(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 June 2013 (06.06.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/079601 A1

(51) International Patent Classification:
A01N 25/34 (2006.01) *A01M 23/08* (2006.01)
A01N 25/10 (2006.01) *A01M 1/02* (2006.01)
A01N 53/00 (2006.01) *A01M 1/10* (2006.01)
A01G 13/10 (2006.01) *A01M 29/34* (201 1.01)

(21) International Application Number:
PCT/EP2012/073977

(22) International Filing Date:
29 November 2012 (29.1 1.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/566,062 2 December 201 1 (02. 12.201 1) US
11196073.8 29 December 201 1 (29. 12.201 1) EP

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

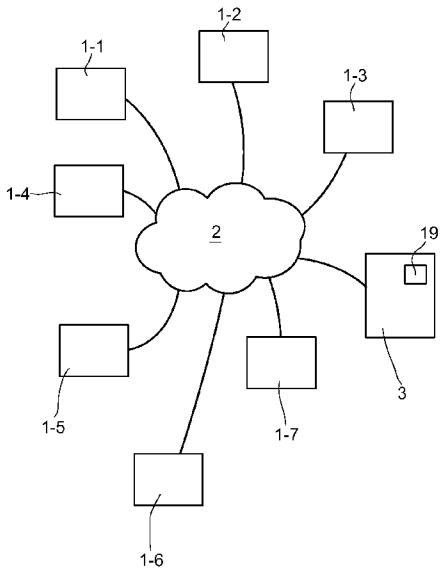
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU,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

Published:

— *with international search report (Art. 21(3))*

(54) Title: METHOD AND SYSTEM FOR MONITORING CROPS AND/OR INFESTATION OF CROPS WITH HARMFUL ORGANISMUS DURING STORAGE

FIG.1



(57) Abstract: The present invention relates to a method for monitoring crops and/ or infestation of crops with harmful organisms during storage. The method comprises storing the crops of a plurality of entities at different locations being geographically remote from each other. At each geographical location, the crops are covered with at least one cover (6-1, 6-2, 6-3) which has a protective activity against said harmful organisms. Further, at each geographical location, at least one trap (8, 9) for the harmful organisms are arranged inside and/or outside the cover, said trap is adapted to capture the harmful organisms such that the caught pests can be counted. A first set of characteristics of the trap is transferred to a local computer device (10) of said geographical location and a second set of characteristics of the trap is transferred via a network from the local computer devices of each geographical location to a central computer device. At the central computer device the characteristics of the trap that have been transferred from the local computer devices are analyzed and a general analysis for geographical locations and/or a specific analysis for the geographical locations of at least one entity is generated. Moreover access for the local computer devices to the analysis of the central computer device is provided whereby the access is filtered so that the local computer devices of a particular entity may only access the general analysis and/or the specific analysis for the geographical locations of this particular entity. Furthermore, the invention relates to a system for carrying out this method and the use of this system for monitoring tobacco, dried fruit, nuts and/or cocoa.

WO 2013/079601 A1

Method and system for monitoring crops and/or infestation of crops with harmful organismus during storage

The present invention relates to a method for monitoring crops and/or infestation of crops with harmful organisms during storage. The invention further relates to a system for monitoring crops and/or infestation of crops with harmful organisms during storage.

Harmful organisms, like insects, acarides or fungi, are a major threat to harvests worldwide and require an extensive use of plant protection agents (pesticides), like insecticides and fungicides

Although the continuous research and development in this field has led to products with considerably reduced toxicity for humans and improved environmental compatibility, there is still the problem that some application methods lead to a certain level of pesticide residues in the plants. This is prohibitive for the use of certain highly effective pesticides. With other pesticides it may delay the possible consumption or processing of fruits and vegetables which could be undesirable with regard to harvesting, storage and sale of the respective products.

Accordingly, there is a demand for methods by which crops can be protected from harmful organisms that allow the choice of certain effective pesticides without causing considerable residues of pesticides in the plants.

It is known to cover the crops with a cover which has a protective activity against harmful organisms. For example, an impregnated netting may be used. The following documents describe such methods for protecting crops and composition for the impregnation of the cover: WO 2005/064072 A2, WO 2008/052913 A1, EP 2031 962 B1, WO 2008/1 421 03 A1, WO 2008/1 51984 A1, WO 201 0/072724 A2, WO 2010/012671 A2, WO 201 1/003845 A2, WO 201 1/003861 A2.

However, there is still the problem that the cover may be installed incorrectly, that the cover is defect or the impregnation is not effective any more. Therefore, there is

a demand for monitoring crops during storage that have been covered with a cover which has a protective activity against harmful organisms.

Moreover, there is a demand for monitoring the occurrence, the distribution and expansion of harmful organisms over different countries and continents. There is also a demand for a customer service which helps to efficiently control pests during storage, at a minimum effort and at a minimum pesticide experience for the storage location owner.

It is therefore the object of the present invention to provide a method and a system for monitoring crops and/or infestation of crops with harmful organisms during storage by which data regarding the occurrence and distribution of harmful organisms can be monitored and provided in an efficient manner. In particular, the method and system should provide monitoring of crops stored at different locations being remote from each other and/or infestation of crops being remote from each other with harmful organisms during storage.

This object has been solved by a method comprising the features of claim 1 and a system comprising the features of claim 11. Particular embodiments are described in the dependent claims.

According to the method of the present invention, the crops of a plurality of entities are stored at different locations being geographically remote from each other. At each geographical location, the crops are covered with at least one cover which has a protective activity against harmful organisms. Furthermore, at each geographical location, at least one trap, in particular a plurality of traps for the harmful organisms is arranged inside and/or outside the cover. The trap or the traps are adapted to capture the harmful organisms such that the caught harmful organisms can be counted. A first set of characteristics of the trap or of the traps is transferred to a local computer device of the geographical location. Furthermore, a second set of characteristics of the trap or of the traps is transferred from the local computer devices of each geographical location to a central computer device via a network. At the central computer device, the characteristics of the trap or of the traps that have been transferred from the local computer devices are analyzed and a general

analysis for geographical locations of different entities and/or a specific analysis for the geographical locations of at least one entity is generated. Finally, access is provided for the local computer devices to the analysis of the central computer device whereby the access is filtered so that the local computer devices of a particular entity may only access the general analysis and the specific analysis for the geographical locations of this particular entity.

An entity may for example be a company or somehow related companies or computer devices of this or these companies which store crops at different locations. Different entities may be competitors for one product, wherein the stored crops are used for this product. In this case, the method of the present invention may provide for all entities a general analysis of the occurrence, the distribution and the expansion of organisms that are harmful for the stored crops taking advantage of the characteristics of the traps used by all entities. However, by filtering the access to the analysis of the central computer device, the method guarantees that one entity can not obtain information as to data of the traps of a competing entity.

According to an embodiment of the method of the present invention, the access to the analysis of the central computer device is filtered by using authentification technology. For example, a password may be used, however, authentification and encryption technology that is more sophisticated is preferred.

The phrase "geographically remote" as used herein means that the crops are not stored only in one warehouse. This phrase means in particular that the crops are stored at different cities, countries or even continents. For example different locations are located at distances from each other that are greater than at least 100 kilometres, in particular at least 1,000 kilometres. Therefore, the method of the present invention may particularly monitor a plurality of locations for storing crops at a central computer device wherein the locations may be distributed over the earth.

According to the method of the present invention any failure of the protection of the crops by the covers is detected and monitored. If the characteristics of the traps located inside the cover are collected and transferred to the central computer device, the central computer device stores statistics as to the development of harmful

organisms inside the cover. This statistic does not only show the temporal development of harmful organisms that infest the crops but also the geographical distribution of such infestation. If the characteristics of the traps that are arranged outside the covers are collected and transferred it is also possible to monitor the occurrence of harmful organisms in the neighborhood of the locations where the crops are stored.

The first set of characteristics includes for each trap at least the current number of harmful organisms caught by said trap. Furthermore, the first set of characteristics of the trap or of the traps may include features of the trap, in particular the type of the trap, and a location characteristic of the trap. The location characteristic of the trap may comprise the information whether the trap is arranged inside or outside a cover, the position of the trap relative to the cover and relative to the crops covered by the cover and/or the geographical location of the trap.

The transferred second set of characteristics includes for each trap at least the number of harmful organisms caught by the respective trap and a locations characteristic of the trap. Furthermore, the second set of characteristics of the trap may comprise all characteristics of the first set of characteristics. However, it may comprise additional characteristics. For example at at least one geographical location the crops are stored in packets in a warehouse, each packet being covered by a separate cover. In this case, the characteristics of the second set of characteristics transferred from the local computer device of this geographical location to the central computer device includes in addition the following characteristics alone or in combination: the type of caught harmful organisms, and/or an indication of the type of the trap, additional location characteristics such as the geographical location of the warehouse and the location of the trap within the warehouse as well as a flag indicating whether the trap is located inside or outside a cover, a time stamp indicating the time the first set of characteristics has been transferred to local computer device, the size of the warehouse, the number of covers used within the warehouse and/or the type of the cover.

In a further embodiment of the method of the present invention the general analysis is generated so that one entity can not obtain knowledge of the characteristics of

the traps of another entity. For example the general analysis only contains statistical data from which the characteristics of a particular trap can not be calculated. By this measure the characteristics of the traps of one entity can be kept confidential with respect to other entities.

In a further embodiment of the method of the present invention notifications are generated based on the characteristics of the trap or of the traps, said notifications are provided to at least one of the local computer devices and/or a computer device of a customer service for at least one of the geographical locations. Therefore, a customer service may be provided for locations storing the crops so that the operator of the storage location may not be familiar with the handling of the covering of the crops and the handling of the traps. If, for example, a cover needs to be replaced because the present cover is not effective against harmful organisms that occur in the neighborhood of the respective location the customer service will automatically be notified by the central computer device.

In a further embodiment of the method of the present invention, warnings are generated based on the characteristics of the trap or of the traps at different locations of more than one entity, said warnings are provided to local computer devices of all or some of the plurality of entities. For example a pest infestation has been monitored in a particular region. Furthermore, it has been monitored that the region of the pest infestation expands. These data may be generated by analyzing the traps of a particular entity or of different entities. Based on this analysis an estimated point in time can be calculated at which the pest infestation reaches locations at which crops are stored that have not yet been infested. The central computer device can then provide warnings to the local computer devices of these geographical locations. However, if the warnings are generated based on characteristics of traps of different entities, the warnings are generated so that one entity can not obtain knowledge of the characteristics of the traps of another entity. Therefore, again, confidentiality is kept.

According to a further embodiment of the method of the present invention, the efficiency of the covers is analyzed and failure of covers is detected based on the characteristics of the trap or of the traps at the central computer device.

In a further embodiment of the present invention, for at least one cover at least one trap is arranged inside said at least one cover and at least one trap is arranged outside said at least one cover. Advantageously, in this case the efficiency of said at least one cover is analyzed based on the difference of the number of harmful organisms caught by said at least one trap that is arranged inside said at least one cover and the number of harmful organisms caught by said at least one trap that is arranged outside said at least one cover. Surprisingly, it has been found that according to this embodiment of the method of the present invention the traps can not only be used to capture the harmful organisms but also to analyze and monitor the efficiency of a cover. Therefore, the combination of covers for covering the crops, the traps located inside and outside the covers, and the analyzation of the number of harmful organisms caught by the traps inside and outside the covers provides the synergetic effect of monitoring the occurence of harmful organisms as well as any potential failure of a cover for protecting the crops against harmful organisms.

According to a further embodiment of the method of the present invention, the central computer device then automatically generates and transfers notifications to the local computer devices that indicate that a cover should be replaced or repaired based on the characteristics of the trap or of the traps. If, for example, the traps that are located inside a particular cover, show a high number of harmful organisms for the crops, such data are interpreted by the central computer device that the cover within which these traps are located are defect. The notification indicating such defect is then transferred to the local computer device at the geographical location where the defect cover is arranged. In particular, it is also indicated which of the covers of this geographical location is defect.

In a further embodiment of the method of the present invention different types of covers are used at different locations. In this case the central computer device automatically generates notifications for the local computer devices that indicate the efficiency of a particular type of cover against a particular harmful organism based on the characteristics of the traps. An analysis of the traps arranged outside the covers provide data as to the types of harmful organisms that occur at a specific geographical location. The central computer device then provides data for this geo-

graphical location which cover may be used efficiently against this particular harmful organism. By this measure the entities can better protect the stored crops by choosing the most efficient cover.

According to the present invention there is further provided a system for monitoring crops and/or infestation of crops with harmful organisms during storage. The system comprises storage depots, e. g. warehouses, for the crops at different locations being geographically remote from each other. The system further comprises at least one cover, in particular a plurality of covers, that cover the crops at each geographical location, said cover has a protective activity against harmful organisms. Furthermore, at least one trap, in particular a plurality of traps, for the harmful organisms is arranged inside and/or outside the cover at each geographical location, said trap is adapted to capture harmful organisms such that the caught harmful organisms can be counted. Furthermore, the system comprises a local computer device at each geographical location. Furthermore, the system comprises an interface for transferring characteristics of the trap or of the traps from the trap or the traps to the local computer device of said geographical location, said characteristics include for each trap the current number of harmful organisms caught by said trap. Furthermore, the system comprises a network for transferring characteristics of the trap or of the traps from the local computer devices to a central computer device. The central computer device comprises an analyzing unit for analyzing the characteristics of the trap or of the traps that have been transferred form the local computer devices and for generating a general analysis for geographical locations and a plurality of specific analysis for the geographical locations of at least one entity. Finally the system includes a communication unit for providing access for the local computer devices to the analysis of the central computer device. This communication unit comprises a filter unit for filtering the access so that the local computer devices of a particular entity may only access the general analysis and/or the specific analysis of the geographical locations of this particular entity.

The system of the present invention is particularly adapted to carry out the method of the present invention. It provides therefore the same advantages as the method of the present invention.

According to a further embodiment of the system of the present invention, the analyzing unit is adapted to detect the efficiency of the covers and failure of covers based on the characteristics of the traps.

For example, for at least one cover at least one trap is arranged inside said at least one cover and at least one trap is arranged outside said at least one cover. The analyzing unit may then be adapted to analyze the efficiency of said at least one cover based on the difference of the number of harmful organisms caught by said at least one trap that is arranged inside said at least one cover and the number of harmful organisms caught by said at least one trap that is arranged outside said at least one cover.

In a further embodiment of the system of the present invention, the central computer device is adapted to automatically generate and transfer notifications to the local computer devices that indicate that a cover should be replaced or repaired based on the characteristics of the traps.

In a further embodiment of the system of the present invention the cover is a netting, in particular a netting impregnated with a pyrethroid insecticide.

The present invention relates also to the use of the above mentioned system for monitoring tobacco, tobacco bales, other tobacco products, dried fruit, nuts, coffee and/or cocoa.

The term "crops" as used herein means any kind of harvest from crop plants, including but not limited to cereals, rice, legumes, cotton, tobacco, vegetables, herbs and fruit plants.

Preferred are high value crops like vegetables, fruit plants and plants for the beverage, pharmaceutical and tobacco industry and plants from which e.g. natural dyestuffs and natural compounds for applications in cosmetics, cleaning and caring formulations or further chemical and/or biotechnological processing are won.

Vegetable plants or crops include, for example, potatoes, preferably starch potatoes, sweet potatoes and table potatoes; root vegetables, preferably carrots, rutabaga (table

beet, stubble turnips, turnips, Brassica rapa. var. rapa f. teltowiensis), scorzoneras, Jerusalem artichoke, root parsley, parsnip, radish and horseradish; tuberous vegetables, preferably kohlrabi, red beet, celeriac, radish; bulbous vegetables, preferably leeks and onions (onion sets and onions for seed production); cabbages, preferably cabbages from the Capitata group (white cabbage, red cabbage, kale, savoy cabbage), cauliflower, Brussels sprouts, broccoli, Brassica oleracea. var. sabellica, stem kale, seakale and Brassica oleracea L. convar. oleracea var. gemmifera DC; fruiting vegetables, preferably tomatoes (field-grown tomatoes, bush tomatoes, beefsteak tomatoes, greenhouse-grown tomatoes, cocktail tomatoes, processing tomatoes and tomatoes to be sold fresh), melons, egg plants, aubergines, capsicums (bell peppers, paprika, Spanish pepper), chillis, pumpkins, zucchini and cucumbers (field-grown cucumbers, greenhouse-grown cucumbers, snake cucumbers, gherkins); vegetable legumes, preferably dwarf beans (as sword beans, beech beans, flageolet beans, butter beans; dried beans for boiling with green- and yellow-podded varieties), pole beans (as sword beans, beech beans, flageolet beans, butter beans with green-, blue- and yellow- podded varieties), faba beans (field beans, broad beans, varieties with white and black mottled flowers), peas (chickling vetches, chick peas, marrowfat peas, whole-pod peas, sugar peas, peas for shelling, varities with light-green and dark green immature seeds) and lentils; leaf and stem vegetables, preferably Chinese cabbage, lettuce, cos lettuce, corn salad, iceberg lettuce, romaine lettuce, oak-leaf lettuce, chicory, radicchio, lollo rosso, arugula, endives, spinach, Swiss chard (leaves and stems) and parsley; other vegetables, preferably asparagus, rhubarb, chives, artichokes, mints, sunflowers, Florence fennel, dillweed, garden cress, mustard, poppies, peanuts, sesame and chicories for salad use.

Fruit plants include, for example, fruits from the Rosacea family, like apple, pear, and quince; stone fruits, like apricot, cherry, plum and peach; berries, specifically bramble fruits, like blackberry, raspberry, loganberry and thimbleberry, true berries, like blueberry and cranberry, other berries, like gooseberry and mulberry; accessory fruits, like strawberry; fruits from the Cucurbitacea family, like gourds, including squash and pumpkin; melons and watermelons; citrus and other subtropical fruits, like lemon, lime, grapefruit, mandarine, Clementine, tangerine, orange, avocado, guave, kumquat, logan, lychee and passion fruit; dates, figs, grapes, olives and pomegranate; and tropical fruits, like banana, coconut, durian, eggfruit, mango, mangosteen, papaya, pineapple and tamarind.

Plants for the beverage and tobacco industry include tea varieties, coffee and cocoa varieties and tobacco.

Further preferred are nuts, herbs and spices.

Nuts include almond, Brazil nut, butternut, cashew, chestnut, macadamia, pecan, pistachio and walnut.

Herbs and spices include anise, balm, basil, chamomile, caraway, catnip, celery, chives, coriander, cumin, curry leaf, dandelion, dill, fennel, hyssop, mint, rue, sage, sweet bay, tarragon, thyme, wintergreen and wormwood.

In a preferred embodiment, the crops are seedlings of a crop plant, more preferred of a crop plant mentioned above.

In a further preferred embodiment, the crops are nuts, cocoa, dried fruit, bamboo, paper products or wood. In particular the crops are tobacco.

The term "harmful organism" as used herein means pests, specifically arthropod pests, including insects and arachnids, and harmful micro-organisms, specifically fungi including spores, microbes and viruses.

The terms "covering" or "cover" as used herein mean that a physical barrier is arranged between the plant to be protected and the harmful organism, but does not imply that the plant is in physical contact with the cover material or that the harmful organism is prevented from reaching the plant. Covers are in particular textile coverings such as fabrics and nettings.

Generally, the covering is made from a non-rigid material. It is preferably a textile material, like a non-woven or woven fabric, knitgoods, tarpaulins, meshes or meshed fabric, or plastics material such as plastic foils. The covering, in particular the textiles may be coated with a coating composition. The netting material may be prepared by any method known in the art, for example by weaving, circular knitting or warp knitting, or by sewing parts of a netting to obtain the desired nettings.

The textile material may be made from a variety of natural and synthetic fibers, also as textile blends in woven or non-woven form. Natural fibers are for example cotton, wool, silk or bast fibers, like jute, linen, ramie, hemp and kenaf. Synthetic fibers are for example fibers from polyamides, polyaramides, polyesters, polyacrylonitriles, polyole-

fines, for example polypropylene, polyethylene, poly(vinylchloride) or poly(tetrafluoroethylene) (Teflon) and mixtures of fibers, for example mixtures of synthetic and natural fibers. Synthetic fibers from the group of fibers from polyamides, polyolefins and polyesters, such as polyethylene terephthalate, are preferred.

The term material also includes non-textile substrates such as perforated foils.

In a particular embodiment, the covering is a cellulose-containing material, e.g. cotton material, such as cotton fabrics or cotton nets.

In another particular embodiment, the covering is a textile or foliar covering from plastic material, e.g. polypropylene, polyethylene, polyester or polyamide.

In particular preferred embodiment, the covering is selected from nettings made from polyester, especially polyethylene terephthalate. In a further preferred embodiment the material is a cellulose containing material.

If the covering is a textile material, in particular a meshed fabric, suitable dimensions of the mesh sizes (side length of a mesh) are in the range of 5 mm, preferably 2.5 mm, more preferred 1.5 mm as an upper limit and 0.1 mm, preferably 0.25 mm, more preferred 0.5 mm, in particular 0.75 mm as a lower limit. In the case of very small pests a wide-meshed woven fabric may be preferred as a textile material.

Preferably, the covering is treated with a composition comprising a pesticide, however, the invention is not limited to such embodiments. E.g., the pesticide can also be incorporated into a fiber during the production of the fiber.

Such materials show good results in controlling the pests and provide long lasting protection to the stored tobacco. In a preferred embodiment, the pesticide is incorporated into the material (e.g. into the plastics matrix) or applied to the surface of the material or both.

In a most preferred embodiment, the material of the cover is treated with a pesticidal composition comprising: a) at least one pesticide (component A), and b) at least one polymeric binder (component B).

The pesticidal composition comprises in general 0.001 to 95 % by weight preferably 0.1 to 45 % by weight, more preferably 0.5 to 30 % by weight, most preferably 0.5 to 25 % by weight, based on the weight of the composition, of at least one pesticide.

The pesticidal composition preferably comprises the following components, based on the solids content of the composition a) 0.1 to 45 % by weight, preferably 0.5 to 30% by weight, more preferably 1 to 25 % by weight of at least one pesticide (component A), and b) 55 to 99 % by weight, preferably 70 to 98 % by weight, more preferably 75 to 90 by weight of at least one polymeric binder (component B).

In a further preferred embodiment the pesticidal composition comprises the following components, based on the solids content of the composition, a) 20 to 70 % by weight, preferably 25 to 65 % by weight, more preferably 30 to 65 % by weight of at least one pesticide (component A), and b) 30 to 80 % by weight, preferably 35 to 75 % by weight, more preferably 35 to 70 by weight of at least one polymeric binder (component B).

The term "pesticide" as used herein comprises repellents and fungicides, and in particular insecticides.

The term "insecticides" as used herein comprises agents with arthropodicidal (specifically, insecticidal, acaricidal and miticidal), nematicidal, molluscicidal and rodenticidal activity, if not otherwise stated in the context. The term "fungicides" as used herein comprises agents with fungicidal, microbicidal and viricidal activity, if not otherwise stated in the context.

Preferably, the pesticide is an insecticide or repellent.

One or more pesticides may be used in the invention. If a combination of pesticides is used, the number of pesticides is preferably from 2 to 5, more preferably 2 or 3 different pesticides.

The pesticidal composition is particularly suitable for application to polyester nettings as used for mosquito nets.

The pesticidal composition of the present invention may be applied to textile materials or plastics material, before their formation into the desired products, i.e. while still a yarn or in sheet form, or after formation of the desired products.

Pesticide (component A)

Preferably, the pesticide is an insecticide and/or repellent with a fast paralyzing or killing effect of the insect and low mammalian toxicity. Suitable insecticides and/or repellents are known by a person skilled in the art. Suitable insecticides and repellents are disclosed e.g. in E. C. Tomlin et al., The Pesticide Manual, 13ed., The British Crop Protection Council, Farnham 2003, and the literature cited therein.

Suitable examples of pesticide compounds which are active against arthropod pests such as insects or acarids or nematodes are the compounds listed in groups M.1 to M.29

M.1 Acetylcholine esterase (AChE) inhibitors from the class of
M.1 A carbamates, for example aldicarb, alanycarb, bendiocarb, benfuracarb, butocarboxim, butoxycarboxim, carbaryl, carbofuran, carbosulfan, ethiofencarb, fenobucarb, formetanate, furathiocarb, isoprocarb, methiocarb, methomyl, metolcarb, oxamyl, pirimicarb, propoxur, thiodicarb, thiofanox, trimethacarb, XMC, xylylcarb and triazamate; or from the class of
M.1 B organophosphates and organothiophosphates, for example acephate, azamethiphos, azinphos-ethyl, azinphosmethyl, cadusafos, chlorethoxyfos, chlorfenvinphos, chlormephos, chlorpyrifos, chlorpyrifos-methyl, coumaphos, cyanophos, demeton-S-methyl, diazinon, dichlorvos/ DDVP, dicrotophos, dimethoate, dimethylvinphos, disulfoton, EPN, ethion, ethoprophos, famphur, fenamiphos, fenitrothion, fenthion, fosthiazate, heptenophos, imicyafos, isofenphos, isopropyl-O-(methoxyaminothio-phosphoryl) salicylate, isoxathion, malathion, mecarbam, methamidophos, methidathion, mevinphos, monocrotophos, naled, omethoate, oxydemeton-methyl, parathion, parathion-methyl, phenthoate, phorate, phosalone, phosmet, phosphamidon, phoxim, pirimiphos- methyl, profenofos, propetamphos, prothiofos, pyraclofos, pyridaphenthion, quinalphos, sulfotep, tebupirimfos, temephos, terbufos, tetrachlorvinphos, thiometon, triazophos, trichlorfon and vamidothion;

M.2. GABA-gated chloride channel antagonists such as:
M.2A cyclodiene organochlorine compounds, as for example endosulfan or chlordane; or
M.2B fiproles (phenylpyrazoles), as for example ethiprole, fipronil, flufiprole, pyrafluprole and pyriprole;

M.3 Sodium channel modulators from the class of
M.3A pyrethroids, for example acrinathrin, allethrin, d-cis-trans allethrin, d-trans allethrin, bifenthrin, bioallethrin, bioallethrin S-cylclopentenyl, bioresmethrin, cycloprothrin, cyfluthrin, beta-cyfluthrin, cyhalothrin, lambda-cyhalothrin, gamma-cyhalothrin, cypermethrin, alpha-cypermethrin, beta-cypermethrin, theta-cypermethrin, zeta-

cypermethrin, cyphenothrin, deltamethrin, empenthrin, esfenvalerate, etofenprox, fenpropathrin, fenvalerate, flucythrinate, flumethrin, tau-fluvalinate, halfenprox, imiprothrin, meperfluthrin,metofluthrin, permethrin, phenothrin, prallethrin, profluthrin, pyrethrin (pyrethrum), resmethrin, silafluofen, tefluthrin, tetramethylfluthrin, tetramethrin, tralomethrin and transfluthrin; or

M.3B sodium channel modulators such as DDT or methoxychlor;

M.4 Nicotinic acetylcholine receptor agonists (nAChR) from the class of

M.4A neonicotinoids, for example acteamiprid, chlothianidin, dinotefuran, imidacloprid, nitenpyram, thiacloprid and thiamethoxam; or

M.4B nicotine.

M.5 Nicotinic acetylcholine receptor allosteric activators from the class of spinosyns, for example spinosad or spinetoram;

M.6 Chloride channel activators from the class of avermectins and milbemycins, for example abamectin, emamectin benzoate, ivermectin, lepimectin or milbemectin;

M.7 Juvenile hormone mimics, such as

M.7A juvenile hormone analogues as hydroprene, kinoprene and methoprene; or others as

M.7B fenoxycarb, or

M.7C pyriproxyfen;

M.8 miscellaneous non-specific (multi-site) inhibitors, for example

M.8A alkyl halides as methyl bromide and other alkyl halides, or

M.8B chloropicrin, or

M.8C sulfuryl fluoride, or

M.8D borax, or

M.8E tartar emetic;

M.9 Selective homopteran feeding blockers, for example

M.9B pymetrozine, or

M.9C flonicamid;

M.10 Mite growth inhibitors, for example

M.10A clofentezine, hexythiazox and diflovidazin, or

M.10B etoxazole;

M.1 1 Microbial disruptors of insect midgut membranes, for example *bacillus thuringiensis* or *bacillus sphaericus* and the insecticdal proteins they produce such as *bacillus thuringiensis subsp. israelensis, bacillus sphaericus, bacillus thuringiensis subsp.*

aizawai, bacillus thuringiensis subsp. kurstaki and *bacillus thuringiensis subsp. tenebrionis,* or the Bt crop proteins: CrylAb, CrylAc, Cryl Fa, Cry2Ab, mCry3A, Cry3Ab, Cry3Bb and Cry34/35Ab1 ;

M.12 Inhibitors of mitochondrial ATP synthase, for example
M.12A diafenthiuron, or
M.12B organotin miticides such as azocyclotin, cyhexatin or fenbutatin oxide, or M.12C propargite, or
M.12D tetradifon;

M.13 Uncouplers of oxidative phosphorylation via disruption of the proton gradient, for example chlorfenapyr, DNOC or sulfluramid;

M.14 Nicotinic acetylcholine receptor (nAChR) channel blockers, for example nereistoxin analogues as bensultap, cartap hydrochloride, thiocyclam or thiosultap sodium;

M.15 Inhibitors of the chitin biosynthesis type 0, such as benzoylureas as for example bistrifluron, chlorfluazuron, diflubenzuron, flucycloxuron, flufenoxuron, hexaflumuron, lufenuron, novaluron, noviflumuron, teflubenzuron or triflumuron;

M.16 Inhibitors of the chitin biosynthesis type 1, as for example buprofezin;

M.17 Moulting disruptors, Dipteran, as for example cyromazine;

M.18 Ecdyson receptor agonists such as diacylhydrazines, for example methoxyfenozide, tebufenozide, halofenozide, fufenozide or chromafenozide;

M.19 Octopamin receptor agonists, as for example amitraz;

M.20 Mitochondrial complex III electron transport inhibitors, for example
M.20A hydramethylnon, or
M.20B acequinocyl, or
M.20C fluacrypyrim;

M.21 Mitochondrial complex I electron transport inhibitors, for example
M.21A METI acaricides and insecticides such as fenazaquin, fenpyroximate, pyrimidifen, pyridaben, tebufenpyrad or tolfenpyrad, or
M.21 B rotenone;

M.22 Voltage-dependent sodium channel blockers, for example
M.22A indoxacarb, or
M.22B metaflumizone;

M.23 Inhibitors of the of acetyl CoA carboxylase, such as Tetronic and Tetramic acid derivatives, for example spirodiclofen, spiromesifen or spirotetramat;

M.24 Mitochondrial complex IV electron transport inhibitors, for example
M.24A phosphine such as aluminium phosphide, calcium phosphide, phosphine or zinc phosphide, or
M.24B cyanide.

M.25 Mitochondrial complex II electron transport inhibitors, such as beta-ketonitrile derivatives, for example cyenopyrafen or cyflumetofen;

M.28 Ryanodine receptor-modulators from the class of diamides, as
for example flubendiamide, chloranthraniliprole (rynaxypyr®), cyanthraniliprole (cyazypyr®), or
the phthalamide compounds
M.28.1: (R)-3-Chlor-N1-{2-methyl-4-[1,2,2,2-tetrafluor-1-(trifluormethyl)ethyl]phenyl}-N2-(1-methyl-2-methylsulfonylethyl)phthalamid and
M.28.2: (S)-3-Chlor-N1-{2-methyl-4-[1,2,2,2-tetrafluor-1-(trifluormethyl)ethyl]phenyl}-N2-(1-methyl-2-methylsulfonylethyl)phthalamid, or the compound
M.28.3: 3-bromo-N-{2-bromo-4-chloro-6-[(1-cyclopropylethyl)carbamoyl]phenyl}-1-(3-chlorpyridin-2-yl)-1H-pyrazole-5-carboxamide, or the compound
M.28.4: methyl-2-[3,5-dibromo-2-({[3-bromo-1-(3-chlorpyridin-2-yl)-1H-pyrazol-5-yl]carbonyl}amino)benzoyl]-1,2-dimethylhydrazinecarboxylate;

M.29 insecticidal active compounds of unknown or uncertain mode of action, as for example azadirachtin, amidoflumet, benzoximate, bifenazate, bromopropylate, chinomethionat, cryolite, dicofol, flufenerim, flometoquin, fluensulfone, flupyradifurone, piperonyl butoxide, pyridalyl, pyrifluquinazon, sulfoxaflor, or the compound
M.29.1: 4-[5-(3,5-Dichloro-phenyl)-5-trifluoromethyl-4,5-dihydro-isoxazol-3-yl]-2-methyl-N-[(2,2,2-trifluoro-ethylcarbamoyl)-methyl]-benzamide, or the compound
M.29.2: cyclopropaneacetic acid, 1,1'-[(3S,4R,4aR,6S,6aS,12R,12aS,12bS)-4-[[(2-cyclopropylacetyl)oxy]methyl]-1,3,4,4a,5,6,6a,12,12a,12b-decahydro-12-hydroxy-4,6a,12b-trimethyl-1-oxo-9-(3-pyridinyl)-2H,11H-naphtho[2,1-b]pyrano[3,4-e]pyran-3,6-diyl] ester, or the compound
M.29.3: 11-(4-chloro-2,6-dimethylphenyl)-1-2-hydroxy-1,4-dioxa-9-azadispiro[4.2.4.2]-tetradec-1-en-10-one, or the compound
M.29.4: 3-(4'-fluoro-2,4-dimethylbiphenyl-3-yl)-4-hydroxy-8-oxa-1-azaspiro[4.5]dec-3-en-2-one, or the compound
M.29.5: 1-[2-fluoro-4-methyl-5-[(2,2,2-trifluoroethyl)sulfinyl]phenyl]-3-(trifluoromethyl)-1H-1,2,4-triazole-5-amine, or actives on basis of *bacillus firmus* (Votivo, 1-1582).

The commercially available compounds of the group M listed above may be found in The Pesticide Manual, 15th Edition, C. D. S. Tomlin, British Crop Protection Council (201 1) among other publications.

The phthalamides M.28.1 and M.28.2 are both known from WO 2007/101540. The anthranilamide M.28.3 has been described in WO2005/077943. The hydrazide compound M.28.4 has been described in WO 2007/043677.-The quinoline derivative flometoquin is shown in WO2006/013896. The aminofuranone compounds flupyradifurone is known from WO 2007/1 15644. The sulfoximine compound sulfoxaflor is known from WO2007/149134. The isoxazoline compound M.29.1 has been described in WO2005/085216. The pyripyropene derivative M.29.2 has been described in WO 2006/129714. The spiroketal-substituted cyclic ketoenol derivative M.29.3 is known from WO2006/089633 and the biphenyl-substituted spirocyclic ketoenol derivative M.29.4 from WO2008/06791 1. Finally triazoylphenylsulfide like M.29.5 have been described in WO2006/043635 and biological control agents on basis of *bacillus firmus* in WO2009/1 24707.

Preferred insecticides and/or repellents are mentioned below:
organo(thio)phosphate compounds such as those mentioned in group M.1 B;
carbamate compounds such as those mentioned in group M.1A;
pyrethroid compounds such as those mentioned in group M.3A;
Chlorfenapyr;
Insecticides with a sterilising effect on adult mosquitoes such as 1-(alpha-(chloro-alpha-cyclopropylbenzylidenamino-oxy)-p-tolyl)-3-(2,6-difluorobenzoyl)urea,
Diflubenzuron: 1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl)urea
Triflumuron: 2-Chloro-N-(((4-(trifluoromethoxy)phenyl)-amino-)carbonyl)benzamide, a triazin such as N-cyclopropyl-1 ,3,5-triazine-2,4,6-triamin; and
Lambda-cyhalothrine: [alpha]-cyano-3-phenoxybenzyl-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropane carboxylate, in particular as a 1 :1 mixture of (Z)-(l R,3R), R-ester and (Z)-(1S,3S), S-ester.

The repellent is preferably selected from N,N-Diethyl-meta-toluamide (DEET), N 1N-diethylphenylacetamide (DEPA), 1-(3-cyclohexan-1-yl-carbonyl)-2-methylpiperine, (2-hydroxymethylcyclohexyl) acetic acid lactone, 2-ethyl-1 ,3-hexandiol, indalone, Methyl-neodecanamide (MNDA), a pyrethroid not used for insect control such as {(+/-)-3-allyl-2- methyl-4-oxocyclopent-2-(+)-enyl-(+)-trans-chrysantemate (Esbiothrin), a repellent derived from or identical with plant extracts like limonene, eugenol, (+)-Eucamalol (1), (-)-1 -epi- eucamalol or crude plant extracts from plants like Eucalyptus maculata, Vitex rotundifolia, Cymbopogan martinii, Cymbopogan citratus (lemon grass), Cymopogan

nartdus (citro-nella), IR3535 (ethyl butylacetylaminopropionate), icaridin (1-piperidinecarboxylic acid 2-(2- hydroxyethyl)-1-methylpropylester).

A suitable molluscicide is for example niclosamide.

Suitable rodenticides are first generation anticoagulant rodenticides and second generation anticoagulant rodenticides, where second generation rodenticides are preferred. Examples for first generation anticoagulant rodenticides are warfarin, chlorphacinone, coumatetralyl, suitable second generation anticoagulant rodenticides are for example flocoumafen, brodifacoum, difenacoum, bromadialone, difethialone, and bromethalin.

In a further embodiment, the material of the cover is treated with a contact pesticide. The contact pesticide may be of any nature, including biological agents such as bacteria, viruses and fungi specific for the target pests, but chemical pesticides are most preferred. Appropriate chemical contact pesticides useful in the invention include, without being limited to the Fipronil and chlorfenapyr.

The covering may also contain a pesticide compound from the group of fungicide compounds, i.e. compounds which are active against harmful fungi. These fungicide compounds may be used alone or preferably in combination with one or more of the aforementioned compounds that are active against arthropod pests, nemathodes or rhodents. Suitable fungicide compounds are those mentioned in groups F.I to F.XI:

F.I) Respiration Inhibitors

F.I-1) Inhibitors of complex III at Qo site (e.g. strobilurins)

strobilurins: azoxystrobin, coumethoxystrobin, coumoxystrobin, dimoxystrobin, enestroburin, fluoxastrobin, kresoxim-methyl, metominostrobin, orysastrobin, picoxystrobin, pyraclostrobin, pyrametostrobin, pyraoxystrobin, pyribencarb, triclopyricarb/chlorodincarb, trifloxystrobin, 2-[2-(2,5-dimethyl-phenoxymethyl)-phenyl]-3-methoxy-acrylic acid methyl ester and 2 (2-(3-(2,6-dichlorophenyl)-1-methyl-allylideneaminooxymethyl)-phenyl)-2-methoxyimino-N methyl-acetamide;

oxazolidinediones and imidazolinones: famoxadone, fenamidone;

F.I-2) Inhibitors of complex II (e.g. carboxamides):

carboxanilides: benodanil, bixafen, boscalid, carboxin, fenfuram, fenhexamid, fluopyram, flutolanil, furametpyr, isopyrazam, isotianil, mepronil, oxycarboxin, penflufen, penthiopyrad, sedaxane, tecloftalam, thifluzamide, tiadinil, 2-amino-4 methyl-thiazole-5-carboxanilide, N-(3',4',5' trifluorobiphenyl-2 yl)-3-difluoromethyl-1-methyl-1 H-pyrazole-4 carboxamide, N-(4'-trifluoromethylthiobiphenyl-2-yl)-3 difluoromethyl-1-methyl-1 H pyra-

zole-4-carboxamide and N-(2-(1 ,3,3-trimethyl-butyl)-phenyl)-1 ,3-dimethyl-5 fluoro-1 H-pyrazole-4 carboxamide;

F.I-3) Inhibitors of complex III at Qi site: cyazofamid, amisulbrom;

F.I-4) Other respiration inhibitors (complex I, uncouplers)

diflumetorim; tecnazen; ferimzone; ametoctradin; silthiofam;

nitrophenyl derivates: binapacryl, dinobuton, dinocap, fluazinam, nitrthal-isopropyl,

organometal compounds: fentin salts, such as fentin-acetate, fentin chloride or fentin hydroxide;

F.II) Sterol biosynthesis inhibitors (SBI fungicides)

F.II-1) C14 demethylase inhibitors (DMI fungicides, e.g. triazoles, imidazoles)

triazoles: azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, paclobutrazole, penconazole, propiconazole, prothioconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, uniconazole;

imidazoles: imazalil, pefurazoate, oxpoconazole, prochloraz, triflumizole;

pyrimidines, pyridines and piperazines: fenarimol, nuarimol, pyrifenox, triforine;

F.II-2) Delta 14-reductase inhitors (Amines, e.g. morpholines, piperidines)

morpholines: aldimorph, dodemorph, dodemorph-acetate, fenpropimorph, tridemorph;

piperidines: fenpropidin, piperalin;

spiroketalamines: spiroxamine;

F.II-3) Inhibitors of 3-keto reductase: hydroxyanilides: fenhexamid;

F.III) Nucleic acid synthesis inhibitors

F.III-1) RNA, DNA synthesis

phenylamides or acyl amino acid fungicides: benalaxyl, benalaxyl-M, kiralaxyl, metalaxyl, metalaxyl-M (mefenoxam), ofurace, oxadixyl;

isoxazoles and iosothiazolones: hymexazole, octhilinone;

F.III-2) DNA topisomerase inhibitors: oxolinic acid;

F.III-3) Nucleotide metabolism (e.g. adenosin-deaminase)

hydroxy (2-amino)-pyrimidines: bupirimate;

F.IV) Inhibitors of cell division and or cytoskeleton

F.IV-1) Tubulin inhibitors: benzimidazoles and thiophanates: benomyl, carbendazim, fuberidazole, thiabendazole, thiophanate-methyl;

triazolopyrimidines: 5-chloro-7 (4-methylpiperidin-1 -yl)-6-(2,4,6-trifluorophenyl)-[1 ,2,4]triazolo[1 ,5 a]pyrimidine

F.IV-2) Other cell division inhibitors

benzamides and phenyl acetamides: diethofencarb, ethaboxam, pencycuron, fluopicolide, zoxamide;

F.IV-3) Actin inhibitors: benzophenones: metrafenone;

F.V) Inhibitors of amino acid and protein synthesis

F.V-1) Mmethionine synthesis inhibitors (anilino-pyrimidines)

anilino-pyrimidines: cyprodinil, mepanipyrim, nitrapyrin, pyrimethanil;

F.V-2) Protein synthesis inhibitors (anilino-pyrimidines)

antibiotics: blasticidin-S, kasugamycin, kasugamycin hydrochloride-hydrate, mildiomycin, streptomycin, oxytetracyclin, polyoxine, validamycin A ;

F.VI) Signal transduction inhibitors

F.VI-1) MAP / Histidine kinase inhibitors (e.g. anilino-pyrimidines)

dicarboximides: fluoroimid, iprodione, procymidone, vinclozolin;

phenylpyrroles: fenpiclonil, fludioxonil;

F.VI-2) G protein inhibitors: quinolines: quinoxyfen;

F.VI I) Lipid and membrane synthesis inhibitors

F.VI 1-1) Phospholipid biosynthesis inhibitors

organophosphorus compounds: edifenphos, iprobenfos, pyrazophos;

dithiolanes: isoprothiolane;

F.VII-2) Lipid peroxidation

aromatic hydrocarbons: dicloran, quintozene, tecnazene, tolclofos-methyl, biphenyl, chloroneb, etridiazole;

F.VII-3) Carboxyl acid amides (CAA fungicides)

cinnamic or mandelic acid amides: dimethomorph, flumorph, mandiproamid, pyrimorph;

valinamide carbamates: benthiavalicarb, iprovalicarb, pyribencarb, valifenalate and N-(1-(1-(4-cyano-phenyl)ethanesulfonyl)-but-2-yl) carbamic acid-(4-fluorophenyl) ester;

F.VII-4) Compounds affecting cell membrane permeability and fatty acids

carbamates: propamocarb, propamocarb-hydrochlorid

F.VI II) Inhibitors with Multi Site Action

F.VI 11-1) Inorganic active substances: Bordeaux mixture, copper acetate, copper hydroxide, copper oxychloride, basic copper sulfate, sulfur;

F.VIII-2) Thio- and dithiocarbamates: ferbam, mancozeb, maneb, metam, methasulphocarb, metiram, propineb, thiram, zineb, ziram;

F.VIII-3) Organochlorine compounds (e.g. phthalimides, sulfamides, chloronitriles):

anilazine, chlorothalonil, captafol, captan, folpet, dichlofluanid, dichlorophen, flusulfamide, hexachlorobenzene, pentachlorphenole and its salts, phthalide, tolylfluanid, N-(4-chloro-2-nitro-phenyl)-N-ethyl-4-methyl-benzenesulfonamide;

F.VIII-4) Guanidines: guanidine, dodine, dodine free base, guazatine, guazatine-acetate, iminoctadine, iminoctadine-triacetate, iminoctadine-tris(albesilate);

F.VIII-5) Ahtraquinones: dithianon;

F.IX) Cell wall synthesis inhibitors

F.IX-1) Inhibitors of glucan synthesis: validamycin, polyoxin B;

F.IX-2) Melanin synthesis inhibitors: pyroquilon, tricyclazole, carpropamide, dicyclomet, fenoxanil;

F.X) Plant defence inducers

F.X-1) Salicylic acid pathway: acibenzolar-S-methyl;

F.X-2) Others: probenazole, isotianil, tiadinil, prohexadione-calcium;
phosphonates: fosetyl, fosetyl-aluminum, phosphorous acid and its salts;

F.XI) Unknown mode of action:
bronopol, chinomethionat, cyflufenamid, cymoxanil, dazomet, debacarb, diclomezine, difenzoquat, difenzoquat-methylsulfate, diphenylamin, flumetover, flusulfamide, flutianil, methasulfocarb, oxin-copper, proquinazid, tebufloquin, tecloftalam, triazoxide, 2-butoxy-6-iodo-3-propylchromen-4-one, N-(cyclopropylmethoxyimino-(6-difluoro-methoxy-2,3-difluoro-phenyl)-methyl)-2-phenyl acetamide, N'-(4-(4-chloro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N methyl formamidine, N' (4-(4-fluoro-3-trifluoro-methyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N-methyl formamidine, N'-(2-methyl-5-trifluoromethyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine, N'-(5-difluoromethyl-2 methyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine, 2-{1 -[2-(5-methyl-3-trifluoromethyl-pyrazole-1 -yl)-acetyl]-piperidin-4-yl}-thiazole-4-carboxylic acid methyl-(1 ,2,3,4-tetrahydro-naphthalen-1-yl)-amide, 2-{1-[2-(5-methyl-3-trifluoromethyl-pyrazole-1-yl)-acetyl]-piperidin-4-yl}-thiazole-4-carboxylic acid methyl-(R)-1 ,2,3,4-tetrahydro-naphthalen-1-yl-amide, methoxy-acetic acid 6-tert-butyl-8-fluoro-2,3-dimethyl-quinolin-4-yl ester and N-Methyl-2-{1-[(5-methyl-3-trifluoro-methyl-1 H-pyrazol-1-yl)-acetyl]-piperidin-4-yl}-N-[(1 R)-1 ,2,3,4-tetrahydronaphthalen-1-yl]-4-thiazolecarboxamide, 3-[5-(4-chloro-phenyl)-2,3-dimethyl-isoxazolidin-3 yl]-pyridine, pyrisoxazole, 5-amino-2-isopropyl-3-oxo-4-ortho-tolyl-2,3-dihydro-pyrazole-1 carbothioic acid S-allyl ester, N-(6-methoxy-pyridin-3-yl) cyclopropanecarboxylic acid amide, 5-chloro-1 (4,6-dimethoxy-pyrimidin-2-yl)-2-methyl-1 H-benzoimidazole, 2-(4-chloro-phenyl)-N-[4-(3,4-dimethoxy-phenyl)-isoxazol-5-yl]-2-prop-2-ynyloxy-acetamide;

In a most preferred embodiment the insecticide is a pyrethroid, in particular deltamethrin or alpha-cypermethrin.

The method an the system of the present invention are useful for monitoring crops that are protected from any kind of pests and disease encountered in the cultivation of the plant.

Such pests include:

Insects from the following orders:

lepidopterans (Lepidoptera), for example Agrotis ypsilon, Agrotis segetum, Alabama argillacea, Anticarsia gemmatalis, Argyresthia conjugella, Autographa gamma, Bupalus piniarius, Cacoecia murinana, Capua reticulana, Cheimatobia brumata, Choristoneura fumiferana, Choristoneura occidentalis, Cirphis unipuncta, Cydia pomonella, Dendrolimus pini, Diaphania nitidalis, Diatraea grandiosella, Earias insulana, Elasmopalpus lignosellus, Eupoecilia ambiguella, Evetria bouliana, Feltia subterranea, Galleria mellonella, Grapholitha funebrana, Grapholitha molesta, Heliothis armigera, Heliothis virescens, Heliothis zea, Hellula undalis, Hibernia defoliaria, Hyphantria cunea, Hyponomeuta malinellus, Keiferia lycopersicella, Lambdina fiscellaria, Laphygma exigua, Leucoptera coffeella, Leucoptera scitella, Lithocolletis blancardella, Lobesia botrana, Loxostege sticticalis, Lymantria dispar, Lymantria monacha, Lyonetia clerkella, Malacosoma neustria, Mamestra brassicae, Orgyia pseudotsugata, Ostrinia nubilalis, Panolis flammea, Pectinophora gossypiella, Peridroma saucia, Phalera bucephala, Phthorimaea operculella, Phyllocnistis citrella, Pieris brassicae, Pieris rapae, Plathypena scabra, Plutella xylostella, Pseudoplusia includens, Rhyacionia frustrana, Scrobipalpula absoluta, Sitotroga cerealella, Sparganothis pilleriana, Spodoptera frugiperda, Spodoptera littoralis, Spodoptera litura, Thaumatopoea pityocampa, Tortrix viridana, Trichoplusia ni and Zeiraphera canadensis;

beetles (Coleoptera), for example Agrilus sinuatus, Agriotes lineatus, Agriotes obscurus, Amphimallus solstitialis, Anisandrus dispar, Anthonomus grandis, Anthonomus pomorum, Aphthona euphoridae, Athous haemorrhoidalis, Atomaria linearis, Blastophagus piniperda, Blitophaga undata, Bruchus rufimanus, Bruchus pisorum, Bruchus lentis, Byctiscus betulae, Cassida nebulosa, Cerotoma trifurcata, Cetonia aurata, Ceuthorrhynchus assimilis, Ceuthorrhynchus napi, Chaetocnema tibialis, Conoderus vespertinus, Crioceris asparagi, Ctenicera ssp., Diabrotica longicornis, Diabrotica semipunctata, Diabrotica 12-punctata Diabrotica speciosa, Diabrotica virgifera, Epilachna varivestis, Epitrix hirtipennis, Eutinobothrus brasiliensis, Hylobius abietis, Hypera brun-

neipennis, Hypera postica, Ips typographus, Lema bilineata, Lema melanopus, Leptinotarsa decemlineata, Limonius californicus, Lissorhoptrus oryzophilus, Melanotus communis, Meligethes aeneus, Melolontha hippocastani, Melolontha melolontha, Oulema oryzae, Otiorrhynchus sulcatus, Otiorrhynchus ovatus, Phaedon cochleariae, Phyllobius pyri, Phyllotreta chrysocephala, Phyllophaga sp., Phyllopertha horticola, Phyllotreta nemorum, Phyllotreta striolata, Popillia japonica, Sitona lineatus and Sitophilus granaria;

flies, mosquitoes (Diptera), e.g. Aedes aegypti, Aedes albopictus, Aedes vexans, Anastrepha ludens, Anopheles maculipennis, Anopheles crucians, Anopheles albimanus, Anopheles gambiae, Anopheles freeborni, Anopheles leucosphyrus, Anopheles minimus, Anopheles quadrimaculatus, Calliphora vicina, Ceratitis capitata, Chrysomya bezziana, Chrysomya hominivorax, Chrysomya macellaria, Chrysops discalis, Chrysops silacea, Chrysops atlanticus, Cochliomyia hominivorax, Contarinia sorghicola Cordylobia anthropophaga, Culicoides furens, Culex pipiens, Culex nigripalpus, Culex quinquefasciatus, Culex tarsalis, Culiseta inornata, Culiseta melanura, Dacus cucurbitae, Dacus oleae, Dasineura brassicae, Delia antique, Delia coarctata, Delia platura, Delia radicum, Dermatobia hominis, Fannia canicularis, Geomyza Tripunctata, Gasterophilus intestinalis, Glossina morsitans, Glossina palpalis, Glossina fuscipes, Glossina tachinoides, Haematobia irritans, Haplodiplosis equestris, Hippelates spp., Hylemyia platura, Hypoderma lineata, Leptoconops torrens, Liriomyza sativae, Liriomyza trifolii, Lucilia caprina, Lucilia cuprina, Lucilia sericata, Lycoria pectoralis, Mansonia titillanus, Mayetiola destructor, Musca autumnalis, Musca domestica, Muscina stabulans, Oestrus ovis, Opomyza florum, Oscinella frit, Pegomya hysocyami, Phorbia antiqua, Phorbia brassicae, Phorbia coarctata, Phlebotomus argentipes, Psorophora columbiae, Psila rosae, Psorophora discolor, Prosimulium mixtum, Rhagoletis cerasi, Rhagoletis pomonella, Sarcophaga haemorrhoidalis, Sarcophaga spp., Simulium vittatum, Stomoxys calcitrans, Tabanus bovinus, Tabanus atratus, Tabanus lineola, and Tabanus similis, Tipula oleracea, and Tipula paludosa;

thrips (Thysanoptera), e.g. Dichromothrips corbetti, Dichromothrips ssp., Frankliniella fusca, Frankliniella occidentalis, Frankliniella tritici, Scirtothrips citri, Thrips oryzae, Thrips palmi and Thrips tabaci,

termites (Isoptera), e.g. Calotermes flavicollis, Leucotermes flavipes, Heterotermes aureus, Reticulitermes flavipes, Reticulitermes virginicus, Reticulitermes lucifugus, Reticulitermes santonensis, Reticulitermes grassei, Termes natalensis, and Coptotermes formosanus;

cockroaches (Blattaria - Blattodea), e.g. Blattella germanica, Blattella asahinae, Periplaneta americana, Periplaneta japonica, Periplaneta brunnea, Periplaneta fuligginosa, Periplaneta australasiae, and Blatta orientalis;

bugs, aphids, leafhoppers, whiteflies, scale insects, cicadas (Hemiptera), e.g. Acrosternum hilare, Blissus leucopterus, Cyrtopeltis notatus, Dysdercus cingulatus, Dysdercus intermedius, Eurygaster integriceps, Euschistus impictiventris, Leptoglossus phyllopus, Lygus lineolaris, Lygus pratensis, Nezara viridula, Piesma quadrata, Solubea insularis, Thyanta perditor, Acyrthosiphon onobrychis, Adelges laricis, Aphidula nasturtii, Aphis fabae, Aphis forbesi, Aphis pomi, Aphis gossypii, Aphis grossulariae, Aphis schneideri, Aphis spiraecola, Aphis sambuci, Acyrthosiphon pisum, Aulacorthum solani, Bemisia argentifolii, Brachycaudus cardui, Brachycaudus helichrysi, Brachycaudus persicae, Brachycaudus prunicola, Brevicoryne brassicae, Capitophorus horni, Cerosipha gossypii, Chaetosiphon fragaefolii, Cryptomyzus ribis, Dreyfusia nordmannianae, Dreyfusia piceae, Dysaphis radicola, Dysaulacorthum pseudosolani, Dysaphis plantaginea, Dysaphis pyri, Empoasca fabae, Hyalopterus pruni, Hyperomyzus lactucae, Macrosiphum avenae, Macrosiphum euphorbiae, Macrosiphon rosae, Megoura viciae, Melanaphis pyrarius, Metopolophium dirhodum, Myzus persicae, Myzus ascalonicus, Myzus cerasi, Myzus varians, Nasonovia ribis-nigri, Nilaparvata lugens, Pemphigus bursarius, Perkinsiella saccharicida, Phorodon humuli, Psylla mali, Psylla piri, Rhopalomyzus ascalonicus, Rhopalosiphum maidis, Rhopalosiphum padi, Rhopalosiphum insertum, Sappaphis mala, Sappaphis mali, Schizaphis graminum, Schizoneura lanuginosa, Sitobion avenae, Trialeurodes vaporariorum, Toxoptera aurantiiand, Viteus vitifolii, Cimex lectularius, Cimex hemipterus, Reduvius senilis, Triatoma spp., and Arilus critatus;ants, bees, wasps, sawflies (Hymenoptera), e.g. Athalia rosae, Atta cephalotes, Atta capiguara, Atta cephalotes, Atta laevigata, Atta robusta, Atta sexdens, Atta texana, Crematogaster spp., Hoplocampa minuta, Hoplocampa testudinea, Lasius niger, Monomorium pharaonis, Solenopsis geminata, Solenopsis invicta, Solenopsis richteri, Solenopsis xyloni, Pogonomyrmex barbatus, Pogonomyrmex californicus, Pheidole megacephala, Dasymutilla occidentalis, Bombus spp., Vespula squamosa, Paravespula vulgaris, Paravespula pennsylvanica, Paravespula germanica, Dolichovespula maculata, Vespa crabro, Polistes rubiginosa, Camponotus floridanus, and Linepithema humile;

crickets, grasshoppers, locusts (Orthoptera), e.g. Acheta domestica, Gryllotalpa gryllotalpa, Locusta migratoria, Melanoplus bivittatus, Melanoplus femurrubrum, Melanoplus mexicanus, Melanoplus sanguinipes, Melanoplus spretus, Nomadacris septemfasciata, Schistocerca americana, Schistocerca gregaria, Dociostaurus maroccanus, Tachycines asynamorus, Oedaleus senegalensis, Zonozerus variegatus, Hieroglyphus daganensis,

Kraussaria angulifera, Calliptamus italicus, Chortoicetes terminifera, and Locustana pardalina;

arachnoidea, such as arachnids (Acarina),

e.g. of the families Argasidae, Ixodidae and Sarcoptidae, such as Amblyomma americanum, Amblyomma variegatum, Ambryomma maculatum, Argas persicus, Boophilus annulatus, Boophilus decoloratus, Boophilus microplus, Dermacentor silvarum, Dermacentor andersoni, Dermacentor variabilis, Hyalomma truncatum, Ixodes ricinus, Ixodes rubicundus, Ixodes scapularis, Ixodes holocyclus, Ixodes pacificus, Ornithodorus moubata, Ornithodorus hermsi, Ornithodorus turicata, Ornithonyssus bacoti, Otobius megnini, Dermanyssus gallinae, Psoroptes ovis, Rhipicephalus sanguineus, Rhipicephalus appendiculatus, Rhipicephalus evertsi, Sarcoptes scabiei, and Eriophyidae spp. such as Aculus schlechtendali, Phyllocoptrata oleivora and Eriophyes sheldoni; Tarsonemidae spp. such as Phytonemus pallidus and Polyphagotarsonemus latus; Tenuipalpidae spp. such as Brevipalpus phoenicis; Tetranychidae spp. such as Tetranychus cinnabarinus, Tetranychus kanzawai, Tetranychus pacificus, Tetranychus telarius and Tetranychus urticae, Panonychus ulmi, Panonychus citri, and Oligonychus pratensis; Araneida, e.g. Latrodectus mactans, and Loxosceles reclusa;

fleas (Siphonaptera), e.g. Ctenocephalides felis, Ctenocephalides canis, Xenopsylla cheopis, Pulex irritans, Tunga penetrans, and Nosopsyllus fasciatus,

silverfish, firebrat (Thysanura), e.g. Lepisma saccharina and Thermobia domestica,

centipedes (Chilopoda), e.g. Scutigera coleoptrata,

millipedes (Diplopoda), e.g. Narceus spp.,

earwigs (Dermaptera), e.g. forficula auricularia,

lice (Phthiraptera), e.g. Pediculus humanus capitis, Pediculus humanus corporis, Pthirus pubis, Haematopinus eurysternus, Haematopinus suis, Linognathus vituli, Bovicola bovis, Menopon gallinae, Menacanthus stramineus and Solenopotes capillatus.

Collembola (springtails), e.g. Onychiurus ssp..

plant parasitic nematodes such as

root knot nematodes, Meloidogyne hapla, Meloidogyne incognita, Meloidogyne javanica, and other Meloidogyne species; cyst-forming nematodes, Globodera rostochiensis and other Globodera species; Heterodera avenae, Heterodera glycines, Heterodera schachtii, Heterodera trifolii, and other Heterodera species; Seed gall nematodes, Anguina species; Stem and foliar nematodes, Aphelenchoides species; Sting nematodes, Belonolaimus longicaudatus and other Belonolaimus species; Pine nematodes, Bursaphelenchus xylophilus and other Bursaphelenchus species; Ring nematodes, Criconema species, Criconemella species, Criconemoides species, Mesocriconema species; Stem and bulb nematodes, Ditylenchus destructor, Ditylenchus dipsaci and other Ditylenchus species; Awl nematodes, Dolichodorus species; Spiral nematodes, Helicotylenchus multicinctus and other Helicotylenchus species; Sheath and sheathoid nematodes, Hemicycliophora species and Hemicriconemoides species; Hirshmanniella species; Lance nematodes, Hoploaimus species; false rootknot nematodes, Nacobbus species; Needle nematodes, Longidorus elongatus and other Longidorus species; Lesion nematodes, Pratylenchus neglectus, Pratylenchus penetrans, Pratylenchus curvitatus, Pratylenchus goodeyi and other Pratylenchus species; Burrowing nematodes, Radopholus similis and other Radopholus species; Reniform nematodes, Rotylenchus robustus and other Rotylenchus species; Scutellonema species; Stubby root nematodes, Trichodorus primitivus and other Trichodorus species, Paratrichodorus species; Stunt nematodes, Tylenchorhynchus claytoni, Tylenchorhynchus dubius and other Tylenchorhynchus species; Citrus nematodes, Tylenchulus species; Dagger nematodes, Xiphinema species; and other plant parasitic nematode species.

In a particular embodiment, the pests may be the tobacco beetle and tobacco moths.

Embodiments of the present invention are now described with reference to the drawings.

Figure 1 shows schematically the general design of an embodiment of the system of the present invention,

Figure 2 shows schematically an example of a warehouse at a particular geographical location and the crops stored therein in accordance with an embodiment of the system of the present invention,

Figure 3 shows schematically a trap used in the embodiment of the system of the present invention, and

Figure 4 shows schematically the general design of the central computer device of an embodiment of the system of the present invention.

The general structure of an embodiment of the system and method for monitoring crops is described with reference to figures 1 and 2:

In the embodiment tobacco is stored and should be protected against pests. In particular, tobacco is stored at different locations 1-1 to 1-7 (in the following also generally designated as 1). Locations 1 are geographically remote from each other. For example locations 1 are distributed over different countries and continents. At each location 1, a local computer device 10 is provided. The local computer devices 10 are connected to a network 2, for example the internet. Furthermore, a central computer device 3 is connected via the network 2 with all local computer devices 10. Therefore, data may be transferred from the local computer devices 10 to the central computer device 3 and vice versa.

Figure 2 shows a storage depot like a warehouse 4 of one geographical location 1. Within the warehouse 4 several packets 5-1, 5-2, 5-3 (in the following also generally designated with 5) or pales of stored tobacco are arranged. Each packet 5 is covered by a cover such as a netting 6-1, 6-2, 6-3 (in the following also generally designated as 6). In other embodiments at least one packet 5 is covered by a netting 6. Furthermore, at least the outer packets 6 near the wall of the warehouse 4 are covered by a netting 6 and inner packets 6 are not covered by a netting 6.

The netting 6 may be arranged by any suitable stabilizing structure. The stabilizing structure provides support to the meshed fabric of the netting 6 in order for it to cover the crops to be protected. For example, ropes 7 may be used to position the nettings 6 such that the packets 5 are fully covered by the nettings 6. In another embodiment the stabilizing structure is a simple pole which is fixed in the ground and from which the fabric is suspended and preferably fixed to the ground, e.g. by tent pegs in order to form a tent like structure. Several poles can be used as well for the tent like structure. Furthermore, the stabilizing structure may comprise one or more clamp like structures over which the fabric is suspended. Moreover, the stabilizing structure may be a framework to which the mesh material is allocated in order to form an enclosed interior

in which one or more packets comprising crops are protected from the harmful organisms. It is also possible that the stabilizing structure is provided by pots or potting trays.

The stabilizing structure may be inside or outside of the protective fabric of the netting 6 and may be formed by separate structural elements like poles, clamps etc. or in another embodiment form cage-like structures.

The nettings 6 are impregnated with a pesticide such as alpha-cypermethrin. However, any other pesticide may be used as described above.

Inside each netting 6 or a subset of the nettings 6 one or more traps 8 are positioned. Therefore, a pest that has got through the barrier of the netting 6 and that may come into contact with the stored tobacco of the packets 5 may also come to the traps 8.

Furthermore, the traps 8 are adapted to capture the pests and the caught pests can be counted as described later. The number of pests that are caught by the traps 8 therefore shows a possible pest infestation of the stored tobacco as well as the degree of infestation. Therefore, by means of the traps 8 inside the nettings 6, the efficiency of the nettings 6 and possible failure of the nettings 6 may be detected.

In addition, further traps 9 are arranged outside the volume that is covered by the nettings 6. In the present embodiment, these traps 9 are, however, located inside the warehouse 4. Traps 9 are of the same type as traps 8. Therefore the number of pests that are caught by traps 9 shows the degree of exposure of the nettings 6 to pests. Furthermore, the type of pests that are caught by traps 9 shows which pests occur in the neighbourhood of warehouse 4.

In particular, for each netting 6 one trap 8 located inside this netting 6 and one trap 9 located outside this netting 6 is associated to the netting 6. Therefore, a pair of traps 8 and 9 is associated to each netting. Analyzing pests caught by such a pair of traps 8 and 9 will provide data that may be analyzed for monitoring the efficiency and any potential failure of the associated netting 6.

The traps 8, 9 are adapted to attract pests. The traps 8, 9 in particular make use of pheromones in order to attract the pests. Suitable pheromones are

colepteran attractants such as brevicomin, dominicalure, frontaline, grandlure, ipsdienol, ipsenol, japonilure, lineatin, megatomoci acid, a-multistriatin, oryctalure, sulcatol or trunk-call;

dipteran attractants such as ceralure, cruelure, latilure, medlure, moguchun, muscalure or trimedlure;

lepidopteran attractants such as disparlure, codlelure, gossyplure, hexalure, litlure, looplure, orfralure or ostramone;

unclassified insect attracants such as eugenol, methyl eugenol or siglure.

The geographical location 1 comprises the local computer device 10 having a wireless local area network interface 12 as well as an interface for an electronic cable connection like a universal serial bus (USB) and a connection 11 to network 2 such as the internet.

With reference to figure 3, the structure of the traps 8, 9 is described:

Trap 8, 9 comprises an opening 13 so that the pests may enter trap 8, 9. Furthermore, trap 8, 9 comprises a unit 14 for capturing the pests. Such units 14 are known in the art. For example a path may be defined on which the pests can move only in one direction so that they can not come back to the opening 13. Alternatively, sticking glue may be used to capture the pests. The pheromones may be attached to the glue.

Moreover, the trap 8, 9 comprises a unit 15 that may automatically count the caught pests. For example, unit 15 comprises an image processing unit, a weighing machine or other means to count the pests. In addition, unit 15 may analyze the type of caught pests.

Data indicating the number of caught pests and optionally the type of caught pests are transferred from unit 15 to a wireless local area network interface 16 of the trap 8, 9. Via the wireless local area network interface 16, characteristics of the trap 8, 9 are automatically and repeatedly be transferred to local computer device 10 of the respective geographical location 1. The following characteristics are transferred: The number of caught pests, the type of caught pests, and/or an indication of the type of the trap 8, 9. These characteristics are denoted as first set of characteristics of traps 8, 9.

Alternatively, the trap 8, 9 comprises a label 17 including for example a visual code such as a bar code. The bar code indicates an indication of the type of the trap 8, 9. This characteristic may be read optically by a mobile reading device 18 that comprises a laser scanner for reading the bar code of label 17. Furthermore, the mobile reading device comprises an input unit so that the user can manually input the current number of caught pests and the type of the pests.

After the characteristics of the traps 8, 9 in warehouse 4 has been read by the mobile reading device 18, the mobile reading device 18 is electronically connected to local computer device 10 and the first set of characteristics of the traps 8, 9 are electronically transferred to local computer device 10.

Local computer device 10 is adapted to transfer a second set of characteristics of traps 8, 9 of the respective geographical location 1 via network 2 to the central computer device 3. In the method of the present invention the local computer devices 10 of each geographical location 1 transfer the second set of characteristics of the respective traps 8, 9 of via network 2 to the central computer device 3.

The second set of characteristics includes the characteristics of the first set of characteristics and comprise the following additional characteristics: location characteristics such as the geographical location 1 of the warehouse 4 and the location of the trap 8, 9 within the warehouse 4 as well as a flag indicating whether the trap 8, 9 is located inside or outside a netting 6, a time stamp indicating the time the first set of characteristics has been transferred to local computer device 10, the size of the warehouse 4, the number of nettings 6 used within the warehouse 4 and the pesticide used in connection with nettings 6.

Central computer device 3 comprises an interface 20 to network 2 such as the internet. By means of this interface 20 characteristics of the traps 8, 9 are transferred from the local computer devices 10 of the geographical locations to the central computer device 3.

Furthermore, central computer device 3 comprises a communication unit 22 that includes a filter unit 21 for filtering the access of the local computer devices 10 to data of the central computer device 3. The filter unit 21 may comprise an authentification unit

by which a local computer device 10 that is connected to the central computer device 3 by the network 2 may be authentificated. For example filter unit 21 comprises storage for storing passwords of different entities. The filter unit 21 may provide access for a local computer device 10 that has transferred a particular password only to particular data of the central computer device 3 that are associated with this entity.

Communication unit 22 manages on the one hand the access of local computer devices 10 to data of central computer device 3 and on the other hand transfers warnings and notifications to local computer devices 10 as described later. Instead of transferring such notifications and warnings to local computer devices 10 the communication unit 22 may also provide access for particular local computer devices 10 to such notifications and warnings.

Central computer device 3 further comprises an analyzing unit 19 that is connected to the communication unit 22 for analyzing the characteristics of the traps 8, 9 that have been transferred from all local computer devices 10 of the plurality of geographical locations 1-1 to 1-7.

The analyzing unit 19 generates a general analysis for geographical locations 1 of different entities, preferably for all geographical locations 1. Furthermore, the analysing unit 19 generates a specific analysis for the geographical location 1 of at least one entity. Alternatively or in addition, a specific analysis for the geographical locations 1 of at least one entity is generated. Furthermore, specific analysis for the geographical locations 1 of each entity is generated by the analyzing unit 19. When generating these analyses, the analyzing unit uses the characteristics of the traps 8, 9 that have been transferred to the central computer device 3 partly or in total.

By means of the data of the characteristics of the traps 8, 9 of all geographical locations 1 it is possible to monitor and track the infestation of harmful organisms inside the warehouses 4 of all geographical locations 1 and of the crops that are protected by nettings 6 in particular the infestation of harmful organisms and the product performance of the covers 6 can be monitored in real time and online by accessing the central computer device 3. Therefore, the ability to manage the use of the covers 6 and the operations of the warehouses 4 is enhanced. Furthermore, it is possible to monitor the

potential occurrence of resistances of harmful organisms against the protective activity of the covers 6.

Moreover, the efficiency of a netting 6 is analyzed by the analyzing unit 19. For this purpose, the analyzing unit 19 calculates the difference of the number of pests caught by the trap 8 that is arranged inside the associated netting 6 and the number of pests caught by the trap 9 that is arranged outside the associated netting 6. The development of this difference is monitored over the time. If, for example, this difference increases, the analyzing unit 19 concludes that the corresponding netting 6 is not efficient any more and should be replaced. Furthermore, the analyzing unit 19 may conclude that the netting 6 comprises a leakage, such as a hole or the like. Furthermore, the analyzing unit 19 may compare the development of the above-mentioned difference over the time of one netting 6 with another netting 6 or all other nettings 6. If only for one particular netting 6 this difference increases it is highly probable that a failure of this particular netting 6 has occurred.

The notifications and warnings that are generated by the central computer device 3 may be related to any conclusions that are drawn from the monitoring of the crops. For example, it may be indicated that a cover 6 should be replaced, that more covers 6 or less covers 6 shall be used or that the covers 6 may be larger or shall be smaller. Furthermore, it may be indicated that it is not necessary that all packets 5 of crops need to be protected by covers 6 or even that the crops stored in particular warehouses 4 need not be protected by covers 6, for example, if there is only minor infestation of harmful organisms in the surrounding of this particular warehouse 4.

As described above, the local computer devices 10 may access the central computer device 3 by means of network 2 such as the internet. Therefore, a web based tool can be provided that can assist the entities in the management of the protection of the stored crops. However, by the filter unit 21, the system and the method guarantees that one entity can not access confidential characteristics of the traps 6 or warnings or notifications of another entity that may be a competing company. However, all entities take advantage of the analyses that are generated by the analyzing unit 19 of the central computer device 3 based on characteristics of trap 6 of different entities.

The general analysis as well as the specific analyses may comprise reports showing pest counts with and without the use of covers 6 for protecting the crops. Furthermore, these reports may show the results for different types of covers 6. Therefore, the method and the system facilitate to control pest infestation as well as prevent pest infestations. In addition, the performance of cover 6 can be tracked, the life cycle of the covers 6 can be valuated and advice may be generated for the use of particular cover 6.

Furthermore, an automatic customer service may be provided for the operators of the warehouses 4 at the geographical locations 1. Based on the characteristics of the traps 8 and/or 9 notifications may be generated and transferred to a computer device of a customer service automatically. The notification indicates a service that needs to be carried out with a particular cover 6 of a warehouse 4. For example, it may be indicated that the cover 6 needs to be replaced or that another cover 6 that is effective for another type of pests needs to be arranged to cover crops stored at that geographical location 1. In response to such notification the customer service will carry out the service for the warehouse 4.

According to another embodiment of the method of the present invention only crops stored at different compartments within one warehouse 4 are monitored. The compartments may be the packets 5 that have been described with reference to Fig. 2. Therefore, different packets 5 are separated from each other. All of the packets 5 or a subset of the packets 5 are covered by the covers 6. The covers 6 are impregnated with a pesticide as described with reference to Fig. 2. Furthermore, traps 8 and 9 are arranged at least inside, preferably inside and outside of covers 6. The traps 8 and 9 are adapted to capture harmful organisms such that the caught harmful organisms can be counted as described with reference to Figs. 2 and 3.

Characteristics of the traps 8 and 9 are transferred to the local computer device 10. For example, the first set of characteristics is transferred as described above. Therefore, at least one of the characteristics of the first set of characteristics is transferred by an optical, a wireless and/or an electronic interface from the traps 8, 9 to the local computer device 10. The characteristics of the traps 8, 9 may then be analyzed within the local computer device 10. For this analysis further characteristics of the traps 8, 9 may be used that are stored within the local computer device 10. Alternatively, the characteristics may be transferred from the local computer device 10 to central computer device 3.

For example, a second set of characteristics as described above is transferred to central computer device 3 via network 2. Central computer device 3 then analyses the transferred second set of characteristics as described above.

Furthermore, the efficiency of a cover 6 may be analyzed based on the difference of the number of harmful organisms caught by associated traps 8 and 9 located inside and outside a cover 6 as described above with respect to the first embodiment of the method and the system of the present invention.

List of reference signs

1, 1-1 to 1-7	geographical location
2	network, internet
3	central computer device
4	warehouse
5, 5-1 to 5-3	packets with tobacco
6, 6-1 to 6-3	netting, cover
7	ropes
8	traps
9	traps
10	local computer device
11	interface
12	wireless local area network interface
13	opening
14	unit for capturing pests
15	unit for counting caught pests
16	wireless local area network
17	label with bar code
18	mobile reading device
19	analyzing unit
20	interface
21	filter unit
22	communication unit

Claims

1. Method for monitoring crops and/or infestation of crops with harmful organisms during storage comprising

   – storing the crops of a plurality of entities at different locations being geographically remote from each other,

   – at each geographical location, covering the crops with at least one cover which has a protective activity against said harmful organisms,

   – at each geographical location, arranging at least one trap for the harmful organisms inside and/or outside the cover, said trap is adapted to capture the harmful organisms such that the caught pests can be counted,

   – transferring a first set of characteristics of the trap to a local computer device of said geographical location and transferring a second set of characteristics of the trap via a network from the local computer devices of each geographical location to a central computer device,

   – at the central computer device, analyzing the characteristics of the trap that have been transferred from the local computer devices and generating a general analysis for geographical locations and/or a specific analysis for the geographical locations of at least one entity, and

   – providing access for the local computer devices to the analysis of the central computer device whereby the access is filtered so that the local computer devices of a particular entity may only access the general analysis and/or the specific analysis for the geographical locations of this particular entity.

2. Method of claim 1, wherein the general analysis is generated so that one entity cannot obtain knowledge of the characteristics of the traps of another entity.

3. Method of claim 1, wherein notifications are generated based on the characteristics of the traps, said notifications are provided to at least one of the local

computer devices and/or a computer device of a customer service for at least one of the geographical locations.

4. Method of claim 1, wherein warnings are generated based on the characteristics of the traps at different locations of more than one entity, said warnings are provided to local computer devices of all or some of the plurality of entities.

5. Method of claim 4, wherein the warnings are generated so that one entity cannot obtain knowledge of the characteristics of the traps of another entity.

6. Method of any one of the preceding claims, wherein the efficiency of the covers is analyzed and failure of covers is detected based on the characteristics of the traps at the central computer device.

7. Method of any one of the preceding claims, wherein for at least one cover at least one trap is arranged inside said at least one cover and at least one trap is arranged outside said at least one cover.

8. Method of claim 7, wherein the efficiency of said at least one cover is analyzed based on the difference of the number of harmful organisms caught by said at least one trap that is arranged inside said at least one cover and the number of harmful organisms caught by said at least one trap that is arranged outside said at least one cover.

9. Method of any one of claims 6 to 8, wherein the central computer device automatically generates and transfers notifications to the local computer devices that indicate that a cover should be replaced or repaired based on the characteristics of the traps.

10. Method of any one of the preceding claims, wherein different types of covers are used at different locations and wherein the central computer device automatically generates notifications for the local computer devices that indicate the efficiency of a particular type of cover against a particular harmful organism based on the characteristics of the traps.

11. System for monitoring crops and/or infestation of crops with harmful organisms during storage comprising

– storage depots for the crops at different locations being geographically remote from each other,

– a plurality of covers that cover the crops at each geographical location, said covers have a protective activity against harmful organisms,

- at least one trap for the harmful organisms that are arranged inside and/or outside the covers at each geographical location, said trap is adapted to capture the pests such that the caught pests can be counted,

– a local computer device at each geographical location,

– an interface for transferring characteristics of the trap from the trap to the local computer device of said geographical location, said characteristics include for each trap the current number of harmful organisms caught by said trap,

– a network for transferring characteristics of the trap from the local computer devices to a central computer device,

– an analyzing unit at the central computer device for analyzing the characteristics of the trap that have been transferred from the local computer devices and for generating a general analysis for geographical locations and/or a specific analysis for the geographical locations of at least one entity, and

– a communication unit for providing access for the local computer devices to the analysis of the central computer device comprising a filter unit for filtering the access so that the local computer devices of a particular entity may only access the general analysis and/or the specific analysis for the geographical locations of this particular entity.

12. System according to claim 11, wherein the analyzing unit is adapted to detect the efficiency of the covers and failure of covers based on the characteristics of the traps.

13. System according to claim 11 or 12, wherein for at least one cover at least one trap is arranged inside said at least one cover and at least one trap is arranged outside said at least one cover.

14. System according to claim 13, wherein the analyzing unit is adapted to analyze the efficiency of said at least one cover based on the difference of the number of harmful organisms caught by said at least one trap that is arranged inside said at least one cover and the number of harmful organisms caught by said at least one trap that is arranged outside said at least one cover.

15. System according to any one of claims 11 to 14, wherein the central computer device is adapted to automatically generate and transfer notifications to the local computer devices that indicate that a cover should be replaced or repaired based on the characteristics of the traps.

16. System according to any one of claims 11 to 15, wherein the cover is a netting.

17. System according to any one of claims 11 to16, wherein the cover is a netting impregnated with a pyrethroid insecticide.

18. Use of the system according to any one of claims 11 to 17 for monitoring tobacco, tobacco bales, other tobacco products, dried fruit, nuts, cocoa, cereals, rice, legumes, cotton, vegetables, herbs and/or fruit plants.

FIG.1

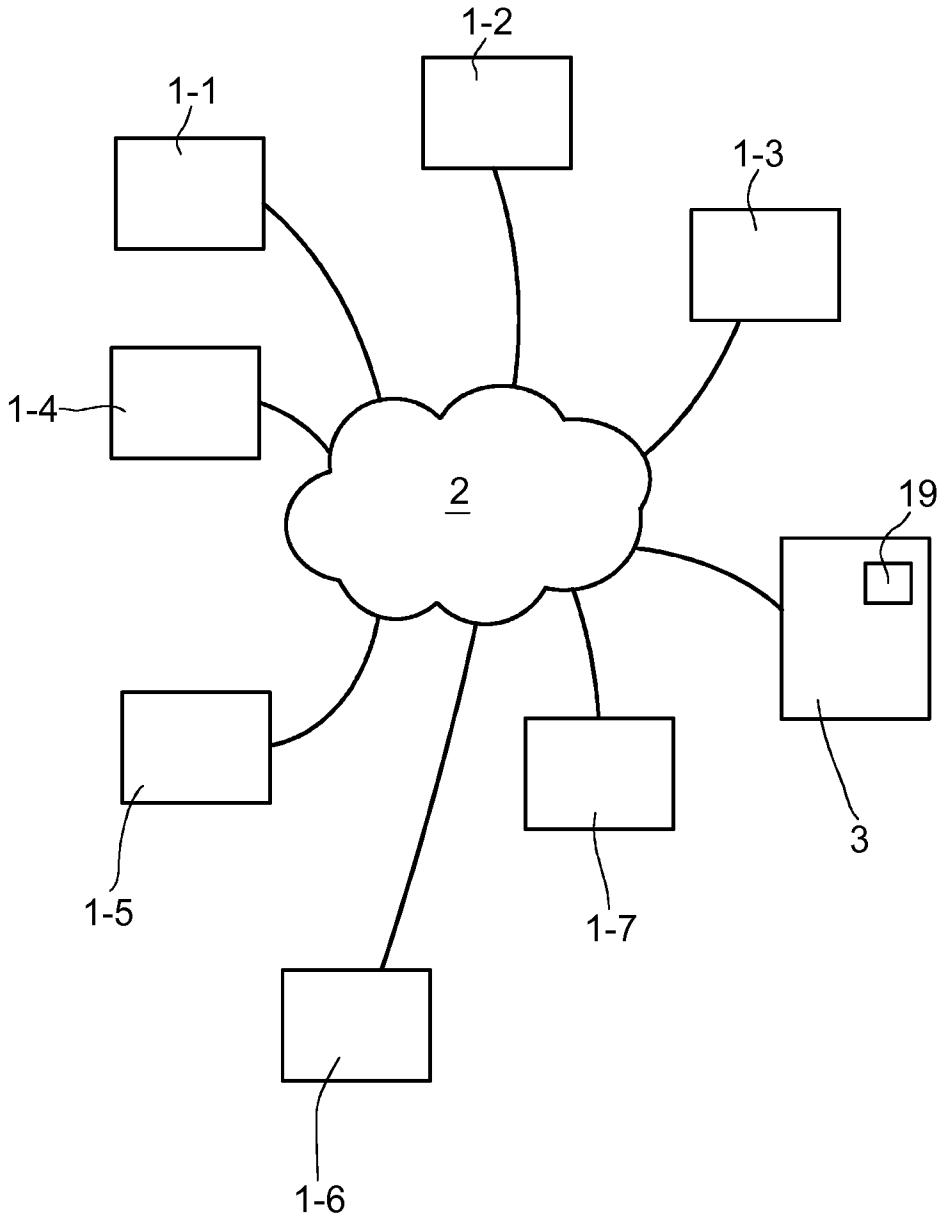


FIG.2

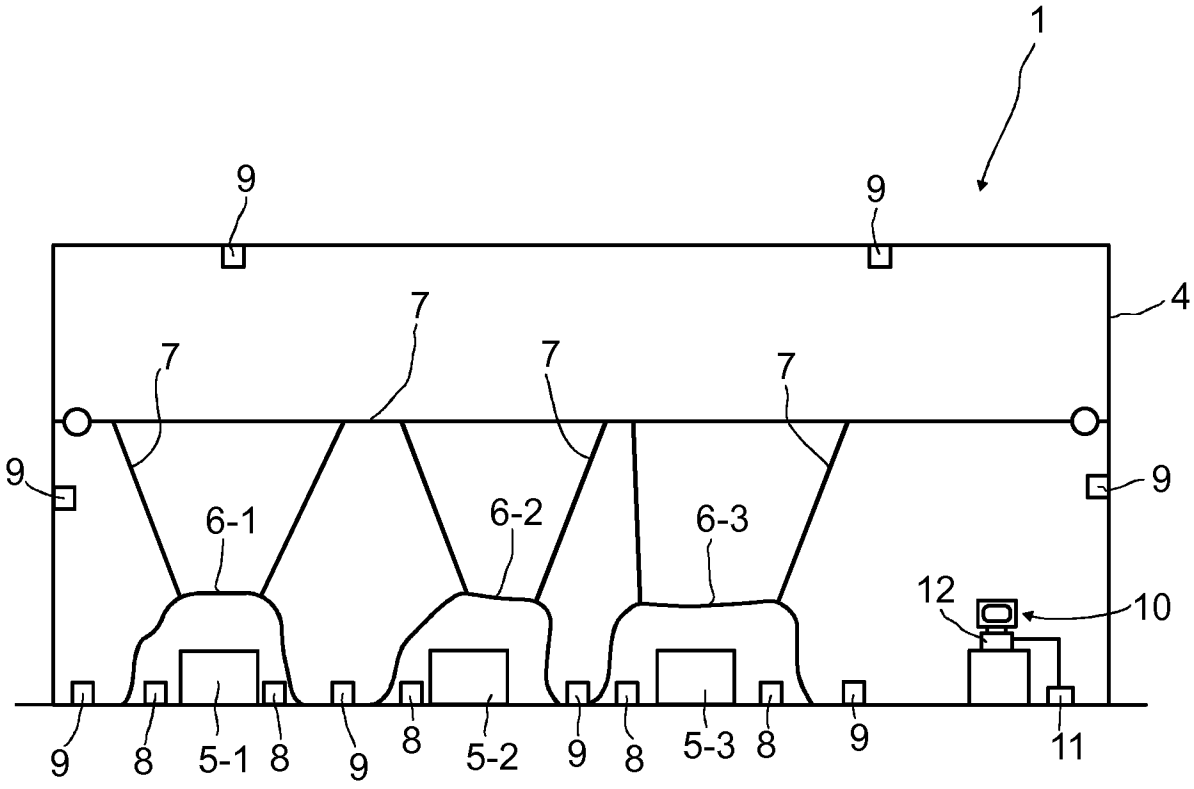


FIG.3

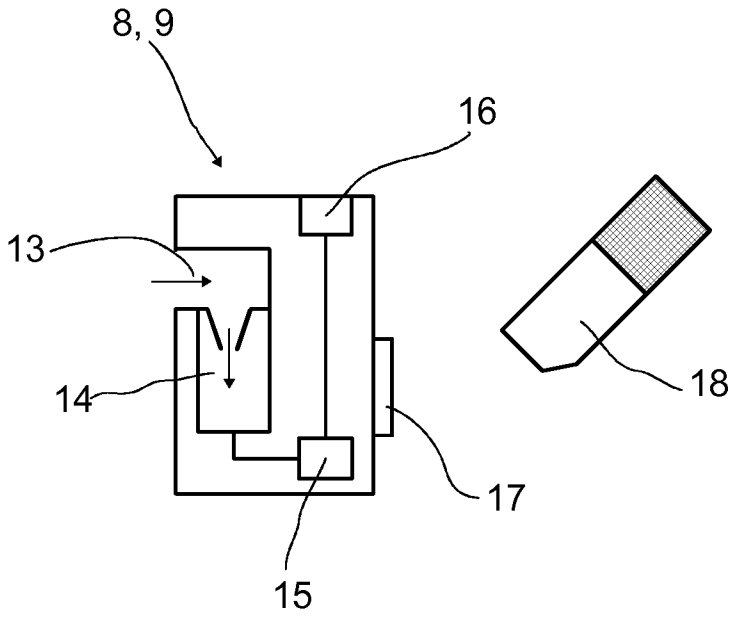
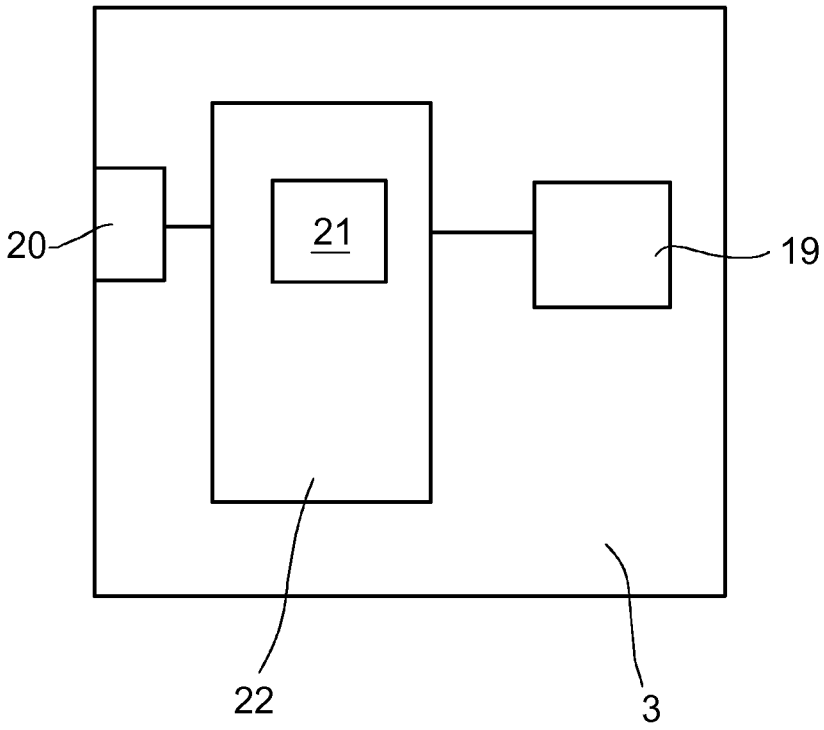


FIG.4



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/073977

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01N25/34 A01N25/10 A01N53/00 A01G13/10 A01M23/08
A01M1/02 AOIMl/10 A01M29/34
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01M A01G A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007/144401 A2 (BASF AG [DE] ; LEININGER HARTMUT [DE] ; HUFF JUERGEN [DE] ; KARL ULRICH [) 21 December 2007 (2007-12-21) claims 1-4	1-5 ,7,8, 11, 13-18
Y	US 5 005 416 A (VICK KENNETH W [US] ET AL) 9 April 1991 (1991-04-09) column 3 - column 9; figures 1,6,8-10	1-5 ,7,8, 11, 13-18
Y	WO 03/084320 Al (EC0LAB INC [US]) 16 October 2003 (2003-10-16) page 3 - page 17; figures 1-6	1-5 ,7,8, 11, 13-18
Y	US 2011/109460 Al (LLOYD JEFFREY D [US] ET AL) 12 May 2011 (2011-05-12) paragraph [0025] - paragraph [0091] ; figures 1-21	1-5 ,7,8, 11, 13-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 February 2013	01/03/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Moeremans , Benoit

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

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