

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
4 September 2008 (04.09.2008)

PCT

(10) International Publication Number  
**WO 2008/104807 A2**

(51) International Patent Classification:  
A01N 63/00 (2006.01) A01P 7/04 (2006.01)  
A01P 7/02 (2006.01)

(74) Agent: MARKS & CLERK; 62-68 Hills Road, Cambridge, Cambridgeshire CB2 1LA (GB).

(21) International Application Number:  
PCT/GB2008/050129

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date:  
26 February 2008 (26.02.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
0703672.6 26 February 2007 (26.02.2007) GB  
0710122.3 26 May 2007 (26.05.2007) GB

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (for all designated States except US): **BI-  
OLOGICAL CROP PROTECTION LIMITED**  
[GB/GB]; Stourside Place, 4th Floor, 35-41 Station Road,  
Ashford Kent TN23 1PP (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **SMYTHEMAN, Peter  
Ronald** [GB/GB]; 25 Abbey Way, Ashford Kent TN24  
0HY (GB).

Published:

— without international search report and to be republished upon receipt of that report



**WO 2008/104807 A2**

(54) Title: MITE COMPOSITION

(57) Abstract: A composition comprising a population of a predatory mite and a host mite population selected from the family of *Suidasiidae* or *Chortoglyphidae*.

## Mite composition

### Technical Field

The present invention relates to a mite composition, a method for rearing a mite, a rearing system, a use of the composition in biological pest control, and to a method of biological pest control.

### Introduction

Biological pest control is a component of an integrated pest management strategy in agriculture and is an alternative to treating crops with insecticides. It is described as the reduction of pest populations by natural enemies. Pests that affect plants and such have an impact on crop yield include aphids, caterpillars, thrips, mites, white-flies and slugs. Many commercial insectaries rear and market a variety of natural enemies, including predaceous mites, lady beetles, lacewings, praying mantids, and several species of parasitoids. For example, it is known to use a composition of a rearing population of predatory mite fed on a factitious host supported on a carrier in biological pest control. Such a composition is often supplied in a housing having a predatory mite exit aperture. The housing is placed on or adjacent to plants and the predatory mite exits the housing to prey on unwanted pests such as white-flies, thrips, spider mites and tarsonemid mites. Examples of such compositions are described in the literature, including WO2006057552 and WO2006071107 in the name of Koppert BV. One example is the predaceous mite *Phytoseiulus persimilis* which is used for control of the two-spotted spider mite. Another mite that has been used in pest control is *Amblyseius cucumeris*, a small predator that feeds on a wide range of small arthropod prey. It is used primarily for control of thrips,

particularly *Frankliniella occidentalis*, but can also be used for control of Tarsonemid mites on a number of crops and can reduce Rust Mite (*Eriophyidae*) populations. Methods for isolating predatory mites from their natural environments and for culturing predatory mites are known in the art.

A problem for the manufacturers of mite compositions for use in biological pest control is finding an economical and easily bred host for predatory mites. Different mite families and indeed different mite species have different characteristics and requirements, such as breeding temperature, life cycle, size which results in different behaviour when using the mite to serve as a food source for a predatory mite. Other criteria which are important include the ability to live and thrive in an environment also suitable for the predatory mite, not to produce toxins which adversely affect the predatory mite, and to have a multiplication rate which does not lead to an overwhelming of the culture, but still is rapid enough to maintain a steady food supply for the predator which it supports, without its self being too rapidly eliminated. Furthermore, the impact of the mite on the crop plants should be minimal. Another factors to consider include the allergenic properties of the mite as this causes problems in production and in products which are shaken over the crop.

The inventors have found that a host comprising species from the super family of *Acaroidea*, such the family *Suidasiidae*, e.g. *Suidasia medanensis* (Oudemans, 1924), or from the super family of *Glycyphagoidea* can be economically and easily bred. A benefit of *Acaroidea*, especially *Suidasia medanensis*, is that it is very small, and all life stages (adults, nymphs and eggs) of *Acaroidea*, especially *Suidasia medanensis*, are of a size which can be eaten by young and adult prey mites. Such a host has been found particularly

useful for rearing phytoseiid predatory mite species, such as *Amblyseius swirskii*. In its natural habitat, *Amblyseius swirskii* feeds on plant feeding mites such as spider mites, tarsonemid and eriophyid mites and a range of plant dwelling insects. In nature, *Amblyseius swirskii* does not encounter mites from the family of *Suidasiidae* and *Chortoglyphidae* which are not plant dwelling species.

#### Description of Invention

The invention relates to a mite composition comprising a breeding population of a predatory mite species, and a factitious host population comprising at least one species selected from the super family of *Acaroidea*, such as *Suidasiidae* or *Acaridae* or of the super family of *Glycyphagoidea*.

In one aspect, the invention relates to a composition comprising a population of a predatory mite and a host mite population selected from the family of *Suidasiidae* or *Chortoglyphidae*.

The population of the predatory mite and the host population are each preferably breeding populations, thus leading to an increase in the number of individuals present in the population. The population comprises adults from both sexes and preferably individuals of other stages in the life cycle.

Mites as described herein are isolated from their natural environment and combined in the composition.

In one embodiment the host population comprises at least one species selected from the family *Suidasiidae*. The preferred genus is *Suidasia*. The host species may be selected from *Suidasia medanensis*, *S. medanensis*, *S. nesbitti*, *S. pontifica* or *S. reticulata*. The most preferred host species of the family *Suidasiidae* is *Suidasia medanensis* (Oudemans, 1924).

In another embodiment, the host population comprises at least one species selected from the family *Acaridae*, such as of the genus *Acarus*, preferably *Acarus gracilis* (Hughes, 1957).

In another embodiment, the host mite population is selected from the superfamily *Glycyphagoidea*, preferably from the family of *Chortoglyphidae*, such as the genus *Chortoglyphus*. In a preferred embodiment, the genus is *Chortoglyphus*. In another preferred embodiment, the species of the genus *Chortoglyphus* is *Chortoglyphus arcuatus* (Troupeau, 1879).

In another embodiment, the host population may comprise a mixture of at least two different species, for example from the same genus or from different genera. For example, the composition may comprise a combination of *Acarus gracilis*, *Suidasia medanensis* and/or *Chortoglyphus arcuatus*. Furthermore, in one embodiment *Suidasia medanensis* and/or *Chortoglyphus arcuatus* may also be combined with other known species, such as *Carpoglyphus*.

The breeding population of predatory mite species may be a phytoseiid predatory mite species such as *Amblyseius swirskii*, *Amblyseius cucumeris*, *Amblyseius andersoni* or

*Amblyseius californicus* or *Typhlodromus pyri*. Preferably, the predatory mite is *Amblyseius swirskii*. The composition may include combinations of the predatory mites listed above.

Thus, in one preferred aspect, the invention relates to a composition comprising a population of *Amblyseius swirskii* and a host population of *Suidasia medanensis*.

In another preferred aspect, the invention relates to a composition comprising a population of *Amblyseius swirskii* and a host population of *Chortoglyphus arcuatus*.

Preferably, the composition comprises a carrier for individuals of said populations. The carrier may be bran flakes or wood chips or other similar organic materials, vermiculite or any other suitable light granular material. The composition may further comprise a food substance suitable for the factitious host population. The composition may further comprise an inert component such as vermiculite. Preferably, the number of individuals of the predatory mite species relative to the number of individuals of the factitious host is from about 100:1 to 1:20, such as about 1:1 to 1: 10, e.g. about 1:4, 1:5 or 1: 7. A skilled person would know that these amounts represent a general guide and that the exact dosage depends on the species used. As this is a living culture the precise ratios will vary over time as the food supply and prey species is consumed and the predator population multiplies. However, in general, the number of individuals of the host population should exceed that of the predatory mite.

According to the invention, the composition described herein can be used in a method for biological crop protection and biological pest control. The use of the composition is

particularly beneficial because it allows mass rearing of *Amblyseius swirskii*. The host population in the composition is a factitious host and serves as a source of food for the predatory mite if other food sources are not available. The composition and methods described herein can be used on crops such as vegetables, fruit crops, ornamental crops or tree crops, e.g. peppers, eggplants, cucumbers, melons, watermelons, strawberries, raspberries, roses, gerberas, chrysanthemums, or citrus trees or any other suitable crops. The pest may be selected from white-flies, thrips, spider mites and tarsonemid mites.

According to another aspect of the present invention there is provided a method for rearing or culturing a predatory mite such as *Amblyseius swirskii*, comprising providing a composition according to the invention and allowing individuals of the predatory mite to prey on individuals of said factitious population. The method may further comprise maintaining the composition at 17-36°C and/or 59-96% humidity, e.g. 27°C and 85% humidity. The composition may comprise a carrier and a suitable food substance.

Another aspect of the present invention relates to use of *Acaroidea*, preferably of the family *Suidasiidae* preferably of the genus *Suidasia*, such as *Suidasia medanensis*, or *Glycyphagoidea*, preferably from the family of *Chortoglyphidae*, such as the genus *Chortoglyphus* as a factitious host for rearing a predatory mite such as *Amblyseius swirskii*.

According to another aspect of the present invention there is provided a device for rearing a predatory mite, such as *Amblyseius swirskii*, comprising providing a container holding the composition according the present invention. The container may comprise an exit for at least one mobile life stage of the predatory mite. The exit may be suitable for providing a

sustained and/or controlled release of the mite. The container may be in the form of a sachet. The exit may be an aperture in the sachet. The sachet may include a hook to support the sachet on a plant. A suitable delivery system is for example described in GB2393890. The product may be distributed into the crop by being released into an artificial wind current, or dispensed from a rotating tube or similar dosing device.

Another aspect of the present invention relates to a method of biological pest control in a crop in which a composition as described herein is applied to a crop. The crop pest may be selected from white-flies, thrips, spider mites and tarsonemid mites. A suitable amount of the composition is applied, preferably to each crop plant. The amount may be from 1-15 ml preferably 2-7 ml. The composition may be applied to the crop in different ways, for example by sprinkling the crop with the composition or as the device as described herein.

Further modifications will be apparent to those skilled in the art without departing from the scope of the present invention.

Non limiting examples of the invention and suitability of *Acaroidea*, such as at least *Acaridae*, e.g. *Acarus gracilis*, Suidasiidae, e.g. *Suidasia medanensis* or *Chortoglyphus arcuatus* as a factitious host for rearing a predatory mite are given below.

### Examples

#### Example 1

As indicated in the study data below, trials have shown that at 29°C and 75% RH the mean number of eggs laid per female *Amblyseius swirskii* is in the range 1.80 to 1.85 eggs per female per day when feeding on excess supply of *Suidasia medanensis*. This is a rate of reproduction which is very suitable for economic production of *Amblyseius swirskii*.

#### Study data

Each replicate = 1 adult female *A.swirskii* on a leaf disc arena with all stages of *Suidasia medanensis* as food.

Number of offspring was counted after 48 hours.

Arenas were maintained at 29 deg.C and 75%RH

Replicate	Ova	Nymph	Total	Daily mean
1	3	1	4	2.00
2	3	1	4	2.00
3	2	0	2	1.00
4	4	0	4	2.00
5	1	0	1	0.50
6	3	0	3	1.50
7	3	1	4	2.00
8	4	1	5	2.50
9	4	1	5	2.50
10	5	0	5	2.50
Total	32	5	37	
		48 hr mean	3.70	<u>eggs/female/day</u>
		Daily mean	1.85	<u>eggs/female/day</u>

Each replicate = 1 adult female *A.swirskii* on a leaf disc arena with all stages of *Suidasia medanensis* as food.

Number of offspring was counted after 72 hours.

Arenas were maintained at 29 deg.C and 75%RH

Replicate	Ova	Nymph	Total	Daily mean
1	1	3	4	1.33
2	3	1	4	1.33
3	1	3	4	1.33
4	5	3	8	2.67

5	4	1	5	1.67
6	2	2	4	1.33
7	5	1	6	2.00
8	1	2	3	1.00
9	3	4	7	2.33
10	2	2	4	1.33
11	2	2	4	1.33
12	7	2	9	3.00
13	5	2	7	2.33
14	6	0	6	2.00
15	4	2	6	2.00
16	4	2	6	2.00
17	3	3	6	2.00
18	5	2	7	2.33
19	3	3	6	2.00
20	3	2	5	1.67
21	2	4	6	2.00
22	2	4	6	2.00
23	2	1	3	1.00
24	3	1	4	1.33
25	6	0	6	2.00
Total	84	52	136	
		72 hr mean	5.44	eggs/female/day
		Daily mean	1.81	eggs/female/day

### Example 2

A composition comprising a breeding population of predatory mite species *Amblyseius swirskii* and a factitious host comprising *Acarus gracilis*, *Suidasia medanensis* or *Chortoglyphus arcuatus* are supported on a carrier such as bran flakes or wood chips, along with suitable foodstuffs such as cereal extracts, yeast etc. The composition is placed in a sachet with a predatory mite exit aperture. The sachet has a hook to hang the sachet on a plant. Preferably the number of individuals of the predatory mite species relative to the number of individuals of the factitious host is from about 100:1 to 1:20, such as about 1:1 to 1:10, e.g. about 1:4, 1:5 or 1:7. The composition has proved useful in controlling whiteflies, thrips, spider mites and tarsonemid mites on crops.

### Example 3

A composition comprising a breeding population of predatory mite species *Amblyseius swirskii* and a factitious host comprising *Acarus gracilis* *Suidasia medanensis* or *Chortoglyphus arcuatus* are supported on a carrier such as bran flakes or wood chips, along with suitable foodstuffs such as cereal extracts, yeasts etc. The mixture is diluted by adding extra carrier material such as bran. The number of individuals of the predatory mite species relative to the number of individuals of the factitious host may be from about 100:1 to 1:20, such as about 1:1 to 1: 10, e.g. about 1:4, 1:5 or 1: 7. The composition may be added to a container such as a tube or bottle, from which the composition can be sprinkled or otherwise distributed onto a crop. The composition has proved useful in controlling whiteflies, thrips, spider mites and tarsonemid mites on crops. *Suidasia medanensis* thrives in aerated media, and benefits from addition of a suitable inert component to the culture medium such as vermiculite. This also enhances the suitability of the culture environment for the production of plant and soil dwelling predatory species of mites. This is equally true in bulk commercial culture and in individual breeding sachets. Optimum culture conditions are around 27°C and 85% relative humidity.

Claims

1. A composition comprising a population of a predatory mite and a host mite population selected from the family of *Suidasiidae* or *Chortoglyphidae*.
2. A composition according to claim 1 wherein the predatory mite is a phytoseid mite.
3. A composition according to claim 2 wherein the predatory mite is *Amblyseius swirskii*.
4. A composition according to any of claims 1 to 3 wherein the host population is selected from *Suidasiidae*.
5. A composition according to claim 4 wherein the host population is selected from *Suidasia*.
6. A composition according to claim 5 wherein the host population is *Suidasia medamensis*.
7. A composition according to any of claims 1 to 3 wherein the host population is selected from *Chortoglyphidae*.
8. A composition according to claim 7 wherein the host population is selected from *Chortoglyphus*.
9. A composition according claim 8 wherein the host population is *Chortoglyphus arcuatus*.
10. A composition according to a preceding claim wherein the host population is selected from the family of *Suidasiidae* or *Chortoglyphidae* and further comprises at least a second mite species.

11. A composition according to a preceding claim wherein the composition further comprises a carrier.
12. A method for biological pest control comprising applying a composition as defined in any of claims 1 to 11 to a crop.
13. The use of a composition as defined in any of claim 1 to 11 for biological pest control.
14. A method for rearing or culturing a population of a predatory mite comprising providing a host population of *Suidasia medamensis* or *Chortoglyphus arcuatus* to a predatory mite.