

PARASITISM BY UNIONICOLA SPP LARVAE ON CHIRONOMIDS.

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Abstract

The larvae belonging to the genus *Unionicola* hatch from eggs in freshwater mussels. Larvae of the same genus are found attached to the legs and abdomens of adult Chironomids. Larvae of these two very different habitats are described and it is demonstrated that two of those found on Chironomids are identical to two obtained from mussels. It is thus confirmed that some species of the genus *Unionicola* which lay their eggs in mussels also have larvae which parasitise Chironomids.

Introduction

Parasitism by adult mites of the genus *Unionicola* in freshwater mussels has been known for two hundred years (Bonz, 1783). In 1965 I reported finding *Unionicola* *atomedia* Koenicke larvae and the larvae of another *Unionicola* species on chironomids (Jones, 1965 b) but the evidence was in my unpublished thesis (Jones, 1965 a). This finding has since been rejected (Davids, 1973) on the grounds that precise descriptions of *Unionicola* larvae do not exist, that he was unable to show any growth between the newly hatched larvae and the nymphochrysalis and that *Unionicola* larvae are 'short-lived'.

The purpose of the present work is to present and review the evidence for parasitism by *Unionicola* larvae on chironomids and to provide descriptions of the larvae of this genus which I have obtained both from fresh water mussels and from chironomids.

Methods

Mussels were gathered in the spring and summer and brought into the laboratory. Larvae which hatched out were kept in petri dishes or small aquaria to test their longevity and afterwards mounted in Hoyer's medium for examination and measurement. Mantle tissue from the mussels was removed and nympho-chrysalids and larvae from this were examined and mounted as above.

Chironomids were collected in the field by means of a net, pootered into glass tubes and shaken with Viets' fluid. The mites were later removed from the bodies and legs of the hosts and mounted.

Measurements were made on each mite and these are listed in Table 1. Measurements of nympho-chrysalids removed from the mussels are given in Table 2 together with measurements of larvae, both newly hatched and removed from chironomids, for comparison.

Results

In my earlier collections I examined 204 midges, of which 141 were carrying mite larvae. There were 1004 mite larvae in all, of which 891 were *Unionicola* spp. and the remaining 213 belonged to other genera. A further 40 parasitised midges carrying 261 *Unionicola* spp larvae were examined in 1976.

Of the mussels examined *A. anatina* L produced mites of two distinct types in approximately equal numbers. I called these 'Types A & B'. The latter was indistinguishable from one of the larvae found commonly on the chironomids.

A. cygnea L produced one type which is referred to as 'Type D'.

TABLE 1.

Measurements of larval types A - D. All measurements are in μ . Where measurement of only one specimen was obtained a single number appears in the table. Where more than one was measured but the measurements did not differ this is shown by repeating the measurement, e.g. 66 - 66. With very few exceptions, measurements of at least five larvae were made for each entry.

IDIOSOMA		A.	B.	B.	C.	D.
			Ex Mussel	Ex Midge		
1. Dorsal Plate						
Long		396-432	360-372	34-360	288-304	384-432
Wide		204-216	192-192	180-192	128	210-228
Lp1 - Lp1		53-61	58-60	58-61	48-48	56-61
Mp1 - Mp1		59-68	64-68	64-66	48-51	64-68
Lp2 - Lp2		113-125	109-113	109-116	88-90	124-132
Mp2 - Mp2		80-84	64-66	64-69	51-55	80-96
Lp1 - Mp1		14-16	10-13	13-13	13-15	16-16
Mp1 - Mp2		51-58	47-58	50-51	45-45	51-64
Front of Plate						
to Lp1		32-34	19-21	19-23	13-16	29-32
to Mp1		45-50	31-32	32-34	26-30	43-53
to Lp2		64-77	53-55	55-58	42-45	64-77
to Mp2		96-113	80-88	80-87	66-75	96-117
2. Ventral						
Overall long		396-430	384-444	502-565	317-444	412-428
wide		238-254	174-278	352-400	238-364	238-243
Plates Cx.I		110-129	113-127	113-121	93-106	122-125
Cx.II,III		181-196	173-192	178-192	144-154	160-167
Setae - C1		80-91	61-80	62-75	62-74	51-68
C2		75-84	80-84	53-87	58-64	48-63
C3		117-135	122-129	108-121	90-96	103-122
C4		103-119	129-147	121-133	105-133	125-141
V1		45-51	42-64	45-53	31-31	32-32
V2		49-64	55-61	53-62	31-34	32-45
V3		45-52	46-55	43-50	37-40	42-55
V4		170-192	194-220	189-207	130-154	174-205
Ex.Pore plate Length		33-42	35-45	37-42	28-35	32-42
Width		33-34	32-35	31-35	22-27	26-29
Front of plate to E1		8-10	10-16	9-16	2-3	5-8
E1 - E2		10-11	16-18	14-16	11-12	10-11
Setae E1		33	42-51	48-55	13-15	19-19
E2		51-62	55-64	64-64	40-52	39-45
E1 - E1		10-16	17-19	14-21	5-6	10-13
E2 - E2		23-26	22-23	19-24	16-17	19-23
Front of plate to front of pore		22-26	26-31	27-31	16-19	19-21
GNATHOSOMA						
Capitulum Long		90-100	90-113	107-109	61-64	93-96
Wide		80-87	80-87	77-87	56-64	71-90
Setae Ta1		87-125	103-122	103-128	47-64	64-80
Ta2		130-145	141-158	138-160	81-96	96-125
Ta3		72-80	103-109	95-115	31-31	35-64
Ge1		113-116	90-103	93-116	71-78	87-106
Claw		35-35	39-42	41-45	20-23	42

TABLE 2.

The following overall measurements were obtained from Nymphochrysalids removed from mussels, newly hatched larvae and larvae removed from midges.

	Nymphochrysalids		Newly hatched larvae		Larvae from midges	
	Length	Breadth	Length	breadth	Length	Breadth
Type A	464-480	336-368	396-430	238-254	NONE	
Type B	566-580	332-360	413-452	222-278	502-565	330-400

The majority of mites found on the abdomens of the midges were Type B as mentioned above, while the majority of those found attached to the upper parts of the legs of the midges were of another type I have referred to as Type C.

Three mites were found on midges (two on abdomens and one on a leg) which appear identical to type D. above.

Descriptions

For simplicity I have followed the terminology used by Prasad & Cook, (1972) Plate 1 illustrates the main taxonomic features used.

1. General characteristics of larvae of the family Unionicoidae, Oudemans (From Prasad & Cook).

Dorsal plate very large, covering almost entire length of gnathosoma and bearing four pairs of propodosomal setae; coxal plates II and III on either side fused with each other and I separate from II-III; coxal plates II-III very narrow and pointed posteriorly; excretory pore plate with two pairs of setae; V4 very long and whip-like, and borne on very short tubercles; cheliceral bases fused with each other; chela edentate; palps very short, tibia and tarsus very small, tarsus thumb like with a long solenidium (Tarsal legs five-segmented and each with three claws. (Sparing from *U. bonzi* has only two claws) tarsi I and II with one solenidia (Ti and Ti 2) on tibiae II and III very long; setae located on proximal half of segment; femur of leg I with one long setae.

2. Characteristics of the genus *Unionicola* Haldeman, modified from Prasad & Cook).

Excretory pore located behind or in line with E2; and on the posterior half of excretory pore plate; some setae on palpal tarsus very long; empodial claw on legs bifurcate

at tip; and eupathidium (Ta 2) on tarsi I to III comparatively long and setose.

3. Diagnostic features of Types A to D.

Measurements of features of the larvae are given in Table 1. At least as far as the British members of the genus are concerned, the excretory pore plate and the setae thereon, together with the palpi appear to be sufficient to separate the species.

Type A. (Ex *A. anatina*.)

Excretory pore plate round or nearly so, with a slight point at the front and a tongue-like projection at the rear; E1-E1 about half the value of E2-E2; E1 reaching beyond the rear of the plate but not as far as the base of V4. Three long, strong bristles on palpal tarsus, of which the middle one is the longest; Dorsal plate setae Mp2 much further apart than Mp1 or Lp1.

Material examined: 42 larvae bred from *A. anatina* from several sites in Nottinghamshire.

Type B.

Excretory pore plate more or less round with a point at the front rim of pore almost touching rear edge of plate; E2 almost level with the front of the plate; E1 very long, reaching beyond the rear of the body; V1 also extending beyond the body rear edge; Middle seta of the palpal tarsus reaching half way down Cx.I; dorsal plate setae Lp 1, Mp 1, and Mp 2 forming two almost parallel rows.

Material examined: 18 larvae bred from *A. anatina* from sites in Nottinghamshire; also 37 larvae removed from the abdomens of midges.

Type C.

Excretory pore plate considerably longer than wide, and tapered anteriorly. E1 placed very close together and near to the front of the plate; E1 hardly reaching the middle of the pore plate; gnathosoma less than 1/5 the length of the body (in unexpanded larvae) V1 not reaching

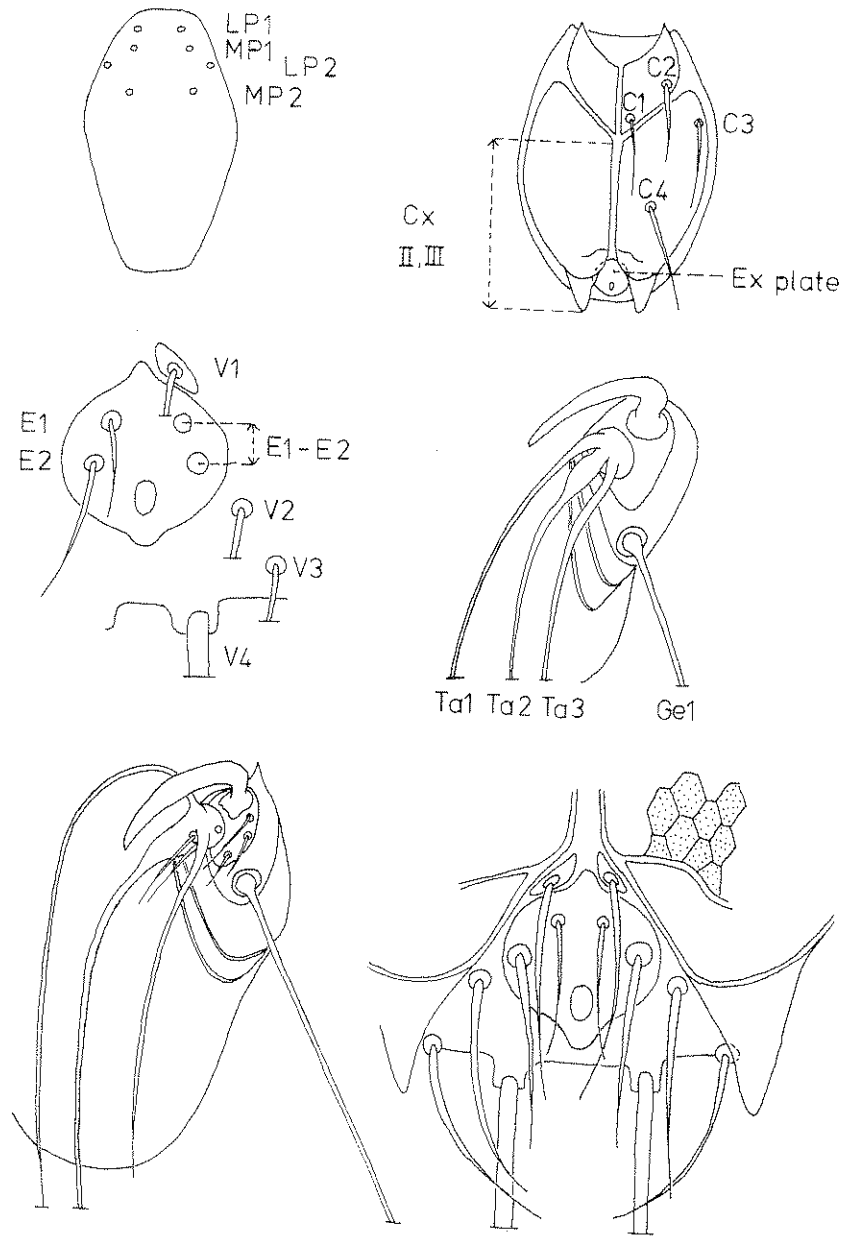


Plate 1.

- Above: General features used in the tables and descriptions.
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|-----------|---------------------------|-------------|------------------------|
| Top left: | Dorsal Plate | Right: | Ventral Plates |
| Middle: | Excretory field
Type A | Left palpus | |
| Below: | Left: | Left palpus | Right: Excretory field |



Plate 2.

Left palpus
 Top Type B
 Middle Type C
 Bottom Type D

Excretory field
 Type B
 Type C
 Type D

the rear of the excretory pore plate. Mp 2 further apart than Mp 1.

Material examined: 38 larvae removed from the legs of chironomids from Beeston, Nottinghamshire.

Type D. - *Unionicola ypsilophora*. Bonz.

Excretory pore plate with a long tongue-like projection at the rear. E1-E1 a little more than half E2-E2; E1 reaching to middle of excretory pore; V1 reaching to rear edge of excretory pore; setae on palpal tarsus very fine, difficult to see and curved. Tarsal claw powerfully developed. Mp 2 much further apart than Lp 1 or Mp 1.

Material examined: 26 larvae bred from *A. cygnea* from sites in Nottinghamshire and Lancashire and also three larvae removed from midges.

Discussion

Seven species of the genus *Unionicola* have been reported from the British Isles, and of these adequate larval descriptions exist for only one, *U. gracilipalpis* Viets. (Prasad & Cook, 1972). Of the others *U. figularis* Koch is comparatively rare and apparently free-living in the adult and nymphal stages, *U. crassipes* Müller spends most of its life in fresh water sponges, although a free-living subspecies *U. crassipes minor* Soar has been described, *U. aculeata* Koenicke is said to spend only the resting stages in mussels, and the other three *U. ypsilophora* Bonz, *U. intermedia* Koenicke and *U. bonzi* Claparede are found in mussels in their adult and nymphal stages and also in their resting stages.

Sparing (1959) described the larvae of *U. bonzi*, *U. ypsilophora*, *U. aculeata* and *U. crassipes*, but none of her descriptions are sufficiently full to give a positive identification of any of the species. However, she does state that *U. bonzi* larvae have only two claws on each leg, and since all my specimens have three claws on each leg it seems reasonable to eliminate *U. bonzi* from the list of possible candidates.

Since type D was bred out from *Anodonta cygnea* it can be assumed that this is the larva of *U. ypsilophora* which is the normal inhabitant of this mussel. Similarly it can be deduced that either Type A or Type B (or both) should be referable to *U. intermedia*. It is of course possible that A and B should be polymorphic forms of the same mite species, even though polymorphism has seldom been observed. It does, however, occur in *Thyas stollii* Koenicke (Cook, 1959.)

Of the mites found on chironomids, Type B can be

positively identified as being identical with Type B bred out of *A. anatina*. The specimens of Type D were identified with Type D bred out of *A. cygnea*, while Type C does not resemble any of the three types obtained from mussels.

Although positive identification to species of these larvae is not yet possible except in the case of Type D, it has been shown conclusively that there are at least three different types of *Unionicola* larvae which use chironomids as a dispersal means.

Various authors have claimed that there is no difference between the newly hatched larvae found on mussels and the nymphochrysalids found in the mantle tissue. My measurements of Type B showed that the nymphochrysalids were much nearer in size to the larvae found on midges than to the larvae measured immediately after emerging from the mussels. Measurements of Type A nymphochrysalids also showed a considerable growth compared to the newly emerged larvae, suggesting that they also feed before returning to the mussels. There is also a great increase in dorso-ventral depth of the nymphochrysalis compared to the newly hatched larvae which must account for a considerable increase in volume.

It has been claimed that *Unionicola* larvae are short-lived. The ability of mite larvae to find hosts appears to be dependent on (1) the number of eggs laid, (2) the longevity of the larvae and (3) the general availability of the hosts. Larvae which run on the water surface and parasitize Hemiptera or Coleoptera while the latter are taking inae have short-lived larvae (4-7 days active life) but lay very large numbers of eggs. (over 2000 per female in many *E. lais* spp.) Those which find their hosts while the latter are in the pupal stage, on the other hand, mostly lay from 30-50 eggs and have an active span of from two to six weeks. The *Unionicola* spp. appear to lay at least 100 eggs per female and live for two to three weeks. There is therefore nothing here to suggest that they might have difficulty in finding host midges.

Acknowledgements

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Summary

1. In the present work mite larvae bred out from the mussels *A. anatina* and *A. cygnea* are described.
2. Three types of larvae belonging to the genus *Unionicola* have been found attached to *Chironomus plumosus* Meigen and other large chironomids.
3. Two of these larvae have been positively identified as being identical with two of those bred out from the mussels.
4. Measurements of nymphochrysalids removed from the mantle of the mussel *A. anatina* have shown that they are of considerably greater volume than the newly hatched larvae from the same mussel.
5. It is therefore confirmed that some mites of the genus *Unionicola* which lay their eggs in mussels also have larvae which are parasitic on chironomids.

Zusammenfassung

Wassermilbenlarven von der Gattung *Unionicola* entwickeln sich in Eiern, die in Süßwassermuscheln abgelegt werden. Larven von der gleichen Gattung sind an den Beinen und Hinterleibern von erwachsenen Chironomiden zu finden. Larven von diesen beiden sehr verschiedenen Fundorten werden beschrieben, und es wird gezeigt, dass zwei von den an Chironomiden gefundenen mit zwei von den in Muscheln ausgebrüteten Arten identisch sind. Es wird somit bewiesen, dass einige Milben von der Gattung *Unionicola*, die ihre Eier in Muscheln ablegen, auch Larven haben, die Chironomiden parasitieren.

Resumé

Les larves des Hydrachnes du genre *Unionicola* sortent de oeufs qui sont pondus dans les moules d'eau douce. On trouve les larves du même genre attachées aux jambes et aux abdomens des Chironomes adultes. Les larves issues de ces deux habitats très différents sont décrites et on montre que deux de celles qui ont été trouvées sur les Chironomes sont identiques aux deux venant des moules. On a ainsi confirmé que certains Hydrachnes du genre *Unionicola* qui pondent des oeufs dans les moules ont aussi des larves qui vivent au parasites chez les Chironomides.

References

Bonz, 1783. Observatio X Acarus ypsilophorus. Nova Acta Acad. Caesar. Leop. Carol. 7: 52-53.
Cook, D. R. 1959. Studies on the Thyasinae of North America. Am. Midl. Nat. 62: 402-428.
Davids, C. 1973. The relations between mites of the genus *Unionicola* and the mussels *Anodonta* and *Unio*. Hydrobiologia 41.1: 37-44.
Jones, R. K. H. 1965 a. An investigation into the Life-histories and Ecology of the Hydracarina. Unpublished Thesis. University of Leicester.
Jones, R. K. H. 1965 b. Parasitism by larvae of *Unionicola* intermedia Koenicke and another *Unionicola* spp (Acarina, Pionae) on Chironomids. Nature, Lond. 207: 317-318.
Prasad V. & Cook, D. R. 1972. The taxonomy of Water Mite Larvae. Mem. Am. ent. Inst. 18: 1-326.
Sparing, I. 1959. Die Larven der Hydrachnellae, ihre parasitische Entwicklung und ihre Systematik. Gustav Fischer Verlag, Jena.