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## CALIFORNIA SHIELD BEETLE IS A DANGEROUS QUARANTINE PEST OF AN ORCHARD IN THE SOUTH-EAST OF KAZAKHSTAN

**Abstract.** The article presents data on the influence of damage to trees by the California shield on the measurement of growth processes of Apple trees. On trees with a degree of damage of 4 points and covered with shields, cracks were formed, which eventually lead to the suppression of growth processes and the gradual death of trees. Therefore, the California shield should be suppressed as much as possible in the first generation to prevent damage to the fruit.

During the research, we used generally accepted methods of plant protection and quarantine. Pheromone traps for catching the California shield were hung during Apple blossom, along the periphery of the tree crowns at a height of 2 m, in the middle rows of the array at the rate of 1 trap per 2 hectares of fruit-bearing garden. Surveys of fruit stands using pheromone traps were carried out only during the summer of males. The traps were checked every 7-10 days, and the pheromone was changed 1 time in mid-summer.

The results of observations showed that with the highest degree of infection of trees, which is 4 points, the growth of shoots is reduced compared to a healthy tree by 36.4%, respectively, the leaf surface area is reduced by 38.8%. On trees with a degree of damage of 4 points and covered with shields, cracks were formed, which eventually lead to the suppression of growth processes and the gradual death of trees.

According to the data obtained, when trees were populated with 2 points, the percentage of affected apples was 14.3%, when a tree was populated with 3 points, 42.5%, and 55.6% of the fruit was damaged with 4 points. Even if the pest infects 14% of apples, the products are perceived as not standard and not high-quality, so the California shield should be suppressed as much as possible in the first generation to prevent damage to the fruit.

**Key words:** California shield, quarantine, pheromone, traps, damage, population, monitoring.

**Introduction.** California shield-*Q uadraspidotusperniciosus* Comstock (family Diaspididae, subfamily Aspidiotinae, tribe Aspidiotini) was first described by D. Comstock (Comstock, 1881) in California. In Europe known as "mealybug St. Joseph " (San Jose scale). It is one of the dangerous quarantine pests of many fruit, berry, ornamental and forest species [1].

**Research materials and methods.** During the research, we used generally accepted methods of plant protection and quarantine. Pheromone traps for catching the California shield were hung during Apple blossom, along the periphery of the tree crowns at a height of 2 m, in the middle rows of the array at the rate of 1 trap per 2 hectares of fruit-bearing garden. Surveys of fruit stands using pheromone traps were carried out only during the summer of males. The traps were checked every 7-10 days, and the pheromone was changed 1 time in mid-summer.

To determine the degree of damage to the Apple tree by the California shield, a four-point scale developed by A. N. Kirichenko was used as a basis[2].

0 - points-the tree is clean;

1 - point-the damage is weak, isolated individuals of the shield were found on the tree;

2 - points - damage to the plant is average, there are colonies of shield plants;

3 - points-the damage is severe, the tree on the 1/3 surface is covered with colonies, there is an initial stage of cracking of the bark, there is a shrinkage of semi-skeletal branches;

4 - points-the damage is very severe, the trunk and main skeletal branches are covered with a solid inlay of shield colonies

The number of California woodchip in gardens was determined using the tree population coefficient (K) according to the formula:

$$K = \frac{P * A}{100}$$

P - percentage of tree population, %; A - average density of tree population by live females. The density of tree population was determined before early spring processing (March-April). To do this, in the field, using a band-aid or tweezers, the insect's flaps were removed, then the average density of living individuals was calculated on 5 sites of 2 cm in size in various places of the trunk and branches of the tree.

**Research result.** The research was conducted in Apple orchards, the main fruit-growing areas in the South-East of Kazakhstan.

California shield is a dangerous pest of fruit crops, and therefore the effective protection of trees from it, ensuring a reduction in numbers and obtaining a commercial crop, should be directed to the efforts of producers, which will eliminate or reduce economic damage. Since the California shield beetle is a sucking insect, its larvae attach themselves to the bark of the tree and suck out the SAP, which causes irregularities in the bark of the trunk and young shoots to form around the damaged area. Redness of damaged areas appears on the leaves, leading to their deformation, as a result of which they fall off, moreover, the total amount of green mass decreases, and the overall development of the tree decreases (figure 1).



a - tree



b - escape

Figure 1 – Damage to Apple trees by California shield

If in the first and second year the trunks and branches of trees damaged by the California shield are covered with foci of shields, which causes them to form bark irregularities and red spots, then in the third year the pest forms a continuous cover of shields. In damaged trees, infected leaves fall off, the buds do not completely bloom in the spring, and the shoots shrink. As a result, the growth of shoots and the size of leaves are significantly reduced. We measured such biometric indicators as growth of shoots and leaf surface area in order to determine the influence of tree population by California shield on growth processes (table 1).

Table 1 – Influence of damage to trees by California shield on measurements of growth processes of Apple trees variety ("Zaiyliysk", "Janibek" farm in Enbekshikazakh district of Almaty region (2017)

The degree of infestation of trees, point	Replication	Growth of shoots, cm	Leaf surface area, cm <sup>2</sup>	Reduction of leaf surface area in comparison with indicators of a healthy tree	
				Growth of shoots, cm	leaf surface area, cm <sup>2</sup>
1 points	1	57	48	1,8	4,0
	2	59	45	3,3	2,2
	3	61	46	3,2	2,1
	average	59,0	46,3	2,8	2,7
2 points	1	58	47		6,0
	2	56	46		4,4
	3	57	44		6,4
	average	57,0	45,6	6,0	5,6
3 points	1	49	34		30,0
	2	51	35		28,3
	3	51	35		25,6
	average	50,3	34,6	17,0	27,9
4 points	1	37	31		38,0
	2	39	30		37,0
	3	40	28		40,5
	cp.	38,7	29,6	36,4	38,5
A healthy tree	1	58	50		100
	2	61	56		100
	3	63	49		100
	average	60,6	48,9	100,0	100,0
SSD		0,948	0,930	0,971	0,968

As can be seen from the data given in the table with a high degree of infection of trees, which is 4 points, the growth of shoots is reduced compared to a healthy tree by 36.4% ,respectively, the leaf surface area is reduced by 38.8%. On trees with a degree of damage of 4 points and covered with shields, cracks were formed, which eventually lead to the suppression of growth processes and the gradual death of trees.

As many researchers note [1] the first generation of the California shield is considered the most harmful. Born vagabonds spread on the tree, and along the way damage the fruit, causing apples to be covered with red spots. The commodity value of such a crop falls sharply. If the degree of infection of the tree is estimated at 1 point, the percentage of infection of the fruit is about 50%. We took into account the de.

Table 2 – Percentage of infected fruit depending on the degree of tree population with California shield ("Janibek" farm, variety of Zailiysk (2017))

Degree of tree population, point	Replication	Number of fruits, PCs.	Of them are damaged, pieces.	%, damages
1 points	1	105	11	10,4
	2	100	8	8
	3	97	9	9,2
	average	100,0	9,4	9,2
2 points	1	113	18	15,9
	2	100	14	14,0
	3	93	12	12,9
	average	102,0	14,6	14,3
3 points	1	105	40	38,0
	2	80	41	51,2
	3	94	38	40,4
	average	93,0	39,6	42,5
4 points	1	70	44	62,8
	2	75	38	50,6
	3	74	40	54,0
	average	73,0	40,6	55,6
SSD		0,703	0,943	0,943

According to the data obtained, when the tree was populated with 2 points, the percentage of affected apples was 14.3%, when the tree was populated with 3 points, 42.5%, and 55.6% of the fruit was damaged with 4 points. Even if the pest infects 14% of apples, the products are perceived as not standard and not high-quality, so the California shield should be suppressed as much as possible in the first generation to prevent damage to the fruit. Figure 2 shows fruits with red spots, the degree of infection of which is from 10 to 55%.

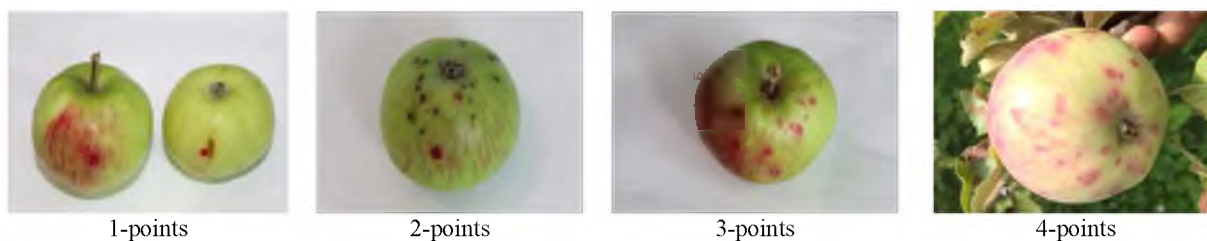


Figure 2 – Fruits damaged by California shield, "Olzhas" and "Janibek»farms

It should be noted that in this garden, a set of protective measures was carried out against the California shield, which provided a significant suppression of its development. The level of tree population when taking into account the number of shield plants and damaged shoots was on average about 7-10%. The relatively weak population of the California shield in this garden provided a low level of damage to the fruit (figure 3). Therefore, even with a population level of 2 points, the percentage of damaged fruit was only 6.3% [3].



Figure 3 – Damage to the California Apple tree shield

Completing the analysis of the results of field and laboratory studies, it is necessary to identify individual periods that determine the development of the California shield and affect the effectiveness of protective measures against the pest. Based on the data obtained, we found that the weather conditions during the research years were favorable for overwintering the pest. Even in very severe winters with sharp drops in temperature, the shield did not completely die, and the surviving individuals give numerous offspring in the summer, which was seen in these years by the results of pheromone monitoring. Depending on weather factors, the life cycle of a single replenishment larvae is completed in 30 days, while a certain part of the larvae of the first summer generation hatched in early August goes into diapause and at the stage of the black shield remain to winter.

Analysis of the biological features of the development of the California shield also showed that the vulnerable phase for protective measures is the stage of the appearance of vagrants [4]. The hatching of vagrants of the overwintered generation occurred at the beginning of the first decade of June, and vagrants

of the first summer generation were recorded in August – early September. The beginning of development of the California shield-larvae of the first instar was noted in the second decade of April. Males were observed during the entire month of May, and vagrants occupied the trees from the third decade of May to the end of June. The second-generation imago of the California shield cat lasted from late June to mid-July. The departure of the third-generation imago was greatly extended from mid-August to the first days of October. Vagrants of the California shield having completed the development cycle in September-October months, massively passed into the wintering stage – larvae of the first age under the shield. The effectiveness of measures to combat the California shield primarily depends on the timing of protective measures. Treatments against California shield should be carried out in the following terms. The first processing is carried out in the spring during the period from budding (March 10 - April 10). The second processing is carried out - after flowering - the fruits are in a state of walnut (May 15-20).

**Conclusion.** The results of observations showed that with the highest degree of infection of trees, which is 4 points, the growth of shoots is reduced compared to a healthy tree by 36.4%, respectively, the leaf surface area is reduced by 38.8%. On trees with a degree of damage of 4 points and covered with shields, cracks were formed, which eventually lead to the suppression of growth processes and the gradual death of trees.

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### **ҚАЗАҚСТАННЫҢ ОҢТҮСТІК-ШЫҒЫСЫНДАҒЫ ЖЕМІС БАҚТАРЫНЫҢ ҚАУШПІ КАРАНТИНДІК ЗИЯНКЕСІ – КАЛИФОРНИЯЛЫҚ ҚАЛҚАНШАЛЫ СЫМЫРЫ**

**Аннотация.** Мақалада алма ағашының өсу үдерісін өлшеу барысында калифорниялық қалқаншаның зақымдау деректері келтірілген. Калифорниялық қалқаншалы сымырдың зақымдау деңгейі 4 балды көрсеткенде ағаштарда жарықшақ пайда болып, ағаштың өсу үдерісі тежеліп, ақырындап өле бастайды. Сондықтан калифорниялық қалқаншалы сымырдың жемісті зақымдауына жол бермеу үшін бірінші буын кезеңінде-ақ барынша күресу шараларын жүргізу керек.

Зерттеу барысында өсімдіктерді қорғау мен карантинде жиі қолданылатын әдістер қолданылды. Калифорниялық қалқаншалы сымырды аулауға арналған феромон тұзақтары алма ағашы гүлденгенде 2 м биіктегі ағаштың шеткі жиегі бойынша массивтің ортаңғы қатарында 2 ға жеміс беретін бақта 1 тұзақ мөлшерінде ілінген. Жеміс көшетін феромонды аулағыштар арқылы бақылау жұмыстары жазда, аталық зиянкестер ұшқанда жүргізілді. Аулағыштарды 7-10 күнде бір рет тексеріп, феромонды жаздың ортасында бір рет өзгерттік.

Бақылау нәтижелері көрсеткендей, ағаштардың зақымдануының жоғары деңгейі 4 балды көрсетеді, бұтақтар өсімі сау ағашпен салыстырғанда сәйкесінше 36,4% азайды, жапырақ бетінің ауданы 38,5% қысқарды. Калифорниялық қалқаншалы сымырлардың зақымдау деңгейі 4 балды қамтығанда ағаштарда жарықшақ пайда болып, ағаштың өсу үдерісі тежеліп, біртіндеп өміршеңдігін жоғалтады.

Алынған мәліметтерге сәйкес, 1 балл деңгейінде бүлінген ағаш – 9,2%, 2 балл деңгейінде бүлінген алмалар 14,3%-ды көрсетті, 3 балл деңгейінде бүлінген ағаштар 42,5% болды, 4 балл деңгейінде 55,6% жеміс бүлінген. Зиянкестер алманы 14% зақымданғанда өнім стандартты емес және сапасыз деп қабылданады, сондықтан калифорниялық қалқаншалы сымырдың жемісті зақымдауына жол бермеу үшін бірінші буын сатысында-ақ оған қарсы күресу шараларын қолға алған жөн.

**Түйін сөздер:** калифорниялық қалқанша, карантин, феромон, аулағыштар, зақымдану, мониторинг.

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### **КАЛИФОРНИЙСКАЯ ЩИТОВКА ОПАСНЫЙ КАРАНТИННЫЙ ВРЕДИТЕЛЬ ПЛОДОВОГО САДА НА ЮГО-ВОСТОКЕ КАЗАХСТАНА**

**Аннотация.** В статье приведены данные поврежденности деревьев калифорнийской щитовкой на измерениях ростовых процессов яблони. На деревьях со степенью повреждения 4 балла и покрытых щитками образовались трещины, которые в конечном итоге и приводят к угнетению ростовых процессов и постепенной гибели деревьев. Поэтому калифорнийскую щитовку следует максимально подавлять еще в первом поколении, чтобы не допустить повреждения плодов.

При проведении исследований использовались общепринятые в защите и карантине растений методики. Феромонные ловушки для отлова калифорнийской щитовки развешивали во время цветения яблони, по периферии крон деревьев на высоте 2 м, в средних рядах массива из расчета 1 ловушка на 2 га плодоносящего сада. Обследования плодовых насаждений с помощью феромонных ловушек проводили только во время лета самцов. Ловушки проверяли раз в 7-10 дней, феромон меняли 1 раз в середине лета.

Результаты наблюдений показали, что при высшей степени заражения деревьев, которая составляет 4 балла, прирост побегов снижен по сравнению с здоровым деревом на 36,4%, соответственно на 38,5% уменьшена площадь листовой поверхности. На деревьях со степенью повреждения 4 балла и покрытых щитками образовались трещины, которые в конечном итоге и приводят к угнетению ростовых процессов и постепенной гибели деревьев.

Согласно полученных данных, при заселении деревьев в 1 балла процент поражённых яблок составил - 9,2%, при заселении дерева в 2 балла - 14,3%, в 3 балла - 42,5%, при 4-х баллах была повреждена 55,6% плодов. Даже при заражении вредителем 14% яблок, продукция воспринимается, как не стандартная и не качественная, поэтому калифорнийскую щитовку следует максимально подавлять еще в первом поколении, чтобы не допустить повреждения плодов.

**Ключевые слова:** Калифорнийская щитовка, карантин, феромон, ловушки, повреждения, заселенность, мониторинг.

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