

***Epitrix papa* sp. n. (Coleoptera: Chrysomelidae: Galerucinae: Alticini), previously misidentified as *Epitrix similaris*, is a threat to potato production in Europe**

MARINA J. ORLOVA-BIENKOWSKAJA

A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, 33 Leninskiy Prospekt, 119071 Moscow, Russia;
e-mail: marinaorlben@yandex.ru

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Abstract. A nonnative pest of potato recently established and causing significant economic damage in Portugal and Spain was initially identified as *Epitrix similaris* Gentner and included on lists of quarantine pests. The identity of this pest was doubted by some experts, since *E. similaris* is a rare species previously recorded only from California and does not damage potato in its native range. Our comparison of 20 specimens of this pest from Portugal with paratypes of *E. similaris* has revealed that it is not *E. similaris*. The name “*Epitrix similaris*” should be removed from lists of quarantine pests. The damage to potato tubers caused by the larvae of this pest is similar to that of *E. tuberis* Gentner, but examination of paratypes of *E. tuberis* has revealed that the pest is not *E. tuberis*. This pest differs from all species of *Epitrix* recorded in the Holarctic and from all known *Epitrix* pests of potato in the world. Herewith it is described as a new species *Epitrix papa* sp. n., whose native range is unknown.

INTRODUCTION

The representatives of the genus *Epitrix* Foudras (Coleoptera: Chrysomelidae: Galerucinae: Alticini) are tiny pubescent flea beetles that feed mainly on Solanaceae. Some species are serious pests of potato, egg-plant, tobacco and other cultivated plants. The genus is distributed worldwide and includes about 180 species (Döberl, 2000). Several pest species have been inadvertently introduced into and become established on other continents and oceanic islands far from their native ranges (Beenen & Roques, 2010; Döberl, 2010). The identification of *Epitrix* species is difficult, since the taxonomy is poorly understood. In particular, North American species need to be revised as many species native to North America are still undescribed (Riley et al., 2002; Deczynski, 2014).

A new kind of potato tuber damage was detected in the Northern part of Portugal in 2004 (Boavida, 2009). In 2008 entire consignments of potatoes sent from Portugal to France, Spain and other countries were rejected because the tubers were damaged (Cuthbertson, 2015). This damage was caused by larvae of flea beetles of the genus *Epitrix*. The pest was identified as *E. similaris* Gentner, a rare North American species previously recorded only from California (Boavida & Germain, 2009; Doguet, 2009; EPPO, 2011). At the same time another nonnative pest, *E. cucumeris* (Harris), native to North America was found in the northern part of Portugal. Experiments and observations have shown that larvae of the species identified as *E. similaris* damage tubers leaving superficial tracks (“worm tracks”) and shallow holes. This species was the main cause of the damage to the potato crop in Portugal in 2008 (Boavida et al., 2013).

In 2010 *E. similaris* was included on the list A2 of quarantine pests of the European and Mediterranean Plant Protection Organization as a nonnative pest and a threat to potato production in Europe (EPPO, 2015). But the identity of the pest was doubted by some experts for zoogeographical and ecological reasons (Eyre & Giltrap, 2012). First, *E. similaris* is not regarded as a pest in North America. Second, *E. similaris* is a rare species (Deczynski, 2014), so the probability of it spreading to another continent is low. Third, *E. similaris* has a very restricted distribution in America: it is only recorded in California (Riley et al., 2003) and it is believed that the origin of *Epitrix* in Portugal is bulk imports of seed potatoes from the Canadian provinces of Prince Edward Island and New Brunswick (Eyre & Giltrap, 2012). The distance between California and this part of Canada is about 4000 km. *Epitrix similaris* is not recorded in Canada (Riley et al., 2003; EPPO, 2015). In particular, it is not listed in the new list of Chrysomelidae of New Brunswick (Webster et al., 2012). The genetic study by Germain et al. (2013) proves that this species is not *E. cucumeris*, *E. tuberis*, *E. hirtipennis* (Melsheimer), *E. subcrinita* (LeConte) or *E. fasciata* Blatchley. But this study does not prove that it is *E. similaris*, since it was not compared with material of *E. similaris* from North America.

Currently Dr. A. Bieńkowski and I are preparing a key for the identification of all *Epitrix* species known from the Holarctic Region. So we decided to check the identification of the pest established in Portugal.

MATERIAL

316 specimens of 20 *Epitrix* species were obtained from the National Museum of Natural History (USA), Instituto Nacional

TABLE 1. Examined material, photographs and figures.

Species	Examined specimens			Examined photographs and figures		
	Total number	Males with dissected aedeagus	Females with dissected spermatheca	General view	Aedeagus	Spermatheca
<i>abeillei</i> (Bauduer)	31	13	17	[4]	[5], [3], [8]	[5]
<i>allardii</i> (Wollaston)	1	1	–	–	[5]	[5]
<i>atropae</i> Foudras	23	4	5	[3]	[5], [8]	[5]
<i>brevis</i> Schwarz	3	2	1	[4]	–	[4]
<i>caucasica</i> (Heikertinger)	9	2	4	[3]	[5], [3], [8]	[5]
<i>cucumeris</i> (Harris)	11	3	5	[4], [6]	[4], [5], [6]	[4], [5], [6]
<i>dieckmanni</i> (Mohr)	1	1	–	[2]	[5]	[5]
<i>ermischi</i> (Mohr)	39	5	6	–	[5]	[5]
<i>fasciata</i> Blatchley	–	–	–	[4]	[5]	[5]
<i>flavotestacea</i> Horn	–	–	–	[4]	–	[4]
<i>fuscata</i> (Duval)	–	–	–	[1]	–	–
<i>fuscula</i> Crotch	4	1	1	[4]	[4]	[4]
<i>harilana rubia</i> Bechyne & Bechyne	–	–	–	[7]	–	–
<i>hirtipennis</i> (Melsheimer)	7	1	2	[4], [3], [9]	[5], [10]	[4], [5], [10], [9]
<i>humeralis</i> Dury	–	–	–	[4]	–	[4]
<i>intermedia</i> Foudras	4	4	–	[3]	[5]	[5]
<i>krali</i> Döberl	1	–	1	[3]	[5]	[5], [3]
<i>lobata</i> Crotch	–	–	–	[4]	–	[4]
<i>muehlei</i> Döberl	1	1	–	–	[5]	[5]
<i>papa</i> sp. n.	20	2	2	[6]	[6]	[6]
<i>priesneri</i> (Heikertinger)	6	5	1	[3]	[5], [3], [8]	[5]
<i>pubescens</i> (Koch)	119	17	2	[4], [3]	[5], [8]	[4], [5]
<i>robusta</i> Jacoby	–	–	–	[4]	–	[4]
<i>setosella</i> (Fairmaire)	5	2	3	[11]	[5]	[5]
<i>similaris</i> Gentner	4	4	–	–	[10]	[10]
<i>solani</i> (Blatchley)	–	–	–	[4]	–	[4]
<i>subcrinita</i> (LeConte)	4	1	1	[4]	[10]	[4], [10]
<i>tuberis</i> Gentner	23	9	4	[4]	[10]	[4], [10], [6]
<i>ubaquensis</i> Harold	–	–	–	[7]	–	–
<i>warchalowskii</i> (Mohr)	–	–	–	–	[5]	[5]
<i>yanazara</i> Bechyne	–	–	–	[7]	–	–

References: [1] – Barriga-Tuñón, 2011; [2] – Bezděk & Batelka, 2011; [3] – Borowiec, 2013; [4] – Deczynski, 2014; [5] – Döberl, 2000; [6] – EPPO, 2011; [7] – Gaiani, 2014; [8] – Heikertinger, 1950; [9] – Orlova-Bienkowskaja, 2014; [10] – Seeno & Andrews, 1972; [11] – Smirnov, 2006.

de Investigação Agrária e Veterinária (Portugal), Russian Plant Quarantine Center, Zoological Institute of Russian Academy of Sciences, Moscow State Pedagogical University (Russia), and private collections of L.N. Medvedev and A.O. Bieńkowski (Russia) and M. Döberl (Germany) (Table 1).

RESULTS

Examination of 20 specimens of the pest from Portugal and comparison of them with the paratypes of *E. similaris* has revealed that the pest is not *E. similaris*. The specimens from Portugal do not correspond to the type specimens and the original description of *E. similaris* by Gentner (1944) and subsequent description by Seeno & Andrews (1972) (Table 2, Figs 1, 2). The pest damaging potato tubers in Portugal is undoubtedly not *E. similaris* as it differs significantly in the shape of its spermatheca, aedeagus and other characters.

The damage that larvae of the invasive pest do to potato tubers is similar to that of *E. tuberis* (Boavida et al., 2013). But comparison of the pest with the paratypes of *E. tuberis*

from the National Museum of Natural History (USA) has revealed that the pest is not *E. tuberis*. We tried to identify the pest using an analysis of the characters of all the species of *Epitrix* native to the Holarctic (Döberl, 2010; Riley et al., 2003; Deczynski, 2014; EPPO, 2011) and all known *Epitrix* pests of potato in the world (Saunders et al., 1983; Vreugdenhil et al., 2011). But the pest clearly differs from all of them. So herewith it is described as a new species.

Epitrix papa sp. n.

Type specimens of *Epitrix papa* sp. n.: Holotype (♂), paratypes (13♂, 6♀). The specimens were collected 24.iii.2015 from cages in the INIAV (Instituto Nacional de Investigação Agrária e Veterinária) in Lisbon. The culture was established in 2012 from adults collected from a farm near the village of Toxofal, located 70 km north of Lisbon and refreshed with wild adults from the same location twice a year. Holotype and three paratypes will be deposited in the collection of Zoological Institute of Russian Academy of Sciences (St.-Petersburg, Russia), four paratypes in the National Museum of Natural History (Washington, USA), four paratypes in the Natural History Museum (London, UK),

TABLE 2. Comparison of characters of *Epitrix similis* from California and *Epitrix papa* sp. n. from Portugal.

Sources of information	<i>Epitrix similis</i>			<i>Epitrix papa</i> sp. n.		
	Three male paratypes and one male identified by T. Seeno	Gentner, 1944	Seeno & Andrews, 1972	Twenty specimens from Portugal	EPPO, 2011	Boavida & Germain, 2009
Punctures on pronotum	coarse and close			more fine and sparse		
Distances between punctures	less than their diameters	—	—	more than their diameters	—	—
Transverse antebasal pronotal impression	deep	—	—	weak to obsolete, especially medially	—	—
Lateral margin of pronotum	serrated	—	—	not serrated		
Dorsal coloration	“piceous” (brownish-black)		—	black with bronze reflection	—	—
Setae in elytral intervals 1–5	form 2 irregular rows, so the beetle looks more pubescent	—	—	form 1 regular row, so the beetle looks less pubescent	—	—
Apex of the aedeagus	pointed	—	pointed	blunt	—	—
Spermathecal pump	—	—	attached to the top of receptacle and lies in sagittal plane	attached to the lateral side of receptacle and does not lie in sagittal plane		

four paratypes in the private collection of M. Döberl (Abensberg, Germany) and four paratypes in the private collection of A.O. Bieńkowski (currently at the A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow).

Comparative type material. *Epitrix similis* paratypes: California, Playa del Roy, 20.4.1935, A.T. McClay leg., 1♂; California, Santa Barbara, 16.6.1932, A.T. McClay leg., 1♂; California, Monterey Co., Paraiso Springs, 5.5.1922, 1♂. *Epitrix tuberis* paratypes: Washington, Satus, 24.6.1940, H.P. Lomdester leg., 1♂; Nebraska, Scottsbluff, 28.6.1943, on potato, R.E. Hill leg., 1♂; Nebraska, Scottsbluff, 27.9.1940, on potato, H.-D. Tate leg., 1♂; Nebraska, Scottsbluff, 28.6.1943, on potato, R.E. Hill leg., 1♂; Colorado, Ft. Collins, 22.10.1931, 1♀.

Description

Male (holotype) (Figs 1, 2). Body elongate, length 1.72 mm, width of elytra 0.85 mm, pronotum 1.6 times as wide as long, ratio of width of elytra to width of pronotum 1.38. Body shiny, smooth, with head, pronotum, and elytra without microsculpture, not alutaceous; above black, with weak bronze reflection, femora dark brown (piceous) with apices yellow, tibiae, tarsi, and antennae yellow (11th antennomere slightly darkened). Combined width of eyes when viewed from front 1.3 times less than interocular distance. Frontal ridge narrow, convex. Supracallinal sulci curved at angle. Vertex with 3 large setiferous pores near each eye. Pronotum evenly convex; entirely covered with moderately large distinct punctures separated by approximately twice their diameter; pronotal lateral margin with setae, but not serrated; anterolateral callosity with obtuse angle, the callosity as long as 0.3–0.4× the rest part of lateral side, transverse antebasal impression weak, longitudinal basal furrows distinct. Elytra with humeral calli weak but distinct, with 11 regular rows of large dense punctures, sutural row abbreviated, ending at basal 1/3 of elytral length, others distinct to apex, with single row of setifer-

ous pores at intervals between puncture rows; setae white, long, slightly longer than intervals between puncture rows. Pygidium with distinct longitudinal furrow except near apex. Last abdominal sternite convex, unmodified. Tarsi narrow, with 1st protarsomere slightly narrower than the apex of fore tibia. Aedeagus with almost parallel lateral sides, apically rounded, with small lamella, in lateral view evenly weakly curved over almost entire length, with apex weakly curved dorsally. **Males (paratypes).** Body length 1.7–1.8 mm. **Females (paratypes).** Body length 2.1–2.2 mm. Transverse antebasal impression on pronotum weak to obsolete (especially medially). Last abdominal sternite convex, unmodified. Spermatheca: receptacle curved and slightly constricted medially, spermathecal pump attached to lateral side of the apex of receptacle and does not lie in the sagittal plane.

Differential diagnosis

Epitrix papa sp. n. differs from Palaearctic *E. pubescens* (Koch) and *E. intermedia* Foudras by the smooth, not alutaceous surface of pronotum, sparser punctures on pronotal disk, and from the other black or dark metallic Palaearctic species by a short sutural row of punctures on elytra ending at basal 1/3 of elytral length. *Epitrix papa* sp. n. differs from most *Epitrix* species inhabiting North America north of Mexico by the bronze reflection of the dorsal body surface. In addition, it differs from *E. cucumeris*, *E. tuberis* and *E. similis* by the even, not serrated lateral border of pronotum, weak to obsolete pronotal antebasal impression (especially medially), and one row of elytral setae in each interval between punctures; from *E. fuscula* Crotch by the even lateral border of pronotum, sparser punctures on pronotal disk (punctures usually separated by intervals 2× wider than their diameter), and aedeagus not angularly broadened at mid-length; from *E. brevis* Schwarz and *E.*

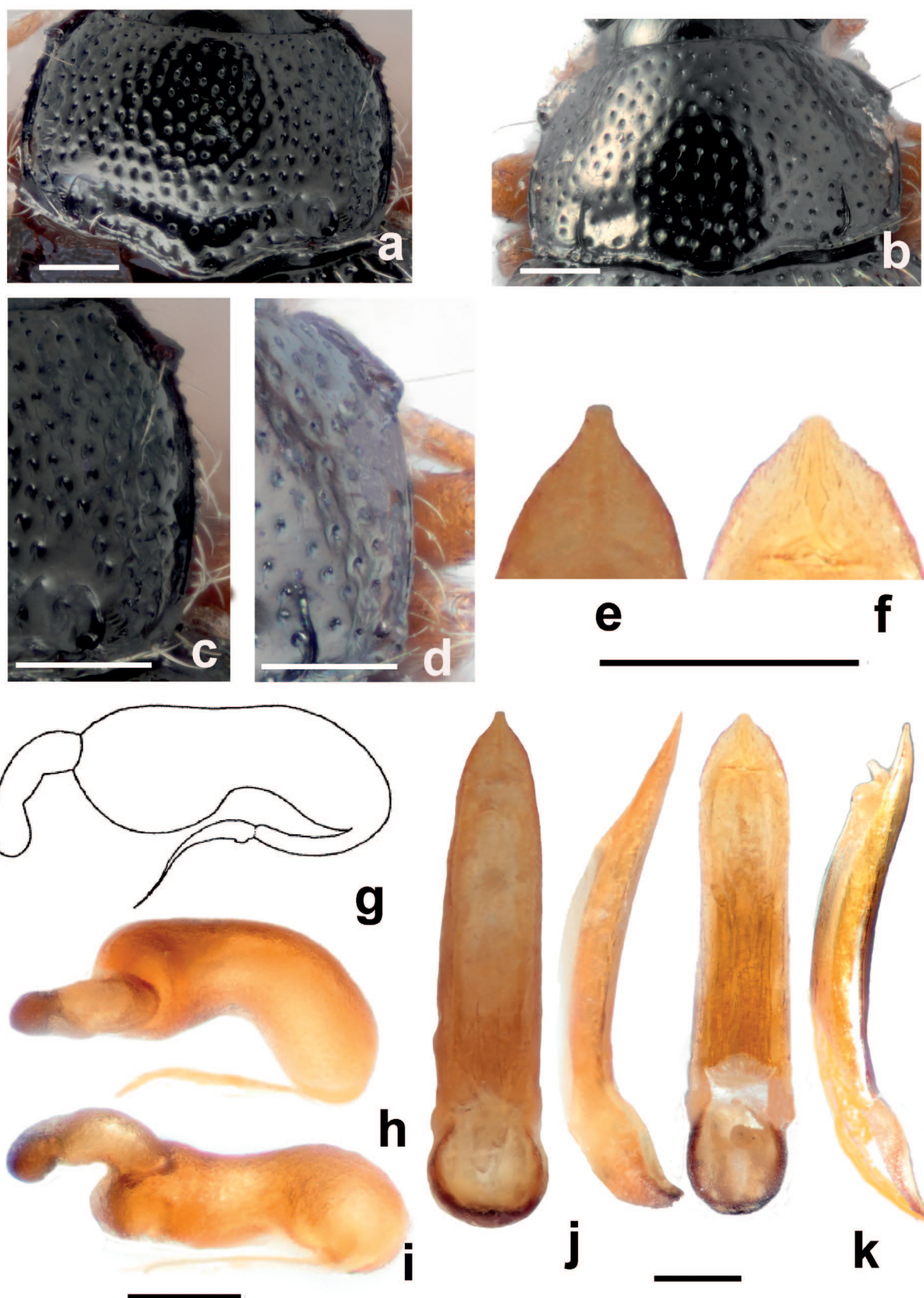


Fig. 1. Differences between *Epitrix papa* sp. n. from Portugal and *E. similaris* from California. a – pronotum of *E. similaris* paratype, b – pronotum of *E. papa* holotype, c – lateral margin of pronotum of *E. similaris* paratype, d – lateral margin of pronotum of *E. papa* holotype, e – apex of the aedeagus of *E. similaris* paratype, f – apex of the aedeagus of *E. papa* holotype, g – spermatheca of *E. similaris*, lateral view, h – spermatheca of *E. papa* paratype, lateral view, i – spermatheca of *E. papa*, ventral view, j – aedeagus of *E. similaris* paratype, ventral and lateral view, k – aedeagus of *E. papa* holotype, ventral and lateral view. Figures are original except g after Seeno & Andrews, 1972. Scale bars 0.1 mm.

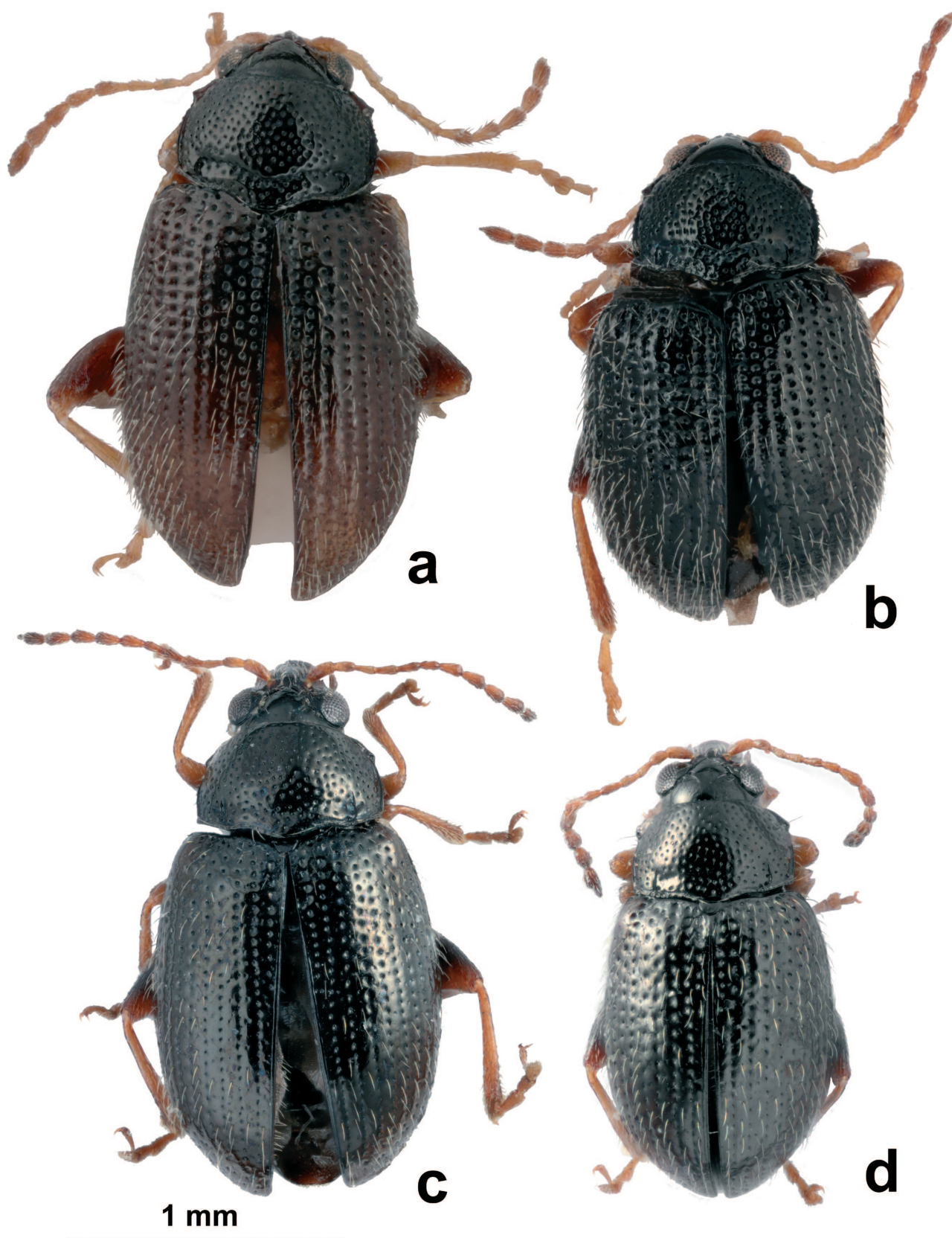


Fig. 2. Total view of *Epitrix*. a – *E. tuberosa* paratype, female, b – *E. similis* paratype, male, c – *E. papa* sp. n. paratype, female, d – *E. papa*, holotype, male.

lobata Crotch by elongate body; from *E. robusta* Jacoby by smaller body length, even lateral border of pronotum, and sparser punctures on pronotal disc. It differs from *E. sub-*

crinita, the only other known species with bronze coloration in this region, by the even lateral border of pronotum, sparser punctures on pronotal disk, and differently shaped

aedeagus: evenly arc-shaped and slightly curved dorsally at the apex. It differs from the potato pests from C. and S. America as follows: *Epitrix papa* sp. n. differs from *E. fuscata* (Duval) by the bronze reflection of dorsal surface, elytral setae much sparser, and pronotum covered with sparser punctures on disc and without serration at lateral margin. It differs from *E. ubaquensis* Harold in the body being more elongate, with lateral sides nearly parallel at mid-length, in dorsal coloration black with bronze reflection, anterior and middle femora dark with apex yellow, pronotal antebasal impression shallow, and elytral humeral calli weak. It differs from *E. harilana rubia* Bechyne & Bechyne in pronotal lateral margin without serration and antebasal pronotal impression more shallow, especially medially. It differs from *E. yanazara* Bechyne in antebasal pronotal impression more shallow.

Etymology. The name “papa” means “potato” in Spanish.

Host plants. *Solanum tuberosum*, *S. melongena*, *S. nigrum*, *Lycopersicon esculentum*, *Datura stramonium* (Boavida et al., 2013).

Distribution. Portugal, Spain. The damage to potato tubers caused by this species was detected in 2004 in the northern part of Portugal (Oliveira et al., 2008). Then it was realized that this species is widely distributed in Portugal (Boavida & Germain, 2009). In 2008 a single adult was found in Spain, at Xinzo, near the Portuguese border (Boavida & Germain, 2009). In 2014 the pest was detected in A Coruña, Ourense and Pontevedra provinces in Spain (EPPO, 2014). Native range is unknown. It is quite possible that this pest is from North America. First, it was detected in Europe at the same time and in the same place with *E. cucumeris* native to North America. Second, it is believed that the origin of *Epitrix* in Portugal is related to the bulk imports of seed potatoes from Canada (Eyre & Giltrap, 2012). Third, at least 30% of North American *Epitrix* species are undescribed (Riley et al., 2002; Deczynski, 2014). Theoretically, introduction from outside the Holarctic is also possible.

DISCUSSION

It is rather surprising that *E. papa* sp. n. was not described before it arrived in Europe. But similar cases are known for beetles. For example, *Paropsisterna selmani* Reid & De Little (Coleoptera: Chrysomelidae: Chrysomelinae), a significant pest of plantations of eucalypts native to Australia, was described only when it was detected in Ireland (Reid & De Little, 2013). Quarantine measures to prevent insects entering a country tend to focus on well-known pests but a large proportion of the recently established nonnative pests were not known to cause significant damage in their native range, or were not even known to science before their introduction (Roques et al., 2014). A revision of the genus *Epitrix* world-wide or at least in North America is now needed to identify the native range of *E. papa* sp. n. Since the new potato flea beetle recently detected in Europe that damages potato tubers is not *E. similaris*, the name “*E. similaris*” should be removed from the A2 list of quaran-

tine pests of EPPO and from lists of quarantine pests of European countries.

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