Blossom weevils of Israel (Curculionidae: Curculioninae: Anthonomini)

Article *in* Israel Journal of Entomology · July 2016

1 author:

Laibale Friedman
Tel Aviv University
16 PUBLICATIONS **136** CITATIONS

ISRAEL JOURNAL OF ENTOMOLOGY, Vol. 46, pp. 57–76 (28 July 2016)

Blossom weevils of Israel (Curculionidae: Curculioninae: Anthonomini)

Ariel-Leib-Leonid Friedman

The Steinhardt Museum of Natural History, Israel National Center for Biodiversity Studies and Department of Zoology, Tel Aviv University, Tel Aviv, 69978 Israel.
E-mail: laibale@post.tau.ac.il

ABSTRACT

The fauna of the blossom weevils (Curculionidae: Curculioninae: Anthonomini) in Israel is surveyed. Four species of *Anthonomus* (*A. chevrolati connexus*, *A. curtulus*, *A. multifasciatus* and *A. stierlini*), as well as *Bradybatus fallax* and *Assuanensius peyerimhoffi* are recorded for the first time, in addition to four known previously. *Assuanensius discoidalis* is removed from the list of the Israeli weevils. For most of the species their host plants are recorded, some of them also for the first time. An identification key and illustrations for all genera and species are provided.

KEYWORDS: Anthonomini, blossom weevils, taxonomy, faunistics, zoogeography, identification key, host plants.

INTRODUCTION

The Anthonomini is a tribe within the subfamily Curculioninae of the Curculionidae (sensu Alonso-Zarazaga & Lyal 1999 and Caldara *et al.* 2014). The tribe currently comprises 43 genera and 826 known species; a majority of species (558) are assigned to the genus *Anthonomus* Germar, 1817 (Alonso-Zarazaga & Lyal 1999; Clark 2010; Caldara *et al*. 2014).

Kojima and Idris (2004) diagnosed the tribe as follows: eyes more or less convex; rostrum cylindrical; procoxal cavities generally contiguous; at least fore and middle tibiae tibiae uncinate (at least on fore and middle legs); tarsal claws not widely divergent, generally sharply bifid, and with one seta each; posterior margin of abdominal ventrites 2–4 straight, not laterally angled; aedeagus narrowed or emarginated at base in lateral aspect and with apodemes articulating at ventral surface; sternite VIII of male paired, devoid of setae along caudal margin; sternite IX of male bilobed, with apodeme more or less curved and oblique to axis of aedeagus; spermatheca with lateral lobe indefinite, spermathecal gland long, linear.

The Anthonomini feed and develop on more than 40 families of plants. In the Palaearctic Region the majority of anthonomines are associated with the Rosaceae, particularly those in the genus *Anthonomus*, although a few species are associated with the Aceraceae (*Acer*), Mimosaceae (*Acacia*), Rhamnaceae (*Ziziphus*), Ulmaceae (*Ulmus*, *Celtis*), and Pinaceae (*Pinus*, *Picea*). Larvae develop mainly in flower buds and flower heads, the habit that is reflected in their common name ‘blossom

http://www.entomology.org.il/publications; ISSN (online) 2224-6304
urn:lsid:zoobank.org:pub:A8405E0E-C3D1-4B0A-994F-C185E0376B35

weevils', but they also develop in leaf buds, fruits and seeds, while some species develop as inquilines in galls produced by various organisms (Scherf 1964; Dieckmann 1968; Burke 1976; Gates & Burke 1972; Caldara *et al.* 2014).

Some of the anthonomines, particularly members of *Anthonomus* are considered serious agricultural pests: several members of the Palaearctic and Nearctic *Anthonomus* cause serious damage to the Rosaceae (*Amygdalus*, *Cerasus*, *Fragaria*, *Prunus*, *Rubus*) (Dieckmann 1968; Burke 1976); the boll weevil *A. grandis* Boheman, 1843 is a notorious pest of cotton (Cross *et al.* 1975) and one of the most extensively studied weevils in the world (Scataglini *et al.* 2006); the Central American pepper weevil *A. eugenii* Cano, 1894 is a serious pest of *Capsicum* (Solanaceae) (Clark & Burke 1996), having spread throughout North America, and in recent years reaching Europe (the Netherlands, Italy) (EPPO 2013; Speranza *et al.* 2014). The South American *A. santacruzi* Hustache, 1924, in contrast, is used successfully as a biocontrol agent of *Solanum mauritianum* (Solanaceae) in South Africa (Olckers 2009).

The Anthonomini of Israel have never been extensively studied. Four species have been recorded to date: *Anthonomus* (*Persexarthrus*) *baudueri* (Desbrochers) was recorded by Bodenheimer (1937) by its junior synonym name *Anthonomus cyprius* Marshall, and later by Halperin and Fremuth (2003), who misspelled its name as '*badueri*'; *Sphincticraerus bruleriei* (Desbrochers) by Bodenheimer (1937) (genus name misspelled as *Sphinctocraerus*); *Anthonomus* (*Persexarthrus*) *variabilis* (Hoffmann) and *Assuanensius discoidalis* (Tournier) by Halperin and Fremuth (2003). The latter name is a result of a misidentification of two different species: *Assuanensius erectesetosus* (Peyerimhoff) (recorded from Israel by Abdel-Dayem *et al.* 2015) and the newly recorded *A. peyerimhoffi* (Hoffmann). Košťál (2014) revised the Near Eastern subgenus *Persexarthrus*, and first mentioned *A. baudueri* from Israel according to its correct name, but overlooked the record of *A. variabilis* by Halperin and Fremuth (2003) .

MATERIALS AND METHODS

Most of the studied material is deposited in the National Collection of Insects, The Steinhardt Museum of Natural History, Israel National Research Center, Department of Zoology, Tel Aviv University, Tel Aviv, Israel (SMNHTAU), and therefore this material is not marked by the acronym in the 'Material examined' section. Some specimens, mainly of *Anthonomus chevrolati connexus* is deposited in the private collection of Eylon Orbach, Qiryat Tiv'on, Israel (ORB) and in the private collection of Enzo Colonnelli, Rome, Italy (COL). No specimens of Anthonomini were found in the collection of the Plant Protection and Inspection Services, Ministry of Agriculture, Bet Dagan, Israel.

Line-art illustrations and measurements were made using a drawing tube attached to a stereomicroscope Leica M125. Sketches were scanned and processed using Adobe Illustrator 9.0. Total body length was measured in the dorsal view

from the base of the rostrum to the tip of the elytra. Images of the weevil habitus were captured with a Leica DFC295 digital camera mounted on a Leica M205C microscope, combining image stacks with Leica Application Suite 4.2.0 and Helicon Focus 5.3, and editing the final images when necessary with Adobe Photoshop CS5. Genitalia were extracted by soaking dry specimens in hot water, breaking off the posterior abdominal sternites and boiling them in a 10% water solution of KOH. Extracted genitalia were preserved in glycerin in plastic tubes and pinned next to the specimens on the same pin. Transliterated names of localities in Israel follow the *Israel Touring Map* and *List of settlements* published by the Survey of Israel (2009). Where names of localities have changed, the most recent transliterated Hebrew names are given followed by the old names in brackets, for example: ‘En Hemed [Aquabella]. Erroneous spellings are also included in brackets following correct ones. Plant names are given after Feinbrun-Dothan and Danin (1991) and Vafdar *et al.* (2014). Regional zoogeographic subdivision of Israel follows Theodor (1975).

TAXONOMY

Tribe Anthonomini C.G. Thomson, 1859

Key to genera and species of Anthonomini in Israel

1 Antennal funicle 4-segmented; head, pronotum and elytra covered with erect bristle-like scales, in addition to appressed scales (Figs 10, 11, 14, 15, 21, 22); bases of claws merged, basal denticles of claws merged in one median process (Fig. 29); body length 1.8–2.0 mm; on *Acacia* [genus *Assuanensius*]..... 2

– Antennal funicle 6- or 7-segmented; body vestiture with only appressed scales; bases of claws and basal denticles of claws separated (Figs 23–28, 30–31) 3

2 Rostrum thicker than protibia, 3.5× as long as wide, 0.85× as long as head and pronotum together, slightly bent, dorsally distinctly punctate, with three longitudinal carinae, occasionally median carinae obsolete; pronotum and elytra covered sparsely with erect pale narrow scales, not condensed in tufts (Figs 10, 14, 21) ..... *erectesetosus*

– Rostrum thinner than protibia, 6.5× as long as wide, as long as head and pronotum together, or slightly longer, distinctly bent, dorsally glabrous, without carinae; pronotum and elytra covered densely with erect more or less narrow scales, pale, yellowish or brownish, part of erect scales condensed in tufts, particularly on pronotum and at sub-basal quarter of 2nd elytral interstria (Figs 11, 15, 22)... ..... *peyerimhoffi*

3 Antennal funicle 6-segmented; claws dentated or not dentated..... 4

– Antennal funicle 7-segmented; claws dentated [genus *Anthonomus* s. str.] 7

4 Head constricted transversely between eyes and vertex (Fig. 17, 20); body sphaerical, yellowish to pale brown (Figs 12, 17); femur not or slightly incrassate,

femoral tooth thin, sometimes obsolete or absent, often not visible being hidden by vestiture; claws dentated; body length 2.2–2.7 mm; on *Ziziphus* .... *Sphincticraerus bruleriei*

– Head not constricted behind eyes; body oblong, red to dark testaceous; femur strongly incrassate, femoral tooth distinct, triangular (Figs 32–38) 5

5 Rostrum short and thick, less than 5× as long as wide (Figs 6, 16); fore tibia with median tooth (Fig. 38); claws dentated (Fig. 30); body length 3.5 mm; Har Hermon; on *Acer* ..... *Bradybatus fallax*

– Rostrum long and slender, more than 5× as long as wide (Figs 7, 8, 13); fore tibia without median tooth (Figs 36, 37); claws not dentated (Figs 27, 28); body length 2.0–3.5 mm; on *Amygdalus* [genus *Anthonomus* (*Persexarthrus*)] 6

6 Profemoral tooth large, ¼–⅓ of femur width at widest part (Fig. 36); body length 2.6–3.5 mm, usually 3.0–3.5 mm..... *baudueri*

– Profemoral tooth small, 0.2 of femur width at widest part (Fig. 37); body length 2.4–3.5 mm, usually 2.0–2.5 mm..... *variabilis*

7 Scales on frons directed anteriorly, not parted medially (Fig. 18); elytral pattern: two transverse complete bands comsisting of white scales, one subapical and one sub-basal; longitudinal stripe comprised of yellow scales along median part of elytral suture (Fig. 1); body length 2.5–4.0 mm; on *Crataegus* ....*chevrolati connexus*

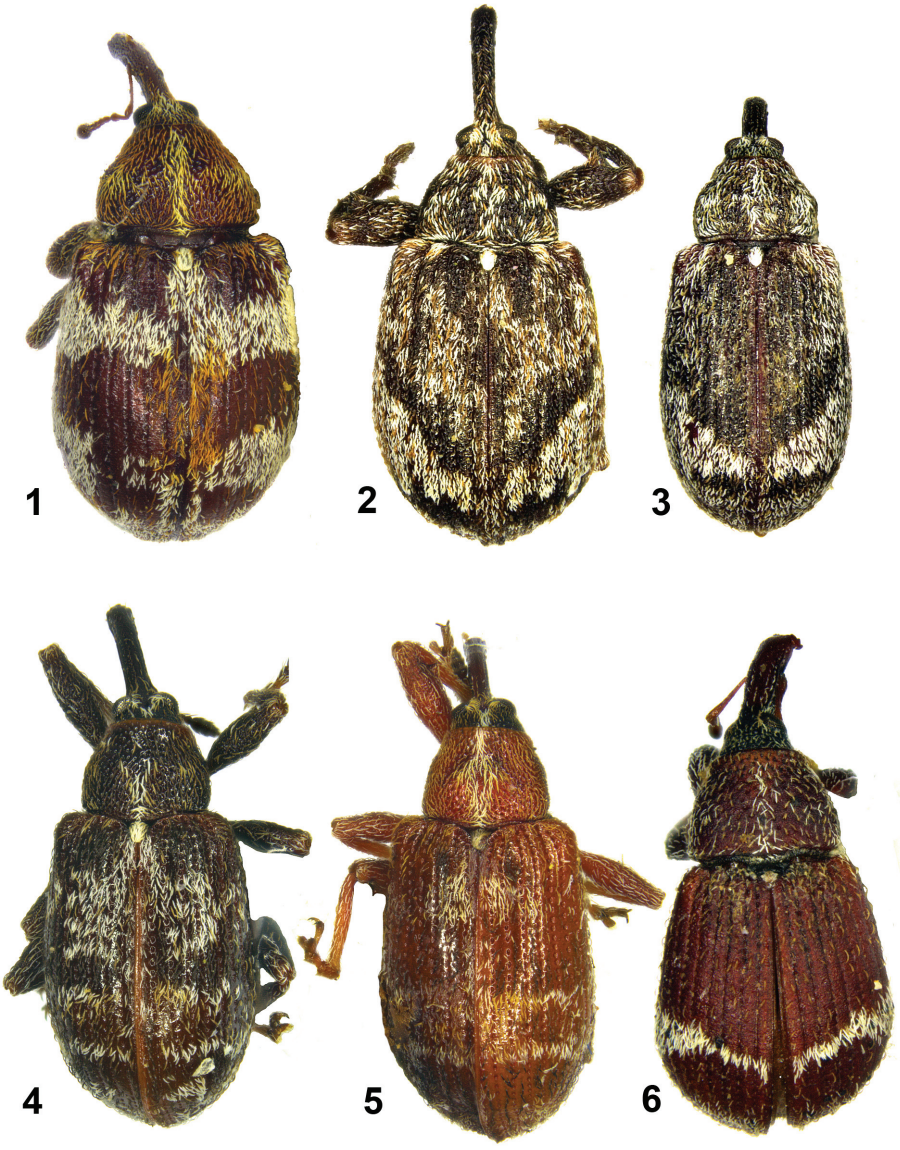
– Scales on frons directed laterally, parted medially (Fig. 19); elytral pattern different, never including sub-basal transverse complete band (Figs 2–5); body length 3.5–5.0 mm.....8

8 Fore tibia straight at anterior ⅔ and slightly bent at base (Fig. 34); frons with deep short median sulcus behind eyes; elytra subapically with two narrow complete transverse bands of white scales in both sexes, and with large sub-basal patch of white scales in male (Figs 4, 5); body and elytra red, testaceous or reddish brown; body length 3.5–4.5 mm; Har Hermon ..... *multifasciatus*

– Fore tibia bent medially and at base, with more or less produced rounded projection at anterior edge (Figs 33, 35); frons without median sulcus behind eyes; elytral pattern different, even or comprises wide transverse bands (Figs 2, 3); body and elytra brown; body length 3.0–5.0 mm.....9

9 Body slightly wider, more rounded apically; elytral pattern does not comprise white transverse complete bands, covered more or less evenly by white scales with transverse dark patches of black scales subapically and mediobasally; body, elytra and legs pale brown (Fig. 2); body length 4.5–5.0 mm.....*curtulus*

– Body slightly narrower, less rounded apically; elytra subapically with one wide complete transverse band of white scales, limited anteriorly and posteriorly by narrow band of black scales; body and elytra dull brown, femora medially black or dark brown (Fig. 3); body length 3.0–3.5 mm ..... *stierlini*



Figs 1–6. Anthonomini, habitus, dorsal view: (1) *Anthonomus chevrolati connexus*; (2) *Anthonomus curtulus*; (3) *Anthonomus stierlini*; (4, 5) *Anthonomus multifasciatus*, male (5) and female (5); (6) *Bradybatus fallax*.

Species accounts

Taxa new for Israel are marked with an asterisk (*).

Genus *Anthonomus* Germar, 1817

Anthonomus comprises 558 known species worldwide, 69 of them in the Palaearctic Region (Dieckmann 1968; Caldara 2013). The majority of the Palaearctic species are associated with Rosaceae; two species are associated with Ulmaceae (*Ulmus*, *Celtis*) and two with Pinaceae (*Picea*, *Pinus*) (Dieckmann 1968). Israel hosts six species in two subgenera, *Anthonomnus* s. str. and *Persexarthrus*.

Subgenus *Anthonomus* s. str.

There are 52 known species in the Palaearctic Region, majority of them occurring in the temperate zone (Dieckmann 1968; Caldara 2013); two species develop on Ulmaceae, others on Rosaceae (Dieckmann 1968). Israel hosts four species, distributed in the Mediterranean area, mostly in the northern part of the country and at higher altitudes; all recorded here for the first time.

**Anthonomus (Anthonomus) chevrolati connexus* Dieckmann, 1968

(Figs 1, 18, 23, 39)

Material examined: Israel: Har Hermon: Har Hermon, 1600 m, 15.vi.2011, E. Morgulis (1 ex.); Har Hermon, Biq'at Man, 1600 m, 10.x.2002, E. Orbach (2, ORB); Har Hermon, 1500–1600 m, 33°18'N 35°46'E, 6.vi.2002, L. Friedman (1 ex.); Har Hermon, Nahal 'Ar'ar, 1500 m, under Lower Ski Station, 7.vi.2002, E. Orbach (1 ex., ORB); Har Hermon, 1400 m, 24.v.2012, L. Friedman (1 ex.); Har Hermon, 1 km W Majdal Shams, 30.v.2003, E. Orbach (1 ex., ORB). Golan Heights: Mezudat Nimrod, 33°15'N 35°43'E, 760 m, 17.v.2011, A. Freidberg (1 ex.); HaGoshrim (?), 2.iv.1988, J. Halperin, on *Crataegus aronia* (1 ex.); Odem Forest, 23.v.1998, E. Orbach (1 ex., ORB); Allone haBashan, 20.iv.2001, E. Orbach (1 ex., ORB). Upper Galilee: Har Meron, 18.v.1981, J. Kugler (1 ex.); Har Meron, 800 m, 22.v.1998, A. Freidberg (1 ex.); Har Meron, 'En Zeved, 24.iv.2002, T. Stern (1 ex.); Har Meron, 32°59'N 35°24'E, 30.iv.2007, T. Levanony, Malaise trap (1 ex.); Har Kefir, 900 m, 17.v.1996, E. Orbach (1 ex., ORB); Har Kefir, 850 m, 29.iv.1998, E. Orbach (3 ex., ORB). Lower Galilee: Ya'ar haSolelim Nature Reserve, 4.iv.2003, E. Orbach (1 ex., ORB). Carmel Ridge: Carmel, 5.iv.1991, J. Halperin, on *Crataegus aronia* (1 ex.); Nahal Oren, 29.03.1996, Pavlíček & Chikatunov (1 ex., COL).

Host plants: *Crataegus aronia* (L.) DC. (Rosaceae) (first record).

The nominative subspecies *A. chevrolati chevrolati* is associated with *Crataegus* spp. and *Sorbus* spp. (Dieckmann 1968).

Phenology: Collected in April–May, at high altitudes (Har Hermon) in June.

Distribution: Lebanon (Dieckmann 1968; Caldara 2013). First record from Israel.

**Anthonomus (Anthonomus) curtulus* Desbrochers des Loges, 1892

(Figs 2, 24, 33, 39)

Material examined: Israel: Upper Galilee: Meron Reserve, 'En haZaqen, 32°58'N 35°25'E, 24.iv.2002, L. Friedman (2 ex.).

Host plant: Unknown.

Phenology: The two specimens were collected together at the end of April.

Distribution: Turkey, Lebanon (Dieckmann 1968; Caldara 2013). First record of this species from Israel.

**Anthonomus (Anthonomus) multifasciatus* Pic, 1926

(Figs 4, 5, 25, 34, 39)

Material examined: Israel: Har Hermon: Har Hermon, 1800 m, 25.v.1998, V. Chikatunov (1 ex.), 25.v.1999, L. Friedman (1 ex.); Har Hermon, 1700 m, 17.v.2009, L. Friedman (1 ex.); Har Hermon, Busheri turn, 1770 m, 1.vi.2016, L. Friedman, on *Amygdalus korschinskyi* (2 ex.).

Host plants: *Amygdalus dulcis* (Mill.) D.A. Webb, *Prunus persica* L., *P. armeniaca* L. (Rosaceae). The species is considered a serious pest of almonds and plums (under its junior synonyms *A. amygdali* Hustache, 1930 and *A. ornatus* Reiche, 1860) (Dieckmann 1968; Lodos 1981). In Israel, *Amygdalus korschinskyi* Hand.-Mazz. (new record).

Phenology: Mid May–early June.

Distribution: France, Italy, Malta, Slovenia, Bosnia and Herzegovina, Croatia, Bulgaria, Greece, Turkey (western coast), Algeria (Dieckmann 1968; Caldara 2013). First record from Israel and from the Levant; in Israel found only in a single spot, known as 'Busheri turn', on Har Hermon (1700–1800 m).

**Anthonomus (Anthonomus) stierlini* Desbrochers des Loges, 1869

(Figs 3, 26, 35, 39)

Material examined: Israel: Golan Heights: Ramat haGolan, 209 m, 12.iii.2013, D. Furth (1 ex.); Har Avital, 28.iv.2015, D. Furth (5 ex.). Upper Galilee: Nahal Ziv'on, Sasa-Jish road, 700 m, 28.iv.1996, E. Orbach (1 ex., ORB); Har Meron Reserve, Bet haYa'aran, 1100 m, 32°59'N 35°24'E, 25.iv.2002, L. Friedman (1 ex.). Carmel Ridge: Zomet Elyaqim, 1.2 km NW, 32°39'N 35°04'E, 1.iv.2012, L. Friedman, on *Amygdalus* (1 ex.). Samaria: Shilo, Nahal Shilo, 10.iv.2012, L. Friedman, on *Amygdalus* (2 ex.).

Host plants: *Amygdalus dulcis* (Mill.) D.A. Webb, *Amygdalus korschinskyi* Hand.-Mazz. (Rosaceae) (new record).

Phenology: Collected in March–April.

Distribution: Italy, Croatia, Bosnia and Herzegovina, Macedonia, Greece, Turkey, Lebanon (Dieckmann 1968; Caldara 2013). First record for Israel; distributed in the Mediterranean area, at altitudes between 200 and 1100 m.

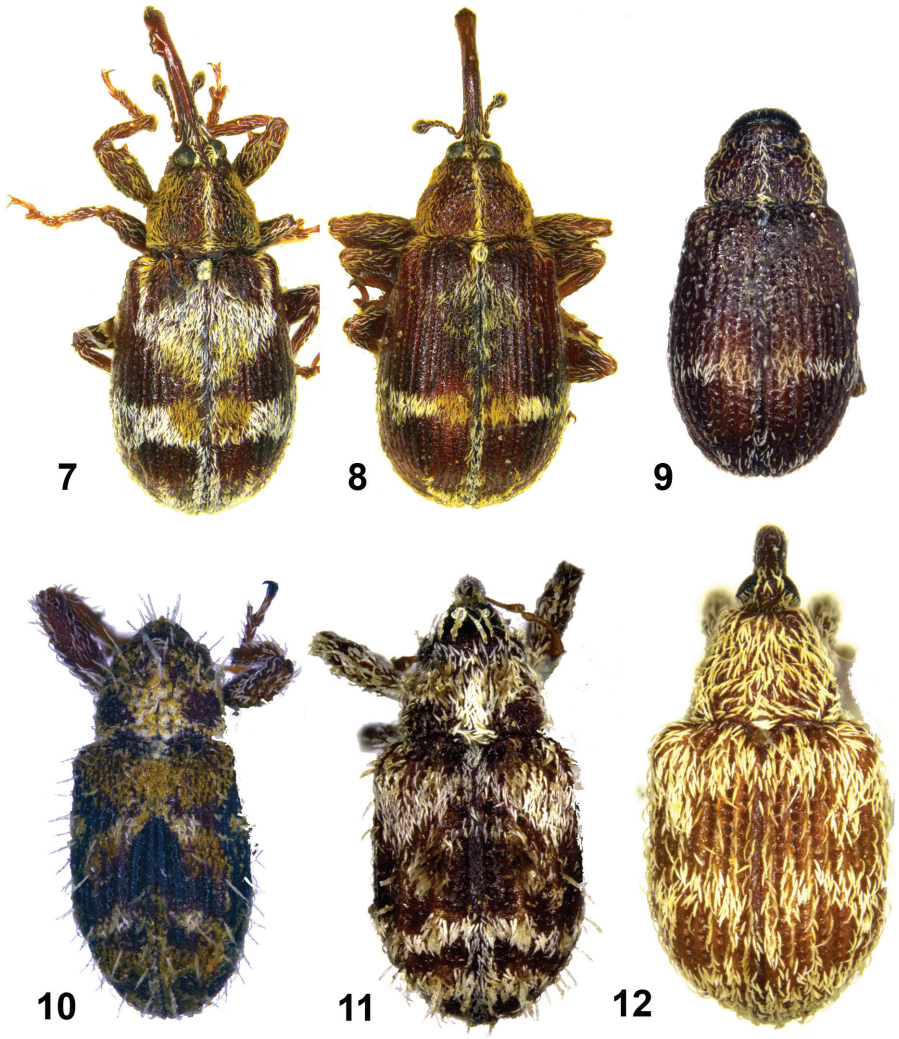
Subgenus *Persexarthrus* Voss, 1944

Comprises five known species, distributed in the Eastern Mediterranean, Caucasus and Iran (Dieckmann 1968; Caldara 2013); all species are associated with *Amygdalus* and *Prunus* (Rosaceae) (Dieckmann 1968). In Israel two species, in the Mediterranean zone, associated with *Amygdalus*.

Anthonomus (Persexarthrus) baudueri Desbrochers des Loges, 1875

(Figs 7, 8, 13, 19, 27, 36, 40)

Material examined: Israel: Har Hermon: Newe Ativ, 26.iv.1974, D. Furth (1 ex.); Newe Ativ, 950 m, 33°15'N 35°44'E, 5.iv.2014, E. Colonnelli (3 ex., COL); Majdal Shams, 1160 m, 33°15'N 35°45'E, 5.iv.2014, E. Colonnelli (1 ex., COL). Upper Galilee: Nahal 'Ammud, 7.iv.1978, D. Furth (1 ex.), 5.iv.1991, J. Halperin on *Anagyris* (1 ex.). Lower Galilee: Nahal Adami, 0–150 m, 7.iv.2015, L.



Figs 7–12. Anthonomini, habitus, dorsal view: (7, 8) *Anthonomus baudueri*, male (7) and female (8); (9) *Anthonomus variabilis*; (10) *Assuanensius erectesetosus*; (11) *Assuanensius peyerimhoffi*; (12) *Sphincticraerus bruleriei*.

Friedman, on *Amygdalus* (3 ex.); Kokhav haYarden, moat of castle, 26.iii.2001, L. Friedman (3 ex.); Kokhav haYarden, 26.iii.2001, V. Chikatunov (2 ex.), 27.iii.2001, L. Friedman (7 ex.). Samaria: Qarne Shomeron, 18.iii.2016, L. Friedman, on *Amygdalus* (4 ex.); Nahal Qana, Ein-el-Juze, 11.iii.2016, L. Friedman, on *Amygdalus* (8 ex.); El Funduq, 11.iii.2016, L. Friedman, on *Amygdalus* (1 ex.); Qedumim, 2–3 km N, Nahal Te'enim, 300–400 m, 1.iv.2016, L. Friedman, on *Amygdalus* (1 ex.); Qedumim, 2.iv.1999 (8 ex.), v.1999 (1 ex.), iv.2000 (1 ex.), 27.xii.2000 (1 ex.), 16.iii.2001 (3 ex.), 27.iii.2005 (4 ex.), 23.iii.2012 (2 ex.), 23.i.2015, on *Amygdalus* (1 ex.), 11.xii.2015, on blooming *Amygdalus* (3 ex.), 1.iv.2016, on *Amygdalus*, all L. Friedman; Qedumim, Park Znirim, 370 m, 5.iv.2015 (5 ex.), 6.iv.2015 (5 ex.), 22.iii.2016 (11 ex.), all L. Friedman, on *Amygdalus*; Qedumim, 1 km SW, Mizpe 'Ammi, 390 m, 13.iii.2015 (8 ex.), 3.iv.2015 (5 ex.), all L. Friedman, on *Amygdalus*; Itamar, Tel Aroma, 570–840 m, 10.xii.2015, L. Friedman (1 ex.); Elon More, 'En Kefir, 530 m, 17.iii.2015, L. Friedman, on *Amygdalus* (2 ex.); Shilo (ancient), 695 m, 18.xi.2015, L. Friedman, on *Amygdalus* (1 ex.); Majdal Bani Fadil, East, Rt. 505, 515 m, 15.iii.2016, L. Friedman, on *Amygdalus* (1 ex.). Central Coastal Plain: Tel haShomer, 10.iv.1981, E. Shney-Dor (1 ex.). Foothills of Judea: Nahshon, 19.iv.1997, R. Hoffman (1 ex.); Bet Guvrin, 5.iv.2000, H. Ackerman (1 ex.). Judean Hills: Eshta'ol, 300 m, 9.iv.1995, E. Colonnelli (2 ex., COL); Bet Shemesh, 10.iii.2004, L. Friedman (1 ex.); Mahseya, South, Deir Aban ruins, 265–300 m, 9.iii.2016, L. Friedman (4 ex.); Bet Zayit, 800 m, 9.iv.1995, E. Colonnelli (1 ex., COL); Efrata, 31°39'30"N 35°09'03"E, 12–27.i.2016, M. Mostovski, Malaise trap (9 ex.); Tel Zif, E, lentil field, 800 m, 15.iv.2015, L. Friedman, on *Amygdalus* (2 ex.).

Host plants: *Amygdalus dulcis* (Mill.) D.A. Webb (Halperin & Fremuth 2003; Košťál 2014), *Prunus persica* (L.) Batsch, 1801 (Marshall 1925). Most specimens in the SMNHTAU were collected on *Amygdalus dulcis*, but some (those from Har Hermon and Lower Galilee) probably on *Amygdalus korschinskyi* Hand.-Mazz. (Rosaceae).

Phenology: Adults are active in March–April and October–January. I did not find adults on almonds in full bloom in January–February. In spring most of the adults were collected on the trees at the end of the blooming season or after it, when the tree was covered with leaves and young fruit. Most of the adults collected in autumn–winter were found on trees with some of flowers blooming.

Distribution: Cyprus, Syria, Lebanon, Israel, Jordan (Dieckmann 1968; Caldara 2013; Košťál 2014).

Comments: *A. baudueri* was first recorded for Israel by Bodenheimer (1937). No specimens collected by Bodenheimer are deposited in the SMNHTAU. Bodenheimer sent most of the weevils he collected for determination to G.A.K. Marshall at the then British Museum of Natural History, London, UK (BMNH). The specimen from the BMNH, recorded by Dieckmann (1968) as "Jerusalem, November 1929, leg. Bodenheimer", is almost certainly the specimen identified by Marshall.

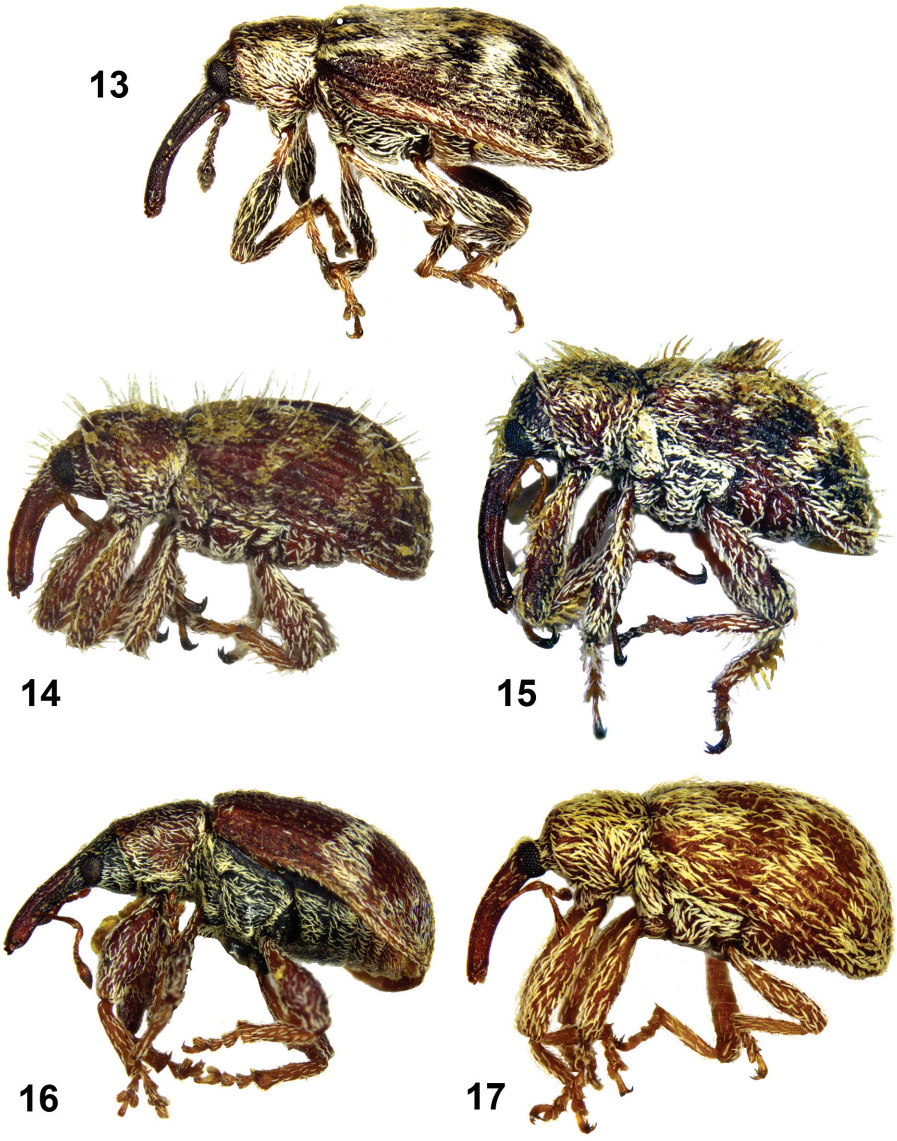
Anthonomus (Persexarthrus) variabilis (Hoffmann, 1963*a*)

(Figs 9, 28, 37, 40)

Material examined: Israel: Samaria: Qedumim, Park Znirim, 370 m, 6.iv.2015, L. Friedman, on *Amygdalus* (1 ex.); Pedu'el, Deir Qala', 27.iii.2013, L. Friedman (1 ex.).

Host plants: *Amygdalus eburnea* Spach, *A. erioclada* Bornmueller, *A. lycioides* Spach (Rosaceae) (Košťál 2014); these species do not occur in Israel. I collected both specimens on *Amygdalus dulcis* (Mill.) D.A. Webb (a new record).

Halperin and Fremuth (2003) recorded *A. variabilis* from the Chinese plum *Prunus salicina* Lindl., from the Judean Hills. The exact locality was not given, and the specimen was not found in Halperin's collection. Chinese plum does not occur



Figs 13–17. Anthonomini, habitus, lateral view: (13) *Anthonomus baudueri*; (14) *Assuanensius erectesetosus*; (15) *Assuanensius peyerimhoffi*; (16) *Bradybatus fallax*; (17) *Sphincticraerus bruleriei*.

naturally in Israel, therefore this East Mediterranean weevil's association with a tree native to the Far East is dubious.

Phenology: Adults were collected in March–April; in Iran adults were collected in April–May (Košťál 2014).

Distribution: Turkey, Israel, Iran (Dieckmann 1968; Lodos 1981; Halperin & Fremuth 2003; Caldara 2013; Košťál 2014). The distribution in Israel remains unclear, as only two specimens have been collected, despite intensive efforts over the last three years.

Genus *Assuanensius* Pic, 1900

This Afrotropical genus with four species penetrating the Palaearctic Region in North Africa, southern Levant and Saudi Arabia is associated with *Acacia* (Mimosaceae) (Dieckmann 1968; Alonso-Zarazaga & Lyal 1999; Caldara 2013; Abdel-Dayem *et al.* 2015). Israel hosts two species, distributed along the Arava Valley, southern part of Dead Sea coast and in the Southern Negev.

The records of *Assuanensius discoidalis* (Tournier, 1873) by Halperin and Fremuth (2003) and Caldara (2013) are erroneous, based on the specimens collected by Halperin and erroneously identified by Fremuth. I studied all specimens, bearing Fremuth's identification labels; all appear to be either *A. erectesetosus* or *A. peyerimhoffi*. Therefore, I remove *A. discoidalis* from the list of the Israeli weevil fauna. However, it is not impossible that *A. discoidalis* will be found in Israel in the future, since this species, known previously from Algeria, Libya, Chad and Ethiopia (Hoffmann 1963*b*; Caldara 2013), has been recently recorded from Saudi Arabia (Abdel-Dayem *et al.* 2015).

Assuanensius erectesetosus (Peyerimhoff, 1948)

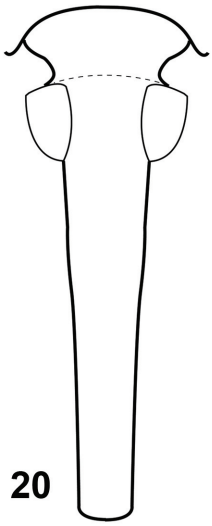
(Figs 10, 14, 21, 41)

Material examined: Israel: Dead Sea Area: Mezada, Rt. 90, 12.xi.2013, L. Friedman, on *Acacia raddiana* (13 ex.); Mezad Zohar, 2.iv.2001, L. Friedman, on *Acacia* (7 ex.), 9.iv.2002, L. Friedman, on *Acacia raddiana* (1 ex.). Central Negev: Mezad Sayif, Nahal Zin, Rt. 227, 30°51.7'N 35°09.8'E, 60 m, 8.iii.2010, L. Friedman, on *Acacia* (10 ex.). Southern Negev: Nahal Paran, Rt. 40, 13.vi.2013, L. Friedman, on *Acacia raddiana* (2 ex.); Elat, 13.iii.1990, J. Halperin, on *Acacia raddiana* (1 ex.). Arava Valley: Nahal Hazeva, Rt. 227, W 'Iddan, 13.ix.2012, L. Friedman, on *Acacia* (9 ex.); Nahal Neqarot, 28.ix.1999, A. Freidberg, on *Acacia raddiana* (2 ex.); Sappir, pond, 28.ix.1999, A. Freidberg (1 ex.); Zofar, 5 km S, 10.vi.1997, L. Friedman (1 ex.).

Host plants: Mimosaceae: *Acacia seyal* (Delile) P.J.H. Hurter (Hoffmann 1963*b*), *A. ehrenbergiana* Hayne, *A. gerrardii* Benth. (Abdel-Dayem *et al.* 2015); in Israel, *Acacia raddiana* Savi (Halperin & Fremuth 2003).

Phenology: Adults collected in March–November, some on the blooming *Acacia*, at the end of the bloom.

Distribution: Morocco, Libya, Egypt, Israel, Saudi Arabia (Dieckmann 1968; Halperin & Fremuth 2003; Caldara 2013; Abdel-Dayem *et al.* 2015).



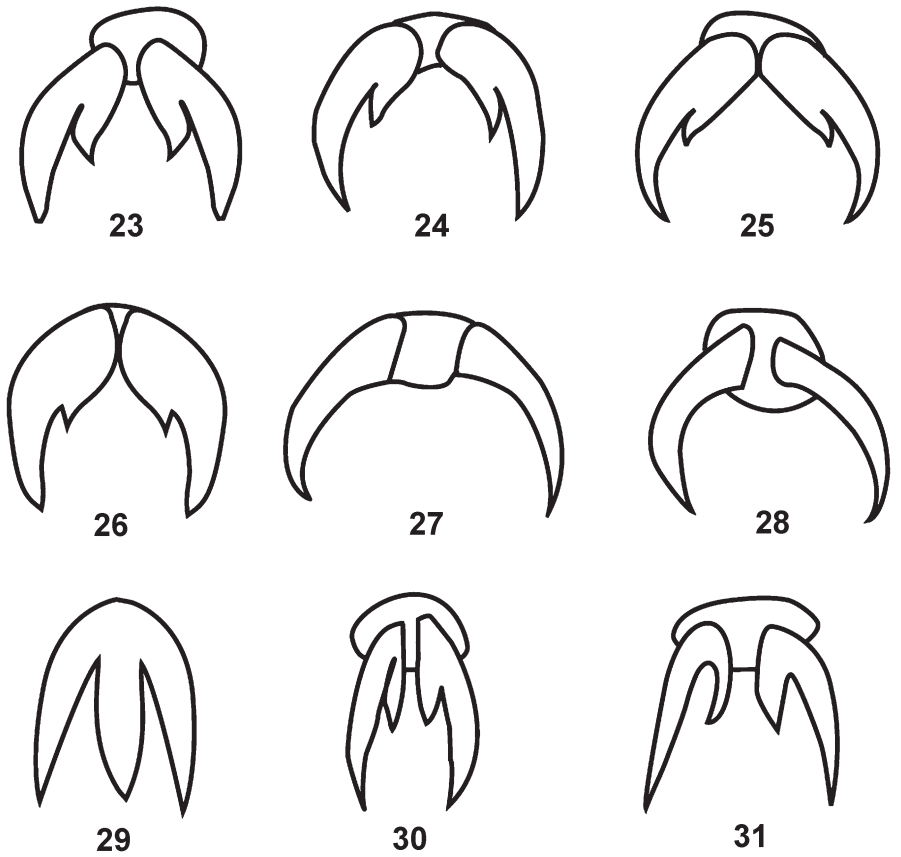
Figs 18–22. Anthonomini, head, frontal view: (18) *Anthonomus chevrolati connexus*; (19) *Anthonomus baudueri*; (20) *Sphincticraerus bruleriei*; (21) *Assuanensius erectesetosus*; (22) *Assuanensius peyerimhoffi*.

**Assuanensius peyerimhoffi* (Hoffmann, 1963*b*)

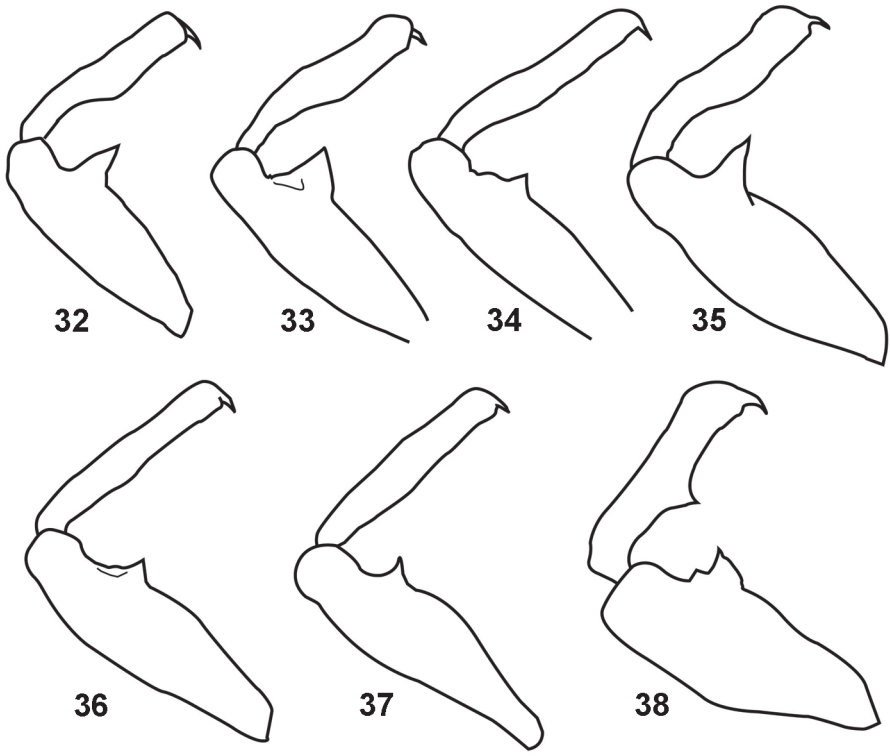
(Figs 11, 15, 22, 29, 41)

Material examined: Israel: Dead Sea Area: Mezada, Rt. 90, 12.xi.2013, L. Friedman, on *Acacia raddiana* (12 ex.). Southern Negev: Nahal Zihor, 8.xi.1991, J. Halperin, on *Acacia negevensis* (12 ex.). Arava Valley: Nahal Hazeva, Rt. 227, W 'Iddan, 13.ix.2012, L. Friedman, on *Acacia* (16 ex.).

Host plants: Mimosaceae: *Acacia seyal* (Delile) P.J.H. Hurter (Hoffmann 1963*b*), *A. ehrenbergiana* Hayne, *A. gerrardii* Benth. (Abdel-Dayem *et al.* 2015); in Israel, *Acacia raddiana* Savi (Halperin & Fremuth 2003). All specimens that I collected were from *A. raddiana*. However, 12 specimens collected by Halperin are labelled as found on *Acacia negevensis* Zohary (a junior synonym of *Acacia pachyceras* O. Schwartz), which does not correspond to his abovementioned publication.



Figs 23–31. Anthonomini, claws: (23) *Anthonomus chevrolati connexus*; (24) *Anthonomus curtulus*; (25) *Anthonomus multifasciatus*; (26) *Anthonomus stierlini*; (27) *Anthonomus bauduer*i; (28) *Anthonomus variabilis*; (29) *Assuanensius peyerimhoffi*; (30) *Bradybatus fallax*; (31) *Sphincticraerus bruleriei*.



Figs 32–38. Anthonomini, profemora and protibia: (32) *Anthonomus chevrolati connexus*; (33) *Anthonomus curtulus*; (34) *Anthonomus multifasciatus*; (35) *Anthonomus stierlini*; (36) *Anthonomus baudueri*; (37) *Anthonomus variabilis*; (38) *Bradybatus fallax*.

Phenology: Adults collected in September–November, some on the blooming *Acacia*, at the end of the bloom.

Distribution: Algeria, Chad (Peyerimhoff 1948; Caldara 2013; Abdel-Dayem *et al.* 2015). A first record from Israel.

Genus **Bradybatus* Germar, 1824

The genus comprises 18 known species, distributed in Western Europe, European part of Russia, Ukraine, Caucasus, Central Asia and one species native to North Africa; associated with *Acer* (Aceraceae) (Dieckmann 1968; Alonso-Zarazaga & Lyal 1999; Caldara 2013). Israel hosts species of the subgenus *Nothops*.

Subgenus *Nothops* Marseul, 1868

There are 11 known species, mainly at the warmer edges of the West Palaearctic (North Africa, Caucasus, Central Asia and Mediterranean). Two species are

recorded from the Eastern Mediterranean: *B*. (*N*.) *abeillei* Desbrochers des Loges, 1888 from Cyprus and *B*. (*N*.) *delagrangei* Desbrochers des Loges, 1895 from Turkey. Surprisingly, the only species found in Israel is the primarily Central European *B*. (*N*.) *fallax* (although known also from Greece), which is recorded here for the first time.

**Bradybatus (Nothops) fallax* Gerstaecker, 1860

(Figs 6, 16, 30, 38, 41)

Material examined: Israel: Har Hermon: Har Hermon, 1600 m, 18.v.2009, L. Friedman, on *Acer monspessulanum microphyllum* (1 ex.).

Host plants: *Acer pseudoplatanus* L. and *A. platanoides* L. (Dieckmann 1968). In Israel, on *Acer monspessulanum microphyllum* (Boiss.) Bornmueller (Sapindaceae) (a new record).

Phenology: The single specimen was collected in mid May, probably at the end of the adult activity.

Distribution: Central, Eastern and Southern Europe, Russia, Ukraine (Dieckmann 1968; Caldara 2013). A first record from Israel and from Asia.

Genus *Sphincticraerus* Marseul, 1871

The genus comprises 11 known species, mainly in the Palaeotropical area, with three species in the Palaearctic Region; associated with *Ziziphus* (Rhamnaceae) (Dieckmann 1968; Clark 2010; Caldara 2013). Israel hosts one species.

Sphincticraerus bruleriei Desbrochers des Loges, 1873

(Figs 12, 17, 20, 31, 41)

Material examined: Israel: Upper Galilee: Hermon Field School, 22.vii.2015, L. Friedman, on blooming *Ziziphus spina-christi* (1 ex.). Jordan Valley: Park haYarden, 32°55'N 35°38'E, -200 m, 19.vii.2009, L. Friedman, on *Ziziphus spina-christi* (2 ex.); Tel Saharon, -242 m, 11.v.2016, L. Friedman, on *Ziziphus spina-christi* (2 ex.). Southern Coastal Plain: Holot Nizzanim Nature Reserve, 1 km NW Nizzan, 31°45'N 34°38'E, 30 m, 9.vi.2016, L. Friedman, on *Ziziphus lotus* inflorescence (6 ex.).

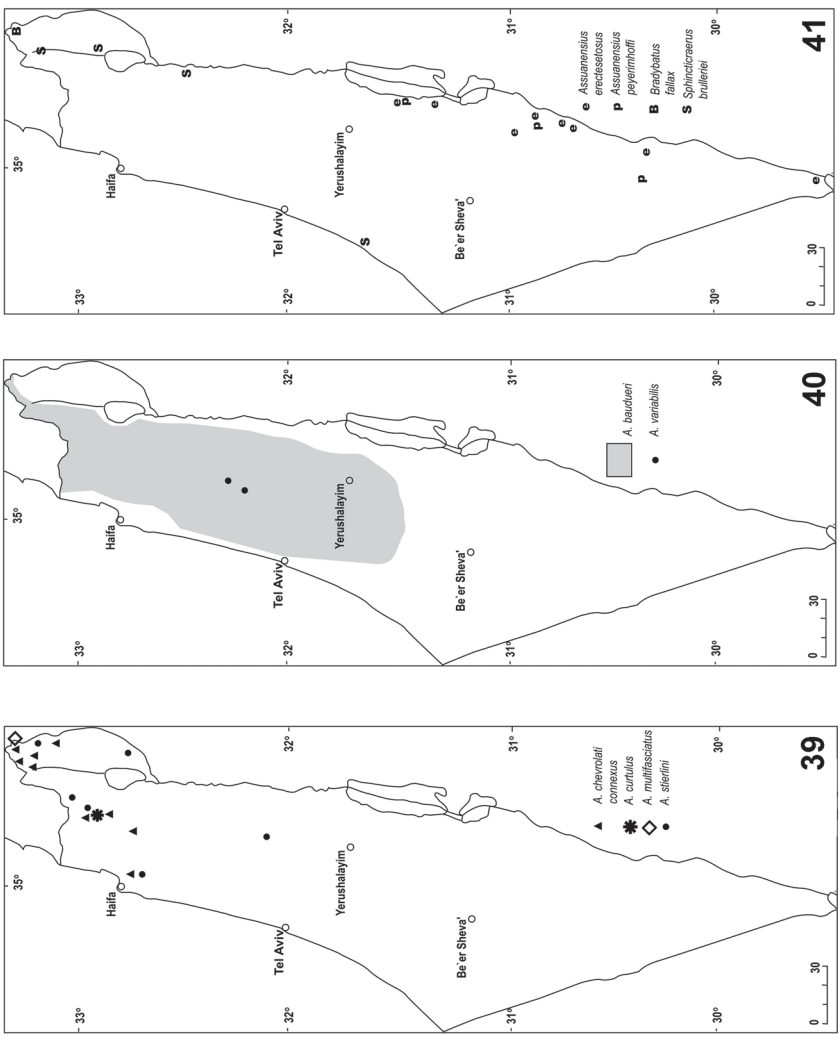
Host plants: *Ziziphus spina-christi* (L.) Desf. and *Ziziphus lotus* (L.) Lam. (Rhamnaceae) (new records).

Phenology: Adults collected in May–August.

Distribution: Egypt, Israel (Bodenheimer 1937; Dieckmann 1968; Caldara 2013). In Israel in the Rift Valley and in the Southern Coastal Plain.

DISCUSSION

Ten species of Anthonomini are recorded here from Israel, six of them for the first time. It is noticeable that five of the six newly recorded species are at the southernmost edge of their distribution. The season of the adult activity of these



Figs 39–41. General distribution of Anthonomini in Israel: (39) *Anthonomus* (*Anthonomus*) spp.; (40) *Anthonomus* (*Persexarthrus*) spp.; (41) *Assuanensius*, *Bradybatus* and *Sphincticraerus* species.

species is in early spring, before the main collecting season, therefore these colorful beetles were not revealed previously.

The Israeli fauna of the Anthonomini is composed of three zoogeographical elements: Euro-Mediterranean (*Anthonomus multifasciatus*, *A. stierlini*, *Bradybatus fallax*), East-Mediterranean (*A. chevrolati connexus*, *A. curtulus*, *A.* (*Persexarthrus*) *baudueri*, *A.* (*P.*) *variabilis*) and Afrotropical (*Assuanensius erectesetosus*, *A. peyerimhoffi*, *Sphincticraerus bruleriei*). All Euro-Mediterranean species and local endemics in the subgenus *Anthonomus* s. str. occur only at high elevations and their adult activity is restricted to early spring. *Persexarthrus* is an East-Mediterranean subgenus of *Anthonomus*, and its representatives are distributed throughout the Mediterranean region of Israel, even in semi-arid areas such as the southern and eastern slopes of the Judean Hills and eastern slopes of the Samarian Hills, bordering the desert. *A.* (*P.*) *baudueri* is the commonest and most widespread anthonomine in Israel, with adult activity lasting from early spring to April–May, depending on altitude. The Afrotropical genus *Assuanensius* (2 spp.) and the Palaeotropical *Sphincticraerus* (1 sp.) are both represented by species distributed in the southern part of the Middle East (North Africa, Levant, Arabian Peninsula), associated with tropical plants (*Acacia* and *Ziziphus*, respectively), and active mainly in mid summer. The phenology of all blossom weevils reveals a strong correlation with the blooming period of their host plants.

Many species of *Anthonomus* are known as notorious agricultural pests (Dieckmann 1968), also in the Eastern Mediterranean (Angelov 1966; Talhouk 1969; Lodos 1981). Two species are mentioned in particular as serious pests of almonds and plums in the Near East: *Anthonomus multifasciatus* in Turkey (Dieckmann 1968; Lodos 1981) and *Anthonomus baudueri* in Turkey (Lodos 1981) and Lebanon (Talhouk 1969). *A. multifasciatus* in Israel is restricted to high altitudes on Har Hermon, and *A. variabilis* is generally a rare species. Consequently, neither is seen as a potential threat to agriculture. *A. baudueri* is widely distributed throughout the country, including the southernmost edge of the Mediterranean zone, and is common in both nature and orchards. Surprisingly, this species is not considered a pest in Israel. Not even a single specimen of *A. baudueri* is deposited in the collection of the Plant Protection and Inspection Services of the Ministry of Agriculture of Israel in Bet Dagan. *A. baudueri* is completely unknown to almond growers in Israel and the damage that it may be causing is probably insignificant (Liat Gidron, pers. comm.).

ACKNOWLEDGMENTS

I thank E. Colonnelli (Rome, Italy), M. Košťál (Brno, Czech Republic), J. Hájek (Natural History Museum, Prague, Czech Republic), E. Orbach (Qiryat Tiv'on, Israel) and Liat Gidron (Plant Protection and Inspection Services, Ministry of Agriculture of Israel, Bet Dagan, Israel) for their kind help. I thank Naomi Paz (Tel Aviv University, Israel) for editing an earlier draft of the manuscript. I thank the Israel Nature and Parks Authority for providing collection permits for collecting weevils in nature reserves and national parks, and kind assistance in finding plants and localities. I thank Netta Dorchin (Tel Aviv University, Israel) for providing me with an opportunity to carry out this research and for a

lot of assistance in different ways. I thank my good friend Lev Karnibad for financial support of this research. I acknowledge the Israeli Ministry of Science, Culture and Sport for supporting the National Natural History Collections at Tel Aviv University, as a biodiversity, environment, and agriculture research knowledge center.

CHECKLIST OF ANTHONOMINI IN ISRAEL

Taxa new for Israel are marked with an asterisk (*).

**Anthonomus* (*Anthonomus*) *chevrolati connexus* Dieckman, 1968
**Anthonomus* (*Anthonomus*) *curtulus* Desbrochers des Loges, 1892
**Anthonomus* (*Anthonomus*) *multifasciatus* Pic, 1926
**Anthonomus* (*Anthonomus*) *stierlini* Desbrochers des Loges, 1869
Anthonomus (*Persexarthrus*) *baudueri* Desbrochers des Loges, 1875
Anthonomus (*Persexarthrus*) *variabilis* (Hoffmann, 1963)
Assuanensius erectesetosus (Peyerimhoff, 1948)
**Assuanensius peyerimhoffi* (Hoffmann, 1963)
**Bradybatus* (*Nothops*) *fallax* Gerstaecker, 1860
Sphincticraerus bruleriei Desbrochers des Loges, 1873

REFERENCES

Abdel-Dayem, M.S., Colonnelli, E., Allah Fadl, H.H. & Al Dhafer, H.M. 2015. New records of Curculionoidea (Coleoptera) in the Kingdom of Saudi Arabia. *The Coleopterist Bulletin* **69** (4): 639–644.

Alonso-Zarazaga, M.A. & Lyal, C.H.C. 1999. *A world catalogue of families and genera of Curculionoidea (Insecta: Coleoptera) (Excepting Scolytidae and Platypodidae)*. Entomopraxis S.C.P., Barcelona. 315 pp.

Angelov, P. 1966. Izsledvaniya v'rkhu faunata na khobotnizhite (Curculionidae, Coleoptera) ot Rodopite. *Izvestiya na Zoologicheskiya Institut s Muzej* **21**: 15–63.

Bodenheimer, F.S. 1937. Prodromus Faunae Palestinae. *Memoires de l'institute d'Egypte* **33**: 1–286.

Burke, H.R. 1976. Bionomics of the anthonomine weevils. *Annual Review of Entomology* **21**: 283–303.

Caldara, R. 2013. Curculionidae: Curculioninae. *In*: Löbl, I. & Smetana, A. (eds), *Catalogue of Palaearctic Coleoptera*. Vol. 8. Brill, Leiden, pp. 51–56, 117–172.

Caldara, R., Franz, N.M. & Oberprieler, R.G. 2014. 3.7.10 Curculioninae Latreille, 1802. *In*: Leschen, R.A.B. & Beutel, R.G. (eds), *Handbook of Zoology. Coleoptera, Beetles – Morphology and Systematics*. Vol. 3. De Gruyter, Berlin, pp. 589–628.

Clark, W.E. 2010. *List of Species of Curculionidae (Coleoptera) assigned to the tribe Anthonomini.* (http://www.auburn.edu/~clarkwe/anthspp.htm; accessed 13/07/2016)

Clark, W.E. & Burke, H.R. 1996. The species of *Anthonomus* Germar (Coleoptera: Curculionidae) associated with plants in the family Solanaceae. *Southwestern Entomologist*, *Supplement* **19**: 1–114.

Cross, W.H., Lukefahr, M.J., Fryxell, P.A. & Burke, H.R. 1975. Host plants of the boll weevil. *Environmental Entomology* **4**: 19–26.

Desbrochers des Loges, J. 1869. [untitled]. *Petites Nouvelles Entomologiques* **1** (8): [2–3 =29–30].

———1873. Monographie des Balaninidae et Anthonomidae. 1er supplément. *Annales de la Société Entomologique de France* (5) **2** [1872]: 413–419.

———1875. [untitled]. *Annales de la Société Entomologique de France* (5) **5**: clxxxvi–clxxxvii.

———1892. Révision de balaninides et de anthonomides de l'Europe et des confins de la Méditerranée, en Afrique et en Asie (Suite). *Le Frelon* **2**: 101–144.

Dieckmann, L. 1968. Revision der westpaläarktischen Anthonomini (Coleoptera: Curculionidae). *Beiträge zur Entomologie* **17**: 377–564.

EPPO, 2013. *Anthonomus eugenii*. Data Sheet on Quarantine Pests, No. 202, 3 pp. (https://gd.eppo.int/taxon/ANTHEU/documents; accessed 13/07/2016)

Feinbrun-Dothan, N. & Danin, A. 1991. *Analytical Flora of Eretz-Israel*. CANA Publishing House Ltd., Jerusalem. 1040 pp.

Gates, D.B. & Burke, H. R. 1972. Review of gall-inhabiting weevils of the genus *Anthonomus*, with description and biology of a new species (Coleoptera: Curculionidae). *Annals of the Entomological Society of America* **65**: 1215–1224.

Germar, E.F. 1817. Miscellen und Correspondenz-Nachrichten. *Magazin der Entomologie* **2**: 339–341.

———1824. *Insectorum species novae aut minus cognitae, descriptionibus illustratae*. Volumen primum. Coleoptera. Cum tab. aen. II. Impensis J. C. Hendelii et filii, Halae. xxiv+624 pp., 2 pls.

Gerstaecker, C.E.A. 1860. *Bradybatus* Germ. *Entomologische Zeitung (Stettin)* **21**: 396–398.

Halperin, J. & Fremuth, J. 2003. Contribution to the knowledge of Curculionoidea (Coleoptera) and their host plants in Israel. *Zoology in the Middle East* **29**: 93–100.

Hoffmann, A. 1963*a*. Contribution à la connaissance de la faune du Moyen-Orient (Mission G. Remaudière 1961) Coléoptères curculionides. *Revue de Pathologie Végétale et d'Entomologie agricole de France* **42**: 77–98.

———1963*b*. Descriptions et observations concernant plusieurs espèces de Curculionides des régions sahariennes. *Bulletin de l'IFAN (A)* **25** (1): 211–218.

Hustache, A. 1930. Observations sur quelques curculionides (Col.). *Bulletin de la Société Entomologique de France* **35**: 191–195.

Kojima, H. & Idris, A.B. 2004. The Anthonomini from Malaysia, with notes on the Oriental taxa (Coleoptera: Curculionidae). *Serangga* **9**: 103–129.

Košťál, M. 2014. Revision of the subgenus *Persexarthrus* Voss of the genus *Anthonomus* Germar (Coleoptera: Curculionidae: Anthonomini). *Zootaxa* **3785** (4): 561–574. (http://www.mapress.com/zootaxa/2014/f/z03785p574f.pdf)

Lodos, N. 1981. Reverse effect of insects in fruit setting of almond trees (*Prunus*, *Amygdalus*) in Turkey. GREMPA, colloque 1980. Paris. *CIHEAM: Options Méditerranéennes: Série Etudes* **1**: 109–111.

Marseul, S.A. de. 1868. Matériaux pour l'étude des curculionides; par A. Gerstaeker (Stet. 1855.167). *L'Abeille, Mémoires d'Entomologie* **5** [1868–1869]: 261–270.

———1871. Description de coléoptères nouveaux. *L'Abeille, Memoire d'Entomologie* **6**: 369–452.

Marshall, G.A.K. 1925. New Curculionidae attacking cultivated plants (Col.). *Bulletin of Entomological Research* **16** (1): 67–75.

Olckers, T. 2009. 20. *Solanum mauritianum* Scopoli (Solanaceae). *In*: Muniappan, R., Reddy, G.V.P. & Raman, A. (eds), *Biological Control of Tropical Weeds using Arthropods*. Cambridge University Press, Cambridge, UK, pp. 408–422.

Peyerimhoff, P. de 1948. [new taxa]. *In*: Bernard, F. & Peyerimhoff, P. de. *Mission scientifique du Fezzân (1944–1945). Tome V. Zoologie*. Institute de Recherches sahariennes de l'Université d'Alger, Paris. 248 pp., 2 pls.

Pic, M. 1900. Diagnoses de coléoptères d'Orient récoltés en 1899. *Bulletin de la Société d'Histoire Naturelle d'Autun* **13**: 25–32.

———1926. Notes diverses, descriptions et diagnoses (Suite). *L'Échange, Revue Linnéenne* **42**: 13–14.

Reiche, L.J. 1860. Coléoptères de Sicile recueillis par M.E. Bellier de la Chavignerie et déterminés par M.L. Reiche et descriptions de dix espèces nouvelles. *Annales de la Société Entomologique de France* (3) **8**: 717–737.

Scataglini, M.A., Lanteri, A.A. & Confalonieri, V.A. 2006. Diversity of boll weevil populations in South America: a phylogeographic approach. *Genetica* **126**: 353–368. (http://dx.doi.org/10.1007/s10709-005-1399-2)

Scherf, H. 1964. Die Entwicklungsstadien der mitteleuropäischen Curculioniden (Morphologie, Bionomie, Ökologie). *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* **506**: 1–335.

Speranza, S., Colonnelli, E., Garonna, A.P. & Laudonia, S. 2014. First record of *Anthonomus eugenii* (Coleoptera: Curculionidae) in Italy. *Florida Entomologist* **97** (2): 844–845. (http://journals.fcla.edu/flaent/article/view/83245/80112)

Survey of Israel. 2009. *Israel – Touring map. North & South sheets. List of settlements, antiquity sites and road distances. Scale 1:250,000.* The Survey of Israel, Tel Aviv.

Talhouk, A.M. 1969. Insects and mites injurious to crops in Middle Eastern countries. *Monographien zur Angewandten Entomologie* **21**: 1–239.

Tournier, H. 1873. Curculionides nouveaux. *Mittheilungen der Schweizerischen Entomologischen Gesellschaft* **4** [1872–1877]: 170–191.

Voss, E. 1944. Anthonominen-Studien (Col., Curc.) (97. Beitrag zu Kenntnis der Curculioniden). *Stettiner Entomologische Zeitung* **105**: 34–51.

Theodor, O. 1975. *Diptera Pupipara. Fauna Palaestina. Insecta I.* The Israel Academy of Sciences and Humanities, Jerusalem. 170 pp.

Thomson, C.G. 1859. *Skandinaviens Coleoptera, sinoptiski bearbetade*. Tom 1. Berlingska Bocktryckeriet, Lund. [4]+290 pp.

Vafadar, M., Kazempour Osaloo, S. & Attar, F. 2014. Molecular phylogeny of the genus *Amygdalus* (Rosaceae) based on nrDNA ITS and cpDNA trnS-trnG sequences. *TÜBİTAK Turkish Journal of Botany* **38**: 439–452.
(http://dx.doi.org/10.3906/bot-1303-46)