

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

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ABSTRACT

Thirteen species of *Chaetocnema* Stephens are recorded from Israel. General and Israeli distribution and foodplants as well as the phenology in Israel are given for the 13 Israeli species. Distribution and foodplant information are also given for one species from Egypt that may eventually be recorded in Israel. Seven species are definite and 4 species are probable new records from Israel, 3 are new from Jordan and one from Cyprus. New observations on their biology in Israel are given. A key to all 14 species is given accompanied by genitalia figures. A brief discussion of zoogeography and foodplants is included.

KEY WORDS: Coleoptera, chrysomelidae, Alticinae, *Chaetocnema*, Israel, zoogeography, foodplants.

INTRODUCTION

The genus *Chaetocnema* Stephens, 1831 (Coleoptera: Chrysomelidae) is one of the larger genera of flea beetles (Alticinae) and one of the relatively few with a truly cosmopolitan distribution. A search of a few faunistic references reveals approximately 400 species worldwide with the following distribution: Nearctic = 32; Oriental = 43; Australian (+ Oceania) = 50; Palearctic = 58; Neotropical = 85; and Ethiopian = 125 (Csiki and Heikertinger, 1940; Laboissiere, 1942; Heikertinger, 1951; Scherer, 1962, 1962a; Gressitt and Kimoto, 1963; Scherer, 1969; Samuelson, 1973; Wilcox, 1975; Seeno, Scherer, and Corwin, 1976; Lopatin, 1977). It is apparent from these figures that the greatest concentration of *Chaetocnema* species diversity is in the tropical regions of Africa and South America. This unusually large concentration of extant species from these two major southern continents may indicate a Gondwanian origin of *Chaetocnema*, before the split of Africa and South America, in the middle to late Cretaceous Period, about 100 million years ago. *Chaetocnema* is a still relatively unknown genus in need of study in most regions, especially in the tropics, and many additional species will certainly be discovered in the future.

There have been few studies concerning *Chaetocnema* alone, but it has been included in many regional faunistic surveys along with other alticine genera. The only notable revisionary work on *Chaetocnema* during this century has been by Bryant (1928) for tropical Africa and Heikertinger (1951) for the eastern (including some Oriental) and western Palearctic Region. There has been no research on the *Chaetocnema* fauna of the Middle East, although a preliminary list was established by

Furth (1976). Bodenheimer (1937:148) listed five species from Palestine, but two of these (*C. schlaeflii* Stierl. and *C. aridula* Gyllenhal) were certainly misidentifications of *C. major* and *C. aerosa*, respectively. *Chaetocnema concinna* listed by Bodenheimer was also a questionable record because of its present-day rarity (only known from Mt. Hermon) and probably was a misidentified *C. tibialis* or *C. scheffleri*. *C. hortensis* and *tibialis* are also questionable records (see species remarks below). The present study concerns 13 species recorded in present-day Israel and one potential immigrant from Egypt. A key to all 14 species is included. In several cases either Syria or Jordan are recorded in the literature even though the exact locality is in present-day Israel. To be consistent and current, these are considered here as new to Israel.

Chaetocnema is usually divided into two subgenera (*Chaetocnema sensu stricto* and *Tlanoma* Motschulsky, 1845) (see key below). Although *Chaetocnema* s.s. is more widespread worldwide, *Tlanoma* is not only limited to the Palearctic and Ethiopian Regions, as implied by Seeno and Wilcox (1982). *Tlanoma* is also found in the Oriental (Scherer, 1969) Oceanic (Samuelson, 1973), and apparently in the Nearctic and Neotropical Regions (Heikertinger, 1951:32).

Morphologically *Chaetocnema* is distinctive, with the middle and hind tibiae strongly excavated on the preapical, outer dorsal margin. This excavation has a dense row of bristle-like setae and the mesal part is raised into a dorsal-projecting tooth. Only a few other alticine genera in the world have any such excavation of the tibiae, e.g. *Blepharida* Chevrolat, *Podontia* Dalman, *Ophrida* Chapuis, *Oedionychus* Berthold, and of these only *Blepharida* occurs in Israel. *Blepharida* species are larger (6-9 mm) than *Chaetocnema* (1.5-4.0 mm) and have patterned elytra (reddish-brown longitudinal stripes or blotches on a yellow background). The body shape of *Chaetocnema* is also rather distinctive being rounded, convex, somewhat barrel-like. Many species are metallic colored and most have the elytral puncture striae in discrete rows. Male aedeagus and female spermatheca morphology (illustrated below for each species) is definitive in separation of species. This study follows the treatment and methodology used in the previous studies of Israeli Alticinae (Furth, 1979, 1980, 1980a, 1981, 1984).

I am pleased and honored to be able to dedicate this paper to Prof. Joshua Kugler. He has influenced my career as a research entomologist as well as personally. He has certainly been a major influence on biological teaching and research in Israel as well as internationally.

ISRAELI SPECIES OF *CHAETOCNEMA*

In this study the complete known distribution of each species is given based on the literature as well as on specimens examined by the author from various collections. These collections are abbreviated as follows: BMNH = British Museum (Natural History), London; BZMH = Zoologische Museum der Humboldt-Universität, Berlin; MF = Museum G. Frey, Tutzing/München; MNP = Museum National d'Histoire Naturelle, Paris; MT = Museum of Turku University, Turku, Finland; MVe = Museo Civico di Storia Naturale Verona, Italy; MBG = Museum Beit Gordon (Palmoni Collection), Kibbutz Deganya A, Israel. Specimens collected by the author during this study are deposited in the entomological collection of the Department of Zoology, Tel

Aviv University and in the collection of the author.

All recorded distribution is from Heikertinger (1951) 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); Eth = Ethiopian. The affinity designation includes general distribution and local ecological considerations and does not include minor extensions into adjacent areas that may be recorded in the distribution section. The abbreviations used for Israeli distribution refer to the following geographical areas: MH = Mt. Hermon, with elevation (meter); 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.

Foodplant information is given as recorded in the literature; all recorded foodplants are from Heikertinger (1925) unless otherwise indicated. The authors of Israeli foodplants can be obtained from Zohary (1977), and non-Israeli plants in most cases from the indicated references. Israeli foodplants are all from the author's field research and they are listed approximately in a decreasing order of preference. The plant family associations for the genera mentioned in both the recorded and Israeli foodplant sections are: AMARANTHACEAE – *Amaranthus*, CHENOPODIACEAE – *Atriplex*, *Beta*, *Camphorosma*, *Chenopodium*, *Salicornia*, *Salsola*, *Spinacia*, CYPERACEAE – *Carex*, *Cyperus*, *Eleocharis*, *Scirpus*, GRAMINEAE – *Agrostis*, *Alopecurus*, *Bromus*, *Calamagrostis*, *Chloris*, *Dactylis*, *Festuca*, *Hordeum*, JUNCACEAE – *Juncus*, POLYGONACEAE – *Fagopyrum*, *Polygonum*, *Rheum*, *Rumex*, TYPHACEAE – *Typha*. The season consists of the range of dates collected in Israel only (unless otherwise indicated).

Chaetocnema aerosa (Letzner, 1846)

Distribution: N., Mid, E. Europe from mid-Scandinavia, Finland, west to mid-France, south to Alps; Spain; ? Italy; N. Balkans; Yugoslavia (Gruev, 1979); USSR (Russia), Egypt (form *latipennis* Pic), Israel (new). ES.

Israeli Distribution: GH; UG; CCP; JV.

Recorded Foodplants: *Scirpus ovatus* (Heikertinger, 1951).

Israeli Foodplants: unknown.

Season: 24 April – 27 June; 12 September, 15 December.

Chaetocnema batophiloides Abeille, 1909

Distribution: Algeria; Sudan; Palestine (= Jordan). SA.

Israeli distribution: DS (MF).

Recorded Foodplants: *Atriplex halimus* (Heikertinger, 1951), *Salsola vermiculata* (Peyerimhoff, 1911).

Israeli Foodplants: unknown.

Season: 10 March (MF – Jericho); 29 April (MNP – Algeria).

Chaetocnema bilunata Demaison, 1902

Distribution: Egypt; Sudan; Chad and Zaire (Scherer, 1972). SA.

Israeli Distribution: not yet recorded.

Recorded Foodplants: cotton, grass, sugar cane, probably Chenopodiaceae (Heikertinger, 1951).

Chaetocnema chlorophana (Duftschmid, 1825)

Distribution: N. and W. France; Austria; Czechoslovakia; S. Poland; Hungary; Rumania; Bulgaria (Warchalowski, 1974); Yugoslavia (Gruev, 1979); Greece (Mohr, 1965); european Turkey.

variation *pelagica* Caillol: Iberian Peninsula, S. France, Balearics, middle and S. Italy, Sardinia; Sicily; Morocco to Tunisia; asian Turkey; Syria; Iraq; Palestine (= Israel, LG) (Sahlberg, 1913 and MT). Med.

Israeli Distribution: MH (1900); GH; UG; LG; C; YV; JV; S.

Recorded Foodplants: *Calamagrostis epigeos*; *Carex* (Normand, 1937); *Calamagrostis arundinacea*, *Dactylis glomerata*, *Festuca pratensis*, *Alopecurus pratensis*, *Scirpus holoschoemus*, *Carex vulpina*, *Juncus* sp. (Nonveiller, 1978).

Israeli Foodplants: *Cyperus longus*, *Cyperus* spp., *Carex stenophylla* (?).

Season: found in all months of the year.

Remarks: Notes by Heikertinger in his collection at the Museum G. Frey say that he considered the three aberrations described from Iraq by Weise (*amoena*, *kolbei*, *laeta*) and *syriaca* Demaison from Syria as synonymous with *pelagica*. Heikertinger apparently ultimately considered *pelagica* as a Mediterranean form of *chlorophana*. I agree that *pelagica* is only a more brightly metallic colored form of *chlorophana* and not a true species or subspecies.

Chaetocnema concinna (Marshall, 1802)

Distribution: N. and Mid Europe, south to Pyrennes; ? Balearic Isl.; Mid Italy; Yugoslavia (Gruev, 1979); Bulgaria (Mohr, 1969); Rumania (Konnerth-Ionescu, 1963); Albania; asian Turkey; USSR (Caucasus, Siberia, Ussur region = SE USSR); Japan; Kazakh SSR, Turkmen SSR (Lopatin, 1977); Korea, China (Gruev, 1977); Israel (? new). ES.

Israeli Distribution: MH (1900-2000).

Recorded Foodplants: *Rumex maritimus*, *R. obtusifolius*, *R. silvester*, *R. crispus*, *R. arifolius*, *R. acetosa*, *Polygonum amphibium*, *P. lapathifolium*, *P. persicaria*, *P. mite*, *P. aviculare*; *Rumex hydrolapathum*, *Polygonum hydropiper* (Jolivet, 1967);

Rheum rhaponticum, *Fagopyrum tataricum*, *Beta vulgaris* (Fogato and Leonardi, 1980).

Israeli Foodplants: unknown.

Season: 22 May – 27 June, 8 August.

Remarks: Recorded by Bodenheimer (1937) in Palestine, but apparently misidentified.

Chaetocnema conducta (Motschulsky, 1838)

Distribution: Iberian Peninsula; north to S. England; S. France; all Italy (Fogato and Leonardi, 1980); Austria, Czechoslovakia; Hungary; Rumania; Yugoslavia (Gruev, 1979); Bulgaria, Albania, Greece (Mohr, 1965); USSR (S. Russia, Caucasus, Armenia, Turkmen, Kazakh); Tadzhik SSR (Lopatin and Tadjibaev, 1972); Kirgiz SSR (Lopatin, 1977); Iran (Warchalowski, 1973); Turkey; Syria, Med. Islands; N. Africa – Morocco to Egypt; Tanzania (Kilimandjaro); Kenya (Furth, 1985); Ethiopia, Zaire (Scherer, 1972); S. Africa (BMNH); Israel (new). Med/ES/Eth.

Israeli Distribution: CCP.

Recorded Foodplants: *Eleocharis palustris* (Peyerimhoff, 1915); *Carex* sp. (Jolivet, 1966, Lopatin, 1977); *Carex vulpina* (Nonveiller, 1978); *Carex panicea*, *C. pallescens*, *Scirpus maritimus*, *Agrostis alba*, *A. tenuis*, (Fogato and Leonardi, 1980); *Juncus acutus* (Tölg, 1938).

Israeli Foodplants: sweeping ? *Carex*, ? *Chloris gayana*.

Season: 7-26 October.

Chaetocnema coyei (Allard, 1863)

Distribution: SE Europe; Rumania; european and asian Turkey; Greece, USSR (S. Russia, Caucasus, Armenia); Bulgaria (Mohr, 1969); Yugoslavia (Warchalowski, 1976); Iran (Warchalowski, 1973); Iraq; Syria; Cyprus (new – BMNH); Jordan (new – MVe); Israel (? new – see remarks below). E. Med/ES.

Israeli Distribution: MH (1400-1600); GH; ? LG (Sahlberg, 1913) – see remarks below; C; JF; CCP.

Recorded Foodplants: *Scirpus maritimus*, *Carex vulpina* (Tölg, 1938).

Israeli Foodplants: *Cyperus longus*, *Cyperus* spp., *Scirpus* sp., *Carex divisa*, *C. otrubae*, *Hordeum bulbosum*.

Season: all months of the year.

Remarks: Sahlberg (1913) recorded this species from along the Kishon River (LG); however, it was not listed by Bodenheimer (1937). Heikertinger listed Palestine in the catalogue (1940), but that could have been either present-day Israel or Jordan. Heikertinger did not list either place in his more recent and comprehensive monograph (1951) on the genus; therefore, Sahlberg's record may have been an erroneous identification. The author has not found any specimens of this species in the Sahlberg collections borrowed from Turku University or University of Helsinki.

Chaetocnema delarouzei (Ch. Brisout, 1884)

Distribution: Algeria; Tunisia (MF); Morocco (Madar and Madar, 1964); Jordan (Jericho); Israel (new). SA.

Israeli Distribution: JV (from Gilgal to Kfar Ruppin, Bet Zera, Deganya); DS.

Recorded Foodplants: *Atriplex halimus* (Peyerimhoff, 1911).

Israeli Foodplants: *Atriplex halimus*.

Season: 14 February – 15 June.

Remarks: This species co-exists on its foodplant with *Psylliodes saulcyi* Allard (see Furth, 1984:46) in an interesting sympatry. All of the locations for this species in Morocco, Algeria, and Tunisia are either along the Mediterranean coast or in a lowland depression; the populations seem to be endemic disjunctions. Madar and Madar (1964) first re-established the species status of this taxon based primarily on the form of the aedeagus; it had been considered only a variation or form of *C. tibialis* (Heikertinger, 1951). There are also other differences: antennae entirely yellow except ultimate and sometimes penultimate segments dark; frontal punctures near eyes fewer in number (up to about 6 on each side) than *tibialis*, male aedeagus and female spermatheca different in form, and separate geographical distribution.

Chaetocnema hortensis (Geoffroy, 1785)

Distribution: all Europe, from Finland to Mediterranean; N. Africa and parts of Near East; in various forms across Central Asia to E. China; Rumania (Konnerth-Ionescu, 1963); Bulgaria (Mohr, 1969); Yugoslavia (Gruev, 1979); Albania (Mohr, 1965); Iran (Warchalowski, 1973); Iraq (Berti and Rappilly, 1973); Afghanistan (Kimoto, 1966); Mongolia (Lopatin, 1975); Chad (Scherer, 1961); Sudan, W. Aden Prot. (Scherer, 1972); Saudi Arabia (Doguet, 1985); Israel (? new – see remarks below). ES/IT/Med.

Israeli Distribution: MH (1400-1900); GH; UG; JV (MBG); SCP; SM.

Recorded Foodplants: *Phleum pratense*, *Hordeum bulbosum* (possibly *C. montenegrina* Heikertinger) (Tölg, 1938); cereal grain pests, grasses, *Cyperus esculentus* (Heikertinger, 1951).

Israeli Foodplants: unidentified grasses.

Season: 26 April – 16 December.

Remarks: This species was recorded in Palestine by Bodenheimer (1937), but not clearly from Israel or Jordan; however, the authority Heikertinger (1940, 1951) did not consider this record valid; this makes Bodenheimer's record questionable.

Chaetocnema major Jacqueline Duval, 1852

Distribution: Spain; S. France; Italy; Corsica; Rumania; Hungary; Yugoslavia; Turkey; USSR (S. Russia); Bulgaria, Kazakh SSR (Lopatin, 1977); Iran (Rappilly, 1978); Iraq; Syria (Jaffa); Israel (new). Med.

Israeli Distribution: GH, YV, C (BZMH) (det. as *schlaeflii*), NCP, CCP, JV.

Recorded Foodplants: *Scirpus maritima*, *Carex vulpina*, *Typha* sp. (Nonveiller, 1978); *Calamagrostis epigeios* (Tölg, 1938).

Israeli Foodplants: *Cyperus* sp., *Scirpus* sp., *Carex divisa*.

Season: 6 March – 17 June; 20 September.

Remarks: *C. major perrisi* (Bauduer, 1874) has been considered an eastern Mediterranean subspecies (Heikertinger, 1951), but it seems only to be a color variation from the typical form and there is no difference in aedeagus form.

Chaetocnema orientalis (Bauduer, 1874)

Distribution: Bulgaria (Gruev, 1975); Rumania; Greece, Corfu; european and asian Turkey; Iran (Rapilly, 1978); USSR (Caucasus, Georgia, Turkmen) (Lopatin, 1977); Syria; Jordan (new – MVe); Palestine (? = Israel) (Heikertinger, 1940); Israel (new). E. Med.

Israeli Distribution: GH; UG; LG; C; YV; JV; S; CCP; SCP; JF; JD; DS (J. Wahrman Collection, Jerusalem).

Recorded Foodplants: none.

Israeli Foodplants: *Cyperus longus*, *Cyperus papyrus*, *Cyperus* spp.

Season: all months of the year.

Chaetocnema scheffleri (Kutschera, 1864)

Distribution: Iberian Peninsula; S., Mid Italy; Balkans (N. Greece) north to Germany and Austria; Hungary; Bulgaria (Mohr, 1965); Yugoslavia (Gruev, 1979); USSR (S. Russia, Caucasus, ? Kazakh); Turkey; Iran (Warchalowski, 1973); Iraq (Rapilly, 1978); ? Syria; Algeria; Tunisia; Israel (new). ES/ Med.

Israeli Distribution: MH (1600); GH.

Recorded Foodplants: *Rumex pulcher*, *R. acetosella* (Peyerimhoff, 1926:361).

Israeli Foodplants: unknown.

Season: 28 April – 22 May.

Chaetocnema tibialis (Illiger, 1807)

Distribution: Iberian Peninsula; Mid Europe, north to Mid and W. France; SW Germany; S. Alps – Austria; Czechoslovakia; S. Poland; USSR (S. Russia, Caucasus, Kazakh); Rumania (Konnerth-Ionescu, 1963); Bulgaria (Warchalowski, 1974); Yugoslavia (Gruev, 1979); Turkey; Iran (Rapilly, 1978); Iraq; Turkmen SSR, S. Uzbek SSR, Tadjik SSR, Kirgisia SSR (Lopatin, 1977); Med. Isl.; Syria; Jordan (new – MT, MVe); Israel (? new – see remarks); Morocco to Egypt; Cyprus (BMNH). Med/ES/IT

Israeli Distribution: MH (1000-2000); GH; UG; LG; C; YV; S; JV; SCP; JF; JM; DS; CN.

Recorded Foodplants: *Beta vulgaris*, *Chenopodium album*, *Atriplex hastatum*, *Salicornia herbacea*, *Amaranthus blitum*, *Salsola kali*, *Atriplex patula*, *A. portulacoides*, *Salicornia fruticosa*, *Spinacia oleracea*, *Amaranthus hybridus* (allotrophy on Soybean, Sweetpotato, crucifers) (Jolivet, 1967), *Chenopodium glaucum*, *Amaranthus retroflexus* (Nonveiller, 1978), *Atriplex tatarica*, *A. halimus*, *Camphorosma ovata* (Heikertinger,

1951).

Israeli Foodplants: *Chenopodium album*, *C. morale*, *c. foliosum*, *Atriplex leucoelada*, *A. halimus*, *Amaranthus retroflexus*, *A. blitoides*, *A. arenicola*, *A. gracilis*, *Beta vulgaris*, *Spinacia*.

Season: all months of the year.

Remarks: Bodenheimer (1937) probably got the record of this species in Palestine from Sahlberg (1913), but apparently Sahlberg's record was *delarouzei* (MT) which was considered a form of *tibialis* until recently (see above). Bodenheimer collected specimens of *delarouzei* and labeled them: "Palestine, Jordan" (BMNH). Heikertinger (1940, 1951) clearly did not consider *tibialis* to be known from Palestine (Israel or Jordan). Thus, the true *tibialis* is technically a new record for Israel.

Chaetocnema wollastoni Baly, 1877

Distribution: S. Africa (Csiki and Heikertinger, 1940); Sudan, Ethiopia (Eritrea), Zaire (east) (Scherer, 1972); Saudi Arabia (Doguet, 1985); Israel (new). Eth Israeli Distribution: CCP.

Recorded Foodplants: none.

Israeli Foodplants: probably *Cyperus*, swept from *Cyperus* in swampy area.

Season: 21 April.

Remarks: Scherer (1961) records this species in Chad; however, two females determined by Scherer from Chad (examined by the author) proved not to be conspecific.

KEY TO ISRAELI CHAETOCNEMA

1. Nasal (frontal) carina evident (raised) between antennal bases; median portion of frons and vertex impunctate/smooth; elytral punctures arranged in regular rows (striae) (*Tlanoma*) 4
(*orientalis* and *conducta* in the subgenus *Tlanoma* have yellow-patterned elytra, and a broad, flat nasal carina with minute punctures covering most of the frons and vertex).
- Nasal carina absent or undeveloped and flat; frons and vertex punctate throughout; elytral striae variable (*Chaetocnema*) 2
2. Elytral punctures coarse and deep, all arranged in striae except a few near suture and scutellum; body shape oval and convex 3
- Elytral punctures weaker, not deeply depressed and not arranged into distinct striae (confused, especially anteriorly); body shape more elongate and somewhat flattened; Lb = 1.9-2.4 mm; genitalia (figs. 1a-c); *hortensis*
3. Confused elytral punctures just posterior to scutellum and nearest suture not extending posteriorly more than 1/4 of elytral length; background surface texture of head smooth or only lightly shagreened; body size usually larger (Lb = 2.1-2.5 mm); dorsum strongly metallic green or bronze; genitalia (figs. 2a-c) *wollastoni*
- Confused elytral punctures nearest scutellum extending past middle of elytra;

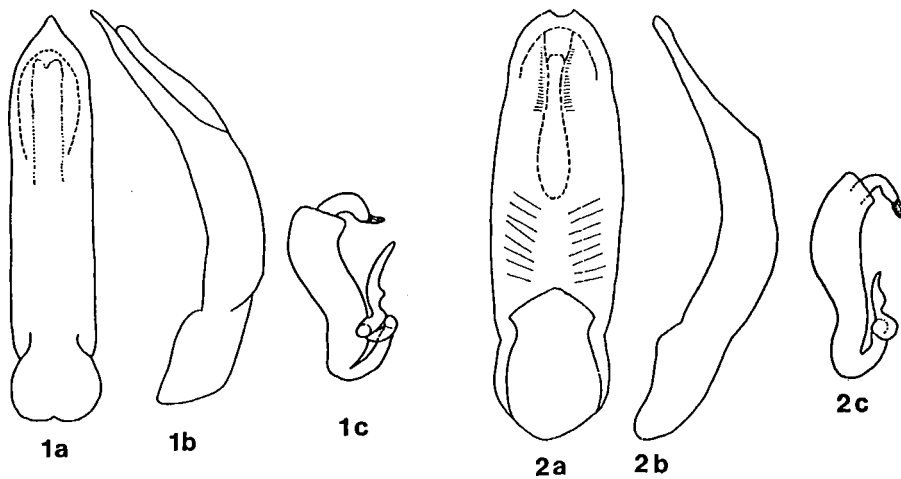


Fig. 1. *C. hortensis* a-b: Qusbiye, GH (0.84 mm). c: Mt. Hermon (1400 m) (0.39 mm).

Fig. 2. *C. wollastoni* a-b: Zaire (= Belgian Congo) (MF) (0.89 mm). c: Zaire (MF) (0.43 mm).

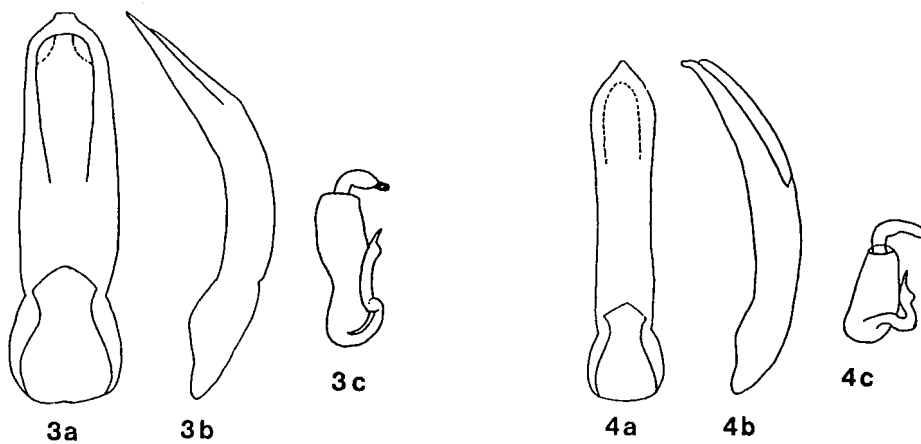
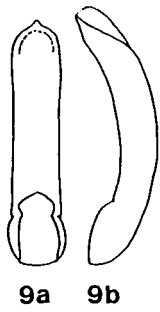
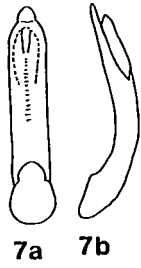
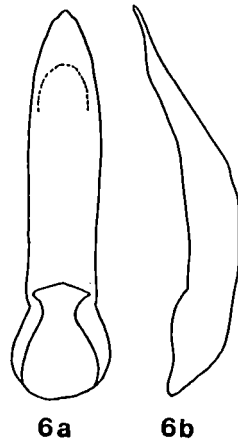
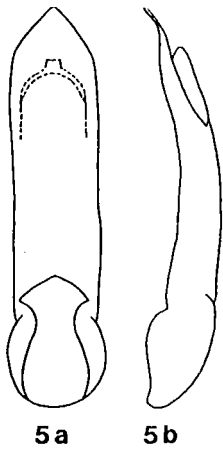


Fig. 3. *C. aerosaa* a-b: Mahanayim, UG (0.76 mm). c: Mahanayim (0.34 mm).

Fig. 4. *C. bilunata* a-b: Egypt, Saft (MF) (0.64 mm). c: Egypt, Luxor (MF) (0.24 mm).

All figures: a = male aedeagus ventral view; b = male aedeagus lateral view; c = female spermatheca lateral view. For all figures the Israeli locality and the actual length of the structure are given.



All figures: a = male aedeagus ventral view; b = male aedeagus lateral view; c = female spermatheca lateral view. For all figures the Israeli locality and the actual length of the structure are given.

- background surface texture of head very shagreened; body size smaller (Lb = 1.9-2.1 mm); dorsum not metallic; genitalia (figs. 3a-c) *aerosa*
4. Elytra mostly or partially yellow or yellow-brown 5
 – Elytra uniformly dark and/or metallic colored, not yellow or with yellow pattern 7
5. Each elytron with apical yellow (light brown) spot covering apical 1/5 or 1/4 of elytron, some also with tiny yellow spot sub-basally near median suture; nasal carina distinct, narrow and raised; only a small dorso-lateral cluster of punctures on vertex; Lb = 1.7-1.9 mm; genitalia (figs. 4a-c). (otherwise very similar to *tibialis*) *bilunata*
 – Each elytron without apical yellow spot; elytron yellow with sutural and lateral borders black; nasal carina broad, flat, somewhat indistinct; frons and vertex covered with many, very fine punctures, although a narrow median strip impunctate 6
6. Black sutural border broadened in basal 1/3 of elytron, covering 4 or 5 elytral striae (approx. 1/2 elytral width); punctation on head and pronotum very fine, almost indistinct; Lb = 1.7-2.1 mm; genitalia (figs. 5a-c); feeds on *Cyperus*
 *orientalis*
 – Black sutural border of elytron narrow basally, only covering 1 or 2 elytral striae; punctation of head and pronotum fine but distinct; Lb = 1.7-2.1 mm, genitalia (figs. 6a-c); usually feeds on *Carex* *conducta*
7. Head broad basally (behind the eyes) and baso-lateral part of head normally visible in dorsal view; body size large (3.0 mm and over); dorsum usually strongly metallic colored (i.e. bronze/copper, green, blue) 8
 – Head narrower basally and baso-lateral part generally not visible in dorsal view; body size smaller, less than 2.5 mm; dorsum generally black and not strongly metallic colored 10
8. Base of pronotum without a pair of sublateral, longitudinal depressions; frons and vertex mostly covered with many distinct punctures; elytral inter-striae space almost smooth with a few very fine punctures, only slightly rugose; dorsum usually metallic bronze, sometimes bluish; Lb = 2.7-3.8 mm; genitalia (figs. 7a-c) *coyei*
 – Base of pronotum with a pair of sublateral, longitudinal depressions; frons and vertex with few punctures; elytral inter-striae space either completely smooth or very rugose and punctate; dorsum metallic bronze or green, blue or copper . . . 9
9. Frons impunctate and vertex with only 7-10 fine, but distinct, punctures extending mesally from the postero-lateral margin of the eye, almost forming a narrow band of punctures across the vertex; elytral inter-striae surface completely smooth, without fine punctures or rugosity; dorsum usually strongly

Fig. 5. *C. orientalis* a-b: Netanya, CCP (0.80 mm). c: Netanya (0.22 mm).

Fig. 6. *C. conducta* a-b: Mikve Israel, SCP (0.69 mm). c: Mikve Israel (0.26 mm).

Fig. 7. *C. coyei* a-b: Qusbiye, GH (1.40 mm). c: Netanya (0.32 mm).

Fig. 8. *C. chlorophana* a-b: Ramat Magshimim, GH (1.0 mm).

Fig. 9. *C. major* a-b: Tel Aviv, CCP (1.39 mm). c: Tel Aviv (0.31 mm).

Fig. 10. *C. concinna* a-b: Mt. Hermon (1900 m) (0.84 mm). c: Mt. Hermon (1900 m) (0.15 mm).

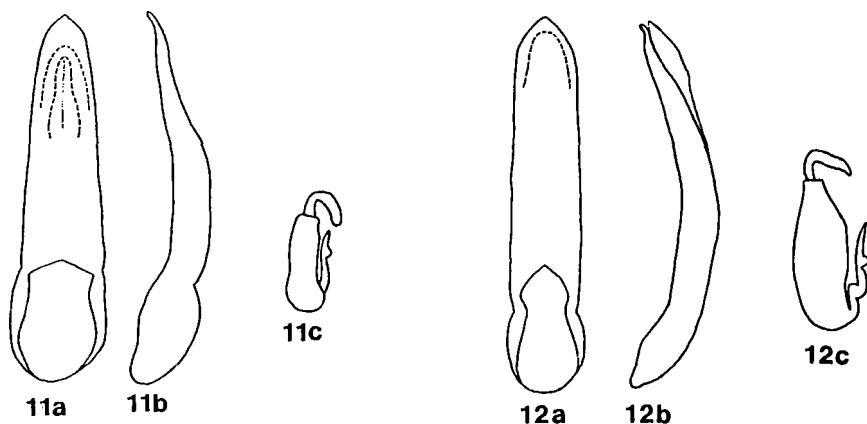


Fig. 11. *C. batophiloides* a-b: Jericho (MF) (0.69 mm). c: Jericho (MF) (0.21 mm).

Fig. 12. *C. scheffleri* a-b: Merom HaGolan, GH (0.73 mm). c: Merom HaGolan (0.32 mm).

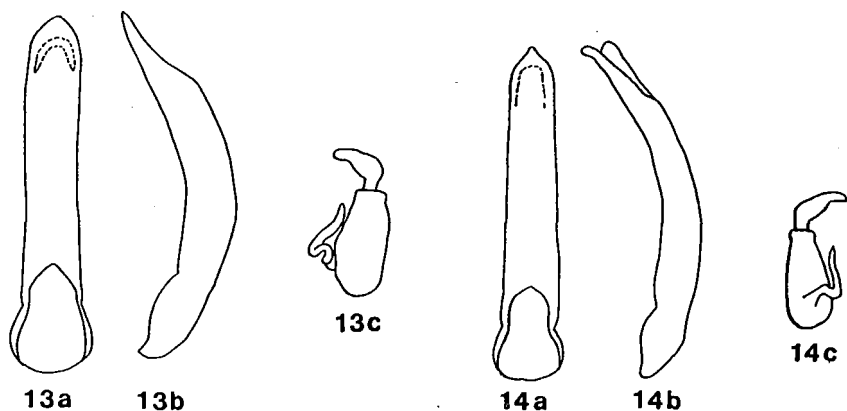


Fig. 13. *C. delarouzei* a-b: Jericho, JV (0.79 mm). c: Jericho (0.29 mm).

Fig. 14. *C. tibialis* a-b: Merom HaGolan, GH (0.67 mm). c: Merom HaGolan (0.26 mm).

All figures: a = male aedeagus ventral view; b = male aedeagus lateral view; c = female spermatheca lateral view. For all figures the Israeli locality and the actual length of the structure are given.

- metallic green, sometimes blue-green or copper; Lb = 2.6-3.5 mm; genitalia (figs 8a,b) (spermatheca same as 7c) *chlorophana*
- Frons impunctate and vertex appearing impunctate, but with a few, very fine (indistinct) punctures usually clustered near the eyes; elytral interstriae surface with dense, strong punctures and a strongly rugose texture that almost obscures the punctures of the striae; dorsum metallic bronze; Lb = 2.9-4.1 mm; genitalia (figs. 9a-c) *major*

10. Base of pronotum with a pair of sublateral (opposite the elytral stria just mesad of the humeral callus) approximately longitudinal depressions (sometimes faint); dorsal frontal lines deeply impressed; nasal carina distinctly raised and narrow; frontal punctures fewer (usually 6); dorsum of base of first antennal segment distinctly darkened; pronotum without metallic reflection; Lb = 1.9-2.2 mm; genitalia (figs. 10a-c) *concinna*
- Base of pronotum with no indication of sublateral depressions; dorsal frontal lines only faintly impressed or absent; nasal carina broad and flattened; other characters variable 11
11. Dorsal frontal lines completely absent; nasal carina entirely flattened and only faintly apparent; frons and vertex with many (more than 10) coarse punctures; dorsum of elytra somewhat elongate and flattened; base of elytra no wider than base of pronotum; elytral striae weak, punctures somewhat confused anteriorly; Lb = 1.5-1.8 mm; genitalia (figs. 11a-c) *batophiloides*
- Dorsal frontal lines apparent but often weak; nasal carina distinct, although broad and flattened; frons and vertex with fewer (6-10) fine punctures; dorsum of elytra more oval and distinctly wider at base than pronotum (distinct humeral calli); elytral striae strongly impressed 12
12. Pronotum longer and not strongly tapered anteriorly; punctures between elytral striae fine but distinct and appearing to be in longitudinal rows; basal 1/2 of first antennal segment with dorsum distinctly darkened; body shape elongate-oval and somewhat depressed; Lb = 1.9-2.3 mm; genitalia (figs. 12a-c) . . . *scheffleri*
- Pronotum short and broad (almost twice as wide as long), strongly tapered or constricted anteriorly; punctures between elytral striae extremely fine, often indistinct, confused, appearing as transverse rugosity; dorsum of first antennal segment entirely yellow or light brown; body shape distinctly oval and convexed 13
13. Antennae entirely yellow with only the last (apical) segment darkened, the penultimate segment sometimes partially darkened; few fine punctures (usually not more than 6) close to mesal margin of each eye; found only in Rift Valley localities; genitalia (figs. 13a-c); Lb = 1.7-2.2 mm *delarouzei*
- Apical 4 (5) antennal segments darkened; usually more than 8 fine punctures near mesal margin of each eye; found in all areas of Israel, especially in the north; genitalia (figs. 14a-c); Lb = 1.6-2.2 mm *tibialis*

ZOOGEOGRAPHY

The zoogeographic affinity of a species is often difficult to decipher because the current distribution may extend beyond its primary region of affinity into other areas, thus disguising true affinity. The zoogeographic affinity of each species is listed above and a detailed analysis of the Israeli fauna can be attempted in order to indicate possible historical zoogeographic origins of the *Chaetocnema* of the Middle East. The 13 species of *Chaetocnema* recorded in Israel contain 3 species with widespread zoogeographic affinities (three or more): *hortensis*, *conducta*, and *tibialis*. As explained in previous studies of the Israeli Alticinae (Furth, 1979, 1980a, 1981), it is more meaningful to eliminate these widespread species from analysis of the area to be

studied. Two other species (*coyei* and *scheffleri*) have biregional zoogeographic affinity (both involving the Mediterranean and Euro-Siberian subregions of the Palearctic) and, although less widespread, may be best to eliminate for the most meaningful zoogeographic analysis. The remaining eight species have uniregional zoogeographic affinity and are used for the following analysis of the Israeli fauna: Mediterranean (37.5%); Saharo-Arabian (25%); Euro-Siberian (25%); Ethiopian (12.5%). As with the previous studies of Israeli Alticinae, the Mediterranean affinity is dominant. The other Palearctic subregions show affinities somewhat similar to *Psylliodes* (Furth, 1984): significant influence from both the arid Saharo-Arabian (Eremian) areas as well as the cold northern Euro-Siberian areas and absence of central Asian Irano-Turanian influence.

Chaetocnema differs from other Israeli alticine genera studied until now (*Phyllotreta*, *Longitarsus*, *Altica*, *Psylliodes*) by the distinct presence of an Afrotropical (Ethiopian) element. This is not surprising considering that almost one third of the known species of *Chaetocnema* in the world are from the Ethiopian Region. However, the Alticinae fauna in Israel, and the entire Middle East, still does not demonstrate a strong affinity to tropical Africa, a pattern similar to certain other insect groups such as Diptera – Tachinidae (Kugler, 1963) and Tephritidae (Kugler and Freidberg, 1975). This is in contrast to other animal groups in Israel with high tropical African affinity (Furth, 1975). There is little endemism in Israeli *Chaetocnema* although a few taxa, e.g. *orientalis* and the local variety *major perrisi*, indicate a restriction to the eastern Mediterranean area while others (*batophiloides* and *delarouzei*) seem to be endemic disjunct populations. If, as indicated above by its world distribution, *Chaetocnema* is an old Gondwanian-originated group, then one might not expect to find the apparently relatively recent endemism displayed by some other alticine genera. Of course, this is only speculative until more regions of the world *Chaetocnema* fauna are studied in greater depth.

FOODPLANTS

The *Chaetocnema* species of Israel have been recorded on a few plant families and several of these foodplant families are related: Chenopodiaceae and Amaranthaceae; Polygonaceae; Cyperaceae, Juncaceae, and Typhaceae; Graminae. These are also the primary foodplant families for most of the European *Chaetocnema* (Heikertinger, 1925, 1951 and Mohr, 1966). Experience in the field in North American and in Africa (Kenya) indicates that at least Gramineae and Cyperaceae are also foodplant families in other regions (Furth, 1985 and unpublished). The larvae are presumably stem borers or feed on the rootlets of the foodplants. Field work (and literature search) for the present study revealed the following foodplant associations for *Chaetocnema* in Israel: Cyperaceae (7 species = 54%); Chenopodiaceae (3 species = 23%); Polygonaceae (2 species = 15%); and Gramineae (1 species = 8%).

Therefore, as with other flea beetle genera, it appears that *Chaetocnema* foodplant families are few in number, sometimes botanically (possibly chemically) related and that associations with these few foodplant groups are probably worldwide in scope. When more extensive foodplant associations are made for *Chaetocnema* in other regions, this will probably strengthen the above observations for the major plant

families (i.e. Gramineae, Cyperaceae, and Chenopodiaceae) and indicate possible phylogenetically related beetle species groups.

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