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Trichocera (*Metatrichocera*) *regelationis* (LINNAEUS), 1758: intraspecific variability in European populations (Diptera, Trichoceridae)

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Abstract. The morphological variability within the species *Trichocera regelationis* is illustrated and discussed; following characters are dealt with in the males: size, body and wing colour, first two antennal segments and two last palpal segments, height of VIII sternite, height of the gonocoxal bridge, shape of parameres and of basal and lateral apodemes. In the females: shape of ovipositor, width of the genital fork and gap between the bristles of supragenital plate. Mode of working of tarsal claws and their sexual dimorphism in this species is discussed.

Key words: Trichoceridae, *Trichocera*, sexual dimorphism, tarsal claw.

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I. INTRODUCTION

Trichocera regelationis (LINNAEUS), 1758 was the first described species of the family. Easily recognizable by its wings with single spot, this species was reported from different regions of the Holarctics. EDWARDS (1938) and TOKUNAGA (1938), the first in Europe and the latter in Japan, were the first authors which observed the variability in the wing spots. Both noted that, apart from a single spot on cross-vein r-m, also an additional cloud may appear on m-cu. DAHL (1966) illustrated the differences in shape of the gonostylus, bridge, in arrangement of setae on margin of sternite IX and in the shape of lateral apodemes of the aedeagus. She also compared autumn and spring populations and did not find differences between them. Other hints on variability come from comparison of drawings and descriptions of various authors. The body colour was defined as brownish black (MEIGEN 1818, TOKUNAGA 1938), but also as red! (LAWRENCE 1957). Ovipositor is strongly curved and with massive base in TOKUNAGA (1938), and more slender in DAHL (1966). The vaginal fork is thin over entire length in DAHL (1966), but with widened apical portion in PRATT (1987). All this information leads to the question whether the authors mean the same species; the question is essential in view of absence of a holotype, with the lectotype in poor condition, devoid of the abdomen (DAHL, 1966). My observations on different European populations led me to conclusion that the species is very variable in size, colour of the body, expression of wing spots and clouds. Larger specimens, with well defined additional clouds, may be taken for *T. maculipennis* MEIGEN, 1818. Specimens bleached by the time in old collections may be taken for *T. rufescens* EDWARDS, 1938,

when basing on artificial, misguiding colour of the body. Remarkable, until now not defined variation occurs in the antennae, palpi and outer and inner genitalia of male and female.

The present work aims at describing variation in those structures within this species. If the populations examined represent more than one species, it is plausible that some of these characters should be linked (i. e., co-present) in the specimens. To be sure that the variation observed concerns only one species, I had started the study on a sample of siblings. Then I have widened the study to a sample of population collected in one locality and time; and eventually, the results are compared to specimens from European collections of Great Britain, France, Switzerland, Sweden, Germany and Poland. Additionally, a mode of working of a tarsal claw and the sexual dimorphism in its size is described for *T. regelationis*.

A b b r e v i a t i o n s

DEI – Deutsches Entomologisches Institut; Eberswalde, Germany

ISEZ – Institute of Systematics and Evolution of Animals, Krakow, Poland

MHNN – Musée d'histoire naturelle, Neuchâtel, Switzerland

NHM – Natural History Museum, London, UK

ZIW – Zoological Institute, Pol. Acad. Sci., Warszawa, Poland.

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II. MATERIAL

S a m p l e S (sibling males): a most reliable way to obtain a sample of siblings would be to rear them from eggs laid by a single female. In spite of multiple trials, I never succeeded in rearing Trichoceridae from eggs laid by a caged female. However, I had the opportunity to discover such a sample after rising the cover of a barrel with liquid compost. A cloud of 15 males was promptly collected (Kraków-Zabierzów, garden, 20.x.1989). They shared some peculiar characters of wing venation (defined in the Results), which convinced me that they must have come from the eggs laid by a single female which was earlier accidentally imprisoned in the barrel.

S a m p l e P representing the local population was collected the same day and locality (Kraków-Kurdwanów, garden, 20.x.1998) and consisted of 44 males and 14 females.

S a m p l e s o f s p e c i m e n s l i s t e d i n T a b l e I V: Poland. PL-G: Gdańsk-Oliwa: garden, 21.X. 1989, 1♂, 2 ♀♀ (R. SZADZIEWSKI); Kraków: PL-K1: Zabierzów 20.X. 1989, 15 ♂♂, 3 ♀♀; PL-K2: Kosocice X-XII. 1989, 2 ♂♂, 2 ♀♀; PL-K3: Kosocice, 27.II.1999, 20 ♂♂, 1 ♀ (W. KRZEMIŃSKI); PL-K4: Kraków Kosocice, 2.IV. 1989, 1 ♀. Ojców National Park: PL-O1: 6.IV.1989, 3 ♀♀; PL-O2: 16-27.IV.1989, 1 ♂, 1 ♀ (A. PALACZYK); PL-O3: Murownia 27.III. 1990, 1 ♀ (A. KLASA); PL-Kr: Krynica Górska: 9.I. 1999, 1 ♀; 13.I., 1 ♀; 16.I. 1 ♀; 27.I, 1 ♂, 5 ♀♀ (R. SOSZYŃSKI; on snow); PL-Pi: Pieniny Mts, Polana Szopka, 650 m, 24.X. 1998, 1 ♂, 1 ♀ (A. PALACZYK). Great Britain (all NHM): GB-1: Surrey, Addington 19.XI.1948 (R. L. COE), 1 ♀; GB-2: Winkworth arboretum, 26.X.1969, 1 ♀ (R. J. VANE-WRIGHT); GB-3: Merioneth, Brithdir, nr Dolgellau 23.V.1973 (A. M. HUTSON) – 2 ♀♀; GB-4: Loch Rannoch, VI. 1931 – 1 ♀; (F. W. EDWARDS); GB-5: Dublin, 27.III. 1921, reared from rotten swede – 1 ♂, 1 ♀ (J. G. RHYNEHART). Switzerland. CH: Ticino, Aurigeno, 4-9.XI.1980, 6 ♂♂, 1 ♀ (W. GEIGER; MHNN). Germany. D: Pommerania: Woldegk, 1.IV.1900, 1 ♀ (Ketel Coll., DEI)

O t h e r m a t e r i a l. Poland: Dolina Nidy – Pełczyska, 3. XI. 1992, 14 ♂♂, 7 ♀♀; Wola Zagojska-strumyk, 3.XI. 1992, 8 ♂♂, 2 ♀♀(E. KRZEMIŃSKA, E. SKALSKA); Oświęcim-Brodła, 25.II. 1989, 20 ♂♂; Kraków-Kosocice, 21. X. 1989, 1 ♂ (W. KRZEMIŃSKI); Ojców National Park, Wąwóz Skałbania, 11.IV. 1999, 35 ♂♂ (A. KLASA); Zawoja 20.III. 1989, 10 ♂♂ (W. KRZEMIŃSKI); Gorce Mts: Zabrzeż 26.X.1989, 4 ♂♂, 1 ♀(J. WIEDEŃSKA), Przysłop-Małe Jaszcze,

15-17.X. 1991, 5 ♂♂ (E. SKALSKA); Tatry Mts: Głodówka, 5.XI. 1989 4 ♂, 1 ♀(W. KRZEMIŃSKI), Wodogrzmoty Mickiewicza, 5.XI. 1989, 6 ♂♂, Gubałówka, 6.X. 1991, 3 ♂♂ (E. SKALSKA); Sudety Mts: Świeradów Zdrój, 13. I. 1997, 3 ♀♀ (–3°C, on snow; B. SOSZYŃSKI); Szklarska Poręba, 5.VIII.1982, 2 ♂♂ (W. KRZEMIŃSKI). Pogórze Przemyskie: Brzezie k. Dubiecka, 4.IV.1989, 6 ♂♂ (E. KRZEMIŃSKA), Rybotycze, 25.X. 1989, 5 ♂♂, 2 ♀♀ (W. KRZEMIŃSKI), Bieszczady Mts: Przełęcz Wyżnia, 872 m, 1 ♂ (W. KRZEMIŃSKI), Ustrzyki Górne 26.X. 1989, 11 ♂♂ (W. KRZEMIŃSKI), 26.IX. 1991, 7 ♂♂ (W. KRZEMIŃSKI), potok Zwór, 800-900 m, 22-24.X. 1992, 13 ♂♂, 3 ♀; potok Halicz, 650 m, 21.X. 1992, 5 ♂; Lutowiska 26.X. 1989, 2 ♂♂ (W. KRZEMIŃSKI). Pieniny Mts, Sromowce Wyżnie – Kąty 25.X.1998, 3 ♂♂ . Great Britain (all NHM): Pertshire, Killin distr., Ben Chalum 9-10.VI.1932., 800-2500 ft., 3 ♂♂; Kent, Dungeness, 28.XII. 1963 (A. M. HUTSON), 1 ♀. Sweden: Uppsala, Botanical Garden, 17-19.X. 1999 – 3 ♂♂.

If not otherwise stated, material belongs ISEZ and was collected by the author.

III. METHODS

Preparation of genitalia was performed as in KRZEMIŃSKA (1999). Measurements were taken at a built-in micrometer scale of the binocular at various magnifications and in Tables I-III are given in the units of this scale. Real values (in mm) of these measurements can be obtained by dividing the scale units by the magnification. Magnification used for wing size: 10×; for wing venation, antennae, palpi, female genitalia (gap between the bristles), male outer genitalia (sternite VIII, bridge): 60×; male inner genitalia (width of basal apodemes): 400×.

IV. RESULTS – MALES

Characteristics of a sample S (siblings)

A g e: the adults of the sample obviously did not hatch at the same time. Five out of fifteen must have been just hatched, since their abdomens were filled with fat and coiled upwards; their antennae and genital parts were so poorly sclerotized, soft and plump, that they were excluded from this study. Of the remaining 10 specimens examined, only two were dark brown and with hardened, fully sclerotized genitalia and antennae. No females were present; probably they hatched later, after the males. However, DAHL (1969) observed that males and females appear at the same time.

W i n g v e n a t i o n (Figs 1-3; Table I) was characterized by the following small deviations:

1. Starting point of a cross-vein rm. Usually, rm leaves R5 at a short distance below the fork of Rs into R3+4 and R5; this small section is here named bR5 (basal section of R5; Fig. 1A). In a sample examined, all but two specimens did not possess this section, since the beginning of rm was shifted either to the fork of Rs (Figs 1B, 2), or even more proximally, and started before this fork (Figs 1C, 3). In the latter case a small, additional section of Rs appeared between rm and fork of Rs (section is named here dRs = distal section of Rs). These three character states (Fig. 1 A-C) are given in a Table 1, with a state A coded by the length of bR5 given in positive values, state B by "0" and state C by the length of dRs in negative values.

2. Shape of distal part of cell r. In all specimens rr was extremely short and in the majority the vein R2+3 was also very short (ca. 3-4 times shorter than R2+3+4; Figs 2-3); their length ratio is given in Table 1.

3. Spur on cross-vein mcu (Fig. 2). The spur was present in all but three specimens, and varoiusly expressed: from only a trace looking as unevenness of mcu, to a well expressed short vein,

generally directed to the inside of the wing (in two cases however directed to the outside of the wing).

All these characters were expressed to a different degree in the specimens; in most cases at least two of them coincided (Table I).

Very interesting, but beyond the scope of this study were the characters of venation in which the specimens were different: the shape of d cell, shape and length of m1 cell, length of mcu (compare both wings in Figs 2 and 3).

O u t e r g e n i t a l i a o f m a l e s (Figs 4-9) shared following characters: sternite IX relatively long, of ca. 1/4 its width and gonostyles with tips pointed and large tubercles. The differences concerned: setation pattern on IX sternite, length of VIII sternite, height of the bridge, shape of parameres in lateral view and shape of basal and aedeagal apodemes.

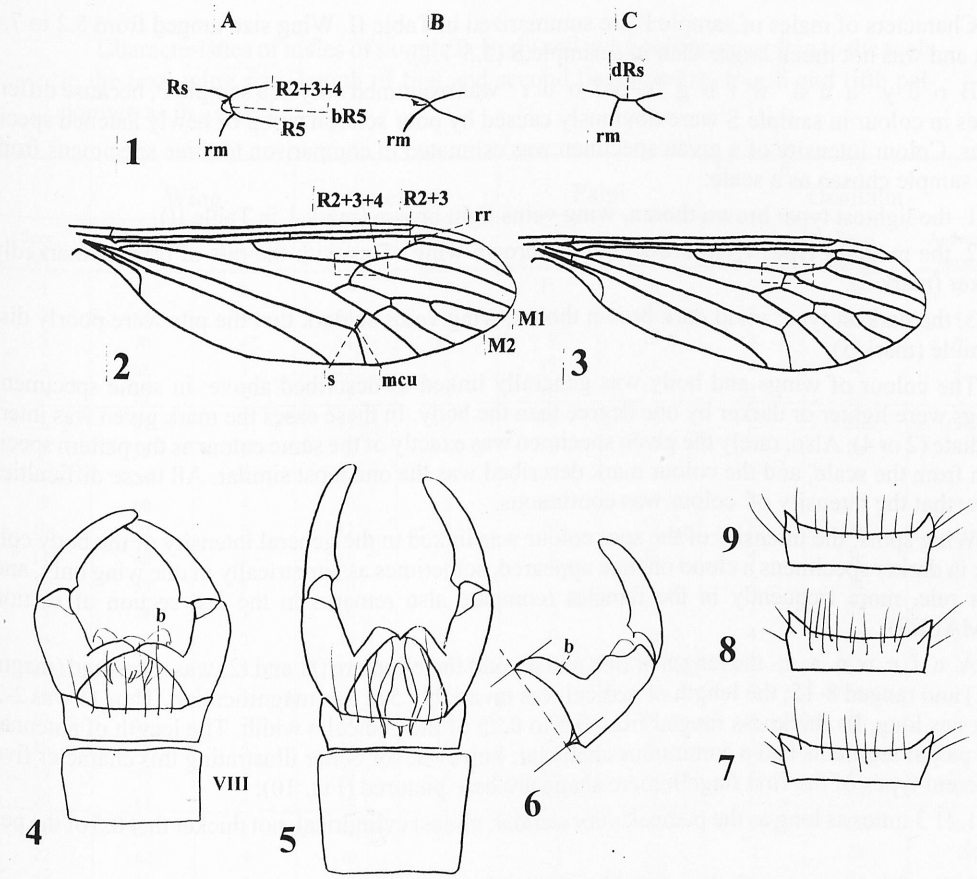
Arrangement of bristles on margin of sternite IX was different nearly in every specimen; setae were arranged in one (Fig. 7) or in two rows (one case, Fig. 9) or irregularly, at different levels (Fig. 8). The setae were abundant (14) or only few. Two central, strong setae so characteristic for *Trichocera annulata* MEIGEN, *T. rufescens* EDWARDS and *T. michali* KRZEMIŃSKA (KRZEMIŃSKA 1999), were here present only in some specimens, and even then could be positioned on different levels (Fig. 7).

Length of the bristles: Figs 7-9 show only the basal, thick part of the bristles. When examined under larger magnifications (60×), the bristles appear very long and reach the tip of the bridge as shown in Figs 4-5. Their thinned and transparent distal sections are usually not visible under magnifications usually applied (10-30×).

Table I

Characteristics of sibling males (sample S); wing size in 0.1 mm; codes for parameres, basal apodemes and aedeagal apodemes defined in the text. Other measurements in units of scale, according to the Methods; n.a. – non applicable.

	Wing				Antennae		Palpi		Genitalia			
Spec. no.	Size	rm	R_{2+3+4}/ R_{3+4}	spur	fl	f2	p4	p5	VIII st. w/l	Parame res	Basal apod.	Aedeag. apod.
1	71	0	4.4	pres.	14	8	9	11	1.40	3	1a	6
2	65	+2	3.8	pres.	11	8	10	14	1.55	3	1b	4
3	71	0	1.7	pres.	11	7	10	15	1.61	3	2a	6
4	67	-6	2.3	pres.	11	8	10	15	1.76	3	3c	6
5	64	+4	4.4	abs.	11	8	9	14	1.87	3	3c	4
6	65	+3	4.4	abs.	11	8	8	13	2.0	2	3c	4
7	65	-6;-7	2.1	abs.	10	7	8	11	1.87	2	1b	4
8	66	-6	2.8	pres.	11	8	9	13	1.75	3	2a	3
9	66	0	1.7	pres.	11	7	10	15	1.22	4	2b	6
10	64	0;+3	4.4	pres.	11	8	8	13	1.64	1	3c	6
Min.	55	n.a.	1.7	n.a.	10	7	8	11	1.22	n.a.		
Max.	71		4.4		14	8.5	10	15	2.00			
Mean	65.4		3.20		11.4	7.8	9.2	13.5	1.667			
SD	4.45		1.193		1.02	0.59	0.88	1.54	0.235			



Figs 1-9. Sample of sibling specimens. Fig. 1. Mode of origin of the abnormality descibed in the text: A – usual condition with short basal section of R5 present; B – beginning of rm shifted to the fork of Rs; C – beginning of rm shifted proximally to the fork of Rs; short vein dRs arises. Arrows illustrate the direction of a shift illustrated in a subsequent drawing. Figs 2-3. Two original wings of specimens No. 9 – Fig. 2 and No. 7 – Fig. 3 of Table I. Figs. 4-5. Variability of outer genitalia: b – bridge; VIII – sternite VIII; IX – sternite IX. Fig. 6. Mode of measuring of the bridge (b). Figs 7-9. Three examples of arrangement of the bristles on distal margin of sternite IX.

Length of sternite VIII: the width/length ratio is given in Table I. Two extreme lengths of sternite VIII are pictured in Figs 4, 5.

Height of the bridge appeared to be also very different (two extreme cases are pictured in Figs 4-5, promptly after the maceration); however, after prolonged soak in alcohol or water with glycerine, everyone of the "low" bridges (Fig. 4) moved out and back from the sternite IX and appeared as high as one shown in Fig. 5. The length of inner margin of half of the bridge (Fig. 6) was measured after separating one gonocoxite; the measure was taken from the tip of the bridge to beginning of the gonocoxite apodeme and ranged 13-14.5 (magn. 60×).

Other features of the sample are characterized below, on the background of a larger sample P.

2. Variability of males in a sample of population (P) compared to a sample of siblings (S)

Characters of males of sample P are summarized in Table II. Wing size ranged from 5.2 to 7.4 mm and was not much larger than in a sample S (5.5-7.1).

B o d y a n d w i n g c o l o u r was examined only in a sample P, because differences in colour in sample S were obviously caused by poor sclerotization of newly hatched specimens. Colour intensity of a given specimen was estimated in comparison to three specimens from this sample chosen as a scale:

1. the lightest type: brown thorax, wing veins light brown (mark 1 in Table II).

2. the medium type: vivid brown thorax, brown wing veins with the pits of bristles markedly darker (mark 3).

3. the darkest type: vivid dark brown thorax, wing veins so dark that the pits were poorly discernible (mark 5).

The colour of wings and body was generally linked as described above; in some specimens wings were lighter or darker by one degree than the body. In these cases the mark given was intermediate (2 or 4). Also, rarely the given specimen was exactly of the same colour as the pattern specimen from the scale, and the colour mark described was the one most similar. All these difficulties show that the intensity of colour was continuous.

Wing spots: the intensity of the spot colour was linked to the general intensity of the body colour; in darker specimens a cloud on mcu appeared, sometimes assymetrically in one wing only, and as a rule, more frequently in the females (compare also remarks in the last section of section FEMALES).

A n t e n n a e: the length of first and second flagellomere (f1 and f2) was measured (magn. 60×) and ranged 8-15; the length of pedicel was invariably 5 at this magnification. Thus f1 was 2-3 times as long. Its thickness ranged from 0.5 to 0.75 of the pedicel's width. The length of antennal and palpal segments had a continuous character; however, for better illustrating this character five different types of the first flagellomere shape are here pictured (Fig. 10):

1. f1 3 times as long as the pedicel; very slender, almost cylindrical, not thicker that 0.5 of the pedicel.

2. f1 of the same length, but club-like, thicker at the base.

3. f1 ca. 2.5-2.7 as long as the pedicel, 0.75 times as thick, spindle-like or club-like.

4. f1 short and thick; 2 times as long and 0.65-0.75 times as thick as the pedicel; barrel-like.

5. f1 of the same length as type 4, but more slender (0.5 of the pedicel width); club-like.

P a l p i: the fourth and fifth palpomere (p4 and p5) were measured (magn. 60×). The relative length of p5 shows a great variability and can range from not much longer than the preceding one (p5/p4 length ratio 1.12; case 7 in Table II) to almost twice as long (1.89; case 13). Three examples of p5 compared to p4 are illustrated in Fig. 11 (with p5/p4= 1.2, 1.5 and 1.9) . In a sample S the length ratio p5/p4 ranges 1.22 to 1.63 (Table I, cases 7 and 10, resp.) – a remarkably wide range for the siblings (the two nearly extreme examples of this range are illustrated in Fig. 11(2,3).

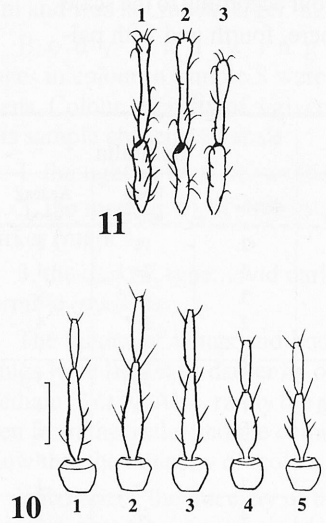
R e l a t i o n o f f 1, f 2, p 4, p 5 a n d c o l o u r t o w i n g s i z e. Surprisingly, none of these characters seemed to be influenced by the wing length (wl), which is an indicator of overall body size.The Pearsson coefficient for f1/wl was 0.410; for f2/wl= 0.419; for p4/wl= 0.519; for p5/wl= 0.597; for colour/wl= 0.543 (this last calculation was performed only for sample P; colour was treated as a meristic variable with values given in Table II). Plots of these variables against wing length are presented in Figs 12-14. The strongest relation was stated between length of last palpomere and wing length. No noticeable relation between lengths of all segments was stated (the greatest r = 0.647 was found for f1 and f2).

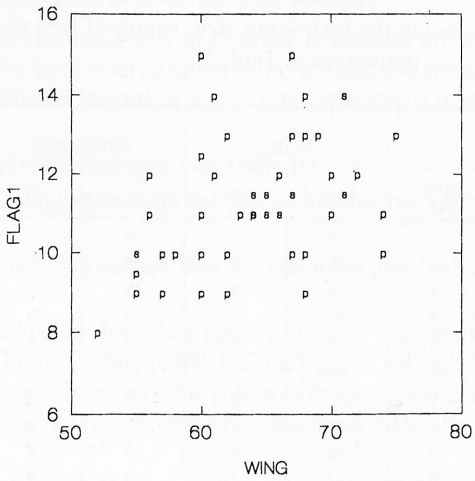
V a r i a b i l i t y i n a e d e a g a l s t r u c t u r e s (Figs 15-18; Tables I and II) concerned length and shape of parameres (Fig. 16), shape and width of basal apodemes

Table II

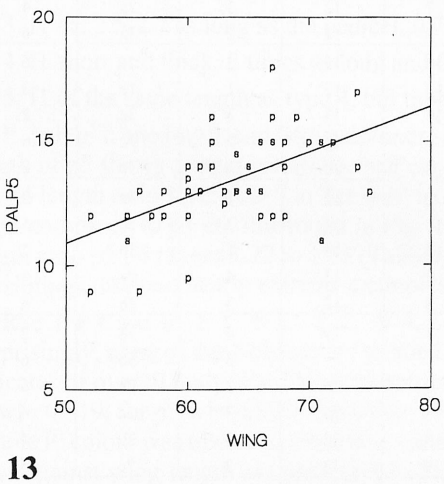
Characteristics of males of sample P. Body and wing colour according to the scale in the text; wing size, length of first and second flagellomere, fourth and fifth palpomere as in Table I.

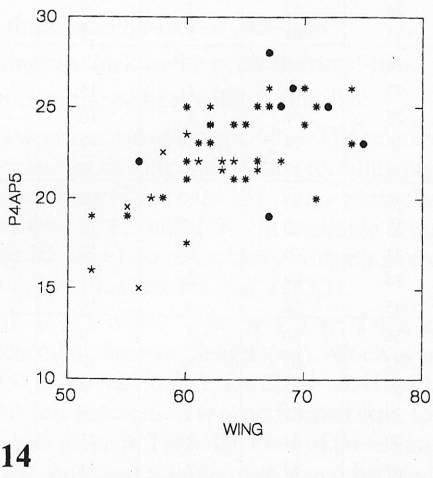
	Wing		Antennae		Palpi		Genitalia		
Spec. No.	Size	Colour	fl	f2	p4	p5	Parameres	Basal apod.	Aedeag. apod.
1	68	5	9	7	11	14	2	1a	2
2	68	3	14	9	10	12	3	2c	4
3	70	4	11	10	9	15	3	2c	6
4	68	5	13	9	10	15	2	3c	4
5	62	3	9	8	10	14	3	2a	1
6	67	5	13	9	10	18	2	3b	3
7	52	2	8	7	8	9	1	2b	4
8	56	1	12	7	6	9	3	2b	4
9	60	4	10	8	10	12	2	3b	4
10	72	5	12	9	10	15	3	3a	1
11	68	3	10	8	8	14	4	3b	2
12	57	5	10	9	–	–	2	3a	3
13	74	3	10	8	9	17	3	2a	4
14	67	3	10	8	10	16	4	2c	3
15	60	4	11	8	8	13	3	2b	2
16	70	4	12	8	11	15	2	1c	3
17	61	2	11	8	9	14	x	2a	5
18	69	5	13	9	10	16	3	2a	5
19	75	5	13	8	10	13	2	3c	4
20	61	4	12	10	10	13	2	2a	5
21	66	3	12	8	10	12	2	2a	3
22	62	4	10	8	8	15	2	2a	1
23	56	5	11	9	9	13	3	3a	6
24	52	3	9	6	7	12	3	2a	4
25	67	5	15	9	7	12	2	3a	6
26	62	3	13	9	10	15	3	2c	6
27	60	1	15	9	10	12	1	1c	3
28	58	1	10	7	10	13	3	3c	2
29	74	4	11	8	9	14	2	3c	6
30	57	2	9	7	8	12	3	3c	2
31	55	1	10	7	7	12	1	3a	3
32	60	4	13	9	11	14	3	1b	5
33	60	2	10	8	10	14	1	3b	2
34	64	2	11	9	9	13	4	2a	3
35	58	4	10	9	8	12	3	3b	6
36	60	3	9	8	8	10	4	3b	2
37	63	4	12	8	–	–	3	3b	6
38	62	4	9	6	9	16	3	2b	6
39	55	1	9	7	8	12	3	2c	4
40	63	2	11	8	9	13	3	2b	4
41	63	2	11	9	9	13	3	2c	5
Min.	52	n.a.	8	6	6	9	n.a.		
Max.	75		15	10	11	18			
Mean	63.0		11.1	8.1	9.0	13.4			
SD	6.02		1.83	0.98	1.26	1.97			





Figs 10-12. Fig. 10. Shapes of the first and second flagellomere observed in a sample P and S (described in text). Bar = 0.1 mm. Fig. 11. Shapes of the fifth and fourth palpomere onserved in a sample P and S: 1 – p5/p4 length ratio = 1.9; 2 – p4/p5 = 1.5; 3 – p4/p5 = 1.2. Fig. 12. Plot of length of first flagellomere against wing size (in 0.1 mm); s – specimens of sample S; p – specimens of sample P.





Figs 13-14. Fig. 13. Plot of length of last palpomere against wing length. Other details as in Fig. 12. Fig. 14. Plot of summarized length of fourth and fifth palpomere against wing length; sample P. Specimens' symbols correspond to their body/wing colour mark (given in the text and Table II). Symbols: cross – colour mark 1 (defined in the main text); five armed star – mark 2; six armed star – mark 3; eight armed star – mark 4; full dark circle – mark 5.

(Fig. 17) and shape and type of sclerotization of aedeagal apodeme (Fig. 18). It must be stressed that, as in earlier described structures, the variability had continuous character and the type ascribed to each specimen was the one most similar to that observed.

Parameres: general characteristics of parameres in the *regelationis* group of species was given by KRZEMIŃSKA (1999). In *T. regelationis* usually a point may be discerned about the distal third section of parameres from which they became thin, straight and divergent in apical view (the point is marked by arrow in Fig. 15). The following four types of parameres, according to their length and shape in lateral view, were distinguished (Fig. 16):

1. Parameres short, midth part highly vaulted, with terminal parts raised; the width/height ratio of aedeagal complex is lesser than 1.0 (Fig. 16-1). A rare type, stated in 4 specimens of sample P and in one specimen of S.

2. Parameres rather short, with midth part highly vaulted, with terminal parts bent downwards (toward basal apodemes); width/height ratio about 1.0. A rather frequent type, found in 12 specimens of P (almost 30%) and in 2 specimens of sample S.

3. Parameres longer than the height of aedeagal complex in lateral view (width/height ratio ca. 1.1), regularly arched, terminal parts bent about 1/3. A most frequent type, present in 20 specimens of P (almost 50%) and 4 specimens of S.

4. Very long parameres (width/height ratio ca. 1.2 or more), with midth part flattened in lateral view (arrowed in Fig. 16-4). A rare type; 4 specimens of sample P and 1 in sample S.

One misshaped, abnormal aedeagus was found (specimen No. 17 in Table II; Fig. 18(5), with parameres and lateral apodemes strongly bent toward basal apodemes. This type of abnormality may happen also in other species, since I have found it also in one specimen of *T. montana* Stary.

Basal apodemes showed striking variability in the width and shape (Fig. 17). Three major classes were discerned on the basis of their width:

1. The widest type of ca. 8 units (magn. 80×) across the midth and up to 10-12 across the widest, lower part.

2. Medium, of 6-7 units across the midth and up to 8-9 across the lower part.

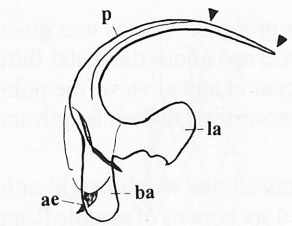
3. Thin, of ca. 5 units across the midth.

In each of these classes three shapes were discerned: A – the symmetric type; B – slightly assymmetric, with basal part directed to lateral apodemes; C – greatly assymmetric type. The above defined codes are given in Tables I and II. The widest and of medium width apodemes were the most frequent ones (17 and 20 in sample P, respectively). Thin apodemes, although rare, were present in both samples.

Lateral apodemes were of a rather uniform appearance, rounded to slightly expanded in lateral view (compare Figs 1, 2 and 3, 4) and positioned at a straight angle in relation to basal apodemes (Fig. 15); provided that the apparatus was kept in accurate, horizontal position under the binocular, so that the upper apodeme lied ideally over the lower one. Any smallest tilting caused drammatical change in shape and angle.

Aedeagal apodemes exbibited great variability; among 41 specimens of sample P not less than 25 different shapes could be discerned (Fig. 18). They are grouped according to their width and tip shape (blunt, sharp) into six types; in each type all different patterns of sclerotization (dark parts) are drawn. I suspect that the appearance of the tip may be changed by remnants of a muscle, left after the preparation, because in some specimens the tip shape has changed after some weeks of soak in glycerine. Also, to some extent, the dark parts had been "diluted" within the apodeme. Since, however, the aim of this work to present variation as it is observed among the specimens, I give here all images that were observed during the preparation.

Males from other collections did not exhibit other types in structures than those described. An interesting case represent three males from Sweden (Uppsala): each of them had different type of



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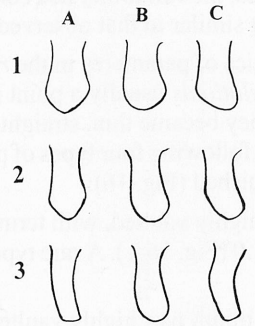

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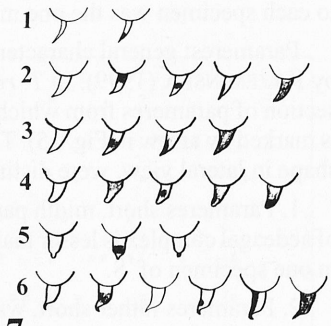

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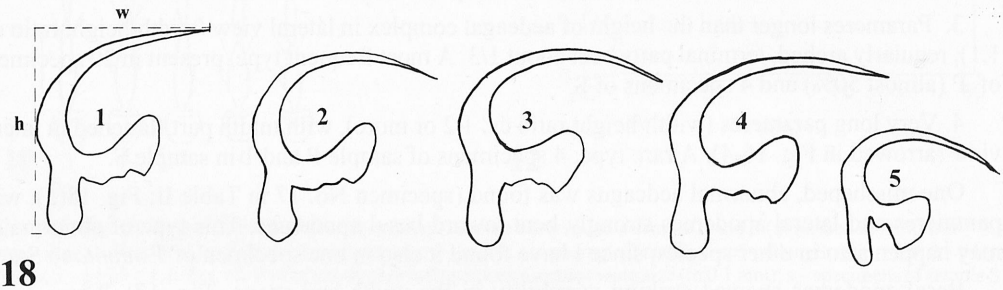

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Figs 15-18. Variations in the aedeagal structures in *T. regelationis* (all figures except (18-5) are to the same scale). Fig. 15 – general view of the aedeagal complex, laterally; ae – aedeagus; ba – basal apodeme; la -lateral apodeme; p – parameres; arrows indicate thinned and divergent sections of parameres. Fig. 16. Shapes of basal apodemes; three basic types according to width (1-3) and three variations within each type (A-C). Fig. 17. Aedeagal apodemes; six basic types (1-6) and variations in the tip and sclerotization within each type. Fig. 18 – Parameres laterally, four basic shapes (1-4) and one abnormal (5).

PARAMERES	1	2	3	4	5	6
4		33	22			2*3
3	23	233	2*	1*22 2222 3*	122	1*2* 222 3333*
2	2	1	12 33	1*3*3 33	2	332
1		3	13	22		3*

AEDEAGAL APODEMES

19

Fig. 19. Distribution of character states of aedeagal structures in 41 males of sample P and 10 males of sample S (marked with *). Specimens are labeled by the codes of their basal apodemes' shape (given in Figs 16-18).

parameres (2, 3 and 4), of basal apodeme (2a, 1a and 3a, resp.) and of aedeagal apodeme (6, 3, 5). This proves that the wide range of variability occurs also in *terra typica* of the species.

V. FEMALES

In females of *T. regelationis* the sternite VIII is distinctly convex and with a small protuberance in lateral view (Figs 20, 21). Females differ in the following characters of the genitalia: shape of the ovipositor, width of the vaginal fork of the hypogynial plate and the gap between two bristles of supravaginal plate. These characters for 14 females of sample P are set in a Table III. and are defined as below:

S h a p e o f t h e o v i p o s i t o r: six shapes were discerned (Fig. 22).

1. Ovipositor very broad at base, with setulose area strongly concave; strongly curved about the midth; basal half of dorsal margin slightly concave; second half much thinner.

2. Similar shape, but ovipositor less curved, setulose area less convex; the second half of ovipositor not as thin as ovipositor 1.

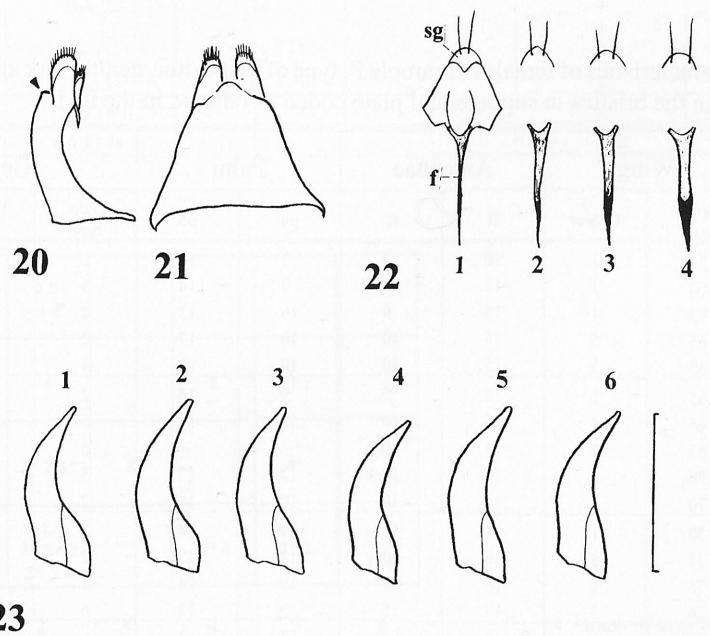
3. Broad up to the midth; regularly crescently curved

4. More slender; setulose area barely convex; regularly curved about the midth

5. Very slender (as the type 4), but curved over the midth (in the outer half); dorsal margin just before the tip with a small depression

6. Similar to 5, but the setulose area still less convex (basal ventral margin almost straight)

Small depressions in dorsal margin in the basal half and just before the tip occured in almost any type.



Figs 20-23. Figs 20-21. Female, sternite VIII in lateral (Fig. 20) and ventral view (Fig. 21). The protuberance is arrowed. Fig. 22. Variability of genital and supragenital plate: 4 types of the gap between the bristles in supragenital plate and 4 types of genital fork. sg, supragenital plate; f, fork. Fig. 23. Six types of ovipositor (1-6) met in T. regelationis; bar = 0.5 mm.

Genital plate: width of the vaginal fork (Fig. 23) About the midlength of the genital fork both margins are tucked to the inside, forming a tube; at this point the fork is often widened and from this point to the tip the fork appears darker and thinner. The tip is sharp to blunt, depending on how tightly is coiled the terminal part of the tube.

Four main types of the fork were discerned:

1. very thin over entire length
2. broad in the proximal part, narrowing triangularly to midlength, then thin
3. broad section extends beyond midlength
4. very broad fork

Supragenital plate: gap between the bristles (Fig. 23)

Four discrete widths of the gap between the bristles are discerned (width in units of the scale, magn. 40×):

1. 2.0-3.5
2. 3.6-5.0
3. 5.1-6.5
4. 6.6-8

Table III presents characters set for 14 females of one population (sample P), arranged according to the increasing wing size. Almost all these females were characterized by the type of the fork 1 or 2 (narrow fork); only one had broad fork (type 4). They exhibited four out of six types of ovipositors and all sizes of the gap between the bristles. This small sample shows that the size of gap between the bristles and the ovipositor's shape do not accompany each other.

Table III

Characteristics of females of sample P; type of ovipositor, genital fork and the gap between the bristles in supragenital plate coded as defined in the text.

	Wing		Antennae		Palpi		Genitalia		
Spec. No.	Wing size	Colour	fl	f2	p4	p5	Ovip. type	Bristle gap	Fork type
1	53	1	10	7	7	11	2	3	4
2	60	1	12	9	9	14	6	1	2
3	63	1	15	9	10	13	2	1	1
4	65	5	14	10	10	17	2	1	1
5	65	3	15	10	10	15	4	3	1
6	65	1	14	9	9	15	2	2	1
7	66	4	15	10	10	16	5	4	2
8	67	1	13	10	–	–	6	3	1
9	70	1	12	10	12	17	5	2	1
10	70	3	13	10	10	14	2	4	1
11	70	1	15	10	9	14	2	4	2
12	71	5	16	10	12	17	2	3	1
13	75	4	16	11	10	15	2	1	2
14	76	3	13	8	9	11	6	2	2
Min.	53	n.a.	10	7	7	11	n.a.		
Max.	76		16	11	12	17			
Mean	66.9		13.8	9.4	9,7	14.5			
SD	5.96		1.79	1.06	1.30	1.99			

Table IV

Characteristics of female genital structures (ovipositor, fork and the gap between bristles) of females from samples listed in MATERIAL

Locality	Date	Wing size	Ovipositor	Gap	Fork
PL-K1	20.X.89.	66	2	3	5
		73	6	4	2
		67	2	1	1
PL-K2	X-XII.89	55	2	4	3
		65	5	1	3
PL-K3	27.II.99	95	2	2	1
PL-K4	2.IV.89	66	6	4	2
PL- O1	6.IV.89	75	6	3	1
		76	4	4	1
		74	1	3	1
PL-O2	16-27.IV.89	75	1	4	1
PL-O3	27.III.90	68	6	2	1
PL-P1	24.X.99.	63	5	2	1
PL-Kr	9.I.99	69	4	1	3
	13.I.99.	71	3	3	1
	16.I.99	72	2	4	4
PL-G	21.X.89	75	1	3	2
		70	1	3	1
GB-1	19.XI.48	76	1	2	1
GB-2	26.X.69	68	2	2	2
GB-3	23.V.72	70	1	4	5
			1	4	5
GB-4	VI.31	47	2	2	4
GB-5	27.III.21	68	2	3	1
D-1	12.IV.1900	71	2	4	5
CH-1	4-9.XI.84.	72	3	2	2

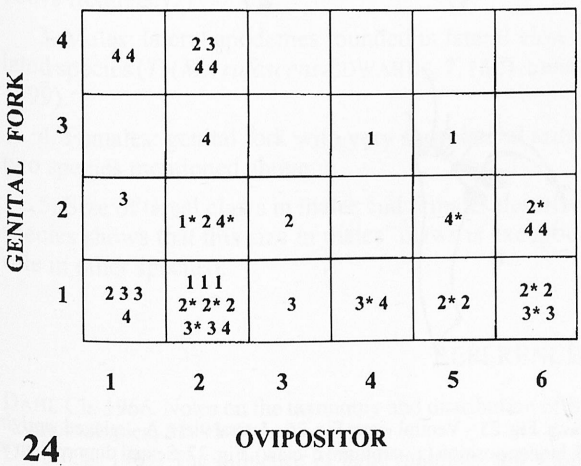


Fig. 24. Graph of distribution of character states for ovipositor and the fork in 40 females of sample P (marked with *) and females of Table IV. Specimens are labeled by the codes of their gap type.

Females of other collections: 26 females of Polish and other European collections are characterized in Table IV. They come from north and south of Poland, from Great Britain, Germany and Switzerland; and also of different year seasons. The graph (Fig. 24) shows the distribution of ovipositor shapes, the fork width and the gap between the bristles.

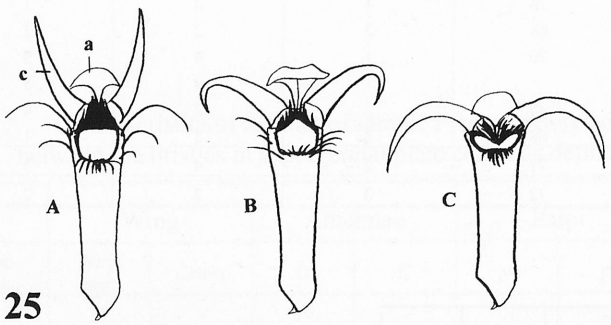
Noteworthy are the females from Krynica (sample PL-Kr), collected from the snow. They exhibit two extreme widths of the fork and of the gap between the bristles. Their body colour was almost black. The dark body colour of the specimens occuring on snow is a rule also in other groups of insects and probably enhances the amount of warmth absorbed from the environment. All females and the accompanying male had the wings dark grey infuscated and conspicuous spots on rm; the females had also an additional cloud on mcu, which lacked in the male.

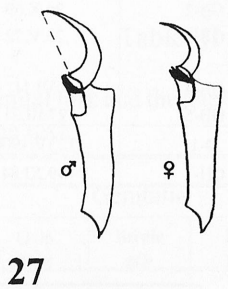
VI. TARSAL CLAW

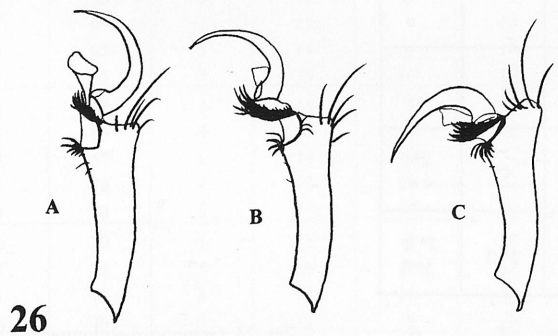
How does it work?

The tarsal claw can bend, i.e., can change its position in relation to the end of the ultimate tarsomere (to the acropod). In Figs 25-26 the different positions of a tarsal claws are shown, from the upright, most relaxed to the most bent one, in ventral and lateral views. All they can be traced in one given tarsomere, if it is observed while the medium is changed, for instance from water to alcohol or to glycerine; or simply, when the medium is warmed by the heat of the lamp.

On ventral side under the acropod the depression (recessed area) is present; when the acropod (and the claw) begins to bend, the depression is squeezed; in most strained position it almost disappears and the claw is bent at ca. 90° in relation to the relaxed position. Between both claws the strong tuft of curly short bristles is present and just over it – an arolium (according to McALPINE et al.







Figs 25-27. Figs 25-26. Working positions of tarsal claws. Fig. 25 – Ventral view; Fig. 26 – lateral view; A – relaxed, upright position; B – intermediate position; C – constricted, hidden position (a – arolium; c -claw). Fig. 27. Sexual dimorphism in size of tarsal claws in *Trichocera regelationis*.

1981). This structure is transparent, poorly visible and its shape is various depending on an angle at which it is observed (compare Figs. 25 and 26). An arolium of Tipulidae, described by McALPINE et al. (1981) seems very similar. In one specimen the arolium was dark pigmented in one leg.

Sexual dimorphism in size

The tarsal claw is larger in males and reaches 1/2 the fifth tarsomere's length while in the female it reaches only 1/3 of fifth tarsomere. The mode of measuring in shown in Fig. 27; the size of the claw is estimated as the length of the chord of the claw's arch. Since this estimation depends of the position of the claw under a binocular and becomes shorter when the claw is twisted from the plane of the glass, the claw was positioned as laterally to the base, as possible.

VII. CONCLUSIONS

An essential question whether all variability of different structures, described above, concerns only one species, can be answered in positive. Firstly, a sample of siblings only gives an insight into a potential range of variability in the males. Within a sample P there is no hint that it is composed of more than one species, because no one of characters' states examined accompanies only one character state of other structure. Although applying of statistical methods to coded characters was not possible (because of lack of such a method applicable to small groups), a graph showing the co-presence of all types of aedeagal structures is presented (Fig. 19). Even 10 males of sample S are distributed nearly over a whole graph.

Similar conclusions may be drawn for the females, although noteworthy is the observation, that the widest genital forks (code: 4) appear only together with strongly concave ovipositors (codes: 1, 2) and are absent in classes of narrow ovipositors (codes: 3-6) (Fig. 24). However, no separation between these females can be done now; more data should verify this observation.

At present, I propose to include the variability described into our conception of this species.

Now, a question arises, which characters are stable in the species and should distinguish its specimens among those of other species related? On the basis of this work I propose to base a diagnosis of *T.* (*M.*) *regelationis* on combination of following characters:

1. Wing spots: one at rm; additional spot may appear on mcu, and also sometimes a slight dark smudging along Cu. Additional spot and smudging are generally more frequent in the females.

2. Wing venation: m-cu is shifted proximally from the fork of M3+4 in all specimens examined. This character is not unique to *T. regelationis* only; but especially in this species it seems to have 100% frequency.

3. Males: lateral apodemes rounded in lateral view and extended dorsal, when compared to related species (*T.* (*M.*) *rufescens* EDWARDS, *T.* (*M.*) *annulata* MEIGEN, *T.* (*M.*) *michali* KRZEMIŃSKA, 1999).

4. Females: genital fork with very short lateral arms. Such fork is however present also in first two species mentioned above.

5. Size of tarsal claws in males and females described here (preliminary comparison with other species shows that this size in males' claws is exceptionally large and sexual dimorphism is not a rule in other species).

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