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AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Grower Summary

Headline

Biopesticides are urgently needed for soft fruit production but in the UK there are only 15 biopesticide *active substances* registered, compared to 279 in the USA, as registration is such a major hurdle.

Background and expected deliverables

Across Europe, there has been increasing retailer (and consumer) pressure on growers to reduce chemical pesticide residues on fresh produce, often to below the levels recommended and enforced by the European authorities.

A new, more stringent, legislative framework setting the Maximum Residue Limit's (MRL) came into force in Europe on 1 September 2008 on pesticide residues (Regulation (EC) 396/2005), but despite this, there is still pressure for produce to have residue levels below those recommended in this new legislation.

Biopesticides can be suitable alternatives to some chemical products. In many cases, due to their mode of action, their use will not result in the presence of significant residues.

Several other issues are also promoting interest in biopesticides as crop protection agents:

- Loss of active ingredients as a result of the EU pesticide review.
- Anticipated losses of active ingredients following the changes in the EU Plant Protection Product Regulation (91/414/EEC).
- Need for wider range of crop protection products to support resistance management.
- Continued development of sustainable production methods, including in response to the EU thematic strategy – for safer sustainable food production.
- Increased reliance on Integrated Pest/Crop Management (IP/CM) crop protection.

Around the world, there are over 1500 biopesticide products which are widely used for crop protection in conventional agriculture and horticulture. They are used both as individual products and in Integrated Pest Management programmes, and can be used for organic crop production.

Currently, few biopesticide products are available to UK soft fruit growers: this project aimed to provide growers with information about biopesticides, and their potential for use as part of robust integrated crop protection protocols that support soft fruit production systems. It was

intended that this information could be used to develop policies and strategies on biopesticides, to encourage streamlining the registration and marketing of the products needed by growers.

Summary of the project and main conclusions

These aims were addressed through liaison with key grower associations, relevant trade associations and buyer organisations. In addition, information was obtained from links with UK and European regulators and relevant biopesticide companies and distributors, to ascertain product availability and ways to encourage an increase in biopesticide product availability for the UK.

The information gathered is summarised in a series of databases:

1. List of biopesticide products currently registered in the UK and biopesticide products exempted from registration in the UK (Tables 1 & 2 and Tables 5 & 6).
2. List of companies producing and distributing biopesticides available in UK (Table 7).
3. List of active ingredients registered in EU (Table 8).
4. Cross-referencing of six soft fruit crops (strawberry, raspberry, blackberry, blackcurrant, blueberry and rhubarb) with UK-available biopesticides plus potential products, that is those listed in the EU but not yet registered in UK (Tables 9 to 14).

Biopesticides – status in UK and discussion

Definition

Like chemical plant protection products, biopesticides are regulated under the Council Directive 91/414/EEC and its subsequent amendments. There is no standardised definition of a biopesticide in Europe. However, in the UK, the regulatory authority, Chemicals Regulatory Directorate (CRD) (formerly Pesticide Safety Directorate - PSD) describes biopesticides as 'micro-organisms, botanicals (or biochemicals or plant extracts) and semiochemicals (including pheromones) and an additional category of 'other' which is judged on a case-by-case basis'.

Registration

Active substances are registered by the EU and thereafter *products* are registered in each member state (Figure 1). The registration process of both active substance and product takes about 5 years (range of 2-10 years) and costs on average, between €200,000 and €2 million for development of data and registration fees. The actual costs depend on the country of registration and the type of product.

Although biopesticides may in recent years have been considered 'natural' or 'safe' these are inappropriate terms. If any product claims to have a plant protection effect, (ie. it reduces the incidence of invertebrates, diseases or weeds), it must be registered under 91/414/EEC and its recent amendments, unless specifically exempted.

Specific

A feature of many biopesticides is that they are specific in their target activity, therefore it is likely that growers will need many more biopesticide products in future to support soft fruit production compared to chemical pesticides.

Biopesticides registered in the UK

Biopesticides available in the UK are summarised in Tables 1 and 2 with full details listed in Tables 5 and 6, with information on distributors in Table 7. Table 6 lists those non-registered products that are officially exempt from registration requirements. In addition to the products listed below there are some products, for example based on micro-organisms which, do not make any crop protection claims so do not have to be registered and have not been listed. These types of products are not considered in this project.

Table 1. Registered biopesticide products in the UK (July 2009)

Active Substance	Product Name	Type of product	Target(s)
(E,E)-8,10-dodecadien-1-ol	Exosex CM	Pheromone	Codling moth
<i>Bacillus subtilis</i> QST713	Serenade ASO	Bacteria	Botrytis/Grey mould
<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Bacteria	Lepidoptera pests
<i>Beauveria bassiana</i> ATC74040	Naturalis-L	Fungus	Whitefly, thrips
<i>Candida oleophila</i> Strain O	Nexy1	Yeast	Post harvest diseases
<i>Coniothyrium minitans</i> Strain	Contans WG	Fungus	Sclerotinia

CON/M/91-08			
<i>Cydia pomonella</i> Granulosis Virus	Cyd-X	Granulosis virus	Codling moth
<i>Cydia pomonella</i> Granulosis Virus	Cyd-X Extra	Granulosis virus	Codling moth
Fatty Acids	Savona	Fatty Acids	Whitefly, thrips, spider mite, aphids
Laminarin	Vacciplant	Plant extract/glucan	Cereal diseases
<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	Fungus	Whitefly, thrips, scale insects, mealybug
<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	Fungus	Aphids
<i>Peniophora gigantea</i>	PG Suspension	Fungus	PGR
Plant oils_citronella oil	Barrier H	Herbicide	Weeds
<i>Pseudomonas chlororaphis</i> MA 342	Cerall	Bacteria	Seed treatment for cereal diseases
Zucchini Yellow Mosaic Virus Weak Strain	Curbit	Plant virus	Plant viruses

Table 2. Exempted biopesticide products in the UK (July 2009)

Active Substance	Product Name	Type of product	Target(s)
<i>Steinernema feltiae</i>	Nemasys	Entomopathogenic nematode	Sciarids, leafminer, WFT
<i>Steinernema krausseii</i>	Nemasys L	Entomopathogenic nematode	Vine weevil
<i>Heterorhabditis megidis</i>	Nemasys H	Entomopathogenic nematode	Vine weevil,
<i>Heterorhabditis megidis</i>	Lavanem	Entomopathogenic nematode	Vine weevil
<i>Heterorhabditis megidis</i>	Nemasys H	Entomopathogenic nematode	Grubs
<i>Steinernema carpocasae</i>	Nemasys C	Entomopathogenic nematode	Codling moth (occasional cutworms)
<i>Steinernema carpocasae</i>	Nemasys C	Entomopathogenic nematode	<i>Hylobius</i> sp., Lepidoptera
<i>Steinernema carpocapsae</i>	Capsanem	Entomopathogenic nematode	Lepidoptera
<i>Phasmarhabditis hermaphrodita</i>	Nemaslug	Slug parasitic nematode	Slugs
Maltodextrin	Majestik	Other	Aphids
<i>Trichoderma harzianum</i> Rifai (T-22)	Trianum	Micro-organism	Root diseases

Registration in the USA and other countries

In the USA there are over 279 biopesticide *active substances* registered compared to 77 in the EU and 15 in the UK (16 products). A comparison of the categories of pesticides

registered in the EU and USA is made in Tables 3 and 4. The US has had a biopesticide-specific registration system in place for over 15 years. In 1994, the USA Environmental Protection Agency established the Biopesticides and Pollution Prevention Division in the Office of Pesticide Programmes to help the registration of biopesticides. It also promotes the use of safer pesticides, including biopesticides, as components of IPM programmes. It seems obvious that the large differences in product availability must, in part, be because registration in the EU is a hurdle to biopesticide availability.

Other factors contributing to the disparity between the USA and Europe include the fact that:

- the European biopesticide industry is younger,
- the EU markets are highly fragmented and smaller compared to the USA,
- the USA has government support for development of biopesticide capacity through the IR-4 programme.

The IR-4 project is a co-operative programme of the United States Department of Agriculture (USDA) and the State Agricultural Experiment Stations, to support registration of newer, reduced risk, crop protection products for speciality crops. It is the only publicly funded programme in the USA that conducts research and submits applications for uses in such crops. The crops include both edibles and ornamentals, where total production is less than 300,000 acres (121,400ha) or those crops for which there is insufficient economic incentive for commercially backed registration. Given the relatively small UK markets for biopesticides, this project, while likely to be illegal under EU rules, has demonstrated that it is possible to improve biopesticide product availability.

In the Netherlands, a government-supported programme (www.genoeg.net) was set up to address the business issues and to increase growers' knowledge and effective use of 'natural origin' pesticides. The aim was to identify effective products, to assist registration (including costs up to €100,000), and share knowledge about such products. The fact that more products became available and growers learned more about using them is a mark of the programme's success. A similar approach could help growers in the UK.

Table 3. Biopesticide active substances listed on the EU Active Substances list

	Insecticide	Fungicide	Herbicide	Nematicide	Repellant	Other
Microorganism Bt	5	-	-	-	-	-
Microorganism non-Bt	3	20	0	1	0	1
Botanical	0	0	0	0	2	7
Baculovirus	4	-	-	-	-	-
Semio-chemical + pheromone	28	-	-	-	-	-
Other	2	1	1	0	1	1
Total	42	21	1	1	3	9

Table 4. Biopesticide active substances available in USA, April 2009

	Insecticide	Fungicide	Herbicide	Nematicide	Repellant	Other
Microorganism Bt	44	-	-	-	-	-
Microorganism non-Bt	11	41	5	3	0	1
Botanical	8	6	1	2	28	1
Baculovirus	7	-	-	-	-	-
Semio-chemical + pheromones	56	-	-	-	-	-
Other	25	8	3	0	8	21
Total	151	55	9	5	36	23

The main restraints on product availability are:

- Registration – in the US, as a result of a biopesticide specific registration system that has been in place over 15 years, plus the minor uses project, IR-4, significantly more products are available than in Europe and UK. The GENOEG project in the Netherlands also confirms this.
- UK soft fruit pests and diseases represent a small market for many biopesticide products, so it is often uneconomical to support a product registration relative to the market value of the product.
- Few products have been available so growers have limited experience with biopesticides, which may result in a lack of confidence in their efficacy, limiting their uptake.

Biopesticide Gaps

Specific details of biopesticides available for each of the soft fruit crops, is provided in the cross-referencing tables (9 to 14). Details of producers of UK active substances and distributors of the associated products are listed in Table 7.

The most obvious gap for all soft fruit is that in the UK, there is only one bio-herbicide. This is not an issue specific to the UK but a general feature of biopesticides. Globally, there are few bio-herbicides available. This may well be driven by the low cost margins for these types of products, making biopesticide development economically unfeasible. The one product that is available, Barrier H, is for use against ragwort in horse pasture.

Another significant gap is that in the UK, there are no biopesticides available for use against nematodes. Globally, few bio-nematicides are available but some are in development. The limited number of products is probably a reflection of the technical complexities of developing these products.

There is a limited range of biopesticide products in the UK (Table 1 and 2) which means that for UK soft fruit pests and diseases, few products are available. The exceptions are for some fungal diseases such as *Sclerotinia* spp. and *Botrytis* spp., for Lepidopterous larvae and some sucking pests (aphids and thrips). However, there are several new biopesticide products in the process of being registered in the UK which will become available shortly, including products with activity against fungal and bacterial diseases and insect pests.

Considering the list of active substances available in Europe, it is reasonable to assume that there is potential for an increase in biopesticide product availability in the UK, provided manufacturers consider it financially viable to register here. Also, there is an increase in USA based biopesticide companies starting to register active substances in Europe. Although it may take several years before they are available to growers, there is reason to be optimistic.

Conclusions

- In the UK there are 15 biopesticide *active substances* registered, compared to 77 in the EU and approximately 279 in the USA.
- Biopesticides are ideally suited for soft fruit production systems aiming to produce residue free crops, along with IPM systems and to aid resistance management.

- With few products available, the UK soft fruit industry currently has no access to biopesticides for nematode and weed control and there are significant gaps in the availability of biopesticides for pest and disease management.
- Biopesticide product availability in the UK is increasing. However it seems that this is at a rate that may be too slow to meet growers' needs unless additional action is taken.
- Product registration still represents the greatest hurdle to biopesticide product availability in the UK.
- The limited target specificity of many biopesticide products means their potential markets are highly fragmented, often making new product development unviable.

Financial benefits

The changes to the EU plant protection regulatory system will potentially lead to fewer crop protection options in future and a serious threat to horticultural food production in the UK including soft fruits. Biopesticides will be of increasing significance in helping sustain production.

Action Points - for improving UK biopesticide availability and use

- There is a need for government support within relevant UK bodies to develop and facilitate biopesticide registrations. Good examples are provided by US regulators, through the EPA Biopesticide registration system and accompanying IR-4 project.
- Improved support of companies registering biopesticide products is essential, for example the GENOEG project in Netherlands.
- Increased government support is needed for the mainly SME biopesticide companies to develop these types of products that support sustainable agriculture.
- A forum for crop groups with similar pest or disease problems would help with collaboration and to identify biopesticide product needs. This could be linked to relevant producers and distributors to facilitate biopesticide availability.
- Improve information sources about biopesticide products and their availability.

- Develop specialist biopesticide product distributors in the UK to provide detailed and accurate biopesticide product knowledge.
- Support work on implementation of biopesticides to provide guidance on features, development of use programmes and improve knowledge on field delivery using existing equipment.

Relevant Links

1. UK regulatory authority: Chemicals Regulation Directorate - Pesticides (formerly Pesticides Safety Directorate) – biopesticide information pages:
www.pesticides.gov.uk/biopesticides_home.asp
2. USA regulatory authority biopesticide web pages:
www.epa.gov/pesticides/biopesticides/#factsheet
3. EU plant protection databases including lists of active substances:
http://ec.europa.eu/food/plant/protection/evaluation/index_en.htm
4. US programme to support minor uses:
(IR-4 programme: <http://ir4.rutgers.edu>)
5. Legislation on new MRL regulations
http://ec.europa.eu/food/plant/protection/pesticides/index_en.htm
6. International Biocontrol Manufacturers Association
www.ibma.ch
7. Biopesticide Industry Association (US)
www.biopesticideindustryalliance.org
8. GENOEG project - Netherlands
www.genoeg.net

Table 5: List of UK Biopesticide Products - Registered

Active Substance	Product Name	Type of product	Target(s)	SOLA	Annex I listed	Producer	Distrbutor	Comments
(E,E)-8,10-dodecadien-1-ol	Exosex CM	Pheromone	Codling moth	No	Yes	Exosect Ltd.	Exosect Ltd	
<i>Bacillus subtilis</i> QST713	Serenade ASO	Bacteria	Botrytis	Yes	Yes	Agraquest Inc.	Fargro Ltd. Syngenta Bioline Ltd.	
<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Bacteria	Lepidoptera pests	Yes	Yes	Sumitomo Chemical Agro Europe SA	Fargro Ltd. Interfarm UK Ltd.	
<i>Beauveria bassiana</i> ATC74040	Naturalis-L	Fungus	Whitefly, thrips, spidermite	No	Yes	Intrachem Bio	Belchim Crop Protection Limited	
<i>Candida oleophila</i> Strain O	Nexy1	Yeast	Post harvest diseases	No	Pending	BioNext sprl	BioNext sprl	
<i>Coniothyrium minitans</i> Strain CON/M/91-08	Contans WG	Fungus	Sclerotinia	No	Yes	Prophyta Biologischer Pflanzenschutz	Fargro Ltd., Belchim Crop Protection Ltd.	Registered under COPR in UK
<i>Cydia pomonella</i> Granulosis Virus	Cyd-X	Granulosis virus	Codling moth	No	Yes	Certis Europe BV	Certis Europe BV	
<i>Cydia pomonella</i> Granulosis Virus	Cyd-X Extra	Granulosis virus	Codling moth	No	Yes	Certis Europe BV	Certis Europe BV	
Fatty Acids	Savona	Fatty Acids	Whitefly, thrips, spidermite, aphid	Yes	?	Koppert B.V.	Koppert B.V.	
Laminarin	Vacciplant	Plant extract/glucan	Cereal diseases	No	Yes	Goemar SA	Goemar SA	
<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	Fungus	Whitefly, thrips, scale insects, mealybug	Yes	Yes	Koppert B.V.	Koppert B.V., Fargro Ltd.	Registered under COPR in UK
<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	Fungus	Aphids	Yes	Yes	Koppert B.V.	Koppert B.V., Fargro Ltd.	Registered under COPR in UK
<i>Peniophora gigantea</i>	PG Suspension	Fungus	PGR	No	No	Forestry Commission	Forest Research	Registered under COPR
Plant oils_citronella oil	Barrier H	Herbicide	Weeds	No	Yes	Barrier Biotech Ltd	Barrier Biotech Ltd	
<i>Zucchini</i> Yellow Mosaic Virus Weak Strain	Curbit	Plant virus	plant viruses	No	Pending	Bio-Oz Biotechnologies Ltd	Bio-Oz Biotechnologies Ltd	Registered under COPR in UK

Table 6: List of UK Biopesticide Products – Exempt from Registration

Active Substance	Product Name	Type of product	Target(s)	Licence	Producer	Distrbutor
<i>Steinernema feltiae</i>	Nemasys	Entompathogenic nematode	Sciarids, leafminer, WFT	UK isolate	Becker Underwood	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna, Sylvan
<i>Steinernema kraussei</i>	Nemasys L	Entompathogenic nematode	vine weevil	Uk isolate	Becker Underwood	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna
<i>Heterorhabditis megidis</i>	Nemasys H	Entompathogenic nematode	vine weevil,	Uk isolate	Becker Underwood	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna
<i>Heterorhabditis megidis</i>	Lavanem	Entompathogenic nematode	Vine weevil		Koppert BV	Koppert UK
<i>Heterorhabditis megidis</i>	Nemasys H	Entompathogenic nematode	Grubs	UK isolate	Becker Underwood	Scotts
<i>Steinernema carpocasae</i>	Nemasys C	Entompathogenic nematode	codling moth (occasional cutworms)	UK isolate	Becker Underwood	Agrovista
<i>Steinernema carpocasae</i>	Nemasys C	Entompathogenic nematode	Hylobius	UK isolate	Becker Underwood	Forestry product
<i>Steinernema carpocapsae</i>	Capsanem	Entompathogenic nematode	Lepidoptera		Koppert BV	Koppert UK
<i>Phasmarhabditis hermaphrodita</i>	Nemaslug	slug parasitic nematode	Slugs	Uk isolate	Becker Underwood	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna, Branstons, Procam, Wallace of Kelso
Maltodextrin	Majestik	Other	Aphids	N/A	Certis LLC	Certis Europe BV
<i>Trichoderma harzianum</i> Rifai (T-22)	Trianum	Micro-organism	Root diseases		BioWorks Inc.	Koppert UK

Table 7: List of UK Active Biopesticide Producers and Distributors

Company	Country	Website	Comments
Agraquest Inc.	USA	www.Agraquest.com	
Agrauxine	FR	www.agrauxine.fr	
Agrifutur s.r.L.	IT	www.agrifutur.com	
Agro Green	Israel	www.agrogreen.co.il	
Becker Underwood Inc.	USA, UK	www.beckerunderwood.com	
Belchim Crop Protection Ltd.	BE, UK, ES, IT, HU	www.belchim.com	
BioNext sprl	BE		Post harvest products
Bio-Protect GmbH	DE	www.bio-protect.de	
Bioworks Inc.	USA	www.bioworksbiocontrol.com	
Certis LLC	USA, UK	www.certis.com	
Ecospray Ltd.	UK	www.ecospray.com	
E-Nema GmbH	DE	www.e-nema.de	
Exosect Ltd.	UK	www.exosect.com	
Fargro Ltd	UK	www.fargro.co.uk	
Futureco S.L	ES	www.futureco.net	
Intrachem Bio S.r.L	IT, FR	www.intrachem.it	
Intrerfarm (UK) Ltd.	UK	www.interfarm.co.uk	
Koppert B.V.	NL	www.koppert.nl	
Novozymes Biologicals Inc.	USA, EU	www.novozymes.com	
Prophyta GmbH	DE	www.prophyta.de	
Vedera Oy	FI	www.verdera.fi	
W. Neudorff GmbH KG	DE	www.neudorff.de	
www.sourcon-padena.de			Pseudomonas sp. Starin DSMZ 13134
Xeda International		www.xeda.com	Plant oils for post harvest

Table 8: List of EU Active Substances

EU Active PPP March 2009	Category ^a	Annex I 91/414	*RMS ^b	MRLs Reg 396/2005
<i>Bacillus thuringiensis</i> subsp. <i>Aizawai</i> (ABTS-1857 and GC-91)	IN	In	IT	
<i>Bacillus thuringiensis</i> subsp. <i>Israelensis</i> (AM65-52)	IN	In	IT	
<i>Bacillus thuringiensis</i> subsp. <i>Kurstaki</i> (ABTS 351, PB 54, SA 11, SA12 and EG 2348)	IN	In	DK	
<i>Bacillus thuringiensis</i> subsp. <i>Tenebrionis</i> (NB 176)	IN	In	IT	
<i>Beauveria bassiana</i> (ATCC 74040 and GHA)	IN	In	DE	
<i>Cydia pomonella granulosis virus</i> (CpGV)	IN	In	DE	
<i>Lecanicillium muscarium</i> (Ve6) (former <i>Verticillium lecanii</i>)	IN	In	NL	
<i>Metarhizium anisopliae</i> (BIPESCO 5F/52)	IN	In	NL	
<i>Phlebiopsis gigantea</i>	FU	In	EE	
<i>Pythium oligandrum</i> (M1)	FU	In	SE	
<i>Streptomyces griseoviridis</i> (K61)	FU	in	EE	
<i>Trichoderma atroviride</i> (IMI 206040) (T 11) (formerly <i>Trichoderma harzianum</i>)	FU	In	SE	
<i>Trichoderma harzianum</i> Rifai (T-22)	FU	In	SE	
<i>Trichoderma polysporum</i> (IMI 206039)	FU	In	SE	
<i>Trichoderma gamsii</i> (formerly <i>T. viride</i>) (ICC080)	FU	In	FR	
<i>Verticillium dahliae alboatrum</i> (WCS850) (formerly <i>Verticillium dahliae</i>)	FU	In	NL	
Acetic acid	HB	In	DE	Reg. 839/2008
Blood meal	RE	In	BE	Reg. 839/2008
Extract from tea tree	RE	In	LV	Reg. 839/2008
Oleic acid (CAS 112-80-1)	FU	In	IE	

EU Active PPP March 2009	Category ^a	Annex I 91/414	*RMS ^b	MRLs Reg 396/2005
Pelargonic acid (CAS 112-05-0)	FU	In	IE	
Garlic extract	RE	In	PL	Reg. 839/2008
Hydrolysed proteins	IN	In	EL	
Kieselguhr (diatomaceous earth)	IN	In	EL	Reg. 839/2008
Pepper	RE	In	HU	Reg. 839/2008
Plant oils / Citronella oil	HB	In	UK	Reg. 839/2008
Plant oils / Clove oil	RE	In	UK	Reg. 839/2008
Plant oils / Rape seed oil	IN	In	ES	Reg. 839/2008
Plant oils / Spearmint oil	FU	In	SE	Reg. 839/2008
Sea-algae extract (formerly sea-algae extract and seaweeds)	PG	In	IT	Reg. 839/2008
Straight Chain Lepidoptera Pheromones:	AT	In	AT	
Dodecyl acetate	AT	In	AT	
(E)-5-Decen-1-yl-acetate	AT	In	AT	
(E)-8-Dodecen-1-yl acetate	AT	In	AT	
(E/Z)-8-Dodecen-1-yl acetate	AT	In	AT	
(Z)-8-Dodecen-1-yl acetate	AT	In	AT	
(Z)-9-Dodecen-1-yl acetate	AT	In	AT	
(7E, 9E)-Dodecadien 1-yl acetate	AT	In	AT	
(7E, 9Z)-Dodecadien 1-yl acetate	AT	In	AT	
(Z)-11-Hexadecen-1-yl acetate	AT	In	AT	
(7Z, 11E)-Hexadecadien-1-yl acetate	AT	In	AT	
(7Z, 11Z)-Hexadecadien-1-yl acetate	AT	In	AT	
(2E, 13Z)-Octadecadien-1-yl acetate	AT	In	AT	

EU Active PPP March 2009	Category ^a	Annex I 91/414	*RMS ^b	MRLs Reg 396/2005
(E)-11-Tetradecen-1-yl acetate	AT	In	AT	
(Z)-9-Tetradecen-1-yl acetate	AT	In	AT	
(Z)-11-Tetradecen-1-yl acetate	AT	In	AT	
(9Z, 12E)-Tetradecadien-1-yl acetate	AT	In	AT	
(E)-5-Decen-1-ol	AT	In	AT	
(Z)-8-Dodecen-1-ol	AT	In	AT	
(E,E)-8,10-Dodecadien-1-ol	AT	In	AT	
Tetradecan-1-ol	AT	In	AT	
(Z)-11-Hexadecen-1-ol	AT	In	AT	
(Z)-7-Tetradecenal	AT	In	AT	
(Z)-9-Hexadecenal	AT	In	AT	
(Z)-11-Hexadecenal	AT	In	AT	
(Z)-13-Octadecenal	AT	In	AT	
(Z)-13-Hexadecen-11yn-1-yl acetate	AT	In	AT	
(Z,Z,Z,Z)-7,13,16,19-Docosatetraen-1-yl isobutyrate	AT	In	AT	
<i>Ampelomyces quisqualis</i> strain AQ10	FU	In	FR	Reg. 149/2008
<i>Bacillus subtilis</i> strain QST 713	BA, FU	In	DE	Reg. 149/2008
<i>Coniothyrium minitans</i>	FU	In	DE	Reg. 149/2008
<i>Gliocladium catenulatum</i> strain J1446	FU	In	FI	Reg. 839/2008
<i>Paecilomyces fumosoroseus</i> Apopka strain 97	FU	In	BE	Reg. 149/2008
<i>Paecilomyces lilacinus</i>	FU	In	BE	
<i>Pseudomonas chlororaphis</i> strain MA342	IN	In	SE	Reg. 149/2008
<i>Spodoptera exigua</i> nuclear polyhedrosis virus	FU	In	NL	

EU Active PPP March 2009	Category ^a	Annex I 91/414	*RMS ^b	MRLs Reg 396/2005
<i>Adoxophyes orana</i> GV strain BV-0001	IN	pending	DE	
Ascorbic acid	FU	pending	NL	
<i>Aureobasidium pullulans</i>	FU, BA	pending	AT	
<i>Candida oleophila</i> strain O	FU	pending	UK	
<i>Helicoverpa armigera</i> nucleopolyhedrovirus (HearNPV)	IN	pending	EE	
<i>Paecilomyces fumosoroseus</i> strain Fe9901	NE	pending	BE	
<i>Pseudomonas</i> sp. Strain DSMZ 13134	FU	pending	NL	
<i>Pseudozyma flocculosa</i>	FU	pending	NL	
<i>Spodoptera littoralis</i> nucleopolyhedrovirus	IN	pending	EE	
<i>Trichoderma atroviride</i> starin I-1237	FU	pending	FR	
Zucchini Yellow Mosaik Virus, weak strain	FU	pending	UK	

Abbreviations as follows:

- ^a - AC = acaricide,
AT = Attractant
BA = Bactericide
FU = fungicide,
HB = herbicide,
IN = insecticide,
NE = nematocide,
PG = plant growth regulator;
RE = repellent,
RO = rodenticide,

*RMS = Rapporteur Member States

^b – AT = Austria, IT = Italy, DK = Denmark, NL= Netherlands, EE = Estonia, SE = Sweden, FR = France, BE= Belgium, LV = Latvia, IE = Ireland, PL = Poland, EL = Greece, HU = Hungary, UK = United Kingdom, ES = Spain, FI = Finland.

Table 9: Biopesticide Gap Assessment for Strawberry *Disclaimer: Items in grey indicate where information not confirmed*

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Strawberry aphid Shallot aphid Melon & cotton aphid Potato aphid	<i>Chaetosiphon fragaefolii</i> <i>Myzus ascalonicus</i> <i>Aphis gossypii</i>	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	Yes			Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	In UK for protected crops only
Glasshouse & potato aphid Violet aphid Black bean aphid Strawberry root aphid Yellow rose aphid	<i>Aulacorthum solani</i> <i>Myzus ornatus</i> <i>Aphis fabae</i> <i>Aphis forbesi</i> <i>Rhodobium porosum</i>			N/A	Maltodextrin	Majestik	Certis Europe BV	Certis LLC	Maltodextrin	Pending	
								Thermo trilogy	<i>Paecilomyces fumosoroseus</i> (<i>Apopka strain 97, PFR 97 or CG 170, ATCC20874</i>)	unknown	Unknown if still in production as Thermo trilogy no longer in business
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
								Intrachem Bio srl	<i>Beauveria bassiana ATC74040</i>	Naturalis-L	UK registered for whitefly and thrips
							Certis Europe BV	Bioworks Inc.	<i>Beauveria bassiana GHA</i>	Botanigard	
Vine weevil	<i>Otiorhynchus sulcatus</i>				<i>Steinernema kraussei</i>	Nemasys L	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Nemasys H	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Lavanem	Koppert UK Ltd	Koppert B.V.			
					<i>Heterorhabditis bacteriophora</i>			E-Nem a GmbH	N/A		
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	Submitted for UK registration, marketing 2010

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments	
		Active	Product		Active	Product						
Strawberry Blossom weevil	<i>Anthonomus rubi</i>											
Tarsonemid mite	<i>Phytonemus pallidus</i> ssp. <i>fragariae</i>											
Two spotted spider mite	<i>Tetranychus urticae</i>						Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips	
Carnation thrips Flower thrips Rose thrips Onion thrips Western flower thrips	<i>Thrips atratus</i> <i>Frankliniella intonsa</i> <i>Thrips majo</i> <i>Thrips tabaci</i> <i>Frankliniella occidentalis</i>	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	No	No		Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips	
		<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	Yes	Yes		Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal		
								Bioworks Inc.	<i>Beauveria bassiana</i> GHA	Botanigard		
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,		
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,		
							<i>Steinernema feltiae</i>	Nemasys F	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna, Sylvan	Becker Underwood Ltd.	N/A	
Capsids	<i>Lygus</i> spp.											
Tarnish plant bug	<i>Lygus rugulipennis</i>											
Cuckoo spit/froghopper	<i>Philaenus spumarius</i>											
Blackberry leaf midge	<i>Dasineura plicatrix</i>											
Strawberry tortrix	<i>Acleris comariana</i>	<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Yes			Fargro Ltd., Interfarm (UK) Ltd.	Valent Biosciences Inc.	<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Bt Isolate: (ABTS 351, PB 54, SA 11, SA12 and EG 2348)	
						<i>Steinernema carpocapsae</i>	Nemasys C	Agrovista	Becker Underwood Ltd,			
						<i>Steinernema carpocapsae</i>	Capsanem	Koppert Uk Ltd	Koppert B.V.			
						<i>Steinernema carpocapsae</i>	Nematop	Fast Products Ltd.	E-Nem a GmbH			

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Whitefly	<i>Trialeurodes vaporariorum</i>	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	Yes			Koppert B.V., Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	
		Fatty acids	Savona				Koppert B.V.	Koppert B.V.	Fatty acids	Savona	
		<i>Beauveria bassiana</i> ATC74040	Naturalis-L	No			Belchim Crop Protection Limited	Intrachem Bio	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	
								Futureco Biosciences	<i>Beauveria bassiana</i> GHA	Botanigard	Mycotal - protected crops only
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
								Futureco S.L.	<i>Paecilomyces fumosoroseus</i> strain Fe9901 pending	Nofly	
Shore fly	<i>Scatella</i> spp.										
Free living nematodes	<i>Pratylenchus penetrans</i> , <i>Xiphinema diversicaudatum</i> , <i>Longidorus</i> spp.										
Slugs and other molluscs	<i>Derocerus</i> sp. <i>Milax</i> sp., <i>Helix</i> sp.				<i>Phasmarhabditis hermaphrodita</i>	Nemaslug	Fargro Ltd., Becker Underwood Ltd.	Becker Underwood Ltd.	N/A		

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Grey mould	<i>Botrytis cinerea</i>	<i>Bacillus subtilis</i> QST713	Serenade ASO	Yes			Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	
Angular leaf spot/leaf blight	<i>Xanthomonas arboricola</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	UK registration for botrytis only
Wilt	<i>Verticillium dahliae</i>				Trichoderma harzianum Rifai (T-22)	Triatum	Koppert	BioWorks Inc.	Trichoderma harzianum Rifai (T-22)	Root Shield WP or Granules, Triatum	Will be registered in the UK
	<i>Verticillium albostratum</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
Crown rot	<i>Phytophthora cactorum</i>							Biopreparaty Co. Ltd	<i>Pythium oligandrum</i> (M1)	Polyversum	
Black spot	<i>Colletotrichum acutatum</i>							Verdera Oy	<i>Gliocladium catenulatum</i> strain J1446	Gliomix	Seedlings
Soft rot	<i>Mucor</i> spp. <i>Rhizopus</i> spp.							Verdera Oy	Streptomyces K61 (K61) (formerly streptomyces griseoviridis)	Mycostop	
Rots	<i>Pythium</i> sp. <i>Rhizoctonia</i> sp. <i>Phytophthora</i> sp.							Unknown	<i>Trichoderma aspellerum</i> (ICC012) (T11) (TV1)	unknown	
								unknown	<i>Trichoderma polysporum</i> (IMI 206039)	unknown	
								unknown	<i>Trichoderma atroviride</i> (IMI 206040) (T 11)	unknown	
								unknown	<i>Trichoderma gamsii</i> (ICC080)	unknown	
Powdery mildew	<i>Sphaerotheca macularis</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
								Intrachem Bio	<i>Ampelomyces quisqualis</i> strain AQ10	AQ10	
Red core	<i>Phytophthora fragariae</i>										

Table 10: Biopesticide Gap Assessment for Raspberry *Disclaimer: Items in grey indicate where information not confirmed*

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Vine weevil	<i>Otiorhynchus sulcatus</i>				<i>Steinernema kraussei</i>	Nemasys L	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Nemasys H	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Lavanem	Koppert UK Ltd	Koppert B.V.			
					<i>Heterorhabditis bacteriophora</i>			E-Nema GmbH	N/A		
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	Submitted for UK registration, marketing 2010
Double dart moth	<i>Graphiphora augur</i>	<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Yes			Fargro Ltd., Interfarm (UK) Ltd.	Valent Biosciences Inc.	<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Bt Isolate: (ABTS 351, PB 54, SA 11, SA12 and EG 2348)
Rapsberry moth	<i>Lampronia rubiella</i>				<i>Steinernema carpocapsae</i>	Nemasys C	Agrovista	Becker Underwood Ltd,			
					<i>Steinernema carpocapsae</i>	Capsanem	Koppert Uk Ltd	Koppert B.V.			
					<i>Steinernema carpocapsae</i>	Nematop	Fast Products Ltd.	E-Nema GmbH			
Raspberry beetle	<i>Byturus tomentosus</i>										
Raspberry cane midge	<i>Resseliella theobaldi</i>										
Large raspberry aphid	<i>Amphorophora idaei</i>	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	Yes			Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	In UK for protected crops only
Small raspberry aphid	<i>Aphis idaei</i>			N/A	Maltodextrin	Majestik	Certis Europe BV	Certis LLC	Maltodextrin	Pending	
Potato aphid	<i>Macrosiphum euphorbiae</i>							Thermo trilogy	<i>Paecilomyces fumosoroseus</i> (Aopka strain 97, PFR 97 or CG 170, ATCC20874)	unknown	Unknown if still in production as Thermotrilogy no longer in business

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Peach potato aphid	<i>Myzus persicae</i>							Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
Melon & cotton aphid	<i>Aphis gossypii</i>							Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
								Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips
							Certis Europe BV	Bioworks Inc.	<i>Beauveria bassiana</i> GHA	Botanigard	
Common green capsid	<i>Lygocoris pabulinus</i>										
Tarnished plant bug	<i>Lygus rugulipennis</i>										
Cantharid beetle	<i>Rhagonycha fulva</i>										
Shield bug	various										
Glasshouse whitefly	<i>Trialeurodes vaporariorum</i>	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	Yes			Koppert B.V., Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	
		Fatty acids	Savona				Koppert B.V.	Koppert B.V.	Fatty acids	Savona	
		<i>Beauveria bassiana</i> ATC74040	Naturalis-L	No			Belchim Crop Protection Limited	Intrachem Bio	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	
								Futureco Biosciences	<i>Beauveria bassiana</i> GHA	Botanigard	Mycotal - protected crops only
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
								Futureco S.L.	<i>Paecilomyces fumosoroseus</i> strain Fe9901 pending	Nofly	
Leafhoppers	<i>Macropsis fuscula</i>										
Two-spotted spider mite	<i>Tetranychus urticae</i>						Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Raspberry leaf and bud mite	<i>Phyllocoptes gracilis</i>										
Blackberry mite	<i>Acalitus essigi</i>										
Scale insect	<i>Pulvinariaspp.</i>										
Raspberry sawfly	<i>Priophorus morio</i>										
Thrips	<i>Frankliniella occidentalis</i>	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	No			Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips
		<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	Yes			Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Mycotal	
								Bioworks Inc.	<i>Beauveria bassiana</i> GHA	Botanigard	
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
					<i>Steinernema feltiae</i>	Nemasys F	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna, Sylvan	Becker Underwood Ltd.	N/A		
Springtails	Collembola										
Sciarids	<i>Bradysia</i> sp.				<i>Steinernema feltiae</i>	Nemasys F	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna, Sylvan	Becker Underwood Ltd.	N/A		
Freeliving nematodes	<i>Pratylenchus</i> sp., <i>Xiphenema diversicaudatum</i> <i>Longidorus</i> sp.										

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Grey mould	<i>Botrytis cinerea</i>	<i>Bacillus subtilis</i> QST713	Serenade ASO	Yes			Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	
Cane blight	<i>Leptosphaeria coniothyrium</i>										
Cane spot	<i>Elsinoe veneta</i>										
Raspberry root rot	<i>Phytophthora fragariae var. rubi</i>				Trichoderma harzianum Rifai (T-22)	Triatum	Koppert	BioWorks Inc.	Trichoderma harzianum Rifai (T-22)	Root Shield WP or Granules, Triatum	Will be registered in the UK
Spur blight	<i>Didymella applanata</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
Midge blight	<i>R. theobaldi + Phoma/Fusarium</i>							Biopreparaty Co. Ltd	<i>Pythium oligandrum</i> (M1)	Polyversum	
Wilt	<i>Verticillium dahliae</i>							Verdera Oy	<i>Gliocladium catenulatum</i> strain J1446	Gliomix	Seedlings
	<i>Cladosporium</i> sp.							Verdera Oy	<i>Streptomyces K61 (K61)</i> (formerly <i>streptomyces griseoviridis</i>)	Mycostop	
	<i>Penicillium</i> sp.							Unknown	<i>Trichoderma aspellerum</i> (ICC012) (T11) (TV1)	unknown	
	<i>Rhizopus</i>							unknown	<i>Trichoderma polysporum</i> (IMI 206039)	unknown	
	Mucor							unknown	<i>Trichoderma atroviride</i> (IMI 206040) (T 11)	unknown	
	<i>Verticillium albotratum</i>							unknown	<i>Trichoderma gamsii</i> (ICC080)	unknown	
Raspberry yellow rust	<i>Phragmidium rubi-idaei</i>										
Powdery Mildew	<i>Sphaerotheca macularis</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
								Intrachem Bio	<i>Ampelomyces quisqualis</i> strain AQ10	AQ10	

Table 11: Biopesticide Gap Assessment for Blackberry *Disclaimer: Items in grey indicate where information not confirmed*

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Vine weevil	<i>Otiorhynchus sulcatus</i>				<i>Steinernema kraussei</i>	Nemasys L	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Nemasys H	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Lavanem	Koppert UK Ltd	Koppert B.V.			
					<i>Heterorhabditis bacteriophora</i>			E-Nema GmbH	N/A		
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	Submitted for UK registration, marketing 2010
Blackberry-cereal aphid	<i>Sitobium fragariae</i>	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	Yes			Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	In UK for protected crops only
Blackberry aphid	<i>Aphis ruborum</i>			N/A	Maltodextrin	Majestik	Certis Europe BV	Certis LLC	Maltodextrin	Pending	
								Thermo trilogy	<i>Paecilomyces fumosoroseus</i> (Apopka strain 97, PFR 97 or CG 170, ATCC20874)	unknown	Unknown if still in production as Thermotrilogy no longer in business
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
								Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips
							Certis Europe BV	Bioworks Inc.	<i>Beauveria bassiana</i> GHA	Botanigard	
Blackberry leaf midge	<i>Dasineura plicatrix</i>										
Blackberry mite	<i>Acalitus essigi</i>										
Redberry mite											
Two spotted spider mite	<i>Tetranychus urticae</i>						Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Whitefly (protected)	<i>Trialeurodes vaporariorum</i>										
Tortrix	<i>Acleris comariana</i>	<i>Bacillus thuringiensis var kurstaki</i>	DiPel DF	Yes			Fargro Ltd., Interfarm (UK) Ltd.	Valent Biosciences Inc.	<i>Bacillus thuringiensis var kurstaki</i>	DiPel DF	Bt Isolate: (ABTS 351, PB 54, SA 11, SA12 and EG 2348)
					<i>Steinernema carpocapsae</i>	Nemasys C	Agrovista	Becker Underwood Ltd,			
					<i>Steinernema carpocapsae</i>	Capsanem	Koppert Uk Ltd	Koppert B.V.			
					<i>Steinernema carpocapsae</i>	Nematop	Fast Products Ltd.	E-Nema GmbH			
Capsid	<i>Lygocoris pabulinus</i>										
Leaf hopper	<i>Hauptidia macroccana Macropsis fuscula</i>										
Raspberry beetle	<i>Byturus tomentosus</i>										
Springtail	Collembola										
Thrips	<i>Frankliniella occidentalis</i>	<i>Beauveria bassiana ATC74040</i>	Naturalis-L (protected only)	No			Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana ATC74040</i>	Naturalis-L	UK registered for whitefly and thrips
		<i>Lecanicillium muscarium (formerly Verticillium lecanii)</i>	Mycotal	Yes			Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium (formerly Verticillium lecanii)</i>	Mycotal	
								Bioworks Inc.	<i>Beauveria bassiana GHA</i>	Botanigard	
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae (F52)</i>	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae (BIPESCO 5)</i>	GranMet WP,	
					<i>Steinernema feltiae</i>	Nemasys F	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna, Sylvan	Becker Underwood Ltd.	N/A		

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Wilt	<i>Verticillium dahliae</i> & <i>erticillium albotratum</i>				Trichoderma harzianum Rifai (T-22)	Trianum	Koppert	BioWorks Inc.	Trichoderma harzianum Rifai (T-22)	Root Shield WP or Granules, Trianum	Will be registered in the UK
Cane Blight	<i>Leptosphaeria coniothyrium</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
								Biopreparaty Co. Ltd	<i>Pythium oligandrum</i> (M1)	Polyversum	
								Verdera Oy	<i>Gliocladium catenulatum</i> strain J1446	Gliomix	Seedlings
								Verdera Oy	Streptomyces K61 (K61) (formerly streptomyces griseoviridis)	Mycostop	
								Unknown	<i>Trichoderma aspellerum</i> (ICC012) (T11) (TV1)	unknown	
								unknown	<i>Trichoderma polysporum</i> (IMI 206039)	unknown	
								unknown	<i>Trichoderma atroviride</i> (IMI 206040) (T 11)	unknown	
								unknown	<i>Trichoderma gamsii</i> (ICC080)	unknown	
Grey mould	<i>Botrytis cinerea</i>	<i>Bacillus subtilis</i> QST713	Serenade ASO	Yes			Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	
Downy mildew	<i>Peronospora sparsa</i>										
Powdery mildew	<i>Sphaerotheca macularis</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
								Intrachem Bio	<i>Ampelomyces quisqualis</i> strain AQ10	AQ10	
Purple blotch	<i>Septocya ruborum</i>										
Leaf and Cane spot	<i>Septoria rubi</i>										
Cane and leaf rust	<i>Kuehneola uredinis</i>										
Blackberry yellow rust	<i>Phragmidium violaceum</i>										

Table 12: Biopesticide Gap Assessment for Blackcurrant (including Ribes spp. red currant, gooseberry)

Disclaimer: Items in grey indicate where information not confirmed

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Vine weevil	<i>Otiorhynchus sulcatus</i>				<i>Steinernema kraussei</i>	Nemasys L	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Nemasys H	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Lavanem	Koppert UK Ltd	Koppert B.V.			
					<i>Heterorhabditis bacteriophora</i>			E-Nema GmbH	N/A		
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	Submitted for UK registration, marketing 2010
Two-spotted spider mite	<i>Tetranychus urticae</i>						Belchim Crop Protection Limited	Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips
Blackcurrant gall mite	<i>Cecidophyopsis ribis</i>										
Big-bud mite	<i>Cecidophyopsis ribis</i>										
Blackcurrant aphid Gooseberry aphid Currant sow thistle or currant lettuce aphid Permanent currant aphid Red currant blister aphid	<i>Cryptomyzus galeopsidis</i> <i>Aphis grossulariae</i> <i>Hyperomyzus lactucae</i> <i>Aphis schneideri</i> <i>Cryptomyzus ribis</i>	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	Yes			Fargro Ltd.	Koppert B.V.	<i>Lecanicillium muscarium</i> (formerly <i>Verticillium lecanii</i>)	Vertalec	In UK for protected crops only
				N/A	Maltodextrin	Majestik	Certis Europe BV	Certis LLC	Maltodextrin	Pending	
								Thermo trilogy	<i>Paecilomyces fumosoroseus</i> (Apopka strain 97, PFR 97 or CG 170, ATCC20874)	unknown	Unknown if still in production as Thermo trilogy no longer in business
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	
								Agrifutur s.r.l	<i>Metarhizium anisopliae</i> (BIPESCO 5)	GranMet WP,	
								Intrachem Bio srl	<i>Beauveria bassiana</i> ATC74040	Naturalis-L	UK registered for whitefly and thrips

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Aphids contd.							Certis Europe BV	Bioworks Inc.	<i>Beauveria bassiana</i> GHA	Botanigard	
Clearwing	<i>Synanthedon tipuliformis</i>										
Leaf curling midge	<i>Dasineura tetensi</i>										
Common Green Capsid	<i>Lygocoris pabulinus</i>										
Scale insect	<i>Pulvinaria vitis</i> syn. <i>P. ribesiae</i>										
Winter moth	<i>Operophtera brumata</i>	<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Yes			Fargro Ltd., Interfarm (UK) Ltd.	Valent Biosciences Inc.	<i>Bacillus thuringiensis</i> var <i>kurstaki</i>	DiPel DF	Bt Isolate: (ABTS 351, PB 54, SA 11, SA12 and EG 2348)
Rose Tortrix	<i>Archips rosana</i>				<i>Steinernema carpocapsae</i>	Nemasys C	Agrovista	Becker Underwood Ltd,			
					<i>Steinernema carpocapsae</i>	Capsanem	Koppert Uk Ltd	Koppert B.V.			
					<i>Steinernema carpocapsae</i>	Nematop	Fast Products Ltd.	E-Nema GmbH			
Earwig	<i>Forficula auricularia</i>										
Blackcurrant Sawfly Gooseberry sawfly	<i>Nematus olfaciens</i> <i>Nematus ribesii</i>										
Molluscs	<i>Derocerus</i> sp. <i>Milax</i> sp., <i>Helix</i> sp.				<i>Phasmarhabditis hermaphrodita</i>	Nemaslug	Fargro Ltd., Becker Underwood Ltd.	Becker Underwood Ltd.	N/A		
Free living nematodes	<i>Pratylenchus</i> sp.										

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Grey mould	<i>Botrytis cinerea</i>	<i>Bacillus subtilis</i> QST713	Serenade ASO	Yes			Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	
Powdery mildew	<i>Sphaerotheca mors-uvae</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
								Intrachem Bio	<i>Ampelomyces quisqualis</i> strain AQ10	AQ10	
Leaf spot	<i>Drepanopeziza ribis</i>										
Stem death	<i>Botrytis sphaeria</i>										
Rust	<i>Cronartium ribicola</i>										
Dead arm Eutypa											
Honey fungus	<i>Armillaria mellea</i>										
Sudden bush death	<i>Phomopsis</i> sp. + bacterium, <i>Eutypa</i> sp. <i>botrytis</i>										
Fusarium (on fruit)	<i>Fusarium</i> spp.										

Table 13: Biopesticide Gap Assessment for Blueberry Disclaimer: Items in grey indicate where information not confirmed

**asterisk identifies pests and diseases which can be expected to become a problem.*

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Vine weevil	<i>Ortiorhynchus sulcatus</i>				<i>Steinernema kraussei</i>	Nemasys L	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Nemasys H	Syngenta bioline, BCP, Hutchinsons, Avoncrop, Fargro, UAP, JF McKenna	Becker Underwood Ltd.	N/A		
					<i>Heterorhabditis megidis</i>	Lavanem	Koppert UK Ltd	Koppert B.V.			
					<i>Heterorhabditis bacteriophora</i>			E-Nema GmbH	N/A		
								Novozymes Biologicals Inc.	<i>Metarhizium anisopliae</i> (F52)	Bio1020, Met52,	Submitted for UK registration, marketing 2010
Leaf curling midge also known as gall midge	<i>Dasineura xylococcum</i>										
Light brown apple moth	<i>Epiphyas postvittana</i>										
Winter moth	<i>Operophtera brumata</i>	<i>Bacillus thuringiensis var kurstaki</i>	DiPel DF	Yes			Fargro Ltd., Interfarm (UK) Ltd.	Valent Biosciences Inc.	<i>Bacillus thuringiensis var kurstaki</i>	DiPel DF	Bt Isolate: (ABTS 351, PB 54, SA 11, SA12 and EG 2348)
Carnation tortrix	<i>Cacoecimorpha pronubana</i>				<i>Steinernema carpocapsae</i>	Nemasys C	Agrovista	Becker Underwood Ltd,			
Other tortricids					<i>Steinernema carpocapsae</i>	Capsanem	Koppert Uk Ltd	Koppert B.V.			
					<i>Steinernema carpocapsae</i>	Nematop	Fast Products Ltd.	E-Nema GmbH			
Blueberry bud mite *	<i>Acalitus vaccinii</i>										
Scale insects											
nematodes*											

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Grey mould	<i>Botrytis cinerea</i>	<i>Bacillus subtilis</i> QST713	Serenade ASO	Yes			Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	
Powdery mildew*	<i>Microsphaera vaccinii</i>						Fargro Ltd.& Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO or Max	UK registration for botrytis only
								Intrachem Bio	<i>Ampelomyces quisqualis</i> strain AQ10	AQ10	
Mummy berry*	<i>Monolinia</i> sp.										
Alternaria leaf spot and fruit rot*	<i>Alternaria tenuissima</i>										
Leaf spots	<i>Septoria albopunctata</i>										
	<i>Gleosporium</i> spp.										
Anthracnose fruit rot	<i>Colleotrichum acutatum</i>										
Cankers and twig blight*	<i>Phomospsis vaccinii</i>										
	<i>Fussicoccum putrefaciens</i>										
Bacterial canker	<i>Pseudomonas syringae</i>										
Phytophthora root rot	<i>Phytophthora</i> sp.										
Bacterial canker	<i>Pseudomonas syringae</i>										
Rust	<i>Pseudophragmidium vaccinii</i>										

Table 14: Biopesticide Gap Assessment for Rhubarb *Disclaimer: Items in grey indicate where information not confirmed*

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Rosy rustic moth	<i>Hydraecia micacea</i>										
Stem nematode	<i>Ditylenchus dipsaci</i>										
Molluscs	<i>Derocerus</i> sp. <i>Milax</i> sp., <i>Helix</i> sp.				<i>Phasmarhadtis hermaphrodita</i>	Nemaslug	Fargro Ltd., Becker Underwood Ltd.	Becker Underwood Ltd.	N/A		

Target Organism Common name	Target organism Scientific name	UK - registered		SOLA	UK non-registered ^		UK Distributor	Manufacturer	EU registered - listed active	EU product	Comments
		Active	Product		Active	Product					
Botrytis/Grey mould	<i>Botrytis cinerea</i>	<i>Bacillus subtilis</i> QST713	Serenade ASO	Yes			Fargro Ltd. & Syngenta bioline Ltd.	Agraquest Inc.	<i>Bacillus subtilis</i> QST713	Serenade ASO	
Downey mildew	<i>Peronospora jaapiana</i>										
Crown rot	<i>Erwinia rhapontici</i>										
Violet root rot	<i>Helicobasidium purpureum</i>										
Honey fungus	<i>Armillaria mellea</i>										

Figure 1 - Overview of the EU Regulatory Process for a New Active Substance

(From: Microbial biopesticides in the European Union with specific reference to the UK. R L Gwynn and J Dale. February 2009)



