ECOLOGY, BIOTECHNOLOGY, AGRICULTURE AND FORESTRY

IN THE 21ST CENTURY

PROBLEMS AND SOLUTIONS

EDITED BY
S.STANKEVYCH, O.MANDYCH

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The monograph is a collection of the results of scientists' achievements obtained directly in real conditions. The authors are recognized specialists in their fields, as well as young scientists and graduate students of Ukraine. The studies are conceptually grouped in sections: biotechnology, ecology, agriculture, forestry, sustainable development of the economy and the principles of effective agribusiness. The monograph will be of interest to specialists in biotechnology, ecology, breeding, plant protection, agrochemistry, soil science, forestry, agribusiness, etc., researchers, teachers, graduate students and students of specialized specialties of higher educational institutions, as well as everyone who is interested in sustainable development in the agricultural sphere and Green Deal Implementation strategies.

Keywords: sustainable development, modern technologies, agricultural production, biotechnology, ecology, plant protection, forestry, agribusiness.

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MASS BREEDING TECHNOLOGY OF THE PREDATORY MITE PHYTOSEIULUS BY THE BOX METHOD AND ITS APPLICATION IN PLANT PROTECTION

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The predatory mite *Phytoseiulus persimilis* Athias-Henriot belongs to the Phytoseiidae family of the free-living gamasid mite subfamily Parasitiformes. Under the natural conditions, phytoseiulus lives in warm coastal areas of Chile, Algeria, Lebanon, Italy, southern France, and Australia. In 1958, it was accidentally imported on orchid roots from Chile to Germany. From where it has already been specially delivered to many countries, including the former Soviet Union. In film shelters, greenhouses, winter gardens and in indoor conditions on windowsills, phytoseiulus is successfully used with a very dangerous pest – spider mite. It is also used in the open ground on strawberries, berry bushes during the period when night temperatures are not less than 10-12 ˚C. The classic technology of phytoseiulus mass breeding in industrial biological laboratories includes a

number of technological processes: preparation of a room for mites breeding; cultivation of fodder plants for spider mites; breeding of spider mites; breeding of phytoseiulus; collecting and storage of phytoseiulus. Mass breeding of phytoseiulus is carried out year-round on spider mites, which are propagated on plants of soybeans, beans, fodder beans, corn, cucumber, etc. In this article, the authors ground the box method of mass breeding of phytoseiulus.

Key words: *Phytoseiulus persimilis* Athias-Henriot, *Tetranychus urticae* Koch., biological protection of plants, biotechnology, mass breeding technology, box method.

Introduction

The predatory mite *Phytoseiulus persimilis* Athias-Henriot belongs to the Phytoseiidae family of the free-living gamasid mite of Parasitiformes order.

Phytoseiids are microscopic mites (0.2–0.8 mm), in the Palearctic no more than 0.6 mm. The dorsal scutellum of the idiosome is covered with 25–36 pairs of setae (a minimum number of 14 pairs was observed in representatives of the genus *Amblyseiulella*) in Palearctic forms. The body is oval in shape, divided into two parts: gnathosoma and idiosome (the latter, as a rule, with one dorsal scutellum). The gnathosoma is a complex of oral parts, and the idiosome is the entire rest of the body, carrying 4 pairs of walking limbs.

Predators of other types of mites and some small insects. They can eat up to 20 phytophagous mites per day. They are connected with land plants and soil. In the fauna of Ukraine, most species are related to plants (about 100 species belonging to 18 of the 32 genera of three subfamilies known in the Patearctic), and geobionts are represented in only 4 genera of the Amblyseiini tribe (*Ambiyseius, Amblyseiulus, Xeoseiuhis, Chelaseius*). Geobiont species have the most ancestral features that bring them closer to their ancestral forms: a smoother surface and larger dorsal scutella covering most part of the idiosome; in general, larger body size; dense sclerotization; reduced number of setae (in Palearctic species on the dorsal side of the idiosome, there are up to 23 pairs of them).

These predatory mites are natural regulators of the number of different phytophages groups in natural and man-made plant associations. The most highly effective types of phytoseiids are intensively used in the biological protection of plants in both open and closed ground conditions.

Fig. 1. Predatory mite *Phytoseiulus persimilis* Athias-Henriot and its feeding on spider mites
(http://nsau.edu.ru/images/people/lra/middle-middle-color-center-center-1-0-0-1446306449.673.jpg)

More than 2 thousand species are described, grouped into 70 genera (https://ru.wikipedia.org/wiki/Phytoseiidae).

The body size of acariphage is about 0.5 mm. The body colour varies from orange-red to dark red, sometimes cherry (fig. 1).

The eggs are oval, milky white in colour with a yellowish-orange tint, measuring 0.18 × 0.21 mm. They differ well from smaller (0.14 mm) and spherical eggs of a spider mite. Eggs of acariphage are more demanding of hydrothermal conditions than larvae, nymphs, and adults. The six-legged larva is yellowish-orange in colour. The body size is 0.17-0.20 mm. The

larvae are slow-moving and do not feed (http://www.biotech-systems.ru/ru/production/entomophages-and-acariphages/phytoseiulus-persimilis/).

Mating begins after the last molt of the nymph. Fertilized females lay their eggs among pest colonies, attaching them to webs or directly to the leaf surface. Predator eggs differ from spider mite eggs in their oval shape, pale pink colour, and bigger size (fig. 1). From the eggs, six-legged larvae are hatched, which live at the expense of the embryonic yolk. The larva locates near the abandoned egg shell and goes into a dormant state, which ends in molting.

After the first molt, an eight-legged protonymph (nymph of the first age) appears, feeding mainly on pest eggs, consuming 5-7 pieces during the development period (one day). After finishing feeding, the protonymph molts and turns into a daytonymph (nymph of the second age). It differs from the previous phases in its extreme mobility and voracity, destroying 9-16 eggs during the development period (one day). The development cycle ends with the appearance of an adult mite.

Predator has no diapause in its life cycle and develops all year round. However, its development is greatly influenced by temperature and relative humidity. It takes 4.9 days to fully complete one predator generation at 30 °C, 5.5 days at 27 °C, 6.0 days at 25 °C, and 49 days at 10 °C. At the same temperatures, the phytoseiulus develops on average 1.5–1.9 times faster than its victim – a spider mite.

Predator is especially demanding of external conditions during embryonic development. For the development of acariphage, the most favorable temperature is 25...26 °C. At a constant temperature of 35–37 °C, its eggs do not develop. Larvae, nymphs and adult mites are less demanding of temperature conditions. They develop satisfactorily at a temperature of 13–33 °C, and for a short time (3–4 hours).) its increasing even to 40–42 °C does not affect their development, but when it decreases to 7 °C, the development of acariphage stops.

Phytoseiulus is a hygrophilic species, so its development, voracity and fertility are significantly affected by the level of relative humidity in the air. So, at a humidity of 50 %, predator eggs dry out, at 60 % – egg development is possible only at high temperatures. Young and adult mites are more resistant to lower humidity and develop normally at 60 %. At a relative humidity of 25–35 %, regardless of the temperature, phytoseiulus cannot develop. For the development of a predator, the optimal relative humidity is 70–80 %.

The high voracity of phytoseiulus is fully manifested in optimal conditions and depends on the relative air humidity: when it increases, the amount of consumed food decreases. Thus, at a temperature of 25 °C and humidity of 50–70 %, one female destroys 21–23 spider mite individuals every day in different phases of its development (fig. 1). At the same temperature, but with an air humidity of 98 %, the predator destroys 11 individuals of the victim.

The fertility of female predatory mites depends on several factors. As humidity decreases, the number of laid eggs decreases. At a temperature of 25 °C and a relative humidity of 30, 50.70–98%, the daily fertility of female phytoseiulus is 0.8, 1.3 and 4.3 eggs, respectively.

The biological parameters of the phytoseiulus, at other equal conditions (temperature, humidity), largely dependent on the species of fodder plant on which the spider mite feeds. When breeding of phytoseiulus on a spider mite that developed on soybean, its fertility averages 69.1 eggs, on a rose – 59.6, on a chrysanthemum – 45.1 and on a clove – 32.5 eggs. A similar tendency is observed with the lifetime of females and the duration of the egg-laying period, which are maximal during the breeding of the victim on soybean and consistently decrease from rose to carnation.

The sex ratio is usually 1 : 4 in favor of females (http://www.biotech-systems.ru/ru/production/entomophages-and-acariphages / phytoseiulus-persimilis/).

During the development of eggs, larvae, proto- and deutonymphs, the natural mortality rate of the predator is observed only in the egg phase and is 2.5 % for soybean, 5.4 % for rose, 11.6 % for chrysanthemum and 14.5 % for carnation.

The voracity of acariphage on all crops with different lifetime is relatively the same and in terms of the number of eaten eggs ranges from 270 to 340 pieces.

At the same time, for each laid egg, the female phytoseiulus eats 4.0 spider mite eggs on soybean, 4.6 on rose, 7.4 on chrysanthemum, and 9.1 on clove.

From a practical point of view, the topics of predator population growth on various fodder plants are of the greatest interest. It was found that during spider mite feeding on soybean, the population of phytoseiulus increases by 28 times on the 10th day, on roses by 20, on chrysanthemums – by 16, and on carnations only 11 times. Therefore, under the same conditions for reproduction and equal pest numbers, the acariphage population on a rose will increase almost 2 times faster than on a carnation.

This fact should be taken into account when using phytoseiulus on various crops as well as when choosing a fodder crop during mass breeding of phytoseiulus.

Being a specialized predator of spider mites, phytoseiulus cannot remain for a long time on plants that are free of its victim, and soon (in three to four days) dies (Bilyk, 2012).

Under the natural conditions, phytoseiulus lives in warm coastal areas of Chile, Algeria, Lebanon, Italy, southern France, and Australia (Bilyk, 2012).

In 1958, it was accidentally imported on orchid roots from Chile to Germany. From where it has already been specially delivered to many countries, including the former Soviet Union (http://fontgarden.ru/sad/179-fitosejulyus).

In film shelters, greenhouses, winter gardens and in indoor conditions on windowsills, phytoseiulus is successfully used with a very dangerous pest – spider mite.

It is also used in the open ground on strawberries, berry bushes during the period when night temperatures are not less than 10–12 °C (the lowest threshold for the development is 7 °C) (http://fontgarden.ru/sad/179-fitosejulyus).

Materials and methods

By processing domestic and foreign information sources and on the base of own experience gained during plant protection works, the authors have developed an improved technology for mass breeding of the predatory mite phytoseiulus by box method, a technological map of predator mass reproduction has been developed, and a technology for its use in the biological protection of plants from spider mites have been proposed.

Results and discussion

By food specialization, phytoseiulus is a typical oligophagus. It feeds on representatives of the spider mite family (two-spotted spider mite, garden spider mite, hawthorn spider mite, etc.). There is information about the predator's ability to destroy the species *Bryobia lagodechiana* (on the early stages) and *Panonychus citri*. The victim is completely sucked out. Phytoseiulus can feed on mites both in the active phases of their development and on their eggs. Females of phytoseiulus destroy up to 30 eggs daily or up to 25 individuals of the pest of later phases of its development. It is better to eat new-laid eggs of the victim.

When feeding on diapause females of the spider mite, the predator destroys 4-5 female pests per day, but the acariphage's fertility decreases. Without food, female predators die in 4 days. Adult predators with an excess of victim destroy mainly adult pests and larger nymphs, leaving some of the nymphs, larvae and eggs to feed the larvae of their own offspring. After destroying the main part of the pest colony, adult mites migrate to other leaves inhabited by spider mites, where they lay eggs again and continue their activities.

Nymphs of acariphage almost completely abolish the remains of the pest colony and also move to other leaves in search of food. Phytoseiulus is an aggressive predator that is largely adapted to living colonies of spider mites which are highly spun with spider's web. Thanks to morphological adaptations, long dorsal setae and specially arranged praetarsus of limbs, mites are able to slide between the threads of the web without getting tangled in it. Cannibalism in phytoseiulus is poorly expressed (http://planeta2012.com.ua/produktsiya/biologicheckie-agenti/101-pomoshniki-klechi?start=2).

Due to the constantly growing demand for environmentally friendly products, phytoseiulus is becoming increasingly popular, which stimulates the necessity of predator's mass breeding.

The classic technology of mass breeding of phytoseiulus in industrial biological laboratories includes a number of technological processes:

1) preparation of the room for mites breeding;
2) growing fodder plants for spider mites;
3) spider mites breeding;
4) breeding of phytoseiulus;
5) collecting and storage of phytoseiulus (Bilyk, 2012).

A biological laboratory for mass breeding of a predator can be created in any heated room where the air temperature can be maintained within 20...25 °C, and the relative humidity is not lower than 70 %. Practice has shown that it is most advisable to use specially built winter greenhouses, which are placed at a certain distance from the main production greenhouses, in order to prevent unwanted entering of spider mites the production plantings of vegetable crops. Depending on the time of year, spring greenhouses under film or glass can also be used for this purpose. In summer, for example, when the air temperature does not fall below 10–15 °C, it is more expedient to propagate acariphages in spring greenhouses under a film, because they are not inferior in productivity to winter ones at this time, and the cost of phytoseiulus is significantly reduced. Mass

breeding of predatory mites is often organized on a section which is isolated from the production greenhouse, but at the same time the entrance to it is separated.

Continuous, stable getting a predator in such a biological laboratory is possible only with the correct organization and clear sequence of performing the main technological elements of acariphage breeding. The size of the greenhouse of the biological laboratory is determined for every specific case, based on the volume of greenhouse areas planned for biological protection against spider mites. Currently, the following approximate standards have been adopted when planning the size of the greenhouse of a biological laboratory (breeding), depending on the volume of areas intended for biological plants protection from spider mites. So, when protecting cucumbers in winter greenhouses, the area of such a greenhouse should be about 1 %, and in spring greenhouses – 0.5 % of the area planned for biosecurity.

Approximately 10 % of the area of the breeding greenhouse is allocated for breeding of the mother crop of spider mites. This part of the greenhouse is carefully isolated from its main part in order to prevent unauthorized penetration of phytoseiulus into it, since this can lead to an early termination of the biological laboratory as a result of the destruction of the mother culture of spider mite by a predator.

The remaining area of the greenhouse is divided into seven equable sections on which fodder plants are grown. Plants can be grown both directly in the ground and in boxes, the height of the side walls of which is 25–30 cm, on racks. Of great importance is the rational placement of racks in the greenhouse. Racks are made of boards in the form of decking on props with a height of 60 cm. The width of the side racks of the greenhouse should not exceed 60–70 cm, the middle ones – 120 cm. The width of the aisles between the racks is about 120 cm, and at the ends – 50 cm. The distance from the side wall of the outermost racks to the side cover of the greenhouse should be about 40 cm. The length of the racks is determined by the size of the greenhouse.

When using racks in winter, it is easier to maintain optimal conditions for plants and mites, since no underground heating is required. To organize a kind of conveyor for obtaining a predator during the entire growing season of cucumber plants, seeds of fodder crop are sown at each of the seven sections at intervals of five to seven days.

Accounting for the quantity of phytoseiulus is carried out by calculating its absolute number on test plants with further interpolation of

the average value for the entire area of the surveyed rack or section. To obtain a satisfactory level of probability of conducted accounting of acariphage, at least 20 plants must be taken for counting from each square meter of the accounting area. Due to the fact that when calculating phytoseiulus, on average, about 3 hours are spent on an area of 10 m^2, it is not difficult to calculate the total cost of working time associated with performing this operation.

There is a method of accounting for a predator using a special separator, the use of which significantly reduces the unproductive cost of working time associated with estimating the number of acariphages.

The technological map of phytoseiulus mass breeding includes the following main stages:

Stage 1. Preparation of the room. The area of the greenhouse for spider mites breeding is divided into four to five sections to create a green conveyor. The timing of sowing seeds and the number of sections in the conveyor is determined by the seasonal need for the number of phytoseiulus. As a rule, sowing seeds on separate sections is carried out in six to seven days. It should be kept in mind that with this technology, there are no sections for phytoseiulus breeding in the greenhouse, and plants are cut during the period of the greatest number of spider mites on them, so the total area of the breeding greenhouse is reduced by a third of the usual one.

Stage 2. Growing a fodder plant (soybean) for spider mites. With this method of predator breeding, soybean plants not only accumulate a large number of spider mites, but also thanks to the fibrous stems of the crop, good conditions are created for aeration of the cage, and the plants retain their fodder suitability when placed in the cage during the seven days. Sowing soybean seeds and caring for plants is the same as described above.

Stage 3. Breeding of spider mites. 15–20 days after sowing, fodder plants (the phase of three or four real leaves) are populated with spider mites at the rate of 40-50 individuals per plant. The accumulation of spider mites on soybean plants by the time they are cut continues until clearly visible marbling appears on the leaves (10–15 days after the mites' colonization). Sections allocated for spider mites breeding can be used again for growing soybeans in 30–35 days.

Stage 4.Breeding of phytoseiulus is carried out in a rectangular insect vivarium (box) made of transparent material (organic glass), with a bottom and a cone-shaped or flat roof (fig. 2).

The dimensions of the structure are 30 × 30 × 60 cm. In the center of the roof there is a neck with an adapter. The adapter corresponds to the size

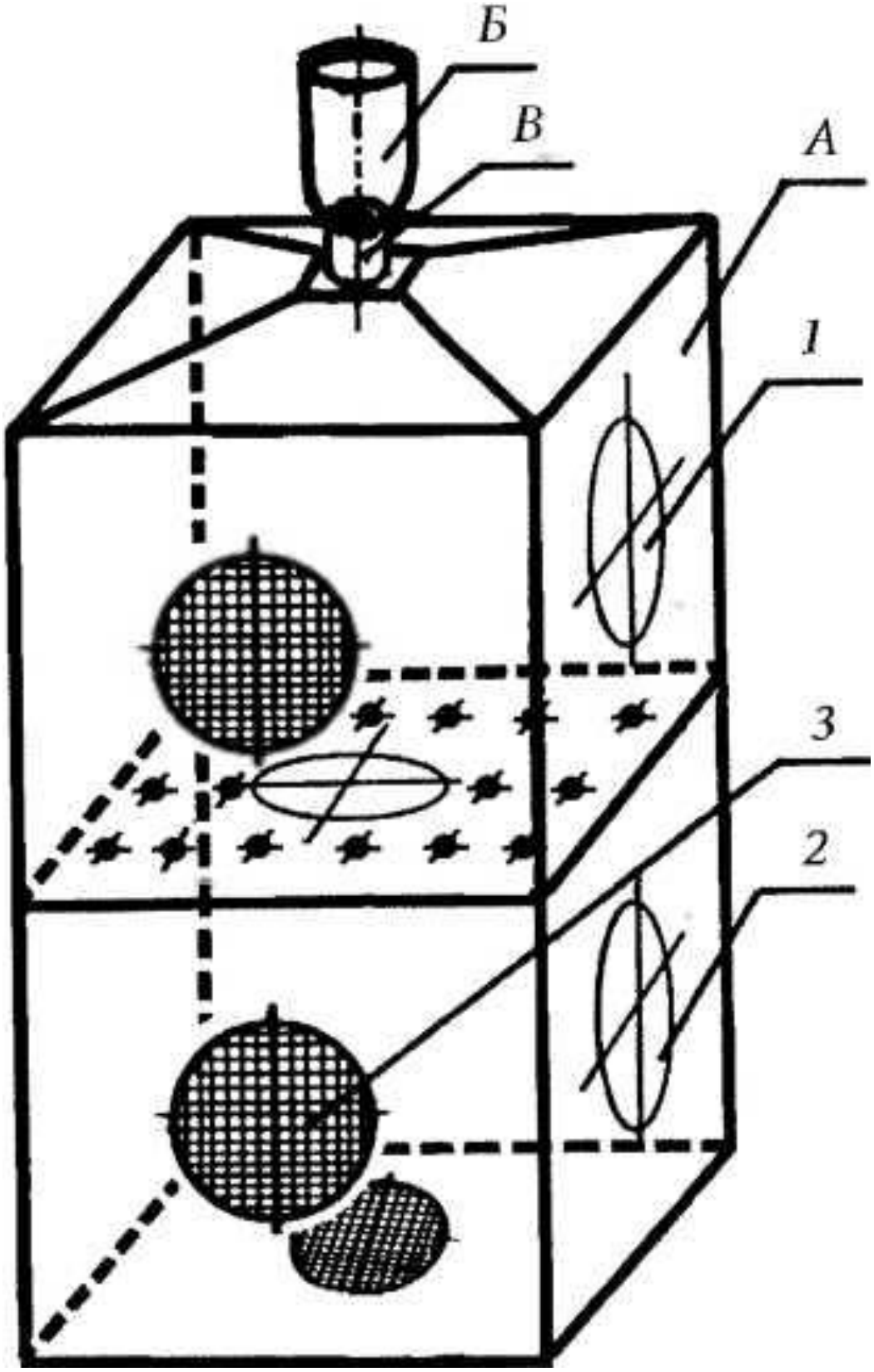

Fig. 2. Vivarium box for phytoseiulus breeding: *A* –vivarium case: 1) loading hole; 2) unloading hole; 3)ventilation hole; *B* – vivarium-receiver; *C* – adapter (according to M. O. Bilyk, 2012)

of the neck of the vivarium-receiver, which is a glass jar with a capacity of 0.5-3.0 liters. In the walls of vivarium there are two holes with a diameter

of up to 20 cm, through which plants are loaded and removed. These holes are tightly closed with lids. Five holes with a diameter of 15 cm, tightened with nylon net (No. 55), provide aeration of the vivarium. The area for ventilation should be 15–20 % of the total area of the vivarium walls. Inside, the vivarium box is divided into two identical parts by a horizontal partition, which has a hole with a diameter of 15 cm in the center and many holes with a diameter of 1 cm over the entire surface. The bottom of the box has four legs with a height of 5 cm. When breeding a predator, the box is placed in a tray with water, the holes are covered with lids, the neck is covered with a thick cloth. In a room with a vivarium, the temperature should be maintained at the level of 26...28 °C and relative humidity at 40–60 %.

To feed the phytoseiulus, plants on which the damage to the leaves by a spider mite is 70–80 % of the surface are cut. Soybean plants cut under the root with a spider mite are carried to the predator breeding room and the

upper part of the vivarium is filled through the loading hole of 1/3 of the volume. Plants are laid out in an equable friable layer, phytoseiulus is settled at the rate of 1,000 adults per a vivarium. To feed the predator, new plants with the same amount of spider mites are carried in every two days.

Mobile phases of the phytoseiulus (nymphs and adults) migrate to fresh plants, and predator and victim's eggs remain in the lower layer, serving as food for acariphage larvae which are hatching. If phytoseiulus accumulates near the neck of the vivarium, the amount of feed must be increased.

Five days after the start of phytoseiulus breeding, plant remnants are redistributed. To do this, one opens the unloading hole and transfers the first laid layer of plants to the lower part of the box. In the same way, they act before each subsequent "feeding" of the acariphage. Plant remnants from the lower cage of the box are removed every two-three days, when the larvae of the phytoseiulus hatched from the eggs move to the plants with the victim in the upper part of the box. The breeding cycle of phytoseiulus in the box lasts 14 days. During this period, its number increases 30–40 times.

Stage 5. Collecting phytoseiulus. Two or three days before the acariphage is collected, the predator is not given food. It, if the ratio of its and its victim approaches 1 : 1, leaves the plants and migrates up. On the opening with an adapter in the roof of the vivarium box, install a cage-receiver (a glass jar with a capacity of 1.0 liters) with the neck down. To prevent the acariphage from spreading, the gap between the jar and the receiver wall is sealed with an adhesive plaster. When phytoseiulus accumulates in the cage-receiver (the walls of the jar are completely covered

with mites), it is replaced with another one (four to five times) until the complete collection of mite. Each jar is then filled with 50–100 cm^3 of crumbly substrate (bran). Mix the substrate in a circular motion and collect the mites from the walls of the jar. The contents of all jars are strewed into one container and the volume is adjusted to 1 liter. From the received mixture, three or four samples of 1 cm^3 are taken and the amount of phytoseiulus in each is counted. To do this, pour out each sample on white paper and count the mites coming out of the substrate and determine the total number of predators in 1 liter of filler.

Table 1

Technological map of mass breeding of phytoseiulus on spider mites (according to M. O. Bilyk, 2012)

No	Types of work	Terms of conducting		Purpose and characteristic of the work	Optimal conditions		Devices and equipment	Notes
		beginning	duration		temperature	humidity		
1	Preparation of the greenhouse room for spider mites breeding			Preparation of the greenhouse room for spider mites breeding			Greenhouse, racks	Dividing the greenhouse into 4–5 sections to create a green conveyor
2	Growing fodder plants for spider mites			Growing fodder plants for spider mites	20–25 ºC	70 %	Greenhouse, racks	400–450 seeds per 1 m^2
3	Settling of fodder plants by spider mites	13–15 days after sowing seeds		Settling of fodder plants by spider mites	20–25 ºC	70 %	Greenhouse, racks	40–60 individuals per plant
4	Release of the predatory mite phytoseiulus	14–15 days after the release of spider mite		Release of the predatory mite phytoseiulus	20–25 ºC	70 %	Greenhouse, vivarium 30 × 30 × 60 cm	10–15 individuals per plant
5	Collecting a predator	15–20 days after the release of predator		Collecting a predator	20–25 ºC	70 %	Separator	Collecting of 1.5 thousand predator individuals from 1 m^2
6	Short-term predator storage			Short-term predator storage	3–5 ºC	80–90 %	Refrigerating plant	Storage up to 7 days

For one cycle of phytoseiulus breeding in the vivarium box, a spider mite collected from plants grown per 1 m^2 is consumed. This ensures obtaining of 30–40 thousand predator adults.

Short-term storage of phytoseiulus – up to seven days is possible at a temperature of 3...5 °C and 80–90 % humidity.

Phytoseiulus is applied on peppers, tomatoes, potatoes, beans, corn, cucumbers, melons, strawberries, eggplants, as well as gerberas, roses and other ornamental plants.

Local method – release near the pest focus, which includes the examining greenhouses once a week. Depending on how the leaf blade is damaged, on average 10–60 individuals are released per plant. Phytoseiulus is applied on soybean leaves, each of which contains up to 10 individuals. In foci with a high density, spider mites are released in the predator-victim ratio 1 : 50 and in addition 20–30 individuals per neighboring plants that are not infected with the pest.

Fig. 3 Application of phytoseiulus in a greenhouse on tomatoes
(http://www.saninskoe.ru/images/saninskoe06/saninskoe06-210.png)

Mass method – soybean leaves with a predator are laid out evenly throughout the greenhouse, and in the detected foci they are laid out locally. It is better to use the mass method as a preventive one. 3–4 weeks after plants planting, 30-40 individuals are released per 1 m^2. As the leaf surface increases, the number of release should be increased. With preventive colonization, it is better to carry out three-fourfold releases of acariphage after 10–12 days, each time increasing the norm – 30 individuals per 1 m^2 for the first time, 40 – for the second, 60 – for the third and 80 – for the fourth. This contributes to the complete protection of greenhouses from the pest.

Mass colonization – involves a well-established and reliable breeding system for phytoseiulus. To do this, it is necessary to have a greenhouse for breeding, the area of which is 0.5–1.0 % of the total area of greenhouses that will be protected by biological method.

It should be noted that the effectiveness of the predator is significantly reduced on strongly pubescent crops (http://ggiskzr.promblogus.com/goods/2053-fitoseyulyus_Phytoseiulus_persimilis_Ath_Henr.html).

Biological efficiency is expressed by an indicator of the death or destruction of the number of harmful organisms or the degree of damage to plants by them.

Conclusions

1. The predatory mite *Phytoseiulus persimilis* Athias-Henriot belongs to the Phytoseiidae family of the free-living gamasid mite subfamily Parasitiformes. Under the natural conditions, phytoseiulus lives in warm coastal areas of Chile, Algeria, Lebanon, Italy, southern France, and Australia. In 1958, it was accidentally imported on orchid roots from Chile to Germany. From where it has already been specially delivered to many countries, including the former Soviet Union.

2. In film shelters, greenhouses, winter gardens and in indoor conditions on windowsills, phytoseiulus is successfully used with a very dangerous pest – spider mite. It is also used in the open ground on strawberries, berry bushes during the period when night temperatures are not less than 10-12 °C.

3. The classic technology of phytoseiulus mass breeding in industrial biological laboratories includes a number of technological processes: preparation of a room for mites breeding; cultivation of fodder plants for spider mites; breeding of spider mites; breeding of phytoseiulus; collecting and storage of phytoseiulus.

4. Mass breeding of phytoseiulus is carried out year-round on spider mites, which are propagated on plants of soybeans, beans, fodder beans, corn, cucumber, etc. In this article, the authors ground the box method of mass breeding of phytoseiulus.

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