

*This contribution is published
to honor Prof. Vladimir Chikatunov,
a scientist, a colleague and a friend,
on the occasion of his 80th birthday.*

Notes on the lily leaf beetles *Lilioceris* Reitter in Israel (Chrysomelidae: Criocerinae)

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ABSTRACT

Lilioceris faldermanni and *L. lillii lillii* are recorded from Israel and keyed, their distribution is corrected and summarized. The biology of *L. faldermanni* on *Fritillaria persica* and *Lilium candidum* is described.

KEYWORDS: Chrysomelidae, *Lilioceris*, Liliaceae, biology, leaf beetles, lily beetle, taxonomy, identification key, Palearctic, zoogeography.

INTRODUCTION

The genus *Lilioceris* Reitter, 1913 comprises about 170 extant species in the Palearctic, Oriental, Afrotropical and Australasian regions (Monrós 1960; Bukejs & Schmitt 2016); one species (*L. lillii*) invaded North America (Brown 1946; Lesage 1983; Ernst 2005). *Lilioceris* includes 65 extant species throughout the Palearctic Region, with only seven extant and one fossil species in the West Palearctic (Europe, West Asia and North Africa) (Bezděk & Schmitt 2017).

All species, whose biology is known, are associated with monocots (Asparagaceae, Dioscoreaceae, Liliaceae) (Lesage 1983; Cox 2001; Salisbury 2003; Haye & Kenis 2004; Ernst 2005; Konstantinov *et al.* 2011; Pankow & Schmitt 2017). In the recent years, additional information has been published on the biology of *Lilioceris* in the Eastern Mediterranean: Greece (Papadoulis & Tsagkarakis 2012) and Iran (Mojib Hagh Ghadam *et al.* 2013).

Two species of *Lilioceris* were recorded from Israel, based on the material deposited in the National Collection of Insects, the Steinhardt Museum of Natural History, National Research Center, Tel Aviv University, Israel (Lopatin *et al.* 2003). The recent research has revealed that most of the specimens were incorrectly identified, and therefore their distribution was erroneously recorded. Herewith, the re-identified original material along with results of collecting efforts and observations over the last 20 years is provided, and the distribution of the *Lilioceris* species in Israel is clarified. Observations on the biology of *Lilioceris faldermanni* are also summarized.

MATERIALS AND METHODS

All studied material is deposited in the National Collection of Insects, the Steinhart Museum of Natural History, National Research Center, Tel Aviv University, Israel. Observation records based on photographs made by members of the Facebook group *Arthropods, Reptiles and Amphibian Photography* have also been used.

The observations on the biology of *Liliocerus faldermanni* were mainly done by Attai Yoffe in his Botanical Garden in the kibbutz Netiv haLamed He (31°41'14"N 34°59'01"E). Images of the beetle habitus, eggs and larvae were taken by Attai Yoffe with a cellular phone.

Transliterated names of localities in Israel follow the Israel Touring Map and List of settlements published by the Survey of Israel (2009). The most recent transliterated Hebrew names are given followed by alternative, old or erroneously cited names in brackets, for example: Yerushalayim [Jerusalem].

RESULTS

The *Liliocerus* species in Israel are easily recognized from other Criocerinae (*Criocerus* Geoffroy, 1762 and *Oulema* Des Gozis, 1886) by the pronotum being dilated anteriorly and constricted medially (Figs 1, 2), the claws being free at the base and by a large body size (8–10 mm). Both Israeli species have a bright red coloration of the pronotum and elytra (Figs 1–3), which often turns testaceous, orange or yellow after years of preservation. This character led in the past to numerous misidentifications and to confusion of the Israeli *Liliocerus* with other chrysomelid genera of the Criocerinae and Galerucinae.

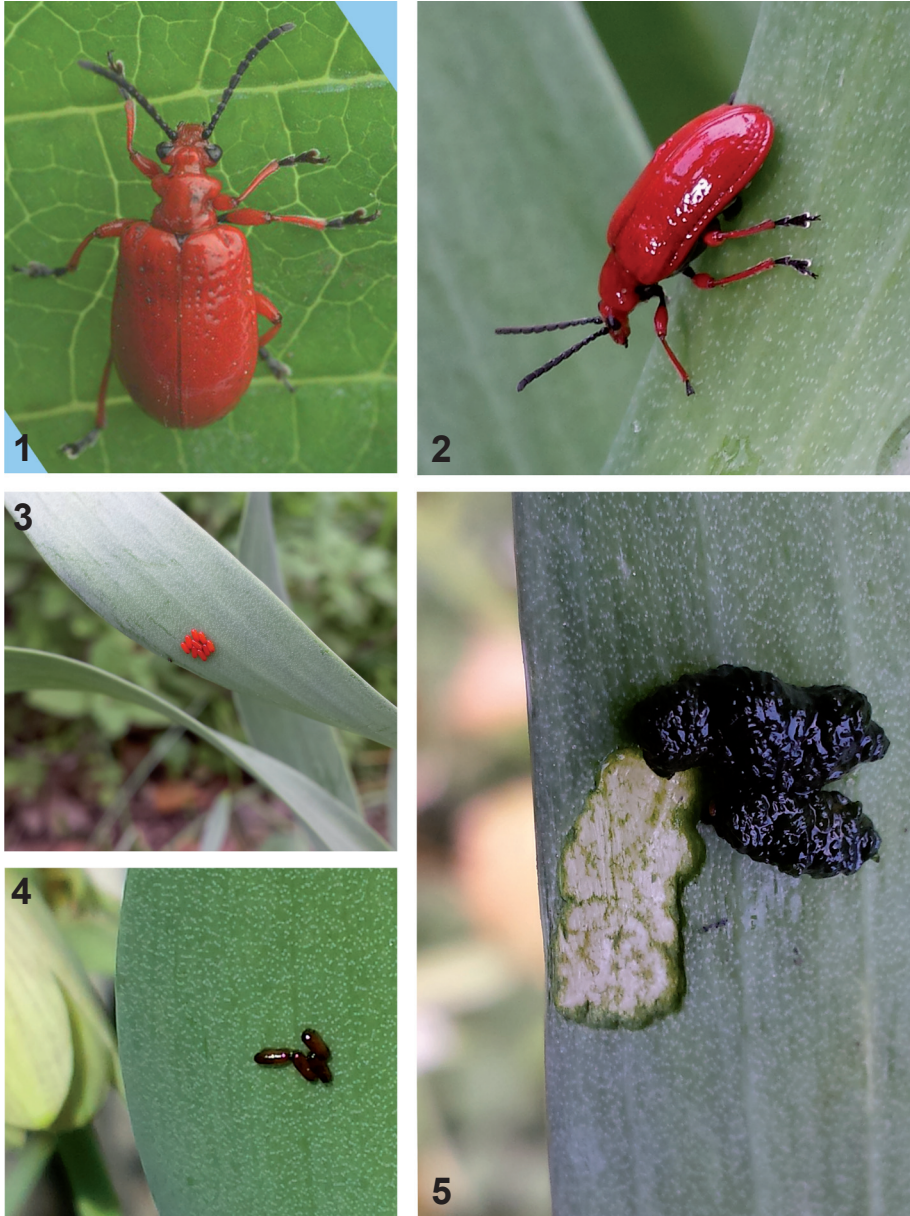
Identification key to the Israeli *Liliocerus*

- 1 Head red, coxa, trochanter, basal 0.3–0.4 of femur and occasionally distal tip of femur (“knee”) black, rest of femur and tibia red *faldermanni*
 – Head and legs black *lilii lilii*

Liliocerus faldermanni (Guérin-Méneville, 1844)

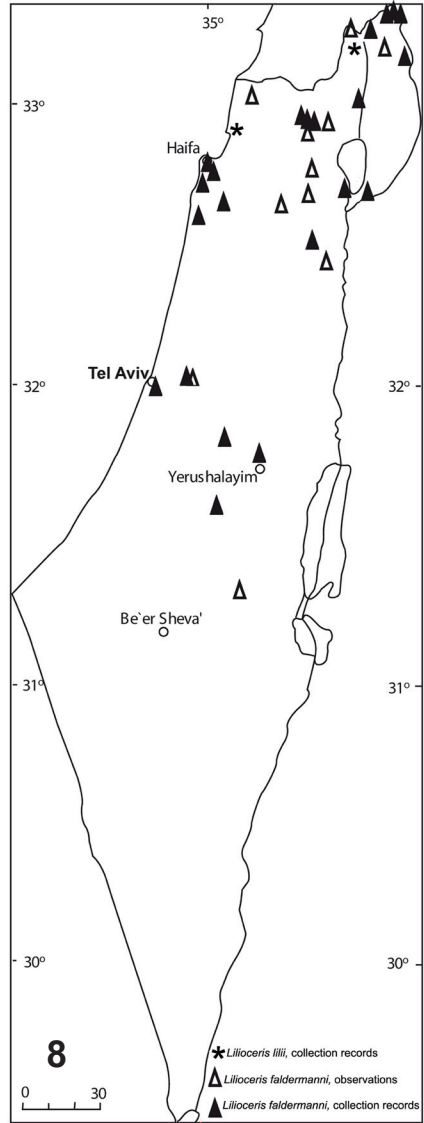
(Figs 1–7)

Material examined: **Israel:** ‘Israel’ (1 old specimen, with no additional details); **Hermon:** Hermon Nature Reserve, Sheluhat Duvdevan, Plot E6, 33.314°N 35.791°E, 2076 m, 29.v.2019, L. Friedman, on *Acer monspessulanum microphyllum* (1 ex.); Har Hermon [Mt Hermon], 2000 m, 5.v.1977, A. Freidberg (1 ex.); Har Hermon, 2.vi.1993, V. Chikatunov (1 ex.); Har Hermon, 1600 m, 21.v.2002, A. Freidberg (1 ex.). **Golan Heights:** 10 km S Quneitra, 6.v.1977, A. Freidberg (1 ex.); Hammat Gader [El Hamma], 18.ii.1980, A. Rubin (1 ex.). **Hula Valley:** Dan, Bet Ussishkin, 33°14'N 35°39'E, 11.v.2015, M. Shemesh (1 ex.). **Upper Galilee:** Har Meron [Mt Meron], 1000 m, 32°59.7'N 35°24.7'E, 14.iv.2011, L. Friedman (2 ex.); Har Meron [Jermak] (1 ex.), [Germak], 29.v.1957, J. Kugler (1 ex.); Nahal 'Ammud, 17.x.1972, D. Furth (1 ex.); Gadot, 15.v.1973, J. Halperin, on *Lilium candidum*, died 14.x.1973 (1 ex.). **Jordan Valley:** Kinneret, 22.iii.1973, J. Halperin, on *Lilium candidum* (1 ex.), 19.iv.1973, J. Halperin, on *Lilium candidum* (1 ex.), 15.v.1973, J. Halperin, on *Lilium candidum*, lab rearing (1 ex.), 20.v.1973, J. Halperin, on *Lilium candidum*, lab rearing, died 20.ix.1973 (1 ex.), 16.vi.1973, J. Halperin, on *Lilium candidum*, lab rearing, died 5.ix.1973 (1 ex.). **Carmel Ridge:** Haifa, 22.x.1972, A. Freidberg (1 ex.); Nahal Kelah, river bed, 17.viii.2010, L. Friedman, on *Laurus nobilis* (1 ex.); Nahal Oren, 5.iii.1996, V. Chikatunov & T. Pavliček (1 ex.); Binyamina [Benjaminah Dist.],



Figs 1–5: (1) *L. faldermanni*, dorsal view, Har 'Amassa (courtesy Ya'akov Salaviz); (2) *L. faldermanni* on *Fritillaria persica*, dorsolateral view, Netiv haLamed He; (3, 4) eggs of *L. faldermanni* on *Fritillaria persica*, Netiv haLamed He, immediately after oviposition (3) and before hatching (4); (5) larvae of *L. faldermanni* feeding on *Fritillaria persica*, Netiv haLamed He.

vii.1926, O. Theodor (1 ex.), [Benjamina], 12.iv.1947, H. Bytinski-Salz (1 ex.); HaZorea, 15.v.1973, J. Halperin, on *Lilium candidum*, died 10.ix.1973 (1 ex.); 14.vii.1950, J. Halperin, on leaves of *Quercus boissieri* (1 ex.). Samaria: Gilboa, 5.ii.1963, Zehavi (2 exx.); Rosh ha'Ayin, forest, 17.ii.2020, L. Friedman, on *Fritillaria persica* (4 exx.), 3.iii.2020, K. Roguz, on *Fritillaria persica* (2 exx.). Southern Coastal Plain: Tel Aviv [Abu Kabir], 25.ii.1956, L. Fishelsohn (1 ex.). Judean Hills: 'En Hemed [Aqua Bella], 10.v.1950, J. Wahrman (1 ex.); Netiv haLamed He, Atai's Garden, 8.ii.2017, A. Yoffe (5 exx.);



Figs 6–8: (6) *Fritillaria persica* (courtesy Lior Almagor), (7) *Lilium candidum* (courtesy Lior Almagor), (8) distribution of *Liliocercis* spp. in Israel.

Yerushalayim [Jerusalem], 1.ii.1955 (1 ex.), 3.ii.1955, R. Lederer (1 ex.); Har 'Amassa, 17.iii.2020, Ya'akov Salaviz, on *Fritillaria persica* (1 ex.).

Observation records: **Israel:** *Golan Heights:* Ramat haGolan, 4.ii.2019, Nir Finkelstein, on *Fritillaria persica*, feeding. *Upper Galilee:* HaTanur Waterfall, 9.ii.2018, Yuval Evron; Nahal Keziv, 30.v.2018, Nogen Tzabari, on *Smilax aspera* L.; Har Hillel, 7.iv.2017, Nurit Sheizaf, on *Fritillaria persica*, mating; Zefat [Tsfat], Wadi Hamra, iv.2009, Refael Malka, on *Fritillaria persica*. *Lower Galilee:* Mehla'f Golani, 3.ii.2018, Itai Nahshon, on *Fritillaria persica*, 8.ii.2019, Roe'e Peretz, on *Fritillaria persica*; Derekh Nof, Bet Qeshet Forest, 2.iii.2020, Yael Orgad, on *Fritillaria persica*; Nazerat-'Illit, 19.ii.2018, Rotem Goffer, on *Lilium candidum*, feeding, each day several specimens. *Samaria:* Rosh ha'Ayin Forest, 15.ii.2020, Tovi Levin, on *Fritillaria persica*, feeding and mating. *Samaritan Desert:* Nahal Milha/Malha? ('Ein el-Hila?), near Maskiyot, 18.ii.2020, Shahar Shiloach, on *Fritillaria persica*. *Judean Hills:* Har 'Amassa, 17.iii.2020, Ya'akov Salaviz, on *Fritillaria persica*.

Distribution: Europe: Romania, Greece, Turkey, Russia (the Caucasus), Azerbaijan, Georgia, Armenia; Asia: Turkey, Cyprus, Syria, Israel, Jordan, Iran, Iraq (Berti & Rappilly 1976; Bezděk & Schmitt 2017). In Israel, the species is widespread throughout the Mediterranean part (Fig. 8) but rarely observed and collected probably due to its activity mainly in the winter rainy season.

Host plants: *Fritillaria persica* L. (Fig. 6) and *Lilium candidum* L. (Fig. 7) (Liliaceae), a single record from *Smilax aspera* L. (Liliales: Smilacaceae) is probably occasional. There are several specimens collected and reared by the late Joseph Halperin, but it is unclear whether he collected larvae or adults in the abovementioned localities in nature, or studied them as pests in floriculture. Most of the recent observations in nature were made on *F. persica*, widely distributed throughout Israel, in the Mediterranean woodlands and shrublands, in subalpine zone and in the desert, although everywhere very local and rare (Shmida 2020; Danin & Fragman-Sapir 2020). *Lilium candidum* occurs in Israel naturally only in a few locations in the northern part of the Upper Galilee and on the Carmel Ridge (Shmida 2020; Danin & Fragman-Sapir 2020); however, it appears in the floriculture and most of the observations were made on the cultivated plants.

The first author (AY) observed the entire life cycle of *L. faldermanni* in his own small botanical garden in the kibbutz Netiv haLamed He, in the Ela Valley, on the Western slopes of the Judean Hills, referred to as *Attai's Garden* or *The Land of Israel Garden*. The first observations were made circa 2010, on *L. candidum* only, and later also on *F. persica*. The beetles are active between January and April (winter–spring season). The eggs are laid on lower part of leaves, sometimes on stems. The eggs are orange-yellow in the beginning (Fig. 3), turning brown before hatching (Fig. 4). The larvae hatch three weeks after the oviposition. Larvae cover themselves with their feces (Fig. 5). The larvae and adults are feeding on the foliar parenchyma, causing translucent fenestration of leaves (Fig. 5). Pupae have not been found. According to Mojib Hagh Ghadam *et al.* (2013), pupation occurs in the soil beneath the host plant, in a silken cocoon incorporating soil particles.

During the summer (May–October), when the host plants dry out, the adult beetles can be found on trees with thick stiff foliage (*Acer*, *Quercus*, *Laurus* etc.) in the Mediterranean woodlands and scrubs in the mountainous areas (Hermon, Meron, Carmel) of Israel. There is no clear evidence if beetles from other regions

migrate to these areas or each population aestivates in the original locality, northern populations on trees and others probably in soil.

Lilioceris lili lili (Scopoli, 1763)

Material examined: **Israel:** *Upper Galilee:* 'Akko [Acre, Galilee], xii.1924, O. Theodor (1 ex.); Tel Hay [Tel Chai], 18.v.1976, D. Simon (1 ex.). *Note:* All additional specimens of *L. l. lili* listed by Lopatin *et al.* (2003) are either *L. faldermanni* or large red *Crioceris* sp.

Distribution: Eurasia, North Africa, invasive in North America (1940s) (Berti & Rapilly 1976; Ernst 2005; Bezděk & Schmitt 2017). In Israel, it was found only on two occasions (Fig. 8). Both specimens were collected 96 and 44 years ago, respectively, close to the northern border of Israel, which probably represents the southernmost points of their distribution in Western Asia.

Host plants: Larvae develop on Liliaceae: *Fritillaria* (4 spp.), *Lilium* (81 spp.), *Cardiocrinum giganteum* (Wallich) Makino, and Asparagaceae: *Maianthemum canadense* Desf., *Convallaria majalis* L. Adults attack a wider range of hosts (Lesage 1983; Cox 2001; Haye & Kenis 2004; Ernst 2005; Salisbury 2003). The closest host record to Israel is from Greece: *Lilium chalconicum*, *L. martagon* (Papadoulis & Tsagkarakis 2012). The exact hosts in Israel are unknown, these may be *Lilium candidum* and/or *Fritillaria persica*.

DISCUSSION

L. faldermanni was never observed in Israel developing on any plant other than *F. persica* or *L. candidum*, and did not move to any other members of Liliaceae. AY transferred larvae to the leaves of ecologically similar *Scilla hyacinthoides* L. (Asparagaceae) and more closely related *Tulipa agenensis* Redouté (Liliaceae), but the larvae did not develop further. Therefore, *L. faldermanni* can be considered an oligophage of *Fritillaria* and *Lilium*, also showing a strong preference towards local species. This is completely opposed to *L. lili*, attacking numerous plants from the Asparagaceae and Liliaceae, of both Old and New World origin (Brown 1946; Lesage 1983; Cox 2001; Salisbury 2003; Haye & Kenis 2004; Ernst 2005).

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