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**A new species of tiger beetle of the *Cicindela campestris* group
from southern Turkey,
with remarks on the identity of *C. herbacea* Klug, 1832
and other taxa related to *C. desertorum* Dejean, 1825**

(Insecta, Coleoptera, Cicindelidae)

Michael Franzen

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Several populations of tiger beetles of the *Cicindela campestris* group from southern Turkey and Lebanon were investigated with respect to morphometric ratios, male genitalia, and color patterns. As a result, *Cicindela herbacea* from Lebanon appears to be most closely related to *C. turkestanicoides* and *C. desertorum* from eastern Turkey. The full species status of these taxa is provisionally kept but future research is needed to clear their relations. Populations of a taxon from southern Turkey previously referred to *C. herbacea* represent a new species, which is described as *Cicindela thughurica*, spec. nov. The new species appears to be more closely related to *C. campestris*, but differs from the latter by smaller relative aedeagus length, the presence of complete middle bands, and a brownish-green dorsal coloration in most specimens. Syntopic occurrence of *C. herbacea* and *C. thughurica*, spec. nov. is shown to occur in the northern Amanus Mountains, Turkey. Parapatric occurrence of the new species and *C. campestris* is known from the Bolkar dağları.

Michael Franzen, Hauptstr. 1a, D-85467 Neuching, Germany

Introduction

The *Cicindela campestris* group of the Near East comprises the following taxa: *C. campestris pontica* Fischer, 1825, *C. campestris palustris* Motschulsky, 1840, *C. campestris suffriani* Loew, 1843, *C. herbacea* Klug, 1832, *C. desertorum* Dejean, 1825, *C. turkestanicoides turkestanicoides* Horn, 1938, *C. turkestanicoides perreaii* Deuve, 1987, and *C. talyschensis* Chaudoir, 1846 (e.g. Putschkov & Matalin 2003). The taxonomy of these taxa (belonging to “groupe V” sensu Rivalier 1950) in the Middle East is partly still insufficiently known. A major problem concerns the taxonomic status of the so-called *Cicindela* “*herbacea*” of southern Turkey, which specific status and relations are still under discussion (Korell 1988, 1994, Cassola 1999).

Cicindela herbacea has been described from Lebanon (Klug 1832, see also Baker 1997). Subsequently, the name has been referred to various populations of green tiger beetles of the Near East (e.g. Israel, Turkey, “Armenia”, Cyprus: Horn & Roeschke 1891, Horn 1926, 1930, Mandl 1944, 1963, Nussbaum 1987, Korell 1988, Wiesner 1992, Korell 1994, Cassola 1999). Prior to Mandl (1944), who states only very shortly that the taxon requires a specific status, *herbacea* has been regarded as a subspecies of *C. campestris*. Most authors followed Mandl and treated *herbacea* as a separate species (e.g. Werner 1991, Wiesner 1992, Cassola 1999, Putschkov & Matalin 2003). However, its species status has been questioned by Korell (1988, 1994). The author mentioned several populations which appeared to be transitional between

C. campestris and *C. herbacea* and therefore proposed to regard *herbacea* only as a subspecies of *C. campestris* (Korell 1994). Finally, Cassola (1999) again recognized *herbacea* as a full species, because of significant morphological differences to *C. campestris* (*C. "herbacea"* with a smaller, narrower head and pronotum and the presence of a complete, subtransversal, acutely bent middle band). However, Cassola also stated that *campestris* × *herbacea* intergrades may occur in the Antalya province of southwestern Turkey.

During the last years I was able to collect series of all Anatolian taxa of the *Cicindela campestris* group, as well as to study material of *Cicindela herbacea* from Lebanon. The results of these investigations yield a different view on the taxonomy of the green tiger beetles of the genus *Cicindela* of the Levant and southern Turkey.

Material and Methods

Material of a *Cicindela* from southern Anatolia formerly referred to *C. herbacea* (e.g. Korell 1988, 1994, Cassola 1999) was compared to several morphologically similar taxa of the *Cicindela campestris* group of Turkey and the Levant. Since the taxonomy of the Near Eastern subspecies of *C. campestris* (nominal taxa *C. campestris pontica*, *C. c. palustris*, *C. c. suffriani*) urgently needs a revision, I use the term "*C. campestris*" for a morphotype occurring in the Taurus Mountains of Turkey, from the southern Aegean coast in the west to Erzincan province in eastern Anatolia (Franzen, unpublished data).

"True *C. herbacea*" are represented by a sample from near Bcharré (northern Lebanon). Specimens from this locality perfectly match the illustration of the type specimen given by Klug (1832, pl. 21, fig. 1), with respect to body proportions and elytral design. The female type of *C. herbacea* has been collected by C. G. Ehrenberg and W. F. Hemprich "in ora Syria prope Berytum". According to Baker (1997: 171-172), Ehrenberg and Hemprich crossed the Lebanon Mountains twice, on the first occasion near Djebel Sanin and on the second at Mount Lebanon/Bcharré. Since *C. herbacea* is supposed to be restricted to medium and high elevations (see below) the type is most probably originated from one of these localities.

For statistical analysis, samples were aggregated as follows (see also Fig. 1 and Appendix for exact localities and collection data): "*C. sp.*" (Fig. 2): 71 specimens (39 males, 32 females) of so-called *C. "herbacea"* from scattered localities in southern and southeastern Anatolia; "**Sertavul**" (Fig. 3): 29 specimens (16 males, 13 females) from the area of the Sertavul pass in the central Taurus Mountains. Ko-

rell (1988, 1994) and Cassola (1999) mentioned *C. "herbacea"* or *C. campestris* × *C. "herbacea"* intergrades to occur at this locality; "**Hasan**" (Fig. 4): 25 specimens (18 males, 7 females) of *C. campestris* from the northeastern slope of the Hasan dağ massif in Central Anatolia; "**Bcharré**" (Fig. 5): 17 specimens (10 males, 7 females) of *C. herbacea* from the area of Bcharré/Les Cedres at Mount Lebanon; "**Zorkun**" (Fig. 6): 18 specimens (10 males, 8 females) of *C. cf. herbacea* from the environments of Zorkun village in the northern Amanus mountains (Turkey); "**Darboğaz**" (Fig. 7): 20 specimens (10 males, 10 females) of *C. cf. herbacea* from the environments of Darboğaz village at the northern slope of the Bolkar dağları in the central Taurus Mountains; "**Pontus**" (Fig. 8): 40 specimens (19 males, 21 females) of *C. desertorum* from Ovit and Zigana passes in the eastern Pontus Mountains, northeastern Anatolia; "**Van**" (Fig. 9): 24 specimens (17 males, 7 females) of *C. turkestanicoidea perreai* (sensu Cassola 1999) from Karabet and Kuskun Kiran passes south of Lake Van, eastern Taurus Mountains, southeastern Anatolia.

In addition, material of *C. campestris* from various localities in the Taurus Mountains west of the Sertavul pass (see Appendix for detailed locality data) was compared to the group "*C. sp.*", with respect to their elytral markings and coloration.

Measurements taken are: total length (TL, without labrum); head width (HW, across the widest point on the eyes); pronotum length (PL); maximum pronotum width (PWm); basal pronotum width (PWb); elytral length (EL, from scutellum to apex); humeral elytral width (EWh, width of left + right elytron at base, usually at the apical end of the humeral lunule); maximum elytral width (EWm, width of left + right elytron, usually at the middle band); aedeagus length (AL, in a straight line from apex to basal orifice); number of scapal setae (SS, on first antenna segment, except apical sensories; mean of left and right antenna). In addition, the following ratios were calculated: HW/TL (relative head width); HW/PWm (relation of head width and maximum pronotum width); PL/TL (relative pronotum length); PL/PWm (relation of pronotum length and width); PWm/PWb (degree of lateral pronotum curvature); EL/TL (relative elytral length); EWm/TL (relative elytral width); EWm/EL (relation of maximum elytral width and length); EWh/EWm (degree of lateral elytral curvature); AL/EWm (aedeagus length in relation to maximum elytral width).

The above mentioned 10 morphometric ratios plus the characters TL and SS were analysed statistically. Because of possible sex dependent variation, analysis was run separately for males and females. Analysis was done using SPSS for Windows. Groups

mean values were z-transformed and Squared Euclidean distances were clustered using Ward's method.

Collection acronyms are: CFO (Coll. M. Franzen, Oberneuching), CHS (Coll. W. Heinz, Schwanfeld), ZSM (Zoologische Staatssammlung München).

Results and Discussion

1. Morphological analysis

Morphometry. According to the morphometric analysis (comparison of mean values), the investigated groups can be divided into two subgroups (Tabs 1, 2) which correspond to the two major clusters shown in Figure 10. One subgroup comprises the samples "C. sp.", "Sertavul", and "Hasan" (followingly named *C. campestris* subgroup = *ca*), the other comprises the samples "Bcharré", "Zorkun", "Darbogaz", "Pontus", and "Van" (*C. desertorum* subgroup = *de*).

Distinguishing characters between these subgroups are that specimens of the *campestris* subgroup have broader pronota compared to head width (HW/PWm males ≤ 1.15 vs. ≥ 1.20 in *de*; females ≤ 1.13 vs. ≥ 1.15 in *de*), longer pronotal lengths in males (PL/TL 0.18 vs. ≤ 0.18 in *de*), posteriorly more narrowed pronota (PWm/PWb males ≥ 1.24 vs. ≤ 1.23 in *de*; females ≥ 1.28 vs. ≤ 1.29 in *de*), longer elytra in females (EL/TL ≤ 0.62 vs. ≥ 0.62 in *de*), broader bodies with less parallel-sided elytra (EWm/TL males ≥ 0.43 vs. ≤ 0.41 in *de*; females ≥ 0.43 vs. ≤ 0.43 in *de*; EWm/EL males ≥ 0.69 vs. ≤ 0.67 in *de*; females ≥ 0.70 vs. ≤ 0.69 in *de*), and shorter aedeagus lengths (AL/EWm ≤ 0.79 vs. ≥ 0.90 in *de*) (see also Fig. 11).

Within the *C. campestris* subgroup, "Sertavul" and "Hasan" samples are mostly identical or at least very weakly differentiated (characters and ratios TL, HW/TL, HW/PWm, PL/TL, EL/TL, EWm/TL, EWh/EWm, AL/EWm, SS in males; TL, HW/TL, HW/PWm, PL/TL, PL/PWm, EL/TL, EWh/EWm, SS in females). In contrast, the sample "C. sp." seems to form a sister group to the Sertavul/Hasan (= S/H) groups, with the "C. sp." sample having smaller total lengths (TL males 10.9 vs. ≥ 12.4 in S/H; females 11.8 vs. ≥ 13.3 in S/H), broader heads (HW/TL males 0.27 vs. 0.26 in S/H; females 0.28 vs. 0.26 in S/H; HW/PWm males 1.15 vs. ≤ 1.10 in S/H; females 1.13 vs. ≤ 1.08 in S/H), less broader pronota (PL/PWm males 0.76 vs. ≤ 0.75 in S/H; females 0.71 vs. ≤ 0.70 in S/H), shorter elytra in males (EL/TL 0.61 vs. 0.62 in S/H), shorter aedeagus lengths (AL/EWm 0.79 vs. ≥ 0.81 in S/H; Fig. 11), and more scapal setae (SS males 2.4 vs. ≥ 3.4 in S/H; females 1.9 vs. ≥ 2.4 in S/H).

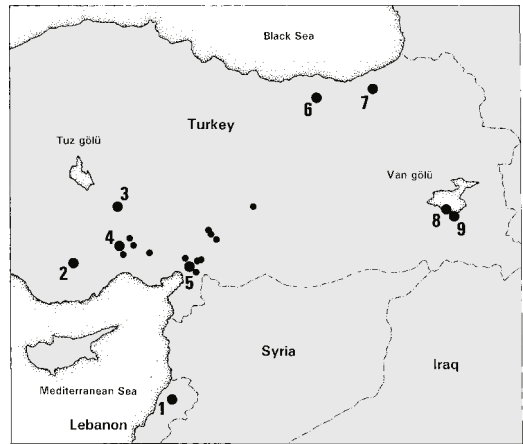


Fig. 1. Collection sites of tiger beetles of the *Cicindela campestris* group used for statistical analysis. Large dots: 1 - Bcharré; 2 - Sertavul pass; 3 - Hasan dağ; 4 - Darbogaz; 5 - Zorkun; 6 - Zigana pass ("Pontus"); 7 - Ovit pass ("Pontus"); 8 - Kuskun Kiran pass ("Van"); 9 - Karabet pass ("Van"). Unnumbered small dots represent localities of "C. sp." aggregated for analysis (see Fig. 13 for exact localities).

Within the *C. desertorum* subgroup, differences between samples are weak and relations are partly sex depending. However, among the five geographical samples, "Van" appears to be unique in possessing the highest mean values for males in the ratios HW/PWm (narrow pronota compared to head width), EL/TL (longest elytra), AL/EWm (longest aedeagi; Fig. 11), while females exhibit lowest means in EWm/TL and HW/TL (narrow elytral and head width). Both sexes of the "Van" sample possess lowest mean values in EWm/EL (narrow and elongate elytra).

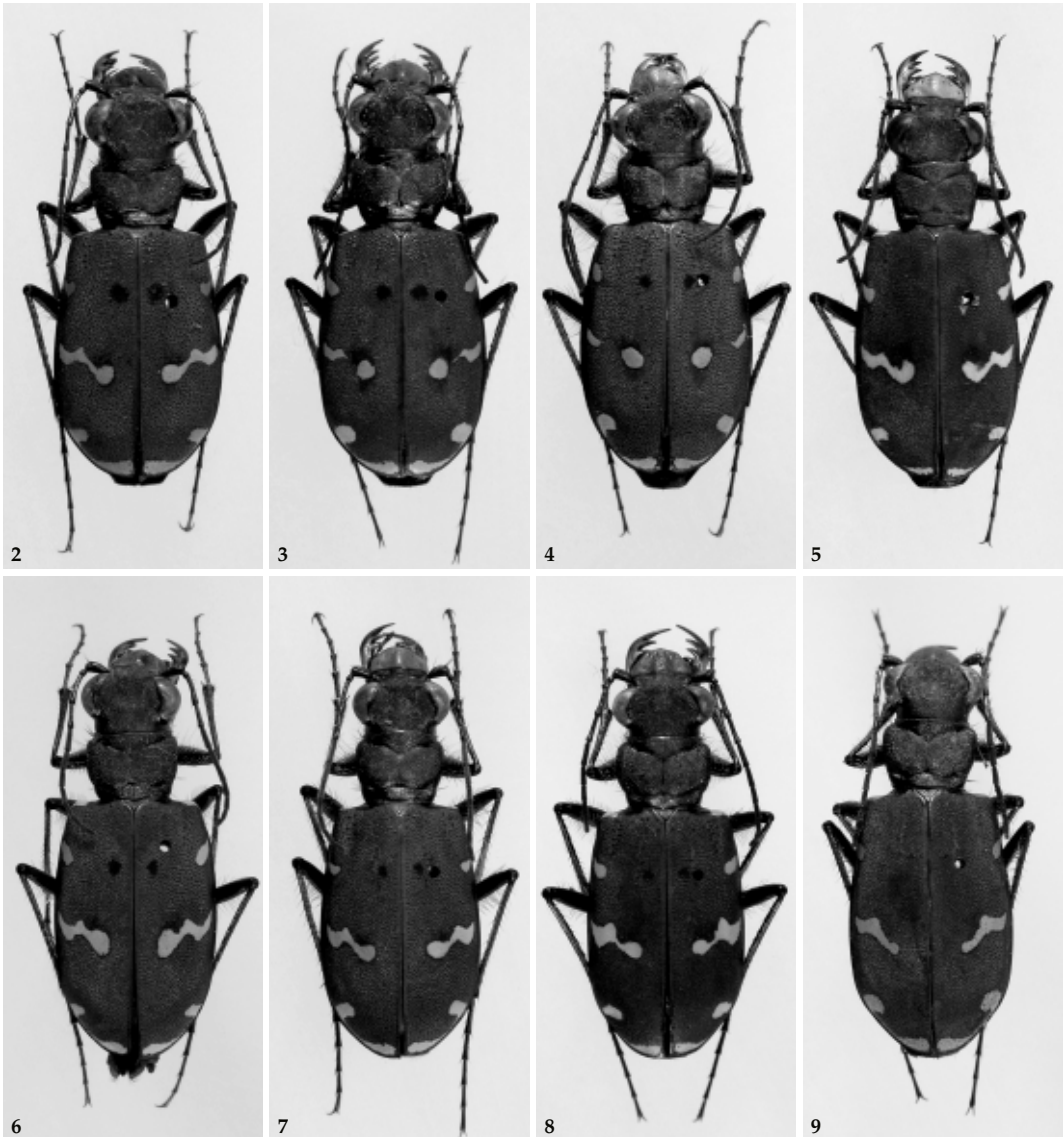
The remaining samples appear less differentiated since mean values largely overlap. In males, the southern samples "Bcharré", "Zorkun", "Darbogaz" are clustering cloth together and form a clade opposite to the "Van", based on similar or identical values in the ratios HW/PWm (relation of head width and maximum pronotum width), EL/TL, EWm/TL (elytral length and width in relation to total length), EWm/EL (elytral proportions), and AL/EWm (aedeagus length in relation to maximum elytral width). Moreover, there seems to be a clinal trend for the ratios HW/PWm (males + females), PL/PWm (females), and EWm/EL, with lowest values in the southernmost population (Bcharré), intermediates in Zorkun and highest values in the northernmost population (Darbogaz).

Tab. 1. Morphometrics of male tiger beetles of the *C. campestris* group. See "Material and Methods" for abbreviations. First line: mean ± standard deviation; second line (in parentheses): range.

	n	TL	HW/TL	HW/PWm	PL/TL	PL/PWm	PWm/PWb	EL/TL	EWm/TL	EWm/EL	EWm/TL	EL/TL	EWm/TL	EWm/EL	EWm/EL	AL/EWm	SS
<i>C. sp.</i>	39	10.9±0.6 (9.8-11.8)	0.27±0.01 (0.26-0.29)	1.15±0.04 (1.09-1.24)	0.18±0.01 (0.17-0.19)	0.76±0.03 (0.70-0.81)	1.25±0.04 (1.17-1.34)	0.61±0.01 (0.58-0.62)	0.43±0.01 (0.41-0.44)	0.70±0.02 (0.67-0.74)	0.80±0.01 (0.76-0.83)	0.79±0.03 (0.72-0.86)	2.4±1.3 (0.5-0)				
Sertavul	16	12.7±0.4 (11.8-13.5)	0.26±0.00 (0.25-0.27)	1.10±0.03 (1.06-1.15)	0.18±0.01 (0.17-0.19)	0.75±0.02 (0.73-0.81)	1.24±0.05 (1.14-1.33)	0.62±0.01 (0.60-0.65)	0.43±0.01 (0.41-0.47)	0.69±0.03 (0.64-0.76)	0.80±0.03 (0.74-0.86)	0.81±0.03 (0.76-0.86)	3.4±2.4 (0.8-0)				
Hasan	18	12.4±0.4 (11.7-12.9)	0.26±0.01 (0.25-0.28)	1.06±0.03 (1.00-1.13)	0.18±0 (0.17-0.19)	0.72±0.03 (0.67-0.77)	1.26±0.04 (1.19-1.35)	0.62±0.01 (0.60-0.63)	0.44±0.01 (0.42-0.46)	0.71±0.02 (0.66-0.75)	0.80±0.02 (0.74-0.84)	0.83±0.03 (0.80-0.89)	5.1±2.5 (0.5-11.0)				
Bcharré	10	12.0±0.4 (11.5-12.8)	0.26±0.01 (0.25-0.26)	1.20±0.04 (1.16-1.25)	0.16±0.01 (0.16-0.17)	0.72±0.03 (0.68-0.76)	1.23±0.03 (1.18-1.29)	0.62±0.01 (0.60-0.64)	0.41±0.01 (0.40-0.43)	0.67±0.01 (0.65-0.69)	0.80±0.01 (0.78-0.82)	0.92±0.03 (0.88-0.98)	2.5±1.0 (1.0-4.0)				
Zorkun	10	11.8±0.2 (11.5-12.3)	0.26±0.01 (0.25-0.26)	1.21±0.03 (1.16-1.29)	0.17±0.01 (0.16-0.18)	0.77±0.04 (0.71-0.83)	1.19±0.03 (1.11-1.23)	0.62±0.01 (0.60-0.63)	0.41±0.01 (0.40-0.42)	0.66±0.02 (0.64-0.69)	0.79±0.02 (0.77-0.84)	0.98±0.03 (0.93-1.03)	2.6±1.1 (1.0-5.0)				
Darbogaz	10	12.1±0.4 (11.4-12.6)	0.25±0.01 (0.24-0.26)	1.23±0.03 (1.19-1.27)	0.17±0 (0.16-0.18)	0.75±0.03 (0.70-0.79)	1.20±0.03 (1.15-1.24)	0.62±0.01 (0.61-0.64)	0.41±0.01 (0.40-0.42)	0.65±0.02 (0.63-0.68)	0.79±0.02 (0.77-0.84)	1.0±0.03 (0.94-1.03)	4.1±1.5 (1.5-6.0)				
Pontus	19	13.3±0.5 (12.0-13.8)	0.26±0.01 (0.24-0.27)	1.24±0.04 (1.14-1.31)	0.18±0 (0.17-0.19)	0.76±0.03 (0.69-0.81)	1.23±0.06 (1.12-1.36)	0.61±0.01 (0.60-0.62)	0.41±0.01 (0.39-0.43)	0.67±0.02 (0.64-0.72)	0.82±0.02 (0.79-0.85)	0.90±0.03 (0.87-0.99)	3.7±1.5 (1.0-6.3)				
Van	17	13.4±0.7 (12.5-14.6)	0.25±0.01 (0.24-0.26)	1.25±0.03 (1.19-1.32)	0.17±0.01 (0.16-0.18)	0.77±0.03 (0.69-0.81)	1.20±0.04 (1.14-1.26)	0.63±0.01 (0.61-0.64)	0.40±0.01 (0.38-0.42)	0.64±0.02 (0.61-0.67)	0.79±0.02 (0.76-0.83)	1.04±0.04 (0.97-1.10)	3.4±1.8 (0.7-0)				

Tab. 2. Morphometrics of female tiger beetles of the *C. campestris* group. See "Material and Methods" for abbreviations. First line: mean ± standard deviation; second line (in parentheses): range.

	n	TL	HW/TL	HW/PWm	PL/TL	PL/PWm	PWm/PWb	EL/TL	EWm/TL	EWm/EL	EWm/TL	EL/TL	EWm/TL	EWm/EL	EWm/EL	SS
<i>C. sp.</i>	32	11.8±0.7 (10.8-13.2)	0.28±0 (0.27-0.29)	1.13±0.03 (1.06-1.19)	0.17±0 (0.16-0.18)	0.71±0.02 (0.66-0.74)	1.30±0.04 (1.23-1.38)	0.61±0.01 (0.59-0.63)	0.43±0.01 (0.42-0.45)	0.71±0.02 (0.68-0.75)	0.80±0.01 (0.77-0.83)	1.9±1.0 (0.5-4.0)				
Sertavul	13	13.3±0.6 (12.2-14.3)	0.26±0 (0.25-0.26)	1.08±0.03 (1.02-1.13)	0.17±0.01 (0.16-0.17)	0.70±0.03 (0.65-0.75)	1.28±0.03 (1.24-1.34)	0.62±0.01 (0.60-0.63)	0.43±0.01 (0.42-0.45)	0.70±0.02 (0.67-0.72)	0.79±0.01 (0.77-0.81)	2.4±1.2 (0.4-0)				
Hasan	7	13.6±1.0 (12.3-15.2)	0.26±0.01 (0.25-0.27)	1.04±0.02 (1.00-1.07)	0.17±0.01 (0.17-0.18)	0.70±0.03 (0.65-0.74)	1.32±0.07 (1.23-1.44)	0.61±0.01 (0.60-0.63)	0.45±0.01 (0.42-0.46)	0.73±0.03 (0.68-0.77)	0.78±0.02 (0.75-0.81)	3.4±2.2 (0.5-5)				
Bcharré	7	12.3±0.6 (11.4-13.4)	0.27±0 (0.26-0.27)	1.15±0.03 (1.09-1.19)	0.16±0 (0.15-0.16)	0.67±0.02 (0.65-0.70)	1.27±0.02 (1.24-1.30)	0.63±0.01 (0.62-0.64)	0.43±0.01 (0.43-0.44)	0.69±0.01 (0.67-0.70)	0.79±0.02 (0.77-0.81)	3.2±1.7 (0.5-0)				
Zorkun	8	12.9±0.7 (11.8-14.2)	0.26±0.01 (0.25-0.27)	1.16±0.02 (1.13-1.18)	0.17±0.01 (0.16-0.18)	0.70±0.01 (0.69-0.72)	1.29±0.03 (1.25-1.36)	0.63±0.01 (0.61-0.64)	0.42±0.01 (0.40-0.44)	0.67±0.02 (0.64-0.70)	0.78±0.01 (0.76-0.79)	2.4±0.4 (2.0-3.0)				
Darbogaz	10	13.1±0.6 (12.2-14.2)	0.26±0 (0.25-0.26)	1.20±0.02 (1.15-1.23)	0.17±0.01 (0.16-0.18)	0.71±0.03 (0.68-0.78)	1.28±0.02 (1.26-1.32)	0.62±0.01 (0.61-0.64)	0.42±0.01 (0.40-0.45)	0.67±0.02 (0.64-0.71)	0.79±0.02 (0.74-0.84)	3.6±1.7 (1.5-6.5)				
Pontus	21	14.1±0.6 (12.6-15.1)	0.26±0.01 (0.24-0.29)	1.21±0.04 (1.16-1.30)	0.18±0.01 (0.16-0.20)	0.72±0.03 (0.66-0.77)	1.28±0.05 (1.17-1.38)	0.62±0.02 (0.60-0.71)	0.42±0.01 (0.40-0.47)	0.68±0.02 (0.65-0.71)	0.80±0.02 (0.78-0.84)	2.7±1.4 (0.5-5.0)				
Van	7	14.5±0.4 (13.8-14.9)	0.25±0.01 (0.24-0.26)	1.18±0.05 (1.10-1.26)	0.16±0 (0.16-0.17)	0.72±0.02 (0.69-0.75)	1.27±0.07 (1.20-1.40)	0.63±0.01 (0.61-0.65)	0.41±0.01 (0.39-0.41)	0.64±0.01 (0.62-0.65)	0.79±0.01 (0.78-0.82)	4.2±2.5 (2.0-9.0)				



Figs. 2-9. Individuals of the *Cicindela campestris* group from Turkey and Lebanon representing the samples of the morphometric analysis (females). 2. *C. thughurica*, spec. nov. ("C. sp."; near Kaypak, 680 m, Osmaniye prov., Turkey). 3. *C. campestris* ("Sertavul"; Sertavul pass, 1500 m, Içel prov., Turkey). 4. *C. campestris* ("Hasan"; Hasan dağ, 1500-1600 m, Aksaray prov., Turkey). 5. *C. herbacea* ("Bcharré"; Bcharré/Les Cedres, Lebanon). 6. *C. herbacea* ("Zorkun"; near Zorkun village, 1750-1850 m, Osmaniye prov., Turkey). 7. *C. herbacea* ("Darboğaz"; above Darboğaz village, 1600-1900 m, Niğde prov., Turkey). 8. *C. desertorum* ("Pontus"; Ovit pass, 2600 m, Rize prov., Turkey). 9. *C. turkes-tanicoides perreau* ("Van"; Kuskun Kiran pass, 2200-2300 m, Van prov., Turkey).

Coloration. Under diffuse natural light, the dorsal coloration of all groups, with the exception of "C. sp.", is metallic green, with more or less distinctive coppery to reddish patches and reflections on the head, pronotum and along the sutural and lateral

margins of the elytra. In contrast, individuals of the "C. sp." group mostly exhibit a brownish green or dull olive dorsal coloration under diffuse natural light. However, colors of "C. sp." also appear clearly metallic greenish under strong direct light.

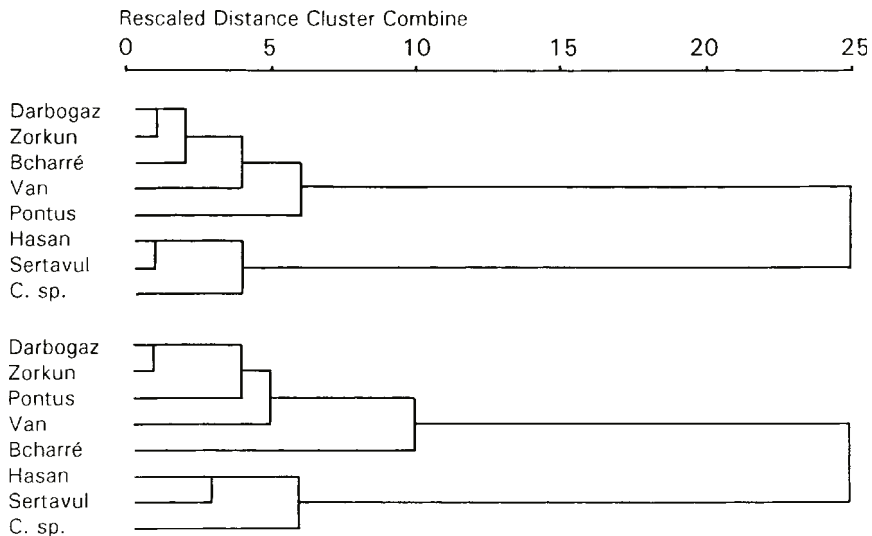


Fig. 10. Phenetic relationships between the investigated groups based on morphometric ratios (mean values; squared Euclidian distances, clustered using Wards's method). Upper: males; lower: females.

Elytral markings: Specimens of all samples possess an interrupted humeral lunule, and mostly a complete apical lunule (Figs. 2-9).

A complete middle band is present in all specimens of the groups "Bcharré", "Zorkun", "Darbogaz", "Pontus", and "Van" (Figs. 5-9). It is mostly not interrupted in the "C. sp." sample (Fig. 2), with the exception of five individuals (= 6.6 %) which have the middle band interrupted at least on one elytron. In contrast, the groups "Sertavul" and "Hasan" exhibit mostly interrupted middle bands (Figs. 3, 4) with eight individuals from "Sertavul" and seven from "Hasan" (= 28 % each) having the middle bands not interrupted. Three individuals of comparative *C. campestris* from Aktoprak and Karagöl, localities which are geographically nearest to the "C. sp." sample (approximately 15-30 km: Figs. 1, 13), have all interrupted middle bands (Figs. 14). Among the comparative material of *C. campestris* from the western Taurus Mountains (see Appendix) individuals from two localities also exhibit complete middle bands. Those individuals make 50 % of the Davraz dağ sample (6 of 12) and 20 % of a small series from Irmasan pass (1 of 5). In contrast, all specimens from Uşak province, Yatağan, Gökçeören, Keçiborlu, Phaselis, and Alanya (n=49) possess all broadly interrupted middle bands.

The "Van" sample is unique in possessing narrow and strongly oblique middle bands (Fig. 9).

Shape of aedeagus: The outer shape of the male genitalia is rather similar within the two subgroups. Specimens of the *desertorum* subgroup ("Bcharré",

"Darbogaz", "Zorkun", "Van", "Pontus": Figs. 12 C-F) exhibit a very long and elongate aedeagus, while it is comparably stout in members of the *campestris* subgroup ("C. sp.", "Sertavul", "Hasan": Figs. 12 A-B).

2. Conclusions

Summarizing the results of the morphological analyses the following conclusions can be drawn:

1. Based on the morphological data, the Middle Eastern species of the "groupe V" sensu Rivalier (1950) can be provisionally arranged in two subgroups, namely the *Cicindela campestris* subgroup (containing *C. campestris* and a new species described below) and the *Cicindela desertorum* subgroup (containing *C. desertorum*, *C. turkestanicoidea*, and *C. herbacea*; *C. talyschensis* also tentatively included). In the Middle East, members of the *C. desertorum* subgroup are usually restricted to humid, medium and high elevations (1000-3000 m a.s.l.), especially within dry continental or Mediterranean climates. In contrast, members of the *C. campestris* subgroup inhabit large altitudinal ranges from sea level to high elevations.

2. Two samples from southern Turkey ("Darbogaz", "Zorkun") are morphologically almost identical with *C. herbacea* from Lebanon and are referable to this taxon. Slight differences between the samples may indicate an infraspecific variation.

3. *Cicindela herbacea* appears to be most similar to *C. desertorum* and especially *C. turkestanicoidea*. It should be noted that Klug (1832) already mentioned the similarity of his new species and *C. desertorum* in the first sentence of his diagnosis of *C. herbacea* ("*C. desertorum* Boeb. proxima ..."). However, at present it seems to be appropriate to treat *C. herbacea* and *C. turkestanicoidea* provisionally as separate species, although distinguishing characters are weak. Future researches should clear the relations of all taxa involved, based on more extensive geographic samples (including topotypical material of *C. t. turkestanicoidea* from northeastern Iran; type locality: "Taesch und Schaku (zwischen Astrabad und Scharud)" [= between Gorgan and Emâm-rûd, eastern Elburz Mountains]) and the analysis of more characters (e.g., female genitalia, males' inner sac structures, molecular data sets).

4. The groups "Hasan" and "Sertavul" are identical in most morphological characters and both must be referred to *C. campestris*.

5. Specimens from southern Turkey formerly referred to *C. "herbacea"* (= *C. sp.*) are morphologically different from "true" *C. herbacea* from Lebanon. Specimens of this form appear to be most similar to *C. campestris* but can not be attributed to any of the investigated forms, and therefore represent an undescribed taxon. The specific status of this form is supported by syntopic occurrence with *C. herbacea* and close parapatric occurrence with *C. campestris* in southern Turkey (see below).

Cicindela thughurica, spec. nov.

Figs 2, 12B, 15

Cicindela herbacea, Mandl 1963: 45 (localities "Namrun", "Pozanti").

Cicindela herbacea, Korell 1988: 100 (part.: localities "Osmaniye: Karatepe", "Amanos Dağl.: Akbes", "Pozanti und Namrun").

Cicindela herbacea (sp. inq.), Korell 1994: 43 (part.: localities "Pozanti [Adana]", "nördlich Maraş [Kahramanmaraş]").

Cicindela herbacea, Cassola 1999: 238 (part.: localities "Namrun", "Adana", "Pozanti", "Osmaniye, Karatepe", "Osmaniye", "N of Maras", "Akbez", "Gülek", "Alexandrette").

Types. Holotype: ♂, with the following labels: "TR, Prov. Osmaniye: Strassenkr. Ri. Kaypak (nw. Fevsipasa), 680 m. Feuchte, lehmige Böschung. 08.04.1998, Franzen & Gruber leg." [typed and printed white label with black margin], "3" [handscript round label], "*Cicindela thughurica* Franzen, 2007, Holotypus" [typed and printed red label] (in ZSM). – **Paratypes.** A total of 76 specimens, all from Turkey. 14♂♂ and 8♀♀ with the

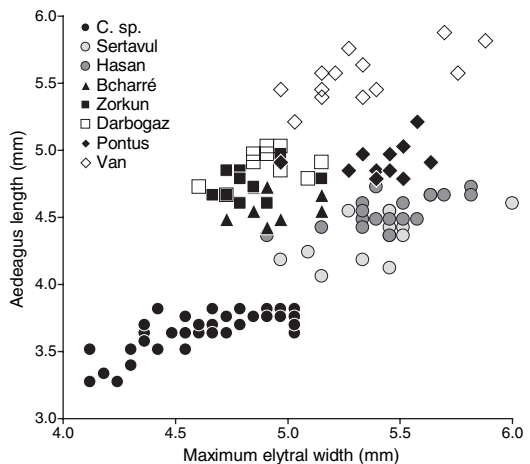


Fig. 11. Relation of aedeagus length and elytral width within the investigated groups.

same data as the holotype (1♂, 1♀ ZSM, 13♂♂, 7♀♀ in CFO); 1♂, 1♀: above Zorkun (Osmaniye prov.), 1750-1850 m, 18.6.1997, Franzen leg. (CFO); 2♂♂, 1♀: above (E of) Yarpuz (Osmaniye prov.), 1550 m, 19.6.1997, Franzen leg. (CFO); 3♂♂, 4♀♀: 5 km N Hieropolis-Castabala (Osmaniye prov.), 150 m, 9.4.1997, Franzen leg. (CFO); 4♂♂, 2♀♀: environments of Çiftehan (Niğde prov.), 850 m, 3.4.1988, de Freina leg. (5 CHS, 1 CFO); 1♂, 2♀♀: eastern slope of Karahan pass (Malatya prov.), 1300 m, 30.4.1999, Franzen leg. (CFO); 5♂♂, 2♀♀: N of Tekir (Kahramanmaraş prov.), 1100 m, 7.4.1998, Franzen & Gruber leg. (CFO); 9♂♂, 7♀♀: 30 km NW Kahramanmaraş (Kahramanmaraş prov.), 580 m, 7.4.1998, Franzen & Gruber leg. (CFO); 1♀: environments of Kahramanmaraş ("Marasch, Syrien", Kahramanmaraş prov.), Reitter (CFO); 1♂: between Çiftehan and Pozanti (Adana prov.), 900-1000 m, 17.4.1973, Heinz leg. (CFO); 1♂, 1♀: E of Pozanti (Adana prov.), 800 m, 11.4.1998, Franzen leg. (CFO); 1♀: Pozanti (Adana prov.), 25.5. 1961, Cadamuro leg. (CHS); 1♀: Çatalan ("Anatolia, Prov. Adana, Catalan", Adana prov.), 50-100 m, 18.4.1985, Barries leg. (CFO); 1♂, 2♀♀: E of Çamlıyayla (İçel prov.), 1100 m, 11.4.1998, Franzen leg. (CFO); 1♀: environments of Akbez ("Akbez, Syr.", Gaziantep prov.), Winkler (CFO).

Type locality. Turkey, Osmaniye Province: at Kaypak road near to the junction with the old Osmaniye-Fevsipaşa road at 37°09.76'N, 36°28.00'E, 680 m elevation.

Referred specimen: 1♀: "Libaah, Syrien", without further collection data (CFO).

Diagnosis. A member of the *Cicindela campestris* group (= "groupe V" sensu Rivalier 1950), with a unique character combination among Middle Eastern species: small relative aedeagus length (≤ 3.8 mm, AL/EWm ≤ 0.86), small total length (≤ 11.8 mm in males, ≤ 13.2 mm in females), brownish-green dorsal

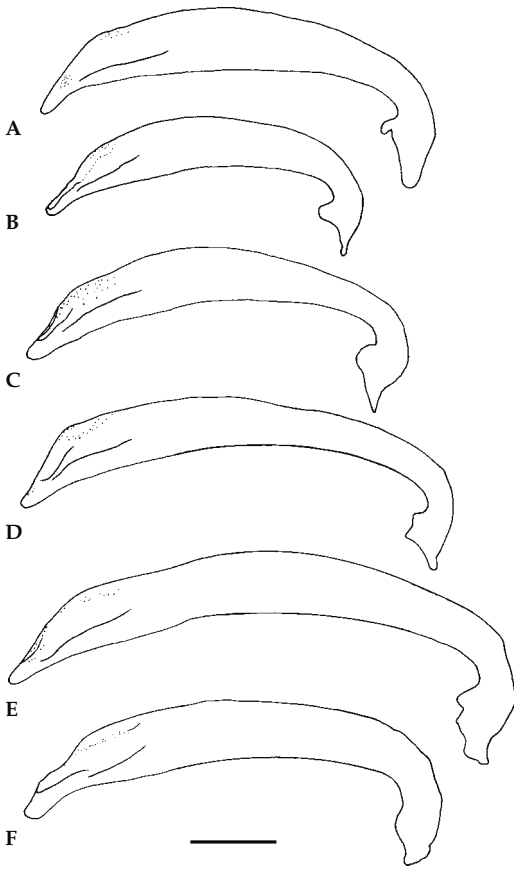


Fig. 12. Aedeagi of green tiger beetles of Turkey and Lebanon (scale bar represents 1 mm): **A**, *Cicindela campestris* (Sertavul pass, İçel prov., Turkey); **B**, *C. thughurica*, spec. nov., holotype ("C. sp.", near Kaypak, Osmaniye prov., Turkey); **C**, *C. herbacea* (Bcharré, Lebanon); **D**, *C. herbacea* (above Darboğaz, Niğde prov., Turkey); **E**, *C. turkestanicoidea perreai* (Kuskun Kiran pass, Van prov., Turkey); **F**, *C. desertorum* (Ovit pass, Rize prov., Turkey).

coloration and complete middle bands in most specimens. *C. thughurica*, spec. nov. differs from Near Eastern *C. campestris* by small aedeagus length (≤ 3.9 mm vs. ≥ 4.1 mm), by less reduced elytral markings (middle bands complete in most *C. thughurica*, interrupted in most *C. campestris*), and by elytral coloration (brownish-green in *C. thughurica*, green in *C. campestris*). *C. thughurica*, spec. nov. differs from similar and geographic nearest (partly sympatric) taxa *C. herbacea*, *C. desertorum*, and *C. turkestanicoidea* by its smaller relative aedeagus length (AL/EWm 0.72-0.86 vs. 0.87-1.10), by the more robust and less elongate shape of the aedeagus with a less pronounced apex, by its smaller total lengths, and

a different elytral coloration (mostly brownish-green in *C. thughurica*, green in *C. desertorum* and *C. turkestanicoidea*). In addition, *C. thughurica*, spec. nov. differs from *C. talyschensis* of northern Iran and Azerbaijan in possessing a setose frons (glabrous in *C. talyschensis*) and in males by the rounded lateral sides of the elytra (elytral margins almost parallel in male *C. talyschensis*).

Description of the Holotype

δ , total length (without labrum) 10.6 mm. Head width 2.8 mm (27 % of TL); head distinctly broader than pronotum (HW/PWm 1.12). Second antennal segments with 3 terminal (sensory) and 4 scapal setae each, third segment glabrous, fourth with 9 erected setae each, fifth with 3 erected setae each. Antennal segments 6-12 with very short, fine hairs. Mandibles with four teeth. Labrum broad, with 6 submarginal setae (right outermost broken), without medial tooth.

Clypeus and genae glabrous. Frons and vertex of head with abundant, long, erect setae in addition to some pairs of supraorbital setae. Vertex strongly concave between eyes, surface strongly rugose, rugae forming fine, parallel ridges near eyes. Pronotum transverse (length 1.9 mm [= 18 % of TL], maximum width 2.5 mm; PL/PWm 0.76), anteriorly distinctly wider than posteriorly (basal pronotum width 2.1 mm; PWm/PWb 1.20). Pronotum deeply wrinkled at lateral margins, shallowly wrinkled on disc, with numerous long setae; anterior transverse sulcus deep, V-shaped; posterior transverse sulcus deep, W-shaped; median longitudinal sulcus shallow. Proepisterna, hindepisterna, and lateral parts of the metasternum with long white setae. Median metasternum glabrous. Abdominal sternites 3-6 with numerous scattered short, fine setae. Procoxa with a small group of long, erect setae, mesocoxa with a large central spot of dense, long, erect setae, and metacoxa with a few scattered fine erect setae. Elytral length 6.5 mm (= 61 % of TL); humeral elytral (body) width 3.6 mm; maximum elytral (body) width at middle band (EWm) 4.5 mm (= 42 % of TL, 69 % of EL). Elytral surface densely scattered with numerous small pits, each associated with a small smooth granule. Granules are most conspicuous at base and less distinctly apically. Elytral apex without microserrulations; small apical spine present. Front and middle trochanters with one subapical seta on each. Front and middle femora dorsally and ventrally with numerous long white erect setae, hind femora only ventrally with setae. Tibia with short white, erect setae. Tarsi with very short white setae. Aedeagus (Fig. 12 B): length 3.6 mm (ratio AL/EWm 0.81).

Coloration: Antennal segments 1-5 metallic red,

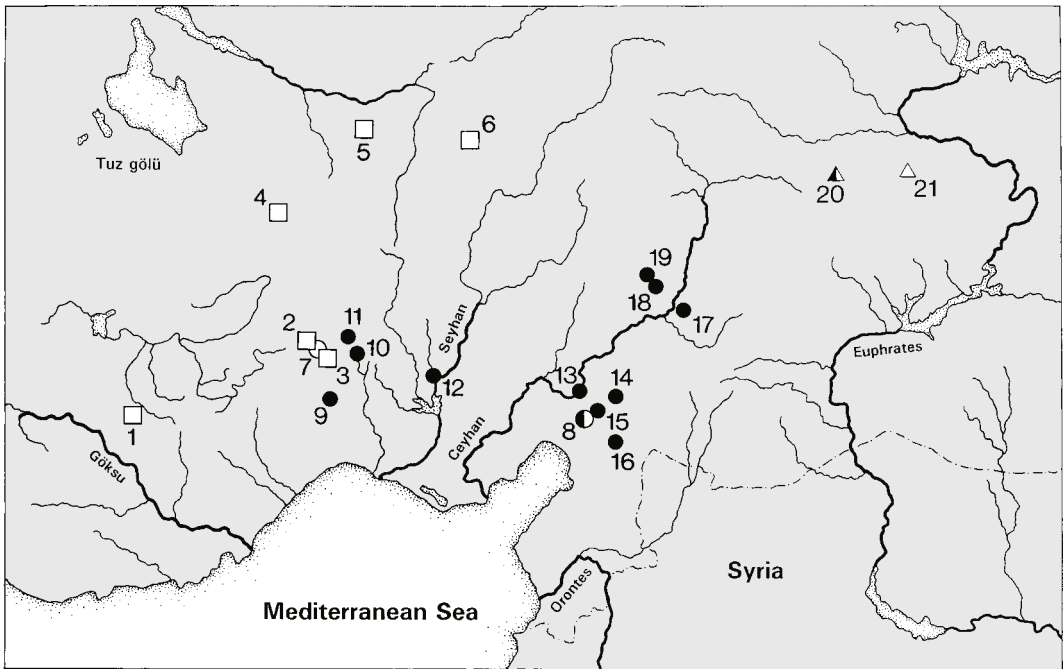


Fig. 13. Distribution of tiger beetles of the *Cicindela campestris* group in central southern Turkey (based on material proofed by the author). ●: *C. thughurica*, spec. nov.; ○: *C. herbacea*; ◐: syntopic *C. thughurica* and *C. herbacea*; □: *C. campestris*; △: *C. turkestanicooides perreaui*; ▲: sympatric *C. thughurica*, spec. nov. and *C. turkestanicooides perreaui*. 1 - Sertavul pass; 2 - Aktoprak; 3 - Karagöl; 4 - Hasan dağ; 5 - Göreme; 6 - Erciyes dağı; 7 - Darboğaz; 8 - Zorkun; 9 - Çamliya; 10 - Pozanti; 11 - Ciftehan; 12 - Çatalan; 13 - Hieropolis-Castabala; 14 - Kaypak; 15 - Yarpuz; 16 - Akbez; 17 - Kahramanmaraş; 18 - 30 km NW Kahramanmaraş; 19 - Tekir; 20 - Karahan pass; 21 - Kubbe pass.

remainder blackish. Mandibles bicolored, with teeth black and remainder brownish-yellow. Labrum brownish-yellow, with a fine black anterior margin. Clypeus and genae both metallic red with greenish margins. Head and pronotum dorsally dull coppery to red with greenish reflections (overall appearance brownish under diffuse daylight). Elytra metallic greenish with coppery to red reflections, elytral pits bluish (overall elytral coloration appears brownish under diffuse daylight). A diffuse, dark brownish area around the inner (sutural) part of the middle band. Elytral lateral margins and suture coppery to red. Elytral maculations creamish-white. Humeral lunule divided, broken into a humeral and post-humeral dot. Marginal band lacking, middle band complete, not broken into marginal and inner dots. Apical lunule complete, although bands between apical and subapical parts are very thin. Anterior underside (proepisterna, hindepisterna, and lateral parts of metasternum) metallic reddish, posteriorly (coxa, median metasternum, abdominal sternites 3-6) dark metallic violet to almost black. Trochanters black, femora metallic coppery to reddish, tibia

metallic greenish, tarsi dull metallic greenish with violet reflections.

Variation. Variation of morphometric characters is shown in Tabs 1 and 2 (“*C. sp.*”). In contrast to the holotype, a small, black labral medial tooth is present in most specimens of the paratypes.

Distribution. To date, *C. thughurica* is only known from southern Turkey (Fig. 13). Localities range from the southern slopes of the Bolkar dağları (Çamliya, Pozanti) in the west to the Karahan pass (west of Malatya) in the northeast. Southernmost reliable localities are in the central Amanus Mountains (Osmaniye prov.). However, Cassola (1999) mentioned *C. “herbacea”* from Iskenderun, Hatay prov. (“Alexandrette, Asia minor”, Kricheldorf), a locality at the western base of the southern Amanus mountains. Most probably, this record also refers to *C. thughurica*. Korell (1988, 1994) and Cassola (1999) list some localities of *C. “herbacea”* from the western Taurus Mountains, west of Sertavul pass (e.g., Irmaşan pass, Akseki, Eğirdir, Gazipaşa, Aphrodisias).



14



15

Figs. 14-15. Individuals of the geographically nearest samples of *Cicindela campestris* and *C. thughurica* from the Bolkar dağları (Turkey). 14, Female of *C. campestris* from near Aktoprak (Niğde prov.). 15, Female of *C. thughurica* from east of Pozantı (Adana prov.).

However, all my material examined during the present study from the western Taurus Mountains (see Appendix for localities) undoubtedly belongs to *C. campestris*.

Although an occurrence of *C. thughurica* in the Mediterranean part of the Levant south of Turkey is likely (e.g. in western Syria), no reliable locality records are available from this area. All localities of old specimens labeled "Syria" (e.g., "Marasch, Syrien", "Akbez, Syr.") are today within Turkey. Moreover, it is unclear if specimens from northern Israel ("*Cicindela campestris herbacea*": Mt. Hermon, Nahal Nimrod, Mt. Meron; Nussbaum 1989) belong to *C. herbacea* or *C. thughurica*. However, I have one old undated *C. thughurica* specimen in my collection which is labeled "Libaah, Syrien". I am not able to find this locality on any modern maps but the name may

refer to the ancient settlement of Libaah in Israel, which is in the surroundings of Betshemesh, at approximately 31°45'N, 34°59'E.

Etymology. The specific name refers to the Arabic term *al-thughur*, as the border zone between the Byzantine and the Arabian territories was called in early Islamic times. This area almost perfectly matches the presently known distribution of the new species.

Notes on habitat and sympatric species. All specimens of *C. thughurica* were collected on clayish substrate with interspersed small stones and no or a very sparse vegetation cover. In most cases occurrence was positively correlated with the presence of moist areas, mostly the edges of small streamlets (Pozantı, Hieropolis-Castabala, Yarpuz, NW Kahramanmaraş, Tekir, Karahan Pass) or puddles and

ditches (Çamliyala, Zorkun). Habitats comprised road embankments (Kaypak), forest roads (Çamliyayla, Yarpuz, Zorkun, NW Kahramanmaraş), footpaths (Hieropolis-Castabala, Tekir), as well as clearings in pine forests (*Pinus nigra*, *P. brutia*: Zorkun, Çamliyayla, NW Kahramanmaraş), and Mediterranean scrub vegetation (Hieropolis-Castabala, Tekir). Microhabitats therefore do not appear to be different from those of *Cicindela campestris*, *C. desertorum*, *C. herbacea*, and *C. turkestanicoides* (Franzen, unpublished data). Most localities of *C. thughurica* are from low to moderate elevations up to 1000 m. The maximum vertical distribution is attained in the central Amanus Mountains near Zorkun at approximately 1750-1850 m.

Syntopic or sympatric occurrence with other members of the *Cicindela campestris* group were found at higher elevations with *C. herbacea* at Zorkun (syntopic) and with *C. turkestanicoides perreai* at Karahan pass (Malatya prov., exact collecting site of *C. turkestanicoides* unknown). At Zorkun, *C. thughurica* and *C. herbacea* were found running together along small puddles on a forest road through pine forest (*P. nigra*), during mid-June. Differences in habitat use were not noted in the field.

Parapatric distribution of *C. thughurica* and *C. campestris* is known from the area of the Bolkar dağları north of Mersin. *C. thughurica* localities in this area are known from Çamliyayla (southern slope of Bolkar dağı) and from the valleys of Çiftahan çayı and Pozanti çayı between Pozanti and Çiftahan. Nearest *C. campestris* localities are at a distance of about 15-30 km in western direction at Aktoprak village and the small mountain lake Karagöl at the northern slope of Bolkar dağları (Fig. 13). Although not separated by any obvious barriers (e.g. a mountain chain), individuals of both species do not show signs of morphological intergradation (Figs 14-15).

The syntopic and parapatric occurrence of four closely related taxa of tiger beetles within the central Taurus/Antitaurus and Amanus Mountains of southern Turkey reminds parallel cases of high vertebrate species numbers in the same area. Schmidler (1997) analysed the distribution of reptiles and amphibians within the Taurus Mountains and found high taxa numbers among closely related forms of dwarf snakes of the genus *Eirenis* (Reptilia: Ophidia: Colubridae) and the scincid genus *Ablepharus* (Reptilia: Lacertilia: Scincidae). In each case the unusual rich species assemblage of the area (with 6 and 5 taxa, respectively) is based on the presumed immigration of species from the west (Balkan elements; here *C. campestris*), the east (Transcaucasian-Iranian elements; here *C. turkestanicoides*), the south (Syrian-Levantine elements; here *C. herbacea*), as well as the presence of local endemics, located in

the Bolkar dağları and the Antitaurus (here *C. thughurica*). Among cicindelids, Franzen (2003) showed that the region also houses an area of morphological intergrades as well as contact zones between western, eastern and southern subspecies of *Homodela ismenia*.

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- Appendix: Comparative material examined**
- All specimens in CFO, unless otherwise cited. Asterisks (*) indicate samples used for the morphometric analysis.
- Cicindela campestris* – Turkey:** ANTALYA prov.: Tekirova/NW of Phaselis, 100 m, 6.3.1995, Heckes & Hess leg. (1♂, 1♀); environments of Taşkesiği (E of Manavgat, at road to Konya), 200 m, 6.4.2001, Schiller leg. (2♂♂, 2♀♀); Irmanan pass, 1300 m, 2.6.1996, Snizek leg. (1♂); Irmanan pass, 1500 m, 14.4.1974, Heinz leg. (2♂♂, 2♀♀); environments of Boztepe (near Alanya), 200 m, 17-20.4.1993, Kuna leg. (1♂). AKSARAY prov.: Hasan dağ, 2-5 km NE Yenipınar, 1500-1600 m, 12.4.1998, Franzen leg. (18♂♂, 7♀♀)*. DENIZLI prov.: 14 km NE Gökçeören (SW Kale), 750 m, 15.4.1997, Franzen leg. (1♂, 3♀♀); 3 km N Çivril, 1000 m, 17.4.1998, Franzen leg. (2♂♂). IÇEL prov.: environments of Medreselik (near Sertavul pass), 30.4.1996, Makovsky leg. (1♂, 2♀♀)*. ISPARTA prov.: Davraz dağ above Yukarıgökdere, 1650 m, 16.4.1998, Franzen leg. (7♂♂, 5♀♀); 23 km SE Dinar, pass above Keçiborlu, 1100 m, 17.4.1998, Franzen leg. (3♂♂, 6♀♀). MUĞLA prov.: 10 km SW Gökçeören, 600 m, 15.4.1997, Franzen leg. (4♂♂, 6♀♀); 14 km NE Gökçeören, 750 m, 15.4.1997, Franzen leg. (1♂, 3♀♀); N of Yatağan, 350 m, 16.4.1992, Franzen & Bischoff leg. (1♂). NIĞDE prov.: Karagöl (SE Ulukışla) (»Asia minor, Bulgar Maaden, Kara-Goel«), 3000 m, v. Bodemeyer leg. (1♀); 1 km N Aktoprak (S Ulukışla), 1500 m, 13.4.1998, Franzen leg. (1♂, 1♀). NEVŞEHİR prov.: environments of Göreme, 1100-1200 m, 2.-5.5.2000, Kautt & Weisz leg. (1♀). KARAMAN prov.: Sertavul pass (S of Karaman), 1400-1600 m, 4.4.1978, Heinz leg. (2♂♂, 2♀♀)*; 17 km S Karaman (environments of Sertavul pass, at road to Lale), 1500 m, 27.4.1992, Franzen & Bischoff leg., 14.4.1998, Franzen leg. (13♂♂, 9♀♀)*. KAYSERİ prov.: Erciyes dağı, 1700 m, 8.4.1976, Heinz leg. (1♂, 1♀). KONYA prov.: 35 km NE Beyşehir, 1350 m, 30.5.1996, Schmidtler & Schmidtler leg. (1♀); western corner of Altunpa barajı (W of Konya), 1300 m, 14.4.1998, Franzen leg. (1♀). UŞAK prov.: Hamamboğazi (NE Banaz), 950 m, 4.4.1992, Heinz leg. (5♂♂, 5♀♀); 2 km S Derbent (NW of Uşak), 700 m, 18.4.1998, Franzen leg. (4♂♂, 2♀♀); 5 km N Sivaslı, 850 m, 17.4.1998, Franzen leg. (1♂, 1♀).
- Cicindela desertorum* – Turkey:** GÜMÜŞHANE prov.: Zigana pass (southern slope), 1600 m, 24.-28.4.1999, Franzen leg. (11♂♂, 8♀♀)*; Zigana pass (southern slope, near Zigana köyü), 1200 m, 24.4.1999, Franzen leg. (1♂, 1♀)*. RIZE prov.: Ovit pass, 2700 m, 6.7.1996, Staven & Skoupy leg. (5♂♂, 10♀♀)*; Ovit pass, 2600 m, 19.7.1987, Heinz leg. (2♂♂, 2♀♀)*.
- Cicindela herbacea* – Lebanon:** Bcharré, Les Cedres, 6.1997, Lasalle (10♂♂, 7♀♀)*. **Turkey:** NIĞDE prov.: 4-7 km E (above) Darboğaz (on road to Karagöl), 1600-1900 m, 13.4.1998, Franzen leg. (10♂♂, 10♀♀)*. OSMANIYE prov.: above Zorkun, 1450 m, 22.5.1994, Bischoff & Bischoff leg. (1♂, 4♀♀)*, 1750-1850 m, 18.6.1997, Franzen leg. (9♂♂, 4♀♀)*.
- Cicindela turkestanicoides perreai* – Turkey:** MALATYA prov.: Kubbe pass (eastern slope), 1700 m, 1.5.1999, Franzen leg. (3♀♀); Karahan pass (40 km W Malatya), 1250 m, 6.5.1993, Schmidtler & Schmidtler leg. (1♂). TUNCELI prov.: environments of Gözen (Munzur dağları), 1500-2100 m, 26.-27.6.1987, Heinz leg. (1♂, 1♀). VAN prov.: Kuskun Kıran pass (W Gevaş), 2200-2300 m, 27.5.1998, 3.5.1989, Heinz leg. (15♂♂, 5♀♀)*; Karabet pass (eastern slope, SW Gevaş), 2500-3000 m, 3.-4.7.1987, Heinz leg. (2♂♂, 2♀♀)*.

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Autor(en)/Author(s): Franzen Michael

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