

Callosobruchus phaseoli (Gyllenhal, 1833) (Coleoptera, Chrysomelidae, Bruchinae): a new invasive species in Kazakhstan

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Abstract

An invasive seed-beetle species cowpea weevil *Callosobruchus phaseoli* (Gyllenhal, 1833), was found in the south-eastern Kazakhstan (Almaty city) for the first time. Its areal includes India (species origin), South and Central America, Europe, Middle East (Israel), North Africa, Arabian Peninsula, Far East, China, Japan, Sri Lanka, Indonesia, Burma, Philippines, Hawaiian Islands, Australia, and Oceania. Damaged plants are adzuki bean *Vigna angularis* (Willd.) Ohwi & H. Ohashi (1969), mung bean *Vigna radiata* (L.) R. Wilczek, broad bean *Vicia faba* Linnaeus, 1753, pea *Pisum sativum* Linnaeus, 1753, pigeon pea *Cajanus cajan* (L.) Huth, 1893, hyacinth bean *Lablab purpureus* (L.) Sweet, 1826, *Wisteria* sp., lima bean *Phaseolus lunatus* Linnaeus, 1753, common bean *Phaseolus vulgaris* Linnaeus, 1753 and other species of beans, chickpea *Cicer arietinum* Linnaeus, 1753, *Sesbania* sp., rattlepod *Crotalaria spectabilis* Roth., lupine *Lupinus* sp. Emerged beetles immediately mate and begin to lay eggs on the same day. Beetle damage both in field and in storage. We were not able to find the species during the monitoring of agriculture lands and natural landscapes near the city. We assumed that the invasion occurred recently and the species did not have time to spread outside Almaty. Since *C. phaseoli* was discovered in Almaty, which is a transit crossroad for many trade routes, further species distribution should be predicted. The most probable corridor for further invasion of cowpea weevil in Kazakhstan is the south and southeast parts of the country, namely Almaty, Zhambyl, Turkestan, and Kyzylorda oblast's.

Keywords

Callosobruchus phaseoli, Coleoptera, Chrysomelidae, Bruchinae, seed-beetles, invasive species, Kazakhstan

Introduction

Cowpea weevil *Callosobruchus phaseoli* (Gyllenhal, 1833) (= *Bruchus phaseoli* Gyllenhal 1833, *B. fguratus* Gyllenhal, 1839, *B. conicicollis* Fairmaire, 1898, *Mylabris phaseoli* Baudi, 1886, *Pachymerus phaseoli* Baudi, 1886, 1919) belongs to the genus *Callosobruchus* Pic, 1902 of the subfamily Bruchinae Latreille, 1802 of the family Crysmelidae Latreille, 1802 (Borowiec 1987, Anton 2010, Kingsolver 2004).

Beetle body is 1.8-3 mm long, pitch-black brown, pronotum and elytra reddish. The pubescence is yellowish, thick, and hard. The head is small, the forehead between the eyes with a narrow keel, the eyes are large, round, coarse-mesh; antennae dark, 4 first and 4 last segments reddish-yellow, 3rd segment reverse conical, almost twice as long as 2nd, 4th triangular, 5-10th acutely elongated, triangular, strongly serrate in male. Pronotum conical, rather densely pubescent, with 2 longitudinal darker stripes; lateral margins almost straight; the middle lobe at the base of the pronotum is raised, with a deep longitudinal groove, covered with a thick, whitish, opaque pubescence. Scutellum densely pubescent. Lateral margins of elytra slightly rounded, raised shoulders; the width of 1 elytra is almost 3 times less than the length; pubescence is yellowish; The 2nd interval from the base to the last quarter is densely pubescent with light hairs, the 4th, 6th and 8th - with the same, but shorter bands located closer to the apex. On the sides of the elytra there are lateral dark spots. The pygidium is reddish, with a dark spot at the apex on both sides. The egg is milky white, 0.8 mm long and 0.55 mm wide.

The larva is white, curved, up to 5 mm long. Pupa is white, up to 3 mm long. The female lays eggs individually or in heaps of 3-6 pieces on both developing and ripened or dry stored beans of fodder plants.

Damaged plants: adzuki bean *Vigna angularis* (Willd.) Ohwi & H. Ohashi (1969), mung bean *Vigna radiata* (L.) R. Wilczek, broad bean *Vicia faba* Linnaeus, 1753, pea *Pisum sativum* Linnaeus, 1753, pigeon pea *Cajanus cajan* (L.) Huth, 1893, hyacinth bean *Lablab purpureus* (L.) Sweet, 1826, *Wisteria* sp., lima bean *Phaseolus lunatus* Linnaeus, 1753, common bean *Phaseolus vulgaris* Linnaeus, 1753 and other species of beans, chickpea *Cicer arietinum* Linnaeus, 1753, *Sesbania* sp., rattlepod *Crotalaria spectabilis* Roth., lupine *Lupinus* sp. Emerged beetles immediately mate and begin to lay eggs on the same day. Beetle damage both in the field and in storage.

Geographical distribution: South (1975) and Central America (1975-1981), Europe (1945), Middle East (Israel) (1975), North Africa (1979), Arabian Peninsula (1981), Far East (1985), China (1985), Japan (1989), India (species origin), Sri Lanka (1981), Indonesia (1993), Burma (1935), Philippines, Hawaiian Islands, Australia (1978), Oceania (1978). In brackets the year when the species was recorded in the country or region. (Lukyanovich & Ter-Minassian 1957, Ter-Minassian 1974, Archibald & Chalmers 1983, Egorov 1996, Tuda 1996, Lambrides & Imrie 1999, Mordkovich & Sokolov 1999, Vasyutin et al. 2001, Porca 2003, Kingsolver 2004, Robinson 2005, Tuda et al. 2005, 2006, Walker 2006, Hagstrum & Subramanyam 2009, Beenen & Roques 2010, Yus Ramos et al. 2014, Anton 2010, Temreshev 2017).

Material and methods

The material was collected in the household common bean seeds in Almaty. The species was determined by I.I. Temreshev. Photographs of the beetle and damaged bean seed were made by V.L. Kazenas. Species taxonomy, biology and distribution data were taken from Lukyanovich & Ter-Minassian (1957), Ter-Minassian (1974), Archibald & Chalmers (1983), Egorov (1996), Tuda (1996), Lambrides & Imrie (1999), Mordkovich & Sokolov (1999), Vasyutin et al. (2001), Porca (2003), King-solver (2004), Robinson (2005), Tuda et al. (2005, 2006), Walker (2006), Hagstrum & Subramanyam (2009), Beenen & Roques (2010), Anton (2010), Yus Ramos et al. (2014), and Temreshev (2017).

Results

C. phaseoli is recorded in Kazakhstan for the first time. The seed-beetles was found in Almaty at one locality in a private house. Infestation of seeds reached 50 % and the bean seeds where the pest was discovered were previously intact. The seeds were grown from last year seeds that were stored in the house for about five years and evidently came from another local breeding center. We suggested the weevils came into the stored seeds from the external environment.

Material examined. 3 males, 5 females, 15.12.2019, Almaty city, Bostandyk district, Alatau microdistrict, in a residential building, in common bean seeds, V.L. Kazenas (Figs 1–2).

Discussion

The species was not previously observed in Kazakhstan. Now, apparently, the city of Almaty has its self-reproducing population. We did not find this species when monitoring the agriculture lands and natural landscapes near the city, and examined the materials of colleagues. We suppose that the invasion occurred recently and the species did not have time to spread outside the Almaty. Invasion corridor: The most obvious route for *C. phaseoli* to enter Kazakhstan is through an invasion from the People's Republic of China, from where a variety of plant products come daily to the city of Almaty, including and legumes. Moreover, the pest spreads at all stages of development with infected legume seeds.

Since *C. phaseoli* was discovered in Almaty, which is a transit crossroad for many trade routes, its further distribution in the country should be predicted. The most probable corridor for further invasion of cowpea weevil in Kazakhstan is the south and southeast parts, namely Almaty, Zhambyl, Turkestan and Kyzylorda oblast. Invasions of other species of seed-beetles, *Megabruchidius dorsalis* (Fahraeus, 1839) and *Acanthoscelides pallidipennis* (Motschulsky, 1874), which were introduced into the Almaty and Turkestan oblast and are currently expanding there, have already been noted (Temreshev & Valieva 2016a, b, Temreshev 2017b, Temreshev &



Figure 1. Seed-beetle *Callosobruchus phaseoli* (Gyllenhal, 1833), specimen from Almaty.

Makezhanov 2019). The central and northern regions are less suitable for the invasion of *C. phaseoli* due to the local weather and climate conditions and set of crops grown with cereals and oilseeds domination. We suggested that the warehouses and residential premises in stored products from fodder plants should be potential conditions for the species development. The same situation is in the western and eastern regions of Kazakhstan. Nevertheless, the Kazakhstan quarantine services should pay serious attention to the further expansion of *C. phaseoli* within the country, since this species is a dangerous polyphagous pest of food, fodder and decorative legumes.

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References

Anton KW (2010) Bruchinae. Chrysomelidae. Löbl I, Smetana A, eds. Catalogue of Palearctic Coleoptera, Volume 6: Chrysomeloidea. Stenstrup, pp. 339-354.



Figure 2. Common bean seed damaged by seed-beetle *Callosobruchus phaseoli* (Gyllenhal, 1833).

- Archibald RD, Chalmers I (1983) Stored product Coleoptera in New Zealand. *New Zealand Entomologist* 7 (4): 371-397. <https://doi.org/10.1080/00779962.1983.9722427>
- Beenen R, Roques A (2010) Chapter 8.3. Leaf and Seed Beetles (Coleoptera, Chrysomelidae). *BioRisk* 4 (1): 267-292. <https://10.11646/zootaxa.3826.3.1>
- Borowiec L (1987) The genera of seed-beetles (Coleoptera, Bruchidae). *Bulletin entomologique de Pologne* 57: 3-207.
- Egorov AB (1996) Family Bruchidae - Seed beetles. *Key to Insect Far East. Vol. III. Part 3. Coleoptera, or beetles.* Vladivostok: Dalnauka (in Russian).
- Hagstrum DW, Subramanyam Bh (2009) *Stored-Product Insect Resource.* AACC International. St Paul, Minnesota, USA.
- Kingsolver JM (2004) *Handbook of the Bruchidae of the United States and Canada (Insecta, Coleoptera).* 2 vol. U.S. Department of Agriculture, Technical Bulletin 1912.
- Lambrides CJ, Imrie BC (1999) Susceptibility of mungbean varieties to the bruchid species *Callosobruchus maculatus* (F.), *C. phaseoli* (Gyll.), *C. chinensis* (L.), and *Acanthoscelides obtectus* (Say.) (Coleoptera: Chrysomelidae). *Australian Journal of Agricultural Research* 51 (1): 85-89. <https://doi.org/10.1071/AR99051>
- Lukyanovich FK, Ter-Minassian ME (1957) Coleoptera, beetles, weevils (Bruchidae). *Fauna of the USSR. Vol. XXIV. Part 1.* Moscow-Leningrad: Publishing House of the Academy of Sciences of the USSR. (In Russian).

- Mordkovich YaB, Sokolov EA (1999) Key of quarantine and other dangerous pests of raw materials, stock products and seed. Research Institute of Plant Quarantine. Moscow: Kolos. (In Russian).
- Porca M (2003) The actual stage the knowledge about the damages Bruchides. Journal of Central European Agriculture 4-3: 199-208.
- Temreshev II (2017a) Pests of stocks and raw materials, common in the territory of the Republic of Kazakhstan, and some related and quarantine species (species composition and brief technology protection measures). Second edition, revised and supplemented. Almaty: LLP "Nur-Print" (In Russian).
- Temreshev II (2017b) Adventive insect species of the Sayram-Ugam National Natural Park, Kazakhstan. Acta Biologica Sibirica 3 (3): 12-22. <https://doi.org/10.14258/abs.v3i3.3626> (In Russian).
- Temreshev II, Makezhanov AM (2019) Expansion of invasive seed beetle *Megabruchidius dorsalis* Fahreus, 1839 (Coleoptera, Chrysomelidae, Bruchinae) in the Turkestan Region (South Kazakhstan). Acta Biologica Sibirica 5(4): 1-4. <http://dx.doi.org/10.14258/abs.v5.i4.6722>. (In Russian). Temreshev II, Valieva BG (2016a) *Megabruchidius dorsalis* Fahreus, 1839 - a new invasive species in the fauna of seed-beetles (Coleoptera, Chrysomelidae, Bruchinae) of Kazakhstan. Eurasian Entomological Journal 15 (2): 139-142. (In Russian).
- Temreshev II, Valieva BG (2016b) Invasion of the seed-beetles *Acanthoscelides pallidipennis* (Motschulsky, 1874) (Coleoptera, Chrysomelidae, Bruchinae) to Kazakhstan. Eurasian Entomological Journal 15 (6): 527-529. (In Russian).
- Ter-Minasyan ME (1974) Family Bruchidae - Seed beetles. Insects and ticks - pests of crops. Part II. Coleoptera. Leningrad: Nauka (In Russian).
- Tuda M (1996) Temporal/Spatial Structure and the Dynamical Property of Laboratory Host Parasitoid Systems. Researches on Population Ecology 38 (2): 133-140. <https://doi.org/10.1007/BF02515721>
- Tuda M, Chou L-Y, Niyomdham C, Buranapanichpan S, Tateishi Y (2005) Ecological factors associated with pest status in *Callosobruchus* (Coleoptera: Bruchidae): high host specificity of non-pests to Cajaninae (Fabaceae). Journal of Stored Products Research 41: 31-45. <https://doi.org/10.1017/S1742758409990397>
- Tuda M, Ronn J, Buranapanichpan S, Wasano N, Arnovist G (2006) Evolutionary diversification of the bean beetle genus *Callosobruchus* (Coleoptera: Bruchidae): traits associated with stored-product pest status. Molecular Ecology 15: 3541-3551. <http://10.1111/j.1365-294X.2006.03030.x>
- Vasyutin AS, Smetnik AI, Mordkovich YaB, Zinchenko VN, Yudin BI, Smirnov SA, ... Maslyakov VYu (2001) Quarantine of plants in Russian Federation. Moscow: Kolos. (In Russian).
- Walker K (2006) Cowpea Weevil (*Callosobruchus phaseoli*) Updated on 1/25/2008 11:59:29 AM Available online: PaDIL - <http://www.padil.gov.au>.
- Yus Ramos R, Ventura D, Bensusan K, Coello-Garcia P, Gyorgy Z, Stojanova A (2014) Alien seed beetles (Coleoptera: Chrysomelidae: Bruchinae) in Europe. Zootaxa 3826: 401-448. <http://dx.doi.org/10.11646/zootaxa.3826.3.1>