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**Mumifikált mealybug kártevő termék és eljárás**

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**(54) MUMMIFIED MEALY BUG PRODUCT AND METHOD**

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(56) References cited:  
**EP-A1- 0 210 447 US-A- 3 786 594**

- **SANDANAYAKA W R M ET AL:** "Aspects of the reproductive biology of *Pseudaphycus maculipennis* (Hym: Encyrtidae), a parasitoid of obscure mealybug, *Pseudococcus viburni* (Hem: Pseudococcidae)", **BIOLOGICAL CONTROL, SAN DIEGO, CA, US, vol. 48, no. 1, 1 January 2009 (2009-01-01), pages 30-35, XP025673747, ISSN: 1049-9644, DOI: 10.1016/J.BIOCONTROL.2008.09.008 [retrieved on 2008-09-30]**
- **CHONG ET AL:** "Functional response and progeny production of the Madeira mealybug parasitoid, *Anagyrus* sp. nov. nr. *sinope*: The effects of host and parasitoid densities", **BIOLOGICAL CONTROL, SAN DIEGO, CA, US, vol. 39, no. 3, 9 November 2006 (2006-11-09), pages 320-328, XP005844420, ISSN: 1049-9644, DOI: 10.1016/J.BIOCONTROL.2006.08.013**
- **AMARASEKARE K G ET AL:** "Efficiency and establishment of three introduced parasitoids of the mealybug *Paracoccus marginatus* (Hemiptera: Pseudococcidae)", **BIOLOGICAL CONTROL, SAN DIEGO, CA, US, vol. 51, no. 1, 1 October 2009 (2009-10-01), pages 91-95, XP026499750, ISSN: 1049-9644, DOI: 10.1016/J.BIOCONTROL.2009.07.005 [retrieved on 2009-07-09]**
- **"Citrus Mealybug Parasite *Leptomastix dactylopii*", , 1 January 2006 (2006-01-01), page 1, XP55034526, Retrieved from the Internet: URL:[http://web.archive.org/web/20061029025952/http://www.rinconvitova.com/bulletins\\_product\\_pdf/Leptomastix\\_BUL.pdf](http://web.archive.org/web/20061029025952/http://www.rinconvitova.com/bulletins_product_pdf/Leptomastix_BUL.pdf) [retrieved on 2012-08-02]**

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**EP 2 706 856 B1**

## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0001] The present invention relates to the field of biological control agents for crop protection, and more particularly using mummified products and methods thereof for crop protection.

#### 2. Background Art

[0002] The use of insects as Biological Control Agents (BCA) is an expanding field with many advantages over chemical pest control and crop protection. Insect BCA's are able to naturally control other insect species that act as pests on the crop.

[0003] Mealybugs, insects of the Pseudococcidae family, feed on the plant juices of greenhouse crops, houseplants and sub-tropical trees. The female mealybug attaches itself to the plant and secretes a protective waxy layer while sucking the plant's sap and attracting ants. Sooty mould develops on the mealybugs' sugary secretions, known as honeydew, thereby increasing the damage to the plant. Prominent mealybug species include the citrus mealybug *Planococcus citri* (Risso), targeting citrus fruit in particular and the polyphagous solanum mealybug, *Phenacoccus solani* (Ferris) that attacks a wide variety of plant species.

[0004] Although there are a variety of chemical methods for controlling mealybugs, biological means directly targeting the pest are preferable both for the environment as well as for the potential consumers. In the case of mealybugs, manual removal with water jets or wiping with methylated spirits is an option for smaller manifestations, but is impractical for larger, commercial crops.

[0005] In nature there are a variety of mealybug natural enemies that may be advantageous as BCA's in controlling mealybugs, such as the ladybird beetles *Cryptolaemus montrouzieri* (Australian Ladybird), *Scymnus* spp. and a whole array of insect parasitoids.

[0006] United States patent US4260108 describes a method and apparatus for the airborne dispensation of dry insect eggs, especially those of parasitic wasps such as *Trichogramma* and including any and all other parasite and predator insects that can be useful in biological control. The eggs are dispersed from a container by gravity through a metering device, a spreader distributes the loose eggs in a suitable broadcast pattern, thus providing a method of dispersing non-adult parasitic wasps as BCA's.

[0007] Chinese patent application CN2810197 discloses an insect-inducing fruit belt for a fruit tree, taking advantage of the hiding and overwintering habit of pests to trap them and comprises a corrugated board, with an outer sticking face or an inner lining board. The corrugated board is arranged between the inner lining board and

the outer sticking face. The insect-inducing belt attracts primary fruit tree pests that overwinter in the peeling cracks of branches, such as spider mites, kang's mealybug, grass shoe scale insects, leaf rollers, etc. The trapping rate of the insect-inducing belt of CN2810197 is up to 95%.

[0008] European patent application EP0210447A provides an agent for controlling harmful insects in agricultural and market garden crops in which living, partly grown parasitic wasps intended for the biological control of insects are filled into gelatin capsules for better dissemination and dosage. The parasitic wasps are of two to three different stages of development per capsule. The capsules have at least one perforation to promote hatching of the parasitic wasps and are preferably made delayed soluble and swellable in water.

[0009] However, there is a long felt need for an effective, efficient and non-toxic BCA for the control of mealybugs that utilizes a natural parasitoid/host relationship.

### SUMMARY OF THE INVENTION

[0010] The present invention relates to the field of insect control and more specifically to a system and method of controlling mealybug infestations with a Biological Control Agent (BCA) system.

[0011] It is one object of the present invention to disclose a Biological Control Agent (BCA) system comprising processed parasitized mealybug mummies; such that the processed parasitized mealybug mummies are essentially devoid of their limbs and waxy covering.

[0012] It is also in the scope of the present invention to disclose a BCA system in which modified parasitized mealybug mummies are processed in a manner that strips off their waxy covering and detaches their limbs without impacting on their viability as a host for parasitoid pupae.

[0013] It is also in the scope of the present invention to disclose a BCA system in which processed parasitized mealybug mummies are encased in specially adapted packaging for delivering and distributing said modified parasitized mealybug mummies.

[0014] It is also in the scope of the present invention to disclose a BCA system in which processed parasitized mealybug mummies has storage capacity of up to about 28 days.

[0015] It is also in the scope of the present invention to disclose a BCA system in which processed parasitized mealybug mummies has storage capacity of between about 14 days to about 28 days.

[0016] It is also in the scope of the present invention to disclose a BCA system in which processed parasitized mealybug mummies has storage capacity of up to about 14 days.

[0017] It is also in the scope of the present invention to disclose a BCA system, in which the mummified mealybug product is derived from any mealybug species including but not limited to *Planococcus citri*, *Planococcus*

*ficus*, *Planacoccus vovae*, *Phenacoccus solani*, *Phenacoccus madeirensis* *Phenacoccus herreni*, *Pseudococcus comstocki*, *Pseudococcus cryptus*, *Pseudococcus viburni*, *Pseudococcus longispinus* *Dysmicoccus brevipes*, and *Maconellicoccus hirsutus* or any combination therein.

**[0018]** It is also in the scope of the present invention to disclose a BCA system in which the parasitoid is selected from species that parasitize mealybug nymphs or adults, especially endo-parasitic wasps.

**[0019]** In another aspect of the present invention a BCA system is disclosed in which the parasitic wasp is selected from the family Encyrtidae including *Leptomastix algerica* and *Anagyrus pseudococci* or any combination therein.

**[0020]** It is one object of the present invention to disclose a method of controlling mealybug infestations on a plant, comprising the steps of infesting a host plant with 1<sup>st</sup> instar stage of the mealybug; and parasitizing mealybug nymphs and young females; wherein the method further comprises the steps of: (a) detaching mealybug nymphs and young females from said host plant, (b) parasitizing said detached mealybug nymphs and young females; (c) incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture; (d) rinsing the mummified parasitized mealybug mixture; (e) separating out the viable mummified parasitized mealybugs, from said mixture; (f) drying the viable mummified parasitized mealybugs; (g) packaging said viable mummified parasitized mealybugs so as to obtain a processed parasitized mealybug mummy product devoid of limbs and waxy covering; and, (h) administering said parasitized mealybug mummy product to a crop at risk of infestation by mealybugs or to an infested crop, thereby controlling mealybug infestations on said plant.

**[0021]** It is also in the scope of the present invention to disclose a method of controlling mealybug infestations on a plant, wherein the method comprises the steps of; (a) infesting a host plant with 1<sup>st</sup> instar stage of the mealybug; (b) detaching mealybug nymphs and young females from said host plant; (c) parasitizing said detached mealybug nymphs and young females; (d) incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture; (e) rinsing the mummified parasitized mealybug mixture; (f) separating out the viable mummified parasitized mealybugs, from said mixture; (g) drying the viable mummified parasitized mealybugs; (h) packaging said viable mummified parasitized mealybugs so as to obtain a processed parasitized mealybug mummy product devoid of limbs and waxy covering; and, (i) administering said parasitized mealybug mummy product to a crop at risk of infestation by mealybugs or to an infested crop, thereby controlling mealybug infestations on said plant.

**[0022]** It is also in the scope of the present invention to disclose the method as defined above, further comprising the step of storing said packaged mummified parasitized mealybugs before administering it to the plant.

**[0023]** It is also in the scope of the present invention to disclose a method of producing a mealybug BCA, comprising the steps of infesting a host plant with 1<sup>st</sup> instar stage of the mealybug, and, parasitizing said detached mealybug nymphs and young females; wherein said method further comprises the steps of: (a) detaching mealybug nymphs and young females from said host plant; (b) incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture; (c) rinsing the mummified parasitized mealybug mixture; (d) separating out the viable mummified parasitized mealybugs, from said mixture; (e) drying the viable mummified parasitized mealybugs; (f) packaging said viable mummified parasitized mealybugs, said packaged mummified parasitized mealybugs are devoid of limbs and waxy covering; and, (g) storing and/or distributing said packaged mummified parasitized mealybugs as a mealybug BCA.

**[0024]** It is also in the scope of the present invention to disclose a method of producing a mealybug BCA, wherein said method comprises the steps of; (a) infesting a host plant with 1<sup>st</sup> instar stage of the mealybug; (b) detaching mealybug nymphs and young females from said host plant; (c) parasitizing said detached mealybug nymphs and young females; (d) incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture; (e) rinsing the mummified parasitized mealybug mixture; (f) separating out the viable mummified parasitized mealybugs, from said mixture; (g) drying the viable mummified parasitized mealybugs; (h) packaging said viable mummified parasitized mealybugs, said packaged mummified parasitized mealybugs are devoid of limbs and waxy covering; and, (i) storing and/or distributing said packaged mummified parasitized mealybugs as a mealybug BCA.

**[0025]** It is a further objective of the present invention to disclose a method of controlling mealybug infestations on a plant, comprising the steps of; infesting a host plant with 1<sup>st</sup> instar stage of the mealybug, detaching mealybug nymphs and young females, parasitizing mealybug 3<sup>rd</sup> instar nymphs and young females, incubating the parasitized mealybugs, rinsing the mummified parasitized mealybug mixture, separating out the viable mummified parasitized mealybugs from said mixture, drying the viable mummified parasitized mealybugs, packaging said viable mummified parasitized mealybugs, and distributing packaged mummified parasitized mealybugs, such that a modified parasitized mealybug mummy product is provided, devoid of limbs and waxy covering and administering said product to a crop at risk of infestation or an infested crop.

**[0026]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, such that the step of infesting comprises an additional step of maintaining said mealybug 1<sup>st</sup> instar nymphs for about 25 days at about 25 °C (for the citrus mealybug) and between about 35 and about 42 days at about 27°C (for the solanum mealybug) and about 60% relative humidity on a factitious plant

host, till they reach the 3<sup>rd</sup> instar nymph or young female stage.

**[0027]** In another aspect of the present invention, a method of producing a mealybug BCA is disclosed in which the factitious plant host is a potato sprout.

**[0028]** It is also in the scope of the present invention to disclose the method as defined above, wherein the step of parasitizing, comprises a step of parasitizing mealybug 3<sup>rd</sup> instar nymphs and young females.

**[0029]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the step of detaching comprises an additional step of blowing mealybug nymphs or young females from their factitious host plant using an air blower.

**[0030]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the step of detaching comprises an additional step of blowing mealybug 3<sup>rd</sup> instar mealybug nymphs or young females from their factitious host plant using an air blower.

**[0031]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, in which the step of parasitizing mealybug nymphs and young females comprises the additional step of separating dirt and small mealybugs from larger mealybugs through a sieving tower.

**[0032]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, in which the step of parasitizing mealybug nymphs and young females comprises the additional step of separating dirt and small mealybugs from larger mealybugs through a sieving tower, thereby obtaining 3<sup>rd</sup> instar mealybug nymphs and young females.

**[0033]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, in which the step of parasitizing mealybug nymphs comprises the additional step of exposing weighed and quantified mealybug nymphs and young females to the prospective parasitoid population in a parasitization cage.

**[0034]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the step of parasitizing mealybug nymphs comprises the additional step of exposing weighed and quantified 3<sup>rd</sup> instar mealybug nymphs and young females to the prospective parasitoid population in a parasitization cage.

**[0035]** It is also in the scope of the present invention to disclose the method as defined above, wherein the step of incubating, comprises the additional step of incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture, in a parasitization cage.

**[0036]** It is also a preferred embodiment of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, in which the step of incubating parasitized mealybugs comprises the

additional step of removing parasitized mealybugs from said parasitization cage to be incubated until the parasitoids reach the pupal or pre-pupal stage, while replenishing the parasitization cage with fresh unparasitized mealybug population.

**[0037]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the step of rinsing parasitized mealybugs comprises the additional step of rinsing parasitized mealybugs that have reached the parasitoid's pupal or pre-pupal stage through a sieving tower with water spray nozzles, and thereby separating out large viable mealybug mummies from dead and/or small mealybugs.

**[0038]** It is also a preferred embodiment of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the step of separating out viable parasitized mealybugs mummies comprises the additional step of selecting floating mealybugs and mummies from mixtures that have been drained in a conical water bath.

**[0039]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the step of drying viable mealybug mummies comprises the additional step of drying said mummies by draining them on a screened tray and exposing them to an air flow in a drying chamber.

**[0040]** It is also a preferred embodiment of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the packing step comprises the additional step of weighing and quantifying said parasitized mealybug mummies by counting samples under a stereoscopic microscope.

**[0041]** In another aspect of the present invention, a method of providing a mealybug population for producing a mealybug BCA is disclosed in which a quantified population of viable parasitized mealybug mummies is provided for storage or distribution.

**[0042]** It is also a preferred embodiment of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA in which the packing step comprises the additional step of mixing parasitized mealybug mummies with fine sawdust in a 5:1 ratio, respectively, in a ventilated and labeled plastic container in preparation for storage at 14°C.

**[0043]** It is also in the scope of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, in which the distribution step comprises the additional steps of obtaining stored or fresh batches of parasitized mealybug mummies, replenishing them with fine sawdust mixture to the desired level, then placing 2 grams, equivalent to 500-1000 parasitized mealybug mummy individuals in a sealed ventilated container with a detachable adhesive label.

**[0044]** It is also a preferred embodiment of the present invention to disclose a method of providing a mealybug population for producing a mealybug BCA, in which a mummified parasitized mealybug product is provided

adapted to be attached to a plant or an object adjoining a crop to function as an effective distribution means of the mealybug BCA at the desired location.

**[0045]** It is one object of the present invention to disclose a method of producing mummified mealybug product devoid of limbs and waxy layer comprising the steps of; incubating mealybugs to the correct nymphal stage or young female on a factitious plant host; detaching the mealybugs with specially adapted air blower from said plant host; obtaining mealybug 3<sup>rd</sup> instar nymphs and young females by separating out detached mealybugs according to size; sampling selected mealybug 3<sup>rd</sup> instar nymphs and young females to estimate population size, exposing selected mealybugs to adult endoparasitoids, incubating parasitized mealybugs until the parasitoids reach pupal or pre-pupal stage and the mealybugs turn into mummies; rinsing and separating out large viable mummies from the population of parasitized mealybugs; drying selected parasitized mealybug mummies on screened tray; such that a mummified parasitized mealybug product is obtained useful as a BCA.

**[0046]** It is one object of the present invention to disclose a mummified parasitized mealybug product, in which each mealybug is essentially devoid of limbs and waxy covering enclosed in a packaged form in a container with detachable adhesive labeling for attaching to a plant or object wherein said mummified parasitized mealybug product is an effective mealybug BCA.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0047]** In order to understand the invention and to see how it may be implemented in practice, a plurality of embodiments is adapted to now be described, by way of non-limiting example only, with reference to the accompanying drawings; wherein:

Figure 1 is a schematic flow diagram illustrating a first incubation stage of the preparation of the mummified pupal product;

Figure 2 is a schematic flow diagram illustrating a second exposure to parasitoid stage in the preparation of the mummified pupal product;

Figure 3 is a schematic flow diagram illustrating a third incubation stage in the preparation mummified mealybug product;

Figure 4 is a schematic flow diagram illustrating a fourth rinsing and preparation stage in the production of the mummified mealybug product;

Figure 5 is a schematic flow diagram illustrating a fifth and final packing stage of the production process of the mummified mealybug product;

Figure 6 is a photographic illustration of processed

and unprocessed mummified parasitized solanum mealybugs containing the pupae of *L. algirica* parasitic wasp;

Figure 7 is a photographic illustration of processed and unprocessed mummified parasitized citrus mealybugs containing the pupae of *A. pseudococci* parasitic wasp;

Figure 8 is a graphic illustration showing the storage capacity of the *Anagyrus pseudococci* mummies product, as an embodiment of the present invention; and,

Figure 9 is a graphic illustration showing storage capacity of the *Leptomastix algirica* mummies product, as a further embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0048]** Mealybugs are insects of the Hemiptera order and belong to the Pseudococcidae family. Most species of mealybugs are found worldwide and are polyphagous pests of a wide variety of plant species. The mealybug sucks the sap of the host plant causing direct and indirect damage. The direct damage is in the form of distortion and yellowing of the foliage and sometimes defoliation as well as loss of flowers and fruit if present. The large quantities of honeydew produced by the mealybug which coats stems, leaves, flowers and fruit, serves as a substrate for sooty-mould fungi (*Capnodium* spp.) and also attracts ants, causing indirect damage to the plant. In high quantities, the sooty-mould is unsightly, inhibits photosynthesis and reduces the desirability of the product to the consumer.

**[0049]** The citrus mealybug, *Planococcus citri* (Risso) is a worldwide polyphagous pest of citrus, vineyards, persimmon and ornamental plants in interior plants capes and protected cultures, feeding on plants from over 25 families. The females and nymphal stages are smaller than 1/8 inch and are soft, oval and wingless and covered with a fluffy white wax ringed with white wax tufts. Males are tiny gnat-like insects that have one pair of wings and do not cause direct damage to plants. Once fertilized by the male, the female will lay about 400 to 600 tiny eggs covered by an ovisac of dense, fluffy white wax and hatch within 2-10 days depending on temperature and other environmental conditions. A temperature of 25°C and a citrus plant are optimal for the life cycle of the citrus mealybug. Females undergo 3 nymphal stages while males undergo 4 nymphal stages. Each nymphal stage is separated by a molt.

**[0050]** The citrus mealybug can develop between 2 to 8 generations in a year and can be found on trees on their trunks and branches and on leaves, usually scattered throughout the tree canopy. Although the females are wingless, they may make periodic migrations to the trunk and main branches to lay eggs. Females are unable

to migrate by flying and can only move by walking. Passive dispersion of females or nymphs occurs when they are carried by the wind and sometimes by ants that attend the mealybugs' colony.

**[0051]** During the period of citrus fruit set, the young nymphs are particularly active and colonize the calyx of the small, developing fruit and during the summer several generations may develop on the fruit surface, covering it with honeydew and consequently attracting sooty-mould. Chlorotic spots caused by the sooty-mould may lead to reduction in fruit size. Thus the mealybug colonies, honeydew, sooty mould, chlorotic spots and reduced fruit size are visible at harvesting and the cosmetic damage can cause extensive financial loss to the citrus fruit industry.

**[0052]** The solanum mealybug *Phenacoccus solani* Ferris is also found worldwide and is a polyphagous species found on over 52 plant species in 25 different botanical families, including many important commercial crops such as pepper, tarragon, tomato, basil, ornamental plants such as *Ornithogalum* and berries such as *Physalis peruviana* and on weeds, particularly *Cyperus rotundus*, *Coryza* spp, *Prosopis farcta* and *Amaranthus* spp.

**[0053]** The solanum mealybug measures between 1/5 to 1/8 inches and is yellowy-brown, oval, slightly rounded insect with red legs covered by white mealy wax. The larva hatches inside the female body immediately after spawning, which lasts 4 to 5 weeks and produces about 120 offspring in the lifetime of the female. The solanum mealybug preferred optimal temperature is 25°C.

**[0054]** The solanum mealybug causes direct and indirect damage to crops in a way similar to the citrus mealybug, by sucking sap and depositing honeydew that attracts both ants and sooty-mould fungi. In addition, the solanum mealybug causes deformations and degeneration in young plants and fruits. The plants are weakened by plant-sucking as a result of toxins penetrating the plant during the time that the solanum mealybug feeds on the plant.

**[0055]** Other species of mealybugs such as the cryptic or citriculus mealybug (*Pseudococcus cryptus* Hempel), the obscure mealybug [*Pseudococcus viburni* (Signoret),] and the longtailed mealybug [*Ps. longispinus* (Targioni Tozzetti)] cause similar types of damage to extensive variety of commercial agricultural crops.

**[0056]** It is therefore a preferred embodiment of the present invention to provide a non-toxic, mummified mealybug, pupal product adapted to control mealybug populations in a non-toxic manner. In this and other embodiments of the present invention a modified or processed mealybug product is disclosed, substantially adapted from native mealybug populations.

**[0057]** In nature the mealybugs possess a multitude of parasitoid species that lay their egg or eggs inside the mealybug and in which the parasitoid larva and pupa take over the mealybug, preventing further mealybug offspring from being produced. The parasitic wasp *Anagyrus pseudococci* (Girault), is a major parasitoid of vine

and citrus mealybug pests and *Leptomastix algerica* Trjapitzin is a parasitoid of the solanum mealybug, the cryptic mealybug, the obscure mealybug and the long-tailed mealybug. Both parasitoids are members of the Encyrtidae family and act as mealybug parasitoids by laying their eggs in mealybug nymphs or adults.

**[0058]** *A. pseudococci* specializes as a parasitoid of citrus mealybug, *Planococcus citri*, the vine mealybug, *P. ficus* and the cypress mealybug *P. vovae*. However as a polyphagous, world-wide solitary endoparasitoid, it also attacks distantly related mealybug species such as *Pseudococcus comstocki* (Kuwana), *Phenacoccus herreni* Cox and Williams, *Dysmicoccus brevipes* (Cockerell), and *Maconellicoccus hirsutus* Green.

**[0059]** *A. pseudococci* is an arrhenotokous species, meaning that fertilized eggs will produce female offspring whereas non-fertilized eggs will yield males. The female is about 1.5-2 mm in length and brown, with distinctive black and white banded antennae. The male is smaller (0.8-0.9 mm in length), black in color bearing an arch-like pair of antennae.

**[0060]** The preferred hosts for the parasitoid are third instar mealybug nymphs, but the wasps will also readily parasitize second instars as well as young females. The female parasitoid lays a single egg in each host and a female can lay up to about 15 eggs a day if provided with an excess of hosts. Eggs laid in smaller hosts usually produce males. The parasitoid's larva consumes the contents of the mealybug from the inside and pupates inside the mummified skin of the host, emerging through an irregular exit hole gnawed at the posterior end of the mummy. Development of *A. pseudococci* occurs within a temperature range of 13°C to 38°C. *A. pseudococci* is strongly attracted to light and is rendered inactive in darkness, thus it is able to reproduce most rapidly during the summer months. Under a constant temperature of 34°C, *A. pseudococci* completes development (from egg to adult emergence) in just over 10 days, such that there can be 2-3 parasitoid generations per each host mealybug generation.

**[0061]** *A. pseudococci* disperses actively by flying from one plant to another and/or by walking along the plant in the search for mealybugs. Within 2 weeks it can be found a few dozens of meters from its original release spot. Once encountered, the mealybug host is examined and probed by the ovipositor of the parasitoid. Oviposition success is affected by the defense activity of mealybugs. Ants must be destroyed before releasing *A. pseudococci* because they encourage honeydew secretion by the mealybugs and transfer them from one place to another whilst protecting them vigorously from the parasitoid' attack.

**[0062]** The parasitic wasp *L. algerica* is an indigenous species, of unknown origin, and also found in Cyprus, Greece, Near East including: Asian Turkey, Caucasian Russian republics, Georgia, Armenia, Azerbaijan, Lebanon, Syria, Jordan, Sinai Peninsula (Egypt), Arabian peninsula, Iran, Iraq and North Africa. *L. algerica* is a parasitoid of some major mealybug pests such as the solanum

mealybug, the cryptic mealybug, the obscure mealybug and the long-tailed mealybug. The specificity of *L. algirica* and its capacity to function effectively even at low levels of mealybugs, make this parasitoid superior to mealybug predators. The female is about 1.4-1.5 mm in length, its body moderately robust, generally dark brown, the male is similar to female but smaller (0.9 mm in length). Its antennae are clothed with long setae.

**[0063]** The duration of development from egg to adult of *L. algirica* is temperature dependant and takes 35, 24, and 19 days at temperatures of 20°C, 25°C and 30°C, respectively. In another embodiment, the duration of development from egg to adult of *L. algirica* takes 20 days at 27°C. Fecundity (at 25°C) is 5 offspring per female per day but could reach as high as 20 offspring per day. The mean percentages of *L. algirica*'s egg encapsulation by the solanum mealybug is low and averaging around 3%, indicating that this parasitoid well fits for biological control of the solanum mealybug.

**[0064]** It is therefore a further preferred embodiment of the present invention to provide a modified or processed mummified mealybug product containing a parasitoid pupal product. In this and other preferred embodiments the parasitoid is preferably a parasitic wasp of the *Encyrtidae* family, including but not limited to *L. algirica* and *A. pseudococci*.

**[0065]** Reference is now made to figure 1 in the drawings in which a schematic flow diagram is shown illustrating the first stage **10** of the preparation of the mummified pupal product. In this first step of this stage **11** infestation with mealybugs is induced. Mealybug crawlers in the 1<sup>st</sup> instar stage are provided with a factitious plant host, such as potato sprouts and commence to infest the aforementioned factitious host. The mealybug young instars are then kept **12** in a darkened climate controlled room for approximately 21-28 days at about 25°C (for the citrus mealybug) and about 35-42 days at about 27°C (for the solanum mealybug) both at approximately 60% relative humidity.

**[0066]** Figure 2 illustrates the second stage of preparation for the mummified mealybug pupal product in which the mealybugs are exposed to the parasitoids **20**. Firstly the mealybugs are detached from the potato sprouts using a high pressure air blower **21** and then the detached mealybugs are run through a sieving tower to separate dirt and small mealybugs from the desired stage and size of mealybug **22**. The aforementioned sieving process filters out mealybug nymphs, i.e. 3<sup>rd</sup> instar nymphs, and adult females, that are then weighed and sampled in order to estimate population size **23**. In the next step of the second stage, mature parasitic wasps are quantified by their weight (the procedure takes place inside a cold chamber to reduce their activity) and are placed in small vials to be used as a sting stock for the mealybugs **24**. In the next step the quantified mealybugs are exposed to the quantified adult wasps in a parasitization cage for the production of mummified mealybugs **25**. At this stage, the ratio of mealybugs to parasites is

variable as is the duration and number of the mutual exposures (3 for the citrus mealybug and up to 12 for the solanum mealybug). The parasitized mealybugs' tray is removed from the parasitization cage **26** while the cage is replenished with a new batch of fresh mealybugs. The latter are introduced into the parasitization cage and the tray containing the mealybugs already parasitized is placed in an incubation chamber for the next stage of the process.

**[0067]** Reference is now made to figure 3 in the drawings schematically illustrating the incubation stage **30** of preparing the mummified mealybug product. In this stage the parasitized mealybugs are incubated for a period of time that is parasitoid specific **31**. Before transferring the parasitized mealybugs to the next stage of the preparation, the parasitoids within the mummified mealybugs should be in the pre-pupal or pupal stage **32**.

**[0068]** Figure 4 illustrates in a schematic flow diagram, the rinsing and preparation process **40** in the next stage of the production of the mummified mealybug product. In this embodiment, in a first step of the cleaning and rinsing stage, the mix of mealybugs and mummies is rinsed through a sieving tower using water spray nozzles **41**. In the next step, viable large mummies are separated from dead and small mealybugs **42**. Small mummies are also separated from large mummies, as the former are more likely to yield male wasps. In the next step the mix of mealybugs and mummies is drained into a conical water bath for a second series of separation between viable mummies, dead mummies or mealybugs **43**. Live mealybug mummies have a floating trait, thus in the next stage the live mummies are separated and distinguished by this feature and the whole mixture is water-sprayed several times to obtain clean viable mummies. In the next step the floating mummies are drained to a screened tray and transferred into a drying chamber where hot air flow is blown against the separated and selected mummies to dry off water residues **44**.

**[0069]** Reference is now made to figure 5 in the drawings, showing a schematic flow diagram of the final packing stage **50** of the production process. In this stage, the mummies are collected from the drying chamber and transferred to a plastic container and weighed **51**. The next step is a quantity control step in which 3 samples of mummies, weighing approximately 0.25g, are each counted under a stereoscopic microscope to estimate batch quantity **52**. In the next step the mummified product is packed either for storage **53** or for marketing **54**. Mummified products for storage are mixed with a fine sawdust mixture at a ratio of 1:5 of sawdust to mummies and then are placed in a ventilated plastic container to be stored at 14°C. Each container is labeled individually with the batch number, packaging date and amount of mummies per package before being put in storage.

**[0070]** In an alternative embodiment, in the next step the mummified product is packed for marketing. In this embodiment the mummies and/or mummies' mixture (taken from storage) are mixed with the fine sawdust to

ensure both the right amount of mummies per container and the right weight per package of approximately 2 grams. Each package contains approximately 500 to 1000 individual mummified mealybugs. In another preferred embodiment, the mummified product is packaged for marketing, previous size selection steps ensure that the larger mummies, generally containing female parasitoids, are selected thereby ensuring that at least 50% of the emerging adults are females. In this and other embodiments, a continuous quality control process is carried out to ensure the quality of the mummified pupal product.

[0071] In another preferred embodiment of the present invention, the final mummified pupal product is packaged to provide a comprehensive BCA system. In this embodiment the mummified pupal products are packaged in a sealed, ventilated, plastic container, further surrounded by a detachable double-sided adhesive label. In this embodiment the sealed container is distributed to the consumer and when required for use, the adhesive label is partially detached, so as to expose an adhesive surface. Said adhesive surface serves at least two purposes, firstly the partially detached adhesive surface can be used to attach the mummified pupal system to the correct branch or other location on the desired plant. The lid of the packaging is then opened to allow the emerging wasps to escape and parasitize further mealybugs. At this stage, the partially detached adhesive label serves its second purpose. In this embodiment, the adhesive label traps ants and other non-desired walking insects attracted to the mealybugs' mummies and as the emerging parasitoid wasps are capable of flying they are not entrapped by the adhesive label and can fly out uninterruptedly.

[0072] Reference is now made to figures 6 and 7 in the drawings, in which the novel mummified pupal product is shown alongside an unprocessed mealybug mummy 60, 70. In figure 6, an unprocessed solanum mealybug mummy 61 is shown, with the body and legs covered by a white mealy wax. The processed mealybug mummy 62 has been stripped of its wax. Both mummies contain the pupa of the *L. algerica* parasitic wasp.

[0073] Figure 7 shows the mummy of an intact, unprocessed citrus mealybug 71, with protruding legs and a covering of soft, fluffy wax. By contrast the processed mummified mealybug product 72 is limbless and devoid of the waxy covering. Both mummies contain the pupa of the parasitic wasp, *A. pseudococci*.

[0074] As used herein the term "about" denotes  $\pm 10\%$  of the defined amount or measure or value.

[0075] In order to understand the invention and to see how it may be implemented in practice, a plurality of preferred embodiments will now be described, by way of non-limiting example only, with reference to the following examples.

#### EXAMPLE 1

##### Storage capacity of the *Anagyrus pseudococci* mummies product

[0076] In this experiment, fresh mummies were put into storage at 14°C and complete darkness. Samples from the stored batch were taken out of storage at different time intervals, between 0 and 28 days, and adult wasps were left to emerge at 25°C. Emergence rate and female fertility were examined for each storage interval.

[0077] Reference is now made to Figure 8 showing a graphical representation relating to the storage capacity of the *Anagyrus pseudococci* mummies product. In this figure, graph (a) represents the number of adults divided by the total of mummies in a sample, and graph (b) represents the number of matured eggs in a young (24 Hrs. old) female ovaries.

[0078] As shown in Figure 8, no significant decrease, in both adult emergence rate and fertility, was observed in mummies, which were stored up to 18 days. Thus, it can be concluded that the processed mummies product of the present invention comprising the parasitoid *Anagyrus pseudococci* can be stored for about 18 days before administering/distributing it as a biological control agent (BCA).

#### EXAMPLE 2

##### Storage capacity of the *Leptomastix algerica* mummies product

[0079] In this experiment, fresh mummies were put into storage at 12°C and complete darkness. Samples from the stored batch were taken out of storage at different time intervals, between 0 and 49 days, and adult wasps were left to emerge at 25°C. Emergence rate and female fertility were examined for each storage interval.

[0080] Reference is now made to Figure 9 showing a graphical representation relating to the storage capacity of the *Leptomastix algerica* mummies product. In this figure, graph (a) represents the number of adults divided by the total of mummies in a sample, and graph (b) represents the number of mature eggs in a young (24Hrs. old) female ovaries.

[0081] As shown in Figure 9, no significant decrease in emergence rate was observed in mummies, which were stored up to 14 days. Furthermore, no significant decrease in fertility was observed in adult females that emerged from mummies, which were stored up to 28 days. Thus it can be concluded that the processed mummies product of the present invention comprising the parasitoid *Leptomastix algerica* can be stored for at least about 14 days before administering/distributing it as a biological control agent (BCA).

## EXAMPLE 3

***Leptomastix algerica* parasitization and the *Phenacoccus solani* acceptance by the wasps**

[0082] Fresh mealybugs were supplied daily to the same female wasp in order to learn about the wasp parasitisation potential through time. The different mealybug batches were incubated until parasitisation could be determined (mummy stage). Number of mummies was counted, followed by adult emergence in order to calculate the number of successful parasitisations conducted by the aging female (during different ages), emergence rate of the offspring of different age mothers and, sex ratio of the offspring.

[0083] In order to determine *Phenacoccus solani* acceptance by the wasps, vital detached mealybugs were introduced to fresh wasps over a period of 12 days. The wasps were changed daily while the mealybugs were aging in order to test their acceptance by the parasitoids. The suspected parasitized mealybugs batches were incubated until parasitization could be established. Mummies and emerging female and male wasps were recorded.

## EXAMPLE 4

***Anagyrus pseudococci* parasitization and the *Planococcus citri* acceptance by the wasps**

[0084] Fresh mealybugs were supplied daily to the same female wasp in order to learn about the wasp parasitisation potential through time. The different mealybug batches were incubated until successful parasitisation could be determined (mummy stage). Mummies were counted followed by adult emergence in order to calculate the number of successful parasitisation by the aging female (during different ages), the emergence rate of the offspring of different age mothers and sex ratio of the offspring.

[0085] In order to assess *Planococcus citri* acceptance by the wasps, vital detached mealybugs were introduced to fresh wasps over a period of 70 hours. The wasps were changed periodically while the mealybugs were aging in order to test their acceptance by the parasitoids. The suspected parasitized mealybugs batches were incubated until parasitization could be established. Mummies and emerging female and male wasps were recorded.

**Claims**

1. A Biological Control Agent (BCA) system comprising processed parasitized mealybug mummies; wherein said processed parasitized mealybug mummies are essentially devoid of their limbs and waxy covering.

2. The BCA system according to claim 1, wherein said processed parasitized mealybug mummies are processed in a manner that strips off their waxy covering and detaches their limbs without impacting on their viability as a host for parasitoid pupae.
3. The BCA system according to claim 1, wherein said processed parasitized mealybug mummies are encased in specially adapted packaging for storing, delivering and/or distributing said modified parasitized mealybug mummies.
4. The BCA system according to claim 1, wherein said processed parasitized mealybug mummies has storage capacity of up to 28 days, particularly between 14 days to 28 days, at a temperature of 14°C.
5. The BCA system according to claim 1, wherein said processed parasitized mealybug mummy is derived from any mealybug species including but not limited to *Planococcus citri*, *Planococcus ficus*, *Planococcus vovae*, *Phenacoccus solani*, *Phenacoccus madeirensis*, *Phenacoccus herreni*, *Pseudococcus comstocki*, *Pseudococcus cyptus*, *Pseudococcus viburni*, *Pseudococcus longispinus*, *Dysmicoccus brevipes*, and *Maconelliococcus hirsutus* or any combination therein.
6. The BCA system according to claim 1 wherein said parasitoid is selected from species that lay their eggs in mealybug nymphs or adults selected from the group consisting of: endo-parasitic wasps, Encyrtidae family, *Leptomastix algerica*, *Anagyrus pseudococci* or any combination thereof.
7. A method of controlling mealybug infestations on a plant, wherein the method comprises the steps of;
- infesting a host plant with 1<sup>st</sup> instar stage of the mealybug;
  - detaching mealybug nymphs and young females from said host plant;
  - parasitizing said detached mealybug nymphs and young females;
  - incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture;
  - rinsing the mummified parasitized mealybug mixture;
  - separating out the viable mummified parasitized mealybugs, from said mixture;
  - drying the viable mummified parasitized mealybugs;
  - packaging said viable mummified parasitized mealybugs so as to obtain a processed parasitized mealybug mummy product devoid of limbs and waxy covering; and,
  - administering said parasitized mealybug mummy product to a crop at risk of infestation

- by mealybugs or to an infested crop, thereby controlling mealybug infestations on said plant.
8. The method according to claim 7, further comprises the step of storing said packaged mummified parasitized mealybugs before administering it to the plant. 5
9. A method of producing a mealybug BCA, wherein said method comprises the steps of; 10
- a. infesting a host plant with 1<sup>st</sup> instar stage of the mealybug;
  - b. detaching mealybug nymphs and young females from said host plant; 15
  - c. parasitizing said detached mealybug nymphs and young females;
  - d. incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture;
  - e. rinsing the mummified parasitized mealybug mixture; 20
  - f. separating out the viable mummified parasitized mealybugs, from said mixture;
  - g. drying the viable mummified parasitized mealybugs; 25
  - h. packaging said viable mummified parasitized mealybugs, said packaged mummified parasitized mealybug is devoid of limbs and waxy covering; and,
  - i. storing and/or distributing said packaged mummified parasitized mealybugs as a mealybug BCA. 30
10. The method according to claims 7 to 9, wherein said step of infesting comprises an additional step of maintaining said 1<sup>st</sup> instar stage mealybug for 25 days at 25°C, or between 35 to 42 days at 27°C, and at 60% relative humidity on a factitious plant host, till they reach the 3<sup>rd</sup> instar nymph or young female stage. 35
11. The method according to any one of claims 7 to 10, wherein said step of parasitizing mealybug nymphs and young females comprises at least one additional step selected from the group consisting of: 40
- a. parasitizing mealybug 3<sup>rd</sup> instar nymphs and young females;
  - b. separating dirt and small mealybugs from larger mealybugs through a sieving tower; and
  - c. exposing weighed and quantified mealybug nymphs and young females to the prospective parasitoid population in a parasitization cage. 45
12. The method according to claims 7 to 11, wherein said method further comprises at least one step selecting from the group of: 50
- a. blowing mealybugs nymphs or young females from their factitious host plant using an air blower;
  - b. incubating the parasitized mealybugs to produce mummified parasitized mealybug mixture in a parasitization cage;
  - c. incubating parasitized mealybugs comprises the additional step of removing parasitized mealybugs from said parasitization cage to be incubated until the parasitoids reach the pupal or pre-pupal stage, while replenishing the parasitization cage with fresh unparasitized mealybug population;
  - d. rinsing parasitized mealybugs comprises the additional step of rinsing parasitized mealybugs that have reached the parasitoid's pupal or pre-pupal stage through a sieving tower with water spray nozzles, and thereby separating out large viable mealybug mummies from dead or small mealybugs;
  - e. selecting floating mealybugs and mummies from mixtures that have been drained in a conical water bath;
  - f. drying said mummies by draining them on a screened tray and exposing them to air flow in a drying chamber, and
  - g. obtaining stored or fresh batches of parasitized mealybugs mummies, replenishing them with fine sawdust mixture to the desired level, then, placing about 2 grams, equivalent to 500-1000 parasitized mealybug mummy individuals in a sealed ventilated container with a detachable adhesive label. 55
13. The method according to claims 7 to 12, wherein said packing step comprises at least one additional step selected from the group consisting of:
- a. weighing and quantifying said parasitized mealybug mummies by counting samples under a stereoscopic microscope;
  - b. providing a quantified population of viable parasitized mealybug mummies for storage or distribution;
  - c. mixing parasitized mealybug mummies with fine sawdust in a 5:1 ratio, respectively, in a ventilated and labeled plastic container in preparation for storage at 14°C. 60
14. The method according to claims 7 to 13, further comprising the steps of providing a mummified parasitized mealybug product adapted to be attached to a plant or an object adjoining a crop, to function as an effective distribution means of the mealybug BCA at the desired location. 65
15. A method of producing mummified mealybug product devoid of limbs and waxy layer, wherein said

method comprises the steps of;

- a. incubating mealybugs to the correct nymph stage or young female on a factitious plant host;
- b. detaching said mealybugs with specially adapted air blower from said plant host;
- c. obtaining mealybug 3<sup>rd</sup> instar nymphs and young females by separating out detached mealybugs according to size;
- d. sampling selected mealybug 3<sup>rd</sup> instar nymphs and young females to estimate population size,
- e. exposing selected mealybugs to adult endoparasitoids,
- f. incubating parasitized mealybugs until the parasitoids reach pre-pupal or pupal stage and the mealybugs turn into mummies;
- g. rinsing and separating out large viable mummies from the population of parasitized mealybugs;
- h. drying selected parasitized mealybug mummies with dry air on screened tray;

thereby a mummified parasitized mealybug product is obtained useful as a BCA.

16. A mummified parasitized mealybug product, in which each mealybug is essentially devoid of limbs and waxy covering enclosed in a packaged form in a container with detachable double-sided adhesive labeling for attaching to a plant or object wherein said mummified parasitized mealybug product is an effective mealybug BCA.

#### Patentansprüche

1. Biologisches Bekämpfungsmittelsystem (BCA-System), umfassend behandelte parasitierte Schmierlausmumien; wobei die behandelten parasitierten Schmierlausmumien im Wesentlichen frei von ihren Gliedmaßen und ihrem wachsartigen Überzug sind.
2. BCA-System nach Anspruch 1, wobei die behandelten parasitierten Schmierlausmumien auf eine Weise behandelt werden, die ihren wachsartigen Überzug abstreift und ihre Gliedmaßen ablöst, ohne ihre Brauchbarkeit als Wirt für Parasitoidpuppen zu beeinträchtigen.
3. BCA-System nach Anspruch 1, wobei die behandelten parasitierten Schmierlausmumien zwecks Lagerung, Lieferung und/oder Vertrieb der modifizierten parasitierten Schmierlausmumien in speziell eingerichteter Verpackung eingeschlossen sind.
4. BCA-System nach Anspruch 1, wobei die behandelten parasitierten Schmierlausmumien eine Lagerfähigkeit

von bis zu 28 Tagen, insbesondere zwischen 14 Tagen und 28 Tagen, bei einer Temperatur von 14°C aufweisen.

5. BCA-System nach Anspruch 1, wobei die behandelte parasitierte Schmierlausmumie von gleich welcher Schmierlausspezies gewonnen ist, einschließlich, jedoch nicht beschränkt auf, *Planococcus citri*, *Planococcus ficus*, *Planococcus vovae*, *Phenacoccus solani*, *Phenacoccus madeirensis*, *Phenacoccus herreni*, *Pseudococcus comstocki*, *Pseudococcus cyptus*, *Pseudococcus viburni*, *Pseudococcus longispinus*, *Dysmicoccus brevipes* und *Maconellicoccus hirsutus* oder gleich welche Kombination davon.
6. BCA-System nach Anspruch 1, wobei der Parasitoid aus Spezies ausgewählt ist, die ihre Eier in Schmierlausnymphen oder adulte Tiere legen, ausgewählt aus der Gruppe, bestehend aus: endoparasitären Wespen, der Familie der Encyrtidae, *Leptomastix algirica*, *Anagyrus pseudococci* oder gleich welcher Kombination davon.
7. Verfahren zur Bekämpfung von Schmierlausbefall auf einer Pflanze, wobei das Verfahren die Schritte umfasst des:
  - a. Besiedeln einer Wirtspflanze mit dem 1. Larvenstadiums der Schmierlaus;
  - b. Ablösens von Schmierlausnymphen und jungen Weibchen von der Wirtspflanze;
  - c. Parasitierens der abgelösten Schmierlausnymphen und jungen Weibchen;
  - d. Inkubierens der parasitierten Schmierläuse zur Produktion von mumifizierter parasitierter Schmierlausmischung;
  - e. Spülens der mumifizierten parasitierten Schmierlausmischung;
  - f. Abscheidens der brauchbaren mumifizierten parasitierten Schmierläuse von dieser Mischung;
  - g. Trocknens der brauchbaren mumifizierten parasitierten Schmierläuse;
  - h. Verpackens der besagten brauchbaren mumifizierten parasitierten Schmierläuse zwecks Erhaltung eines behandelten parasitierten Schmierlausmumienprodukts, das frei von Gliedmaßen und wachsartigem Überzug ist; und
  - i. Ausbringens des besagten parasitierten Schmierlausmumienprodukts auf Kulturpflanzen mit einem Risiko auf Schmierlausbefall oder auf befallene Kulturpflanzen, wodurch Schmierlausbefall auf besagter Pflanze bekämpft wird.
8. Verfahren nach Anspruch 7, weiter den Schritt des Lagerns der besagten verpackten mumifizierten pa-

- rasitierten Schmierläuse vor deren Ausbringen auf die Pflanze umfassend.
- 9.** Verfahren zur Herstellung eines Schmierlaus-BCAs, wobei das Verfahren die Schritte umfasst des:
- a. Besiedeln einer Wirtspflanze mit dem 1. Larvenstadiums der Schmierlaus;
  - b. Ablösens von Schmierlausnymphen und jungen Weibchen von der Wirtspflanze;
  - c. Parasitierens der abgelösten Schmierlausnymphen und jungen Weibchen;
  - d. Inkubierens der parasitierten Schmierläuse zur Produktion von mumifizierter parasitierter Schmierlausmischung;
  - e. Spülens der mumifizierten parasitierten Schmierlausmischung;
  - f. Abscheidens der brauchbaren mumifizierten parasitierten Schmierläuse von dieser Mischung;
  - g. Trocknens der brauchbaren mumifizierten parasitierten Schmierläuse;
  - h. Verpackens der besagten brauchbaren mumifizierten parasitierten Schmierläuse, wobei die verpackte mumifizierte parasitierte Schmierlaus frei von Gliedmaßen und wachsartigem Überzug ist; und
  - i. Lagerns und/oder Vertreibens der verpackten mumifizierten parasitierten Schmierläuse als Schmierlaus-BCA.
- 10.** Verfahren nach Ansprüchen 7 bis 9, wobei der Schritt des Besiedeln einen zusätzlichen Schritt umfasst des Haltens der Schmierlaus im 1. Larvenstadium 25 Tage lang auf 25°C, oder zwischen 35 und 42 Tagen auf 27°C, und bei 60% relativer Feuchtigkeit auf einer künstlichen Wirtspflanze, bis sie das Stadium des 3. Larvenstadiums der Nymphe oder das des jungen Weibchens erreichen.
- 11.** Verfahren nach einem der Ansprüche 7 bis 10, wobei der Schritt des Parasitierens von Schmierlausnymphen und jungen Weibchen mindestens einen zusätzlichen Schritt umfasst, ausgewählt aus der Gruppe, bestehend aus:
- a. dem Parasitieren von Schmierlausnymphen im 3. Larvenstadium und jungen Schmierlausweibchen;
  - b. Abscheiden von Schmutz und kleinen Schmierläusen von größeren Schmierläusen durch einen Siebturm; und
  - c. der zukünftigen Parasitoidenpopulation Aussetzen von gewogenen und quantifizierten Schmierlausnymphen und jungen Schmierlausweibchen in einem Parasitierungskäfig.
- 12.** Verfahren nach Ansprüchen 7 bis 11, wobei das Ver-
- fahren weiter mindestens einen Schritt umfasst, ausgewählt aus der Gruppe des:
- a. Herunterblasens von Schmierlausnymphen oder jungen Weibchen von ihrer künstlichen Wirtspflanze unter Verwendung eines Gebläses;
  - b. Inkubierens der parasitierten Schmierläuse zur Produktion mumifizierter parasitierter Schmierlausmischung in einem Parasitierungskäfig;
  - c. Inkubierens parasitierter Schmierläuse, umfassend den zusätzlichen Schritt des Entfernens parasitierter Schmierläuse aus dem Parasitierungskäfig, um inkubiert zu werden, bis die Parasitoiden das Verpuppungs- oder Vorverpuppungsstadium erreichen, während der Parasitierungskäfig mit frischer unparasitierter Schmierlauspopulation aufgefüllt wird;
  - d. Spülens parasitierter Schmierläuse, umfassend den zusätzlichen Schritt des Spülens parasitierter Schmierläuse, die das Verpuppungs- oder Vorverpuppungsstadium des Parasitoiden erreicht haben, durch einen Siebturm mit Wassersprühdüsen und dadurch Abscheiden großer brauchbarer Schmierlausmumien von toten oder kleinen Schmierläusen;
  - e. Auswählens treibender Schmierläuse und Mumien aus Mischungen, die in einem konischen Wasserbad abgegossen worden sind;
  - f. Trocknens der Mumien, indem sie auf einer Gitterwanne abgetropft werden und in einer Trockenkammer einem Luftstrom ausgesetzt werden, und
  - g. Erhaltens gelagerter oder frischer Chargen parasitierter Schmierlausmumien, deren Auffüllens mit feinem Sägemehlgemisch bis auf das gewünschte Niveau, dann Einbringens von ungefähr 2 Gramm, äquivalent zu 500-1000 individuellen parasitierten Schmierlausmumien, in einen verschlossenen belüfteten Behälter mit einem abnehmbaren Klebeetikett.
- 13.** Verfahren nach Ansprüchen 7 bis 12, wobei der Verpackungsschritt mindestens einen zusätzlichen Schritt umfasst, ausgewählt aus der Gruppe, bestehend aus:
- a. dem Wiegen und Quantifizieren der parasitierten Schmierlausmumien durch Zählen von Proben unter einem stereoskopischen Mikroskop;
  - b. Bereitstellen einer quantifizierten Population brauchbarer parasitierter Schmierlausmumien für Lagerung oder Vertrieb;
  - c. Mischen parasitierter Schmierlausmumien mit feinem Sägemehl jeweils in einem Verhältnis von 5:1 in einem belüfteten und etikettierten

Kunststoffbehälter in Vorbereitung der Lagerung bei 14°C.

14. Verfahren nach Ansprüchen 7 bis 13, weiter die Schritte umfassend des Bereitstellens eines mumifizierten parasitierten Schmierlausprodukts, das dazu eingerichtet ist, an einer Pflanze oder an einem Objekt benachbart zu einer Kulturpflanze befestigt zu werden, um als effizientes Verteilungsmittel des Schmierlaus-BCAs am gewünschten Ort zu wirken.

15. Verfahren zur Herstellung von mumifiziertem Schmierlausprodukt, das frei von Gliedmaßen und wachsartigem Überzug ist, wobei das Verfahren die Schritte umfasst des:

- a. Inkubierens von Schmierläusen bis zum korrekten Nymphenstadium oder jungem Weibchen auf einer künstlichen Wirtspflanze;
- b. Ablösens der Schmierläuse von der Wirtspflanze mit einem speziell eingerichteten Gebläse;
- c. Erhaltens von Schmierlaus-Nymphen des 3. Larvenstadiums und jungen Weibchen durch Abscheiden von abgelösten Schmierläusen nach Größe;
- d. Probeentnehmens von ausgewählten Schmierlausnymphen des 3. Larvenstadiums und jungen Weibchen zur Schätzung der Populationsgröße;
- e. adulten Endoparasitoiden Aussetzens ausgewählter Schmierläuse;
- f. Inkubierens parasitierter Schmierläuse, bis die Parasitoiden das Vorverpuppungs- oder Verpuppungsstadium erreichen und die Schmierläuse sich in Mumien verwandeln;
- g. Spülens und Abscheidens großer brauchbarer Mumien aus der Population parasitierter Schmierläuse;
- h. Trocknens ausgewählter parasitierter Schmierlausmumien mit trockener Luft auf einer Gitterwanne;

wodurch ein mumifiziertes parasitiertes Schmierlausprodukt erhalten wird, das als BCA anwendbar ist.

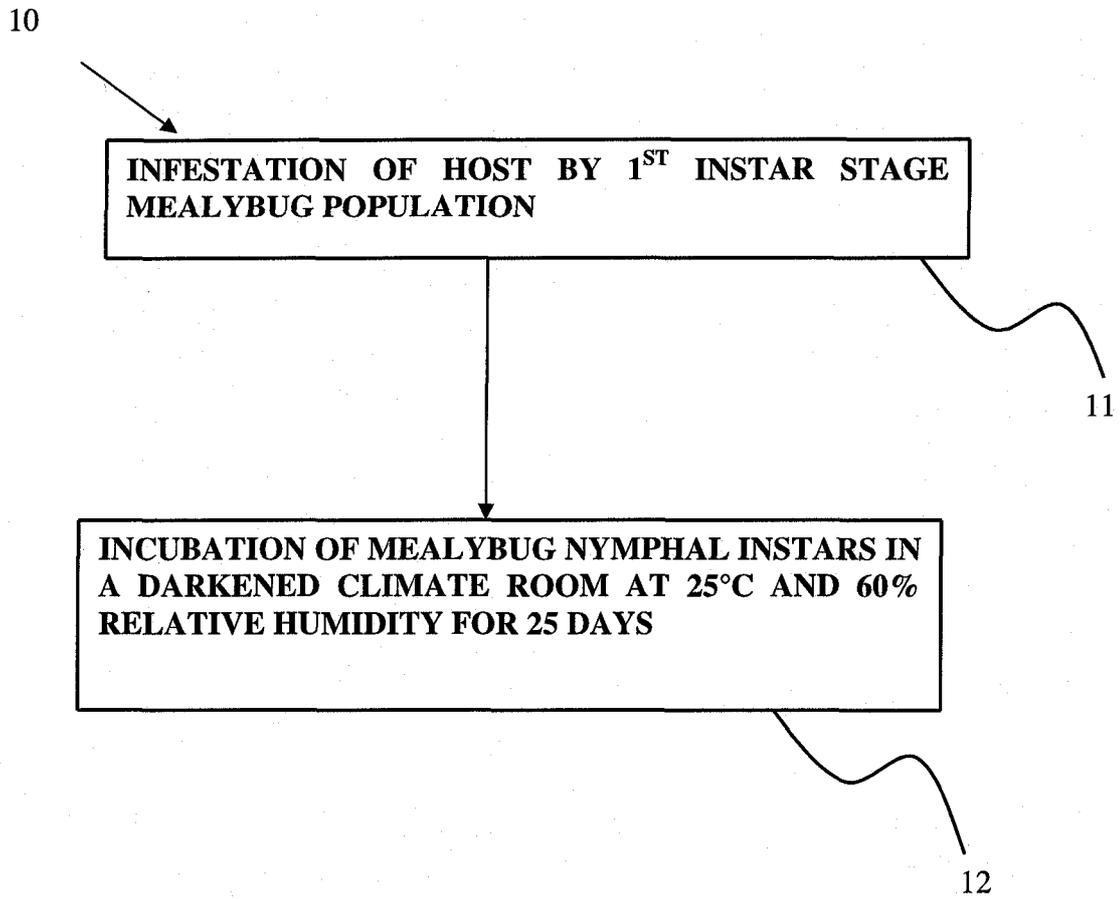
16. Mumifiziertes parasitiertes Schmierlausprodukt, wobei jede Schmierlaus im Wesentlichen frei von Gliedmaßen und wachsartigem Überzug ist, in einer verpackten Form eingeschlossen in einem Behälter mit abnehmbarer doppelseitiger Klebeetikettierung zum Befestigen an einer Pflanze oder einem Objekt, wobei das mumifizierte parasitierte Schmierlausprodukt ein effizientes Schmierlaus-BCA ist.

## Revendications

1. Système d'agent de lutte biologique (BCA) comprenant des momies de cochenilles parasitées traitées, lesdites momies de cochenilles parasitées traitées étant essentiellement dépourvues de leurs membres et de leur revêtement cireux.
2. Système BCA selon la revendication 1, dans lequel lesdites momies de cochenilles parasitées traitées sont traitées d'une manière telle qu'on leur enlève leur revêtement cireux et que l'on détache leurs membres sans avoir un impact sur leur viabilité à titre d'hôte pour des chrysalides parasitoïdes.
3. Système BCA selon la revendication 1, dans lequel lesdites momies de cochenilles parasitées traitées sont enfermées dans un conditionnement spécialement conçu pour l'entreposage, la livraison et/ou la distribution desdites momies de cochenilles parasitées modifiées.
4. Système BCA selon la revendication 1, dans lequel lesdites momies de cochenilles parasitées traitées possèdent une capacité d'entreposage s'étendant jusqu'à 28 jours, en particulier entre 14 jours et 28 jours, à une température de 14 °C.
5. Système BCA selon la revendication 1, dans lequel lesdites momies de cochenilles parasitées traitées dérivent de n'importe quelle espèce de cochenille y compris, mais sans y être limité, *Planococcus citri*, *Planococcus ficus*, *Planococcus vovae*, *Phenacoccus solani*, *Phenacoccus madeirensis*, *Phenacoccus herreni*, *Pseudococcus comstocki*, *Pseudococcus cyptus*, *Pseudococcus viburni*, *Pseudococcus longispinus*, *Dysmicoccus brevipes*, et *Maconelliococcus hirsutus* ou l'une quelconque de leurs combinaisons.
6. Système BCA selon la revendication 1, dans lequel ledit parasitoïde est choisi parmi des espèces qui pondent leurs oeufs dans des nymphes de cochenilles ou dans des cochenilles adultes, choisies parmi le groupe constitué par : des guêpes endoparasitaires, la famille des Encyrtidae, *Leptomastix algirica*, *Anagyrus pseudococci*, ou l'une quelconque de leurs combinaisons.
7. Procédé de lutte contre des infestations de cochenilles sur une plante, le procédé comprenant les étapes consistant à :
  - a. infester une plante hôte avec le premier stade larvaire de la cochenille ;
  - b. détacher des nymphes de cochenilles et des jeunes femelles de ladite plante hôte ;
  - c. parasiter lesdites nymphes de cochenilles et

- lesdites jeunes femelles détachées ;  
d. incuber les cochenilles parasitées pour obtenir un mélange de cochenilles parasitées momifiées ;  
e. rincer le mélange de cochenilles parasitées momifiées ;  
f. séparer dudit mélange les cochenilles parasitées momifiées viables ;  
g. sécher les cochenilles parasitées momifiées viables ;  
h. conditionner lesdites cochenilles parasitées momifiées viables de façon à obtenir un produit constitué de momies de cochenilles parasitées traitées, dépourvu de membres et de revêtement cireux ; et  
i. administrer ledit produit de momies de cochenilles parasitées à une culture exposée à un risque d'infestation par des cochenilles ou à une culture infestée, pour ainsi lutter contre des infestations de cochenilles sur ladite plante.
8. Procédé selon la revendication 7, comprenant en outre l'étape consistant à entreposer lesdites cochenilles parasitées momifiées conditionnées avant leur administration à la plante.
9. Procédé de production d'un agent BCA à base de cochenilles, ledit procédé comprenant les étapes consistant à :
- infester une plante hôte avec le premier stade larvaire de la cochenille ;
  - détacher des nymphes de cochenilles et des jeunes femelles de ladite plante hôte ;
  - parasiter lesdites nymphes de cochenilles et lesdites jeunes femelles détachées ;
  - incuber les cochenilles parasitées pour obtenir un mélange de cochenilles parasitées momifiées ;
  - rincer le mélange de cochenilles parasitées momifiées ;
  - séparer dudit mélange les cochenilles parasitées momifiées viables ;
  - sécher les cochenilles parasitées momifiées viables ;
  - conditionner lesdites cochenilles parasitées momifiées viables, lesdites momies de cochenilles parasitées traitées étant dépourvues de leurs membres et de leur revêtement cireux ; et
  - entreposer et/ou distribuer lesdites cochenilles parasitées momifiées conditionnées à titre d'agent BCA à base de cochenilles.
10. Procédé selon les revendications 7 à 9, dans lequel ladite étape d'infestation comprend une étape supplémentaire consistant à maintenir lesdites cochenilles du premier stade larvaire pendant 25 jours à 25 °C ou entre 35 et 42 jours à 27 °C et sous une humidité relative de 60 % sur une plante hôte factice, jusqu'à ce qu'elles atteignent leur troisième stade larvaire de nymphe ou de jeune femelle.
11. Procédé selon l'une quelconque des revendications 7 à 10, dans lequel ladite étape consistant à parasiter des nymphes et des jeunes femelles de cochenilles comprend au moins une étape supplémentaire choisie parmi le groupe constitué par :
- parasiter des nymphes et des jeunes femelles du troisième stade larvaire de cochenilles ;
  - séparer les saletés et les cochenilles de petite taille par rapport aux cochenilles de plus grande taille à travers une colonne de tamis ; et
  - exposer des nymphes et des jeunes femelles de cochenilles pesées et quantifiées à la population prospective de parasitoïdes dans une cage de parasitation.
12. Procédé selon l'une quelconque des revendications 7 à 11, dans lequel ledit procédé comprend en outre au moins une étape choisie parmi le groupe constitué par :
- éloigner par soufflage de leur plante hôte factice des nymphes ou de jeunes femelles de cochenilles en utilisant un ventilateur ;
  - incuber les cochenilles parasitées pour obtenir un mélange de cochenilles parasitées momifiées dans une cage de parasitation ;
  - le fait que l'incubation des cochenilles parasitées comprend l'étape supplémentaire consistant à retirer des cochenilles parasitées de ladite cage de parasitation pour les soumettre à une incubation jusqu'à ce que les parasitoïdes atteignent leur stade nymphal ou prénympgal, tout en regarnissant la cage de parasitation avec une population fraîche de cochenilles non parasitées ;
  - le fait que le rinçage des cochenilles parasitées comprend l'étape supplémentaire consistant à rincer des cochenilles parasitées qui ont atteint le stade nymphal ou prénympgal de parasitoïde à travers une colonne de tamis avec des lances à brouillard d'eau, pour ainsi séparer des momies de cochenilles viables de grande taille par rapport aux cochenilles mortes ou de petite taille ;
  - sélectionner les momies et les cochenilles flottantes à partir de mélanges qui ont été drainés dans un bain d'eau de forme conique ;
  - sécher lesdites momies en les soumettant à un drainage sur un plateau en forme de grillage et les exposer à un courant d'air dans une chambre de séchage ; et
  - obtenir des lots entreposés ou frais de momies de cochenilles parasitées, les réapprovi-

- sionner avec un mélange à base de sciure fine jusqu'au niveau désiré et placer ensuite environ 2 g, ce qui équivaut à un nombre de 500 à 1000 momies individuelles de cochenilles parasitées dans un récipient ventilé hermétiquement fermé sur lequel on appose une étiquette adhésive amovible. 5
- 13.** Procédé selon l'une quelconque des revendications 7 à 12, dans lequel ladite étape de conditionnement comprend au moins une étape supplémentaire choisie parmi le groupe constitué par :
- a, la pesée et la quantification desdites momies de cochenilles parasitées en procédant à un comptage d'échantillons via un microscope stéréoscopique ; 15
- b, le fait de procurer une population quantifiée de momies de cochenilles parasitées viables à des fins d'entreposage ou de distribution ; 20
- c, le mélange des momies de cochenilles parasitées avec de la sciure fine dans le rapport 5:1, respectivement dans un récipient en matière plastique ventilé et étiqueté, en préparation à un entreposage à 14 °C. 25
- 14.** Procédé selon l'une quelconque des revendications 7 à 13, comprenant en outre l'étape consistant à procurer un produit de cochenilles parasitées momifiées adapté pour pouvoir le fixer à une plante ou à un objet adjacent à une culture, pour faire office de moyen de distribution efficace de l'agent BCA à base de cochenilles, à l'endroit souhaité. 30
- 15.** Procédé de préparation d'un produit de cochenilles momifiées, dépourvu de membres et d'une couche cireuse, ledit procédé comprenant les étapes consistant à :
- a. incuber des cochenilles jusqu'au stade correct de nymphe ou de jeune femelle sur une plante hôte factice ; 40
- b. détacher de ladite plante hôte lesdites cochenilles avec un ventilateur spécialement adapté ;
- c. obtenir des nymphes et de jeunes femelles de cochenilles du troisième stade par séparation des cochenilles détachées en fonction de leur taille ; 45
- d. échantillonner des nymphes et de jeunes femelles de cochenilles sélectionnées du troisième stade pour estimer la taille de la population ; 50
- e. exposer des cochenilles sélectionnées à des endoparasitoïdes adultes ;
- f. incuber des cochenilles parasitées jusqu'à ce que les parasitoïdes atteignent leur stade pré-nymphal ou nymphal et jusqu'à ce que les cochenilles se transforment en momies ; 55
- g. rincer et séparer des momies viables de gran-
- de taille à partir de la population des cochenilles parasitées ;
- h. sécher des momies de cochenilles parasitées sélectionnées avec de l'air sec sur un plateau en forme de grillage ;
- pour ainsi obtenir un produit de cochenilles parasitées momifiées utiles à titre d'agent BCA.
- 16.** Produit de cochenilles parasitées momifiées, dans lequel chaque cochenille est essentiellement dépourvue de membres et d'un revêtement cireux, renfermé sous une forme conditionnée dans un récipient comprenant une étiquette adhésive double face amovible, pour sa fixation à une plante ou à un objet, ledit produit de cochenilles parasitées momifiées représentant un agent BCA efficace à base de cochenilles.



**FIGURE 1**

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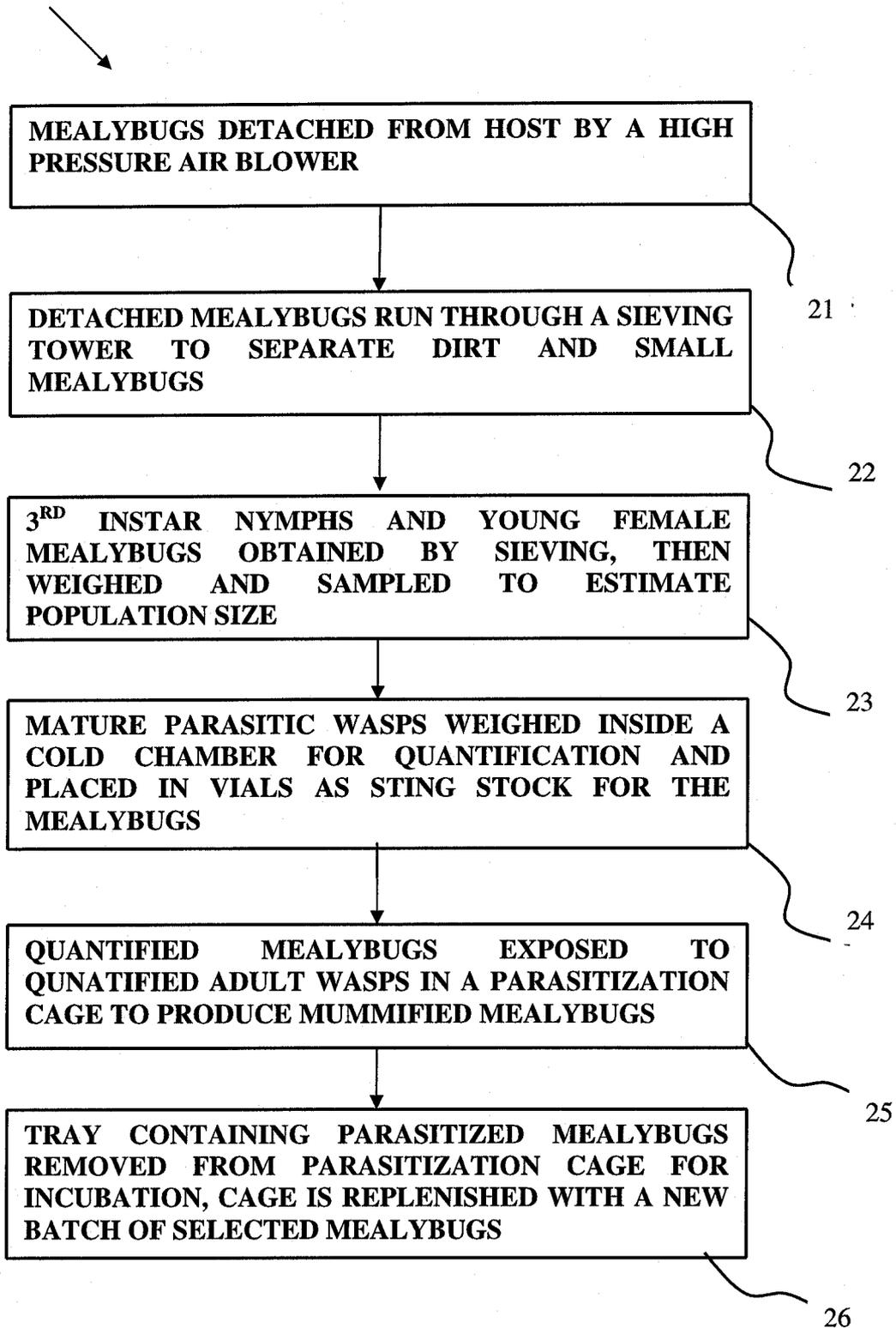
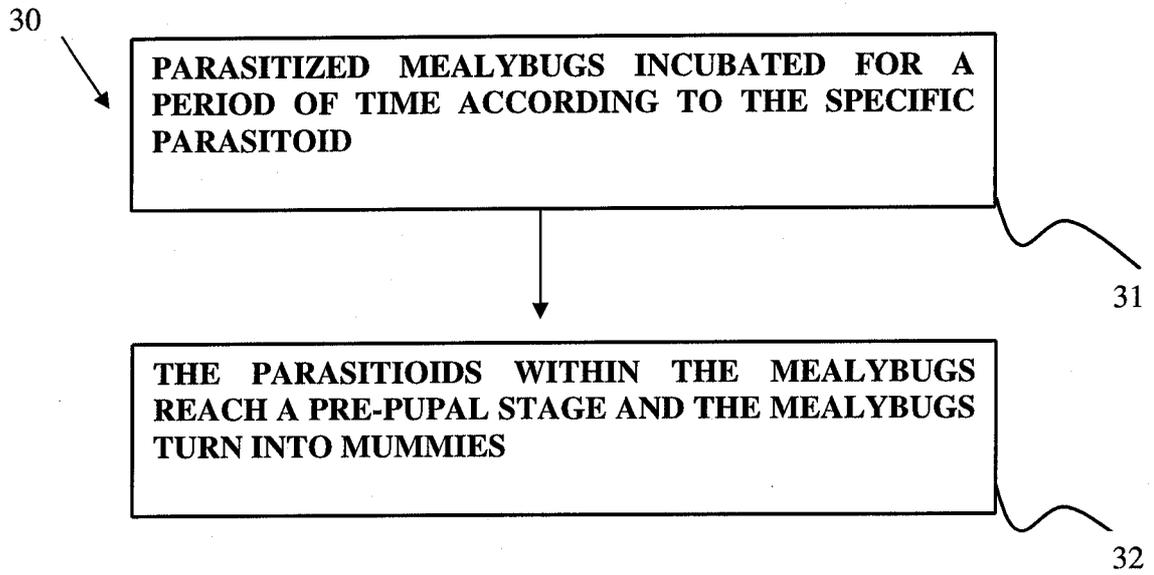


FIGURE 2



**FIGURE 3**

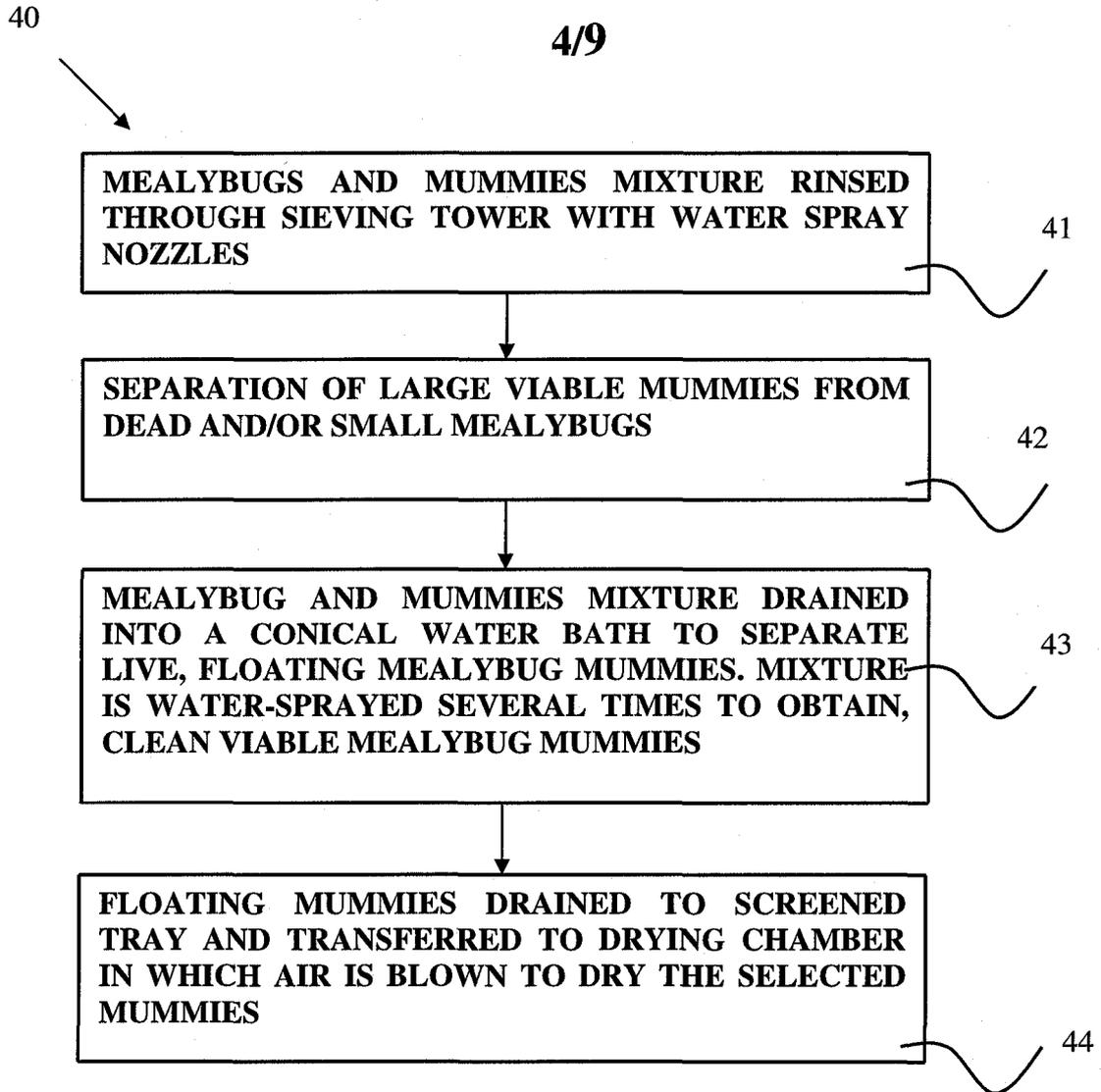


FIGURE 4

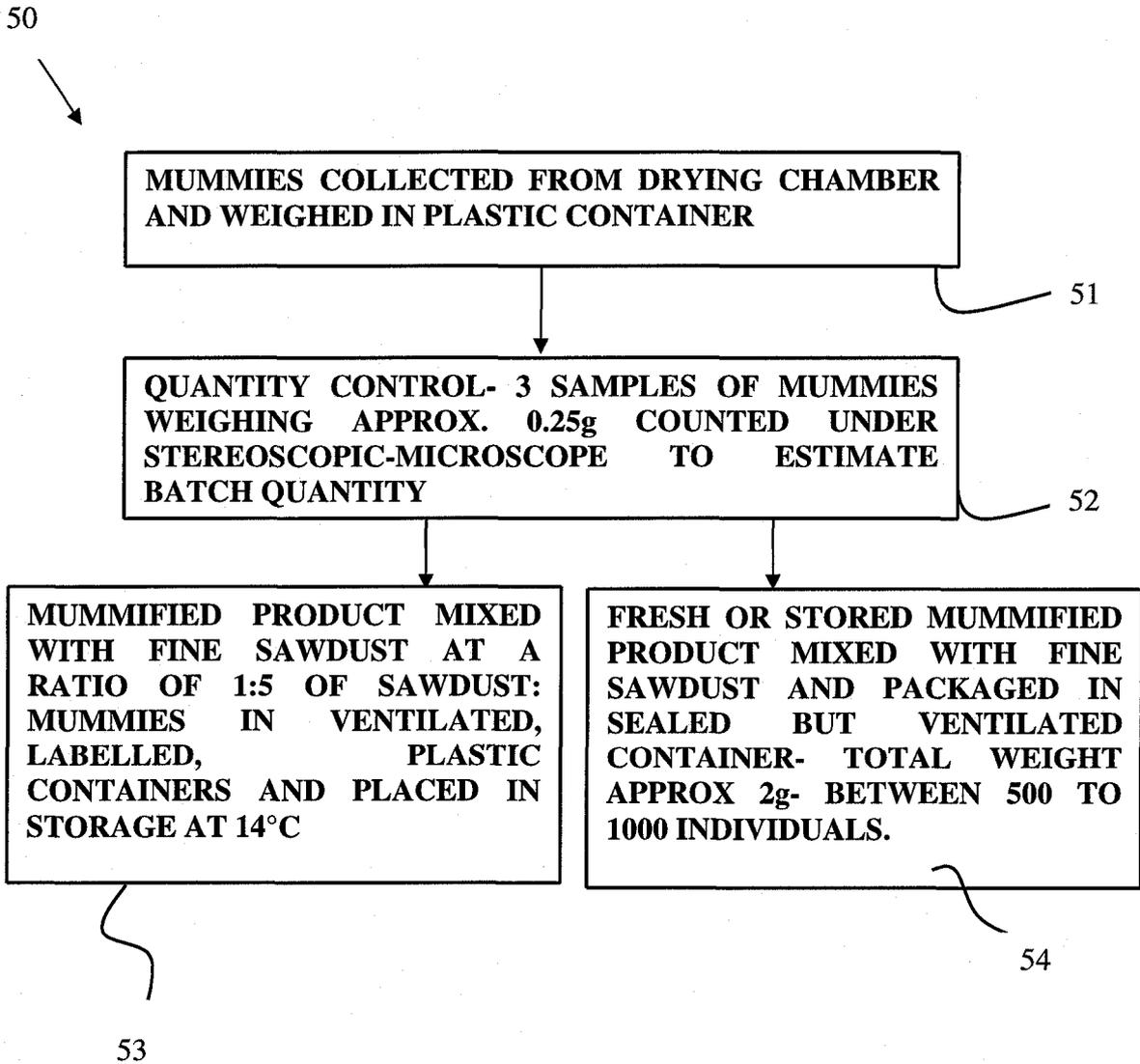
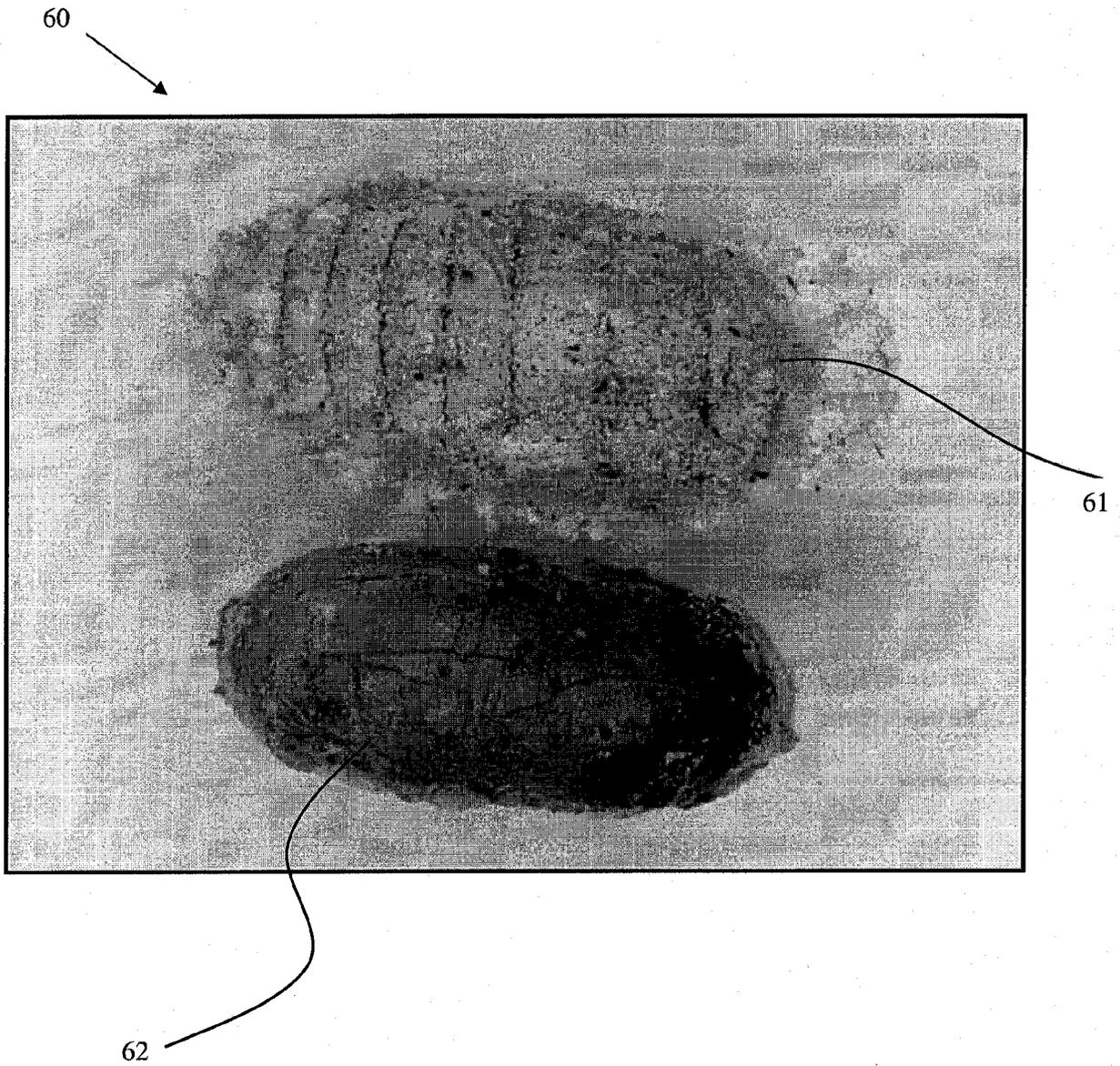


FIGURE 5



**FIGURE 6**

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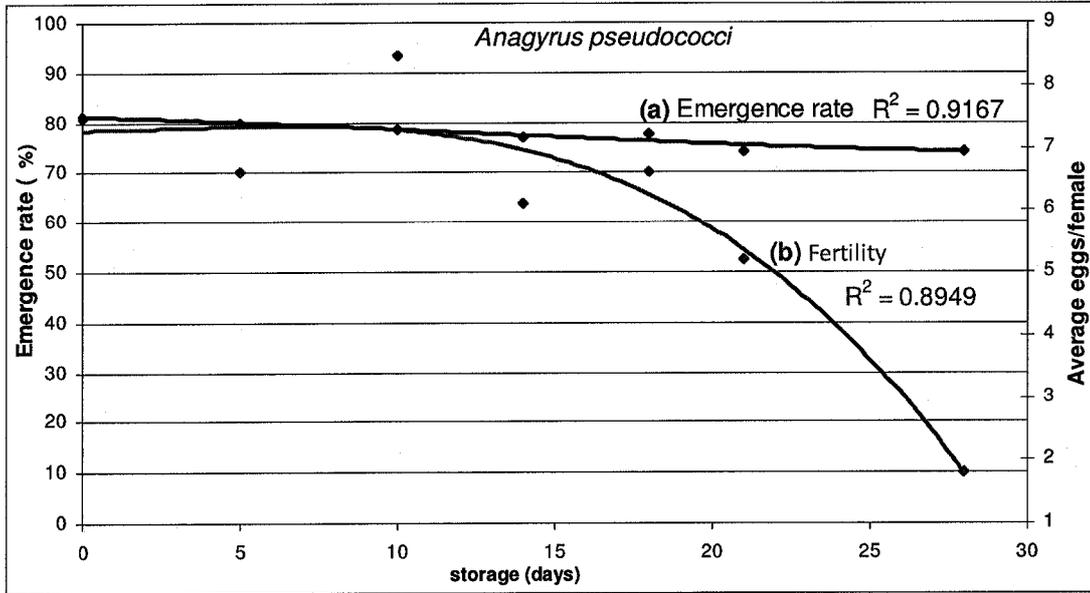


FIGURE 8

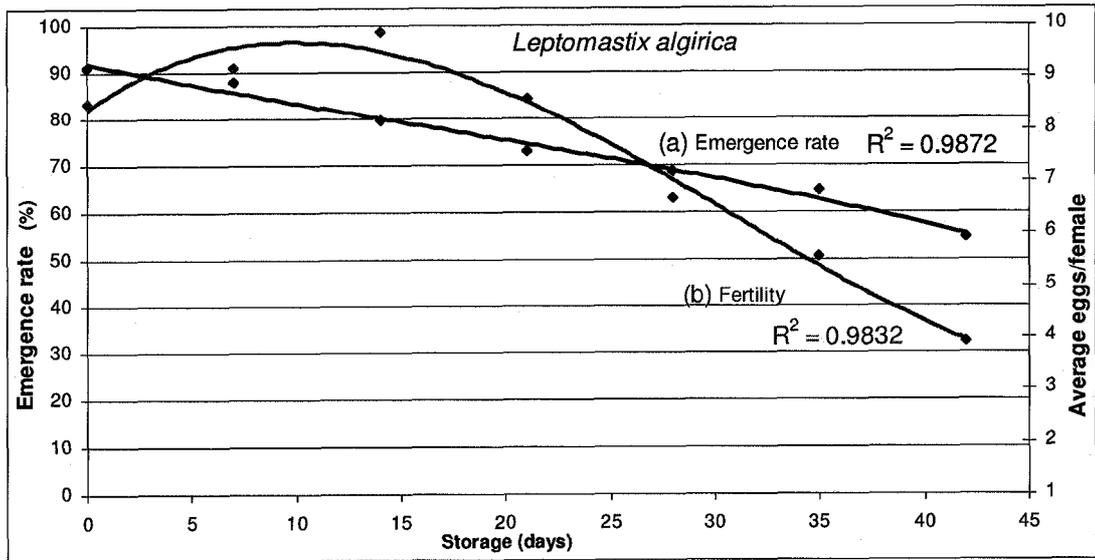


FIGURE 9

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 4260108 A [0006]
- CN 2810197 [0007]
- EP 0210447 A [0008]

MUMIFIKÁLT MEALYBUG KÁRTEVŐ TERMÉK ÉS ELJÁRÁS  
SZABADALMI IGÉNYPONTOK



1. Biológiai Szabályozó Szer [Biological Control Agent (BCA)] rendszer, amely tartalmaz feldolgozott (processed), élősködővé tett (parasitized) mealybug (többféle növénykártevő rovar nemzetközileg elfogadott angol összefoglaló neve; a továbbiakban mealybug) múmiákat (szárított tetem), ahol az említett feldolgozott, élősködővé tett mealybug múmiák lényegében mentesek végtagjaiktól és viaszos bevonatuktól (covering).
2. Az 1. igénypont szerinti BCA rendszer, ahol az említett feldolgozott, élősködővé tett mealybug múmiák olyan módon vannak feldolgozva, hogy le van húzva viaszos bevonatuk, és le vannak választva végtagjaik a nélkül, hogy befolyásolva lenne életképességük gazdaszervezetként (host) élősködő bábokhoz (parasitoid pupa).
3. Az 1. igénypont szerinti BCA rendszer, ahol az említett feldolgozott, élősködővé tett mealybug múmiák be vannak zárva (encase) speciálisan adaptált csomagolásba az említett módosított, élősködővé tett mealybug múmiák tárolásához, szállításához és/vagy elosztásához.
4. Az 1. igénypont szerinti BCA rendszer, ahol az említett feldolgozott, élősködővé tett mealybug múmiák tárolási időtartama (storage capacity) legfeljebb 28 napra terjedhet ki, és elsősorban 14 nap és 28 nap között van 14°C hőmérsékleten.
5. Az 1. igénypont szerinti BCA rendszer, ahol az említett feldolgozott, élősködővé tett mealybug múmiák származhatnak bármilyen mealybug fajlából (species), ide értve a következőket, de nemcsak ezekre korlátozva: *Planococcus citri*, *Planococcus ficus*, *Planococcus vovae*, *Phenacoccus solari*, *Phenacoccus madeirensis*, *Phenacoccus herreni*, *Pseudococcus comstocki*, *Pseudococcus cyprus*, *Pseudococcus viburni*, *Pseudococcus longispinus*, *Dysmicoccus brevipes* és *Maconellicoccus hirsutus*, vagy ezek bármely kombinációja.
6. Az 1. igénypont szerinti BCA rendszer, ahol az említett parazitoidok olyan fajták közül választhatók ki, amelyek petéiket (egg) mealybug nimfákban vagy felnőttekben helyezik el, ahol ezek a következők közül választhatók ki: belparazitás darazsak (endoparasitic wasps), Encyrtidae család (family), *Leptomastix algerica*, *Anagyrus pseudococci*, vagy ezek bármilyen kombinációja.
7. Eljárás mealybug parazitafertőzés (infestation) szabályozására egy növényen, ahol az eljárás a következő lépéseket tartalmazza:
  - a. befertőzünk (infest) egy gazdanövényt a mealybug első lárvaalapotú (1<sup>st</sup> instar) stádiumával;
  - b. leválasztunk (detach) mealybug nimfákat és fiatal nőnemű felnőtteket (female) az említett gazdaszervezetről;
  - c. élősködővé tesszük (parasitizing) az említett mealybug nimfákat és fiatal nőnemű felnőtteket;
  - d. inkubáljuk az élősködővé tett (parasitized) mealybugokat, hogy kialakuljon egy mumifikált, élősködővé tett mealybug keverék;
  - e. leöblítjük (rinse) a mumifikált, élősködővé tett mealybug keveréket;
  - f. elkülönítjük az életképes (viable), mumifikált, élősködővé tett mealybugokat az említett keverékből;
  - g. megszáritjuk az életképes, mumifikált, élősködővé tett mealybugokat;
  - h. becsomagoljuk az említett életképes, mumifikált, élősködővé tett mealybugokat úgy, hogy megkapjunk egy olyan feldolgozott, élősködővé tett mealybug múmia terméket, amely mentes végtagoktól és viaszos bevonattól, és
  - i. bevezetjük az említett élősködővé tett mealybug múmia terméket egy olyan terményhez (crop), amely ki van téve parazitafertőzés kockázatának mealybugok révén, vagy parazitafertőzött (infested) terményhez, ezáltal szabályozzuk a mealybug parazitafertőzéseket az említett növényen.
8. A 7. igénypont szerinti eljárás, amely tartalmazza továbbá az említett becsomagolt, mumifikált, élősködővé tett

mealybugok lárolásának lépését, mielőtt rávezetnénk azt a növényre.

9. Eljárás mealybug BCA előállítására, ahol az említett eljárás a következő lépéseket tartalmazza:

- a. befertőzünk egy gazdanövényt mealybug első lárvállapotú (1<sup>st</sup> instar) stádiumával;
- b. leválasztjuk (detach) a mealybug nimfákat és fiatal nőnemű felnőtteket (female) az említett gazdanövényről;
- c. elősködővé tesszük (parasitizing) az említett leválasztott mealybug nimfákat és fiatal nőnemű felnőtteket;
- d. inkubáljuk az elősködővé tett (parasitized) mealybugokat, hogy kialakuljon egy mumifikált, elősködővé tett mealybug keverék;
- e. leöblítjük (rinse) a mumifikált, elősködővé tett mealybug keveréket;
- f. elkülönítjük az életképes (viable), mumifikált, elősködővé tett mealybugokat az említett keverékből;
- g. megszárlítjuk az életképes, mumifikált, elősködővé tett mealybugokat;
- h. becsomagoljuk az említett életképes, mumifikált, elősködővé tett mealybugokat, ahol az említett becsomagolt, mumifikált, elősködővé tett mealybug mentes végtagoktól és viaszos bevonattól; és
- i. tároljuk és/vagy szétosztjuk az említett becsomagolt, mumifikált, elősködővé tett mealybugokat, mint mealybug BCA-t.

10. A 7-9. igénypontok bármelyike szerinti eljárás, ahol a befertőzés említett lépése tartalmaz egy további lépést, amennyiben az említett első lárvállapotban levő mealybugokat 25 napon át 25°C hőmérsékleten, vagy 35 nap és 42 nap közötti időtartamon át 27°C hőmérsékleten tartjuk, és 60% relatív nedvességtartalomnál egy mesterségesen kiválasztott (factitious) növényi gazdaszervezeten, amíg ezek elérik a harmadik lárvállapotban levő (3<sup>rd</sup> instar) nimfa vagy fiatal nőnemű felnőtt stádiumot.

11. A 7-10. igénypontok bármelyike szerinti eljárás, ahol a mealybug nimfák és fiatal nőnemű felnőttek elősködővé tételének (parasitizing) említett lépése magában foglal legalább egy további lépést, amely a következők közül választható ki:

- a. elősködővé tesszük (parasitizing) a harmadik lárvállapotban levő mealybug nimfákat és fiatal nőnemű felnőtteket;
- b. elkülönítjük (separating) a szennyezett (dirt) és apró mealybugokat a nagyobb mealybugoktól egy rostáló tornyon (sieving tower) keresztül; és
- c. kitevük a lemért (weighed) és mennyiségileg meghatározott (quantified) mealybug nimfákat és fiatal nőnemű felnőtteket egy leendő parazitoid populációra, egy elősködővé tett ketrecben (parasitization cage).

12. A 7-11. igénypontok bármelyike szerinti eljárás, ahol az említett eljárás tartalmaz továbbá legalább egy lépést, amely a következők közül választható ki:

- a. lefúvatjuk (blow) a nimfákat vagy fiatal nőnemű felnőtteket mesterséges növényi gazdaszervezetükről ventilátorral (air blower) alkalmazva;
- b. inkubáljuk az elősködővé tett mealybugokat, hogy kialakuljon egy mumifikált, elősködővé tett mealybug keverék egy elősködővé tett ketrecben (parasitization cage);
- c. inkubáljuk az elősködővé tett mealybugokat, amely eljárás tartalmazza az elősködővé tett mealybugok eltávolításának további lépését abból az említett elősködővé tett ketrecből, amely inkubálandó addig, amíg a parazitoidok el nem érik a báb (pupal) vagy elő-báb (pre-pupal) stádiumot, miközben megtöltjük az elősködővé tett ketrecet friss, elősködővé nem tett (unparasitized) mealybug populációval;
- d. leöblítjük az elősködővé tett mealybugokat, amely eljárás tartalmazza azon elősködővé tett mealybugok leöblítésének további lépését, amelyek már elérik a parazitoidok báb- vagy elő-báb stádiumát, egy rostáló tornyon keresztül vízpermetes fúvókákkal (water spray nozzle), és ezáltal elkülönítjük (separate) a nagy, életképes mumiákat az elpusztult vagy apró mealybugoktól;
- e. leválasztjuk (select) azon lebegő (floating) mealybugokat és mumiákat a keverékből, amelyek leürültek (drain) egy

kúpos vízfürdőben (conical water bath);

f. megszárítjuk az említett múmiákat áttereszve (drain) szeket egy rácsos tálcán (screened tray) és kiléve szeket légáramlatnak egy szárító kamrában; és

g. megkapjuk élősködővé tett mealybug múmiák tároló vagy friss tételeit, feltöljük ezeket finom fűrészpor keverékkel a kívánt szintre, azután elhelyezünk mintegy 2 grammot, amely egyenértékű mintegy 500-1000 élősködővé tett mealybug múmia egyeddel, egy lezárt, szellőztetett tartályban egy eltávolítható ragasztó jelzéssel (adhesive label).

13. A 7-12. igénypontok bármelyike szerinti eljárás, ahol az említett csomagolási (packing) lépés tartalmaz legalább egy további lépést, amely a következők közül választható ki:

a. lemérjük és mennyiségileg meghatározzuk az említett élősködővé tett mealybug múmiákat olyan módon, hogy megszámolunk mintákat sztereoszkopikus (térhatású) mikroszkóp alatt;

b. szorgáztatjuk tároláshoz vagy elosztáshoz életképes, élősködővé tett mealybug múmiák mennyiségileg meghatározott populációját;

c. összekeverünk élősködővé tett mealybug múmiákat finom fűrészporral 5:1 arányban egy szellőztetett és megjelölt műanyag tartályban egy készítménnyel 14°C hőmérsékleten történő tároláshoz.

14. A 7-13. igénypontok bármelyike szerinti eljárás, amely tartalmazza továbbá a következő lépést: szorgáztatunk egy olyan mumifikált, élősködővé tett mealybug terméket, ahol ez úgy van adaptálva, hogy rögződjék (attach) egy növényhez vagy egy terménnyel érintkező tárgyhoz, és ezáltal úgy működjék, mint a mealybug BCA hatékony elosztási eszköze a kívánt elhelyezkedésnél (location).

15. Eljárás olyan mumifikált mealybug termék előállítására, amely mentes végtagoktól és viaszos bevonattól, ahol az eljárás a következő lépéseket tartalmazza:

a. inkubálunk mealybugokat a megfelelő nimfa stádiumba vagy fiatal nőnemű felnőttekké egy mesterségesen kiválasztott növényi gazdaszervezeten;

b. eltávolítjuk az említett mealybugokat speciálisan adaptált ventilátorral (air blower) az említett növényi gazdaszervezetről;

c. megszerzünk harmadik lárvállapotban levő (3<sup>rd</sup> instar) nimfákat és fiatal nőnemű felnőtteket, elkülönítve (separate) méret szerint az eltávolított mealybugokat;

d. megmintázzuk (sample) az elkülönített harmadik lárvállapotban levő (3<sup>rd</sup> instar) nimfákat és fiatal nőnemű felnőtteket, hogy felbecsüljük a populáció méretét;

e. kitevük az elkülönített (szelektált) mealybugokat felnőtt belső parazitoidoknak (endoparasitoid);

f. inkubálunk élősködővé tett mealybugokat, amíg a parazitoidok eléri báb- vagy elő-báb stádiumukat és a mealybugok múmiákká fordulnak át;

g. leöblítjük és elkülönítjük (separate) a nagy életképes múmiákat az élősködővé tett mealybugok populációjából;

h. megszárítjuk a kiválasztott, élősködővé tett mealybug múmiákat száraz levegővel rácsos tálcán;

ezáltal mumifikált, élősködővé tett mealybug terméket kapunk, amely alkalmas BCA-ként.

16. Mumifikált, élősködővé tett mealybug termék, amelyben minden mealybug lényegében mentes végtagjaiktól és viaszos bevonatuktól, ahol a termék csomagolt formában van beletárolva (enclose) egy tartályba eltávolítható, kétoldali ragasztó jelzéssel (adhesive labeling), és rögződni képes egy növényhez vagy tárgyhoz; ahol az említett mumifikált, élősködővé tett mealybug termék hatékony mealybug BCA.