**DESCRIPTIONS OF THE LARVAE
OF *ATURUS SCABER* KRAMER,
PROTZIA EXIMIA PROTZ
AND *PIONA UNCATA* KOENIKE
WITH NOTES ON THE LIFE-HISTORIES
OF THE LATTER TWO.
[Hydracarina]**

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Although more than 3 000 species of water-mites have been described, the life-histories are known for less than 5 % of that number, and comparatively few juvenile stages have been described. This paper describes the larvae of three common mites, one of which was previously widely believed not to produce larvae. Many mites with surface-running larvae have been observed but the precise method by which these larvae attain a position on their hosts has been a matter of conjecture. The method is described for *Protzia eximia* PROTZ which also provides the first published example of a mite whose larvae parasitise adult Caddis Flies.

As life-history records are dispersed throughout a considerable and diffuse literature, it is thought desirable to bring together in one table particulars of the 153 mites whose life-histories have been published.

1. — GENERAL NOTES.

1.1. — *Aturus scaber* KRAMER.

This mite lives in fast-flowing water and the females lay one or two eggs only at one time. The eggs develop slowly within the females and it has therefore been assumed by many authors that they would probably hatch directly to nymphs. In order to test this idea I carefully isolated eleven ovigerous females until they produced, in all, 12 eggs, from which 12 larvae eventually hatched. The larvae lived for about three weeks in the laboratory but none formed nymphochrysalids, suggesting that a parasitic

stage may be needed. Larvae were subsequently found amongst mosses in rivers during the months of June and July, but none has so far been found attached to a host.

1.2. — *Piona uncata* KOENIKE.

Adult females of this species are found in plankton of ponds and ditches as early as March 1st and are usually common by early April, remaining so until June. In the laboratory they catch and feed on Cladocera and this seems to be their main diet. Eggs are laid in the laboratory almost always within a week of the females' capture, but wild females are always full of eggs up to the first week in May, so that it is probable that the normal egg laying period outside is in May and that it is the rise in temperature in the laboratory that promotes the earlier egg-laying. The eggs are laid in long strings containing 6 - 40 eggs. The strings are usually attached to algal threads or to pond weeds. In the laboratory the larvae hatch in two to three weeks and will live for 4 - 6 weeks. STOUT [1953 b] found that larvae of the subspecies *P. uncata exigia* VIETS developed to nymphs in 2 weeks without parasitism, but my specimens showed no signs of metamorphosis. In the field the larvae were in fact found to be parasitic on the midge *Chironomus plumosus* L. and other Chironomids. Their mouthparts were inserted into the arthrodial membranes of the host's abdomen and as many as 20 mite larvae were found on a single host. The host midges were kept in glass tubes containing a piece of rush standing in a few cm³ of water. The mites, on leaving their hosts, made their way down into the water and formed their nymphochrysalids either on the bottom of the tube or in the pith of the rush, often crawling 1 cm into the pith before settling down. The nymphs hatched in three weeks and formed their teleiochrysalids about three months later.

It has been reported by CROWELL [1960] for *Thyas stolli* KOENIKE, BÖTTGER [1962] for *Piona nodata* MÜLLER and PIERSIG [1900] and CROWELL [1960] for *Limnesia undulata* MÜLLER that these mites have alternative methods of development, large eggs giving rise directly to nymphs while smaller eggs produce larvae which must undergo a parasitic phase before reaching the nymphal state, and the situation in *P. uncata* KOENIKE may well be similar.

1.3. — *Protzia eximia* PROTZ.

The eggs of this species were found throughout the winter in crevices in boulders in fast flowing rivers. Egg batches were collected and divided into three separate tubes, one of which was kept in the dash at room temperature while the two others were placed in a refrigerator at 5.5° C. The eggs of the first batch hatched

after 18 - 23 days and the larvae lived for about three weeks. The second batch were raised to room temperature on the 23rd day and hatched in a further 18 days, at which time the third batch was removed from the refrigerator and also hatched after a further 18 days. This seems to offer conclusive evidence that temperature is a critical factor in the hatching of these eggs.

The larvae pass through the water film and run actively on the surface. About two days after hatching they are able to jump a distance of nearly 2 cm from the water surface. They are found in the summer months in large numbers on the moss of boulders which protrude from the water. It has been assumed by many authors that jumping habit observed in some Hydracarine larvae was associated with the attainment of a position on the host and observation of this species proved this to be so. It was found that when the resting larvae are walked over by the fly *Weidemannia bistigmata* CURTIS or by an unidentified female Caddis fly, the larvae jumped upwards, landing on the insect, and rapidly adopting a parasitic attachment to it. Parasitised hosts were found in considerable numbers from early May until September. This can be taken as evidence of a second egg-laying period, as it is unlikely, in view of the laboratory hatching tests, that larvae of the winter eggs would hatch so late in summer.

Of the host insects caught and examined, in May 45 out of 90 were parasitised by a total of 103 mite larvae, while in September of 24 hosts examined 15 were parasitised by 23 mite larvae.

2. — LARVAE.

The nomenclature used for the bristles is that proposed by SPARING [1959] p. 13, "Schema der Körperbeborstung".

2.1. — *Aturus scaber* KRAMER.

The larva is oval in outline with a distinct and deep invagination in the posterior end, reaching forwards further than the rear edges of the dorsal and ventral plates. The excretory field is without a plate but two pairs of long spines (representing probably Exp. 1 and Exp. 2) lie close to the excretory pore. Ex. 2 is inserted on the edge of the third epimeron. Ex. 4 is very long and inserted on a protuberance similar to that in *Hygrobates* spp. P. 3 bears a powerful curved spine. P. 4 ends in a strong almost straight claw and bears two bristles. P. 5 is very small and bears a short curved spine.

The dorsal bristles are very long, Pdb. 1 reaching 55 μ and Db. 1 61 μ . The suture between E. II and E. III is plainly visible

FIG. 1 : *Aturus scaber* KRAMER, larva, dorsal surface. — FIG. 2 : id°, ventral surface.

as far as the rearmost point of the E. I and is almost parallel to the body axis. The bristle Ep. 4 is inserted some distance from the suture.

Measurements (μ) :

	1	2	3
Length of body.	230	225	225
Breadth.	140	140	140
Capitulum.	55	55	55
Posterior bristles.	115	110	110
1 st leg.	140	135	140
2 nd leg.	140	135	145
3 rd leg.	160	140	160

2.2. — *Piona uncata* KOENIKE.

The larva is similar except in size to that of *P. coccinea* KOCH. P. 4 bears two bristles approximately half the length of the long bristle on P. 3. E. I comes to a sharp point reaching past the point bristle of insertion of the palpi.

The suture between E. II & E. III is almost equidistant between the rear edge of E. I and the bristle Ep. 4. The excretory plate

FIG. 3 : *Aturus scaber* KRAMER, larva, palpi. — FIG. 4 : id°, excretory field.

is triangular with well rounded angles. It is rather longer than broad. The rear end of E. III deviates round the bristle Ex. 1.

Measurements (μ) :

	1	2	3	4
Length.	395	395	425	400
Breadth.	220	195	220	220

Capitulum.....	120	120	130	120
Ex. 4.	155	130	155	155
1 st leg.	290	290	310	310
2 nd leg.	340	325	340	325
3 rd leg.	325	360	360	350

Excretory plate :

Length.	45	45	50	45
Breadth.	40	40	45	40

FIG. 5 : *Piona uncata* K., larva, ventral surface. — FIG. 6 : id°, excretory field.2.3. — *Protzia eximia* PROTZ.

On the anterior part of the dorsum is a not very well defined plate bearing the median eye and three pairs of long bristles, the middle pair of which are pectinate and the other two pairs simple. The paired eyes are large and close to the edge of the plate. The rear eye of each pair is not distinctly pigmented.

Db. 1 to 8 are all pectinate. Db. 8 are on rounded protruberances at the extreme posterior end of the larva.

The legs are comparatively long and bear large numbers of long pectinate bristles. The rear side of segment 2 of the second leg and the proximal dorsal part of segment 4 of the third leg

each bear a simple bristle. The claws consist of a very large median claw with two smaller claws, one on either side.

The palpi bear a strong curved spine on P. 2 and a bristled protruberance on P. 3. There are only 4 visible segments.

Measurements (μ) :	1	2	3	4
Length.	250	240	290	290
Breadth.	130	120	120	130
Capitulum.	50	70	50	50
Palpi.	90	100	90	85
1 st leg.	310	380	360	310
2 nd leg.	290	290	310	290
3 rd leg.	325	375	340	325

FIG. 7 : *Protzia eximia* PROTZ, larva, dorsal surface.

3. — LIST OF KNOWN HOSTS OF WATER-MITES.

In the table following the earliest known author is given in each case. Where subsequent authors have given different hosts these are also listed.

The names of hosts are given exactly as in the papers cited and no attempt has been made to bring them up to date, but in the case of the mites themselves the synonyms and classification have been brought into line with VIETS [1956].

I have been able to find no information whatsoever on hosts of the super-families Mideopsae VIETS or Krendowskiaie VIETS.

Mite Classification	HOST. [Host classification]	AUTHOR
1. Super-family Hydrovolziae VIETS		
Hydrovolziidae THOR :		
<i>Hydrovolzia</i> THOR		
<i>H. gerhardi</i> MITCHELL	<i>MICROVELIA AMERICANA</i> UHLER [Ins. Hem.]	MITCHELL 1954
2. Super-family Hydrachnae Part.		
Hydrachnidae LEECH :		
<i>Hydrachna</i> MÜLLER		
<i>H. cruenta</i> MÜLLER	<i>CORIXINAE</i> [Ins. Hem.]	SPARING 1959
<i>H. globosa</i> DE GEER	Dorsal on <i>DYTISCS</i> . [Ins. Col.]	WESENBERG-LUND 1918
	<i>NEPA</i> ; <i>RANATRA</i> [Ins. Hem.]	WESENBERG-LUND 1918
	<i>DYTISCIDAE</i> [Ins. Col.]	VIETS 1936 d
	<i>CYMATIA</i> ; <i>NOTONECTA</i> [Ins. Hem.]	VIETS 1936 d
<i>H. magniscutata</i> MARSCHALL	<i>NOTONECTA UNDULATA</i> ; <i>RANATRA</i> ; <i>ARCTOCORIXA</i> [Ins. Hem.]	CROWELL 1960
<i>H. maramauensis</i> STOUT	<i>ANISOPS WAKEFIELDI</i> ; <i>ARCTOCORIXA ARGUTA</i> [Ins. Hem.]	STOUT 1953 b
<i>H. processifera</i> KOENIKE	<i>DYTISCUS MARGINALIS</i> L. [Ins. Col.]	WESENBERG-LUND 1918
<i>H. uniscutata</i> THOR	<i>DYTISCS</i> [Ins. Col.]	WESENBERG-LUND 1918
<i>H. leegei</i> KOENIKE	<i>NOTONECTA GLAUCA</i> L. [Ins. Hem.]	JONES 1965
3. Super-family Limnocharae VIETS		
Limnocharidae GRUBE :		
<i>Limnochares</i> LATREILLE		
<i>Limnochares aquatica</i> L.	<i>GERRIDS</i> [Ins. Hem.]	DUGES 1834 b
	<i>VELIIDS & HYDROMETRIDS</i> [Ins. Hem.]	SPARING 1959
	<i>AQUARIUS PALLUDUM &</i> <i>LIMNOPHORUS RUFOSCU-</i> <i>TELLATUS</i> [Ins. Hem.]	IMAMURA 1954 b
	<i>ZYGOPTERAN IMAGINES</i> [Ins. Odo.]	KILLINGTON & BATHE 1947

Eylaidae LEECH :
Eylais LATREILLE
E. bisinuosa KOENIKE

E. extendens MÜLLER
E. discreta KOENIKE
E. hamata KOENIKE

E. infundibulifera
 KOENIKE
E. meridionalis THON
E. mutila KOENIKE

E. setosa KOENIKE

E. waikewai STOUT

Protziidae VIETS :
Protzia PIERSIG
P. eximia PROTZ

Partnunia PIERSIG
P. steinmanni WALTER
P. uchidai IMAMURA

CYMATIA COLEOPTRATA FAB.

[Ins. Hem.]

JONES 1965

CORIXINAE [Ins. Hem.]

SPARING 1959

CORIXINAE [Ins. Hem.]

SPARING 1959

CYMATIA [Ins. Hem.]

VIETS 1936 d

DYTISCUS; *COLEMBETES*;

GYRINUS; *HYDROPHILUS*;

GRAPHODERES; *RANTUS*;

ILYBIUS; *HYPHYDRUS*.

[Ins. Col.]

VIETS 1936 d

GILLS OF FISHES [Cho. Pis.]

VIETS 1936 d

DYTISCS & GYRINIDS

[Ins. Hem.]

PIATAKOV 1915

CORIXA [Ins. Hem.]

BOTTGER 1962

DYTISCS & GYRINIDS

[Ins. Col.]

PIATAKOV 1915

DYTISCS & GYRINIDS

[Ins. Col.]

PIATAKOV 1915

ANISOPS WAKEFIELDI

[Ins. Hem.]

STOUT 1953 a

WEIDEMANIA BISTIGMATA

CURTIS [Ins. Dip.]

JONES 1965

UNIDENTIFIED CADDIS FLY

[Ins. Tri.]

JONES 1965

PLECOPTERA [Ins. Ple.]

MUNCHBERG 1954

6 Spp. of *PLECOPTERA* *IMA-*

GINES [Ins. Ple.]

IMAMURA 1954 b

4. Super-family Hydryphantae VIETS

Thyasidae THOR :

Thyasides LUNDBLAD

T. dentata THOR

Panisopsis VIETS

P. curvifrons WALTER

P. n. spp (unnamed)

Thyopsis PIERSIG

T. cancellata PROTZ

Thyas KOCH

T. barbiger VIETS

T. spp. Probably *T.*

pachystoma PIERSIG

T. stoll KOENIKE

Trichothyas VIETS

T. muscicola MITCHELL

Paninus KOENIKE

P. michaeli KOENIKE

Hydryphantidae THOR :

Hydryphant KOCH

H. ruber DE GEER

AEDES LUTESCENS [Ins. Dip.]

LUNDBLAD 1927 c

DIPTERAN IMAGINES

[Ins. Dip.]

WALTER 1915 a

APTEROUS STONEFLIES

[Ins. Ple.]

WOMERSLEY 1953

Various *TIPULIDS* [Ins. Dip.]

MUNCHBERG 1935 b

TIPULIDS [Ins. Dip.]

MUNCHBERG 1935 b

TIPULIDS [Ins. Dip.]

MUNCHBERG 1935 b

1. *AEDES VEXANS* & *AEDES*

spp. [Ins. Dip.]

CROWELL 1960

2. Hatched as nymphs

CROWELL 1960

LIMONIA HUMIDICOLA O. S.

[Ins. Dip.]

MITCHELL 1953

GYROCAMP *UBIGINOSA* HAL.

[Ins. Hym.]

LUNDBLAD 1927 c

CULEX [Ins. Dip.]

VIETS 1936 d

<i>H. dispar</i> VON SCHAU	<i>PALUDINA</i> [Mol. Gas.]	THOR 1899
<i>Georgella</i> KOENIKE	<i>EPHYDRINAE</i> [Ins. Dip.]	SOAR 1906
<i>G. helvatica</i> HALLER	<i>ISCHNURA; AGRION</i>	
Hydrodromidae VIETS	[Ins. Odo.]	MÜNCHBERG 1935
<i>Hydrodroma</i> KOCH		
<i>H. despiciens</i> MÜLLER	<i>CHIRONOMIDS; CORETHRA</i>	
	[Ins. Dip.]	WESENBERG-LUND 1918

5. Super-family Lebertiæ VIETS

Sperchonidae THOR :
Sperchon

<i>S. brevirostris</i> KOENIKE	<i>ORTHOCLADIUS SORDIDEL-</i>	
	<i>LUS</i> ZETTERSTADT [Ins. Dip.]	THIENNEMANN 1908
<i>S. denticulatus</i> KOENIKE	<i>CHIRONOMIDS</i> [Ins. Dip.]	SPARING 1959
<i>S. setiger</i> THOR	Pupae of <i>MELUSINA ORNATA</i>	
	[Ins. Dip.]	BESSELING 1939
<i>S. squamosus</i> KRAMER	<i>ORTHOCLADIUS SORDIDEL-</i>	
	<i>LUS</i> [Ins. Dip.]	VIETS 1936 d
<i>S. glandulosus</i> KOENIKE	4 spp. <i>CHIRONOMIDS</i>	
	[Ins. Dip.]	EFFORD 1960
<i>S. longissimus</i> VIETS	<i>ORTHOCLADIUS FLAVIDULA</i>	
	EDWARDS [Ins. Dip.]	EFFORD 1960
<i>S. jasperensis</i> MARSHALL	<i>SIMULIUM</i> spp. [Ins. Dip.]	DAVIES 1959
<i>S. spp.</i>	<i>CHIRONOMIDS</i> [Ins. Dip.]	JONES 1965
Lebertiidae THOR :		
<i>Lebertia</i> NEUMANN		
<i>L. stigmatifera</i> THOR	Direct development to nymph	
	none	LUNDBLAD 1924
<i>L. glabra</i> THOR	2 spp <i>CHIRONOMIDS</i> [Ins. Dip.]	
Torrenticolidae		
PIERSIG :		
<i>Torrenticola</i> PIERSIG		
<i>T. spongicola</i> VIETS	<i>SPONGES</i> [Porifera]	EFFORD 1960

6. Super-family Pionae VIETS

Pontarachnidae THOR :		
<i>Pontarachna</i> PHILIPPI		
<i>P. punctulum</i> PHILIPPI	<i>OSTREA</i> [Mol. Lam.]	ANDRÉ & LAMY 1930
Limnesiidae THOR :		
<i>Limnesia</i> KOCH		
<i>L. connata</i> KOENIKE	Hatched as nymph	PIERSIG 1900
<i>L. undulata</i> MÜLLER	Hatched as nymph	PIERSIG 1900
	<i>TANYTARSUS DECORUS</i>	
	JOHANNSEN [Ins. Dip.]	CROWELL 1960
<i>L. fulgida</i> KOCH	<i>CHIRONOMIDS</i> [Ins. Dip.]	SPARING 1959
	<i>WATER-BEETLE LARVAE</i>	
	[Ins. Col.]	WESENBERG-LUND 1918
<i>L. maculata</i> MÜLLER	<i>CHIRONOMIDS</i> [Ins. Dip.]	SPARING 1959
Hygrobatidae KOCH :	<i>CHIRONOMIDS</i> [Ins. Dip.]	LUNDBLAD 1926 c
<i>Hygrobatas</i> KOCH		
<i>H. foreli</i> LEBERT	<i>CHIRONOMIDS</i> [Ins. Dip.]	LUNDBLAD 1927 c
<i>H. longipalpis</i> HERMANN	<i>CORETHRA; CHIRONOMIDS</i>	
	[Ins. Dip.]	MÜNCHBERG 1935 b

<i>Atractides</i> KOCH		
<i>A. nodipalpis</i> THOR	MIDGE IMAGINES [Ins. Dip.]	IMAMURA 1954 b
<i>A. spinipes</i> KOCH	Various CHIRONOMIDS	
	[Ins. Dip.]	JONES 1965
Unionicolidae		
OUDEMANS ;		
<i>Unionicola</i> HALDEMAN		
<i>U. aculeata</i> KOENIKE	Not parasitic but resting stages found in MUSSELS	MITCHELL 1955
Adults & nymphs	CAMPELOMA LECISIUM SAY	
	[Mol. Lam.]	CHANDLER 1934
	ANODONTA ANATINA L.	
	[Mol. Lam.]	JONES 1965
Larvae	Various CHIRONOMIDS	JONES 1965 b
<i>U. abnorripes</i> WOLCOTT	LAMPSILLIS SILIQUOIDES	
	[Mol. Lam.]	MITCHELL 1955
<i>U. arcuata</i> WOLCOTT	LAMPSILLIS SILIQUOIDES	
	[Mol. Lam.]	MITCHELL 1955
<i>U. bonzi</i> CLAPAREDE	UNIO DOUGLASSIAE NIP-PONENSIS [Mol. Lam.]	IMAMURA 1953
<i>U. cirrosa</i> KOENIKE	UNIO NEPEANENSIS	
	[Mol. Lam.]	KOENIKE
<i>U. ampullariae</i> KOENIKE	AMPULLARIA [Mol. Gas.]	ANDRÉ & LAMY 1930
<i>U. crassipes</i> MÜLLER	F. W. SPONGES [Porifera]	ARNDT & VIETS 1938
<i>U. diversipes</i> VIETS	NAIADES [Mol. Lam.]	VIETS 1926
<i>U. fissipes</i> KOENIKE	ANODONTA LATIMARGINATA	
	[Mol. Lam.]	ANDRÉ & LAMY 1930
<i>U. formosa</i> DANA & WHELPLEY	4 ANODONTA SPECIES	
	[Mol. Lam.]	MITCHELL 1957
<i>U. fossulata</i> KOENIKE	LAMPSILLIS SILIQUOIDES	
	[Mol. Lam.]	MITCHELL 1955
<i>U. intermedia</i> KOENIKE		
Adults & nymphs	ANODONTA ANATINA L.	
	[Mol. Lam.]	MITCHELL 1955
Larvae	Various CHIRONOMIDS	
	[Ins. Dip.]	JONES 1965 b
<i>U. japonensis</i> VIETS	VIVIPAROUS MALLEATUS	
	[Mol. Gas.]	IMAMURA 1953
<i>U. parasitica</i> UCHIDA & IMAMURA	ANODONTA BERINGUANA	
	[Mol. Lam.]	IMAMURA 1954 b
<i>U. perforatus</i> KOENIKE	ANODONTA LATIMARGINATA	
	[Mol. Lam.]	ANDRÉ & LAMY 1930
<i>U. procurvipes</i> KOENIKE	ANODONTA GIGANTEA	
	[Mol. Lam.]	ANDRÉ & LAMY 1930
<i>U. rugosa</i> KOENIKE	ANODONTA LATIMARGINATA	
	[Mol. Lam.]	ANDRÉ & LAMY 1930
<i>U. uchidai</i> IMAMURA	F. W. MUSSELS [Mol. Lam.]	IMAMURA 1953
<i>U. serrata</i> WOLCOTT	LAMPSILLIS SILIQUOIDES	
	[Mol. Lam.]	MITCHELL 1955
<i>U. ypsilophora</i> BONZ	ANODONTA CYGNEA L.	
	[Mol. Lam.]	MITCHELL 1955
Polyatacides LUNDBLAD		
<i>P. prominens</i> KOENIKE	F. W. MUSSELS [Mol. Lam.]	LUNDBLAD 1937
<i>Atacella</i> LUNDBLAD.		
<i>A. schubarti</i> VIETS	DIPLONDON DELONTUS EX-PANSUS KUSTER [Mol. Lam.]	VIETS 1954
<i>A. clathrata</i> LUNDBLAD	F. W. MUSSELS [Mol. Lam.]	LUNDBLAD 1937
<i>Najadicola</i> PIERSIG		
<i>N. ingenus</i> KOENIKE	3 genera of MUSSELS	
	[Mol. Lam.]	MITCHELL 1955
<i>Neumania</i> LEBERT		
<i>N. deltoides</i> PIERSIG	CHIRONOMIDS [Ins. Dip.]	SPARING 1959

<i>N. uchidai</i> IMAMURA	MIDGES [Ins. Dip.]	IMAMURA 1954 b
<i>Huitfeldtia</i> THOR		
<i>H. rectipes</i>	CHIRONOMIDS [Ins. Dip.]	MÜNCHBERG 1935
Feltriidae THOR :		
<i>Feltria</i> KOENIKE		
<i>F. setigera</i> (?) KOENIKE	CHIRONOMIDS [Ins. Dip.]	VITZTHUM 1941
<i>F. romijni</i> BESSELING	TANYTARSUS FLAVIDULUS EDWARDS [Ins. Dip.]	EFFORD 1960
<i>F. minuta</i> KOENIKE	Several spp. CHIRONOMIDS	EFFORD 1960
Pionidae THOR :		
<i>Typhis</i> KOCH		
<i>T. ornatus</i> KOCH	CHIRONOMUS THUMMI PU- PAE [Ins. Dip.]	UCHIDA 1932
<i>T. spp.</i>	Various CHIRONOMUS IMA- GINES [Ins. Dip.]	JONES 1965
<i>Pionopsis</i> PIERSIG		
<i>P. lutescens</i> HERMANN	CHIRONOMIDS [Ins. Dip.]	SPARING 1959
<i>Pionocercus</i> PIERSIG		
<i>Pionocercus</i> PIERSIG.		
<i>P. leuckarti</i> PIERSIG	Direct development to nymph	LUNDBLAD 1927 c
<i>Piona</i> KOCH		
<i>P. carnea</i> KOCH	CHIRONOMUS THUMMI PU- PAE [Ins. Dip.]	UCHIDA 1932
<i>P. coccinea</i> KOCH	CHIRONOMIDS [Ins. Dip.]	SPARING 1959
<i>P. conglobata</i> KOCH	CHIRONOMIDS [Ins. Dip.]	SPARING 1959
	CHIRONOMUS DORSALUS MEIGEN [Ins. Dip.]	JONES 1965
<i>P. disparalis</i> KOENIKE	CRICOTOPUS spp. [Ins. Dip.]	MOTAS 1928
<i>P. linguaplax</i> CROWELL	POLYPEDILUM spp. [Ins. Dip.]	CROWELL 1953
<i>P. nodata</i> MÜLLER	Direct development to nymph. Larvae large type to nymph. Larvae small type UNKNOWN HOST	PIERSIG 1900 BÖTTGER 1962 BÖTTGER 1962
<i>P. reighardi</i> WOLCOTT	TENDIPES DECORUS JOHANNSEN [Ins. Dip.]	CROWELL 1960 PIERSIG 1900
<i>P. rotunda</i> KRAMER	Direct development to nymph	
<i>P. uncata uncata</i> KOENIKE	CHIRONOMUS PLUMOSUS L. OTHER CHIRONOMIDS [Ins. Dip.]	JONES 1965 STOUT 1953 JONES 1965
<i>P. uncata exigua</i> VIETS	Direct development to nymph	
<i>P. variabilis</i> KOCH	CHIRONOMIDS [Ins. Dip.]	JONES 1965
<i>Foreil</i> HALLER		
<i>F. spp.</i>	Nymphs hatched from eggs.	COOK 1956

7. Super-family Axonopsae

Axonopsidae VIETS :		
<i>Brachypoda</i> LERERT		
<i>B. versicolor</i> MÜLLER	Hatches as nymph	PIERSIG 1900
<i>Ljania</i> THOR		
<i>L. bipapillata</i> THOR	4 species CHIRONOMIDS	EFFORD 1960
<i>Parasitalbia</i> VIETS		
<i>P. sumatrensis</i> VIETS	As adults on EPHEMERID LARVAE [Ins. Eph.]	VIETS 1935

8. Super-family Arrenuræ

Arrenuridae THOR :	
<i>Arrenurus</i> DUGÈS	
Sub-genus <i>Arrenurus</i> s. str. DUGÈS	

<i>A. abbreviator</i> BERLESE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. affinis</i> KENIKE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. agrioncolus</i> UCHIDA.	AGRIONIDAE [Ins. Odo.]	IMAMURA 1958
<i>A. Americanus major</i> MARSHALL	ISCHNURA VERTICALIS SAY [Ins. Odo.]	MÜNCHBERG 1951
<i>A. angelieri</i> Cass. - MÉJEAN	ZYGOPTERA [Ins. Odo.]	CASS.-MÉJEAN 1966
<i>A. batillifer</i> KENIKE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. bicuspidator</i> BERLESE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. bleptopetiolatus</i> COOK	EPICIRDULIA PRINCEPS HAGEN [Ins. Odo.]	MITCHELL 1959
<i>A. bruzelii</i> KENIKE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. claviger</i> KENIKE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. compactilis</i> MARSHALL	ENALLAGMA EBRIUM HAGEN [Ins. Odo.]	MITCHELL 1959
<i>A. compactus</i> PERSIG	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. crenatus</i> KENIKE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. crassicaudatus</i> KRAMER	CORETHRA CRISTALLINA DE GEER [Ins. Dip.]	MÜNCHBERG 1935 a
<i>A. cuspidator</i> MÜLLER	ANOPHELES MACULIPENNIS MEIGEN [Ins. Dip.]	MÜNCHBERG 1958
<i>A. cuspidifer</i> PERSIG	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. daisetsuensis</i> IMAMURA	LIBELLULIDAE [Ins. Odo.] AESCHNA NIGROFLAVA ENALLAGMA DESERTI	MÜNCHBERG 1935 d
<i>A. dimontifer</i> MÜNCHBERG	[Ins. Odo.] ZYGOPTERA [Ins. Odo.]	IMAMURA 1951 a MÜNCHBERG 1958 b
<i>A. fimbriatus</i> KENIKE	ANOPHELES MACULIPENNIS MEIGEN THEOBALDIA ANNULATA [Ins. Dip.]	MÜNCHBERG 1936 c MITCHELL 1959 CASS.-MÉJEAN
<i>A. fissicornis</i> MARSHALL	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1938
<i>A. furcillatus</i> VIETS	ZYGOPTERA [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. latus</i> BARROIS & MONIEZ	ANOPHELES MACULIPENNIS MEIGEN [Ins. Dip.]	MÜNCHBERG 1935 d
<i>A. leuckarti</i> PERSIG	LIBELLULIDAE [Ins. Odo.]	JONES 1965
<i>A. maculator</i> MÜLLER	LIBELLULIDAE [Ins. Odo.]	
<i>A. munchbergi</i> K. O. VIETS & CASSAGNE- MÉJEAN	ZYGOPTERA [Ins. Odo.]	CASS.-MÉJEAN 1966
<i>A. neumani</i> PERSIG	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. octotumuli</i> MÜNCHBERG	ZYGOPTERA [Ins. Odo.]	MÜNCHBERG 1958 b
<i>A. ornatus</i> GEORGE	ZYGOPTERA [Ins. Odo.]	KILLINGTON & BATHE 1947 a
<i>A. planus</i> MARSHALL	ANISOPTERA & ZYGOPTERA [Ins. Odo.]	MÜNCHBERG 1952
<i>A. platy-rotundo-cuspi-</i> <i>dator</i> MÜNCHBERG	ANISOPTERA & ZYGOPTERA [Ins. Odo.]	MÜNCHBERG 1952
<i>A. papillator</i> MÜLLER	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. pollicetus</i> MARSHALL	4 LESTES species [Ins. Odo.]	MITCHELL 1959
<i>A. pustulator</i> MÜLLER	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. radiatus</i> PERSIG	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. robustus</i> KENIKE	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. rodrigensis</i> LUNDBLAD	ZYGOPTERA [Ins. Odo.]	CASS.-MÉJEAN 1966
<i>A. tetracyphus</i> PERSIG	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. tricuspidator</i> MÜLLER	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. virens</i> NEUMAN	LIBELLULIDAE [Ins. Odo.]	MÜNCHBERG 1935 d
<i>A. wallensis</i> COOK	LIBELLULIDAE [Ins. Odo.]	MITCHELL 1959
Sub-genus <i>Megaluraca-</i> <i>rus</i> VIETS		

<i>A. buccinator</i> MÜLLER	Various MOSQUITOES		
		[Ins. Odo.]	MÜNCHBERG 1935 b
<i>A. einbergeri</i> MÜNCHBERG	LIBELLULIDAE	[Ins. Odo.]	2 MÜNCHBERG 1960
<i>A. globator</i> MÜLLER	Various MOSQUITOES		MÜNCHBERG 1936 e
		[Ins. Dip.]	
	CULEX PIPIENS LARVAE		
		[Ins. Dip.]	
	DYTISCUS & CYRINUS LARVAE	[Ins. Col.]	BÖTTGER 1962
<i>A. medio-rotundatus</i> THOR	ANOPHELES CLAVIGER MEIGEN	[Ins. Dip.]	JONES 1965
<i>A. odonatophilus</i> MÜNCHBERG	LIBELLULIDAE	[Ins. Odo.]	MÜNCHBERG 1958
Sub-genus <i>Truncaturus</i> THOR			
<i>A. knauthi</i> KÆNIKE	MOSQUITOES	[Ins. Dip.]	MÜNCHBERG 1936 e
<i>A. nodosus</i> KÆNIKE	MOSQUITOES	[Ins. Dip.]	MÜNCHBERG 1936 e
<i>A. stecki</i> KÆNIKE	MOSQUITOES	[Ins. Dip.]	MÜNCHBERG 1936 e
<i>A. truncatellus</i> MÜLLER	MOSQUITOES	[Ins. Odo.]	MÜNCHBERG 1937 b
Sub-genus <i>Micruracarus</i> VIETS			
<i>A. bisulcicodulus</i> PIERSIG	MOSQUITOES	[Ins. Dip.]	MÜNCHBERG 1937 b
<i>A. integrator</i> MÜLLER	MOSQUITOES	[Ins. Dip.]	MÜNCHBERG 1938 a
<i>A. pugiosifer</i> KÆNIKE	MOSQUITOES	[Ins. Dip.]	MÜNCHBERG 1936 e
<i>A. sinuator</i> MÜLLER	TANNYPUS PUNCTIPENNIS MEIGEN	[Ins. Dip.]	MÜNCHBERG 1936 e
Sub-genus uncertain, probably <i>Arrenurus</i> s. str.			
<i>A. imperator</i> MÜLLER	LIBELLULIDAE	[Ins. Odo.]	MÜNCHBERG 1960
<i>A. retroduobus</i> MÜNCHBERG	LIBELLULIDAE	[Ins. Odo.]	MÜNCHBERG 1959
Sub-genus undetermined			
<i>A. species</i>	Young fish	[Cho. Pis.]	SOAR & WILLIAMSON 1925
<i>A. species 1</i>	DIXA AESTIVALIS MEIGEN		
		[Ins. Dip.]	JONES 1965
<i>A. Species 2</i>	ANATOPYNIA VARIA JOHNSTON		
		[Ins. Dip.]	JONES 1965

SUMMARY

The larvae of these three mites are described for the first time.

1. — *Aturus scaber* KRAMER.

Females of this species lay one, very large egg at a time, suggesting a suppression of the larval stage and direct development to nymph. This expectation has been refuted and the larvae bred in the laboratory. Further information on the life-history is lacking but a parasitic stage is indicated.

2. — *Piona uncata* KOENIKE.

The complete life-history of this mite is described. In the specimens studied the main host was *Chironomus plumosus* L. Work by STOUT shows that this species has an alternative direct development. The larvae are similar except in size to those of *P. coccinea* KOCH.

3. — *Protzia eximia* Protz.

Eggs are found throughout the winter and laboratory tests show that hatching is dependant on temperature. The larvae resemble those of *Panisopsis* species, and run actively on the water film. They are able to jump 2 cm from the surface and use this ability to gain a place on their hosts, an unidentified Trichopteran and the fly, *Weidemannia bistigmata* CURTIS. There are probably two generations a year.

An up-to-date table gives hosts for 150 species and references for this information.

**DESCRIPTION DES LARVES D'ATURUS SCABER KRAMER,
PROTZIA EXIMIA PROTZ ET PIONA UNCATA KÆNIKE
ET NOTES SUR LE CYCLE BIOLOGIQUE
DES DEUX DERNIÈRES ESPÈCES,
[Hydracarina]**

Les larves de ces trois Hydracariens sont décrites pour la première fois.

1. — *Aturus scaber* KRAMER.

Les femelles de cette espèce pondent un très gros œuf unique, fait qui avait suggéré l'absence du stade larvaire et un développement donnant directement une nymphe. Cette supposition s'est avérée inexacte et les larves ont été élevées au laboratoire. On manque encore d'autres données sur le cycle biologique, mais il semble exister un stade parasite.

2. — *Piona uncata* KÆNIKE.

Le cycle biologique complet de cette espèce est décrit. Chez les spécimens étudiés, l'hôte principal est *Chironomus plumosus* L. Un travail de STOUT montre que cette espèce peut également présenter un développement direct. A l'exception de leur taille, les larves ressemblent à celles de *P. coccinea* KOCH.

3. — *Protzia eximia* PROTZ.

On rencontre des œufs de cette espèce pendant tout l'hiver et des expériences réalisées au laboratoire montrent que l'éclosion dépend de la température. Les larves ressemblent à celles des espèces de *Panisopsis* et courent activement à la surface de l'eau. Elles sont capables de sauter à 2 cm de la surface et utilisent cette faculté pour parvenir sur leurs hôtes, un Trichoptère non identifié et le Diptère *Weidemannia bistigmata* CURTIS. Il existe probablement deux générations par an.

Une table mise à jour indique les hôtes de 150 espèces et les références bibliographiques de ces données.

**BESCHREIBUNG DER LARVEN VON ATURUS SCABER KRAMER,
PROTZIA EXIMIA PROTZ UND PIONA UNCATA KÆNIKE
UND ANGABEN ÜBER DEN ENTWICKLUNGSZYKLUS
DER BEIDEN LETZTEN ARTEN.
[Hydracarina]**

Die Larven dieser drei Hydracarinen werden zum erstenmal beschrieben.

1. — *Aturus scaber* KRAMER. Bei dieser Art legen die Weibchen ein

einziges grosses Ei, wodurch man auf das Fehlen des Larvenstadiums und auf eine direkte Entwicklung zur Puppe geschlossen hatte.

Diese Annahme bezeugte sich als ungenau, und die Larven wurden im Laboratorium aufgezogen. Weitere Angaben über den Entwicklungszyklus fehlen noch, aber es existiert auscheinend ein Parasitenstadium.

2. — *Piona uncata* KÖNIKE. Der gesamte Entwicklungsgang dieser Art wird beschrieben. Bei den bearbeiteten Exemplaren ist der hauptsächlichste Wirt *Chironomus plumosus* L.

Eine Veröffentlichung von SROUT zeigt, dass es bei dieser Art ebenfalls eine direkte Entwicklung geben kann. Wenn man von ihrer Grösse absieht, ähneln diese Larven denen von *P. coccinea* KOCH.

3. — *Protzia eximia* PROTZ. Während des ganzen Winters kann man Eier von dieser Art finden und die im Labor durchgeführten Versuche zeigen, dass das Schlüpfen von der Temperatur abhängt.

Die Larven ähneln denen der verschiedenen Arten von *Panisopsis* und bewegen sich aktiv an der Wasseroberfläche. Sie können Sprünge bis zu 2 cm über dem Wasserspiegel machen und benützen diese Fähigkeit, um auf ihre Wirte, eine nicht bestimmte Köcherfliege und den Zweiflügler *Weidemannia bistigmata* CURTIS zu gelangen. Wahrscheinlich gibt es jährlich zwei Generationen.

Eine vervollständigte Tafel zeigt die Wirte von 150 Arten sowie alle diesbezüglichen Literaturnachweise auf.

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