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ABNORMAL TARSI IN A POPULATION OF *AMPHIAGRION SAUCIUM* (BURMEISTER) FROM QUEBEC, CANADA (ZYGOPTERA: COENAGRIONIDAE)

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A population of *A. saucium* breeding in a seepage area near Sand Hill, Quebec was examined for tarsal abnormalities. A total of 107 individuals were captured (37 had one or more legs with abnormal tarsi) and these yielded 593 intact tarsi of which 46 (7.8%) were abnormal. Most of these abnormalities [40/46 (87%)] consisted of a two-segmented tarsus (segments 1 and 3) with segment 3 terminating in a single non-articulated claw. Contingency table analysis (χ^2) indicated no significant tendency for tarsal abnormalities to predominate in one sex or thoracic part.

INTRODUCTION

While examining specimens from a collection of *Amphiagrion saucium* (Burm.), some individuals were noted to have tarsal abnormalities. The possibility that such abnormalities might be useful as genetic markers in mating studies (sperm precedence, removal, displacement, etc.) led me to further investigate the incidence of tarsal abnormalities in this population of *A. saucium*.

STUDY SITE AND METHODS

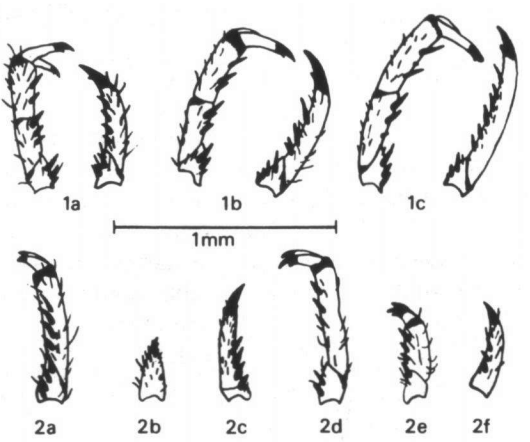
The study site was near Sand Hill, Quebec, Canada (45° 23'N, 71° 44'W) and consisted of a boomerang-shaped seepage area located immediately beside a gravel road. The breeding habitat was 4 m wide at the center and tapered to about 1 m wide at each end. The distance from one end to the other (following the midline curvature) was 23 m. Some of the most conspicuous plants in the habitat were cattails (*Typha* sp.), horsetails (*Equisetum* sp.), grasses and sedges. There were no areas of open water.

Individuals were first collected 9 July 1982 (5 females, 6 males) and the discovery of tarsal

abnormalities in 5 specimens (3 females, 2 males) led to extensive collecting in 1983. This began when individuals first appeared 16 June and ended 19 July, after which none were present. During the 34--day period all mature adults seen were collected (by netting) once every 3.1 days (range 1-5 days). Tenerals were not collected and collecting was not done each day in the hope that oviposition might occur between collections and the population would not be extirpated.

RESULTS

In 1983 specimens were collected as follows: 22 solitary females, 50 solitary males, 6 tandem pairs and 6 copulating pairs. Combining 1982 and 1983 data this yielded 107 individuals (39 females, 68 males) of which 37 (34.6%) had tarsal abnormalities. Sometimes legs (or parts of legs) were missing [either naturally or due to collection and preservation (the latter involved killing by freezing, soaking in acetone for 24 hr and storage in cellophane envelopes)]. This resulted in 593 tarsi (213 female, 380 male) for examination rather than 642 (234 and 408, respectively) which would be the case if all legs had been intact. In addition, the 37 individuals with abnormal tarsi are a minimum since 20 (18.7%) other individuals had one or more missing legs (or parts of legs) while the remaining legs were normal. If any of these missing legs had abnormal tarsi this would increase the number of individuals recorded as possessing abnormalities.



Figs 1-2. *Amphiagrion saucium*: (1) Typical normal (left) and abnormal (right) tarsi: (a) prothoracic (posterior view), — (b) mesothoracic (anterior view), — (c) metathoracic (anterior view); both members of a pair are from the same female but each pair is from a different female. — (2) Atypical abnormal tarsi: (a) male left metathoracic (posterior view), (b) male left metathoracic (anterior view), (c) female right metathoracic (posterior view), (d) female left prothoracic (posterior view), (e) female left metathoracic (posterior view) and (f) male left prothoracic (posterior view); all tarsi are from different individuals.

Figures 1-2 illustrate the tarsal abnormalities. Of the 46 (7.8%) abnormal tarsi, 40 (87%) were as depicted in Figure 1. These consisted of only two segments (1 and 3) with segment 3 tapering to a sclerotized non-articulated claw. Approximately midway along the antero-ventral side of this claw was a short pointed, tooth-like projection. The remaining 6 (13%) tarsi each had different abnormalities (Fig. 2).

Of those individuals which had all six legs intact and also had one or more legs with tarsal abnormalities, 19/24 (79.2%) [6/7 (85.7%) females, 13/17 (76.5%) males] had only one leg with an abnormal tarsus while 5/24 (20.8%) [1/7 (14.3%) females, 4/17 (23.5%) males] had two legs with abnormal tarsi.

Table I
A comparison of the numbers of normal and abnormal tarsi in *Amphiagrion saucium*

Tarsi	Thorax segment						Thorax side				Sex		*Total*
	Pro.		Meso.		Meta.		Left		Right				
	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	
No. examined	68	123	71	124	74	133	109	189	104	191	213	380	*593*
No. abnormal	4	9	5	9	8	11	10	11	7	18	17	29	*46*
% abnormal	5.9	7.3	7.0	7.3	10.8	8.3	9.2	5.8	6.7	9.4	8.0	7.6	*7.8*

Table I records the numbers of normal and abnormal tarsi observed for each sex and thoracic part. Contingency tables were prepared from these data and the results evaluated (χ^2) to see if the observed numbers of abnormalities were significantly different from those expected (assuming an equal chance for abnormalities to be present in either sex or any thoracic part). The comparisons made with these contingency tables (and their resulting χ^2 values) are as follows: (1) Females: prothorax vs. mesothorax vs. metathorax (0.728), left vs. right sides of thorax (0.268), left vs. right sides of prothorax (0.533), left vs. right sides of mesothorax (0.101), left vs. right sides of metathorax (0.244); (2) Males:

Table II
A comparison of the numbers of *Amphiagrion saucium* (males plus females) with abnormal tarsi collected on different dates during the flight season

Collecting date (1983)	No. (%) collected	Observed No. abnormalities	Expected No. abnormalities
June 16	1 (1.04)	1	0.33
20	14 (14.58)	5	4.67
22	17 (17.71)	6	5.67
24	15 (15.63)	5	5.00
28	20 (20.83)	9	6.67
30	6 (6.25)	1	2.00
July 3	8 (8.33)	2	2.67
8	5 (5.21)	1	1.67
14	6 (6.25)	1	2.00
16	2 (2.08)	0	0.67
19	2 (2.08)	1	0.67
Total	*96*	*32*	

$\chi^2 = 3.50$, $p > 0.9$

prothorax vs. mesothorax vs. metathorax (0.134), left vs. right sides of thorax (0.857); left vs. right sides of prothorax (0.258), left vs. right sides of mesothorax (0.557), left vs. right sides of metathorax (1.348); (3) Females plus males: prothorax vs. mesothorax vs. metathorax [0.133 (females), 0.079 (males)], left vs. right sides of thorax [0.497 (females), 0.308 (males)]; (4) Females vs. males: entire thorax (0.012). All these χ^2 values indicated there was no significant tendency for any one sex, thoracic segment or side to have a disproportionate incidence of tarsal abnormalities. In addition, there was no time during the flight season when a significantly greater number of individuals with tarsal abnormalities occurred (Tab. II).

DISCUSSION

The incidence of tarsal abnormalities together with the statistical evaluation of these data are inconclusive as to whether the abnormal trait is genetically transmitted. The abnormal tarsi could be developmental errors but the fact that 40/46 (87%) tarsi are identical in their abnormalities (Fig.1) suggests that some type of genetic transmission may be involved. However, selective mating and rearing studies would have to be done to confirm this. Unfortunately, rearing programs may prove difficult due to *A. saucium*'s requirement for spring seepages as a breeding habitat (WALKER, 1953).

REFERENCE

WALKER, E.M. 1953. *The Odonata of Canada and Alaska.* Vol. 1. Univ. Toronto Press, Toronto.