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PART 7.

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TRANSACTIONS OF THE SOCIETY FOR BRITISH ENTOMOLOGY

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PART 7.

THE BRITISH SPECIES OF *MICRONECTA* (CORIXIDAE, HEMIPT.).

Mr. G. A. WALTON.

In the lists of British Hemiptera and in the standard works on the suborder Heteroptera there are to be found the names of two species of *Micronecta* Kirkaldy, namely, *M. minutissima* (Linné, 1758) recorded from all parts of the British Isles, and *M. scholtzi* (Scholtz), 1846, sometimes mentioned as *M. scholtzi* (Fieber), 1851, or *M. meridionalis* (Costa), 1860, recorded from S.E. England. I possessed series of the so-called *M. minutissima* from Somerset, Pembrokeshire, Herefordshire and Kerry (Eire) and had examined odd specimens whose characters agreed, and was therefore interested to receive a paper from Prof. O. Lundblad of Stockholm, Sweden, describing a new species, *M. borealis* from Sweden, whose characters agreed with the British *M. minutissima*. Another paper by this same author compares the true *M. minutissima* of Sweden with British *M. meridionalis* (Costa); from this paper it was obvious that the British *M. minutissima* was not the true Linnean species. I then wrote to Mr. W. E. China at the British Museum asking him to examine the type of *M. poweri* (Douglas & Scott, 1869) described from specimens collected in the New Forest by the late Dr. Power. In his reply he stated that the type was a female, but that a series of identical specimens in the Butler collection without locality labels contained some males, and he kindly sent drawings of the important parts, and also of the so-called *M. minutissima* from Surrey (in the Power collection). I have since seen all these specimens in the Museum. Prof. Lundblad was so good as to send Swedish examples of the true *M. minutissima* (L.), and upon a comparison it was evident that the Surrey '*minutissima*' and those in my collection were the

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same as *M. poweri* and identical with Prof. Lundblad's *M. borealis* and was widely distributed in the British Isles, but as yet there was no indication of the presence of the true *M. minutissima* (L.). In order to determine whether *M. minutissima* (L.) was a British species, I communicated with a number of collectors of aquatic Hemiptera requesting material for examination. The response was most gratifying, and it is now possible to record *M. minutissima* (L.) as a British species, as three specimens were discovered among material collected by Mr. P. Harwood at Colchester some thirty years ago, and two further specimens in a series of *Micronecta* from the collection of the late Canon Fowler kindly forwarded by the late Mr. H. P. Jones from the Nottingham Museum.

SYSTEMATIC POSITION OF THE BRITISH SPECIES.

These insects belong to the genus *Micronecta* Kirkaldy, 1897, of the subfamily Micronectinae Jaczewski, 1924: *M. minutissima* (L.) and *M. poweri* (D. & S.) on the one hand and *M. meridionalis* (Costa) on the other appear to belong to two different groups although *Micronecta daedala* Distant (N.E. Himalayas) appears to be somewhat intermediate; the former group is of Palearctic affinities, and it is of interest to note that *Micronecta wui* Lundblad from Peking in China has head, legs and genitalia similar to those of *M. poweri* (D. & S.), but the wings and abdominal segments of *M. minutissima* (L.); its length is, however, only 1.4 mm. *M. meridionalis* is of Ethiopian affinities.

This subfamily is characterised by being less than 6 mm. long, in having three-segmented antennae, a very short pronotum which leaves a large portion of the scutellum uncovered, parameres or claspers both free and the aedeagus short, blunt and covered with short spines. There are three genera:—

(1) *Tenagobia* Bergroth, 1899, from Central and northern S. America in which the pronotum is concave behind, and the anterior single-segmented tarsus (pala) fused to the tibia in the females, but distinct in the males which possess no stridulating structure on the abdomen.

(2) *Micronecta* Kirkaldy, 1897, from Europe, Africa, S. Asia, India, E. Indies and Australia (but not New Zealand), in which the pronotum is convex behind, and the pala fused to the anterior tibia in the female, but distinct in the males which possess a stridulating organ in the vast majority of cases.

(3) *Synaptonecta* Lundblad, 1933, from the E. Indies, in which the pronotum is convex behind, and the pala and anterior tibiae completely fused in both sexes. The males possess an abdominal stridulating organ.

A fourth genus is described under the name *Micronectella* Lundblad, 1933, from the E. Indies; the male lacks an abdominal stridulating organ, but as *Micronecta* species occur in a similar condition this seems irrelevant.

DESCRIPTIONS OF BRITISH SPECIES.

Some biological information is included after the following descriptions of the British species.

MICRONECTA POWERI (D. & S.).

Sigara Poweri Douglas, J. W., and Scott, J., 1869, *Ent. mon. Mag.*, 5: 296.
Micronecta borealis Lundblad, O., 1936, *Ent. Tidskr.*, 57: 23-28, 1 pl.

Total length 1.75-2 mm., twice as long as broad. The oblong-oval macropterous specimens have straight lateral margins to the pronotum whose breadth is twice the length in the ♀ and three times in the ♂. The broadly oval brachypterous specimens have small rounded lateral margins to the pronotum whose breadth is three times the length. Head only slightly arcuate in front, from above four times as broad as long, a dark sepia central vertical line. Eyes mauve. Scutellum pale cadmium-yellow. Ground colour of the pronotum and hemelytra which are not very shiny, greenish-grey or clay-yellow, obscured by large vandyke-brown blotches which may be much reduced or entirely absent, but in general arranged as follows:—Pronotum with a large blotch in each lateral half; clavus with a large central and a small apical blotch; corium with two consecutive streaks along the costal border, an inverted V-shaped mark in the basal angle connected to an outer blotch which is in turn connected to a more distal inner mark, at the apex a small streak. Membrane dusky. The relative lengths of the segments of the three pairs of legs as follows:—*anterior legs*: femur: tibia: pala: claw (male) :: 5: 3: 3: 2; *median legs*: femur: tibia: tarsus: claws :: 30: 10: 14: 10; *posterior legs*: femur: tibia: tarsus 1: tarsus 2: claw :: 14: 10: 10: 5: 4.

Specialisations of the Male.

Lower pala edge with a row of 15-19 stout hairs; across the middle of the palmar aspect of the pala a row of 12 spines and along the upper edge 4 slender hairs, in the apical cleft a large thick hair set upon a relatively large tubercle. Lobe of the fifth tergite large and dark, its inner posterior corner directed to the left as an acute angle of 45°, the outer posterior corner variable, in some sharp at right angles but in others obtusely rounded. Strigil relatively large, composed of 45 very long slender teeth. The median lobe of the seventh sternite not very long, sharply pointed and bearing 4-6 spinous hairs. The lobe of the eighth tergite transversely truncated and often slightly convex. The

right paramere is heavily built and rather variable, but its breadth one-fifth the length, bluntly upturned at the apex. The left paramere is simple, oblong-oval with a small apical projection; when flattened (by a cover slip) it appears wider and is obliquely truncated. Along the sides of each of these segments (omitting the eighth) there is a single row of 7-9 small spines (except the right side of the fifth), 2-3 large spines and a group of 2-5 long hairs. Underside brown in parts.

Habitat.

I have examined specimens from the following localities:—

Ireland.—County Kerry: Lough Leane, collected by Mr. E. Bullock; Kenmare Demesne, coll. J. N. Halbert; Anniscaul, near Dingle, coll. S. Stanley and W. Kemp. Waterford: Lisimore, coll. J. N. Halbert. Donegal: Coolmore and Merragh, coll. late Rev. W. F. Johnson. Londonderry or Donegal?: Foyle district, coll. late C. W. Buckle. Sligo: Ballysodare, coll. J. N. Halbert.

England.—Devon: River Exe at Cowley Bridge, coll. Rev. E. J. Pearce; R. Teign at Newton Abbot, coll. G. A. Walton; Marytavy, coll. J. H. Keys. Somerset: R. Yeol at Congresbury, coll. G. A. W. Herefordshire: stream at Stretton Grandison, R. Lugg, R. Arrow, R. Teme, coll. G. A. W. Worcestershire: R. Teme, coll. G. A. W. Shropshire: R. Teme, coll. G. A. W. Essex: Colchester, coll. P. Harwood. Yorkshire: Scarborough at Scally Beck, coll. G. B. Walsh; R. Dee at Dent, coll. J. M. Brown. Derby and Stafford: R. Dove at Burton-on-Trent, Fowler collection. Cambridge: Quy Lode, coll. G. E. Hutchinson. Cumberland and Westmorland: R. Eden, coll. G. E. Hutchinson. Westmorland: R. Irthing and Brothers Water, coll. F. H. Day; R. Kent, coll. K. G. Blair; Lake Windermere, coll. T. T. Macan. Cumberland: Bassenthwaite, coll. H. Britten. Also the Surrey specimens from Wallington and the type from the New Forest, Hampshire, to be included here.

Scotland.—Islay: Oa of Islay and distillery pond, coll. G. E. Hutchinson.

Wales.—Pembrokeshire: R. Solva at Solva and a stream at St. Brides, coll. G. A. W.

MICRONECTA MINUTISSIMA (Linné, 1758).

Notonecta minutissima C. von Linné, 1758, Syst. Nat., ed. 10: 439.

Total length 2 mm., twice as long as broad, widest in the middle, elliptical, macropterous. Head pale clay-yellow, rounded in front, when seen from above three times as long as broad and as long as the pronotum; eyes mauve. Breadth of the pronotum, which has small rounded lateral angles, three times the length; antero-medially a small tubercle tapering into a slight carina for

half its length. Pronotum pale brown, excepting the pale clay-yellow margins and a faint central line. Scutellum and hemelytra pale clay-yellow, the latter streaked with pale brown in the following manner:—clavus with a clear trapezoid basal area, followed in turn by a brown blotch, a smaller pale area and an apical brown mark; two consecutive short brown streaks along the costal border, a narrow inverted V-shaped brown mark at the base of the corium and five narrow obscure longitudinal lines scattered over the remainder, margin of the right membrane dusky. The relative lengths of the three pairs of legs as follows:—*anterior legs*: femur: tibia: pala: claw :: 5: 3: 3: 2; *median legs*: femur: tibia: tarsus: claws :: 32: 10: 17: 10; *posterior legs*: femur: tibia: tarsus 1: tarsus 2: claw :: 15: 12: 12: 5: 4.

Specialisations of the Male.

Lower pala edge with a row of 17 stout hairs; across the palmar aspect a row of 14 spines, and along the upper edge 4 slender hairs. Lobe of the fifth tergite twice as long as broad, inclined slightly to the left and rounded on that side. Strigil quite small, rectangular, composed of about 40 small slender teeth. Median lobe of the seventh sternite relatively long and slender, the left side of the segment obtusely produced. Free lobe of the eighth tergite obliquely truncated, the inner posterior corner smallest. Greater paramere large, eight times as long as broad, moderately sinuate, thickest in the middle and with a more slender slightly upturned apex (the basal articulatory part is very variable and ignored). Lesser paramere relatively large, curved slightly away from the articulating lobe and folded over at the apex in the same direction, ending in a small point. Chaetotaxy of the abdominal segments as in *M. poweri*. Under-side pale yellow.

Habitat.

There is no information on the habitat of this species in Britain. Mr. P. Harwood says that it is so long since he took the specimens at Colchester that he cannot accurately give the place, while the pair of specimens from the Fowler collection are devoid of information other than '57/82' written on the under-side of the card.

There is considerable confusion as to the nomenclature of this third species which I have mentioned above as *M. meridionalis* (Costa), however the following appears to be correct. In 1846 Scholtz published an abstract of a paper of his which did not appear in full until a year later, in this he described a new species called *Sigara scholtzii* stating that Fieber was the real nominator. This species should, therefore, be called *Micronecta scholtzii* Fieber (in Scholtz, 1846).

MICRONECTA SCHOLTZII (Fieb. in Scholtz, 1846).

Sigara scholtzi F. X. Fieber in H. Scholtz, 1847. Prodrömus zu einer Rhynchoten-Fauna von Schlesien.—Uebersicht der Arb. und Veränderungen der Schlesischen Ges. für vaterl. Kultur im Jahre, 1846. Breslau. (Abstracted in 1846.)

Sigara meridionalis A. Costa, 1836. Additamenta ad Centurias Cimicum regni Napolitiani. Atti del R. Inst. d'incoraggiamento alle Scienze Naturali di Napoli. X. Napoli. (abstracted 1860).

Total length 2-2.5 mm. Breadth a little more than half the length. The oblong-oval macropterous specimens (which are exceptionally rare) have short straight lateral margins to the pronotum whose breadth is three times the length. Broadly oval brachypterous specimens have very small rounded lateral angles to the pronotum whose breadth is five times the length. Head pale clay-yellow, the vertex distinctly arcuate, seen from above three times as broad as long, with a pale brown central vertical line and two pale brown spots between this and the inner margins of the mauve eyes on either side. Ground colour of the pronotum and the rather shiny hemelytra olive-green marked with pale brown. Pronotum with pale margins and central longitudinal pale line. Clavus with a clear trapezoid area at the base followed by an inverted furcate dark mark, a pale area and an apical blotch.

Corium with longitudinal dark looped streaks. Membrane dusky. Scutellum brown. The relative lengths of the three pair of legs as follows:—*anterior legs*: femur : tibia : tarsus : claw :: 4 : 2 : 3 : 1.2; *median legs*: femur : tibia : tarsus : claws :: 31 : 10 : 14 : 5 : 12.2; *posterior legs*: femur : tibia : tarsus 1 : tarsus 2 : claw :: 8 : 6 : 7 : 3 : 3.

Specialisations of the Male.

Lower pala edge with a row of 15 stout hairs, across the palmar aspect 14 spines, and along the upper edge 6-7 slender hairs. Lobe of the fifth tergite short and transversely truncated. Strigil large, composed of about 60 long slender teeth. The median process of the seventh sternite rather short, minutely serrated at the apex and bearing two spinous hairs, the right side of the segment rounded. Along the sides of the segments, omitting the eighth, there is a double row of small spines 7-8 in number, 2-4 large spines and 3-4 hairs. The greater paramere is small, falcate, 14 times as long as broad, the lower side faintly sinuate, thicker near the apex and then narrower. The lesser paramere is 5 times as long as broad, thin and twisted at the apex, the whole outer side of the distal half denticulate. Under-side pale.

Habitat.

M. scholtzii is found in large pools. It is very local in its distribution, the brachypterous condition no doubt being respon-

sible, because it is very abundant where it does occur. Although it might have been confused with *M. minutissima* by collectors, it is worth while repeating the distribution given by Butler:— Lincoln, Norfolk, Essex, Surrey, Sussex, Hants, Somerset. I have collected brachypterous specimens in Hatchet pond and Sowley Pond in Hants, and in the fish-pond at Badminton Park, Gloucestershire. A single specimen was also found in the R. Lugg, just on the Herefordshire side of the Herefordshire-Radnorshire border. This specimen is a female and is apparently unique in being macropterous, I have thoroughly studied this part of the R. Lugg for about five miles of its course, and the ponds for miles around, but never found a single other specimen, which rather points to its being a migrating individual. I have also seen a specimen collected in Dover Beck, Woodborough, Nottingham, by Prof. J. W. Carr, and some specimens in the Fowler collection, one of which has '45.82' written under the card and a label bearing the printed characters 'Chob 76' and in ink '6'; presumably this refers to Chobham pond, Surrey.

BIOLOGICAL NOTES ON *Micronecta* WITH PARTICULAR
REFERENCE TO *M. Poweri* (D. & S.).

These 'little swimmers' are to be found in the shallows bordering running water, large ponds and lakes; here they are almost entirely confined to these shallows in which there is an absence of higher plants, but which may vary from a flocculent bottom deposit of cow-manure overlying clay, soft mud-banks or flinty gravel to large boulders. In the latter type *Micronecta* is almost the sole inhabitant apart from occasional may-fly and stone-fly larvae; but when the bottom becomes more friable such forms as *Chironomus*, *Gammarus*, *Planaria*, aquatic Coleopterous larvae and other water-bugs appear. Within their own micro-habitat *Micronecta* are nearly always the most numerous form of visible animal life. The following habitat notes may be of interest:—

Micronecta poweri (D. & S.).

River Yeo at Congresbury, N. Somerset. This is a canal-like strip of water with a rate of flow of 0.7 ft. per sec. in the middle, the banks of variegated marls, in one backwater a cow-manure substrate. *Epilobium hirsutum* L. grows rather thickly in the shallows with occasional plants of *Nasturtium* Br., while a thick growth of *Elodea canadensis* Michx. occurs in the deeper water. The *Micronecta* are present in very large numbers in the gaps between the beds of *Epilobium* and in small numbers amongst this plant and the deeper water. The fauna in the latter places was (roughly in numerical sequence) as fol-

lows:—Corixidae: *Sigara falleni* Fieb., *S. striata* L., *S. fossarum* Leach; Trichoptera: Ephemeroptera; Zygopterid and *Agrion virgo* L. dragonfly nymphs and Hydrachnid mites about equally common; *Gammarus*; three-spined sticklebacks and elvers; on the surface were numerous *Gerris lacustris* L. and a few *Velia currens* F. Water beetles were quite common, especially *Deronectes elegans* Panz., *Haliphus fluviatilis* Aubé, *H. confinis* St., *H. flavicollis* Sturm, *Platambus maculatus* L., *Agabus didymus* Ol.

River Lugg in the vicinity of Aymestrey, Herefordshire. A medium-sized river with banks of Devonian limestone formation winding about through deep valleys, it has alternate shallow rapids and deeper sluggish stretches overhung with alders. In the more sheltered corners beds of *Ranunculus aquatilis* L. and *Elodea canadensis* Michx. provide refuge for a fauna of *Sigara falleni* Fieb., *S. striata* L.; Plecoptera; Ephemeroptera; *Gammarus*; *Deronectes elegans* Panz., *Platambus maculatus* L., *Orectochilus villosus* Müll.; on the surface *Velia currens* F. and *Gerris lacustris* L. The *Micronecta* are numerous in the open shallows between the weed beds and the banks in the sluggish reaches.

A stream near St. Brides, Pembrokeshire (Devonian limestone) has a growth of *Callitrichae* and *Nasturtium* sheltering *Gammarus*; *Sigara venusta* D. & S.; *Corixa affinis* Leach; *Gyrinus urinator* Ill., *G. natator* L.; three-spined sticklebacks.

In L. Windermere the *M. poweri* occur in the open shallows amongst *Littorella*, *Lobelia* and even in beds of *Phragmites*.

Micronecta scholtzii (Fieb. in Scholtz.).

Hatchet Pond, near Beaulieu, Hampshire. This large shallow pool (in Bagshot Bed formation bordering on fluvio-marine beds) has a carpet of *Sphagnum* reaching down into the shallows in most parts; here *Hypericum elodes* L. and *Potamogeton natans* L. form small beds with occasional patches of *Scirpus* L. and *Alisma ranunculoides* L. Fauna is scant, but in the gravelly shallows between the beds of vegetation swarms of *M. scholtzii* occur with a few *Sigara lateralis* Leach, *S. distincta* Fieb. and *S. striata* L., and on the surface *Gerris thoracicus* Schum. and *Microvelia reticulata* Burm.

The fish-pond, Badminton, Gloucestershire, is a rather shallow stony pool (Lower Oolite), and apart from a little *Glyceria fluitans* Br. growing round the margin, and an insignificant amount of *Potamogeton crispus* L., higher plants are absent. Much deer and cow manure forms a flocculent bottom deposit. Among the *Glyceria* the following occur: Hemiptera, *Naucoris cimicoides* L., *Notonecta glauca* L., *Nepa cinerea* L., *Plea minutissima* Fuessl., *Sigara striata* L., *S. falleni* Fieb.; Trichoptera; Coleoptera, *Acilius sulcatus* L., *Haliphus confinis*

St. The *M. scholtzii* were present in large numbers in the shallows all round the pool between the patches of *Glyceria* and were accompanied by a few *Sigara lateralis* Leach and many *Gerris thoracicus* Schum. on the surface. The stomachs of a number of carp weighing up to 1 lb., a few small roach and a perch were examined for *Micronecta*, but none was found.

Although these two species of *Micronecta* are found in a wide range of habitats, yet the micro-habitat to which they are almost entirely confined must conform to the following factors:—

1. Substrate with very low organic content.
2. Water shallow, at most only a couple of inches.
3. Absence of higher plants.
4. Good supply of light.

BEHAVIOUR.

The species of *Micronecta* are gregarious. Watched closely, these tiny water-boatmen may be seen anchored to some support by means of their slender calliper-like middle legs. The hair-fringed oar-like hind legs are held well forward, ready to make a sudden backward stroke, or, as very frequently happens, they are bent over the body and sweep backwards just clear of the hemelytra, returning smartly to the resting position. The short arm-like front legs hang limply down when not in use. The oval palae with their fringe of stout hairs are used for feeding; they resemble little hands and are used in much the same manner as our own. Leaning forward, the *Micronecta* diligently turns over the bottom refuse, seeking for minute plants and animals; with its palae it holds these against its mouth. Filaments of algae are moved along with a hand-over-hand motion while the contents of the cells are sucked out. Small pieces of alga may be swallowed whole and can be found in a lacerated condition in the stomach. But the stomach contents are usually a mass of almost homogeneous, finely divided green or brown matter. The insects change their position by a series of bounds through the water, using rapid rowing-strokes of the hind legs for propulsion, the middle legs momentarily gripping the bottom. After long intervals *Micronecta* darts up to the surface, exposes its back for an instant, and dives down to the bottom with a fresh supply of air to resume its activities. Every now and then, and particularly when contented, the males will produce a sudden burst of high-pitched strident squeaking audible for some distance.

LIFE-HISTORY.

Micronecta poweri spends the winter as a nymph active in the water. Over-wintering nymphs become adult in May and June. Maturity is rapidly attained and mating takes place; the

males hold the females round the thorax by means of their front legs, but this act does not take long. Shortly afterwards the females commence to lay their very small oblong-oval eggs, which are attached to the stems and leaves of aquatic plants lengthways by means of a stiff gummy waterproof substance. After an incubation period of about a fortnight the minute nymphs hatch out. These nymphs may be distinguished from those of the Corixinae, first by their small size and secondly by the presence of three very large abdominal dorsal glands and the relatively short thick legs. The following table summarises the events during a single year :—

Time.	Stage.	No. of spines on lower edge of tibio-tarsus.	Do. on inner edge of tibio-tarsus.	Do. at apex of post. femur.	Spines on tibio-tarsus.	Long. mm.	Wide. mm.
June ...	Egg Nymph					0.40	0.20
July-August	1	7	4	1	—	0.62	0.32
July-August	2	9-10	5-7	2	—	0.80	0.47
Winter ...	3	9-10	6	4	8	0.92	0.54
March-April	4	12	8	2	—	1.08	0.65
May ...	5	c. 16	8	2	—	1.5-	c. 1.0
						2.0	
May-October	Adult	15-19	8	2	—	„	„

FEEDING MECHANISM.

After making several examinations of the stomachs of *Micronecta* and finding the food in a state of subdivision, sections were cut in order to find out by what mechanism this was achieved.

Fig. A. on Plate X is a longitudinal vertical section through the lower part of the head of *M. poweri*. The pharynx is very large and is provided with a complicated mechanism for masticating algae. This is situated at its inner end on the anterior wall. First there is a transverse row of long sharp teeth alternately pointing in two different directions, and with a muscle supply inserted into their base by way of two apodemes. Secondly, there is a wide transverse row of long, narrow, closely placed chitinised elevations, the middle ones longest and the lateral ones shortest; its muscle supply is inserted into its upper end. It is suggested that the algae and any small animals which may be caught by it, are guided into the pharynx and somewhat broken up by the stylets. In the pharynx the food is passed upwards by alternate contractions of the muscles until it reaches the transverse row of teeth which pierce the cellulose

walls and the contents are then squeezed out by a grinding action of the area of elevations and the whole pulverised mass swallowed.

HISTOLOGY OF SOME STRUCTURES IN THE NYMPHAL CUTICLE.

While examining the nymphs for characters of use in separating the instars the star-shaped markings shown on Plate X, fig. B, were noticed and later found to correspond with the integumental structures illustrated by figs. C and D. These structures somewhat resemble campaniform and placoid sensillae and consist of what appears to be a delicate dome of chitin enclosing an almost spherical cavity in the cuticle roughly 0.003 mm. in diameter connecting through to the hypoderm layer by way of a fine canal which in the sections did not appear to transmit any visible structures. The hypoderm is rather thin in this region and immediately beneath is a mass of large cells with clear nuclei each showing a conspicuous nucleolus and large clear-cut vacuoles. These cells are continuous along the spiracular line on the ventral surface of the abdomen; moreover they and the integumental structures are more numerous at those places where the spiracles would be found if the insect had any. A large tracheal tube passes down obliquely from the medial part of the lateral dorsal mass of fat-body, in which runs a longitudinal trunk to, against, or quite near to, the mass of cells, and is here lined with thicker epithelium which almost obliterates the lumen; having reached the mass of cells the tube slides over it and ends against the hypoderm. The star-shaped structures, the cell mass and the tracheal tube do not appear to be inter-connected. No theory is yet offered as to the true function of these structures as it is intended to investigate them after ecdysis.

STRIDULATION.

With regard to the problem of the stridulation of *Micronecta* I have been able to find two parts of the males which could be able to produce such a loud sound. The strigil in *M. poweri* is composed of a row of slender teeth set in a band running a considerable way round a small globular piece of chitin, which is quite loosely attached to the sixth tergite and is very well supplied with muscles from several directions, the whole structure being about 0.50 mm. long. Overlapping the strigil is the heavily chitinised lobe of the superior tergite, against which the strigil could rub if moved by the muscles. The other part is the spiny aedeagus which might rub against irregularities on the eighth segment. *M. poweri* and *M. scholtzii* both possess this latter organ almost identical in structure, yet while the males of *M.*

poweri loudly protest at being captured and almost incessantly squeak when contented and feeding both by day and night, *M. scholtzii* appears to be mute. I have never heard it make a sound, and Butler makes a similar statement. The strigil of *M. scholtzii*, although larger, appears to be fixed and the teeth point in the opposite direction, the supports are feeble, and the lobe of the superior tergite is quite short and not heavily chitinised as in *M. poweri*. It would, therefore, seem that *M. poweri*, and probably also *M. minutissima*, use the 'strigil' to produce the stridulation.

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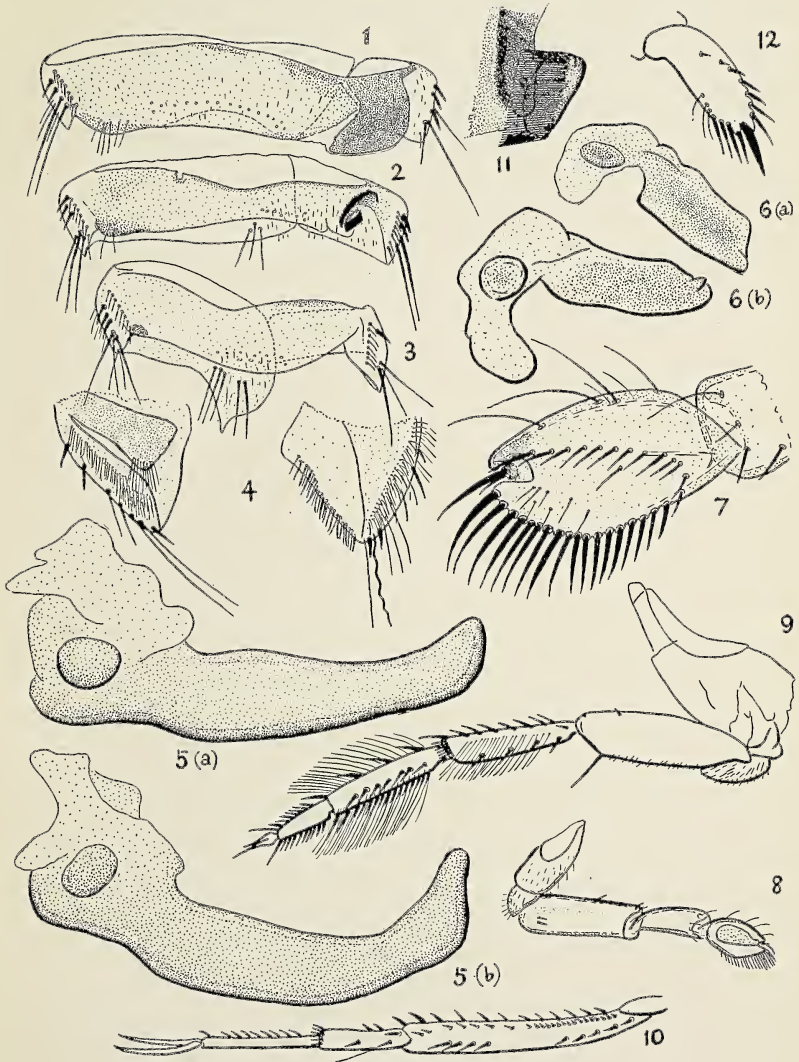
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EXPLANATION OF PLATES.

PLATE VII. *MICRONECTA POWERI* (D. & S.).

- FIGS. 1, 2, 3 and 4.—Respectively 5th, 6th, 7th and 8th abdominal segments. Note the strigil on the 6th.
- FIG. 5 (a) and (b).—Left paramere, showing variation.
- FIG. 6 (a) and (b).—Right paramere, (a) flattened.
- FIG. 7.—Pala.
- FIG. 8.—Front leg.
- FIG. 9.—Posterior leg.
- FIG. 10.—Middle leg.
- FIG. 11.—Strigil highly magnified.
- FIG. 12.—Tibio-tarsus of 1st instar nymph.

PLATE VII.



Micronecta poweri (D. and S.).

PLATE VIII. *MICRONECTA MINUTISSIMA* (L.).

FIGS. 1, 2, 3, 4.—Respectively 5th, 6th, 7th and 8th abdominal segments.

FIG. 5.—Left paramere.

FIG. 6.—Right paramere.

FIG. 7.—Pala.

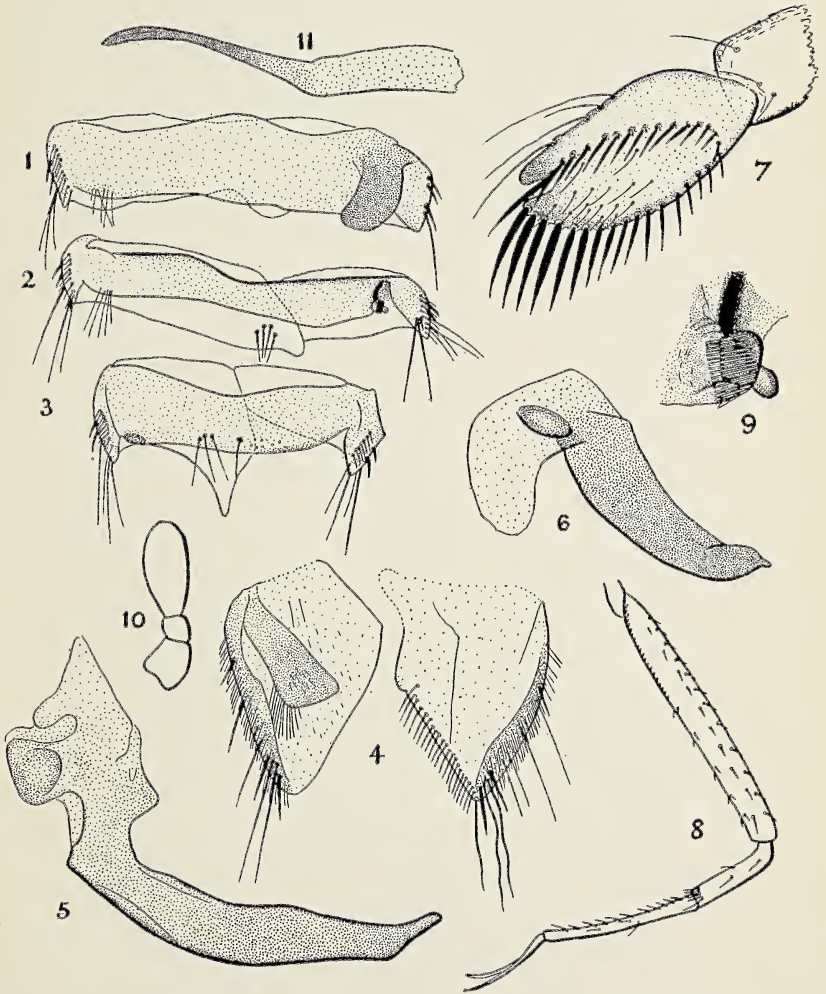
FIG. 8.—Mid leg.

FIG. 9.—Strigil highly magnified.

FIG. 10.—Antenna, front view.

FIG. 11.—Mandibular stylet.

PLATE VIII.

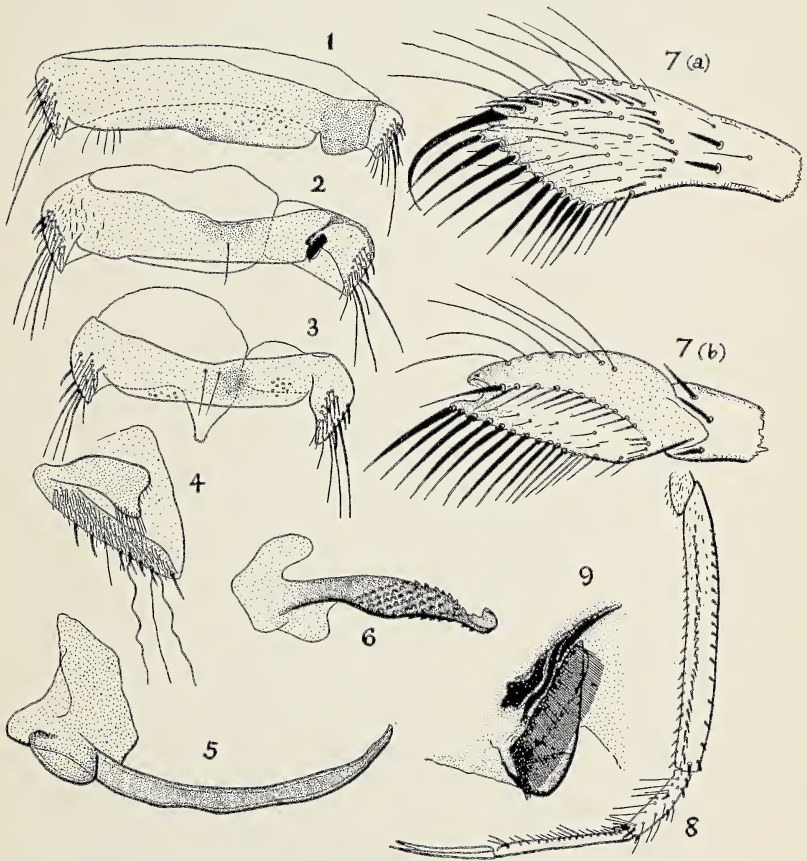


Micronecta minutissima (L.).

PLATE. IX. *MICRONECTA SCHOLTZII* (FIEB.).

- FIGS. 1, 2, 3, 4.—Respectively 5th, 6th, 7th and 8th abdominal segments
FIG. 5.—Left paramere.
FIG. 6.—Right paramere.
FIG. 7.—(a) Pala of female, (b) pala of male.
FIG. 8.—Middle leg.
FIG. 9.—Strigil highly magnified.

PLATE IX

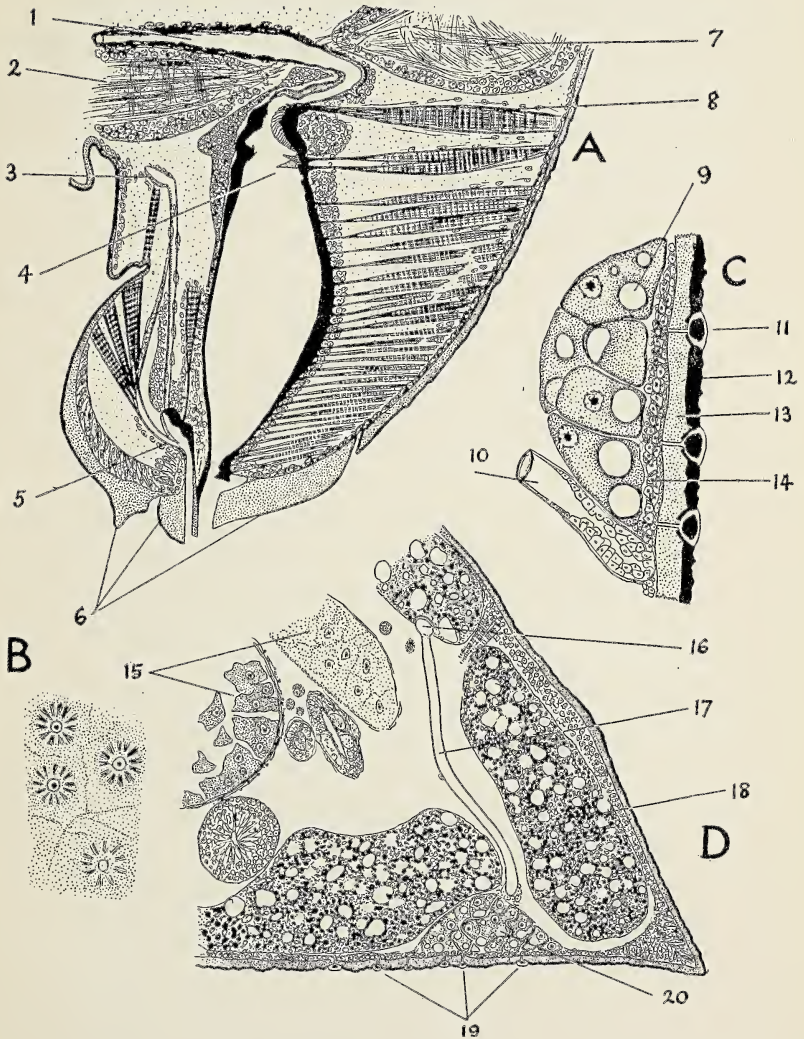


Micronecta scholtzii (Fieb.).

PLATE X. *MICRONECTA POWERI* (D. & S.).

- FIG. A.—1, oesophagus; 2, ant. pt. of fused suboesophageal, thoracic and abdominal ganglia; 3, commencement of common salivary duct; 4, pharyngeal teeth, and above the area of chitinised elevations; 5, salivary pump; 6, parts of the labium; 7, brain; 8, pharyngeal muscles. (See p. 268.)
- FIG. B.—External view of the star-shaped structures (see FIG. C).
- FIG. C.—9, vacuole of one of the large cells; 10, beginning of trachea; 11, star-shaped organ; 12, 13, cuticle; 14, hypoderm.
- FIG. D.—15, parts of gut; 16, longitudinal dorsal tracheal trunk; 17, trachea arising from the side of the vacuolated cell mass; 18, fat body; 19, star-shaped organs; 20, vacuolated cell mass.

PLATE X.



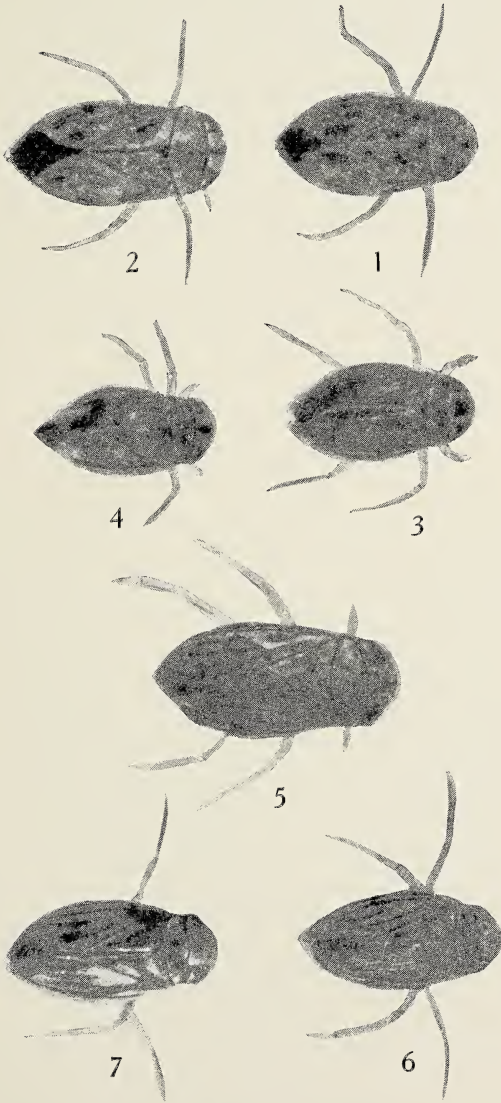
Micronecta poweri (D. & S.).

PLATE XI.

- FIG. 1.—*Micronecta poweri*, macropterous male. R. Exe, at Cowley Bridge, Devon.
- FIG. 2.—*Micronecta poweri*, macropterous female. R. Teme, at Leintwardine, Herefordshire.
- FIG. 3.—*Micronecta poweri*, melanic brachypterous specimen, from Lough Leane, Killarney.
- FIG. 4.—*Micronecta poweri*, diminutive brachypterous example, from Marytavy, Devon.
- FIG. 5.—The unique macropterous *M. meridionalis*, from the R. Lugg, Hereford.
- FIG. 6.—*M. minutissima*, from Colchester.
- FIG. 7.—*M. minutissima*, from the Fowler collection.

[Photo, F. F. Glasspool.]

PLATE XI.



British *Micronecta* species.

11

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