptera aurantii*
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	*Aleurothrixus floccosus*
Date of first use	1970
EPPO countries where introduced	Spain [S], France [C], Italy [S], Morocco [C], Portugal [E], Tunisia [C], Malta, Greece (*Mediterranean distribution*)
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	*Aphis citricola*
Date of first use	1973
EPPO countries where introduced	former Czechoslovakia, France (Corse) [P], Morocco [N] (*Mediterranean countries and possibly others*)
Multiple/single introductions	Single, multiple
Origin of collected material	USA
Target pest	*Toxoptera aurantii*
Date of first use	1973
EPPO countries where introduced	France [S, P], Spain [P], Italy [E], Morocco [N] (*Mediterranean countries and possibly others*)

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	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. Journal of Pest Science, 80: 125-130.
	Pons X., Lumbierres B., Starý P., 2004. Expansión de *Lysiphlebus testaceipes* (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.

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.