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MORPHOMETRIC EXAMINATION OF *CALOPTERYX BALCANICA* FUDAKOWSKI, 1930 AND *C. SPLENDENS ANCILLA* SELYS, 1853 (ZYGOPTERA: CALOPTERYGIDAE)

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The statistical examination confirmed that the males and females of *C. balcanica* have significantly more antenodal crossveins, crossveins in the discoidal cell and cubito-anal crossveins, and more cells in anal-loops than do those of *C. s. ancilla*. This can be used to discriminate the occasional heterochromatic females of *C. balcanica* from the regular heterochromatic females of *C. s. ancilla*.

INTRODUCTION

FUDAKOWSKI (1930) described *Calopteryx splendens balcanica*, as a new subspecies from Herzegovina (Trebinje, 14 ♂, 15 ♀; Mostar, 1 ♂, 2 ♀) and Dalmatia (Metković, 1 ♀). The subspecies has since been found in a karst field in Konavli, SE of, and not far from, the former locations (ADAMOVIĆ, 1967).

Another new subspecies, *C. splendens caprai*, has been described in Italy by C. Conci (CONCI & NIELSEN, 1956). The subspecies has been examined in detail by MAIBACH (1986, 1987).

GALLETTI & PAVESI (1991) pointed out the different wing quotients between *C. s. balcanica* and *C. s. caprai*. Recently, LOHMANN (1992a) treated *C. s. caprai* as a synonym of *C. s. ancilla* Sélys, 1853, and considered *C. balcanica* (i.e. *C. s. balcanica*) a good and "endemic species with broad wings and blue-coloured females, ranging from the Peloponnesus, southern and southwestern Greece, Albania, Montenegro and Herzegovina, to southern Dalmatia".

The males and predominantly homeochromic females of *C. balcanica* are clearly distinguished by wing and body colour from the males and the regularly heterochromic females of *C. s. ancilla*. However, the discrimination of the heterochromic *C. balcanica* females from such of *C. s. ancilla* can be difficult due

to the likeness of the wings and body colour. Therefore, the main purpose of the present paper is to find out quantitative, morphometric features by which specimens – or, at least series – of *C. balcanica* and *C. s. ancilla* can be distinguished, disregarding (or in addition to) the wing and body colouration.

MATERIAL AND METHODS

A total of 134 damselfly specimens pertaining to *C. balcanica* (59 ♂, 75 ♀) and 102 specimens belonging probably to *C. s. ancilla* (42 ♂, 60 ♀) have been examined. The damselflies were collected by the first author in the following five localities:

(1) M e t k o v i ć (43°03'N 17°39'E) – a small town on the bank of the river Neretva. A parallel sided stream of the Neretva with pebbly and sandy bottom, and clean water, lined with marshy vegetation, at about 5 m in altitude.
C. balcanica: 11 ♂, 21 ♀, 29-VII-1949; 16 ♂, 17 ♀, 15-VII-1973.

(2) G a b e l a (43°04'N 17°41'E) – a village situated 4 km ENE from Metković. A side stream of the Neretva, with sandy bottom, and clean water lined with marshy vegetation, at about 5 m.
C. s. ancilla: 19 ♀, 29-VII-1949.

(3) K o n a v l i (42°32'N 18°22'E) – a polje (= karst depression) of fertile soil situated among limestone rocky hills, SE of the town of Dubrovnik. The river Ljuta with pebbly and sandy bottom, and clean water lined partly with marshy vegetation, at about 90 m.
C. balcanica: 1 ♀, 28-V-1948; 5 ♂, 1 ♀, 30-VI-1948; 2 ♀, 3-VII-1948; 7 ♂, 7 ♀, 29-V-1958; 4 ♂, 11 ♀, 4-VI-1958; 4 ♂, 5 ♀, 10-VI-1958; 12 ♂, 10 ♀, 17-VII-1973.

(4) T e m s k a (43°16'N 22°33'E) – a village situated in the SW foothills of Mt Stara Planina (2169 m), E Serbia. The rocky, cascading brook Temštica, with pebbly and sandy bottom, and clean water lined with willow trees and bushes, at about 500 m.
C. s. ancilla: 22 ♂, 7 ♀, 2-VII-1946; 7 ♂, 10 ♀, 12-VII-1990.

(5) D j e v d j e l i j a (41°08'N 22°30'E) – a town situated in the plain of the river Vardar, SE Macedonia. A small tributary stream of the Vardar, with sandy and silty bottom, and clean water lined with marshy vegetation, at about 50 m.
C. s. ancilla: 13 ♂, 24 ♀, 17-VI-1972.

The specimens were measured using callipers. Length was recorded to the nearest 0.1 mm, and tables were set out using suitable class intervals. A total of 17 morphometric characters were examined (10 for the females of *C. s. ancilla* from Gabela), the majority of which are common to both males and females. The mean values ± standard error and standard deviation were calculated separately for males and females. A one-way analysis of variance (ANOVA) and TUKEY and SNK (Student-Newman-Keuls) multiple comparison tests (ZAR, 1984) were carried out on the eight characters which appeared to be most likely to be useful in distinguishing between the two species.

The names of the external features of damselflies and the nomenclature of the wing veins are used according to ASKEW (1988). The material examined is in the collection of the Natural History Museum, Beograd (600BEO 95.733).

RESULTS

The comparable and detailed morphometric data on *C. balcanica* and *C. s. ancilla* are summarised in Tables I and II for males and females respectively. The data for the females of *C. s. ancilla* from Gabela are given in Table III. Eight of the variables for these insects were subjected to analysis of variance (ANOVA) and the

Table I

Measurements (mm) in males of *C. balcanica* from Metković (N=27) and Konavli (N=32), and *C. splendens ancilla* from Temska (N=29) and Djevdjelija (N=13); mean value ± standard error

Character	*balcanica*		*ancilla*	
	Metković	Konavli	Temska	Djevdjelija
Abd	39.47 ± 0.58	39.48 ± 0.20	40.05 ± 0.19	41.08 ± 0.69
Sup app	1.72 ± 0.03	1.74 ± 0.03	1.76 ± 0.03	1.48 ± 0.05
FW	31.20 ± 0.20	31.16 ± 0.17	31.96 ± 0.25	32.49 ± 0.17
w FW	10.31 ± 0.09	10.49 ± 0.08	9.99 ± 0.09	10.53 ± 0.13
100w/FW	33.05 ± 0.20	33.66 ± 0.23	31.28 ± 0.15	32.32 ± 0.40
HW	29.95 ± 0.15	30.23 ± 0.17	30.51 ± 0.22	31.31 ± 0.15
w HW	10.03 ± 0.06	10.22 ± 0.09	9.74 ± 0.06	10.08 ± 0.11
100w/HW	33.33 ± 0.14	33.83 ± 0.29	32.05 ± 0.21	32.10 ± 0.34
Ans FW	36.52 ± 0.86	39.09 ± 0.73	32.10 ± 0.51	32.62 ± 0.63
Ans HW	33.22 ± 0.64	37.06 ± 0.72	28.93 ± 0.42	29.00 ± 1.18
Dc FW	9.52 ± 0.19	10.34 ± 0.22	7.89 ± 0.19	8.15 ± 0.34
Cux FW	14.89 ± 0.23	16.69 ± 0.40	13.65 ± 0.32	13.92 ± 0.36
Anal L FW	70.20 ± 2.19	79.31 ± 1.66	52.41 ± 1.15	52.20 ± 1.76
Anal L HW	95.63 ± 2.72	105.44 ± 3.20	74.10 ± 1.79	69.15 ± 2.48

Abd: length of abdomen (including male appendages); – Sup app: length of superior appendage; – FW: length of forewing; – w FW: width of forewing; – 100w/FW: relative width of forewing (% of wing length); – HW: length of hindwing; – w HW: width of hindwing; – 100w/HW: relative width of hindwing (% of wing length); – Ans FW: number of antenodal crossveins between C and Sc in forewing; – Ans HW: number of antenodal crossveins between C and Sc in hindwing; – Dc FW: number of crossveins in discoidal cell of forewing; – Cux FW: number of cubito-anal crossveins in forewing; – Anal L FW: number of cells in anal-loop of forewing; – Anal L HW: number of cells in anal-loop of hindwing

multiple comparison tests (Tab. IV and Tab. V).

The ANOVA indicated that there are significant differences among the means of the eight characters examined (Tab. IV). All of the F-values were highly significant ($P<0.001$). The multiple comparison tests were applied to the 16 sets of mean values of these characters; the null hypothesis was only rejected when both tests indicated that this was the case. An analysis of the number of cells in the anal-loop of the female forewing using the SNK test is given as an example (Tab. V). Thus there are no significant differences among the means of the *C. s. ancilla* females from Gabela, Temska and Djevdjelija. However, the mean values of the same character of *C. balcanica* females from Metkovic and from Konavli are significantly higher than those of *C. s. ancilla*. Furthermore, a significant difference is found between the means of the *C. balcanica* samples from the two localities examined (Tab. V). The null hypothesis is rejected in all comparisons with *C. balcanica* according to the SNK test. It is also rejected by the TUKEY test, which is more robust. Indeed, it is the largest Q-value (3.86) of all comparisons where the null hypothesis is rejected (Tab. V). In conclusion, *C. s. ancilla* from Temska and Djevdjelija and the

Table II

Measurements (mm) in females of *C. balcanica* from Metković (N=38) and Konavli (N=37), and *C. splendens ancilla* from Temska (N=17) and Djevdjelija (N=24); mean value ± standard error

Character	*balcanica*		*ancilla*	
	Metković	Konavli	Temska	Djevdjelija
Abd	39.18 ± 0.18	38.08 ± 0.22	39.10 ± 0.37	40.38 ± 0.22
FW	34.12 ± 0.17	34.61 ± 0.26	35.44 ± 0.30	35.83 ± 0.07
w FW	10.39 ± 0.09	10.60 ± 0.08	10.16 ± 0.09	10.49 ± 0.08
100w/FW	30.32 ± 0.21	30.69 ± 0.20	28.67 ± 0.19	29.20 ± 0.18
HW	32.82 ± 0.19	32.79 ± 0.24	33.74 ± 0.26	34.60 ± 0.20
w HW	9.93 ± 0.05	10.32 ± 0.09	9.82 ± 0.10	9.89 ± 0.06
100w/HW	30.11 ± 0.12	31.49 ± 0.24	29.12 ± 0.14	28.59 ± 0.16
pt HW	1.85 ± 0.05	1.83 ± 0.05	1.66 ± 0.06	1.65 ± 0.06
nc pt HW	7.34 ± 0.26	9.32 ± 0.37	5.71 ± 0.26	5.92 ± 0.28
N-pt/pt-Ap	6.41 ± 0.21	7.62 ± 0.27	6.02 ± 0.02	6.11 ± 0.21
Ans FW	31.18 ± 0.49	34.73 ± 0.50	28.18 ± 0.53	28.29 ± 0.43
Ans HW	29.47 ± 0.51	31.76 ± 0.43	25.94 ± 0.45	25.54 ± 0.34
Dc FW	9.03 ± 0.17	10.30 ± 0.19	7.76 ± 0.24	7.63 ± 0.23
Cux FW	14.43 ± 0.21	15.59 ± 0.27	12.76 ± 0.35	12.88 ± 0.29
Anal L FW	52.08 ± 0.95	57.95 ± 1.04	39.88 ± 1.07	42.30 ± 0.94
Anal L HW	69.06 ± 1.38	77.02 ± 1.67	52.12 ± 1.47	56.50 ± 0.94

Abd: length of abdomen (including ovipositor); – FW: length of forewing; – w FW: width of forewing; – 100w/FW: relative width of forewing (% of wing length); – HW: length of hind wing; – w HW: width of hindwing; – 100w/HW: relative width of hindwing (% of wing length); – pt HW: pseudopterostigma costal length in hindwing; – nc pt HW: number of cells in pseudo-pterostigma of hindwing; – N-pt/pt-Ap: ratio of nodus-pterostigma/pterostigma-apex of forewing; – Ans FW: number of antenodal crossveins between C and Sc in forewing; – Ans HW: number of antenodal crossveins between C and Sc in hindwing; – Dc FW: number of crossveins in discoidal cell of forewing; – Cux FW: number of cubito-anal crossveins in forewing; – Anal L FW: number of cells in anal-loop of forewing; – Anal L HW: number of cells in anal-loop of hindwing

heterochromic females from Gabela were not significantly different from each other, but differed from *C. balcanica*. Furthermore, the samples of *C. balcanica* from Konavli and Metkovic were significantly different from each other. The same result was obtained for five other variables.

The overall results of the multiple comparison tests applied to the means of all eight morphometric characters subjected to ANOVA confirm that there are no significant differences among the means of the six characters involving the number of crossveins and cells in the wings both of the males and of the females of *C. s. ancilla* (Tab. VI, from Ans FW to Anal L HW).

Taking into account the mean values of the same six variables (Tabs I & II), and the results of the comparison tests (Tab. VI) the authors came to the conclusion that the males and females of *C. balcanica* have significantly more antenodal, discoidal cell and cubito-anal crossveins, and more cells in the anal-loops than do the males

Table III

Measurements (mm) of characters of the heterochromic females of *C. s. ancilla* from Gabela; mean value ± standard error

Character	Measurement
pt HW	1.64 ± 0.04
nc pt HW	5.53 ± 0.28
100w/FW	29.86 ± 0.23
100w/HW	30.06 ± 0.17
Ans FW	27.16 ± 0.38
Ans HW	25.11 ± 0.55
Dc FW	8.05 ± 0.25
Cux FW	12.68 ± 0.31
Anal L FW	42.74 ± 0.10
Anal L HW	57.11 ± 0.13

pt HW: pseudopterostigma costal length in hindwing; – nc pt HW: number of cells in pseudopterostigma of hindwing; – 100w/FW: relative width of forewing (% of wing length); – 100w/HW: relative width of hindwing (% of wing length); – Ans FW: number of antenodal crossveins between C and Sc in forewing; – Ans HW: number of antenodal crossveins between C and Sc in hindwing; – Dc FW: number of crossveins in discoidal cell of forewing; – Cux FW: number of cubito-anal crossveins in forewing; – Anal L FW: number of cells in anal-loop of forewing; – Anal L HW: number of cells in anal-loop of hindwing

and females of *C. s. ancilla*. This can thus be used in addition to wing and body coloration for discriminating these two species. Indeed, the series of 19 heterochromic females taken at Gabela, near Metković, has been identified as *C. s. ancilla* on the basis of these six characters, in addition to a small pseudopterostigma and a small number of cells in the latter, a metallic light green body colour, pale greenish almost hyaline wings, and fairly extensive yellow patterns on the body.

However, the results of the multiple comparison tests applied to the relative widths of the wings disagree partly with the above (Tab. VI, 100w/FW and 100w/HW). Both males and females of *C. balcanica* collected at both sites have significantly wider wings than do males and females of *C. s. ancilla* taken at Temska and Djevdjelija. Similarly, females of *C. balcanica* from Konavli have wider wings than the heterochromic females of *C. s. ancilla* from Gabela. However, no significant differences have been found between the relative width of the forewings and hindwings of the *C. balcanica* females collected at Metković and those of *C. s. ancilla* females taken at Gabela. Perhaps the use of larger sample sizes would produce a more decisive conclusions. Anyhow, the males of *C. s. ancilla* have to be found at Gabela to confirm the sympatric distribution of the two species in that part of the river Neretva valley.

An attempt has been made to define and illustrate the yellow patterns of the females of both species on the sides of the thorax, on the metasternum and on the head in frontal view (Fig. 1 A-C, a-d, n-p). The yellow patterns on the metallic green body of the *C. s. ancilla* females are obviously more extensive than those on the metallic dark blue body of the *C. balcanica* females (Tab. VII). In addition, some males of *C. balcanica* from both Metković (4 ♂ or 1.5%) and Konavli (6 ♂ or 1.9%) had an extremely reduced yellow pattern on the head (Fig. 1, m).

Table IV

Results of the one-way ANOVA of the eight selected characters, which are common to males and females of *C. balcanica* and *C. s. ancilla*. – A total of nine samples (groups) are examined: m a l e s: Metković (N=27), Konavli (N=32), Temska (N=29), Djevdjelija (N=13); – f e m a l e s: Metković (N=38), Konavli (N=37), Temska (N=17), Djevdjelija (N=24), Gabela (N=19). – [Degrees of freedom: m a l e s: between groups 3, within groups 97; – f e m a l e s: bg 4, wg 130]

Characters	Males Mean square Groups / Error	F	Females Mean square Groups / Error	F
100w/FW	31.10 / 1.16	26.81	16.74 / 1.24	13.50
100w/HW	20.51 / 1.26	16.28	35.64 / 0.92	38.74
Ans FW	286.30 / 13.80	20.75	274.03 / 6.74	40.66
Ans HW	402.00 / 10.00	40.20	241.40 / 6.34	38.08
Dc FW	36.00 / 1.24	29.03	36.77 / 1.17	31.43
Cux FW	53.23 / 2.97	17.92	47.47 / 2.11	22.50
Anal L FW	4187.91 /130.46	32.10	1640.36 / 36.39	45.08
Anal L HW	7128.74 /188.97	37.72	2927.29 / 62.10	47.14

All F-values highly significant, P<0.001. – 100w/FW: relative width of forewing (% of wing length); – 100w/HW: relative width of hindwing (% of wing length); – Ans FW: number of antenodal crossveins between C and Sc in forewing; – Ans HW: number of antenodal crossveins between C and Sc in hindwing; – Dc FW: number of crossveins in discoidal cell of forewing; – Cux FW: number of cubito-anal crossveins in forewing; – Anal L FW: number of cells in anal-loop of forewing; – Anal L HW: number of cells in anal-loop of hindwing

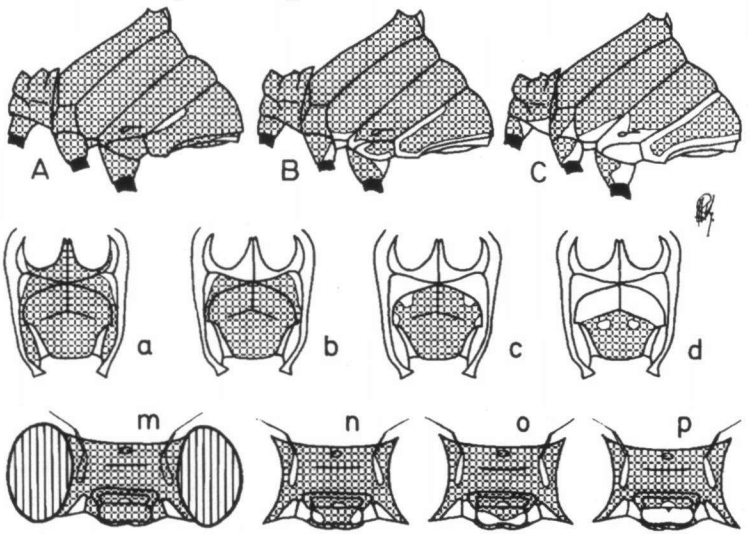

Fig. 1. Yellow patterns (unshaded regions) on the females' metallic dark blue body (*C. balcanica*) and/or metallic green body (*C. s. ancilla*), examined in Dalmatia, E Serbia and SE Macedonia: (A-C) side of thorax; – (a-d) metasternum; – (n-p) head in frontal view; – (m) extremely reduced pattern of some *C. balcanica* male heads.

Table V

The SNK multiple comparison test, with unequal sample sizes, applied on the mean values of number of cells in anal-loop of forewing (Anal L FW), of the following five samples of females: *C. balcanica* from Metković (M) and Konavli (K), and *C. s. ancilla* from Gabela (G), Temska (T) and Djevdjelija (D) – [The probability = 0.05]

Samples ranked by means:	T	D	G	M	K
Ranked sample means:	39.88	42.30	42.74	52.08	57.95
Sizes of samples:	17	24	19	38	37

Comparison	Difference of means	SE	q	p	Q	The null hypothesis
K - T	18.07	1.25	14.46	5	3.86	Reject
K - D	15.65	1.12	13.97	4	3.63	„
K - G	15.21	1.20	12.68	3	3.32	„
K - M	5.87	0.99	5.93	2	2.77	„
M - T	12.20	1.24	9.84	4	3.63	„
M - D	9.78	1.11	8.81	3	3.32	„
M - G	9.34	1.20	7.78	2	2.77	„
G - T	2.86	1.42	2.01	3	3.32	Accept
G - D	0.44	1.31	0.34	2	2.77	„
D - T	2.42	1.35	1.79	2	2.77	„

DISCUSSION

It is felt that there is no need to redescribe either of the two species examined. The specimens of *C. balcanica* from Metković and Konavli fit the original description and illustrations of shape and size of wing spot, body colour, and some other details (cf. FUDAKOWSKI, 1930). All the females examined were homeochromic. The females of *C. balcanica* from Konavli were homogeneous in shape, size and colour of the wing spot. A few variations were noticed among the females of this species from Metković. However, more specimens must be available for a competent survey and to allow comment on that variability. The *C. balcanica* males from Metković and Konavli have obviously more antenodal crossveins in the forewing and the hindwing than the females of this species (Tabs I & II, Ans FW & Ans HW). BARTENEV (1912b) pointed this out when describing his "*C. ancilla*".

The specimens of *C. s. ancilla* from Gabela, Temska and Djevdjelija are similar in shape and wing spot size, body colour and yellow body pattern to the description and illustrations of *C. s. caprai* from Italy published by CONCI & NIELSEN (1956) and MAIBACH (1987). All the *C. s. ancilla* females examined were heterochromic. Some males of this species from Temska (9 or 33.1%) and Djevdjelija (6 or 46.2%) have the apex of the wings completely dark.

According to FUDAKOWSKI (1930), the pseudopterostigma of *C. balcanica* is "etwas grösser als bei ostpreussischen und polnischen *C. s. ancilla*". The present

Table VI

Results of the SNK test applied to the means of morphometric characters of *C. balcanica* from Metković (M) and Konavli (K), and *C. s. ancilla* from Gabela (G), Temska (T) and Djevdjelija (D)

Character	Males				Females				
100w/FW	M	K	T	D	K	M	G	T	D
100w/HW	M	K	T	D	K	M	G	T	D
Ans FW	M	K	T	D	M	K	G	T	D
Ans HW	M	K	T	D	M	K	G	T	D
Dc FW	M	K	T	D	M	K	G	T	D
Cux FW	M	K	T	D	M	K	G	T	D
Anal L FW	M	K	T	D	M	K	G	T	D
Anal L HW	M	K	T	D	M	K	G	T	D

There is no significant difference between or among the samples which are underlined together. – 100w/FW: relative width of forewing (% of wing length); – 100w/HW: relative width of hindwing (% of wing length); – Ans FW: number of antenodal crossveins between C and Sc in forewing; – Ans HW: number of antenodal crossveins between C and Sc in hindwing; – Dc FW: number of crossveins in discoidal cell of forewing; – Cux FW: number of cubito-anal crossveins in forewing; – Anal L FW: number of cells in anal-loop of forewing; – Anal L HW: number of cells in anal-loop of hindwing

examination showed that the pterostigma in the hindwing of the *balcanica* females from Metković and Konavli is longer than in *ancilla* females from Gabela, Temska and Djevdjelija (Tabs I & III).

FUDAKOWSKI (1930) identified five females from Metković as *C. s. ancilla*, although the specimens were "von typischen *C. s. ancilla* aus Polen und Ostpreussen etwas abweichen". He also noticed "Laut diesen Angaben konnte man nicht entscheiden, ob die dalmatinischen Exemplare mit jenen aus Ostpreussen (terra typica) und Polen identisch sind" (FUDAKOWSKI, 1930, pp. 60-61). In the present paper it is suggested that Fudakowski's *ancilla* is a variety of *C. balcanica*. However, a new examination of a series of *C. s. ancilla* from terra typica is necessary.

BARTENEV (1912a) identified the specimens from Lake Skutary, SW Montenegro (10 ♂, 23 ♀) as *C. ancilla*. He joined these specimens, afterwards, to the specimens of the [sub]species from Poland, Belorussia (the Pripet) the Danube Delta (Izmail), and described all of them together as *C. ancilla* (BARTENEV, 1912b, 1930). Consequently, many features of *C. balcanica* are found in his description of *C. ancilla*, including relatively large numbers of crossveins in the wings. There are interesting details in his discussion of the Selys' description[s] of *C. ancilla*. According to Bartenev [translated from Russian] "Selys Longchamps considered formerly the females of this form [*C. ancilla*] with hyaline wings, while females with coloured wings he took for 'variété accidentalle'. Later, in '*Les odonates de l'Asie Mineure*', he started to describe the *C. ancilla* female with an opaque wing spot like the male. " [...] "The author had formerly material almost exclusively from Prussia". [...] "There is no typical *C. ancilla* in Prussia". [...] "The specimens which

Table VII

Frequency of the yellow patterns on the thorax side (A-C), the metasternum (a-d), and the head in frontal view (n-p) (Fig. 1) among the females of *C. balcanica* from: Metković (M, N=38), Konavli (K, N=37); and – *C. s. ancilla* from: Gabela (G, N=19), Temska (T, N=17), Djevdjelija (D, N=24)

Species	Loc.	Thorax			Metasternum				Head		
		A	B	C	a	b	c	d	n	o	p
balcanica	M	6	30	2	21	13	3	1	17	21	-
	K	8	28	1	16	18	2	1	20	17	-
s. ancilla	G	-	12	7	2	-	8	9	5	6	8
	T	-	1	16	1	-	8	8	3	3	11
	D	-	-	24	-	-	7	17	-	5	19

Selys had from Dalmatia, and also 1 ♂ from the island of Korfu, referred to typical *C. ancilla*" (BARTENEV, 1912b, pp. 98-99).

According to a recently published map, *C. s. ancilla* is widespread over a considerable part of Europe and W Asia (LOHMANN, 1992b). It has undoubtedly been recorded in E Serbia (Krupačko jezero; ADAMOVIĆ, 1993) and Temska (this paper) and E Macedonia (Strumička kotlina; ADAMOVIĆ, 1990) and Djevdjelija (this paper).

The areas of coexistence or juxtaposition of *ancilla* and *balcanica* are of particular interest. FUDAKOWSKI (1930) described "*Calopteryx splendens* Harr. form.?" on the basis of a series of males and females, which were found at Vid, a village near Metković, in the marshy plain of the Neretva R. Taking into account that description, the specimens from Vid refer to *C. s. ancilla*. In the present paper, 19 females taken at Gabela near Metković are identified as *C. s. ancilla*. DUMONT et al. (1993) noticed in Albania that "As soon as one moves E into the mountains, male wing spots become smaller and androchrome females disappear". Such a place where the two *Calopteryx* species meet seems to exist in NW Greece (STOBBE, 1990, map 2).

In a letter to the first author, dated 30 September 1950, the late Dr Erich Schmidt made the following statement "I myself have collected *C. splendens balcanica* in numbers, in Kalávrita and Diakoftó in Greece [N Peloponnesus], where the form is much larger" [than the specimens from Trebinje, Metković and Konavli, which were in his collection]. *C. balcanica* is distributed in W Greece and Peloponnesus (BUCHHOLZ, 1954; STOBBE, 1990; LOHMANN 1992a).

C. balcanica has been found in Herzegovina, Dalmatia and Montenegro (BARTENEV, 1912a; FUDAKOWSKI, 1930; ADAMOVIĆ, 1967; DUMONT, 1977). However, its distribution seems to be restricted to the bays of the Mediterranean climate in these countries, the valleys of the rivers emptying into the Adriatic Sea and some karst depressions (Popovo polje and Konavli, for example). A karst polje is usually isolated by limestone hills and mountains. The significant differ-

ences identified between the *C. balcanica* samples taken in Konavli and those collected in Metković could be ascribed to such an isolation of Konavli.

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