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Objekttyp: **Article**

Zeitschrift: **Bulletin de la Société Neuchâteloise des Sciences Naturelles**

Band (Jahr): **120 (1997)**

Persistenter Link: https://doi.org/10.5169/seals-89466

SHAPE AND LENGTH OF THE FIRST TARSOMERE IN TRICHOCERIDAE (DIPTERA, NEMATOCERA).

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Key words: Trichoceridae, *Trichocera, Nothotrichocera, Paracladura.*

Abstract

In three genera of Trichoceridae: *Trichocera*, *Nothotrichocera* and *Paracladura* the length of first tarsal segment (t1) is linked with the flexibility of a joint between this and following tarsomere (t2): in *Paracladaura*, the genus with extremely short t1, the joint is stiff; in *Nothotrichocera* the flexibility of this joint is greatest in species with relatively long t1; in *Trichocera*, the genus characterized by long t1, the joint is fully flexible. The flexibility in two first mentioned genera is hindered by the oblique shape of t1 most distal part.
Relative length of third and fourth tarsal segment differs between *Trichocera* and *Nothotrichocera* + *Paracladura* and can be used for purposes of determination, especially in fossil material, where other generic characters are obscured.

INTRODUCTION

Three genera of Trichoceridae: *Trichocera* Meigen, *Nothotrichocera* Alexander and *Paracladura* Brunetti are distinguished, among others, by a relative length of first tarsal segment (t1). In *Trichocera* (as well as in the fourth genus, *Diazosma* Bergroth) the first tarsomere is longer than the second, t2 (t2/t1 ranges 1.5-1.7); in *Nothotrichocera* t1 is slightly to markedly shorter than t2 (t2/t1 ranges 1.1-1.7; (KRZEMIŃSKA 1994); while in *Paracladura* t1 is extremely short and its length reaches ca. 1/10 of t2. Both last mentioned genera belong to exceptions within the Diptera, where generally the first tarsomere is the longest segment of the tarsus. It has been observed that this relative shortness of t1 is accompanied by the oblique shape of t1 ending (BRUNETTI 1911; EDWARDS 1928). When studying specimens of these genera, I had observed that their legs are never bent between first and second tarsomere, as if this joint was not capable of bending. More detailed study revealed that in *Nothotrichocera antarctica*, which has t1 almost as long as t2 (and relatively the longest within the genus), the leg can be slightly bent between these two tarsomeres; here also the shape of t1 ending is less oblique than in other species (fig. 4). Similar effect was observed in *N. cranstoni*, the species with next longest t1 within the genus (tabl. 2). It seemed that the shorter the first tarsomere is, the more

oblique its ending, thus hindering the flexibility between t1 and t2. In other species of *Nothotrichocera* and in *Paracladura* the joint remained stiff, even after a soak in alcohol or water.

The present paper has two aims:

1. To check the relations between length of first tarsomere, its shape and flexibility of t1/t2 joint.

2. To check the relative length of more distal tarsomeres, assuming that short first tarsomere influences length of remaining ones. The positive results would help our handling of fossil Trichoceridae (KRZEMINSKI, KRZEMIŃSKA & DAHL - in prep.). We have observed that the t1/t2 joint is often poorly visible in the fossil Trichoceridae, in many cases preventing classification into genera. Since the borders between subsequent tarsomeres are generally well preserved, our study of fossil Trichoceridae would give more reliable results if classification could be based on the relative length of distal tarsomeres.

MATERIAL

249 legs of: *Trichocera (Trichocera)*: *annulata* Meigen - 3♂, 2♀; *major* Edwards - 4♂, 4♀; *regelationis* (Linne) - 4♂, 3♀; *hiemalis* (DeGeer) - 3♂, 3♀; *parva* Meigen - 2♂, 2♀; *Trichocera (Metatrichocera)*: *forcipula* Nilssen - 4♂, 4♀; *arctica* Lundström - 1♂, 1♀ (collections from Poland and Netherlands; last species from north Siberia). *Nothotrichocera* Alexander: *cingulata* Alexander - 3♂, 2♀; *terebrella* Alexander - 6♂, 3♀; *cranstoni* Krzemińska - 5♂, 9♀ (CSIRO); *antarctica* Edwards - 3♂, 3♀ (Bishop Museum, Honolulu). *Paracladura* Brunetti - 3♂, 5♀ (unidentified species) (CSIRO). *Diazosma subsinuatum* Alexander - 2♂ (USA; Smithsonian Institution).

METHODS

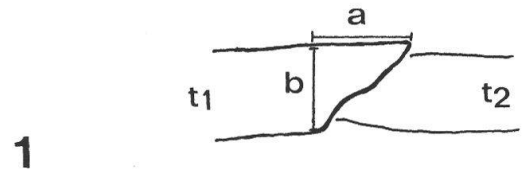
Legs were measured under the microscope with a scale; sections *a* and *b* (fig. 1) at magnifications of ca. 60x. Measurements of the first tarsomere of *Nothotrichocera* and *Paracladura* were taken excluding the oblique section.

RESULTS

1. The obliqueness of the end of the first tarsomere was expressed by an obliqueness index: $OI = a/b$, where *a* is the longest section of an ending from the point where the obliqueness begins and *b* is the width of the leg at this point (mode of measuring is shown in fig. 1).

Since the dipteran leg is bent twofold between femur and the tibia (fig. 2), all subsequent segments from the beginning of the tibia to the end of the leg are aligned more or less along the same direction and support each other. Thus the shortness of t1 is linked with the position of t1/t2 joint along this entire section. The shorter t1 is, the closer t1/t2 joint to the femur/tibia joint. For this reason *OI* was checked in relation to the position of t1/t2 joint along the leg section from tibia to end of last tarsomere (fig. 2).

The scatterplot of *OI* against the position of t1/t2 is shown in fig. 3; it shows a linear relation between these two characters, i. e., the higher along the leg is t1/t2 joint, the more oblique the ending of t1 and the more hindered flexibility of this joint. The latter feature is well evidenced by the anatomy of the joint as seen under microscope with transient light. In figure 4 the lateral cross-section view of t1/t2 joint in three genera is given, based on microscope photographs. The legs are arrayed according to gradually diminishing mobility of t1/t2 joint, i.e. *Trichocera*, *Nothotrichocera antarctica*, other *Nothotrichocera* (here: *N. cingulata*), *Paracladura*. The better working the joint, the less contact



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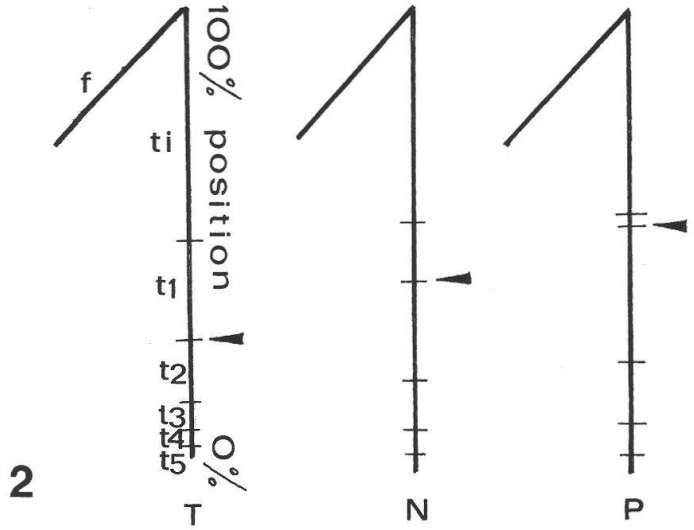

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Figures 1 et 2:

1.Obliqueness index, mode of measurement; t1, t2, first and second tarsomere.

2. Standardized proportions of leg segments in *Trichocera* (T), *Nothotrichocera* (N) and *Paracladura* (P); f, femur; ti, tibia; t1 - t5, tarsomeres 1 - 5. Position of joint t1/t2 arrowed. Further explanation in text.

there is between adjacent parts of t1 and t2. The proximal process of t2 is of distinct shape and moves in a well developed cavity (acetabulum) of t1. The area around process of t2 which contacts during the movement with t1, is recognizable by the absence of setae. Similar features characterize fully flexible, subsequent joints: t2/t3; t3/t4 and t4/t5 and are similar in all genera examined, including *Diazosma*.

On the other hand, in nothotrichoceran and paracladuran legs the obliqueness of t1 ending is distinct and prolongated by a strong, single spine, especially large in *Paracladura*. In this genus also the cavity of t1 is almost tightly fitting the process of t2, thus hindering any movement. The naked area around the process is non-existent.

Basic statistics of leg measurements is given in Table 2. *Nothotrichocera* is split into 4 species differing by t1 length and arrayed according to its gradual diminishing: *N. antarctica*, *N. cranstoni*, *N. cingulata* and *N. terebrella*. To enable comparison, the data are presented as % of total leg length.

2. The shortness of t1 is compensated by length of t2; however, also the more distant tarsomeres are longer in *Paracladura* and *Nothotrichocera* than in *Trichocera* (fig. 2; tabl. 2). figs 5 - 7 present scatterplots of t3 against t4 (standardized by division by t5) in fore, middle and hind legs in three genera.

The best separation of Trichocera from *Nothotrichocera* and *Paracladura* is achieved with fore legs; the worst with the middle ones. By no means, however, can *Nothotrichocera* be separated from *Paracladura*, in spite of clearly linear relation between lengths of t3 and t4.

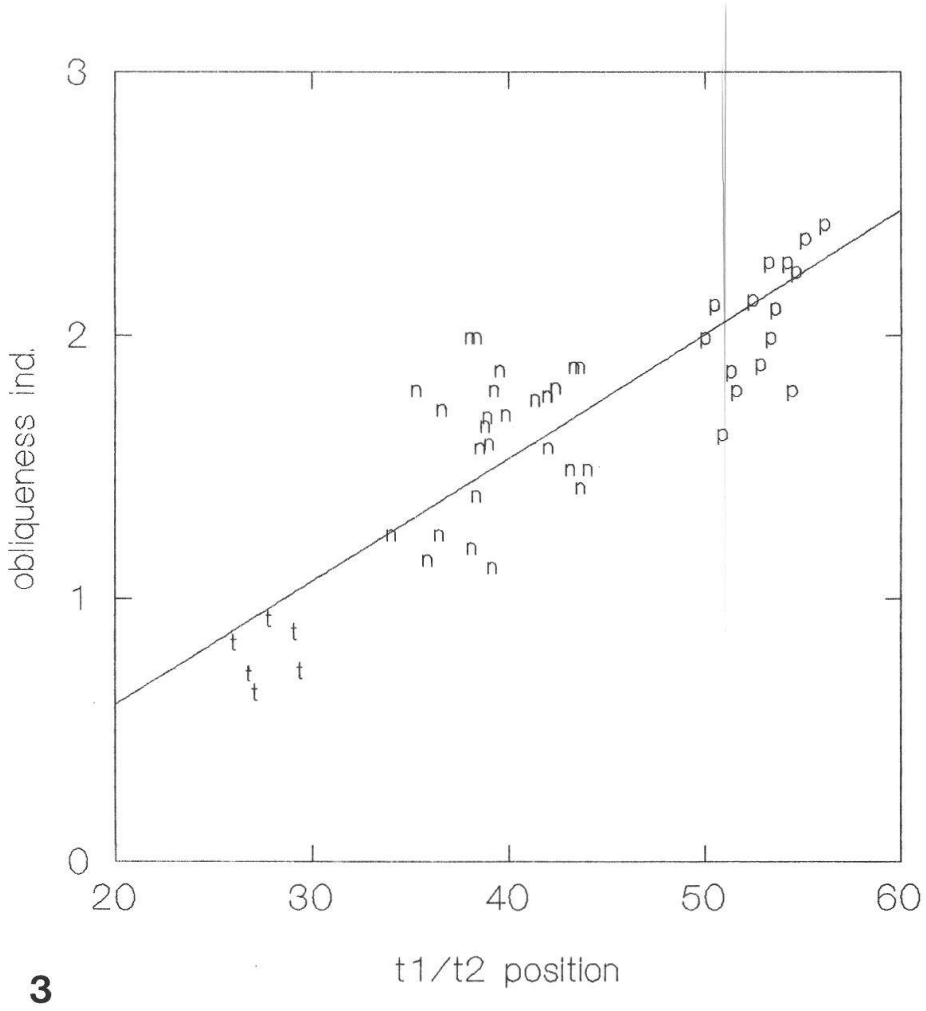

Figure 3: Scatterplot of obliqueness index (OI) against the position of t1/t2 joint in legs of *Trichocera* (t); *Nothotrichocera* (n); *Paracladura* (p). Equation of linear regression: 0.473x + 0.189 = y.

ACKNOWLEDGEMENTS

This paper was presented at the Second International Symposium of Tipulomorpha: Systematics and Phylogeny, in Aletsch, Switzerland, June 1996.

For the loans of material I would like to thank Dr Peter Cranston (CSIRO), Dr Wayne Matthis and Dr Holly Williams (Smithsonian Institution), Dr Neal Evenhuis (Bishop Museum, Honolulu) and Dr Ian van Zuijlen (collection of De Brand National Park, Netherlands).

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Trichocera	N	Min	Max	Mean	SD
obliqueness index	9	0.643	0.923	0.780	0.097
t1/t2 position	9	25.759	29.455	27.543	1.446
Nothotrichocera	N	Min	Max	Mean	SD
obliqueness index	27	1.125	2.000	1.621	0.258
t1/t2 position	27	33.933	43.979	39.657	2.768
Paracladura	N	Min	Max	Mean	SD
obliqueness index	15	1.636	2.429	2.068	0.234
t1/t2 position	15	50.000	56.104	52.962	1.808

Table 1: Obliqueness index for first tarsomere and position of a joint between first and second tarsomere in *Nothotrichocera*, *Paracladura* and *Trichocera*.

Trichocera N = 96	t1 (%)	t2 (%)	t3 (%)	t4 (%)	t5 (%)
Minimum	13.853	7.978	3.733	1.871	1.348
Maximum	19.346	10.627	6.276	3.821	2.567
Mean	**16.120**	**9.328**	**5.194**	**2.772**	**1.944**
SD	1.142	0.650	0.554	0.361	0.247
Nothotrich. antarctica N = 18	t1 (%)	t2 (%)	t3 (%)	t4 (%)	t5 (%)
Minimum	11.238	11.095	7.112	3.359	1.592
Maximum	14.302	15.178	8.940	5.298	2.049
Mean	**12.334**	**13.139**	**7.961**	**4.522**	**2.049**
SD	0.738	1.109	0.465	0.514	0.256
Nothotrich. cranstoni N = 39	t1 (%)	t2 (%)	t3 (%)	t4 (%)	t5 (%)
Minimum	7.814	11.749	6.736	3.380	1.341
Maximum	12.053	16.316	8.667	4.412	2.642
Mean	**10.233**	**13.911**	**7.659**	**3.863**	**0.290**
SD	0.850	1.129	0.461	0.247	0.290
Nothotrich. cingulata N = 15	t1 (%)	t2 (%)	t3 (%)	t4 (%)	t5 (%)
Minimum	7.914	14.366	6.881	3.807	1.408
Maximum	10.324	18.413	9.254	4.776	2.158
Mean	**8.988**	**16.373**	**8.187**	**4.247**	**1.747**
SD	0.764	1.188	0.601	0.315	0.203
Nothotrich. terebrella N = 26	t1 (%)	t2 (%)	t3 (%)	t4 (%)	t5 (%)
Minimum	7.326	14.063	6.875	3.625	1.253
Maximum	9.880	17.708	9.375	5.208	2.151
Mean	**8.629**	**16.291**	**8.127**	**4.192**	**1.732**
SD	0.720	1.149	0.669	0.360	0.239
Paracladura N = 24	t1 (%)	t2 (%)	t3 (%)	t4 (%)	t5 (%)
Minimum	0.823	20.265	8.537	4.090	1.623
Maximum	1.420	23.278	10.323	5.277	2.528
Mean	**1.090**	**22.142**	**9.539**	**4.806**	**2.131**
SD	0.148	0.761	0.533	0.270	0.215

Table 2: Statistics of relative length of tarsomeres (in % of total leg length) in *Trichocera*, 4 species of *Nothotrichocera* and *Paracladura*.

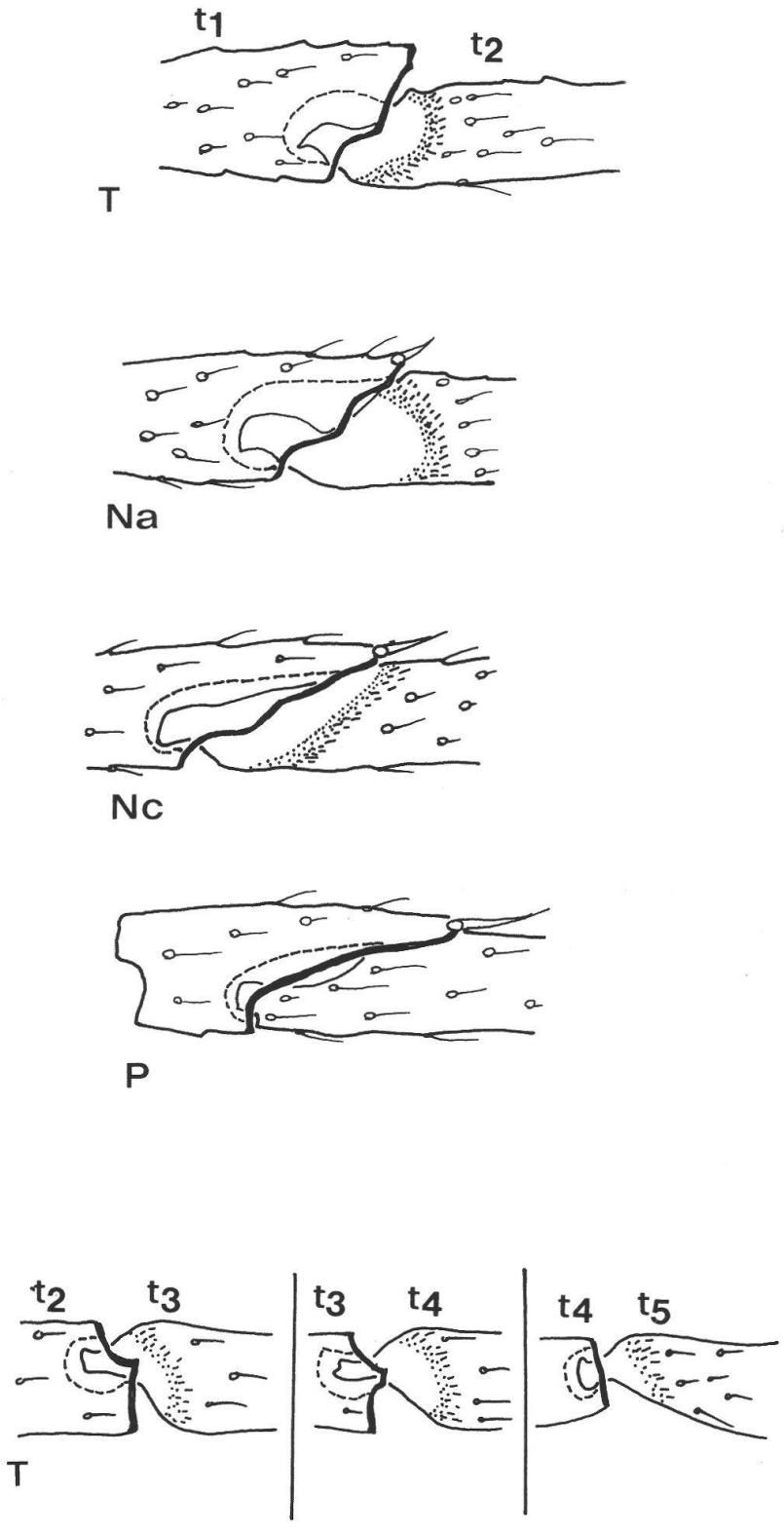
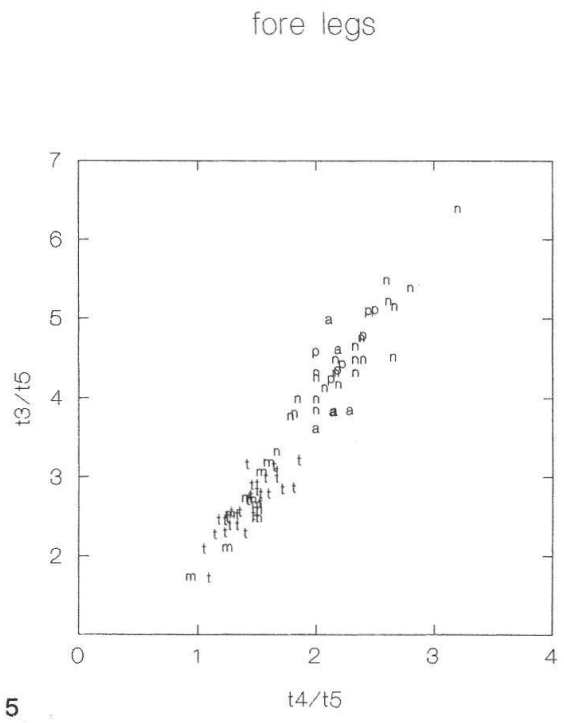


Figure 4: Lateral view of t1/t2 joint in *Trichocera* (T), *Nothotrichocera antarctica* (Na), *N. cingulata* (Nc) and *Paracladura* (P). Below the remaining joints in *Trichocera*.



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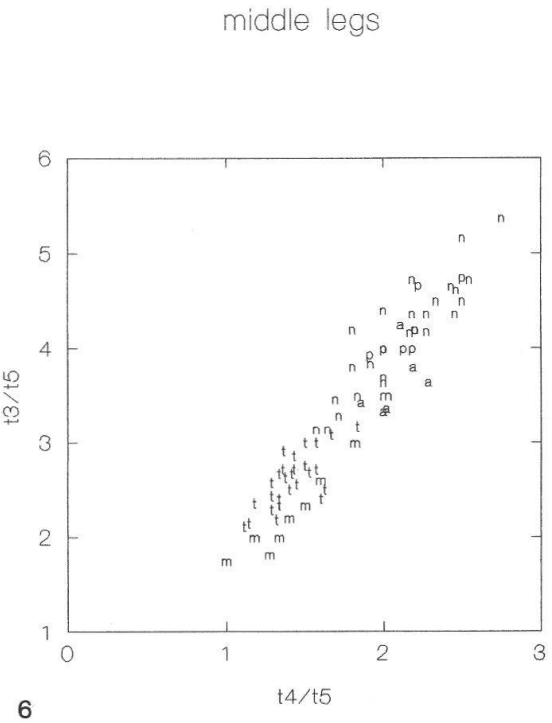

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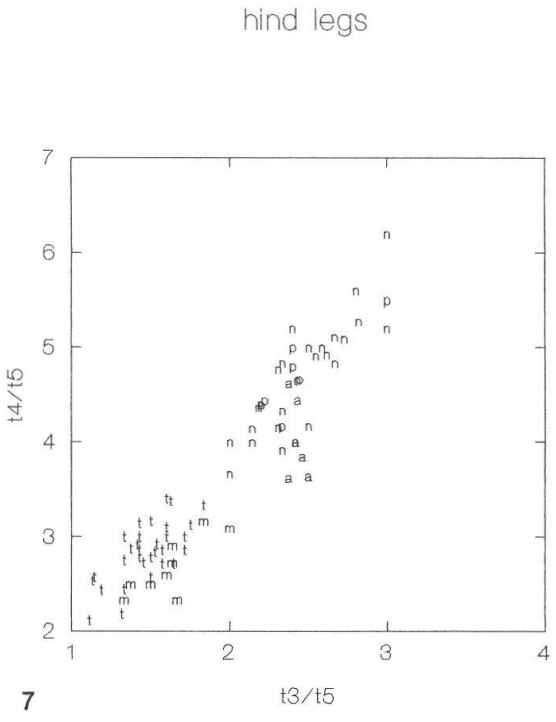

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Figures 5 - 7: Scatterplots of t3 and t4 lengths (standardized at t5) in fore, middle and hind legs of: *Trichocera* (t), *Metatrichocera* (m), *Nothotrichocera antarctica* (a), remaining *Nothotrichocera* (n) and *Paracladura* (p).