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(54) Titre : SYSTEME DE FOURNITURE D'INSECTES OU D'ACARIENS UTILES
(54) Title: SYSTEM FOR PROVIDING BENEFICIAL INSECTS OR MITES

(57) Abrégé/Abstract:
The present invention relates to the field of insect and mite control. Specifically, it relates to the use of beneficial insects or mites for the control of phytophagous insect and mite pests, and a system for providing beneficial insects or mites.

ABSTRACT

SYSTEM FOR PROVIDING BENEFICIAL INSECTS OR MITES

The present invention relates to the field of insect and mite control. Specifically, it relates to the use of beneficial insects or mites for the control of phytophagous insect and mite pests, and a system for providing beneficial insects or mites.

SYSTEM FOR PROVIDING BENEFICIAL INSECTS OR MITES

The present invention relates to the field of insect and mite control. Specifically, it relates to the use of beneficial insects or mites for the control of phytophagous insect and mite pests, and a system for providing beneficial insects or mites.

Plant pests are a major factor in the loss of the world's important agricultural crops. About $8 billion is lost every year in the U.S. due to infestations of plants by non-mammalian pests including insects. In addition to losses in field crops, insect pests are also a burden to vegetable and fruit growers, to producers of ornamental flowers, and to home gardeners. For example, pest thrips such as *Frankliniella occidentalis* and *Thrips tabaci* cause extensive damage to horticultural crops such as salad vegetables, cut flowers and ornamental plants, resulting in significant economic loss to the growers.

Insect pests are mainly controlled by intensive applications of chemical pesticides, which are active through inhibition of insect growth, prevention of insect feeding or reproduction, or cause death. Although the use of such chemicals can result in good control of insect pests, the widespread use of chemical pesticides can result in the appearance of resistant insect varieties. Further, high levels of chemicals on horticultural crops, in particular salad vegetables, is undesirable to many consumers.

Therefore, there exists an alternative method of pest control involving the use of beneficial insects or mites. Said beneficial insects or mites are predatory towards pest insects such as thrips, and can be applied to crops to control insect pests. Beneficial insects or mites may be provided to crop plants in a variety of ways, for example manually or through a controlled release device. The use of beneficial insects or mites forms part of Integrated Crop Management and Integrated Pest Management programs, combining cultural, biological and chemical means to achieve sustainable pest control.

One example of a beneficial insect or mite system is the use of *Amblyseius cucumeris* as a predatory mite for the control of pest thrips. Existing systems involve the mite being provided either loose in bran and vermiculite for sprinkling onto crops, or in sachets for longer periods of protection. *Amblyseius cucumeris* feed on first instar thrips larvae, and

control relies on complete cover of a crop with the predator before thrips establish. Repeated sprinkling of the predator over crops is labour intensive, wasteful and messy as much of the bran falls on the floor or gets stuck on the leaves. Establishment on crops is relatively slow, and therefore the existing sachet products were designed as an improved method of release.

The existing sachet products provide a continuous release of *Amblyseius cucumeris* for several weeks by maintaining a breeding population of the mite with a food source in the form of a grain mite (*Tyrophagus* spp.). The mites are contained in a bran matrix, with or without vermiculite. The breeding colony is maintained in a sachet manufactured from high grade paper-polythene, and a hook is attached to the sachet for placement onto plants, or onto wires used to support the crop. Mites emerge from the sachet onto the crop through a small perforation in the sachet, the emergence hole.

There are several problems with the existing sachet products. In some growing systems, water or nutrient solutions are provided to plants through overhead irrigation systems, usually mist or sprinkler systems. In other growing systems, crops are grown under shade netting and natural rainfall wets the crop. In existing sachets, water can enter the sachet such that the contents become wet, the mites cease to breed, and the sachet life is therefore reduced considerably. For example, water enters the sachet through the emergence hole. Also, water collects on the seals on the outside of the sachet and is drawn into the sachet through capillary action along paper fibres. Another problem with existing sachets is that the hook becomes wet, distorts, and allows the sachet to fall to the ground. Further problems with existing sachets include a variable rate of release of beneficial mites, and a low overall release rate. This is a particular problem in wet conditions.

The present invention describes a new system for providing beneficial insects or mites which overcomes these problems.

According to the present invention, there is provided a system suitable for providing beneficial insects or mites in a protected cropping environment, comprising at least two strips of film material of approximately the same size, one overlaid on the other, sealed

together at their edges and further sealed together at least once at a point along at least one axis to form at least two substantially planar regions, at least one of which regions is a compartment separated by the further seal, wherein the said compartment comprises beneficial insects or mites, wherein the compartment comprising beneficial insects or mites comprises at least one emergence hole on one side of the compartment so that insects or mites can emerge, and wherein the system is capable of being folded to form an inverted V- or U- type conformation wherein the emergence hole or holes are thus located on the inside of the folded conformation, so that water cannot enter the compartment through the emergence hole or holes when the system is in said folded conformation.

According to the present invention there is provided a system suitable for providing beneficial insects or mites in a protected cropping environment, comprising at least one strip of film material, folded along one edge, sealed together at the remaining edges, and further sealed at least once at a point along at least one axis to form at least two substantially planar regions, at least one of which regions is a compartment separated by the further seal, wherein the said compartment comprises beneficial insects or mites, wherein the compartments comprising beneficial insects or mites comprise at least one emergence hole on one side of the compartment so that insects or mites can emerge, and wherein the system is capable of being folded to form an inverted V- or U- type conformation wherein the emergence hole or holes are thus located on the inside of the folded conformation, so that water cannot enter the compartment through the emergence hole or holes when the system is in said inverted folded conformation.

In one embodiment of the present invention, at least one of the regions is in the form of a ballast to counter the weight of the said compartment comprising beneficial insects or mites.

In one embodiment of the present invention, the system is folded along said further seal to form said inverted V- or U- type conformation. Alternatively, the system may be folded at a different position or in a different orientation to the further seal.

According to the present invention there is provided a system suitable for providing beneficial insects or mites in a protected cropping environment, comprising at least two substantially planar regions joined together along one edge, at least one of which regions is a compartment; wherein the said compartment is formed from at least two strips of film material of approximately the same size, one overlaid on the other, and sealed together at their edges, or at least one strip of film material, folded along one edge, and sealed together at the remaining edges; wherein the said compartment comprises beneficial insects or mites; wherein the compartment comprising beneficial insects or mites comprise at least one emergence hole on one side of the compartment so that insects or mites can emerge; and wherein the system is capable of being folded to form an inverted V- or U- type conformation wherein the emergence hole or holes are thus located on the inside of the folded conformation; so that water cannot enter the compartment through the emergence hole or holes when the system is in the said inverted folded conformation.

In one embodiment of the present invention, the said regions are substantially similar in size. The invention includes, but is not limited to regions which are identical in shape and size. In one aspect of the invention, there are two regions. In another aspect of the invention, both regions are compartments. In a further aspect of the invention, both compartments comprise beneficial insects or mites. In a further aspect of the invention, there are at least two regions. In another aspect of the invention, each region is a compartment. In a further aspect of the invention, at least one of the regions is not a compartment.

The term 'protected cropping environment' refers to a variety of growing situations, including for example growing crops in greenhouses, plastic tunnels, glasshouses, shade-houses and other similar environments. However, the invention is not limited to use in such environments, but may alternatively be used outside, for example in a field.

The term 'film material' includes any material which is preferably water resistant and air permeable. In one aspect, the invention includes films such as paper, thermoplastic (such as polythene) and polythene-coated paper. Further examples of other suitable thin materials, include fabric coated with polythene, and goretex™. The film material must

be water resistant to prevent water from entering the system, and permeable to allow gas exchange for survival of the insects or mites within the system. The water resistant property of the film material refers to an ability of the film material to either repel or not absorb water. It includes, but is not limited to materials which are totally impervious to water (waterproof). Therefore, water applied to or falling on the system will run off, rather than be absorbed into the film material. The film material will preferably be lightweight so that the system can easily be hung from branches of plants without damaging them.

The invention includes strips of film material which are any shape or size. Typically, the strip of film will be rectangular, for example measuring approximately 20cm by 4.5cm.

The term 'sealed' includes sealing using glue, heat, tape, or fixing together by any other means. For example, strips of plastic-coated film material may be sealed using heat.

The emergence hole or holes are located in the inner face of the folded conformation. This is important so that, when the system is folded, water cannot enter the emergence holes due to the 'umbrella' effect of the inverted V- or U- type configuration. The present invention includes systems which comprise one or more emergence holes per compartment. In one aspect of the invention, the emergence holes are located in the top half of the compartment when the system is in its inverted V- or U- type configuration. In a further aspect of the invention, the holes are between approximately 0.5mm and 5mm in diameter. In one aspect of the invention, the holes are approximately 1mm in diameter. In another aspect of the invention, the holes are approximately 2mm in diameter. In a further aspect of the invention, the holes are approximately 3mm in diameter.

Prior art 'sachet' products have serrated seals which provide a series of ridges along the edges of the sachet. Further, the process of making a serrated seal often causes the edges of the product to curl. The presence of said ridges and curls allows water to collect on the outside of the sachet, and in time, the water wicks along paper fibres and the sachet contents become wet. This disrupts the micro-climate within the sachet, and therefore can considerably shorten the life of the system. In one embodiment of the present

invention, the regions are sealed along their edges using a substantially seamless seal so that water does not collect on the outside. In one aspect of the invention, the substantially seamless seal is a flat seal. The present invention also includes other types of seal which do not result in ridges, pockets or dips in which water could accumulate.

In one embodiment of the present invention, the film material is paper coated with substantially water impermeable thermoplastic. This film material is both water resistant so that water runs off the system, and permeable to allow gas exchange. In one aspect of the invention, the thermoplastic is polythene with a density of between 5 and 100 g/m^2. In another aspect of the invention, the polythene density is between 10 and 75 g/m^2. In a further aspect of the invention, the polythene density is between 15 and 50 g/m^2. In another aspect of the invention, the polythene density is approximately 20 g/m^2.

The invention includes different film materials which may be suitable for use in the system. For example, the film material may be paper, and the invention includes different paper types suitable for use in the system. In one aspect of the invention, the paper is machine glazed bleached kraft paper. Other suitable paper types include, for example, grid lacquer paper or medical paper. The paper density may be between 10 and 100 g/m^2. For example, for bleached kraft paper, the density may be approximately 40 g/m^2, and for grid lacquer paper, the density may be approximately 60 g/m^2. The invention includes paper which is coated, for example with high density polythene, to ensure that it is water resistant.

In one embodiment of the present invention, the system is folded to form an inverted V- or U- type conformation. This fold may be anywhere in the system. In a preferred aspect of the invention, the fold is positioned approximately centrally at a point along one axis. The invention is not limited to strict inverted V- or U- conformations, but includes systems which are capable of being folded into similar shapes, or an intermediate shape between V- and U- shaped. In one aspect of the invention, the inverted V- or U- type conformation is present at or around the position of the fold itself. The sides of the system may optionally comprise further folds so that the overall configuration of the system does not closely resemble an inverted V- or U- type conformation. In a further aspect of the invention, the sides of the system either side of the fold are different lengths

or sizes. In a still further aspect of the invention, the sides of the system either side of the fold are substantially similar in size. The present invention further includes regions which are constructed individually, and subsequently sealed together so that they may be folded into an inverted V or U- type conformation.

In another embodiment of the present invention, there are an equal number of regions either side of the fold. The invention is not limited to a single region on either side of the fold, but encompasses systems comprising multiple regions. In one embodiment of the invention, the sides of the inverted V- or U- type conformation are approximately equal in weight. This enables the system to hang evenly when suspended from the fold. In one aspect of the invention, there must be substantially the same number of compartments of substantially similar size and substantially similar weight either side of the fold. At least one of the regions must be a compartment which comprises beneficial insects or mites – further regions, however, may also be compartments and may comprise different insects or mites or serve a different function such as simply serving as a counter balance. The invention also includes a system comprising, for example, two compartments wherein one of the compartments is empty.

In one embodiment of the present invention, the fold takes the form of an attachment means which functions as a hook from which to hang said system. The system may, for example, be hooked over a branch of a plant, or over the wires used to support a crop, so that the sides of the inverted V- or U- type conformation are either side of the branch or wire. Alternatively, the system of the present invention may be freestanding, for example on the ground or pot in which the plant is growing.

Optionally, the system may comprise a further hook, for example made from plastic. Such a further hook may be located at or near the fold and may, for example be used to hang the system from branches where the leaves are close together so that hooking using the fold is difficult. Preferably, the system is less than 5cm in width so that it may easily be hooked over the branches of plants between leaf nodes.

In one aspect of the present invention, the system measures approximately 20cm in length and approximately 4.5cm in width. If the system is folded in half with the fold in

the middle of the long axis, each compartment measures approximately 10cm by approximately 4.5cm. The seals around the edges may measure approximately 5 to 10mm in width. When in its folded conformation, the fold itself may, for example, be between 1 and 10mm in width to accommodate branches and wires of different thickness.

In a further embodiment of the present invention, there is provided a system as described in the preceding paragraphs, wherein the inverted V- or U- type conformation provides a stable microclimate, resulting in a steady release rate of beneficial insects or mites over approximately a 6 week period. 'Stable microclimate' refers to a microclimate in and around the compartments of the system which does not fluctuate in humidity and temperature as much as prior art 'sachet' systems. A stable microclimate is important to ensure that the colony of insects or mites continues to breed. In the present invention, the microclimate is stabilised due to the design and conformation of the system. The 'umbrella' effect of the inverted V- or U- type conformation prevents water from entering the compartment through the emergence holes, so that the humidity levels remain relatively constant. In one aspect of the present invention, the substantially seamless seals of the regions prevent water collecting on the outside of the regions and therefore help maintain steady humidity levels. The presence of at least two regions is useful to reduce fluctuations in temperature, for example due to time of day or positioning relative to the sun.

The 'release rate' refers to the number of beneficial insects or mites that are released or emerge from the compartments over a period of time. A steady release rate refers to said release rate being approximately constant over approximately a 6 week period commencing when the system is put in use. For example, the release rate may be between approximately 200 and 300 insects or mites released each week. Therefore a total of approximately 1500 insects or mites may be released over approximately a 6 week period. A high release rate may be in the order of 700 insects or mites per week while a low release rate may be 50 insects or mites per week. Prior art products typically have a release rate which is not steady, but fluctuates over time, for example ranging from 100 mites per week to 750 mites per week.

Emergence of prey mites can be damaging to the crop plants. Therefore an important feature of the invention is the formulation in the compartments. It is important to achieve the correct initial balance between predator and prey to ensure a plentiful and uniform emergence of *Amblyseius cucumeris* without excessive emergence of *Tyrophagus putrescentiae*. Due to the conformation of the present invention, the rate of escape of prey mites is significantly reduced, therefore resulting in decreased damage to crop plants. For example, typically greater than 10,000, and often greater than 20,000 *Tyrophagus* escape from prior art products over a 6 week period, while fewer than 10,000 *Tyrophagus* escape from the present system over the same time period.

In one embodiment of the present invention, there is provided a system suitable for providing beneficial insects or mites in a protected cropping environment, wherein the beneficial insects or mites are maintained as a breeding population. In one aspect of the invention, the compartments comprise a food source for the beneficial insects or mites. In a further aspect of the invention, the food source consists of prey insects or mites. In a further aspect of the invention, the compartments further comprise a food source for said prey insects or mites.

In one embodiment of the present invention, at least one compartment contains a formulation comprising viable *Amblyseius cucumeris*, a predatory mite which may be used for the control of thrips such as *Frankliniella occidentalis*, and *Thrips tabaci*; viable grain or stored product pest mites; and bran. The grain or stored product pest mites may, for example be *Tyrophagus* species such as *Tyrophagus putrescentiae*, *Tyrophagus tropicus*, or another species such as *Acarus siro*. Alternatively, the grain or stored product pest mites may be a mixture of these two species. In one aspect of the present invention, the grain or stored product pest mites are *Tyrophagus putrescentiae*. In one embodiment of the invention, the *Amblyseius cucumeris* and grain or stored product pest mites are present in a ratio of approximately 1:10. This ratio of predatory mites to prey mites is important for maintaining a successful breeding population over a period of 6 weeks or longer. If too few prey mites are present in the system, they will be eaten quickly by the predatory mites, resulting in a high number of predatory mites being released over a short time period, and the system having a short life. In contrast, if too many prey mites are present in the system, they may escape through the emergence

hole(s). This is undesirable since prey mites can cause damage to crop plants. Therefore, the formulation is a key aspect of the present system for effective pest control.

In one aspect of the invention, at least one compartment comprises a formulation consisting of 1 *Amblyseius cucumeris* for every 10 *Tyrophagus putrescentiae* and 0.52g of prey food mix. The prey food mix may be made with steamed bran and a 3:1 mix of yeast and wheatgerm. In one embodiment of the invention, the formulation is split equally between two or more compartments.

The invention also includes other types of beneficial insects and mites which are capable of being maintained as a breeding colony. In particular, the invention includes other species of *Amblyseius*. Further, the invention is not limited to the use of *Tyrophagus putrescentiae* as a food source, but includes other species of *Tyrophagus*, such as *Tyrophagus tropicus*, other mites such as *Acarus siro*, or any other insect or mite which the beneficial insect or mite could feed on. The invention further includes the use of an alternative food source to grain mites. This is useful to reduce damage to crop plants caused by grain or stored product pest mites which escape from the system.

In an embodiment of the present invention, there is provided a system as described above, comprising one region which is a compartment and a second region which is a formed from a substantially planar sheet, wherein said second region is approximately the same weight as the first region when it is in the form of a filled compartment to act as a counterbalance. In one aspect of the invention, the second region is not a compartment. In a further aspect of the invention, the second region is a ballast to act as a counterbalance for the first region.

In one embodiment of the present invention, there is provided a method for providing a steady release rate of beneficial insects or mites comprising providing the beneficial insects or mites in a system as described above. In one embodiment of the present invention, there is a method of controlling thrips in a protected cropping environment comprising providing a system suitable for providing beneficial insects or mites as described above. In one aspect of the invention, said method may be used to control Western Flower Thrips, *Frankliniella occidentalis*. The present invention is also suitable

for the control of other thrip species, such as *Thrips tabaci*, in addition to other pest insects.

In one embodiment of the present invention, there is provided the use of a system as described above for the control of pest insects on horticultural crops in a protected cropping environment. Horticultural crops for which this invention may be used include, for example, salad vegetables, cut flowers and ornamental plants.

EXAMPLES

1. Trials comparing the performance of the novel system to existing controlled release system products in wet conditions.

1.1 Aims

A trial was established to compare emergence of *Amblyseius cucumeris* and prey mite (*Tyrophagus putrescentiae)* from the novel system compared to the standard controlled release system sachets produced by Syngenta Bioline, and the standard products of two competitors.

1.2 Trial design

Several different products were tested in the trial. The table below indicates these products.

Product	Description
A	Novel system 1: 40g/m^2 paper coated with 20g/m^2 polyethylene
B	Novel system 2: 40g/m^2 paper coated with 50g/m^2 polyethylene
C	Existing 'sachet' system, Syngenta Bioline
D	Competitor 1 product
E	Competitor 2 product

All product types were suspended over plants in a greenhouse in identical conditions, with overhead watering from an automatic sprinkler system once each day to represent the watering systems used in many ornamental crops.

Existing sachet systems were fitted with waterproof plastic hooks to ensure that they remained hanging where placed for the duration of the trial, therefore artificially prolonging the life of existing sachets which usually fall to the ground within two weeks after the hooks collapse. This was necessary to compare the effects of watering on the contents of the different systems.

1.3 Assessments

Due to the practical difficulties in measuring mite emergence under overhead irrigation, several sachets / systems were removed from the test conditions at seven day intervals, taken to an environment room, and suspended over a sticky surface to trap mites which emerged over the following 7 days. The numbers of predator mites (*Amblyseius*) and prey mites (*Tyrophagus*) were counted.

1.4 Results

The cumulative number of *Amblyseius* which emerged during the trial are shown in the table below.

Product	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
A	202	746	1014	1303	1456	1490
B	216	754	1009	1371	1486	1531
C	242	525	648	885	892	1168
D	23	109	112	373	648	664
E	225	422	654	991	1757	2059

The cumulative number of *Tyrophagus* which emerged during the trial are shown in the table below.

Product	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
A	1790	4214	5245	8216	8364	8392
B	2871	4566	5704	7148	7258	7301

C	3982	5793	13200	16345	19999	20664
D	3343	9569	10642	13791	14054	14624
E	1273	8934	23922	36290	44351	47382

1.5 Summary

There is no significant difference between products A and B.

Emergence of *Amblyseius cucumeris* is higher throughout the release period from the novel systems (A and B) than from our existing product (C).

Emergence of *Amblyseius cucumeris* from the novel systems (A and B) is significantly higher throughout the release period than for Competitor 1's product (D).

Emergence of *Amblyseius cucumeris* is more uniform throughout the release period than that of Competitor 2's product (E).

Emergence of *Tyrophagus putrescentiae* is lower from the novel systems than from our existing product (C).

Emergence of *Tyrophagus putrescentiae* is lower from the novel systems than from either competitor product.

CLAIMS

1. A system suitable for providing beneficial insects or mites in a protected cropping environment, comprising at least two strips of film material of approximately the same size, one overlaid on the other, sealed together at their edges and further sealed together at least once at a point along at least one axis to form at least two substantially planar regions, at least one of which regions is a compartment separated by the further seal,

- wherein the said compartment comprises beneficial insects or mites,
- wherein the compartment comprising beneficial insects or mites comprises at least one emergence hole on one side of the compartment so that insects or mites can emerge, and
- wherein the system is capable of being folded to form an inverted V- or U- type conformation wherein the emergence hole or holes are thus located on the inside of the folded conformation,

so that water cannot enter the compartment through the emergence hole or holes when the system is in the said folded conformation.

2. A system suitable for providing beneficial insects or mites in a protected cropping environment, comprising at least one strip of film material, folded along one edge, sealed together at the remaining edges, and further sealed together at least once at a point along at least one axis to form at least two substantially planar regions, at least one of which regions is a compartment separated by the further seal,

- wherein the said compartment comprises beneficial insects or mites,
- wherein the compartment comprising beneficial insects or mites comprises at least one emergence hole on one side of the compartment so that insects or mites can emerge, and
- wherein the system is capable of being folded to form an inverted V- or U- type conformation wherein the emergence hole or holes are thus located on the inside of the folded conformation,

so that water cannot enter the compartment through the emergence hole or holes when the system is in the said folded conformation.

3. A system according to claim 1 or 2, wherein at least one of the regions is in the form of a ballast to counter the weight of the said compartment comprising beneficial insects or mites.

4. A system according to any of claims 1 to 3, wherein the said system is folded along said further seal to form said inverted V- or U- type conformation.

5. A system suitable for providing beneficial insects or mites in a protected cropping environment, comprising at least two substantially planar regions joined together along one edge, at least one of which regions is a compartment,

- wherein the said compartment is formed from at least two strips of film material of approximately the same size, one overlaid on the other, and sealed together at their edges, or at least one strip of film material, folded along one edge, and sealed together at the remaining edges,
- wherein the said compartment comprises beneficial insects or mites,
- wherein the compartment comprising beneficial insects or mites comprises at least one emergence hole on one side of the compartment so that insects or mites can emerge, and
- wherein the system is capable of being folded to form an inverted V- or U- type conformation wherein the emergence hole or holes are thus located on the inside of the folded conformation,

so that water cannot enter the compartment through the emergence hole or holes when the system is in the said folded conformation.

6. A system according to any of claims 1 to 5, wherein the said regions are substantially similar in size.

7. A system suitable for providing beneficial insects or mites according to any of claims 1 to 6, wherein the regions are sealed along their edges using a substantially seamless seal so that water cannot collect on the outside.

8. A system suitable for providing beneficial insects or mites according to any of claims 1 to 6, wherein the film material is paper coated with substantially water impermeable thermoplastic.

9. A system according to claim 8, wherein the thermoplastic is polythene with a density of between 5 and 100 g/m^2.

10. A system according to claim 9, wherein the polythene density is approximately 20 g/m^2.

11. A system according to any of the preceding claims, wherein the film material is machine glazed bleached kraft paper.

12. A system according to any of the previous claims, wherein the fold to form an inverted V- or U- type conformation system is positioned approximately centrally at a point along one axis.

13. A system according to claim 9, wherein there are an equal number of regions either side of the fold.

14. A system according to claim 13, wherein the sides of the inverted V- or U-conformation are approximately equal in weight so that the system hangs evenly when suspended from the fold.

15. A system according to any of claims 12 to 14, wherein the fold takes the form of an attachment means which functions as a hook from which to hang said system.

16. A system according to any of the preceding claims, wherein the inverted V- or U-type conformation provides a stable microclimate, resulting in a steady release rate of beneficial insects or mites over approximately a 6 week period.

17. A system according to any of the preceding claims, wherein the beneficial insects or mites are maintained as a breeding population.

18. A system according to claim 17, wherein the compartment comprises a food source for the beneficial insects or mites.

19. A system according to claim 18, wherein the food source consists of prey insects or mites, and the compartment further comprises a food source for said prey insects or mites.

20. A system according to any of the preceding claims, wherein the said compartment contains a formulation comprising viable *Amblyseius cucumeris*, viable grain or stored product pest mites and bran.

21. A system according to claim 20, wherein the grain or stored product pest mites are *Tyrophagus putrescentiae*, and the *Amblyseius cucumeris* and *Tyrophagus putrescentiae* are present in a ratio of approximately 1:10.

22. A system according to claim 21, wherein the formulation is split equally between two compartments.

23. A system according to any of claims 1 to 22, comprising one region which is a compartment and a second region which is a formed from a substantially planar sheet, wherein said second region is approximately the same weight as the first region when it is in the form of a filled compartment to act as a counterbalance.

24. A method for providing a steady release rate of beneficial insects or mites comprising providing the beneficial insects or mites in a system according to any of the preceding claims.

25. A method of controlling thrips in a protected cropping environment comprising providing a system suitable for providing beneficial insects or mites according to any one of claims 1 to 23.

26. A method according to claim 24 or 25, for controlling Western Flower Thrips, *Frankliniella occidentalis*.

27. Use of a system according to claims 1 to 23 for the control of pest insects on horticultural crops in a protected cropping environment.

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