

# Dynamics of the Range of Lily Leaf Beetle (*Lilioceris lili*, Chrysomelidae, Coleoptera) Indicates Its Invasion from Asia to Europe in the 16th–17th Century

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**Abstract**—An analysis of 415 locations of *Lilioceris lili* (Scopoli, 1763), a pest of ornamental liliaceous, allowed tracing the dynamics of the species range in Eurasia from the 18th century to the present. Now the area of distribution is a continuous band across the whole continent, from Portugal to the Khabarovsk krai, but until the end of the 19th century, the range was disjunctive. It consisted of two large subranges: European and Asian. There was a gap of about 2000 km between them. The easternmost of the known European locations of the 19th century lies in Voronezh oblast, while the far west of the Asian location is in the vicinity of Omsk. In Asia, the species ranged in Siberia, the Far East, and northern China. Taking into account the Asian origin of host plants of the lily beetle, as well as the genus *Lilioceris* in general, it can be assumed that the European subrange is secondary, invasive. The disjunctive range could hardly be of relict origin, since *L. lili* can quickly establish and develop vast territories in decades. This ability of the lily beetle is evidenced by the distribution of this invasive species in Britain, Canada, and the United States. From the literature, it is known that in 1688 the lily beetle already inhabited Western Europe, and Siberian species of lilies were first brought there in 1596. Apparently, the pest was introduced together with planting material in this time interval. By the mid-20th century, *L. lili* had settled in the Volga region, the Urals, and the south of Western Siberia. Thus, the range gap virtually ceased to exist. In recent decades, the range in the European part of Russia has expanded to the north and northeast. By now, the lily leaf beetle has populated even some areas where its host plants are found only as cultivated or adventive plants.

**Keywords:** *Lilioceris lili*, Chrysomelidae, Criocerinae, lily leaf beetle, pest, lilies, invasive species, range

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## INTRODUCTION

The lily leaf beetle, *Lilioceris lili* (Scopoli, 1763), is a pest of garden lilies and fritillaries (Fig. 1).

This species is often introduced in a new territory together with planting material and quickly develops entire regions. In 70 years, the lily leaf beetle fully populated the British Isles (Salisbury, 2003) and now is extending its invasive subrange in North America (Majka and LeSage, 2008; Majka and Kirby, 2011).

Where does this species come from, and what is its primary range? The answer to this question is not only of theoretical but also of practical importance, because now there is a search for natural enemies of the pest, in order to develop biological control (Casagrande and Kenis, 2004). In addition, the analysis of the geographical distribution is needed to create an ecological model of the potential invasive range and to offer quarantine measures in order to prevent importation of the pest to new areas.

Recently, a first point distribution map covering the entire current range was composed (Orlova-Bienkowskaja, in press). Present article analyzes the range dynamics over 250 years.

## MATERIALS AND METHODS

The information on locations was collected from sources of four types: (1) collection specimens, (2) photos, (3) published data, and (4) reports from colleagues.

We studied the specimens from the Zoological Institute of the Russian Academy of Sciences (ZIN), the Zoological Museum of Moscow State University (ZMMU), the Russian Centre for Plant Quarantine (RCPQ), and collections of the Galich'ya Gora Nature Reserve (GGNR), as well as from the private collections of S.K. Alekseev, A.O. Bienkowski, L.N. Medvedev, and I.G. Pronina. The lily leaf beetle can be reliably determined from a photograph. The photos posted on the Internet also have been used as material.



Fig. 1. *Lilioceris lili* imago.

As for the literature, publications of the 18th–19th centuries were particularly interesting for the reconstruction of the range history. Now they have become available through the Internet. Especially, lots of the old sources are online at the Biodiversity Heritage Library (<http://www.biodiversitylibrary.org>). The zoological nomenclature of that time differs from the contemporary one. In particular, *L. lili* was called *Lema merdigera*, and the species that is now called *Lilioceris merdigera* was then called *Lema brunnea*.

The maps were produced using the program Arc-View GIS. The geographical labels of the collection samples and photos were listed earlier (Orlova-Bienkowskaja, in press), so here are just maps and summary information about the distribution in the form of tables. For searching for geographic coordinates of the locations, we used a simple Internet technology described recently (Orlova-Bienkowskaja, 2012).

## RESULTS

There are 45 known locations of *L. lili* before 1897 (Table 1, Fig. 2).

In the first third of the 19th century, the species was introduced to England and over the years it ranged around London (Stephens, 1839). At the end of the 19th century, a few other introductions were reported. However, the time of existence of the populations was low (Majka and LeSage, 2008).

A similar situation developed in the New World. *Lema melanocephala* Say, 1826, described from North America, is regarded as synonymous with *L. lili*. (Majka and LeSage, 2008). It is believed that the lily leaf beetle was accidentally introduced to North America in the first third of the 19th century, but it did not naturalize.

In the faunal surveys of the 19th century, *L. lili* was not specified for Moscow oblast (Lindeman, 1871; Mel'gunov, 1892). But a museum in Paris has specimens of *L. lili* labeled as “Moscou 1860” (Berti and Rapilly, 1976). We can assume that this is also a case of random introduction.

The collection of the Siberian naturalist F. Gebler had one specimen of *L. lili* from Kamchatka (Lacordaire, 1845). The exact place where the beetle was found is unknown. But it is likely that, because of low development of the region, the entomological collections at that time were only possible near Petropavlovsk. In the subsequent years, the lily leaf beetle was not found in Kamchatka (Medvedev, 1963).

The points are located on the map in two distinct groups. This indicates that the range was disjunctive. It consisted of two large subranges, European and Asian. The Asian subrange was located in the eastern part of Western Siberia, in Eastern Siberia, in the Far East, and in the north of China. The gap between the easternmost point in Europe (Shipov Forest in Pavlovsky region of Voronezh oblast) and the westernmost point in Asia (Omsk) was 33 degrees in longitude, that is, about 2000 km. The species was not reported in the central, northern, and eastern regions of the European part of Russia or in the western part of West Siberia.

Could such a gap in the distribution of locations be random? A simple calculation shows that the probability of such a chance event is less than 0.003%. The difference in longitude between the westernmost and easternmost location of the species in Eurasia at that time was about 158 degrees in longitude, and the gap between the European and Asian group of locations was 33 degrees. The probability that all 45 points randomly fell outside these 33 degrees is  $((158-33)/158)$  to the power of 45.

The absence of collections of *L. lili* from the vast region in the center of Eurasia cannot be explained by the assumption that it was poorly studied either. After all, this species was found in Eastern Siberia in the 19th century in many places, although in Siberia the entomofauna was studied less than in European Rus-

**Table 1.** Regions in which *L. lili* was reported from 1763 to 1897

Region	Sources of information	
	Materials from collections	References
<b>BRITISH SUBRANGE</b>		
England	–	(Stephens, 1831, 1839)
<b>CONTINENTAL EUROPEAN SUBRANGE</b>		
Western Europe		
Austria	ZIN	(Berti and Rapilly, 1976)
Italy	ZMMU	(Berti and Rapilly, 1976; Warchałowski, 1985)
Carniola (Slovenia)	–	(Scopoli, 1763)
Pomerania (northern Poland and Germany)	–	(Warchałowski, 1985)
Ukraine	ZIN	–
France	ZMMU, ZIN	(Berti and Rapilly, 1976; Fabr, 1993)
Croatia	ZIN	(Berti and Rapilly, 1976)
Sweden	–	(Gyllenhal, 1813)
European part of Russia		
Voronezh oblast	ZIN	–
Moscow	–	(Berti and Rapilly, 1976)
<b>ASIAN SUBRANGE</b>		
Asian part of Russia		
Altai krai	ZIN	(Gebler, 1848)
Amur oblast	ZIN	–
Zabaykalsky krai	ZIN	–
Irkutsk oblast	ZIN	–
Kamchatka	–	(Lacordaire, 1845)
Kemerovo oblast	–	(Gebler, 1848)
Krasnoyarsk krai	ZIN	(Jacobson, 1901)
Omsk oblast	ZIN	–
Khakassia	ZIN	(Jacobson, 1901)
Asia		
China (Yining)	ZIN	–
<b>AMERICAN SUBRANGE</b>		
Northwest Territory (Ohio, Indiana, Illinois, Michigan, Wisconsin, eastern Minnesota)	–	(Say, 1826)

sia. In addition, *L. lili* is one of those insects that are hard to miss. The appearance of the pest in flower gardens leads to severe damage of lilies. The beetles are bright red, and they openly sit on leaves during the day. It is not difficult to determine the lily leaf beetle. Even amateur photographers posting pictures of this beetle on the Internet correctly identify its name in most cases.

Thus, the distribution of locations indicates a disjunctive nature of the range in the 19th century.

By the mid-20th century, *L. lili* spread through central regions of European Russia, the Middle Volga region, the Urals, and the south of Western Siberia (Table 2, Fig. 3). Thus, the gap in the range virtually ceased to exist.

Over the past 70 years, the *L. lili* range became even wider (Table 3, Fig. 4).

In the 1940s, the first stable populations of the lily leaf beetle were found in England and North America (Majka and LeSage, 2008). To date, the species has



Fig. 2. Locations of *L. lili* from 1763 to 1897 (hereinafter, not all regions where species were reported are marked on maps, since for some of them there is no information on specific locations of findings).

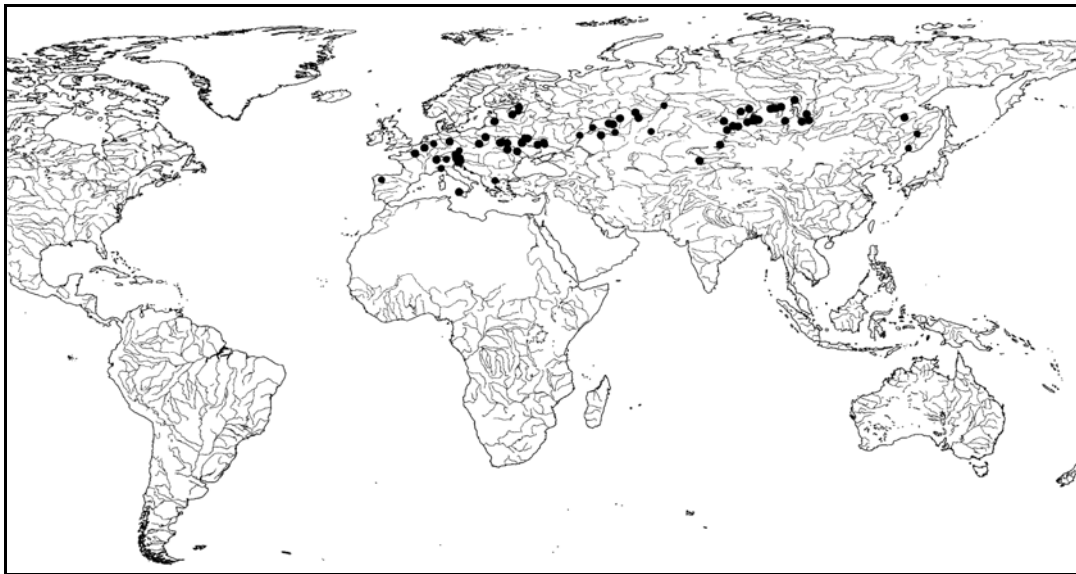


Fig. 3. *L. lili* locations from 1898 to 1939.

colonized the British Isles and become massive there almost everywhere. In America, the pest has spread very rapidly too (Majka and Kirby, 2011). In addition, this adventive species appeared in Norway (NOBANIS ...) and settled on many islands, including those located in the ocean at a great distance from the mainland.

According to our data, the range of the lily leaf beetle in European Russia is also expanding. In recent decades, the species has spread over the European part of Russia to the north and northeast. It was observed in Vladimir, Ivanovo, Kaliningrad, Kirov, Kostroma, Nizhni Novgorod, and Yaroslavl oblasts, as well as in

Udmurtia and Chuvashia. The species became common in Moscow, Leningrad, and Pskov oblasts.

Now the distribution area in Eurasia is a solid band across the whole continent, from Portugal to Khabarovsk krai. In addition, *L. lili* invaded many islands. It completely populated the British Isles, where it became one of the most common pests. In Greece and Turkey, *L. lili* is a rare species noted only at a few points on the coast (Berti and Rapilly, 1976; Özdikmen and Turgut, 2008). *L. lili stercoraria* (Linnaeus, 1767) ranges in North Africa (Algeria, Tunisia, and Morocco) (Berti and Rapilly, 1976). But now this Afri-

**Table 2.** Regions in which *L. lili* was reported from 1898 to 1939

Region	Sources of information	
	Materials from collections	References
BRITISH SUBRANGE MISSING		
EURASIAN CONTINENTAL SUBRANGE		
Western Europe		
Austria	–	(Berti and Rapilly, 1976, Geiser, 2001)
Belgium	–	(Berti and Rapilly, 1976)
Germany	ZIN, collection of L.N. Medvedev	–
Greece	–	(Berti and Rapilly, 1976)
Spain	–	(Berti and Rapilly, 1976)
Italy	ZIN	–
Lithuania	ZIN	–
Poland	ZIN	–
Slovenia	ZIN	–
Ukraine	ZIN, collection of A.O. Bienkowski	–
France	ZIN, ZMMU	(Berti and Rapilly, 1976)
Switzerland	ZIN	–
European part of Russia		
Bashkortostan	ZIN	–
Bryansk oblast	ZIN	–
Leningrad oblast	ZIN	(Romantsov, 2007)
Orenburg oblast	ZMMU, ZIN	(Vorontsovskii, 1922)
Pskov oblast	ZIN	–
Samara oblast	–	(Dmitriev, 1935)
Saratov oblast	ZIN	–
Sverdlovsk oblast	ZIN	–
Chelyabinsk oblast	ZIN	–
Asian part of Russia		
Altai krai	ZIN	–
Amur oblast	ZIN	–
Buryatia	ZIN	–
Irkutsk oblast	ZIN	(Berti and Rapilly, 1976)
Kemerovo oblast	ZIN	–
Krasnoyarsk krai	ZIN, ZMMU	–
Primorsky krai	ZMMU	–
Altai Republic	ZIN	–
Tyumen oblast	ZMMU	–
Khabarovsk krai	ZIN	–
Khakasia	ZIN	–
Asia		
Kazakhstan	ZIN, ZMMU	–
AMERICAN SUBRANGE MISSING		

**Table 3.** Regions in which *L. lili* was reported from 1940 to 2011

Region	Sources of information	
	Materials from collections, web photographs	References
<b>BRITISH SUBRANGE</b>		
England (all counties), Scotland, Northern Ireland	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Salisbury, 2003)
<b>OTHER ISLAND SUBRANGES</b>		
Bornholm (Baltic Sea)	<a href="http://www.fugleognatur.dk">http://www.fugleognatur.dk</a>	–
Vysotsky (Gulf of Finland)	<a href="http://macroclub.ru">http://macroclub.ru</a>	–
Jersey (La Manche strait)	<a href="http://www.flickr.com">http://www.flickr.com</a>	–
Canary Islands	–	(DMPP..., 2012)
Corsica	–	(DMPP..., 2012)
Crete	–	(Berti and Rapilly, 1976)
Malta	–	(DMPP..., 2012)
Montreal (Canada, freshwater archipelago Oshlaga)	–	(Majka and LeSage, 2008)
Rod (island off the Atlantic coast of the United States)	–	(DMPP..., 2012)
Sardinia	–	(DMPP..., 2012)
Sicily	–	(Berti and Rapilly, 1976)
<b>EURASIAN CONTINENTAL SUBRANGE</b>		
<b>Western Europe</b>		
Austria	–	(Geiser, 2001)
Azerbaijan	–	(Schmitt, 2010)
Albania	–	(Schmitt, 2010)
Andorra	–	(DMPP..., 2012)
Armenia	–	(Schmitt, 2010)
Belarus	<a href="http://macroclub.ru">http://macroclub.ru</a>	(Lařrova, 1986)
Belgium	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Schmitt, 2010)
Bulgaria	–	The same
Bosnia and Herzegovina	–	"
Hungary	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	"
Germany	ZIN, <a href="http://www.flickr.com">http://www.flickr.com</a>	"
Greece	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Berti and Rapilly, 1976)
Georgia	–	(Schmitt, 2010)
Denmark	<a href="http://www.fugleognatur.dk">http://www.fugleognatur.dk</a>	The same
Spain	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Schmitt, 2010)
Italy	<a href="http://www.flickr.com">http://www.flickr.com</a> , collection of A.O. Bienkowski	(Berti and Rapilly, 1976)
Canary Islands	–	(DMPP..., 2012)
Latvia	<a href="http://macroid.ru">http://macroid.ru</a>	(Schmitt, 2010)
Lithuania	<a href="http://macroclub.ru">http://macroclub.ru</a>	The same
Liechtenstein	–	"
Luxembourg	–	"
Macedonia	–	"
Malta	–	(DMPP..., 2012)

Table 3. (Contd.)

Region	Sources of information	
	Materials from collections, web photographs	References
Moldova	–	(Schmitt, 2010)
Monaco	–	(DMPP..., 2012)
Netherlands	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Schmitt, 2010)
Norway	<a href="http://public.fotki.com">http://public.fotki.com</a>	The same
Poland	<a href="http://www.flickr.com">http://www.flickr.com</a>	"
Portugal	<a href="http://www.flickr.com">http://www.flickr.com</a>	"
Romania	<a href="http://www.flickr.com">http://www.flickr.com</a>	"
Serbia	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	"
Slovakia	–	"
Slovenia	–	"
Ukraine	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a> , <a href="http://www.zin.ru">http://www.zin.ru</a> , <a href="http://macroid.ru">http://macroid.ru</a> , <a href="http://macroclub.ru">http://macroclub.ru</a>	"
Finland	<a href="http://www.kolumbus.fi">http://www.kolumbus.fi</a> , <a href="http://www.flickr.com">http://www.flickr.com</a>	"
France	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Berti and Rapilly, 1976)
Croatia	–	(Schmitt, 2010)
Montenegro	–	(DMPP..., 2012)
Czech Republic	<a href="http://www.insect.cz">http://www.insect.cz</a>	(Schmitt, 2010)
Switzerland	<a href="http://www.zin.ru">http://www.zin.ru</a>	The same
Sweden	<a href="http://www.flickr.com">http://www.flickr.com</a> , <a href="http://www.ftp.funet.fi">http://www.ftp.funet.fi</a>	"
Estonia	<a href="http://www.zin.ru">http://www.zin.ru</a>	"
European part of Russia		
Bryansk oblast	Collection of A.O. Bienkowski	–
Vladimir oblast	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	–
Volgograd oblast	<a href="http://macroclub.ru">http://macroclub.ru</a>	–
Ivanovo oblast	<a href="http://macroclub.ru">http://macroclub.ru</a>	–
Kaliningrad oblast	ZIN, <a href="http://www.zin.ru">http://www.zin.ru</a>	(Alekseev, 2003)
Kaluga oblast	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	–
Kirov oblast	–	(Shernin, 1974)
Kostroma oblast	Collection of A.O. Bienkowski, <a href="http://macroid.ru">http://macroid.ru</a>	–
Krasnodar krai	<a href="http://macroclub.ru">http://macroclub.ru</a>	–
Kursk oblast	Collection of A.O. Bienkowski	(Bienkowski, 1999)
Leningrad oblast	Collection of A.O. Bienkowski, ZIN, <a href="http://macroclub.ru">http://macroclub.ru</a> , <a href="http://www.zin.ru">http://www.zin.ru</a> , <a href="http://macroid.ru">http://macroid.ru</a>	(Romantsov, 2007)
Lipetsk oblast	GGRN	(Tsurikov, 2009)
Moscow oblast	RCPQ, ZMMU, collection of D.A. Demidov, <a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a> , <a href="http://www.ftp.funet.fi">http://www.ftp.funet.fi</a> , <a href="http://nature.doublea.ru">http://nature.doublea.ru</a> , <a href="http://macroid.ru">http://macroid.ru</a> , <a href="http://macroclub.ru">http://macroclub.ru</a>	(Bienkowski, 1999)

Table 3. (Contd.)

Region	Sources of information	
	Materials from collections, web photographs	References
Nizhni Novgorod oblast	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a> , <a href="http://macroclub.ru">http://macroclub.ru</a> , <a href="http://macroid.ru">http://macroid.ru</a>	—
Orenburg oblast	ZIN	—
Orel oblast	Collection of A.O. Bienkowski, <a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	—
Penza oblast	Collection of I.G. Pronina	—
Pskov oblast	Collection of A.O. Bienkowski	(Antipova and Baikova, 2002)
North Ossetia	Collection of S.K. Alekseev	—
Tatarstan	<a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	(Isaev et al., 2004)
Tula oblast	<a href="http://macroid.ru">http://macroid.ru</a>	—
Udmurtia	—	(Dedyukhin, 2010)
Ulyanovsk oblast	—	(Isaev et al., 2004)
Chelyabinsk oblast	Collection of A.O. Bienkowski, <a href="http://fotki.yandex.ru">http://fotki.yandex.ru</a>	(Gus'kova, 2002)
Chuvashia	—	(Egorov, 2008; Egorov and Egorova, 2009)
Yaroslavl oblast	Collection of A.O. Bienkowski	(Vlasov, 2008)
Asian part of Russia		
Amur oblast	Collection of L.N. Medvedev	(Medvedev and Ammosov, 1978)
Jewish Autonomous Oblast	—	(Medvedev and Skomorokhov, 2009)
Zabaykalsky krai	ZMMU	—
Irkutsk oblast	<a href="http://nature.baikal.ru">http://nature.baikal.ru</a> , collection of L.N. Medvedev	—
Kemerovo oblast	ZMMU	—
Krasnoyarsk krai	ZIN, collection of L.N. Medvedev	—
Kurgan oblast	—	(Pavlov, 1998)
Novosibirsk oblast	<a href="http://www.plantarium.ru">http://www.plantarium.ru</a> , collection of A.O. Bienkowski	—
Altai Republic	ZMMU	—
Tomsk oblast	<a href="http://macroclub.ru">http://macroclub.ru</a>	—
Tuva	—	(Medvedev and Korotyaev, 1976)
Tyumen oblast	ZIN, collection of L.N. Medvedev	—
Khanty-Mansi Autonomous Okrug	<a href="http://commons.wikimedia.org">http://commons.wikimedia.org</a>	—
Yakutia	ZIN	(Medvedev and Ammosov, 1978)
Asia		
Iran		(Schmitt, 2010)
Kazakhstan	ZIN, ZMMU, collection of L.N. Medvedev	(Lopatin, 1977)
China (Jilin, Xinjiang Uygur Autono- mous Region, Inner Mongolia)	—	(DMPP..., 2012)
Mongolia	—	(Schmitt, 2010)
Turkey	—	(Özdikmen and Turgut, 2008)
AMERICAN SUBRANGE		
Canada	<a href="http://www.flickr.com">http://www.flickr.com</a>	(Majka and LeSage, 2008)
United States	<a href="http://www.flickr.com">http://www.flickr.com</a>	The same



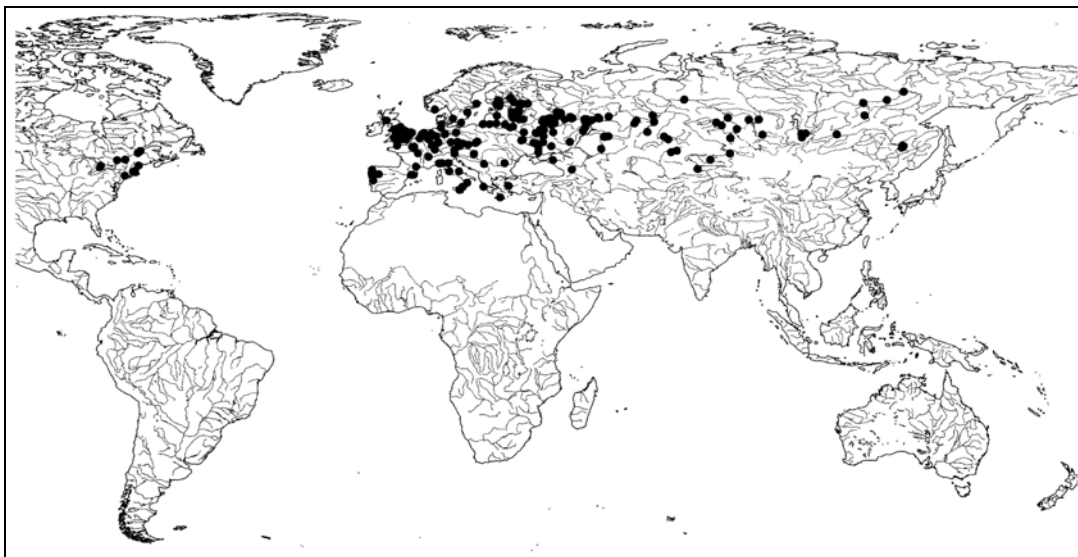


Fig. 4. *L. lili* locations from 1940 to 2011.

can form is considered as a separate species *L. sterco-raria* (Schmitt, 2010). Thus, *L. lili* as such, apparently, is not registered in Africa.

## RESULTS AND DISCUSSION

According to many researchers, the genus *Lilioceris* comes from Asia. It is the center of species diversity (Berti and Rapilly, 1976). The host plants are also of Asian origin. Berti and Rapilly (1976) hypothesized that *L. lili* was introduced to Europe from East Asia in the early Tertiary. According to Lopatin and Nesterova (2005), the settlement occurred in the late Tertiary—the beginning of the Quaternary. However, there is no fossil evidence of ancient times of the range formation.

On the contrary, when comparing the maps of distribution over different years, it is clear that this species has the ability to rapidly colonize new territories, and its present range was formed not over millions but over hundreds of years. Until the end of the 19th century, the range of the lily leaf beetle consisted of two large subranges, European and Asian, between which there was a big gap. Could this area have been formed because of the fact that the species settled from east to west in ancient times, but then died out in the central regions? This is unlikely. If the gap in settlement remained from prehistoric times to the end of the 19th century, it is not clear why it closed over the next 40–50 years. The lily leaf beetle can quickly settle both with humans and on their own, so the species forms stable invasive subranges that expand. Thus, it is most likely that the broken range was formed as a result of invasion of the species from Asia to Europe.

From the literature, it is known that in 1688 the lily leaf beetle was already inhabiting Western Europe (Warchałowski, 1985), and the Siberian species of lil-

ies were first brought there in 1596 (<http://www.sadowod.ru>) when, after Siberia was joined to Russia, Siberian goods began to arrive in Europe. We can assume that it is in this time period, at the end of the 16th or in the 17th century, when the pest was introduced from temperate latitudes of East Asia to Europe.

The contemporary literature has no indications of invasive origin of the species in Europe, but in the middle of the 19th century, Lacordaire wrote that Europe is not a native land to the lily leaf beetle, and that the beetles were imported from somewhere else with bulbs of host plants (Lacordaire, 1845). As possible locations of the origin, the French scientist named India and Brazil. However, according to recent data, *L. lili* does not inhabit these countries (Schmitt, 2010). British florists were closer to the truth, as they sometimes called this beetle Asiatic lily beetle (Fotolibra, 2012).

The biotopical association of the species provides further evidence for the fact that the lily leaf beetle is a native species in Asia and invasive in Europe. In Europe, the lily leaf beetle is encountered almost exclusively on garden lilies, while in Tuva and Kazakhstan, it is found on wild lilies in forb-meadow steppes, floodplains, meadows of foothills, and intermontane lowlands (Medvedev and Korotyaev, 1976; Lopatin and Kulenova, 1986).

Feeding specialization is another strong argument. It was shown experimentally that the larvae of *L. lili* grow well only on the lilies and fritillaries (Clark et al., 2004), and all other forage plants are suitable only for adults. In the central and northern regions of European Russia (north of the Oka), there are no native lilies and fritillaries (Gubanov et al., 1992). The host plants of the lily leaf beetle occur there only in the cultivation, and sometimes they become wild. Thus, the

**Table 4.** Names of *L. lili* in European languages

Language	National name
English	Scarlet Lily Beetle, Lily Leaf Beetle, Lily Beetle, Red Lily Bug, Asiatic Lily Beetle
Hungarian	Liliombogár
Dutch	Leliehaantje, Leliekever
Danish	Liljebille
Italian	Criocera del giglio
Latvian	Melnkāju lilijgrauzis
Lithuanian	Lelijinis lapgraužis
German	Lilienhähnchen, Lilienkäfer
Norwegian	Liljebille
Polish	Poskrzypka liliowa
Russian	Lileinitsa, Treshchalka lileinaya, Krasnyi lileinyi zhuk
Finnish	Liljakukko
French	Puceron de Lys, Criocère du Lys
Czech	Chřestovníček liliový
Swedish	Liljebagge

lily leaf beetle could not live north of the Oka before the time when people began to engage in floriculture.

In local floras of European Russia, the proportion of adventive plants is on average about 20% (Morozova, 2008). Consequently, the proportion of specialized phytophage insects among invasive species should be large. However, the entomofauna was studied far worse than the flora, so the number of the species for which the invasive origin was proven is two orders of magnitude lower than their expected number. For example, out of 580 species of leaf beetles inhabiting this territory, the invasive origin was proven only for two: the Colorado potato beetle (*Leptinotarsa decemlineata* (Say, 1824)) and the specially imported ambrosia leaf beetle (*Zygogramma suturalis* (Fabricius, 1775)) (Maslyakov and Izhevskii, 2011). It appears that in fact the number of invasive species is much greater. Systematic monitoring of the insect fauna of the European part of Russia was never carried out, and introduction of invasive species remained unnoticed. A naturalized species is difficult to distinguish from a local one, since often the introduced pests start eating wild plants in addition to crops. For example, the Colorado potato beetle in the European part develops on some native plants (Maslyakov and Izhevskii, 2011).

Obviously, the introduction of invasive species occurred not only during the last one hundred years. Humanity, throughout its history, was unwittingly engaged in resettlement of insects from one territory to another. The contemporary natural communities in Europe reflect not as much the climatic characteristics of the region as the historical path of its peoples.

Currently, the lily leaf beetle is one of the most common pests of floriculture in Europe. Almost every

European language has a national name for this insect (Table 4).

## CONCLUSIONS

(1) The natural range of the species is located in the temperate latitudes of East Asia: South Siberia and the Far East, northern China and Mongolia, and Kazakhstan.

(2) In Europe, the lily leaf beetle was introduced in the late 16th century or in the 17th century.

(3) The species invaded into the northern half of the European part of Russia (north of Moscow) in the 20th century, and by now has settled to the north of Leningrad oblast, becoming a common pest.

(4) The expansion of the range of the lily leaf beetle is a consequence of cultivation of ornamental liliaceous.

(5) It is likely that many of the insects which are now considered indigenous in Europe and the European part of Russia, in fact, are long ago naturalized invasive species.

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