

## NEWS

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**MONITORING AND ASSESMENT THE EFFICIENCY OF TRAPS  
FOR MASS CAPTURE TUTA ABSOLUTA (POVOLNY) (LEPIDOPTERA:  
GELECHEIIDAE) PEST OF TOMATO CULTURE BREEDING  
IN OUT OF BOUNDS AREA (*SOLANUM LYCOPERSICUM*)**

**Abstract.** The research work *Tuta absoluta* (Povolny) (Lepidoptera: Gelechiidae) was carried out for monitoring under greenhouse conditions and assesment the efficiency of pheromone traps and the possibility eye repertoire in the length of light waves using colored glue traps in the mass capture. Light traps that were previously used for capture butterflies and moths were also tested. The results of the 4-week research show that tomato moths were not glued to colored traps along the length of the wave light, only 65 specimen remained to the black glue trap suspended under the ditch, and a total of 9 specimen remained in other yellow, blue and red colors. In researches using color sex pheromone scents, depending on the color of the trap there were no significant differences in the number of specimen and detained more specimen of pests than in other methods (the average number of specimen caught in the trap is  $18,25 \pm 10,6$ ) The effectiveness of pheromone traps depends on the height of the trap suspension,  $82,41 \pm 35,6$ , specimen were caught at the lower level,  $47,91 \pm 21,9$  specimen were caught at the average level at a height of 1,5 m from the ground, and  $27,08 \pm 11,2$  specimen were caught at the height of 2,5 m from the ground. When testing various types of traps, 0,3% soap solution was filled to the water and light cistern and light capture was less effective than pheromone traps. Even if the quantity of hits of specimen in the light and black traps was less, it was taken into consideration that both male and female specimen fall together.

**Key words:** *Tuta absoluta*, greenhouse, tomato, sex pheromones, trap, biochemical technique, dynamic.

**Introduction.** The tomato leafminer *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) is an oligophagous herbivore considered one of the most devastating pests of tomato (*Solanum lycopersicum* L.) crops [1]. Since its introduction in Eastern Spain in 2006 from South America [2], it has rapidly spread throughout the Mediterranean basin including many European countries, Africa [3], Asia [4], and the Middle East [5].

For the first time, this pest was found that on October 12, 2015 the Fakhirdin greenhouse comple in Birtilek rural district of Saryagash district of Turkestan region was affected on 4.0 ha [6]. Annex 1 to the order of the Minister agriculture of the Republic of Kazakhstan dated March 30, 2015 No. 4-4/282 “bead-roal of quarantine objects and non-indigenous species for which plant quarantine measures are established and accomplished” was introduced by *Tuta absoluta* (Povolny) [7]. The harmfulness of *T. absoluta* kecan be compared with the harmfulness of grasshopper. Along with tomatoes, the pest damages all phases of sweet peppers, potatoes, eggplants and ornamental plants and makes them innaplicable up to 80-100 percent.

As a result of measures to control tomato moths with chemotherapeutic drugs, may occur adaptive properties of the biotype to the preparation, a decrease in profit as a result of high economic losses and decrease in the population of natural entomophages found in this region. Therefore, sexual pheromone traps and entomophages can be used as an additional pest control area, reducing the volume of chemotherapeutic drugs. In Lepidoptera, female moths generally release long range pheromones to attract conspecific mates, and when males are close enough they may release short-range pheromones to help seduce the female, i.e. to facilitate the final steps leading to copula [8]. Although female calling is a general mate-finding strategy in diurnal and nocturnal moths, day-flying butterflies only use visual cues for mate-finding, followed by short-range pheromones released by males when the two sexes are in close proximity [9,10]. This pheromone was identified by Attygalle *et al.*, (1996) as (3E, 8Z, 11Z)-3,8,11-tetradecatrien-1-yl acetate [11]. However, these traps are expensive and their real effectiveness is put in doubt by the phenomenon of parthenogenesis [12]. In Kazakhstan, despite the fact that the traps used for this type of biological method of controlling *T. absoluta* have been sold, but they are little explored. Comparing several types of traps, the research determined the effective one. Due to unfavorable outward conditions and other circumstances, the pheromone capsule is a delta form of traps so as not to injure the pheromone capsule.

**Research materials and methods.** The research was conducted in the greenhouse complex “Adelya”, located in the village Badam in Ordabasy district, Turkestan region. The greenhouse area is 15 hectares, and the tomato F1 hybrid Merlis, Travanza мен Hibachi were sown on 5 hectares. 01.07.2019 in foam cassettes consisting of four cells of 60×40 cm 240 cells, glass-wool plugs were installed, into which the fruits were sprinkled, the surface was filled with vermiculate. Fruit crops are sprouted in growth chambers for 3 days and transferred to a hotbed on the 4th day. 02.08.2019. planted 2.5 pieces of tomato seedlings on 1 m<sup>2</sup> of the R-1 greenhouse area. The drip irrigation system and climate monitoring were automatically managed by the Priva program. As a result of the monitoring work carried out in the hotbed it was found that the seedlings were damaged by *T. absoluta*. After the seedlings were moved to the greenhouse, 15 traps per hectare were posted according to the instructions of the sex pheromone producers.

The 1st experience. Tests of colored glue traps were carried out during 1 interval (span), 31-34 weeks, according to the following scheme.

		Column																																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
Rank	1																																		
	3					Ω						©										£							®						
	5																																		
	7					®						Ω										©							£						
	9																																		
	11					£						®											Ω						©						
	13																																		
	15					©						£											®						Ω						

Scheme 1 – 1st interval order of placement of colored glue traps: Ω-red, ©-yellow, £-blue, ®-black

Specimen who fell into the trap were taken into account twice a day at 8.00 and 18.00.

The 2nd experience. The work using sexual pheromone seducers in Delta traps with colored glue was carried out in the 3-10 interval of 31-44 weeks, in the following scheme.

A	B	C	D
D	A	B	C
C	D	A	B
B	C	D	A

Scheme 2 – Order of placement of traps: A – yellow pheromone trap, B – blue pheromone trap, C – white pheromone trap, D – red pheromone trap

Experiment 3. This work was carried out in a separate interval to determine the effectiveness of the black trap selected from 1 research, the yellow trap selected from 2 research set by the pheromone seducer, the groundwater pheromone trap, and the light trap during the 39-44 week period.

A1	B1	C1	D1
D2	A2	B2	C2
C3	D3	A3	B3
B4	C4	D4	A4

Scheme 3 – order of placement of traps: A-water pheromone trap, B-black glue trap, C-yellow pheromone Delta, D-light trap

**Research result.** Sexual pheromone baits are used to determine the flight date and digital dynamics of Lepidopterous insect. In greenhouse conditions we used sex pheromone traps for mass capture. To determine the effectiveness and quality of sexual pheromone baits, researches were conducted in 2018-2019 In the greenhouse of the district 1 ha of the RC "Naimbekov". The research work tested sexual pheromone baits Flora tutabs and bks tuta from Turkey, Tutasan products from Koppert from the Netherlands, and products from the Federal state budgetary institution "all-Russian plant quarantine center" of the Russian Federation "FSBI ARPQC". During the tests, there will be no distinctive difference in the quality of bait from these manufacturers. Based on this data, we used the bait Flora tutabs of the Turkish state, the price of which is favorable..

The result of work performed was shown (figure 1).

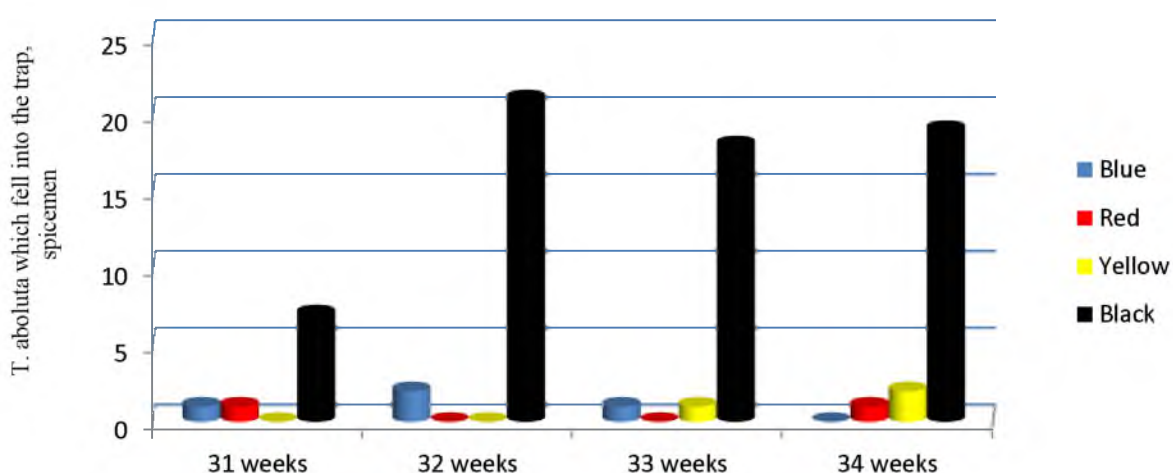


Figure 1 – Dynamics of receipt of *T. absoluta* in colored traps

In the study by Taha, A. M. et al the yellow traps had 76,0 % reflection at 576,8 nm dominant wavelength. The red traps reflected 39,7 % of the incident light at 612.1 nm dominant wavelength. The green traps had 31,76 % reflection at dominant wavelength of 527.2 nm while blue traps reflected only 19,68% of

The incident light at 479,5 nm dominant wavelength [13]. However, in the study Mohamed Braham's (2014) green colored traps captured respectively, more than 7-fold, more than 4-fold, 4-fold and more than 2-fold for red, orange, yellow and white colored traps. The mean number of captured males varies between 3 and 17 [14].

According to information (figure 2) most of the imagos *T. absoluta* fell into black-glue traps. The number of imagos that are trapped prevails at night, since the exit from the doll most often occurs at night, the most active time of adults.

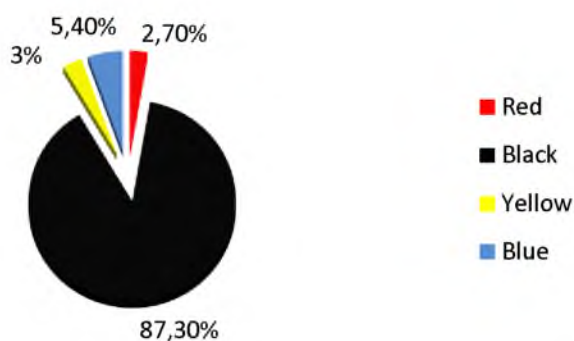


Figure 2 – Percentage of *T. absoluta* in colored traps

After being released from the dummy, the wings of the imago remain stationary until completely dry and then are removed for some distance. To complete ovarian maturation, the necessary time passes: in males, several hours, in females, up to 20-22 hours. When the male and female mating pieces of the uterine cavity are in the glued state from a few minutes to 4-5 hours, after ovum fertilization mainly for a week (maximum of 3-5 pieces) at night, dam off the seeds on the leaf [15]. With this data, the black traps under the ditch were suspended at a height of 10 cm from the Ground. Spicemen in the trap were collected twice a day using clamps in a plastic water container and sent to the laboratory to identify the male and female. The ratio of males and females caught in black traps was 1: 0,87. if only males get to sexual pheromones, then females also got to this trap. The extent of plant damage was detected in a single interval, by random selection with a choice of 100 plants and 100 fruits. In addition to these studies, this pest was not detected from tape traps suspended in the greenhouse (greenhouse whitefly *Trialeurodes vaporariorum* West) yellow and tobacco thrips (*Thrips tabaci* Lind).

The dynamics of butterflies entering other colors was very low, since tomatoes did not develop the ability to see the length of the light wave. However, the data obtained as a result of a 12 week monitoring of the quantitative dynamics of the *T. absoluta* population turned out to be diverse. The dynamics of the biotype development is influenced by various factors (greenhouse temperature, humidity, number of foliage in the leaves, population density). The development of a pest in a greenhouse can be divided into three stages. during the first 4 weeks of some plants transferred from the hotbed to the greenhouse, you can find a caterpillar and damaged tracks, where with a small number of populations, the number of pests detained for four weeks by 15 traps was 88 spicemen. The second stage is the intensive development of the pest, i.e. eggs and caterpillars can be found in the leaves. the number of individuals in four weeks was 392. In the third stage, eggs, caterpillars, and flying imagos were observed on the leaves. For 39-42 weeks, the number of pests that fell into 15 traps was 1784 spicemen. During this period, the population density became higher and is considered the most dangerous for the greenhouse. The percentage of damaged plants was Estimated on a 2-point scale.

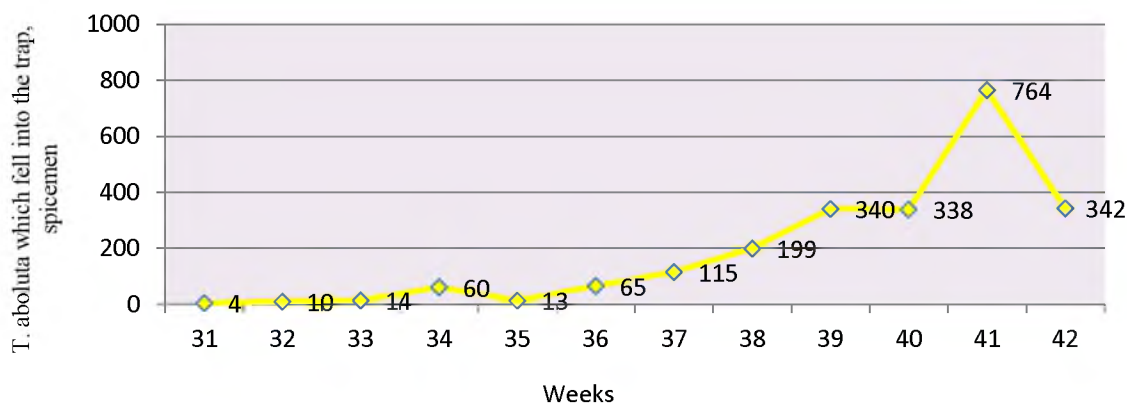


Figure 3 – Dynamics of development of *T. absoluta* in the greenhouse

In particular, as noted by Salas (2004), early in the morning (at sunrise and in the evening, when the colors of the upper part of the spectrum prevail), the pest is more active. During a hot day, they are sluggish and usually localized among the leaves of the host plant [16]. Mitchell clarified, etc. (1989) that the complex eye of a butterfly, in contrast to the ability to distinguish the light spectrum, the ability to smell the bait-pheromone is better developed [17]. However, Agee (1973) a positive correlation between the spectral sensitivity of a night-flying moth's compound eyes and the most effective trap color does not always exist [18]. (Figure 4) at the specified 12 weeks, you can see the dynamics of *T. absoluta* intake in pheromone traps of white, yellow, red and blue colors. Here, *T. absoluta* does not depend on color, depending on the temperature and humidity in the greenhouse, it fell into pheromone traps with different rates depending on the dynamics of development in each area of the greenhouse.

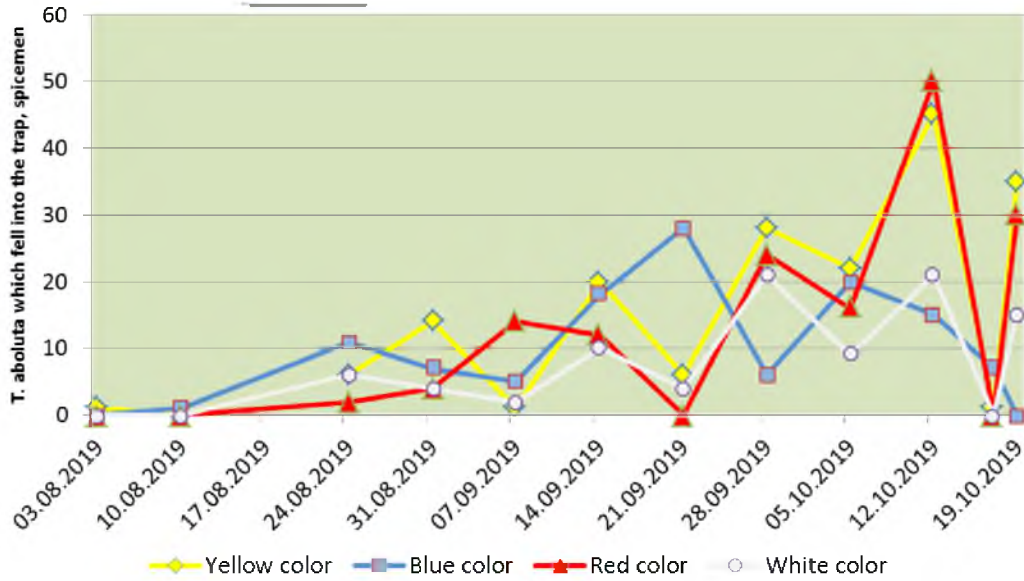
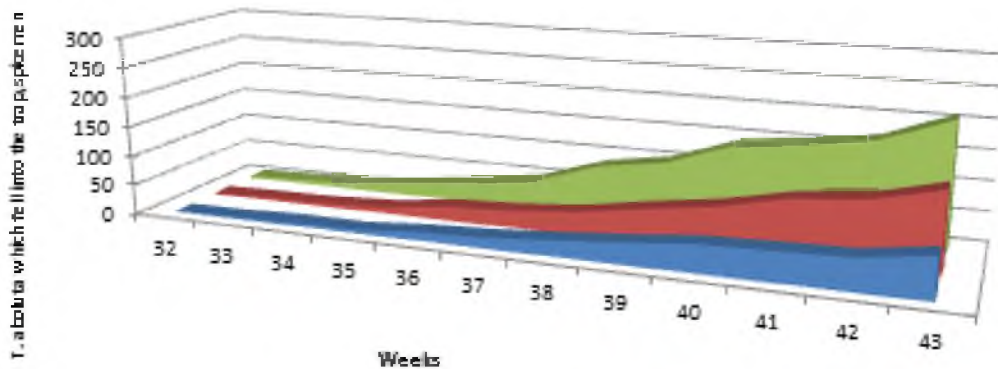


Figure 4 – Quantitative dynamics of *T. absoluta* falling on colored pheromone traps

The bait of a butterfly with sexual pheromones placed in glue traps also depends on its height, suspended in the greenhouse. In the Abdul-Aziz research, at a height of 2 m, the largest butterfly fall was - 398 individuals, at a height of 1 m - 236 individuals, and at a trap placed on the soil surface - 152 individuals [19].



	32	33	34	35	36	37	38	39	40	41	42	43
Upper level	2	3	6	6	14	18	26	35	46	49	52	68
Middle level	3	5	6	11	24	29	38	56	71	95	105	132
Lower level	5	7	12	22	35	50	85	102	140	152	189	210

Figure 5 – Quantitative dynamics of imago *T. absoluta* falling into a three-level trap

And in our study (figure 5) the data indicated in one catch located at a height of 15 cm from the ground surface, hit an average of  $82,41 \pm 35,6$ , and in a catch located at a height of 1,5 m- $47,91 \pm 21,9$  and in a catch located at a height of 2,5 m- $27,08 \pm 11,2$  spicemen. The loss of smaller individuals in upper-level traps is explained by the fact that the plants grow 10-20 cm per week, 2 times lower and the leaves of the middle level are voluminous and woven. In the laboratory state of *T. absoluta* in practice, set to the biology of development 25-30°C, the development of the pest from the egg to the imago included 20-22 days, i.e. during this period, the development of the pest occurs at the middle and lower levels. In October and February, the greenhouse is maintained at an average temperature of 22 to 25C. Therefore, the trap of the lower and middle levels explains the hit of more individuals.

In practice 3, there is a difference between different types of traps. Currently, Ferolite traps offered by Russell IPM are not cost effective. Here, in the center of the dish, there is a grid in which two capsules are installed, and in the upper part-a mechanism for night lighting. given that *T. absoluta* is a moth, they only come at the smell of a pheromone that is amplified twice. That is, pheromone manufacturers offer to install 15 pieces of pheromones per 1 ha of area, then with the Ferolite trap, 30 pieces of pheromones will be installed and the distance of the butterfly's sense of smell must be taken into account. The Ferolite trap is not economically feasible: first, the price is more expensive, from the second it will require energy for lighting, and third, it is more expensive for two pheromone capsules installed on each catch. The price of this trap is on average 18,000 Tg +power supply+ pheromone Price. According to the results of the 3rd practical work, the number of individuals caught in light traps installed without a pheromone was minimal than in other traps.

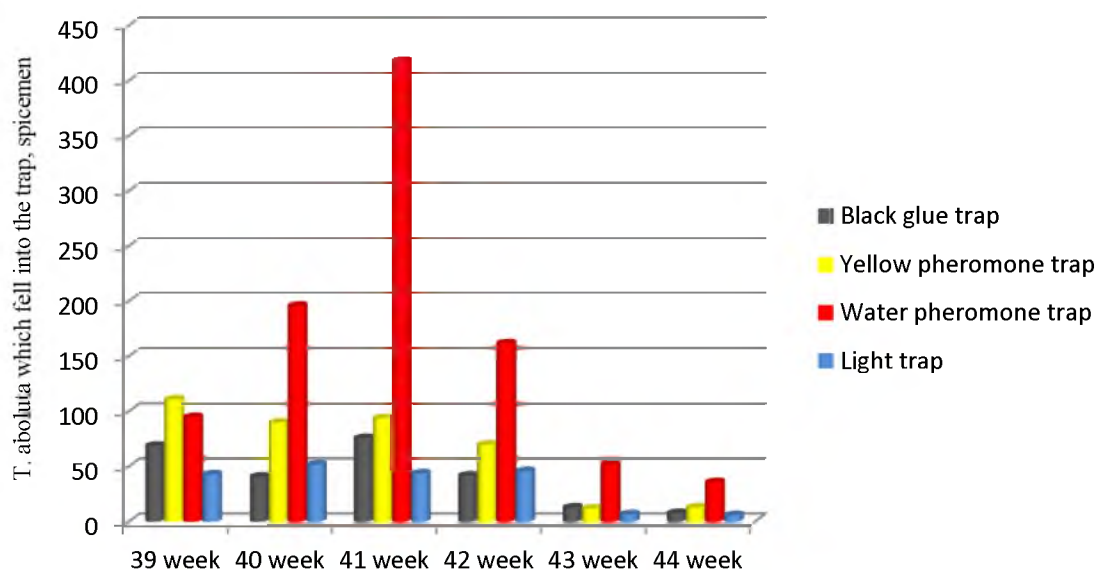


Figure 6 – Evaluating the effectiveness of various types of traps

Water pheromone traps installed on the ground, fell more individuals, than other types. According to the manufacturer's instructions, one pheromone capsule is suitable for use up to 6 weeks, i.e. during these six weeks, *T. absoluta* 959 spicemen were trapped in a water pheromone trap. The yellow pheromone traps, located at an altitude of 1.5 m, received 390 spicemen, the black glue, located under the ditch, 249 spicemen, and the light traps-198 i spicemen. The most profitable of these traps is the water pheromone trap, since at the beginning of the new term, dishes purchased for 5 hectares can withstand the action for up to 3 years. And glue traps should be replaced with pheromones every six weeks, since the surface is full of other sticking pests (greenhouse whitefly, tobacco whitefly, cucumber mosquito, acetic fly). Megido et. (2012) non-fertilized uterine butterflies have shown that the ability of an egg cell reduces the effectiveness of pheromone-type traps [20]. Despite the fact that no other pests were found in the black-gluе traps, individuals of two breeds of pests get caught, and despite the low efficiency of light traps, males and females are found in the laboratory study.

**Conclusion.** According to the study, in practice, 1 of the most effective color glue traps is the black glue trap, where the ratio of 1:0,87 was found in the work on counting the received imago of ovaries and females. On the 2nd practice, it was found that as a result of working with the use of a pheromone to color traps, they are not exposed to color, but only depending on the height of the suspended trap and the digital dynamics of the pest in this region fall on the sex pheromone. As a result of the 3rd work on agricultural water-pheromone traps and colored pheromone traps located at a height of 1,5 m, the largest number of individuals were detained. Light traps contain a female and a female, although the number of individuals caught in the trap and use in the greenhouse causes some difficulties.

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**ЖАБЫҚ АЛАҢДА ӨСІРІЛЕТІН ҚЫЗАНАҚ ДАҚЫЛЫНЫҢ  
(*SOLANUM LYCOPERSICUM*) ЗИЯНКЕСІ *TUTA ABSOLUTA* (POVOLNY)  
(LEPIDOPTERA: GELECHIIDAE) МОНИТОРИНГ ЖҮРГІЗУ  
ЖӘНЕ ЖАППАЙ ҰСТАУҒА АРНАЛҒАН ТҰЗАҚТАРДЫҢ ТИІМДІЛІГІН БАҒАЛАУ**

**Аннотация.** Зерттеу жұмыстары Түркістан облысы, Ордабасы ауданы, Бадам ауылында орналасқан «Аделя» жылыжай кешенінің 5 га алқабында, F1 Мерлис гибридинде *Tuta absoluta* Povolny (Lepidoptera: Gelechiidae) жылыжай жағдайында мониторинг жүргізу және жаппай ұстауда түсті желімді тұзақтар пайдаланып, көз спекторларының жарық толқын ұзындығына тартылу мүмкіндігі мен феромондық елітіргіштердің тиімділігін бағалау мақсатында жүргізілді. Осыған дейінгі көбелектер мен күйелерді ұстауға қолданып келген жарық тұзақтары да сыналды. 4 апта жүргізілген зерттеу нәтижесі көрсеткендей, қызанақ күйе көбелегі жарық толқын ұзындығындағы түсті тұзақтарға жабыспады, тек арық астына ілінген қара түсті желімді тұзаққа 65 дарақ, ал басқа сары, көк және қызыл түстерге жалпы 9 дарақ түсті. Басқа түстерге көбелектердің түсу динамикасы өте төмен болды, өйткені қызанақ күйе көбелегі жарық толқынының ұзындығын көру қабілеті жақсы дамымаған. *T. absoluta* популяциясының сандық динамикасына жүргізілген 12 апталық мониторинг нәтижесінде алынған мәліметтер әртүрлі болып келді. Биотипінің даму динамикасына әртүрлі факторлар (жылыжай температурасы, ылғалдылық, жапырақтағы мина саны, популяция тығыздығы) әсер етеді. Түсті жыныстық феромонды елітіргіштерді пайдаланып жүргізген зерттеулерде тұзақтың түсіне байланысты дарақтар санында аса айрмашылық болмады және басқа тәсілдерге қарағанда көбірек зиянкес дарақтарын ұстады (тұзаққа түскен дарақтардың орташа көрсеткіші  $18,25 \pm 10,6$ ). Феромонды тұзақтардың тиімділігін тұзақты ілу биіктігіне байланысты, төменгі деңгейге ілінген тұзаққа  $82,41 \pm 35,6$ , ортаңғы деңгейдегі жерден 1,5 м биіктіктегі тұзақтарға  $47,91 \pm 21,9$  және жерден 2,5 м биіктікте орнатылған тұзақтарға  $27,08 \pm 11,2$  дарақ түсті. Жоғарғы деңгейдегі тұзақтарға аз дарақтардың түсуі, өсімдіктің аптасына 10-20 см өсіп, 2 рет төмен түсіріп отыруымен және ортаңғы деңгейдегі жапырақтар көлемді және ұлпалы болып келуімен түсіндіріледі. *T. absoluta* зертханалық жағдайда 25-30 °C даму биологиясына қойылған тәжірибеде зиянкес жұмыртқадан имагоға дейінгі дамуы 20-22 тәулікті қамтыды, яғни бұл аралықта зиянкестің дамуы ортаңғы және төменгі деңгейлерде жүреді. Қазан мен ақпан айларында жылыжайды орташа есеппен 22-25 °C температура аралығында ұстайды. Әртүрлі типтегі тұзақтарды сынау барысында тұзаққа түскен көбелектер қайта ұшып кетпеу мақсатында су және жарықтық тұзақтың ыдысына 0,3 % сабын суының ерітіндісі құйылды және тиімділігі жағынан жарықтық тұзақтар феромонды тұзақтардан төмен болды. Жарықтық және қара түсті тұзақтарға дарақтардың түсу саны төмен болғанымен, аталық пен аналық дарақтардың бірге түсетіндігі де ескерілді. Бұл тұзақтардың ішіндегі ең тиімдісі – су феромондық тұзақ, өйткені жаңа егіс мерзімінің басында 5 га сатып алынған ыдыс 3 жылға дейін қолданысқа төзеді. Ал желімді тұзақтарды феромондармен бірге алты апта сайын ауыстыру керек, өйткені оның беті басқа да жабысып қалған зиянкестерге (жылыжай аққанаты, темекі аққанаты, қияр масасы, дрозифила шыбыны) толып қалады.

**Түйін сөздер:** *Tuta absoluta*, жылыжай, томат, жыныстық феромон, тұзақ, биологиялық әдіс, динамика.

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## ОЦЕНКА ЭФФЕКТИВНОСТИ ЛОВУШЕК ДЛЯ МОНИТОРИНГА И МАССОВОГО ВЫЛОВА *TUTA ABSOLUTA* (POVOLNY) (LEPIDOPTERA: GELECHEIIDAE) НА ТОМАТНОЙ КУЛЬТУРЕ (*SOLANUM LYCOPERSICUM*) ЗАЩИЩЕННОГО ГРУНТА

**Аннотация.** Исследовательская работа проводилась в тепличных условиях на площади в 5га тепличного комплекса «Аделя», расположенного в селе Бадам, Ордабасийского района Туркестанской области, в целях оценки эффективности феромонных ловушек и возможности вовлечения спектра глаз на длину световых волн с использованием цветных клеевых ловушек при мониторинге и массовом вылове гибрида F1 Мерлис *Tuta absoluta* Povolny (Lepidoptera: Gelechiidae). Так же, оценке подвергались световые ловушки, использованные ранее для ловли бабочек и мотыльков. Как показывают результаты 4-х недельного исследования, томатная моль не прилипала к цветным ловушкам на расстоянии длины световых волн; лишь в подвешенную под лотком черную клеевую ловушку попало 65 особей, а в другие желтого, синего и красного цветов ловушки попались всего 9 особей. В связи с неразвитой зрительной способностью томатной моли к световым волнам, динамика попадания мотыльков в ловушки других цветов была низкой. 12 недельный мониторинг числовой динамики популяции *T. absoluta* показал различные результаты. На динамику развития биотипа воздействуют различные факторы (температура теплицы, влажность, численность мин на листьях, плотность популяции). В исследованиях, проводимых с использованием цветных ловушек с половыми феромонами, по цвету ловушки в количестве особей не было особых различий и в сравнении с другими методами, в ловушке было больше особей (средний показатель пойманных особей составил 18,25±10,6). Эффективность феромонных ловушек зависит от высоты подвески ловушки, в ловушку, подвешенную на нижнем ярусе попало 82,41±35,6 особей, на среднем ярусе 47,91±21,9 особей, и в ловушки, установленные на высоте 2,5 м над уровнем земли, попало 27,08±11,2 особей. Малое количество пойманных особей в ловушки верхнего яруса объясняется ростом растения на 10-20см в неделю, опусканием ловушек около 2ух раз, так же разрастание листовой пластины и тканей листьев среднего яруса. В лабораторных условиях при 25-30<sup>0</sup>С биология развития *T. absoluta* охватывает 20-22 суток, т.е. этот период развития вредителя проходит на нижнем и среднем ярусах. В период с октября по февраль температура в теплице поддерживается в среднем 22-25<sup>0</sup>С. При испытании различных типов ловушек, в целях препятствовать освобождению пойманных бабочек, в емкости водяных и световых ловушек наливался 0,3% раствор жидкого мыла, световые ловушки оказались менее эффективными. Несмотря на низкое количество попавшихся особей в световые и черные ловушки, нужно учитывать что попадались обоеполюе особи. Среди описанных ловушек, эффективными являются водяные феромонные ловушки, об этом можно говорить потому, что купленная для 5га в начале посевного периода ловушка прослужила 3 года. Клеевые ловушки вместе с феромонами необходимо менять каждые 6 недель из-за прилипших вредителей другого вида на поверхности (тепличная белокрылка, табачная белокрылка, огуречный комар, дрозфила).

**Ключевые слова:** *Tuta absoluta*, теплица, томат, феромон, ловушка, биологический метод, динамика.

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