ANNEX I

FEDERAL SERVICE FOR VETERINARY AND PHYTOSANITARY SUPERVISION

Federal State Institution «ALL-RUSSIAN CENTER OF PLANT QUARANTINE”

ANALYSIS OF PHYTOSANITARY RISK OF KHAPRA BEETLE ***TROGODERMA GRANARIUM*** FOR THE TERRITORY OF THE RUSSIAN FEDERATION

Moscow - 2006

Analysis of phytosanitary risk of the khaprabeetle *Trogoderma granarium* for the territory of the Russian Federation is prepared by the Chief Agronomist of Department of Scientific-Methodical Support of FSI "ARSPQ", Candidate of Science {Biology}Y.A. Sokolov.

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Introduction

The khapra beetle is one of the most dangerous pests of grain and products of its reprocessing in the world. It is included into the list of quarantine pests of all countries with phytosanitary service, as well as the list of international organizations for the plant protection. Khapra beetle damages the whole grain of cereals, rice, corn, oilseeds, bean, seeds of vegetable, forest, ornamental and other crops. In carrying outthe analysis of phytosanitary risk (APR), the methods recommended by the European and Mediterranean Organization forPlant Quarantine and the FAD (2, 4, 6, 10, 11) are used.

Part 1.Scientific argumentation of analysis of phytosanitary risk of *Trogoderma granarium* for the territory ofthe Russian Federation

Name: Khapra beetle – *Trogoderma granarium* Everts

Khapra beetle (Engl.)

Trogoderme (dermeste) du grain (French)

Khaprakafer (German)

Escarabajokhapra (Spanish)

Synonyms: *Trogoderma afrum* Priesner

Systematic position:

Class - Insecta, order - Coleoptera, family - Dermestidae

1. *Geographicalrange*

Countries with focuses of the khapra beetle in the territory:

Europe: Austria, Great Britain, Greece, Spain, Switzerland, Germany.

Asia: Afghanistan, Bangladesh, India, Iran, Iraq, Israel, Jordan, Pakistan, Saudi Arabia, Syria, Turkey, Sri Lanka, Taiwan, Japan, and Kazakhstan and the Central Asian countries - Tajikistan, Turkmenistan and Uzbekistan.

Africa: Algeria, Burkina Faso, Egypt, Zambia, Zimbabwe, Libya, Mali, Mauritania, Morocco, Niger, Nigeria, Senegal, Somalia, Sudan, Tunisia.

South America:Venezuela, Uruguay.

Oceania: New Zealand.

2. *Biology*

Khapra beetle - a typical pest of the human stocks. Under favorable conditions - the presence of food and optimum temperature - develops without facultative diapauses; for a short period of time it can form the outbreak of mass generation; except that the humidity of the air and food have a little effect on the rate of development and they are not a limiting factor, as the larvae develop normally on products with humidity of 6 %, that it gives this species the advantage in competition struggle with other pests stocks.

The larvae of this pest can fall into diapause in the absence of food, over population, increasing or decreasing temperature beyond the optimum. In this state they stop feeding. They migrate from food substrate in search of shelter shuddling up in the cracks of premises, sack tare and similar places. Larvae remain viable up to 3 years without food. Such passive or diapausing larvae are extremely resistant to adverse conditions, including the effect of contact pesticides and fumigants. When receiving fresh food such larvae wake up, proceed to feeding, complete cycle of development and form fertile offspring (Varshalovich, 1963;Sokolov, 1994).

Larvae of 3-7th of age overwinter in a food substrate or shelters. After feeding the larvae of 6thage - future males - and 7th- future females - creep out on the surface of the substrate, where they pupate in the last larval skin (exuvium), which is bursting at the back seam. Larvae of 3-5th start to feed and complete development with increasing the air and substrate temperature above +15 °C.

Khapra beetle develops in the temperature range of 15-46 °C. The conditions above +46°C are unfavorable for it and the larvae migrate in search of less heated places. This phenomenon is observed in the heating of grain and in the premises of malting and brewing plants. In spring, however, the larvae creep out from the cooler substrate to warm heated walls. The optimum growth temperature of khapra beetle is +32 -36 °C. Under these conditions, the development of one generation lasts 26-35 days. When lowering of temperature to 27 °C the development cycle lasts 5,5 months.

Pupal stage, depending on the temperature, lasts from 2 to 23 days. Formed beetles of light-yellow color remain in the last larval skin a few more days to maturation of reproductive activity and darkening of chitin.

Beetles do not need additional food. The females start the oviposition which lasts up to 10 daysafter mating. Eggs are oviposited to the food substrate freely. Average fertility of females is 65, maximum - 126 eggs. The beetles do not fly, so they settle actively only within the premise or enterprise.

3. *Methods of transfer and spread*

First focuses of khapra beetlein the territory of former USSR were found in 1986 in Turkmenistan. In the next two years, after undertaken examination of enterprises which received imported plant products, only 21 focus was identified, including in Turkmenistan - 8 focuses, Uzbekistan - 4, Tajikistan - 5, Russia - 2 and Kazakhstan - 2 (Research report of ARSRIPQ, 1992).

The first case of detection of khapra beetle in warehouses in the territory of Russia was registered in May 1987. Then 2 focuses of khapra beetle were detected in the Stavropol region. Live larvae of khapra beetle were detected in the batch of fodder corn imported from the United States tothe Kochubeevskiy plant of cereal products and Nezlobnenskiy feed milling plant. Both focuses in Russia were declared under quarantine and due to the destructive measures they were successfully localizedand liquidated.

Contaminating with khapra beetle in the territory of the Republic of Kazakhstan took place, apparently, earlier and detected only in 1987, when the focus of this pest was detected in the stock of malt of Merken brewing plant (Dzhambul oblast). Later, other 11 focuses were detected in the territory of East-Kazakhstan, Semipalatinsk, Celinograd, Dzhambul, Kyzyl-Orda and Atyrau oblasts, practically in all climatic zones of Kazakhstan.

The part of focuses was liquidated within 3 years, in particular the bothfocusesin Russiadue to the taken measures.

Khapra beetleis the most dangerous polytrophic pest of the stocks of products of vegetable origin in the world. It prefers to eat the grain of wheat, corn, rice, barley, oat and products of their processing. Repeatedly it was detected during the inspection in the parcel and postal packets with seeds of different cereals, vegetables, forest and ornamental plants coming to the botanical gardens and research institutions.

There have been cases of delivery of the larvae in the production and packaging of imported goods that were not food for this pest. For example, under metal shell of boxes with tea, in bobbins with synthetic yarn, in a corrugated packaging board, in wooden boxes with industrial equipment.The pestisgot to these goods randomly during storage prior to loading or during transportationin contaminatedtransport. However, all cases of such delivery were timely detected and live pests were liquidated.

Practically all detected cases of focus formations occurred as a result of importation of infected products. Thus, all 12 focuses in Kazakhstan and 4 focuses in Uzbekistan formed as a result of importation of infected barley malt to brewing plants. 2 focuses at the bread-baking complexes inRussia and 8 focuses in Turkmenistan formed in connection with the importation of infected batches of fodder corn and wheat.

This occurred because the existing methods of quarantine inspection of cargo at border importation points do not allow to detect in 100% of cases the infection of grain products at a low degree. It is particularly difficult to detect infection of brewing malt, fodder corn and crushed grain products (such as oil cakes, mill cake) in phase of egg or larval instars. Penetrating in this way across borders, khapra beetle infects granaries, vehicles, warehouses of raw materials and flour, mills, animal feed mill, confectioneries, malt stores and crushing department ofbrewing plants.

Inspection of warehouses of enterprises receiving, storing and processing imported vegetable products and other goods of increased risk of importation of

pests of stocks of quarantine value – the object of primary importance for workers of the Phytosanitary Service.

4. Methods of detection of khapra beetle

4.1. Inspection of warehouses, grain elevators, mills and premises of grain processing enterprises

Visual inspection with the sampling and analysis of samples of stored products is carried out 1-2 times during the warm season. Primarily that storages are inspected which located at the importation points: at sea and river ports, airports and border railway stations. Storage depots and workshops of processing imported agricultural products domestically are inspected (industrial complexes of cereal products, oil-processing and animal feed plants, malt-houses and crushing facilities of brewing plants and confectioneries). Grain elevators, mills, seed stores should be thorough inspection, where imported quarantine agricultural products previously were stored or enter now (Barak, 1989; Varshalovich, 1963).

In inspection of warehouses the walls, floor, ceiling, pillars, roof beams, various storage equipment, tools and mechanisms are inspected. At the same time cracks of floor, pillars, rafters and plaster of walls are carefully inspected. Garbage, spills and basters are sollected on asieve cover. All fractions are inspected on paper. Dead insects and larval skins of beetles-trogoderm are placed in separate test tubes. Live beetles and larvae are preliminary exhausted in dyeing mordant, then placed on cotton mattresses, and larvae - to alcoholic solution. Except the premise it is necessary to inspect all stored batches of products.

Inspection is carried out with the dark sides of the piles. Spans between the bags and bales, places of contact with the walls and joints of bags are inspected. Flashlight is used for this purpose. It is recommended to turn and shift to another place 2-3 bags in various places in the warehouse. If the goods are infected, a careful inspection can allow to detect usually live pests. With a weak infestation it

is hard to find live pests, so it is necessary to pay attention to the presence of molting skins and powdery yellowish white fecess pilling through the bagging. This indicates the presence of live pests in bags, including khapra beetle. However, the presence of only feces of larvae is insufficient for conclusion of the quarantine condition of the cargo. To do this, the bag contents are poured out on cardboard or canvas looking through the bag, and all live insects are collected to the test tube. All material is provided with a label and sent to the laboratory for identification.

In addition to warehouses and production inside of the warehouse it is necessary to examine in-stocking territory and outside the warehouse, paying special attention to cracks in the plaster, between the bricks and boards. It is necessary to check spills and basters of grain and vegetable garbage near the warehouse for infection.

4.2. Method offoodbaits

The study of the selective ability to food at the khapra beetlelarvae have shown that they prefer crushed wheat, corn, barley malt, peanut, hazelnut and sunflower seeds. Food mixture,which is placed in the single-layer cheesecloth bags, is prepares from these components. They should be placed in secluded places: on the walls, beams, in boxes of fire hydrants, etc., that to prevent the bag with bait being covered by loaded grain, and to avoid being eaten by rodents. Never hang the bait on the nails, because the beetles do not fly.

Terms of beginning the inspection of food baits. In the spring, when the air temperature in the stock will rise up to +15 °C, larvae, migrating in search of fresh food, penetrate through cheesecloth into the bags with bait where further they feed and reproduce. Bait should be taken and analyzed in autumn in August - September. Each bait is provided with a label,placed in a separate pocket and sent to the laboratory for analysis.

4.3. Method of pheromone glue traps

This method is used specifically to detect imago khapra beetle. At the same time other types of carpet beetles of the genus of Trogoderm and Megatom are caught. Spencer with trogodermalpheromone (usually 1-1.5 - centimeter pieces of rubber tube) is placed on the insert of trap made of laminated papergreased with glue "Pestifix". The construction of the trap is not significant. It is important that it was placed on the surface of walls, supports, beams, but not hanged on a lead not touching the walls, because the imagoof khapra beetle does not fly. The second feature of the method –the traps should be put no earlier than the new generation of beetles will appear becausethe term of attracting ability of pheromone is calculated by days. For the same reason the traps or capsules with pheromone should be replaced after 10-15 days. Pheromone traps should be set in southern Kazakhstan and Uzbekistan at the end of July - beginning of August, in the Central and Western Kazakhstan and southern regions of Russia - in August (Research Report of ARSRIPQ, 1992).

4. *Morphologyandidentification*

Khaprabeetle relates to the Dermestidae family - carpet beetle, the Trogoderma genus - granivorous carpet beetle. The species of this genus are distinguished by the following features:

Body of imago of khapra beetle is fawn-coloured with length from 1.8 to 3.0 mm, a width of 0.9 to 1.7 mm, short oval shape with almost parallel sides (Fig. 1, Appendix). Superior wings are one-color or with obscure slings. Top of body is covered with thin pale yellow, grayish, brownish or almost black hairs. Light areas ofcuticle are covered with lighter hairs. Bottom of body are in thinmonochromatic grayish-yellow or brownish hairs. Males havea number of darker and thickened hairs protruding over the edge of sternum along the edge of the 5^{th} abdominal sternum among thin hairs (Beal, 1956; Diagnostic protocol, 2002; Okimura, 1954).

Imagoof khapra beetle has well-developed mouthparts of biting type,

although the beetles do not feed.

One of the most important and reliable diagnostic features used to determine the species by micro features is the shape of the chin (Fig. 2c). Both males and females have well sclerotized chin. Front side edgesarearcuaterounded and there is a deep hollow in the middle of the front edge that cuts chin at least half of its length. Other closely related species of the Trogoderma genus have different chin shape - in the form of a trapeze or rectangle.

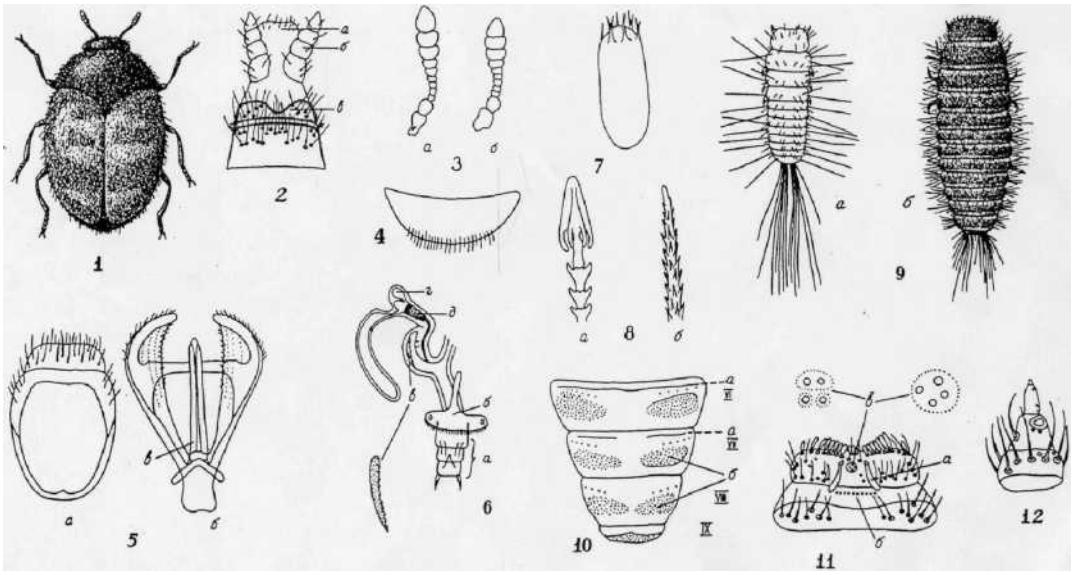

Fig. 1-12.Khapra beetle *Trogodermagranarium* Everts (1-6 - imago; 7 - egg; 8-12 - larva):

1 - Male. 2. lower lip: a - tongue; b–lower palpus; c - chin. 3. Cornicles: a - males; b - females. 4. Fifthsternite of abdomen of male. 5. Genitals of males: a - circular eighthsegment with divided 9thtergum; b - fallobase; c - adeagus. 6. Genitals of females: a - ovipositor, b - scapula; c - sawed logaditis; d - semen collector, e - corrugated part ofsemen collector. 7. Egg. 8. Larva hairs: a - lanciform; б - acanthaceous. 9. Larvae: a – first age; b - sixth age. 10. Anal end of larva - VI - IX tergum of abdomen: a – in-tergal line; b – places of fastening of lanciform hairs. 11. Upperlipbelow: a - palatal logaditis; b - sensorchain; c - sensitive papilla with 4 sensillas. 12. Cornicle/ antenna / larvae.

Number of antennal segments can range from 9 to 11 independent from gender of beetle. More often, however, they can be 11. Antennal club in the male usually is 4-5, and in the female - 3-4-segmented. The apical segment of the clubs in the males is elongated triangle, sharply pointed at the top; about doubly longer than the width at the base of the segment. It is short triangular, not longer than its width at the base of the segment in the females (Fig. 3b).

Eyes on the inner edge are higher than the base of the antennae, without distinct hollow.

Pointed shelf of backedgeoftheprothoraxhasno alongitudinalmediankeel, butmayhavesmalllumpyoutgrowth ontop.

Keeled-shapedfold, limiting the antennal fossa behind, does not reach the lateraledge of the pronotum.

Male genital apparatus consists of fallobase, paramere connected with tectum, and 8-9th reshaped abdominal segments (Fig. 5a, 5b). Ratio of shape and size of these structures are also distinguishing features in the diagnosis of species (Zhantiyev 1976; Sokolov, 1994).

Female genital apparatus includes an ovipositor, copulatory bag with two serrated sickle sclerites with 10-15 teeth each, and seminal collector. Length of serrate sclerites and corrugated part of seminal collector at the khapra beetle are approximately similar (Fig. 6a-e). Other species have clearly different size, shape and the ratio of these values (Varshalovich, 1963).

In addition, it is possible to distinguish khapra beetle from other similar species of trogoderm widespread in Russia (T. variabileBall.,Tg labrum Hbst., T. teukton Beal.), by the costal bristles at the membranous wings: the number of bristle on the costal vein of leading edge of the wing is 6-14 pcs. in the khapra beetle (usually 8-12), whereas other local species have from 16 to 32 pcs. (usually 18-27). Color of veins is pale yellow sometimes they are poorly marked. The number of small bristles located between the costal vein and pterostigma is 2-5 in the khapra beetle, in other species - from 6 to 9 pcs. Membranous wings are

underdeveloped in thekhapra beetle, therefore they are longer than the elytra only 1.3-1.5 times. This ratio in other flying species of Trogoderma is 1.8-2.0. Egg of the khapra beetle is oblong-oval, with average length of 0.7, a width of 0.25 mm. One end is smoothly rounded;another end is narrowed and has a few outgrowths, such as spines (Fig. 7). Newlyoviposited egg is opal color, then it turns yellow and translucent with brownish stripes from brownish body segments of developing larvae.

Larva is light yellow with a darker colored tergites and head. The body length is up to 4, width is up to 1.6 mm, elongated form, slightly narrowing to the head and the back end (Fig. 9a, 9b, Appendix - d). All thoracic and abdominal segments have dark-colored tergites in the shape of chitinized shields on the upper side of the body. Except that, along the front edge of the abdominal tergitesit has schitinous foldknown as antecostal seam or in-tergalline (Fig. 10a). It is absent in the khapra beetle larvae on VIII tergite, and it is stored in the form of lines on VII tergite(Okumura, 1954; Diagnostic protocols, 2002).

The upper side of the body is more convex, covered with numerous reddish-brown, various size, simple and spiny bristles and lanciform hairs. Last ones densely cover the sides of 6-8 tergites of abdomen, forming clusters in the form of rolls. To see intergal line, they should be removed.

There is clusterofsimplebristles atthelastninthsegment, which is equalinlengthtothelastthreesegmentsoftheabdomen.

Antenna or antennae are located on the sides of the head, which consist of 3 segments and which have sensitive bristles. Theirnumber, locationandsizeareconstantforeachspecies (Fig. 12).

Palatine membrane is located on the underside of the upper lip, which is known as epipharynx which has palatal scleritis and round sensitive capsule between them. Number of gustatory pores known as sensilla in the capsule is constant for each species. Khapra beetle has four (Fig. 11).

There is a fold ontergitesofall abdominalsegmentsalongthefrontedgewhich is

known as intergal lineorantecostalseam (Fig. 10a).

Khapra beetle larva is different from the larvae of other species by the following features:

- Tergites of chest and abdomen are mono chromatic straw-yellow or light brown;
- on the 1st antennal segment the bristles are located around the circumference, their length reaches the top of 2nd segment, where there is only one sticking bristle (Fig. 12);
- on epipharynx in the capsule there are 4 sensilla;
- intergal line on the 8th abdominal tergite is absent, or traces of it can be preserved only as dotted points (Fig. 10a).

Pupa is light cream color, its length at an average of 3.5-4.5 mm. The top side of thoracic and abdominal segments is covered with dense long red semiadherent hairs; the same hairs form a cone-shaped crest on the head.

6. Harmfulness

In the presence offeed andthe optimum temperature the khapra beetle develops withoutdiapauseduring the yearand can givea fewgenerations. In such circumstances,the pestgives theoutbreak of mass reproduction already for annual period, whenthe number of pestreaches severalthousand of specimens per 1 kg ofproducts. Infectedgrain productsare turned intothe powder compositionoffeces, moltingskinsandfood residues unsuitable for use in food and animal feedbecause of itstoxicity. Especiallyseeds of differentcrops are strongly damaged,because larvaeprimarilyeat awaythe mostvaluable part ofthe seed,namelythe seed bud. At the same time the seed germination reduces.

6.1. Assessment of economicvalue

The economic damage caused by khapra beetle in the world, is widely reported in the scientific publications (Varshalovich, 1963; Sokolov, 1994; Barak, 1982, Lindgren, 1959). Costs of liquidation of focuses in disinfecting of 455 enterprises declared under the quarantine by khapra beetle in the United States in 1953-56 were more than $ 3 million for fumigation, wet spraying with organophosphate agents and economic and organizational measures in the focuses of infection. $ 8 million was allocated for the campaign of liquidation of the khapra beetle in the U.S. in 1953-59. There are cases where the khapra beetle destroyed up to 70% of the stored products in Africa.

For southern regions of the Russian Federation the example of harmfulness of the khapra beetle can be the case of infestation of barley malt in Kazakhstan in the territory of former USSR, when in Atbasarbrewing plant in 1988-89. (Tselinograd region in the northern Kazakhstan), with the number of larvae of different ages 3670 specimens per 1 kg in a batch of malt with weight of 6.5 tons, the decrease of the grain was 17%. In 1990-91 at the Atyrau (former Guriev in the western Kazakhstan) brewing plant the infection of malt batchwith weigh of 5.5 tons reached 6.000 larvae per 1 kg. Both of these batches of malt could not be used as intended and were destroyed under the sanitary reasons (Final Report ARSRIPQfor 1988-92; Vayutin, 2002).

The economic costs of liquidation of 2 focuses of the khapra beetle in the Stavropol Territory in 1987-89, according to the Russian state quarantine were 6.000.000 rubles.

All countries of the world on the first occasion of detection of khapra beetle focuses take emergency measures fordestruction of this dangerous quarantine pest, preventing economic losses. Therefore, there are no publications related to the economic cost of damage caused byit in the literature about the harmfulness of khapra beetle in the last 10 years.

6.2. Damage to the environment

In the process of disinfection of the enterprise against khapra beetle the methyl bromide is used in large quantities. This preparation is banned in most countries, including the countries of the Western Europe upon the health and environmental concerns. Chemical processing of the enterprises and granaries against pests of quarantine stocks, in particular khapra beetle, by phosphine, organophosphate, pyrethroid and other agricultural chemicals will increase the pesticide load on the environment.

6.3. Socialharm

Due to the possible spread of the khapra beetle in the territory of Russia the social harm will be expressed in a possible loss of foreign market with the countries where this pest is the missing quarantine object. It will prevent the free trade with the countries of the European Union and lay down as additional economic costs of disinfection of exported grain products.

7. Quarantine measures

Import of quarantine vegetable products is allowed to Russia from other states under the followingconditions.

1. In the presence of import quarantine permit issued by the State Phytosanitary Service of the Russian Federation, which establishes the conditions of importation and the use of imported products.

2. In the presence of quarantine certificate or certificate of the State Phytosanitary Authorities of the exporting country certifying the absence of live khapra beetles and other stock pets in imported products.

3. Mandatory quarantine inspection is required at points of importation of agricultural products, container, vehicles from the countries of spreading the

khapra beetles, as well as mandatory detailed secondary quarantine inspection of such products at the point of the receipt and realization.

4. In case of detection of khapra beetle in agricultural products, container or vehicles it is necessary to immediately carry out their disinfection by fumigation with methyl bromide or phostoxinby modes providing 100% mortality of khapra beetle in all phases of development.

5. In detection of khapra beetle in storages or production buildings of enterprises they are subject to quarantine in accordance with the Charter of the State Phytosanitary Service until the complete liquidation of the focus.

6. Quarantinerestrictionsimposedontheenterprisesonkhapra beetle shall be removedafter 3 yearsafterthelastdetectionoflivespecimensofthispestintheenterprise.

8. Risk assessment of importation and acclimatization of Trogoderma granarium in the territory of Russia

9-points caleis used for quantitative estimation frommінimum possibility of the presence of risk factor or damage(score - 1) tomaximum (scope - 9) by the method of EMOPQ(A.D. Orlinskiy, 2002) andmethod ofARSRIPQ (2005).

Part 2.Analysis of phytosanitary risk of the khapra beetle*Trogoderma granarium* Ev.for the territory of the Russian Federationbymerit point system (according to themethod ofEMOPQ)

Phytosanitary risk analysis (hereinafter referred to as PRA) is carried out in accordance with the standards of EMOPQ to detect the quarantine status of khapra beetle *Trogoderma granarium* for the territory of the RussianFederation.

Preparation stage of PRA

No. of point by scheme	Point of scheme	Summary result		To which point it transfers
1	Taxonomic unit and the possibility of	Selected option -	Yes	3

	identifying	Yes	No	2
2	The possibility of identifying the species newly	No	No Yes	3 22
3	Identifying of areal of PRA	Territory of Russia		4
4	Previous PRA for the specific pest	No	No	7
5	The possibility of partial or full application of previous PRA for specific pest		No	7
6	Proceed to the assessment comparing with the previous PRA			7

Assessment of phytosanitary risk.PartA: Classification of specific pest*(qualitative criterions varying quarantine specific pest)*

No. of point by scheme	**Point of scheme**	**Summary result**	**To which point it transfers**	**No. of point by scheme**
Geographic criterion				
7	Presence of pest in area of PRA	No	No	9
8	Spread of pest in area of PRA		Yes	22
Potential possibilities of acclimatization				
9	Food stocks in the area of the PRA (in the nature and / or in storage)		Yes	10
10	Intermediate or additional host plants			
11	The presence of intermediate or additional host plants in the area of the PRA			
12	The presence of the transmitters at the pest			
13	The presence of transmitters (similar species that can become transmitters) in the area of the PRA. The ability to penetrate easily to it andacclimatize itself			
14	The presence of the pest of the eco-climatic zones in the contemporary area that is comparable to eco-climatic zones of the PRA area		Yes	18

15	The possibility of survival and reproductionof the pest in a wider area, including the area of the PRA		Yes	18
16	The possibility of survival and reproduction of the pest in heated premises in the PRA area		Yes	17
17	The presence of food stocks in granaries in the PRA area		Yes	18
Potential economic value				
18	The damage caused to the plants by the pest in the contemporary area that is presents in the territory for which the PRA is carried out		Yes	21
19	The damage caused to the plants by the pest in theareaof the PRA, taking into account all the factors affecting the damage			
20	The damage of another kind (social damage, environmental damage, loss of export market) caused by the pest			
21	The pest can pose a risk to the PRA area		Yes	Part C
22	The pest cannot be classified as a quarantine pest for the PRA area, and the assessment procedure can be terminated			The end

Assessment of phytosanitary risk. Part C: Quantitative assessment *(possibility of purposeless introduction, possibility of acclimatization)*

No. of point by scheme	Coefficient of point	Point of scheme	Summary result		To which point it transfers
1.1	4	Possible ways of distribution for the pest	Different types of commodity and seed products	Min. Max.	1 9
1.2		It is necessary to reply to questions 1.3 – 1.13			Get to 1.3
1.3a		Possibility of distribution of the pest with the way of penetration	Yes	Yes No	1.3b 1.2

1.3b	8	Possibility of connection of the pest with the way of distribution in its beginning	7	Min. Max.	1 9
1.4	5	The value of concentration of the pest in the beginning of the way	6	Min. Max.	1 9
1.5a		The possibility of survival of the pest under existing economic and trade practices	Yes	Yes No	1.5b 1.2
1.5b	7	The degree of probability of survival of the pest under existing economic and trade practices	7		7
1.6	8	The probability of survival of the pest and its preservation as unnoticed under the existing phytosanitary procedures	The probability of survival is higher. The probability of penetration with seeds -5; with malt and oil cakes - 8		8
1.7a		The possibility of survival during transit of the pest	In the food substrate is high - 9	Yes No	1.7b 1.2
1.7b	9	The possibility of survival of the pest during transit	9		9
1.8	3	The possibility of survival of the pest during transit	Depending on cargo temperature		4
1.9	4	The intensity of cargo movement on the distribution way	5		5
1.10	6	The volume and width of distribution of goods in the APR area	8		7
1.11	9	The time during which the arrival of goods will be extended	9		9
1.12a		The possibility of getting the pest with the distribution way to a suitable plant		Yes No	1.12b 1.2
1.12b	9	The possibility of getting the pest with the distribution way to a suitable products	High, because it gets from infected products - 9		9
1.13	9	The probability of introduction of the pest with the intended method of use of the goods	9		9

Assessment of phytosanitary risk.Part C: Quantitative assessment*(estimation of economic harmfulness)*

No. of point by scheme	Coefficient of point	Point of scheme	Summary result		Scope
1.14	6	Number of types of food vegetable products which present in the PRA area	Section 1 – Biology of khapra beetle. More than 100 types of products		7
1.15	5	The frequency of occurrenceof vegetable products in the PRA area?	Everywhere		6
1.16		The frequency of occurrence of the intermediate host plant in the PRA area, if the pest needs it for passage of development cycle			
1.17		Probability of connection of the pest with a suitable transmitter (if required in the transmitter)			
1.18		The presence ofthe pest in crops in conditions of greenhouse elsewhere			
1.19		Probability of role of wild plants in the distribution or supporting of populations of the pest			
1.20	7	The presence of climatic analogs in the area of the PRA area and in the area of origin of the pest			8
1.21	8	The similarity of other abiotic factors in the APR area and in the area of origin of the pest			8
1.22	6	Probability of a lack of competition from existing species in the PRA area	Moderate competition is possible from local xerophytic species of Trogoderma		6
1.23	4	Probability of obstacle of acclimatization of the pest from natural enemies existing in the PRA area	Natural enemies are absent		0
1.24	5	The probability of the conditions for acclimatization of the pest	Heated premises		6
1.25	4	Probability of absence of obstacles of control measures used against other pests in the PRA area acclimatization of the pest	Control measures at the grain processing plants are used only during a stop for		6

			repairs		
1.26	7	Probability of promoting the reproductive capacity and duration of cycle of acclimatizationdevelopment of the pest			8
1.27	6	Probability of the possibility of acclimatization of small populations of the pest	As likely as not - 6		6
1.28	3	The possibility of liquidation ofpopulations of the pest in the APR area	It is possible in a timely manner of the measures taken to localize and liquidate (Chapter "Biology")		2
1.29	5	Genetic adaptiveness of the pest	It is not investigated		**5**
1.30	8	Frequency of introduction (importation) of the pest to new areas outside its area of origin	Importation - often - 6; localization - usually successful - 5; liquidation – passable - 3		4

Assessment of phytosanitary risk.Part C: Quantitative assessment*(estimation of economic harmfulness)*

No. of point by scheme	**Coefficient of point**	**Point of scheme**	**Summary result**		**Scope**
2.1	9	The value of economic losses caused by the pest in its current area	Essential - for the destructive and preventive measures		6
2.2	3	The value of the environmental damage causedthe pest in its current area	Insignificant - because of the low density of focuses		2
2.3	3	The value of social harm caused bythe pest in its current area	Significant - in the area of distribution		4
2.4	7	The value of the PRA area, at which the damage causedthe pest may appear	Whole territory of the Russian		6

			Federation in the heated premises		
2.5	8	Speed of natural way of distribution of the pest in the PRA area	Low - within the enterprise		3
2.6	8	Speed of distribution of the pest with the human in the PRA area	High - with infected products		6
2.7	8	The possibility of limiting the distribution way of the pest in the PRA area	High - in the quarantine restrictions		2
2.8	9	The probability and value of direct impact of the pest on the crop and / or the quality in the PRA area	High economic impact		8
2.9	8	Possibility of impact of the pest on profits of the producers in the PRA area due to changes in prices, yields, etc.	Impact of the pest on trade and prices - high		9
2.10	6	Probability of the pest impact on consumer demand in the PRA area	High		9
2.11	7	Probability of the pest impact on export markets in the PRA area	High		9
2.12	3	The amount of costs associated with the possibility of the introduction (importation) of the pest in the PRA area	High		9
2.13	4	The value of the damage to the environment in the PRA area by the pest	Moderate		2
2.14	4	The value of social damage in the PRA area of the pest	Moderate		5
2.15	2	Probability lack of suppression ofthe pest by natural enemies already existing in the PRA area in case of its introduction (importation)	Impossible		9
2.16	3	The possibility of carrying out various control of the pest	Possible		8
2.17	1	The possibility of violation of the existing system of biological and integrated plant protection from other harmful pests during measures against the pest	Unlikely		3
2.18	1	The probability of undesirable effects and side-effects (for example, on people's health or the environment) during measuresagainst the pest	Unlikely		8
2.19	3	The possibility of making of resistance to the existing plant protection productsin the pest	High probability		7

Totalquantitative assessmentof phytosanitary risk of thekhapra beetle***Trogoderma granarium***Ev.forthe territory of the Russian Federation

Possibility of penetration for the main way of distribution (PP)				Possibility of acclimatization (PA)				Potential economic harmfulness (PEH)			
# point by scheme	Coefficient of point Wi	Assessment in scopes	Wi * ai	# point by scheme	Coefficient of point Wi	Assessment in scopes	Wi * ai	# point by scheme	Coefficient of point Wi	Assessment in scopes	Wi * ai
1.1	4	9	36	1.14	6	7	42	2.1	9	6	54
1.3b	8	7	56	1.15	5	6	30	2.2	3	2	06
1.4	5	6	30	1.16	-	-	-	2.3	3	4	12
1.5b	7	7	49	1.17	-	-	-	2.4	7	6	42
1.6	8	6	48	1.18	-	-	-	2.5	8	3	24
1.7b	9	9	81	1.19	-	-	-	2.6	8	6	48
1.8	3	3	9	1.20	7	8	56	2.7	8	2	16
1.9	4	5	20	1.21	8	8	64	2.8	9	8	72
1.10	6	8	48	1.22	6	6	36	2.9	8	9	72
1.11	9	9	81	1.23	4	0	0	2.10	6	9	54
1.12b	9	9	81	1.24	5	6	30	2.11	7	9	63
1.13	9	9	81	1.25	4	6	24	2.12	3	9	27
				1.26	7	8	56	2.13	4	2	08
				1.27	6	6	36	2.14	4	5	20
				1.28	3	2	06	2.15	2	9	18
				1.29	5	5	25	2.16	3	8	24
				1.30	8	4	32	2.17	1	3	03
								2.18	1	8	08
								2.19	3	7	21
Sums	81	87	620	Sums	74	72	437	Sums	97	115	592

PD= PH*PA*PEH/100 = 7,65*5,9*6,1**: 100 =2,75**

PH= **(∑ai*wi)/ ∑wi** 620 : 81 = 7,65

PA= **(∑ai*wi)/ ∑wi** 437 : 74 = 5,9

PEH **(∑ai*wi)/ ∑wi** 592 : 97 = 6,1

= =

PH - potential harm

PD – potential damage

PA–possibility ofacclimatization

PEH - potential economic damage

Part 3.Assessment of reduction of phytosanitary risk of importation and further distribution of the khapra beetle*Trogoderma Granarium* Ev.

3.1. Identification of distribution ways

Way 1. Food and feed grain of cereals, rise, corn, sorgho and products of their reprocessing

Way2.The seeds of cereals, vegetable, ornamental, forest and other crops.

Way 3.Vehicles- trucks, railway cars and ships carrying the grain products from the countries of the khapra beetle distribution

Way 4.Sacktare, boxes and packing of cargo and equipment stored in the warehouses and premises infected by the khapra beetle.

3.2. Studied ways for reduction of the phytosanitary risk of importation of the khapra beetle from the countries of its distribution

Identification of possible control measuresin various variants of the khapra beetle *Trogoderma granarium* Ev. distribution.

Detection of possible importation of the khapra beetle in phase of imago, larva andpupae is carried out when border inspection of the quarantineable vegetable production in the border points of importation, seaports, airports and post offices.

Way 1. Food and feed grain and grain products, including brewer's malt pass border control for the presence of quarantine pests, including the khapra beetle.

Way 2. Seeds of plants coming to the farms, trade organizations, scientific and

selectedinstitutions and botanical gardens, pass the border control and laboratory testing for the presence of quarantine pests, including the khapra beetlein crossing the border - the border crossings, water ports, airports and post offices.

Way 3. Vehicles - trucks, railwaycars, shipsandplanescarryingthe grain products fromthecountriesofdistribution of the khapra beetle,passthe bordercontrol.

Way 4. Sacktare, boxesandpacking of cargo and equipment stored in thewarehouses and terminals before shipping which are infected by the khapra beetle, pass the disinfection before shipping oron passage.

Conditions of cargo importation to the Russian Federation

Types of imported products	Conditions of importation to the territory of RF
Food, feed grain, products of their reprocessing, brewer's malt, seedsof agricultural plants from the countries, freefromthe khapra beetle; sack tare, packing andboxes with equipment stored in the warehouses and terminals from the countries free from the khapra beetle.	Possible, subject to observance of phytosanitary requirements of the Russian Federation (IFR, FS, or MS); shall pass inspection and laboratory test
Food and feed grains, and processed products thereof, includingbrewer's malt, cultivated crop seeds; sack tare, packaging and boxes of equipment that were stored in warehouses and terminals incountries of Kaprova beetle spread	Possible in compliance with the phytosanitary requirements of RF (IKR, FS); after disinfection by mode against the diapausing larvae of the khapra beetle before shipping or on passage; they pass the inspection and laboratory check.

Conclusion

As a result of the carried out thephytosanitaryrisk analysis of importation of the khapra beetle *Trogoderma granarium* Ev.into the territory of the Russian Federation it was found that the pest in the egg phase, imago, larvae and pupae may be importedwith the food and feed grain, products of its processing: animal feed, oil cake, mill cake,brewing malt, seeds of various agricultural, ornamental, forest and industrial crops; vehicles - road, rail, marine motor vessels and aircrafts which carried the products infected by thekhapra beetle, with a sack tare, packing and boxes of industrial equipment storedin the warehouses infected by thekhapra beetle.

The final quantitative assessmentof phytosanitary risk of importation of the khapra beetle *Trogoderma granarium* Ev.for the territory of the Russian Federation has indicated that the potential damage is 2.75 nominal units while the average parameter for other pests 1.25 USD (Orlinskiy, 2002).

The results of the analysis indicate the necessity to include the khapra beetle *Trogoderma granarium* Ev. into the "List of pests having the quarantine value for the Russian Federation".

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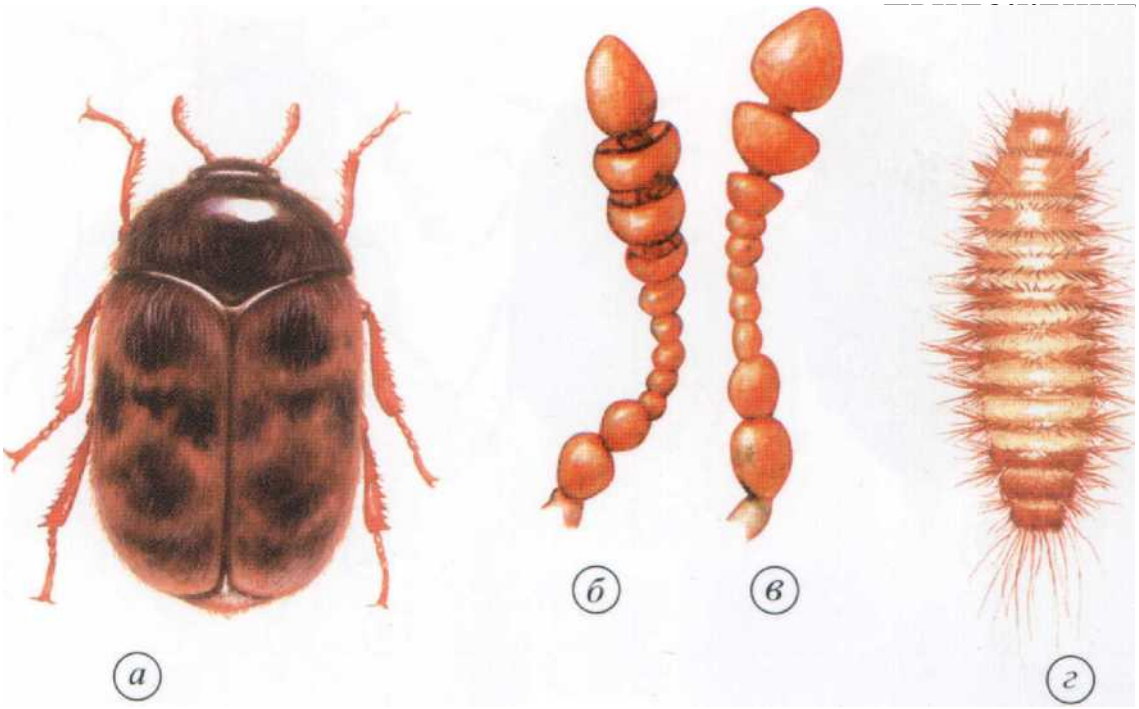

khapra beetle(TrogodermagranariumEv.) а) imago, б) male's antenna, в) female'santenna, г) larva