

ALTICINAE OF ISRAEL: *PSYLLIODES* (COLEOPTERA: CHRYSOMELIDAE)

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ABSTRACT

The 20 species of *Psylliodes* found in Israel (and nearby) are listed with their recorded distribution, food plants, and seasonality in Israel. *Psylliodes hermonensis* and *P. druset* are described as new. *Psylliodes libanicola* Pic and *P. pallidicolor* Pic are raised from synonymy. *Psylliodes testaceoconcolor* Heikertinger and *P. mori-candiae* Peyerimhoff are raised from subspecies to valid species. Three taxa are synonymized: *P. nilfdula* Heikertinger is a junior synonym of *P. elliptica* Allard; *P. hospes arridissima* Peyerimhoff is a junior synonym of *P. hospes* Wollaston; and *P. atriplicis* Jacobson is a junior synonym of *P. saulcyi* Allard. New records include: 6 species from Israel; 5 species from Jordan; 2 species from the Sinai; 1 species from Egypt; and 1 species from Lebanon. Four species listed are not yet recorded in Israel (2 from south Lebanon, 1 from Egypt, 1 from the Sinai). Zoo-geographically over half of the species affinity is Mediterranean with about a quarter each of Euro-Siberian and Saharo-Arabian. Zoogeography, food plants, and evolution of the Israeli *Psylliodes* are discussed.

KEY WORDS: Coleoptera, Chrysomelidae, Alticinae, *Psylliodes*, Israel, distribution, host plants.

INTRODUCTION

The genus *Psylliodes* Latreille is a moderately large group of flea beetles (Alticinae) with an interestingly restricted distribution relative to other genera. There are approximately 140 species in the world; over 70% of these are found in the Palearctic Region. Relatively few are known from other zoogeographical regions: Oriental = 14; Australian = 12; Neotropical = 6; Nearctic = 5; Ethiopian = 2 (Heikertinger and Csiki, 1940; Scherer, 1969; Samuelson, 1973; Wilcox, 1975). Thus, *Psylliodes* seem to thrive in more temperate rather than tropical climates. Bodenheimer (1937:149) correctly listed 7 species from Palestine. The present study deals with 14 species now known from Israel, 4 species that have been collected nearby and certainly will be found there (one from Egypt, one from the Sinai, two from Lebanon), and 2 new species to science from Mt. Hermon.

Relatively few workers have dealt specifically with *Psylliodes*, but this genus has usually been included in keys of larger faunistic surveys, e.g. Heikertinger, 1912; Porta, 1934; Mohr, 1966; Scherer, 1969; Samuelson, 1973. Heikertinger studied in depth certain groups of Palearctic *Psylliodes* such as wingless species (1921) and pale-colored species (1926). Since Heikertinger's studies there was very little work on *Psylliodes* ex-

cept for occasional descriptions of new species and some biological studies of agricultural pest species. Leonardi (1970, 1971, 1972, 1975, 1978) has made a major study of Palearctic *Psylliodes* beginning with a comprehensive treatment of the genus based primarily on the female spermathecae, a relatively new character for alticine study at that time. This character revealed many new and telling relationships within the Palearctic species. Leonardi also proposed a phylogeny for the genus.

Most of the taxonomic changes suggested here were initially mentioned in my Cornell University Ph.D. dissertation (Furth, 1976).

Psylliodes is morphologically quite distinctive having less (10) than the usual number (11) of antennal segments for Alticinae. Also the hind tarsus has its metatibial insertion considerably recessed from the apex of the tibia. The elytra are rarely patterned and are dark, often metallic, reddish or light brown (yellow) in color. Sometimes the head, prothorax, and elytra are differently colored. The shape of the frontal tubercles (bossae), male aedeagus, and female spermatheca are some of the best characters to separate the species. The papers by Mohr and Leonardi mentioned above are the most useful for determination of many of the Palearctic species. In general the methods used and explained in the previous studies of Israeli Alticinae (Furth, 1979, 1980, 1981) have also been followed in the present work. Further descriptive details, comparisons and a key to the species will be published in a future volume on Alticinae of Israel in the Fauna Palaestina series published by the Israel Academy of Science and Humanities.

ISRAELI SPECIES OF *PSYLLIODES*

In the section below the complete known distribution of each species is given using the literature as well as specimens examined by the author from various collections, abbreviated as follows: BMNH = British Museum of Natural History, London; MBG = Museum Beit Gordon (Palmoni Collection), Kibbutz Daganya A, Israel; MF = Museum G. Frey, Tutzing/Munich; MNP = Museum National d'Histoire Naturelle, Paris; MT = Museum of Turku University, Turku, Finland; MVe = Museo Civico di Storia Naturale Verona; MVi = Naturhistorisches Museum, Vienna.

All recorded distribution is from Heikertinger and Csiki, 1940; unless otherwise indicated. Appropriate new records for the Middle East are indicated. The major zoogeographical affinity is given after the distribution using the following abbreviations: Med = Mediterranean; ES = Euro-Siberian; IT = Irano-Turanian; SA = Saharo-Arabian (Eremian). The affinity designation includes general distribution and local ecological considerations and does not include minor extensions into adjacent areas that are recorded in the distribution section. The abbreviations used for Israeli distribution refer to the following geographical areas: MH = Mt. Hermon, with maximum elevation (meters); GH = Golan Heights; UG = Upper Galilee; LG = Lower Galilee; C = Carmel Ridge; YV = Yizre'el Valley; S = Samaria; JV = Jordan Valley; NCP = Northern Coastal Plain; CCP = Central Coastal Plain; SCP = Southern Coastal Plain; JF = Judean Foothills; JM = Judean Mountains; JD = Judean Desert; DS = Dead Sea Area; AV = Arava Valley; NN = Northern Negev; CN = Central Negev; SN = Southern Negev; NS = Northern Sinai; CSF = Central Sinai Foothills; SM = Sinai Mountains; SS = Southwestern Sinai. Food plant information is given as recorded in the literature; all recorded food

plants are from Heikertinger, 1925, unless otherwise indicated. The authors of Israeli food plants can be obtained from Zohary (1966), and non-Israeli plants in most cases from the indicated references.

Israeli food plants — all records are from the author's field data, a “?” after a taxon indicates some question of identification; the plants are listed in their approximate decreasing order of preference. All species are in the family Cruciferae, except *Quercus* (Fagaceae), or unless otherwise indicated *Erysimum verrucosum*, *E. goniocaulon*, *Barbarea minor*, *Alyssum baumgartnerianum*, and other species only found on Mt. Hermon are listed near the end. *Quercus* spp. is listed last if the beetle species was found on oaks after its normal host plant season had finished (= post-season). Season — range of dates collected in Israel only (unless otherwise indicated), with an indication of the peak abundance times (“especially March — May” = March through May). All primary and some secondary types of new species will be deposited at Tel Aviv University, Department of Zoology (TAU).

Psylliodes chrysocephala (Linnaeus, 1758) (all variations)

Distribution: all Europe, north to Scandinavia and Finland, west to Spain, east to Balkans, south to Sicily; USSR (Caucasus, Russia, Siberia); Turkey; Syria; Lebanon; Cyprus; Israel; Morocco to Tunisia. ES/Med.

Recorded Food Plants: *Brassica oleracea*, *B. nigra*, *Sisymbrium officinale*. *Brassica napus*, *Vitis vinifera* (Vitaceae), *Capsella bursa-pastoris* (Nonveiller, 1960).

Psylliodes chrysocephala variation *collaris* Weise, 1888

Distribution: Mediterranean (Spain to Balkans); Turkey, USSR (Russia); Syria; Lebanon (MVi); Israel, Jordan (new) (MVe); Morocco to Tunisia. Med.

Israeli Distribution: MH (2000); GH; UG; LG; YV; C; NCP; CCP; SCP; S; JV; JF; JM; JD; DS.

Recorded Food Plants. Europe — *Brassica napus*; *B. oleracea*; *B. nigra*; *B. rapa*; *Sisymbrium officinale*; *Rapistrum perenne*; *Raphanus sativus*; *Sinapis arvensis*; *Thlaspis arvensis*; *Capsella bursa-pastoris*. N. Africa (Jolivet, 1966) — *Raphanus raphanistrum*, *Diplotaxis auriculata*, *Erucastrum elatum*.

Israeli Food Plants: *Hirschfeldia incana*; *Diplotaxis eruroides*; *Erucaria boveana*; *E. hispanica*; *Rapistrum rugosum*; *Sinapis alba*; *S. arvensis*; *Brassica nigra*; *Raphanus rostratus* ?; *Erysimum verrucosum*; *E. goniocaulon*; *Barbarea minor*; *Quercus*.

Season: 26 October — 14 June; especially March — May.

Remarks: larvae generally mine stems and/or leaves (Jolivet, 1967).

Psylliodes chrysocephala variation *peregrina* Weise, 1888

Distribution: Italy (Sicily) (MF); Greece (MF); Turkey; Syria; Cyprus; Lebanon (MVi); Israel; Jordan (new) (MVe). E Med.

Israeli Distribution. MH (2000); GH; UG; LG; YV; C; S; NCP; CCP; SCP; JF; JM; JD; JV; DS (Klapperich Collection, MVe).

Recorded Food Plants. None.

Israeli Food Plants: *Hirschfeldia incana*; *Erucaria boveana*; *Brassica tournefortii*; *Sinapis alba*; *S. arvensis*; *Raphanus raphanistrum*; *R. sativus*; *Isatis lucitanica*; *Rapistrum rugosum* ?; *Erysimum crassipes*; *E. verrucosum*; *Barbarea minor*.

Season: 25 October – 31 May; especially March – May.

Psylliodes circumdata (W. Redtenbacher, 1842)

Distribution: Southern Europe, north to mid-France, Austria, east to Balkans; Sardinia, Corsica; Turkey; USSR (Crimea, Caucasus, S. Russia); Iran; Syria; Lebanon; Israel; Morocco to Libya. Med/ES.

Israeli Distribution. MH (2000); GH; UG; LG; C; S; CCP; SCP; JV.

Recorded Food Plants: *Brassica nigra*; *Calepina irregularis*; *Bunias erucago*. *Capsella bursa-pastoris* (Nonveiller, 1960).

Israeli Food Plants: *Hirschfeldia incana*; *Brassica tournefortii*; *B. nigra*; *Diplo-taxis erucoides*; *Sinapis alba*; *Rapistrum rugosum*; *Raphanus aucheri*; *Erucaria boveana*; *Ochtodium aegyptiaca*; *Alyssum baumgartnerianum*; *Quercus*.

Season: 6 November – 22 May; especially April – May.

Psylliodes cucullata (Illiger, 1807)

Distribution: Europe, north to England, west to Spain, south to Corsica and N. Italy, east to Austria and Rumania; USSR (Ukraine – Shapiro & Tschernyshenki, 1963, Siberia eastward); Mongolia; China; S. Lebanon (MNP – type of *angustalis* Pic). Morocco (Jolivet, 1967). ES.

Recorded Food Plants: *Sperula arvensis* (Caryophyllaceae), *Eremopyrum cristatum*, *Agropyrum desertorum* (Graminae) (Jolivet, 1967). *Poa pratensis* (Poaceae) (Nonveiller, 1960).

Remarks: This species has not yet been recorded from Israel.

Psylliodes cuprea (Koch, 1803)

Distribution: Europe, north to S. Scandinavia and England, east to Balkans; Turkey; USSR (Ukraine – Shapiro & Tschernyshenki, 1963, S. Russia, Caucasus, Transcaucasia); Mongolia (Kral, 1967); Iran; Syria; Cyprus (Georghiou, 1977); Lebanon (MNP); Israel; Jordan (new) (MVe); Morocco to Tunisia. Med/ES.

Israeli Distribution: MH (2000); GH; UG; LG; YV; C; S; NCP; CCP; SCP; JF; JM; JV; JD; DS.

Recorded Food Plants: *Brassica nigra*; *Sisymbrium officinale*; various cultivated crucifers (Jolivet, 1967). Species of *Sisymbrium*, *Alyssum*, *Brassica*, *Diplo-taxis* (Mohr, 1966).

Israeli Food Plants. *Hirschfeldia incana*; *Sinapis alba*; *S. arvensis*; *Erucaria boveana*; *E. hispanica*; *Diplo-taxis erucoides*; *Rapistrum rugosum*; *Raphanus rostratus*; *Brassica nigra*; *Isatis lucitanica*; *Ochtodium aegyptiaca*; *Erysimum verrucosum*; *E. goniocaulon*; *E. repandum* ?; *Barbarea minor*; *Fibigia macrocarpa*; *Quercus*.

Season: all months; especially late February – May.

Psylliodes drusei n.sp.

Distribution: Israel (Mt. Hermon, 1000–1900 m)

Food Plants: *Quercus* spp.

Season: 24-25 October, 14 June – 27 July, especially June.

Psylliodes elliptica Allard, 1861

Psylliodes nitidula Heikertinger, 1940:561. *New Synonym.*

Distribution. Turkey, Syria; Israel; Jordan (new) (MVe). E Med.

Israeli Distribution: GH; JV (BMNH & MBG); JM ? (BMNH = Jerusalem, F.S. Bodenheimer).

Recorded Food Plants: graminaceous plants (Bodenheimer, 1935); fodder beet, wheat, barley (Avidov & Harpaz, 1969).

Israeli Food Plants: not found; sweeping grasses (A. Freidberg, personal communication).

Season. 10 December – 1 January (till 12 March, MBG).

Remarks: This is a very rare species and does not appear to be a pest of grain crops as indicated by the food plant references above. Perhaps there were a few population explosion years in the past or else some factor in recent years, possibly insecticide useage, has caused its near extinction. I have examined Heikertinger's specimens of *P. nitidula* (MF) and they are only a metallic bronze/copper color variation, with light-colored legs, of *elliptica* this type of variation is also common in *Longitarsus*.

Psylliodes gibbosa Allard, 1860

Distribution: central and western Mediterranean, from Iberian Penninsula east to Balkans and Ionian Islands, north to S. France, N. Italy; Sicily, Morocco, Algeria, Tunisia (Leonardi, 1975); Egypt (new, MNP). Med.

Israeli Distribution: not yet recorded, but certain to be found eventually.

Recorded Food Plants: *Lolium perene*, *Scleropoa rigida* (Graminae), *Sinapis pubescens* (Jolivet, 1967).

Psylliodes hermonensis n.sp.

Distribution: Israel (Mt. Hermon, 1000–1900 m).

Food Plants: *Erysimum verrucosum*; *E. gontocaulon*; *Hirschfeldia* ? *incana*; *Quercus* sp.

Season: 25 October, 26 April – 27 June, especially May-June.

Psylliodes hospes Wollaston, 1854

Psylliodes hospes aridissima Peyerimhoff, 1941:15. *New Synonym.*

Distribution: W. Mediterranean (including islands); S. Spain; S. France; Sardinia; Sicily; Madeira & Canary Isl.; Morocco to Egypt, including Sinai (new); Israel (new). SA/Med.

Israeli Distribution: AV; SN; SS; SM; CSF.

Recorded Food Plants: *Alyssum maritimum* (Jolivet, 1967). *Crambe kralicki* (Peyerimhoff, 1941); *Farsetia ovalis* (MF, Algeria, leg. Peyerimhoff).

Israeli Food Plants: *Diploaxis acris*; *D. harra*; *Zilla spinosa*; *Farsetia aegyptiaca*.

Season: 10 March – 22 April, 4-6 November.

Remarks: *Psylliodes hospes aridissima* is only one (light) of several color forms of this variable species; I have examined Peyerimhoff's *aridissima* types from North Africa (MNP) as well as the types of Wollaston from the Canary Islands (BMNH).

Psylliodes hyoscyami (Linnaeus, 1758)

Distribution: Europe, east to Balkans, Turkey; USSR (Ukraine – Shapiro & Tschernyshenko, 1963, Kazakh, Siberia to Transbaikalia); Iraq; Cyprus (MF); Syria; Israel; Jordan (new) (MVe); Algeria; Tunisia. ES/Med.

Israeli Distribution: MH (1600); UG; CCP; C; S; JM; JD.

Recorded Food Plants: *Hyoscyamus niger*, *Solanum dulcamara* (Solanaceae) (Nonveiller, 1960).

Israeli Food Plants: *Hyoscyamus aureus*.

Season: 1 February – 4 June, 7 December; especially late April – May.

Remarks: This species has often been confused with *chalconera* to which it is very similar, misidentifications have caused *chalconera* to be reported in Israel (Sahlberg, 1913) and Jordan (MVe) erroneously.

Psylliodes inflata Reiche & Saulcy, 1858

Distribution: Turkey; Syria; Lebanon (type locality); Israel (Bodenheimer, 1937); Jordan (new) (MVe); Spain and Morocco to Libya (Leonardi, 1975); Italy (Sicily); Malta. ES/Med.

Israeli Distribution: MH (2000); GH; UG; LG; C (MNP); JV (MBG); JM.

Recorded Food Plants: *Ormenis mixta*, *Anacyclus clavatus*, composites near *Chrysanthemum*, (Compositae) (Jolivet, 1967).

Israeli Food Plants. *Hirschfeldia incana*; *Brassica nigra*; *Sinapis alba* (?), *Erucaria hispanica* (?); *Ballota undulata* (Labiatae); Graminae (?); *Barbarea minor*; *Erysimum verrucosum*.

Season: 5 April – 27 June, 24 October – 17 January; especially late April – May.

Remarks: This species may be confused with *gibbosa* (All.) found primarily in the north and west Mediterranean countries.

Psylliodes instabilis Foudras, 1860

Distribution: Europe, north to England, Netherlands, west to Spain, south through Italy to Sicily, east to Rumania; Bulgaria (Gruev, 1971); Greece; Turkey; Israel (new); Tunisia (Normand, 1937); Algeria; Morocco (Kocher, 1958). ES.

Israeli Distribution: MH (1400–2000); GH.

Recorded Food Plants: in Europe: *Erysimum canescens*; *E. hieracifolium*; *Sinapis arvensis*. In North Africa (Jolivet, 1967): *Erysimum ochroleucum*; *Iberis ciliata*; *Matthiola lunata*; *Alyssum serpyllifolium*; *A. spinosum*.

Israeli Food Plants: *Erysimum verrucosum*; *E. goniocaulon*; *Alyssum baumgartnerianum*; *Barbarea minor*; *Fibigia macrocarpus*; *Quercus* spp.

Season: 27 April – 2 August, especially May – June.

Remarks: Detailed morphological examination produced only subtle differences in the ratio of the hind tibia (Lt/Ld) and of the relative pronotum size (Le/Lp) between Israeli and European specimens. Zoogeographically Mt. Hermon is a considerable extension of the range of this species; the closest previous location was western Turkey. Despite the minor morphological differences and the apparent geographical separation, I do not think that this population should be given a subspecific name. Further collecting will probably reveal other populations, especially in high mountains, further east in Turkey and in Lebanon and Syria; forming a rather continuous distribution with geographical clines of some characters.

Psylliodes libanicola Pic, 1903

(Fig. 1)

Psylliodes picina (Marsham, 1802) of Heikertinger, 1916.

Distribution: Syria (= S. Lebanon) (Pic, 1903). Endemic E Med.

Israeli Distribution: not yet recorded, but certain to be found eventually.

Food Plants: not known.

Remarks: Heikertinger (1916, 1926) said this taxa was synonymous with *picina* (Marsham), however, after discovering a single male specimen (from Lebanon, Beit Meri) in the miscellaneous unsorted Pic Collection (MNP) – I designate it as the lectotype of the valid species. It is similar to *picina* and *pallidicolor* Pic but has a different aedeagus shape than either (Fig. 1). It is also ferrugineous in color, has a strongly convex body form, and with no sub-lateral depressions in the pronotum. The female is unknown.

Psylliodes maculatipes Pic, 1924

Distribution: Egypt, including Sinai (new); Algeria. SA.

Israeli (= Sinai) Distribution: SM.

Recorded Food Plants: *Zilla spinosa* (Peyerimhoff, 1931).

Israeli (= Sinai) Food Plants: *Schouwia schimperii*.

Season: 6 April.

Psylliodes marcida (Illiger, 1807)

Distribution: Mediterranean (coastal and islands), from Spain to Ionian Isl. (= W. Greece); Bulgaria (Black Sea coast) (Gruev, 1970); coastal Atlantic, from Portugal to Scotland, Baltic, S. Scandinavia, S. Finland; Israel (new); Lebanon (new, MNP); Morocco to Tunisia (Jolivet, 1967). Med/ES.

Israeli Distribution: NCP; CCP; SCP.

Recorded Food Plants: *Cakile maritima*, *Alyssum maritimum* (Jolivet, 1967).

Israeli Food Plants: *Cakile maritima*.

Season: 21 April – 10 May.

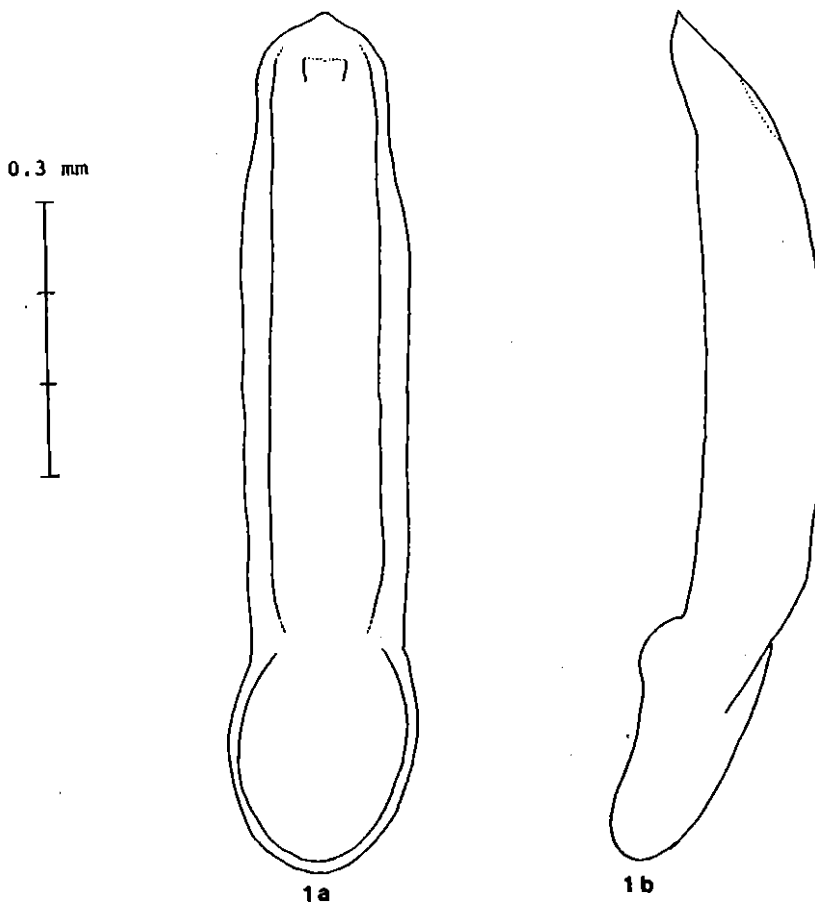


Figure 1. *Psylliodes libanica* Pic, male aedeagus. a) ventral view; b) lateral view. Lectotype.

***Psylliodes pallidicolor* Pic, 1903**
(Figs. 2, 3)

Psylliodes luteola (Mueller, 1776) of Heikertinger, 1916.

Distribution: Bulgaria (Gruev, 1978); Greece (Sahlberg, 1913, MT); Turkey (Doguet, 1976); Iraq (MF); Syria; Lebanon; Israel (new). E Med.

Israeli Distribution: C.

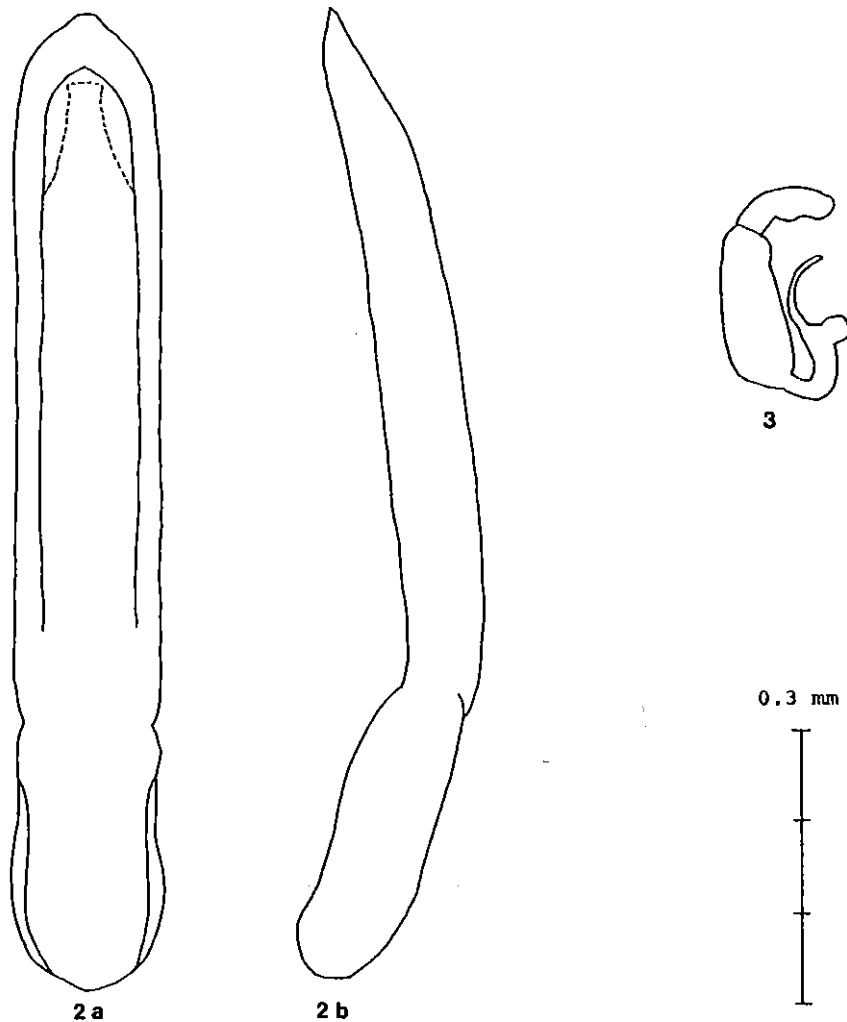
Recorded Food Plants: None

Israeli Food Plants: (none recorded), *Quercus* (? post-season).

Season: 9 May – 27 May, 5 November.

Remarks: Heikertinger (1916, 1926) and Heikertinger and Csiki (1940) placed this taxon in synonymy with *Psylliodes luteola* (Mueller), however, close examination

revealed this to be a valid species. I have designated a female specimen from the Pic Collection (MNP), labelled "Beit Meri, Liban", as the lectotype and two other specimens from there with the same data as paralectotypes. This species is similar to *luteola* (Mueller), *libanicola*, and *wachsmanni* Csiki, but is unique because of its genitalia form (Figs. 2 & 3). It is light brown in color, with sub-lateral pronotal depressions, and less convex body form than *libanicola*. The reports of *luteola* in Palestine (= Israel) and Lebanon, e.g. Sahlberg (1913), were actually *pallidicolor*. Leonardi (1975 and *in litt.*) suggested that this may be a good species.



Figs. 2-3. *Psylliodes pallidicolor* Pic: 2. male aedeagus, a) ventral view; b) lateral view. Lectotype. 3. female spermatheca.

Psylliodes peyerimhoffi Heikertinger, 1916

Distribution: Israel (new); Egypt, including Sinai; Libya; Saudi Arabia (Doguet, 1979). SA.

Israeli Distribution: DS; CN; SN; CSF; SM.

Recorded Food Plants: None.

Israeli Food Plants: *Diplotaxis acris*; *D. harra*; *Erucaria boveana*; *Matthiola longipetala* ?.

Season: 26 February – 9 May; especially March – April.

Remarks: *Psylliodes peyerimhoffi moricandiae* Peyerimhoff, 1925, is a valid species (*New Status*) from North Africa (Algeria, Tunisia on *Moricandia*) and Saudi Arabia (Doguet, 1980). I have examined the three cotypes from the Peyerimhoff Collection (MNP). I designate the male as the lectotype and the two females as paralectotypes; all have the same data as described by Peyerimhoff (1925) from Tunisia. The male and a female type were on the same pin with a determination label in Peyerimhoff's handwriting, also saying "type". This species is entirely light brown in color with rufous head; apex of hind femora dark brown; body form elongate, flattened; frontal punctures coarse; male and female genitalia are very different from those of *peyerimhoffi*.

Psylliodes saulcyi Allard, 1866

Psylliodes atriplicis Jacobson, 1922:529-530. *New Synonym*.

Distribution: USSR (S. Russia); Iraq (MF); Cyprus; Syria; Jordan (MT); Israel (Bodenheimer, 1937); Egypt. SA/Med.

Israeli Distribution. JV; DS; CN.

Recorded Food Plants: *Atriplex* sp. (Chenopodiaceae) (Heikertinger, 1926). *A. lacinata* (Jacobson, 1922).

Israeli Food Plants: *Atriplex halimus*.

Season: 21 March – 9 May; especially late April.

Remarks. Upon comparison of the types and other examples of *Psylliodes atriplicis* Jacobson (MF) with *saulcyi* (specimens compared with the type MNP) and study of the male and female genitalia, I have found no morphological differences. I have not found any significant spermathecal differences. Furthermore, the original labels on the type series of *atriplicis* (in old Russian script) say that they were collected on *Atriplex lacinata* together with *Chaetocnema* sp., probably *C. tibialis* var. *breviuscula* Falderman. I have collected the typical *saulcyi* in Israel on *Atriplex halimus* together with *Chaetocnema tibialis* var. *delarouzei* Brisout. Various species of *Atriplex* extend continuously from North Africa to Central Asia. Therefore, *atriplicis* is synonymous with *saulcyi*.

Psylliodes sophiae Heikertinger, 1914

Distribution: Europe, north to S. Scandinavia and England, south to Spain, S. France & N. Italy, east to Balkans; Turkey; USSR (S. Russia, Caucasus to Kazakh & Siberia); USSR (Uzbekistan) (Mohr, 1977); Afghanistan (Lopatin, 1963); N. China; Iran; Lebanon (new) (MNP); Israel (new); Morocco (Atlas Mountains) (Doguet, 1974). ES/IT.

Israeli Distribution. MH (2000); UG.

Recorded Food Plants: *Sisymbrium sophia*.

Israeli Food Plants: *Barbarea minor*, *Erysimum verrucosum*, *Alyssum baumgartnerianum*.

Season: 26 April – 27 June, 25 October; especially May – mid-June.

Psylliodes testaceoconcolor Heikertinger, 1926 *New Status*
(Figs. 4, 5)

Psylliodes cuprea testaceoconcolor Heikertinger, 1926:122.

Distribution: Syria (= Lebanon); Israel (Leonardi, 1971 – Palestine = Israel).
Endemic E Med.

Israeli Distribution: MH (1600); UG; C.

Recorded Food Plants: None.

Israeli Food Plants: *Crambe hispanica*; *Hirschfeldia incana*; *Quercus* sp.

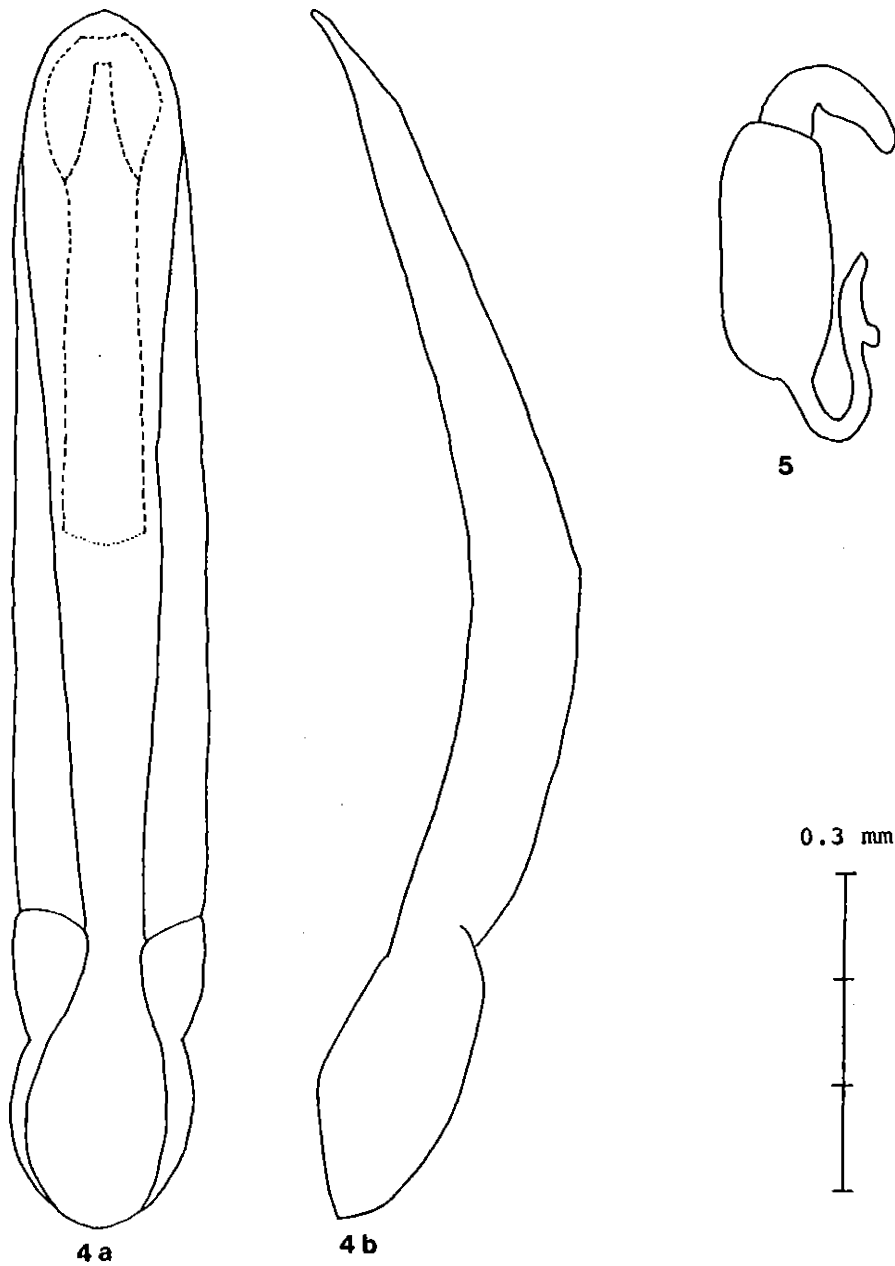
Season: 26 April – 31 October; especially late April – May.

Remarks: Heikertinger (1926) considered this to be a local (Lebanon) variation of *cuprea* (Koch), however, upon examination of the type series of this variation (MF, MVi) and others, it is clearly a valid species. Heikertinger (1926) in the original description said that he was not certain if this was a local variation or a good species. Heikertinger mentions in the description that the several types were in the "Wiener Staatsmuseum" (MVi) and from Beirut, "Appl. 1878". I have examined two (sex undetermined) specimens there (MVi) and a third (female) in the Heikertinger Collection (MF) with this data that are apparent cotypes. Bechyne (1956) mentions the Frey Museum specimen but said that the type, according to Heikertinger's original description, must be in the Vienna Museum. The Frey Museum specimen has a Bechyne paratype label from 1956. This specimen also has a Heikertinger determination label from 1925 in his handwriting, saying "type!" and a red label (Heikertinger's writing) with "*cuprea* f. *testaceoconcolor* m." and the printed word "TYPUS" – and is clearly the specimen Heikertinger meant to be the primary type. Therefore, I designate this female specimen from the Heikertinger Collection (MF) as the lectotype and the two in the Vienna Museum as paralectotypes. Evidently Heikertinger took this specimen into his collection from the Vienna Collection before it was purchased by Dr G. Frey in 1953. It differs from *cuprea* not only in its larger body size and entire light brown (yellow) color, but more importantly in the male aedeagus (Fig. 4). The spermatheca (Fig. 5) shows no significant difference from that of *cuprea* (Leonardi, 1970, fig. 1).

DESCRIPTIONS OF NEW SPECIES

Psylliodes hermonensis Furth, n.sp.
(Figs. 6, 7)

Antennae. Segments 1-3 and usually 4 yellow to light brown, 4 and 5 often darker brown, 6-10 dark brown to black. Segments 1 and 4 subequal, longest; segments 2, 3, 5, 6 subequal, distinctly shorter than 1 or 4.



Figs. 4-5. *Psylliodes testaceoconcolor* Heikertinger: 4. male aedeagus, a) ventral view; b) lateral view. N. Amud, 17 Oct. 1972. 5. female spermatheca. N. Amud, 31 Oct. 1972.

Head. Black, sometimes with slight blue-black metallic reflection. Frontal punctation (between eyes) fine, moderately dense; background surface texture extremely finely shagreened. Nasal keel flat, not raised at all. Frontal tubercles (bossae) not evident as with other species in *napi*-group (see Leonardi, 1970, fig. 48).

Pronotum. Black, with a slight blue-black metallic reflection. Punctuation fine, moderately dense; background texture extremely finely shagreened. Shape very convex, widest just behind the middle. When viewed from above laterally rounded and somewhat constricted anteriorly, antero-lateral angles (bristle pores) not visible. The pronotal shape distinctly different from *milleri milleri* Kutschera which is less convex and more triangular (dorsal view), anteriorly constricted and widest basally; when viewed from above antero-lateral angles somewhat visible.

Elytra. Color metallic blue, blue-black; metallic reflection usually stronger than on pronotum, but dorsum not appearing dichromatic. Punctuation medium-sized striate, with extremely fine irregular punctures between striae; most (not all) striae indistinct at extreme apex of elytra; background texture appears smooth, but actually extremely finely shagreened. Shape elongate-oval, only slightly convex, laterally evenly rounded and gradually tapering apically. Humeral angles well-developed (macropterous and brachypterous) and thus, base of elytra distinctly wider than base of pronotum, much more than in *m. milleri* (see Leonardi, 1971, figs. 8 & 9 and also figs. 10 & 12 for *taurica* Leonardi).

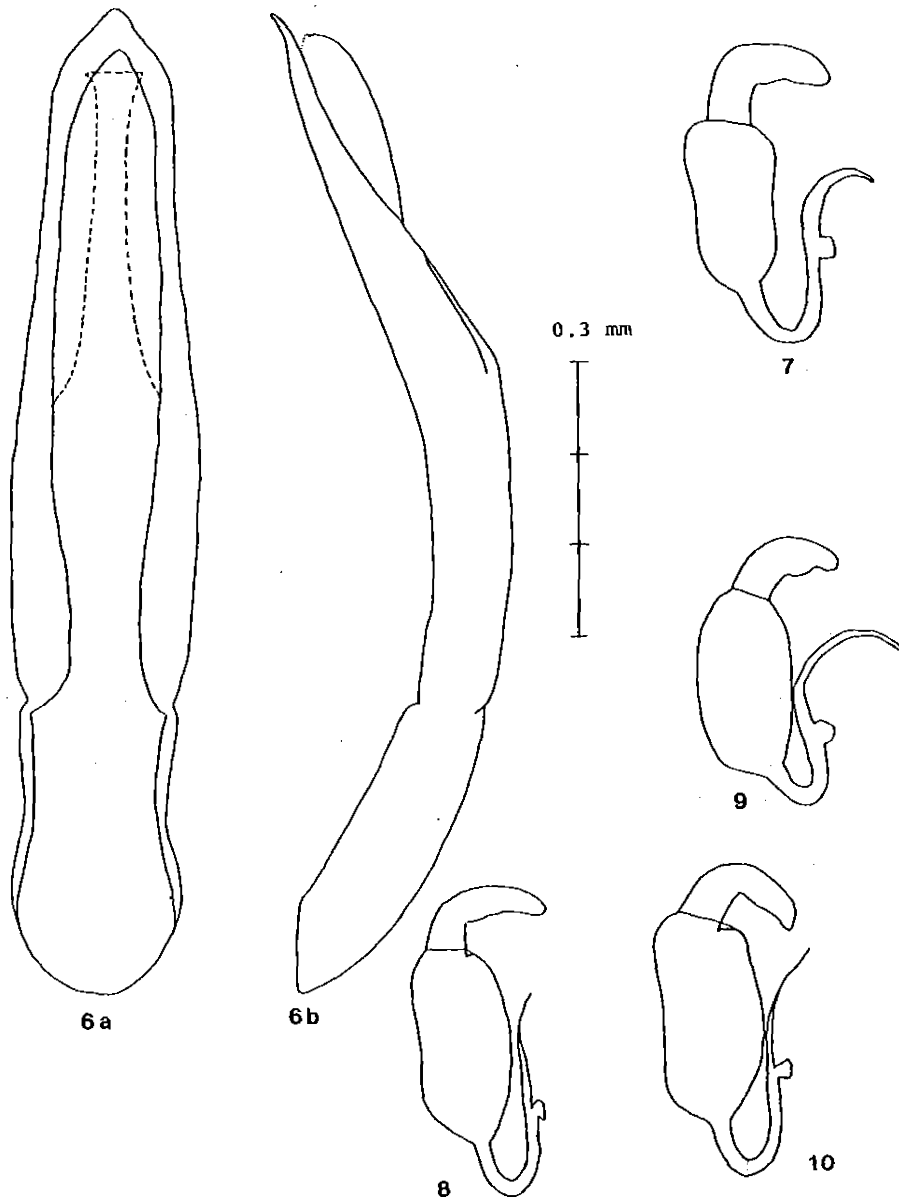
Venter. Color black, not metallic blue reflecting; finely shagreened background texture.

Legs. Front and middle legs with dark (black) femora, except for extreme apex light brown or yellow; tibiae usually black or dark brown in middle with extreme base and apex light brown or yellow; tarsi light brown or yellow. This differs from *m. milleri* and some other related species that have only the base of front and middle femora darkened (brown) with the apical one half of femora and all of tibiae light brown or yellow. Hind legs with entirely black femora; tibiae dark brown or reddish brown (often somewhat lighter color than front and middle tibiae); tarsi light brown. Male first foretarsal segment distinctly swollen, unlike *m. milleri* or *toelgi* Heikertinger which are not very enlarged.

Male genitalia (Fig. 6): Similar to *m. milleri* and *toelgi* in general shape (ventral view) (Leonardi, 1971; figs. 68 and 24, respectively), but with a more broadly triangular yet sharply pointed apex and not as narrow in apical half as *milleri* (more similar to *toelgi*), in lateral view not evenly curved as in *milleri* and *toelgi* but with an angle on dorsal side as in *brisouti* Bedel (Leonardi, 1971, fig. 21), extreme apex rather straight, not distinctly curved ventrally as in *milleri*, quite different in ventral and lateral views from *taurica* and *vindobonensis* Heikertinger (Leonardi, 1971, figs. 66, 67 and 70, 71, respectively).

Female genitalia (Fig. 7): Generally similar to *napi*-group (Leonardi, 1971, figs. 1-5). Pump rather short (similar to *toelgi* and *vindobonensis* — Leonardi, 1970, fig. 2 and 4, respectively); differing from these species by the sides of receptacle usually being slightly concave, especially the side adjacent to ductus, sometimes receptacle subparallel-sided but usually tapered towards insertion of ductus. Differing from *m. milleri* (Fig. 8), *m. lindbergi* (Fig. 9), and *brisouti* (Fig. 10).

Remarks. Leonardi (1971) gives extensive data for hind wing length and its variability for several related species of the *napi*-group. He mentions that *taurica* and *toelgi* have somewhat brachypterous wings, that *vindobonensis* is always (?) brachypterous, that *brisouti* has both brachypterous and macropterous forms, and that



Figs. 6-10. *Psylliodes* spp. 6, 7 *Psylliodes hermonensis* new species. 6. male aedeagus, a) ventral view; b) lateral view. Mt. Hermon, 1450 m, 31 May 1978. 7. female spermatheca. Mt. Hermon, 1450 m, 31 May 1978. 8,9. *Psylliodes milleri milleri* Kutschera. 8. female spermatheca. Italy, Mellitto (courtesy of Dr. C. Leonardi; no scale). 9. female spermatheca. Morocco, Ikanen, Alhacemos, 14 April 1973, leg. P. Alcaide. 10. *Psylliodes brisouti* Bedel, female spermatheca. Italy, Riofreddo (courtesy of Dr. C. Leonardi; no scale).

milleri is always macropterous. Although interesting, detailed data on wing length in Alticinae should not be weighted heavily for taxonomic differentiation because of the high percentage of wing length polymorphism (Furth, 1980b and Shute, 1980). Most examples of *hermonensis* that were dissected had long (macropterous) wings but a few had shorter (brachypterous) wings. Besides *m. milleri*, *hermonensis* is similar to the other species of the *napi*-group mentioned above, but in view of potential wing polymorphism in different ecological and geographical situations, this character should not be weighed heavily in determining relationships.

Measurements. 10 specimens (5 males and 5 females), including the largest and smallest of each sex, were measured for 9 characters abbreviated as follows: Lb = total body length; Le = length of elytron; Lp = length of pronotum; Lt = length of metatibia; Ld = length of distal part of metatibia, distal to insertion of metatarsus; La and Ls = length of aedeagus and spermatheca, respectively (not measured for all); Weh = width of elytra at humeral angles; Wem = maximum width of elytra at middle of abdomen; Wp = width of pronotum. Certain ratios have been computed using the measurements that have been found useful in comparing species of *Psylliodes*, they are Le/Lp (relative prothorax size) and Lt/Ld (relative metatibial socket apex size) (Leonardi, 1971).

Males: Lb = 2.50-2.81; Le = 2.08-2.27; Weh = 1.00-1.19; Wem = 1.19-1.42; Lp = 0.61-0.69; Wp = 0.89-0.96; Lt = 0.76-0.93; Ld = 0.18-0.20; La = 0.96-0.98.

Females: Lb = 2.54-3.12; Le = 1.96-2.42; Weh = 1.00-1.17; Wem = 1.27-1.46; Lp = 0.59-0.72; Wp = 0.87-1.04; Lt = 0.85-0.96; Ld = 0.19-0.24; Ls = 0.30-0.35.

The size (Lb) of *hermonensis* is significantly smaller (males 2.5-2.8, females 2.5-3.1) than *milleri* (males 2.6-3.6, females 2.9-3.7). Lt/Ld for *hermonensis* is 4.3 (average) whereas *toelgi* is rarely more than 3.9 (Leonardi, 1971). The average Le/Lp of *hermonensis* (males = 3.30, females = 3.34) is larger than *taurica* (males = 3.08-3.22, females = 3.20) but considerably smaller than *m. milleri* (males = 3.4-3.7, females = 3.5-3.9) (Leonardi, 1971).

Distribution: Mt. Hermon, 1000-1900 m.

Season: 25 October; 26 April – 27 June; especially May-June.

Food Plants: *Erysimum verrucosum*; *E. goniocaulon*; *Hirschfeldia* ? *incana*; *Quercus* sp.

MATERIAL EXAMINED. Holotype: ♂, Mt. Hermon, 1400-1500 m, 14 June 1978, (TAU). Allotype: ♀, Mt. Hermon, 1450 m, 31 May 1978 (TAU). Paratypes: 1 ♂, 4 ♀♀, 1450 m, 4 June 1974; 10 ♂♂, 9 ♀♀, 1600 m, 25 October 1977; 2 ♂♂, 1650 m, 25 October 1977; 7 ♂♂, 2 ♀♀, 1800 m, 25 October 1977; 3 ♂♂, 2 ♀♀, 1400 m, 26 April 1978; 8 ♂♂, 2 ♀♀, 1650 m, 26 April 1978; 3 ♂♂, 2 ♀♀, 1450 m, 27 April 1978; 33 ♂♂, 38 ♀♀, 1650 m, 30 May 1978; 2 ♂♂, 2 ♀♀, 1400 m, 31 May 1978; 17 ♂♂, 24 ♀♀, 1450 m, 31 May 1978; 12 ♂♂, 12 ♀♀, 1650 m, 2 ♂♂, 1900 m, 13 June 1978; 6 ♂♂, 7 ♀♀, 1400-1500 m, 14 June 1978; 2 ♀♀, 4 ♀♀, 1500-1650 m, 14 June 1978; 1 ♀, 1650 m (Mt. Dov), 15 June 1978; 1 ♂, 1 ♀, 1800 m, 27 June 1978; 1 ♀, 1400 m, 5 May 1979.

All specimens were collected on Mount Hermon by the author.

Paratypes (at least a male and female) will be deposited at the following institutions: TAU; BMNH; MNP; MF; U.S. National Museum (USNM); Museo Civico di Storia Naturale Milano (MMi); Bavarian State Collection, Munich (BSC); Peabody Museum of Natural History, Yale University (PM).

Psylliodes drusei Furth, n.sp.

(Figs. 11, 12)

Antennae. Segments 1-3 yellow or light brown, segments 4 and 5 darker brown, segments 6-10 very dark brown or black. This differs from *cretica* Weise which has entirely light (yellow) antennae. Segment 1 longest, distinctly longer than 4, 4 distinctly longer than 2, 3, 5, 6 (all subequal).

Head. Color black (or dark brown in teneral). Impunctate on frons or vertex; smooth background texture. Frontal tubercles usually evident; dorsal frontal lines more or less forming a straight line across front, only slightly depressed medially (= in center of frons), forming a small depression between tubercles; tubercles club or hatchet-shaped, enlarged medially (similar to fig. 6 for *algerica* Allard, Leonardi, 1972) (*cretica* with even more distinct frontal tubercles, more clearly delineated frontal lines, and larger median depression).

Pronotum. Color black. Punctuation very fine, shallow, moderately dense (sometimes apparently evenly distributed); background texture appears smooth, extremely finely shagreened texture only visible at high magnifications (more than 50 x) (*cretica* appearing shagreened at low magnifications). Short, sublateral, basal depressions (as in *pallidicolor*) vaguely indicated. Shape subrectangular, lateral margins gradually evenly rounded and constricted anteriorly, antero-lateral angles thickened but not protruding or angled away from outline of lateral margins; not very convex in cross-section (*cretica* more convexed with antero-lateral angles not easily visible in dorsal view).

Elytra. Color black (dark brown in teneral), shiny but sometimes (including pronotum) with feeble metallic reflection. Punctuation striate, with coarse, deep punctures, with very tiny secondary punctures between the striae; background texture smooth. Shape elongate-oval, more elongate than *cretica* and less than *laevifrons* (see measurements section). Humeral angles well developed.

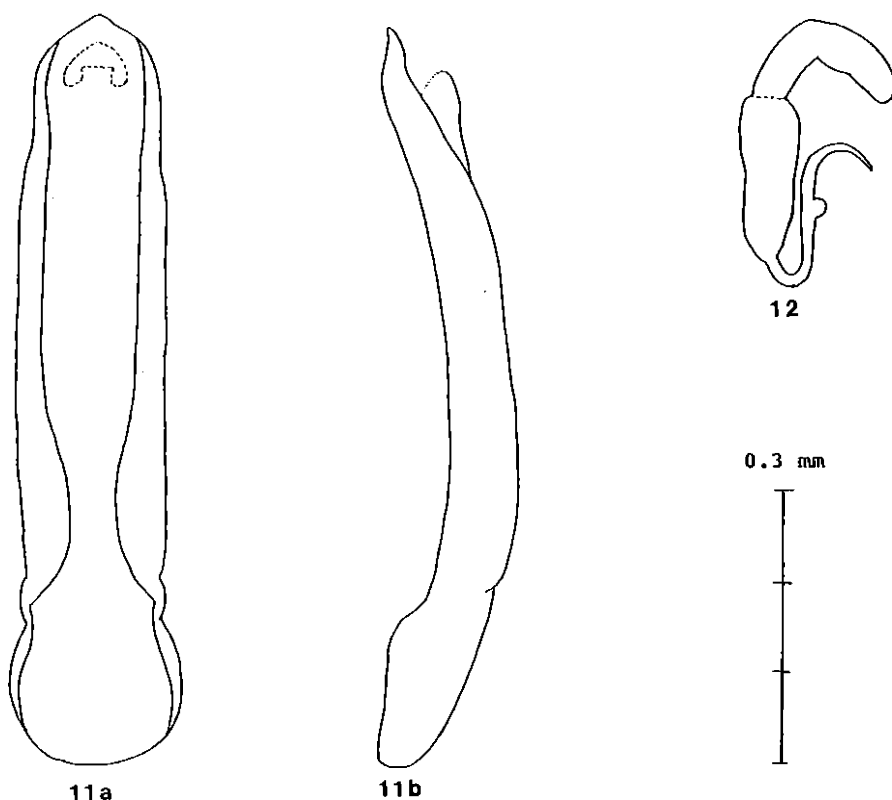
Venter. Color black with light pubescence throughout.

Legs. Color of fore and middle femora dark brown, lighter brown at apex; hind femora black; fore and middle tibiae darker brown in center but distinctly lighter brown at base and apex (*cretica* with light colored fore and middle tibiae); metatibiae reddish-brown, distinctly lighter than metafemora; metatibiae very greatly curved and laterally compressed; apical spine of metatibia not especially prominent; male first foretarsal segment distinctly swollen.

Male genitalia (Fig. 11): Similar to *laevifrons laevifrons* Kutschera and *laevifrons cretica* (*sensu* Leonardi, 1978, figs. 13-19 and 20, respectively) but apex more evenly triangular without apical tip set off (as in *laevifrons*), apical one fifth of shaft slightly tapered or constricted; in lateral view apex with distinct recurve (more than in *cretica*). Dorsal ligula shorter than in *cretica* (see Leonardi, 1978, figs. 13-19, 20).

Female genitalia (Fig. 12): Similar to *cretica* (Leonardi, 1978, figs. 42, 43), but with pump of spermatheca more slender and with depression in side away from ductus. Closer in pump, receptacle, and ductus shape to *feroniae* Leonardi, (Leonardi, 1978, fig. 41).

Measurements. Male: Lb = 1.85-2.69; Le = 1.42-2.04; Weh = 0.83-1.15; Wem = 1.02-1.35; Lp = 0.46-0.65; Wp = 0.70-0.96; Lt = 0.46-0.76; Ld = 0.17-0.28; La = 0.76-0.91. Le/Lp = 3.09-3.43 (3.22 = average); Lt/Ld = 2.70-2.91 (2.82); Le/Wem = 1.39-1.51 (1.47).



Figs. 11-12. *Psylliodes drusei* new species: 11. male aedeagus, a) ventral view; b) lateral view. Mt. Hermon, 1600 m, 25 Oct. 1977. 12. female spermatheca. Mt. Hermon, 1600 m, 20 June 1979.

Female: Lb = 2.00-2.62; Le = 1.62-2.04; Weh = 0.92-1.15; Wem = 1.08-1.39; Lp = 0.50-0.63; Wp = 0.80-0.98; Lt = 0.57-0.74; Ld = 0.24-0.30; Ls = 0.28. Le/Lp = 3.09-3.30 (3.23); Lt/Ld = 2.38-2.79 (2.53); Le/Wem = 1.41-1.54 (1.48).

The average ratios for *laevifrons cretica* are as follows (Leonardi, 1978): Le/Lp – males = 3.31, females = 3.20; Le/Wem – males = 1.45, females = 1.46. The ratio of Lt/Ld was not given by Leonardi and was measured by the author using only 2 females and a single male: male = 2.82, females = 2.54-3.00 (2.53).

Distribution: Mt. Hermon, 1000-1900 m.

Season: 24-25 October; 14 June – 27 July; especially June.

Food Plants: *Quercus* spp.

MATERIAL EXAMINED. Holotype: ♂ – Mt. Hermon, 1600 m, 20 June 1979 (TAU); Allotype: ♀ – same as holotype (TAU). Paratypes: 12 ♂♂, 9 ♀♀, same as holotype; 3 ♂♂, 2 ♀♀, 1700 m, 22 June 1973, leg. A. Freidberg; 1 ♂, 1 ♀, 1900 m, 22 June 1973, leg. F. Nachbar; 1 ♂, 1650 m, 24 October 1977; 1 ♂, 9 ♀♀, 1600 m, 25 October 1977; 1 ♂, 1800 m, 25 October 1977; 2 ♀♀, 1000 m, 14 June 1978; 2 ♂♂, 2 ♀♀, 1650 m, 27 July 1979; 12 ♂♂, 13 ♀♀, 1650 m, 2 July 1980.

All specimens were collected on Mt. Hermon by the author (unless otherwise indicated).

Paratypes (at least a male and female) will be deposited in the collection of the Department of Zoology, Tel Aviv University.

A pair of Paratypes will be deposited in the following collections: BMNH; MNP; MMI; USNM; BSC; PM.

This species is named for the Druse people that inhabit northern Israel, southern Lebanon, and southern Syria and live in three villages on Mt. Hermon.

ZOOGEOGRAPHY

The fact that over 70% of the world's *Psylliodes* species are found in the Palearctic Region is quite unusual compared to the other genera of Alticinae analyzed from the Israeli fauna (Furth, 1979, 1980, 1981). This is not caused by the fact that the Palearctic fauna is best known, because these other genera do not show such a drastically skewed distribution. The fact that the Palearctic has close to 20 times the species diversity as the Nearctic is remarkable since it may be expected that some Holarctic fauna exists or existed in the past. The low number of species present in the tropical regions indicates *Psylliodes* do not survive well in moist warm climates. Thus, *Psylliodes* probably originated in the Old World, especially in the west, paleo-temperate climates of the Tertiary. The Pleistocene glaciation probably pushed many species southward into the Middle East and North Africa where many remained and/or evolved ancestral taxa.

In Israel and vicinity 18 species (excluding the 2 new species) show a primary zoogeographic affinity to the Mediterranean subregion of the Palearctic (51.1%), secondary level affinity to the Euro-Siberian (20.0%) and Saharo-Arabian (27.2%) subregions, and a low level for the Irano-Turanian subregion (1.7%). A significant Euro-Siberian affinity might be expected because of the high number of Euro-Siberian *Psylliodes* species and the possible relictual effects of glaciation mentioned above. The two new species could probably be categorized as Euro-Siberian affinity which would increase the Euro-Siberian affinity closer to that of the Mediterranean. Also interesting is the relatively high percentage of Saharo-Arabian (eremian) affinity, similar to that of *Phyllotreta* (Furth, 1979). One possible explanation for the strong affinity of the Mediterranean and Saharo-Arabian elements in both *Phyllotreta* and *Psylliodes* is the phytogeography of their primary food plant family, Cruciferae, which has its present center of distribution in the Mediterranean (including the Saharo-Arabian and southern Euro-Siberian subregions).

Endemism (excluding the 2 new species) is significant; 5 species (30%) have restricted enough ranges to fall into this category; 4 of these are endemic to the eastern Mediterranean and 1 to the arid regions of the Middle East (Egypt/Libya, Saudi Arabia, Israel). This endemism indicates that a significant proportion of the Middle East *Psylliodes* fauna has evolved there, probably before the Pleistocene-evolved Euro-Siberian species, in the late Tertiary when the climate was somewhat warmer and less arid than today.

FOOD PLANTS

As with most genera of Alticinae (Furth, 1979, 1980, 1981) *Psylliodes* has a primary food plant family, two secondary families, and a few other families with only one beetle species utilizing them. Israeli *Psylliodes* feed on Cruciferae (63%), Solanaceae (5%), Graminae (11%), Chenopodiaceae (5%), and the rest have unknown hosts (16%). This is a similar pattern in general to the 23 European species for which food plants are adequately known (Mohr, 1966): Cruciferae (65%); Solanaceae (13%); Graminae (9%); and one species each (4%) on Compositae, Scrophulariaceae, and Moraceae. *Psylliodes* larvae are usually root feeders, but a few are leaf miners. Several *Psylliodes* species are important pests of cultivated plants in Europe and elsewhere: *P. chrysocephala* on cultivated cruciferous crops (Bonnemaison and Jourdheuil, 1954). *P. affinis* on potatoes and other solanaceous crops and *P. attenuata* on hops and hemp crops (Mohr, 1966). As explained previously (Furth, 1979), flea beetles are attracted to secondary defense chemicals present in their hosts and have presumably co-evolved with their food plants in a biochemical manner. The predominant secondary chemicals in the Cruciferae are thioglucosides (mustard oils) that are responsible for *Phyllotreta* co-evolution with its food plants, thioglucosides also exist in the two other *Phyllotreta* food plant families — Capparidaceae and Resedaceae (Furth, 1979). Therefore, although thioglucosides probably are involved with *Psylliodes* co-evolution, there must be other secondary chemicals involved because the crucifer-feeders do not feed on other plant families. It would seem unlikely that the Solanaceae and Cruciferae have any secondary chemicals in common that could explain the dominance of these families as food plants for *Psylliodes*. The Solanaceae are known to contain toxic alkaloids and anything that feeds on them must have special detoxification or sequestering mechanisms. It is even less likely that the Graminae would have a secondary chemical link to Cruciferae and Solanaceae. However, phytochemical knowledge of many groups is still rather elementary and there may be a chemical link among *Psylliodes* food plants. A more likely explanation, however, is that related groups of *Psylliodes* species have evolved in different directions with respect to their food preference. The genus *Longitarsus* (Furth, 1980) and to a smaller degree *Altica* (Furth, 1981) have similar species groups relative to food plant family preference. The *Psylliodes* species groups exist in different regions of the world and it would be enlightening to study their other similarities, i.e. morphology, biochemistry, genetics, in order to understand better their phylogeny.

EVOLUTION

Leonardi (1970) proposed a phylogeny for 57 Palearctic species of *Psylliodes* based primarily on the spermatheca. Although the spermatheca is certainly an important character, it seems at this point difficult to interpret its morphology as primitive or advanced. The shape of the pump and receptacle do not have very elaborate variations, but the duct certainly does, and Leonardi is probably correct in interpreting the increased coiling as more advanced. However, there are discrepancies in his phylogenetic species groups based on the spermatheca, i.e. *cucullata* whose spermatheca is quite different with a very simple pump, receptacle and ductus, but would externally seem

to fit in exactly where Leonardi has placed it. In Leonardi's *affinis* group, the spermathecal form, especially the ductus, is quite consistent; however, the body form and food plant ecology of *sauleyi* (= *atriplicis*), *dilutella* Heikertinger, and *grigorievi* Jacobson are quite different and suggest they should form a separate group from *affinis* (Paykull) and *cupreata* (Duftschmid). Leonardi also included the frontal tubercles, another useful morphological character for many alticine genera, in his phylogenetic treatment but it seems to be less informative than spermathecae, and with several puzzling exceptions – *dulcamare* Koch has a quite different tubercle from *hyoscyami* of the same phylogenetic group (Leonardi, 1970, figs. 52, 53).

It is too early to consider the phylogeny of the entire genus *Psylliodes* until most of the approximately 140 world species can be studied using a greater variety of characters. Leonardi (1970) has made a valuable contribution towards this goal and provided a working foundation for additional information (including ecological, biochemical, and genetic) to be used in interpreting the evolution of *Psylliodes*.

Psylliodes have classically been placed at the end of catalogues (together with *Nonarthra*) and lists, implying advanced status, presumably because of the reduced number of antennal segments and the sub-apical insertion of the metatibiae. However, it may be that 10 antennal segments is more primitive than 11 (*Nonarthra* has 9) and that *Psylliodes* will be found to be a primitive alticine genus. *Psylliodes* has a rather unique morphology of the metafemoral spring also indicating a unique placement phylogenetically (Furth, 1982). Its present-day zoogeography being heavily centered in the Palearctic Region also implies a special evolutionary history, possibly more recent. It is apparent that this genus is at least morphologically unique; however, until genetic/biochemical and other studies are done, it cannot be considered definitely more advanced than other genera of Alticinae, many of which also have various morphological peculiarities.

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