ЗАЩИТА РАСТЕНИЙ

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APPLICATION OF *PHYTOSEIULUS PERSIMILIS* AGAINST *TETRANYCHUS URTICAE*

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Abstract. The aim of our research is the mass breeding and application of predatory mites against *Tetranychus urticae*. For the breeding of phytoseiulus in laboratory conditions, affordable and technologically feasible techniques are searched for. In the experiment to determine the biological activity we studied the biological efficacy of *Phytoseiulus persimilis* application against common spider mite using on cucumber culture in protected soil. Release of phytoseiulus on cucumber plants was carried out in the ratio predator - victim 1:10. Biological efficiency of predator application on the 10th day was 70%. Two-fold release of acariphage, which further persisted on plants and effectively contained the pest population in economically insusceptible level.

Keywords: spider mite, biological protection, phytoseiulus, indoor cucumbers

КОЛДОНУУ *PHYTOSEIULUS PERSIMILIS* КАРШЫ *TETRANYCHUS URTICAE*

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Аннотация. Биздин изилдөөбүздүн максаты - жырткыч кенелерди көбөйтүү жана аларды *Tetranychus urticae* каршы колдонуу. *Ph. persimilis* лабораториялык шарттарда өстүрүү үчүн жеткиликтүү жана технологиялык ыкмаларды издөө жүргүзүлдү. Биологиялык активдүүлүктү аныктоо боюнча экспериментте биз фитосейулусту бадыраң өсүмдүктөрүндө жөргөмүш кенесине каршы колдонуунун натыйжалуулугун изилдедик. Фитосейулусту бадыраң өсүмдүктөрүнө 1:10 катышта чыгардык. 10-күнү жырткычты колдонууда биологиялык натыйжалуулук 70% түздү. Мындан ары өсүмдүктөрдө сакталып, зыянкечтердин санын чарбалык жактан сезилбеген деңгээлде натыйжалуу кармап турган акарифагдын эки жолку чыгарылышы сунушталат.

Өзөктүү сөздөр: жөргөмүш кенелери, биологиялык коргоо, фитосейулус, жабык жердеги бадыраң

ПРИМЕНЕНИЕ *PHYTOSEIULUS PERSIMILIS* ПРОТИВ *TETRANYCHUS URTICAE*

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Аннотация: Целью наших исследований является массовое разведение и применения хищных клещей против *Tetranychus urticae*. Для разведения фитосейулюс в лабораторных условиях проводятся поиски доступных и технологичных методик.

В эксперименте по определению биологической активности нами было изучено биологическая эффективность применения *Ph. persimilis* против обыкновенного паутинного клеща с использованием на культуре огурца в защищенном грунте. Выпуск фитосейулюса на растения огурца провели в соотношении хищник – жертва 1:10. Биологическая эффективность применения хищника на 10-е сутки составила 70%. Двукратный выпуска акарифага, который в дальнейшем сохранялся на растениях и эффективно сдерживал численность вредителя в хозяйственно неощутимом уровне.

Ключевые слова: паутинный клещ, биологическая защита, фитосейулюс, огурцы закрытого грунта

Introduction

Plant protection against pests and diseases plays an important role in increasing the yield of crops in the protected ground. The greenhouse microclimate is favourable not only for plant development, but also creates optimal conditions for the activity of pests that significantly reduce the yield of greenhouse crops [1].

The most developed technique of biological plant protection against spider mites in greenhouses is the use of the predatory mite phytoseiulus. It is rather risky to rely only on chemical plant protection products to control spider mites, because mites have a wide genetic potential for resistance to acaricides [2].

The common spider mite (*Tetranychus urticae* Koch.) belongs to the family Tetranychidae, genus *Trombidiformes*, family Tetranychidae, genus *Tetranychus*, species Urticae (Koch, 1836) [3]. Yield losses in protected soil conditions due to spider mite damage account for 40-60%. As a result of damage, light spots are formed on leaves in the pest feeding areas, which gradually merge and acquire a marbled colour. The development of one generation of the pest is completed within 7-26 days, depending on environmental conditions [4].

One of the most effective biological control methods against *Tetranychus urticae* K. is the predatory mite *Phytoseiulus persimilis* A.-H. This predator is characterised by high biological efficiency in suppressing the pest population. The adult stage of *Phytoseiulus persimilis* s differs from the spider mite by its much greater mobility. Compared to other species of the phytoseiidae family, this predatory mite has a much higher rate of development and is extremely voracious [3]. Phytoseiulus has no diapause in its life cycle, and therefore develops all year round. Temperature and relative humidity have a great influence on the development of the predator. Optimum temperatures are 25-300 °C and relative humidity 70-80%. High temperatures are unfavourable for *Ph. persimilis* even at optimal humidity. At 70-75% relative humidity, the eggs and nymphs of the mite can withstand a temperature of 35 °C for only 16 hours, and at 40 °C they die [4].

Phytoseiulus release rate depends largely on the density of spider mite infestation, plant species and hygrothermal conditions. On average, the annual rate of phytoseiulus colonistion in greenhouses on cucumber is 0.5-1 million individuals per 1ha. When the first pest foci appear, spread leaves of soybean or other crop on which the predator has been accumulated into mite foci at the rate of 10-60 predator individuals per one infested plant. In neglected pest foci, the predator: prey ratio of 1:20-1:50 depending on the crop to be protected should be observed during release [5].

Materials and methods of research

Field studies were conducted in the greenhouse of «Kavunov Dzhantor» farm, Almaty region, Yenbekshikazakh district.

To develop the predatory mite phytoseiulus, we used a well-known method of its breeding adapted to laboratory conditions [6]. The principle scheme of acariphage production technology included cultivation of beans, which is a food substrate of its victim - spider mite, accumulation of the phytophage on the grown plants and then production of the bioagent itself.

Biological efficiency of phytoseiulus application was determined by determining the degree of death or reduction of spider mite numbers on the protected cro. After release of phytoseiulus, after a certain period of time (3, 5 and 7 days), the number of spider mites was repeated. The obtained data allow to determine the biological efficiency of the bioagent (B), for which the formula is used: [1]

$$B = \frac{(a-c)}{a} * 100, \quad (1)$$

where a - number of spider mites on plants before phytoseiulus release, pcs;

c - spider mite abundance 7 days after acariphage release, pcs.

Research results

Laboratory populations of spider mite and predatory mite phytoseiulus were reared in the laboratory of beneficial insects and mass production of bioagents, Department of Biological Plant Protection (Figure 1).

The study of biological indicators of Phytoseiulus in laboratory conditions showed that decreasing temperature and relative humidity significantly affect the development of acariphagus (Figure 1).

At more favourable temperatures of +25 and +30 °C, relative humidity of 70% and 75%, the duration of acariphage development from egg to adult is 5.2-6.3 days, respectively, which is 2 times faster than that of the spider mite. The female on average lays up to 80 eggs during her life period and destroys about 30 eggs and more than 20 adults of the spider mite.

The biological efficacy of *Ph. persimilis* application against common spider mite was studied under indoor conditions using on cucumber crop in protected soil. As a result of regular phytosanitary monitoring in the greenhouse, the first spider mite outbreaks were detected on plants in early January. At that time, the pest population was low and the infestation of plants did not exceed 1 point on average on a 5-point scale. When counting was repeated one week later, a significant increase in the phytophagous population was observed, and the infestation of plant leaves reached an average of 3 points. Release of phytoseiulus on cucumber plants was carried out in the ratio predator - prey 1:10 (Table 1).

Fig. 1. Laboratory population of *Phytoseiulus persimilis*

Table 1

Biological efficiency of *Phytoseiulus persimilis*

Options	Phytoseiulus abundance per 1 m^2 .			Biological efficiency, %
	prior to processing	in 5 days	in 10 days	
Control	22	43	68	-
Phytoseiulus	20	15	6	70

As can be seen from the table, on the 5th day after release the predatory mite dispersed, actively fed and reproduced in the presence of sufficient number of prey. During subsequent surveys, predatory mite individuals were observed on almost all leaves of plants infested with the pest.

Surveys conducted before the release of the bioagent showed that in the identified foci the pest abundance was within 2 points, i.e. mite infestation of leaves in the foci was about 30%. Phytoseiulus was released into the identified foci at a predator: prey ratio of 1:15, i.e. 15 pest individuals per predatory mite. A second release was made after 7 days. In this case, the number of spider mites on average on 10 counted plants averaged 170 individuals per plant. In subsequent surveys, after the release of Phytoseiulus, the number of mites on these leaves decreased to an average of 50 individuals per plant.

The performed calculation showed that the biological efficiency of phytoseiulus application on cucumbers against spider mite was 70%. Additional releases of phytoseiulus allowed to suppress the development of the mite to economically insensible size and further increase in the number of the mite, due to the activity of phytoseiulus until the end of the crop rotation, was not observed.

Discussion

The sharply continental climate of Kazakhstan does not allow vegetable growers to cultivate vegetable crops in the open ground all year round. Using greenhouses, it is possible to fully satisfy the population's demand for grown products throughout the season. Specific conditions of protected ground and limited species composition of cultivated crops favours the accumulation and mass reproduction of pests such as spider mite (*Tetranichus urticae* Koch.). To reduce the number of protected ground pests, greenhouse farms often use pesticides and toxic chemicals, which lead to contamination of agricultural products, deterioration of sanitary and hygienic working conditions and at the same time the resistance (resistance) of pests to the used pesticides increases. Elimination of undesirable consequences is possible only by searching for new highly effective and at the same time environmentally safe methods of plant protection.

One of the promising ways to obtain ecologically clean products, especially in protected soil, is the application of biological method based on the use of biological agents, i.e. natural enemies of phytophages. In this matter, the use of specialiased acariphage - *Phytoseiulus persimilis* is an effective way.

Conclusions

According to our observations during the study of biological activity of the predator against phytophagus we noted that the predator actively develops in the presence of abundant food and can suppress its number up to 97%. Due to the accumulation of acariphage during its active predatory activity there is no need to use acaricides.

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References

1. Klishina L.I. Application of biological means of plant protection in protected soil // Bulletin of Nizhny Novgorod State Agricultural Academy. Volume: 1: 2012. C. 27-30.
2. Kashutina E.V., Slobodyanyuk G.A., Ignatyeva T.N., Andreenko O.N., Heishkho I.V. Technology of cucumber protection in closed ground in the zone of the Black Sea subtropics // International Research Journal ▪ No. 11 (89) ▪ Part 2 ▪ November. Pages 11-15 DOI: https://doi.org/10.23670/IRJ.2019.89.11.036
3. Adilkhankyzy A., Mukhtarhanova A.A., Alpysbaeva K.A., Chadinova A.M., Nurmanov B. Some bioecological features of the predatory mite *Phytoseiulus persimilis* A.-H. // Izvestiya OshTU, 2019 No. 3. Pages 27-31.
4. Popov P.A., Development of phytoseiulus on spider mite from different fodder plants / O.A. Khudyakova // Parasites and predators in plant defence. Kishinev, 1989. -86 p.
5. Kulikova E.G., Klimova O.A. Efficiency of phytoseiulus application in the fight against spider mite on cucumber in the conditions of JSC "Penza greenhouse plant" // Sursky Vestnik No. 2 (2) 2018. p. 16-19. https://surskiy-vestnik.pgau.ru elibrary_36308578_87225320.pdf
6. Toleubaev K.M., Abzeitova E.A., Nygymetova A.M., Turegeldiev B.A. Methodological guidelines for mass breeding of Phytoseiulus persimilis Ath. - Henr. and its use against the common spider mite (Tetranychus urticae Koch.) in protected soil conditions / - Almaty, 2015. - 20 p.

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РАЗРАБОТКА БИОПЕСТИЦИДОВ НА ОСНОВЕ МИКРОФЛОРЫ И РАСТИТЕЛЬНОГО СЫРЬЯ КЫРГЫЗСКОЙ РЕСПУБЛИКИ

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Аннотация. Проведены эксперименты с экстрактами растений и штаммами микрофлоры, полученными из природных объектов КР с целью разработки биопрепаратов комплексного действия.

Ключевые слова: микрофлора, штаммы, биопестициды, растительные экстракты, семена, томаты, биопрепараты

КЫРГЫЗ РЕСПУБЛИКАСЫНЫН МИКРОФЛОРАСЫНЫН ЖАНА ӨСҮМДҮК ЧИЙКИ ЗАТТЫН НЕГИЗИНДЕ БИОПЕСТИЦИДДЕРДИ ИШТЕП ЧЫГУУ

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Аннотация. Комплекстүү аракеттеги биологиялык продуктуларды иштеп чыгуу максатында Кыргыз Республикасынын жаратылыш объектилеринен алынган өсүмдүктөрдүн экстракттары жана микрофлора штаммдары менен эксперименттер жүргүзүлгөн.

Өзөктүү сөздөр: микрофлора, штаммдар, биопестициддер, өсүмдүктөрдүн экстракттары, уруктар, помидор, биологиялык продуктылар

DEVELOPMENT OF BIOPESTICIDES BASED ON MICROFLORA AND NATURAL PLANT RAW MATERIALS OF THE KYRGYZ REPUBLIC

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Abstract. Experiments were conducted with plant extracts and microflora strains obtained from natural objects of the Kyrgyz Republic with the aim of developing biological products with complex action.

Keywords: microflora, strains, biopesticides, plant extracts, seeds, tomatoes, biological products