Trogoderma granarium 简体中文 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Coleoptera	Dermestidae

Common name khapra beetle (English), trogoderma (dermeste) du grain (French), khaprak�fer (German), escarabajo khapra (Spanish)

Synonym *Trogoderma quinquefasciata* , Leesberg
Trogoderma khapra , Arrow
Trogoderma afrum , Priesner

Similar species

Summary Trogoderma granarium are considered a pest of considerable impact to stored foodstuffs. It maintains its presence in food storage in very low numbers and is able to survive long periods of time in an inactive state.

view this species on IUCN Red List

Species Description
Trogoderma granarium is a member of the Coleoptera family Dermestidae. The adult males are 1.4-2.3mm long, 0.75-1.1mm wide; adult females are 2.1 - 3.4mm long, 1.7 - 1.9mm wide, ovate and densely hairy beetles. Colour of the khapra beetle is as follows: head and pronotum dark reddish-brown, elytra reddish-brown, usually with indistinct lighter reddish-brown fasciae; venter of thorax and abdomen reddish-brown; legs yellowish-brown. The setae on the dorsal surface are of two types: evenly distributed, coarse, semi-erect, yellowish-brown ones; and , few scattered, dark reddish brown setae, colour of setae follows the colour of cuticles.The pronotum medially and laterally has indistinct patches of yellowish-white, ensiform setae, and elytra with two or three indistinct band of yellowish-white, ensiform (flattened) setae. The median ocellus on the front is always distinct. Antennae are yellowish-brown, 9, 10 or 11 segmented, with 3-5 segmented club.
Please see PaDIL (Pests and Diseases Image Library) Species Content Page *Beetles: Khapra beetle* for high quality diagnostic and overview images.

Notes
There are many genera within the Dermestidae family that are similar to *T. granarium*. Separation of genera needs specialist knowledge and a good reference library. There are over 120 described *Trogoderma* spp. worldwide and many more still remains undescribed. A great majority of the species have no economic importance but occasionally turn up in commodities causing confusion amongst stored grain entomologists. *T. variabile* Ballion, *T. inclusum* Le Conte and *T. glabrum* Herbst are some of the species, *T. variabile* being the most common. Identification of the most common stored product pest *T. granarium* and separation of the local *Trogoderma* spp. from them is difficult and needs experience with the genus. The greatest difficulty is that most of the specimens collected in the infested commodity are in larval form and need special preparation to enable the scientist to examine it through a compound microscope. Adult specimens are usually scarce and damaged therefore the genitals should be dissected and examined. It is advisable to do so even in the case of undamaged adults.

Lifecycle Stages
The Khapra beetle development rates and survival varies depending on the host species, temperature, light, moisture, season, based on these factors there can be from one to nine generations per year. High humidity has a slowing down effect on the population buildup. Adult longevity is between 12-25 days and females lay between 50-100 eggs. Larvael development usually takes 4-6 weeks. Larvae molt between 4-15 times. The pupal stage lasts 2-5 days and quiescent adult stage 1-2 days. The larval stage however, can last from a month to a year, if it enters diapause. Also they are capable of surviving without food for a period of several years.

Habitat Description
Trogoderma granarium is synanthropic (associated with man or with human dwellings). They are found in grain stores, food stores, malthouses, seed processing plants fodder production plants, dried milk factories, merchant stores, stores of packing materials (used sacks, bags, crates).
\r\n*Trogoderma granarium* occurs in hot, dry conditions, predictably in areas which, for at least 4 months of the year, have a mean temperature greater than 20°C and an RH below 50% (CABI CPC).

Reproduction
Trogoderma granarium exhibit gonochorism (reproduction involves separate male and female individuals).

Nutrition
Trogoderma granarium will feed on most dried plant or animal matter. However, *Trogoderma granarium* prefer grain and cereal products, particularly wheat, barley, oats, rye, maize, rice, flour, malt and noodles. They can feed on products with as little as 2% moisture content and can develop on animal matter such as dead mice, dried blood and dried insects.
CERIS (2004) lists the primary seed and cereal grain hosts: *Avena sativa* (oat), *Cicer arietinum* (garbanzo), *Glycine max* (soybean), *Hordeum vulgare* (barley), *Lens culinaris* (lentil), *Oryza sativa* (rice), *Pisum sativum* (garden pea), *Sorghum bicolor* (grain sorghums), *Tri ticum aestivum* (wheat), *Vigna unguiculata* (cowpea), and *Zea mays* subsp. *mays* (corn). Preferred animal feeds and concentrates include: rolled and ground barley, ground corn, ground dog food, rolled oats, dried orange pulp, ground rice, and cracked and gr ound wheat bran. Nuts that may serve as primary hosts include: *Arachis hypogaea* (peanut), *Carya illinoensis* (pecan), *Juglans* spp. (walnut), and *Prunus dulcis* (almond). Grocery commodities that sometimes serve as hosts include: bread, dried coconuts, cor nmeal, crackers, white and whole wheat flour, hominy grits, baby cereals, pearl barley, and wheat germ. Larvae can feed, but not fully develop on seeds of *Medicago sativa* subsp. *sativa* (alfalfa), noodles, *Phaseolus lunatus* (lima bean), and raisins.

General Impacts
Trogoderma granarium have no direct effects on the environment. The indirect effects however, are loss of stored grain and the effect of fumigation agents on the environment. If the beetle is left undisturbed in stored grain it can cause significant weight loss and in case of seeds it may lead to significant reduction in seed viability. Weight loss can be between 5-30% in sometimes in extreme cases 70%. Severe infestation may cause unfavourable changes in chemical composition. Larvae typically attack the embryo point or a weak place in the pericarp of grain or seed, but will attack other parts during heavy infestations. Young larvae feed on damaged seed, while older larvae are able to feed on whole grains. The khapra beetle can damage dry commodities of animal origin. Large numbers of larval skins and setae may cause dermatitis and/or allergic reactions. Larvae wander in and out of sacked material, weakening the sacks, which may ultimately tear (CERIS, 2004).The fumigant methyl bromide (CH3Br) is an ozone-depleting substance and in high concentrations, is known to cause a failure in the respiratory functioning and central nervous system in humans. Presence of this pest attracts trade restriction implications. Non-khapra beetle countries enforce quarantine restrictions on the imported commodities from khapra beetle countries.

Management Info
Eradication of khapra beetle can be difficult due to its habit of hiding in cracks and crevices, and its ability to enter diapause, which\r\nmay reduce its susceptibility to some control methods, so control methods designed to eradicate new infestations must be able to\r\npenetrate throughout the infested material or facilities (CERIS, 2004). In case of low level of infestation detection by inspection is not reliable.
Preventative measures: *T. granarium* is of quarantine concern because its spread is mainly through international trade. Inspection at ports and entry points provide an effective way to restrict entry of this pest. The Diagnostic Protocol for the regulated pest *T. granarium* prepared by the EPPO (European and Mediterreanean Plant Protection Organization), in english and french recommends means of positive identification and detection of the insect pest. The protocol also includes information on description, impacts, host range, geographical distribution. The Pest Risk Assessment of the khapra beetle conducted by the United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA, APHIS, PPQ), addresses the likelihood of the beetle becoming established in the United States, the economic consequences of khapra beetle infestation in the US, and available information regarding pathways, probability of detection, and marketing/export consequences of infestation in the US.\r\n
Physical In India, the use of deoiled neem (*Azadirachta indica*) seed powder mixed into wheat seemed to be an effective and cheap method to control the pest in stored wheat (EPPO, 2004). Heat treatment has proved to be very effective. The treatement involves a 30-minute exposure at 60oC (140oF) which has given a 100% kill of all stages of the khapra beetle (Ismail *et al.,* 1988 in CERIS, 2004). Mortality of larvae begins at 42.5oC (108.5oF); complete mortality however required 8 days exposure at that temperature (Battu *et al.,* 1975 in CERIS, 2004). Diapausing larvae are more resistant to high temperatures than non-diapausing larvae. It has been reported that some natural mortality of larvae occur in stores due to warming caused by activities of khapra beetle itself. In storage facilities trapping proved to be a useful surveillance tool using pheromone and larval traps. Treatment with fast electrons, using a linear accelerator, could provide an efficient method of controlling khapra beetle in store grain (CERIS, 2004).
Chemical: The most effective treatment is methylbromide fumigation. The control of the species requires higher concentration of methyl bromide because different developmental stages and physiological states (diapausa) exhibits different sensitivity. Replacement of methyl bromide (CH3BR) with phosphine, carbondioxide, carbonyl sulphide, sulfuryl fluoride or other fumigants and their combination are being investigated. Surface treatment is not reliable because of the unique ability of larvae of spending longer period of time hiding in cracks and crevices in facultative diapausa (inactive state). Khapra beetle is known to show signs of tolerance or resistance to phosphine and malathion. Facilities that can not be fumigated may be sanitized and treated with a surface application of insecticide. Malathion applied repeatedly is currently approved for control of khapra beetle infestations in structures and surrounding surface areas(CERIS, 2004).

Pathway
Increased human movement - tourism.Bulk commodities such as grain and uncleaned containers.

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[1] TURKEY
[5] UNITED STATES
[1] YEMEN
[1] ZIMBABWE

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Graham, R. 2006. Khapra beetle (*Trogoderma granarium*) Pest and Diseases Image Library. Updated on 1/10/2006 4:07:38 PM.
Summary: PaDIL (Pests and Diseases Image Library) is a Commonwealth Government initiative, developed and built by Museum Victoria s Online Publishing Team, with support provided by DAFF (Department of Agriculture, Fisheries and Forestry) and PHA (Plant Health Australia), a non-profit public company. Project partners also include Museum Victoria, the Western Australian Department of Agriculture and the Queensland University of Technology. The aim of the project is: 1) Production of high quality images showing primarily exotic targeted organisms of plant health concern to Australia. 2) Assist with plant health diagnostics in all areas, from initial to high level. 3) Capacity building for diagnostics in plant health, including linkage developments between training and research organisations. 4) Create and use educational tools for training undergraduates/postgraduates. 5) Engender public awareness about plant health concerns in Australia. PaDIL is available from : http://www.padil.gov.au/aboutOverview.aspx, this page is available from: http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=124 [Accessed 6 October 2006]

PaDIL (Pests and Diseases Image Library). Species Content Page Beetles Khapra beetle *Trogoderma granarium* Everts (Coleoptera: Dermestidae: Megatominae)
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Summary: English:
The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (http://www.conabio.gob.mx/invasoras/index.php/Portada), under the section Novedades for information on updates.
Invasive species - insects is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Insectos [Accessed 30 July 2008]
Spanish:
La lista de especies del Sistema de informaci□n sobre especies invasoras de m□xico cuenta actualmente con informaci□n aceca de nombre cient□fico, familia, grupo y nombre com□n, as□ como h□bitat, estado de la invasi□n en M□xico, rutas de introducci□n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p□gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci□n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci□n novedades, para conocer los cambios.
Especies invasoras - Insectos is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Insectos [Accessed 30 July 2008]
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