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THE BRITISH CHORDEUMATIDAE

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The first British representative of this family was found and recorded by Dr. Hilda K. Brade and Rev. S. Graham Birks in the first of their series of Notes on Myriapoda (Brade & Birks, 1916). It was a new variety of Ribaut's Chordeumella scutellare now known as Melogona scutellare. For a long time this species remained the only member of this family known to occur in Britain. Dr. Eason found another species of the genus, M. gallica (Microchordeuma gallicum), in Caernarvonshire (Eason, 1957). In my Synopsis of British Species published a year later it was a simple matter to differentiate between the two species of Melogona (= Microchordeuma) since M. scutellare matures at stadium VIII with 28 rings and M. gallica matures at IX with 30 rings. Adults of M. gallica are consequently larger and have a greater number of ocelli in the ocular field.

In August 1961 I found a flourishing population of a species of Chordeuma in a wood near to the village of Trelill in north Cornwall but had to wait until the following spring to secure adults and assign them to the species Chordeuma sylvestre C.L. Koch. Two years later another species of this genus, Chordeuma proximum Ribaut, was found in the Forest of Dean by Dr. Satchell (see Nelson, 1964). Before the discovery of these two species of Chordeuma, immature examples of a chordeumatid in Britain could at least be referred to a genus, but now collectors are faced with the difficulty of deciding to which of two genera to assign their captures; although adults of the two species of Chordeuma are larger than those of Melogona, the differences are useful only in the comparative sense and even these become less noticeable in sub-adult individuals. Furthermore, there is no easy distinction between adult females of the two species of Chordeuma as is provided by the different segment numbers of the two species of Melogona.

The purpose of this note is to provide the means of differentiating between the four chordeumatids and to summarize what is known of their distribution and biology. My attempt to find sub-adult characters for separation, whilst not wholly successful, has revealed some interesting features in the development of the ocular field. To comprehend the secondary sexual characters necessary for specific diagnosis, we need to become familiar with the most complex gonopodial apparatus within the Diplopoda. The distribution of all four species shows very interesting features; it is vitally important for all concerned to be able to fill in the gaps in our coverage and to further our understanding of these curious distribution patterns.

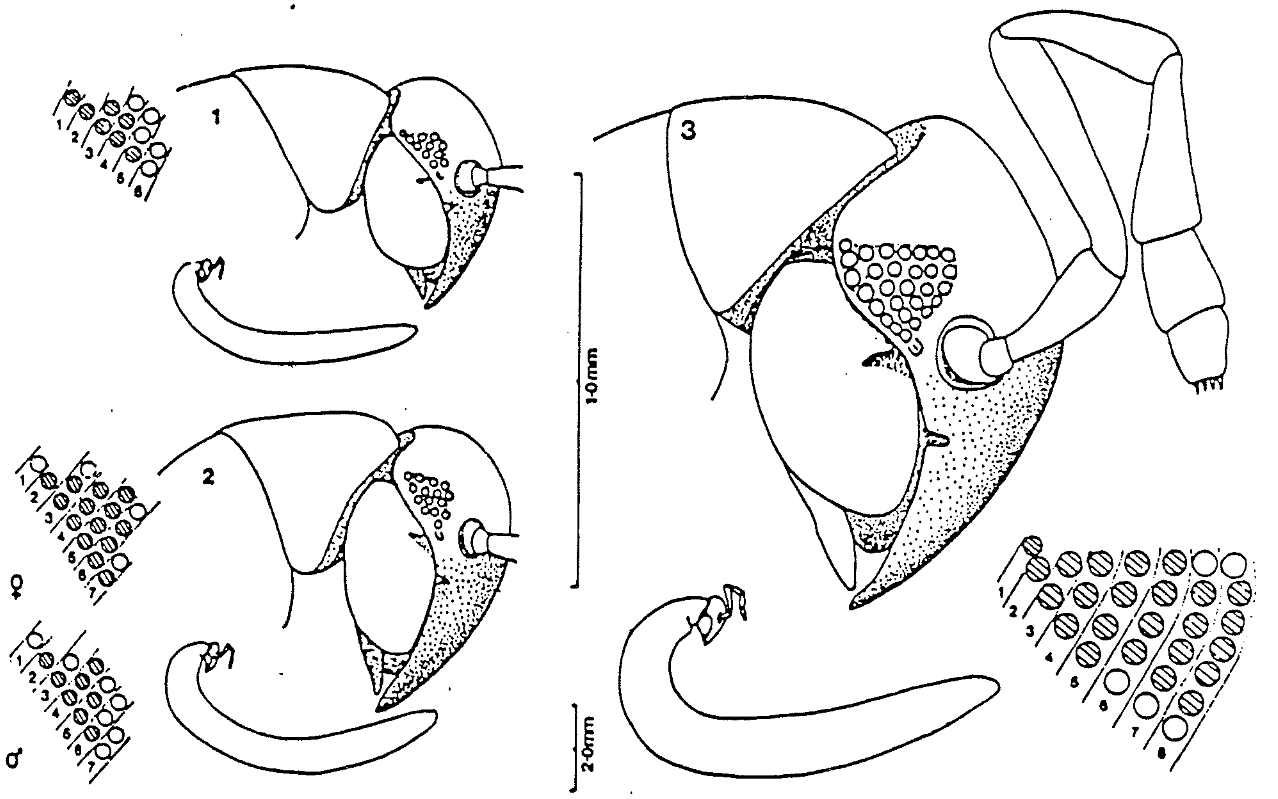
Order N E M A T O P H O R A
Sub-order CHODEUMATIDEA
Family Chordeumatidae

Dr. Jeekel has recently indicated the correct group names to be derived from the genus Chordeuma and genera which are compounds of this name (Jeekel, 1970). In my synopsis I used the spelling Chordeumidae following previous authors without fully understanding the syntax. The sub-order is of special interest partly because of the unique gonopodial equipment involving no fewer than five pairs of appendages. In addition to the modified eighth and ninth limbs of the seventh ring, limbs 7, 10 and 11 are also included in the apparatus. Females are of interest because of the sternite without appendages behind the second pair of legs which Bigler (1913) called the platosternite. Brolemann regarded this structure as the anterior somite of a diplopodous fourth ring. I have recently suggested an alternative explanation (Blower, 1978).

External Characters

If old hands will forgive me I think it worth noting the typically nematophoran features of the chordeumatids since beginners experience real difficulty in deciding whether a smoothly cylindrical animal is to be placed in this order or in the Julida. Figs. 1 - 3, 5 and 11 show clearly the three principal features which distinguish cylindrical nematophorans from julids and blaniulids. These are:

i) The distinct junction between head and collum. The collum abuts up to



Figs. 1 - 3. Comparison of the ocular fields of Chordeuma and Melogona (Microchordeuma)

1. M. scutellare ♀ from Iceridge, Cheshire, 7.11.71
2. M. gallicum ♀ from Barton Wood, Devon, 4.70
3. C. proximum ♀ from Bishop's Wood, Caswell, Gower, 27.9.67

The sketches of whole animals at a small scale to give comparative sizes. The accompanying diagrammatized ocular fields indicate the arrangement of the successive rows; ocelli invariably present are cross-hatched; ocelli which may or may not be present from one individual to another or on one side and not the other, are left open.

the head and does not overlap it.

ii) The cheek lobe is entire with only the beginnings of a division into separate cardo and stipes. The cheek protrudes laterally much more than that of the julids.

iii) There is a trio of setae on each side of each ring; the most ventral of the three is placed more posteriorly, towards the margin of the metazonite except on the posterior rings which carry progressively longer setae closer to the edge of the ring.

We can note the paired spinnerets in Fig. 11 which are characteristic of the order but are hardly of diagnostic utility for beginners.

The ocular field of Chordeuma

In some julids, as was first demonstrated by Vachon (1947) in the spiroboloid Pachybolus, ocelli are added to the ocular field moult by moult. The first ocellus appears in stadium II, two additional ocelli are added in front of this by stadium III, then a row of three ocelli appear by stadium IV and so on, building up an equilateral triangle of ocelli. From the posterior ventral edge of the head capsule, a series of rows build-up anteriorly, each consisting of one fewer ocelli than the number of the stadium. Towards maturity, later rows may have fewer than this ideal complement, since the ocular field may be restricted anteriorly by the base of the antenna.

A similar development of the ocular field occurs in Chordeuma spp. with the noteably difference that only one ocellus appears in each of stadia II and III. Thereafter, a row of two is added for stadium IV, three for stadium V and so on. The field is thus similar to that of a Julid but the initial ocellus remains as an 'odd man out', an extra ocellus oddly positioned at the posterior apex of the equilateral triangle subsequently added. Fig. 3 shows the complete field of an individual C. proximum. Each row added, after the first ocellus of stadium II now contains a number of ocelli equal to the stadium number minus two. At the antero-ventral corner of the field we find the Organ of Tomosvary which is not very easily seen but might just be mistaken for an extra ocellus.

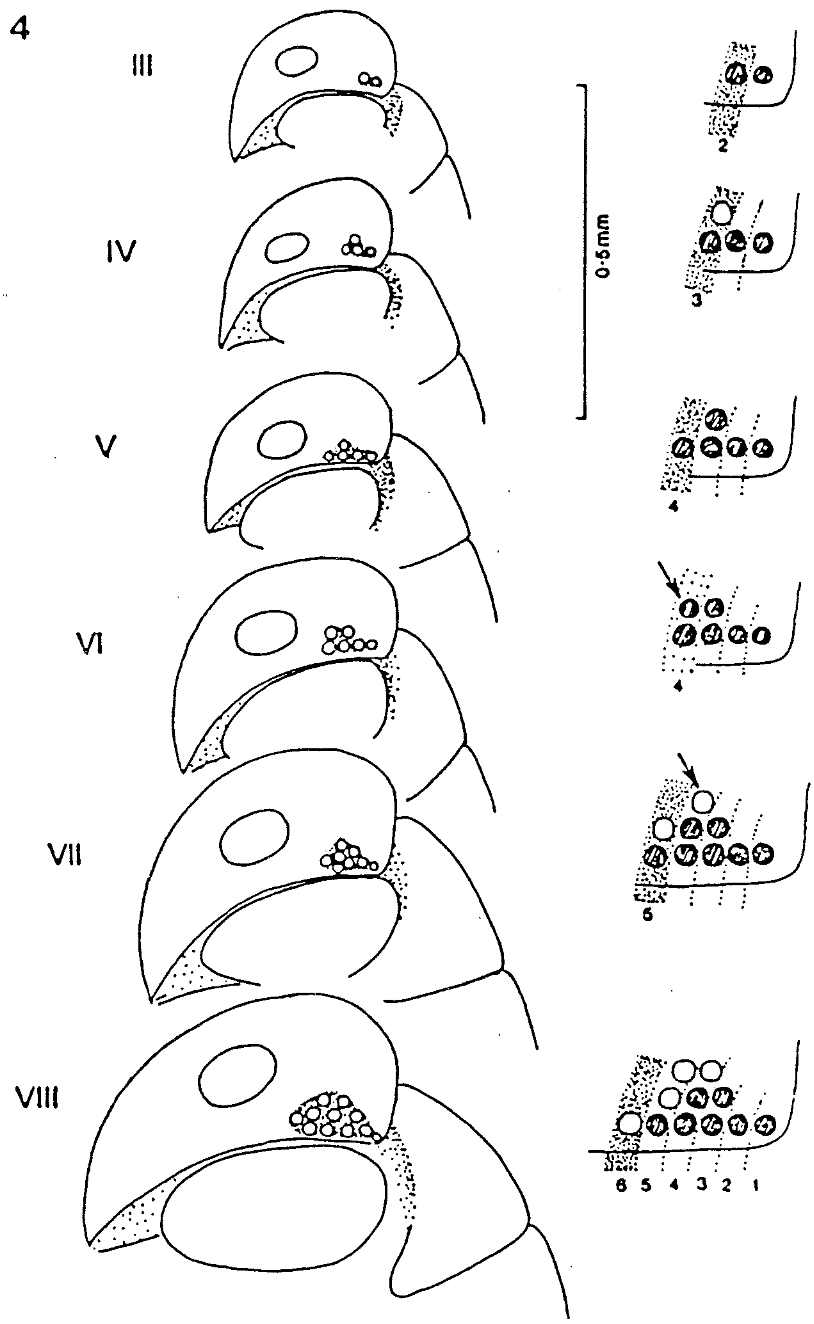


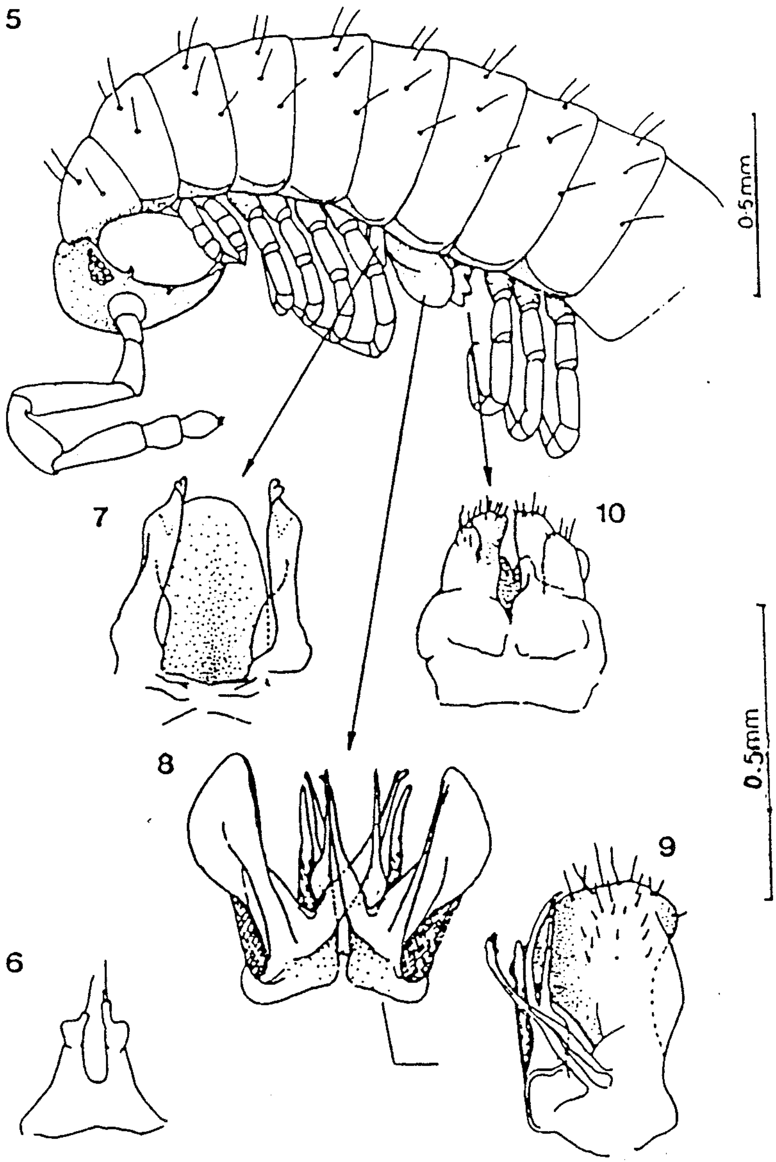
Fig. 4. M. scutellare Growth of the ocular field from stadium 3 to maturity.

Diagrammatized fields are shown at twice the scale of the drawings. The most recently added row is indicated by stipple; the arrows indicate an ocellus added into a pre-existing row. Ocelli invariably present are cross-hatched, ocelli not always present, including those which may occur on one side only, are left open.

In smaller individuals, the last three rows of ocelli added for stadia VII, VIII and IX may have fewer than the 5, 6 and 7 ocelli ideally present. There may be either one or two ocelli missing, most often it is the ventral most ocellus of the tow which fails to appear on one or both sides of the head. (See the open circles in the explanatory diagram of Fig. 3) Individuals of C. proximum are slightly smaller on average than those of C. sylvestre. Since incomplete anterior rows are associated with smaller size, we find that incomplete rows occur more frequently in C. proximum than in C. sylvestre.

The ocular field of Melogona

Since both species of Melogona are smaller than those of Chordeuma we can expect the ocular fields of Melogona to depart further from the ideal equilateral triangle often present in Chordeuma. Departures from regularity involve not only the number of ocelli in a row but also the number of rows (as we have defined them above). In the larger of the two species of Melogona, M. gallica, there are only seven instead of the eight rows characteristic of adults maturing at stadium IX but the single ocellus which appears in stadium II representing the first 'row' often becomes difficult to see in the adults which therefore appear to have only six rows. In the smaller species, M. scutellare, there are only six rows but whilst the single ocellus of the first row is always clearly visible, the last row also consists of just one ocellus and this may be absent leaving just five rows apparent. Loss of a row may also result from the insertion at a moult of one or more ocelli into a pre-existing row; this occurs for example, between stadia V and VI of M. scutellare (see Fig. 4) and a similar insertion must take place in M. gallica at some point. The maximum number of ocelli within a row is three in M. scutellare and M. gallica males but four in M. gallica females. The development of the field in M. scutellare is shown in Fig. 4. Unfortunately, I have no data for sub-adult stadia of M. gallica. The reference to M. scutellare "Pas d'ocelles" in Brolemann (1935) is probably a misprint. The formulae Brolemann (loc. cit) gives for M. gallica, 6, 5, 3 - 6, 5, 4, 2 refer to the numbers of ocelli in rows at right angles to the rows in the developmental sence to which I refer. (cf. Fig. 2)



Figs. 5 - 10. M. scutellare

5. Head end of ♂ from Gower to show gonopods in situ.

6 - 10 Isolated gonopods of ♂ from Compstall, Cheshire at larger scale:

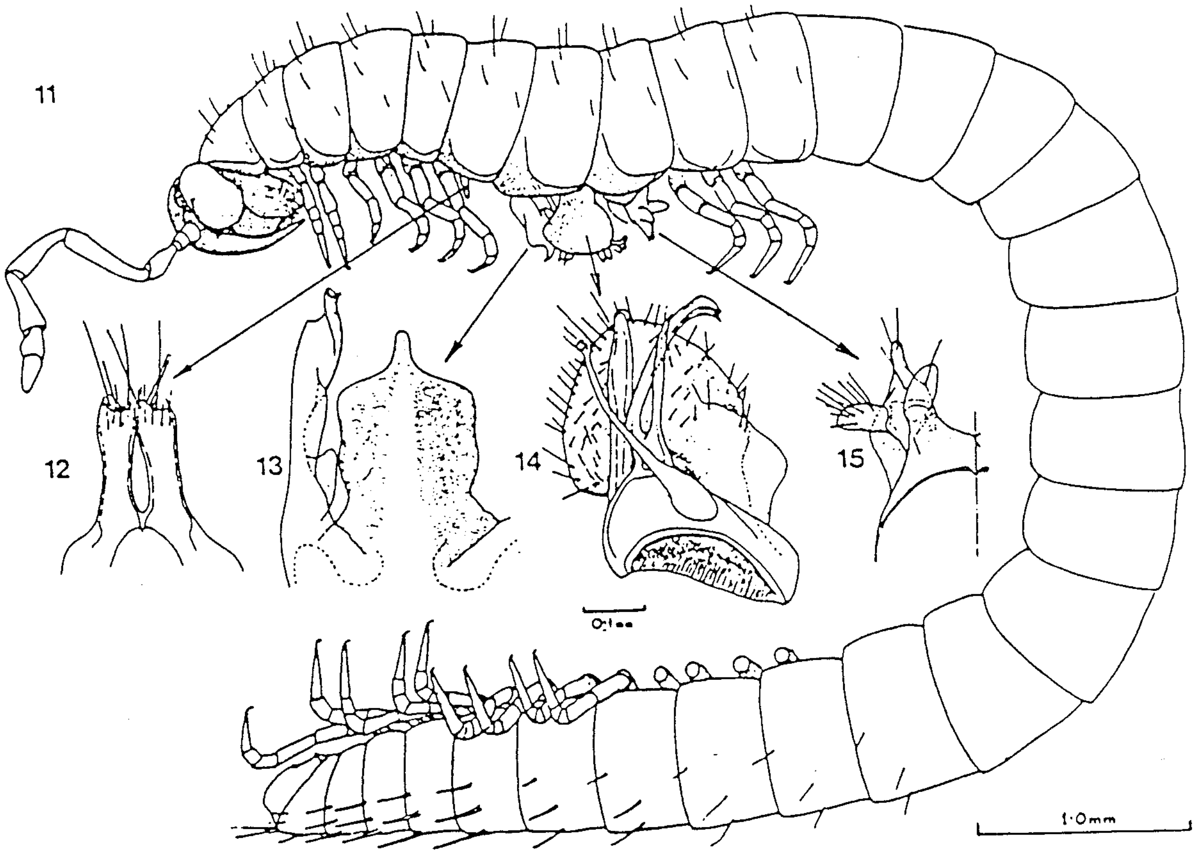
6. Anterior paragonopods (modified 7th pair of limbs) not usually visible in situ, anterior view.

7. Peltogonopods (8th pair) consisting of a median coxal plate, convex anteriorly, and lateral telopodites, posterior view.

8. Gonopods proper (9th pair), posterior view showing outer lobe-like telopodites (the only parts visible in situ) and inner coxal derivatives: an anterior pillar, an intermediate bifurcate lobe and a posterior pseudoflagellum. Each pseudoflagellum crosses over to the other side where their apices lie juxtaposed to the curved branch of the bifurcate lobe.

9. Left gonopod, internal profile.

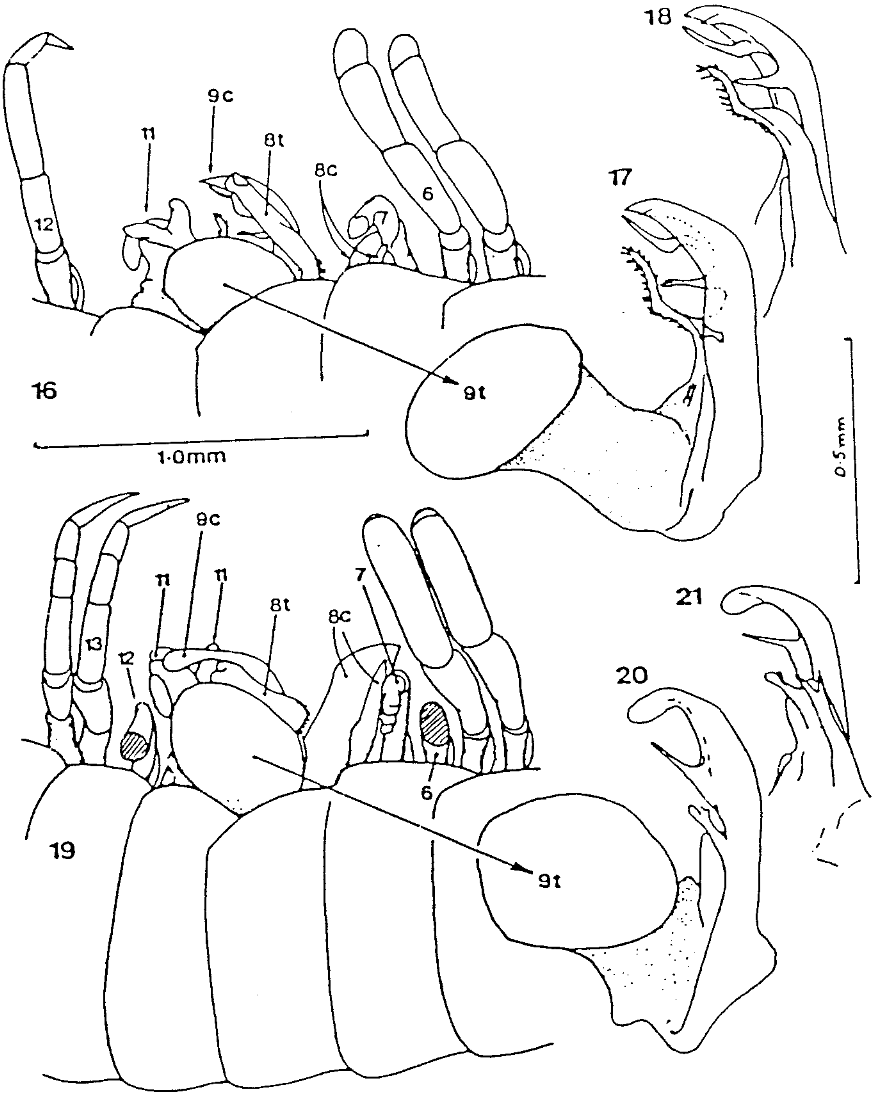
10. Posterior paragonopods (11th pair) posterior view.



Figs. 11 - 15. <u>M. gallicum</u>

11. Entire ♂ showing gonopods <u>in situ</u>.
12. Anterior paragonopods (modified 7th pair).
13. Peltogonopods, anterior view.
14. Left gonopod, internal profile.
15. Posterior paragonopods, posterior view.

(12 - 13 from a ♂ from Beddgelert, Caernarvonshire, after Blower, 1957)



Figs. 16 - 18: Chordeuma sylvestre, ♂ from Trelill, Cornwall.
Figs. 19 - 21: Chordeuma proximum, ♂ from Bishop's Wood, Caswell, Gower.

The numbers of the limb-pairs and their coxal (c) and telopodal (t) derivatives are indicated in the views of the gonopodial regions, 16 and 19. The trunk of the individual C. sylvestre was more extended than that of C. proximum, from which latter limbs 6 and 12 had to be removed to obtain a clear view.

Figs. 17 and 20 show the isolated left gonopods in external profile; 18 and 21 show the coxal pillars of the same in internal profile.

Note the much smaller bifurcate pseudoflagellum of C. proximum compared with the longer pseudoflagellum of C. sylvestre. Note especially the distinctive apices of the main coxal pillars clearly visible in situ. The more prominent coxal processes (8c) of the peltogonopods in 19 is merely a feature of this particular specimen.

Gonopods

The full complement of gonopods of the two species of Melogona are shown in Figs. 5-15. In M. scutellare (Fig. 5) the only parts visible in situ are the large telopods of the gonopods-proper (limbs 8), the telopods of the peltogonopods (limbs 7) in front, and the posterior paragonopods (limbs 11) behind. The anterior paragonopods (limbs 6) are rarely visible. Males of M. gallica usually die in a more extended condition and the gonopodial apparatus is visible in much more detail, including the various coxal processes of the gonopods proper which protrude beyond the ventral edge of the large telopods (Fig. 11). The most noteable differences between the gonopods of the two species of Melogona are the more robust anterior process and the expanded apex of the unarmoured branch of the bifurcate lobe in M. gallica (cf. Figs. 9 and 14).

In Chordeuma spp. the gonopodial apparatus is similar in principle to that of Melogona. In detail, the anterior paragonopods of Chordeuma spp. have a better developed telopod and the coxal part of the peltogonopod consists of three lobes in place of the single plate of Melogona. The anterior coxal pillar of the gonopods proper is themost prominent feature and the form of its apex, pointed in C. sylvestre and rounded in C. proximum is sufficient to identify the species (16-21). In contracted specimens of Chordeuma, the telopods of the poltogonopods (8t) may obscure the apices of the anterior coxal pillars. It is often necessary to reflect or detach the legs adjacent to the gonopodial segments to examine the area properly (see Fig. 19).

The anterior paragonopods and the median plate of the peltogonopods vary in form. The prominent lateral 'elbows' of the anterior paragonopods in Fig. 6 may be produced as distinct exopodal lobes which can sometimes exceed the length of the mesial or endopodal lobes. In association with this tendancy of the anterior paragonopods to become biramous, the ventral apex of the median coxal plate of the peltogonopods changes from slightly concave to distinctly convex, with sometimes a median prominence and the beginning of a keel. Ribaut's type had the uniramous paragonopods and the slightly concave apex to the median plate. The first British individuals had the biramous paragonopods and the 'beaked' peltogonopod plate. Brade & Birks (1916) described this combination of characters as the variety brolemanni. Individuals collected later from Derbyshire were somewhat intermediate in form between typica and brolemanni and were named bagnalli. All three varieties were figured by Brolemann (1935) but Brade-Birks (1939) raised them to the rank of sub-species. More recently, I found all three forms co-existed and that the form of the para- and peltogonopods was a function of size, the smaller individuals exhibiting the typical form and the larger tending towards the brolemanni condition (Blower, 1957). The individual male figured here is of the form bagnalli (Figs. 6 & 7).

Brolemann describes a variety of M. gallica M. gallicum helviorum which differs from the type in the form of the anterior and posterior paragonopods. Meidell (1968) notes that the anterior paragonopods of the Norwegian animals vary between the condition of the type and variety. No extensive analysis of British specimens has been made.

Distribution

In the order in which I present them below, the four species form a declining series of range in Britain but an ascending series of range in Europe. Thus Melogona scutellare is our commonest species in England and Wales and yet is known from only two localities in Europe; Chordeuma sylvestre is the rarest of our species, known only from two localities in Cornwall and yet has the widest range in Europe from France and the Netherlands through to the Caucasus in the East and Southern Italy in the South.

Much of the range of the four species falls within the area with a west maritime climate, with cool (not cold) winters, warmer summers and rain throughout the year. This area does not include the Italian and Eastern extension of C. sylvestre nor does it include the area around Bergen from which M. gallica was recently recorded. On the other hand, Eire is well within the climatic zone and it is rather surprising that there is only one record of the commonest of the four species from here, and this, very recent.

Melogona scutellare (Ribaut, 1913)

First recorded from Lancashire by Drs. H.K. Brade and S.G. Birks (1916) and now known from 20 of the 70 English and Welsh vice-counties. The species is probably wide-spread in England and Wales but is perhaps genuinely absent from the drier South East. The most recent record is that by Mr. Bishop from Cork.

The only European records are from the type locality by Grenoble, France and Piedmont, Italy. Verhoeff refers the animals from Piedmont to the variety horticola but the differences from the type are probably not very significant (see Blower, 1957).

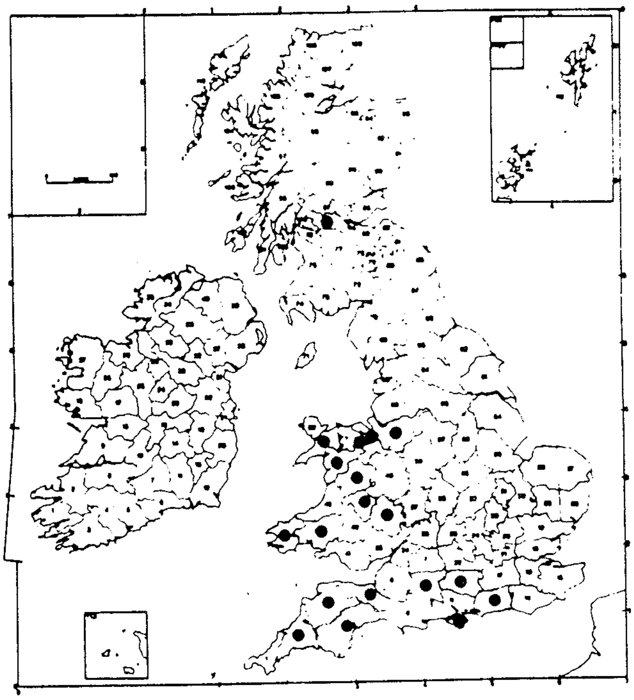
The phenology is well-known from two sites, one in Gower, South Wales, and the other in Derbyshire. In the Welsh site, stadia III appear at the end of March and proceed through to adults (stadia VIII) by October. In Derbyshire, stadia III do not appear until mid-May and proceed only as far as the penultimate stadia (VII) by October. However, the species is clearly an annual in both North and South and reaches similar densities of 30-50 adults per square metre (Blower, 1979).

Melogona gallica (Latzel, 1884)

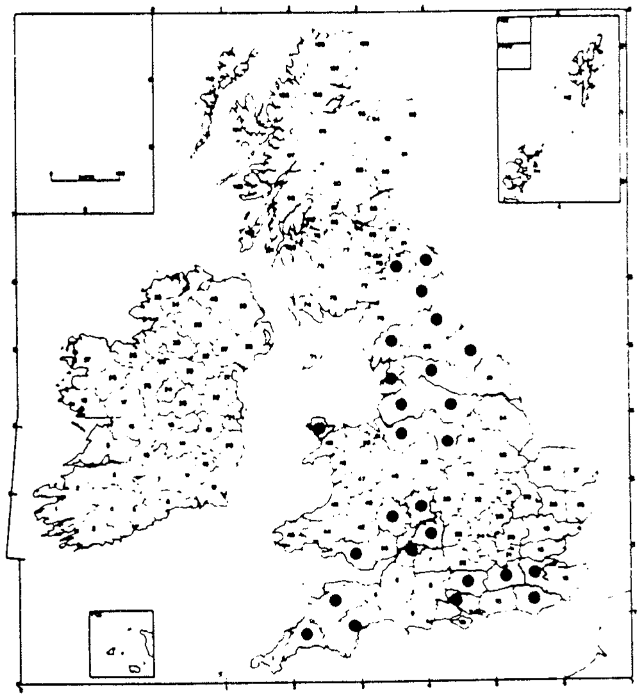
First recorded from Caernarvonshire by Eason (1957). The nine vice-county records are scattered throughout the southern half of England and Wales but again, none of the records come from the extreme South East.

In Europe it occurs in North and Central France, the Netherlands, Luxenbourg, Switzerland, Germany West of the Rhine and recently from around Bergen in Norway.

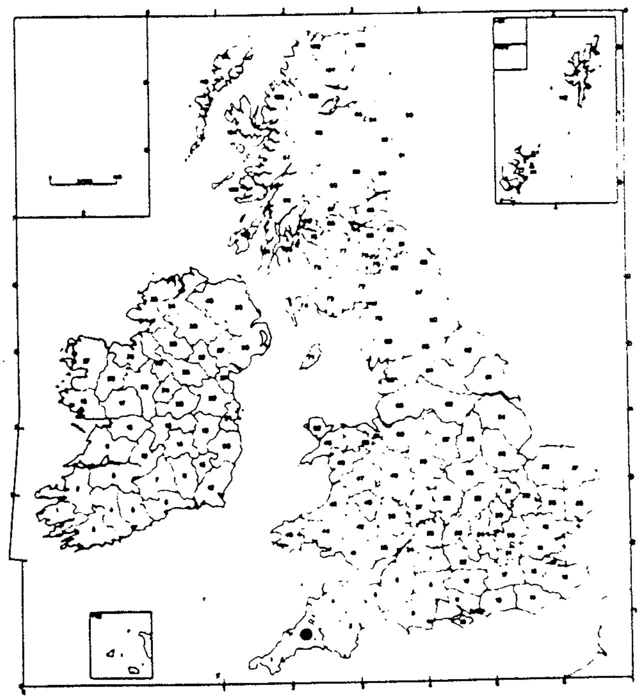
Dr. Erwin Meyer sorted samples from Delamere forest and found adults (stadium IX) and young of stadia VII and earlier in April-May which is rather suggestive of a two-year life cycle but more information is required to establish the phenology of this species.



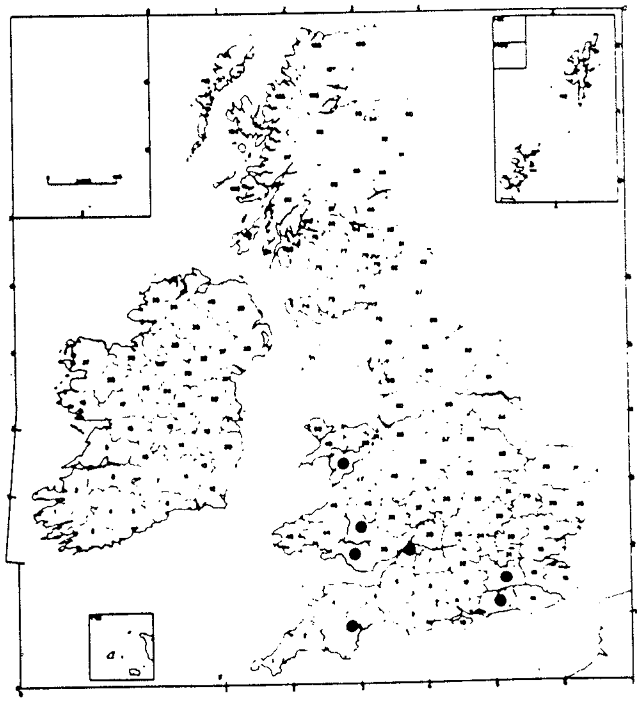
M. gallicum



M. scutellare



C. sylvestre



C. proximum

Fig. 22 Vice-County distribution of the four British Chordeumatids.

Chordeuma proximum (Ribaut, 1913)

First found by Dr. John Satchell in the Forest of Dean, 1955, and recorded by Nelson (1964); more recently by myself in Gower and by Desmond Kime from Devon, Somerset, Hampshire, Surrey and Sussex (Kime, 1978). It was first seen in Gower in a wood by Caswell Bay. A site by Llethrid in Gower has been worked by myself, colleagues and students since 1965 and a small area here has been sampled quantitatively since 1968. Not until 1969 did the species appear at Llethrid where it was found by a student near the sampling area; in 1971 it appeared in the Tullgren extractions from the site, 17 individuals in 20 units of $0.1m^2$. Since 1969 it has increased its representation and now, in 1978, it is threatening to replace M. scutellare on the site. Mr. Alloyan has had the species falling into Pitfall traps set in spoil heaps in the lower Swansea valley. The species has evidently come to stay in the area!

In Europe it is recorded by Brolemann from Orne, Puy de Dome and Tarn in the north, south central and south France.

In Gower most of the animals are adult by the end of September but some lag behind in stadia IV, VII and VIII. In the Forest of Dean, in late March I had stadia IV, VII and IX which is strongly suggestive of a two year cycle.

Chordeuma sylvestre (C.L. Koch, 1847)

I first collected this species in a wood by the village of Trelill in North Cornwall in August 1961 but was not able to be certain of the species until the following April (1962) when a return visit to the site yielded adults. It was recorded from a second Cornish site in 1982.

The species occurs throughout Europe: France, Netherlands, Germany, Switzerland, Italy (as far south as Calabria) and, Czechoslovakia and East to the Caucasus.

In spring 1962 (April) there were newly hatched young and stadia II-VII as well as adults (IX). The following April (1963) there were stadia III, IV and V plus adults. This suggests an extended period of oviposition from early in the year. The complete absence of adults in August (only stadia VII and VIII were present in August 1962) suggests the species is an annual.

Key to the species of Chordeumatidae

1. Adults larger than 10 mm long and 1.1 mm in diameter (height). Well pigmented. Ocelli in an almost equilateral triangular field. With eight rows (Fig. 3)

Stadia	VI,	VII,	VIII	and	IX	(with 23, 26, 28 & 30 rings) with
at least	10,	15,	20	and	24	ocelli
at least	5.5,	6.3,	8	and	10.8	mm long
at least	0.7,	0.8,	1.0	and	1.2	mm diameter ..... Chordeuma

1a. Visible apex of anterior coxal pillar of gonopod pointed.
(Figs. 16-18, 9c) - Chordeuma sylvestre

Visible apex of anterior coxal pillar of gonopod broadly rounded
(Figs. 19-21, 9c) - Chordeuma proximum

2. Adults smaller than 10 mm long and 0.9 mm in diameter. Lightly to moderately pigmented.
Ocellis in a more acute triangular field, with five, six or seven rows. (Figs. 1 and 2)
Never more than 3 or 4 ocelli in a row (at right angles to ventral edge of head capsule).

Stadia	VI,	VII,	VIII	and	IX	with at
most	7,	11,	15,	and	17	ocelli ..... Microchordeuma

2a. Larger, adult males 8.0 mm long and 0.75 mm diameter or larger. Females larger still. Moderately pigmented. Adults with 30 rings. Females with at least one row with four ocelli, three rows with at least 3 ocelli. Males with at least one row, possible two or three rows, with three ocelli. Total of six or seven rows, females with 14-17 ocelli, males with 8-15 ocelli.
(Fig. 2) gonopods as in Figs. 11-15 ..... Microchordeuma gallicum

2b. Smaller, adult females 8.0 mm long and 0.75 mm diameter or smaller, males smaller still. Poorly pigmented, amber to cream colour, adults with 28 rings.
Never more than 3 ocelli in a row, only five or six rows (only one ocellus in the sixth row if present). Total of 7-12 ocelli (Fig. 1) gonopods as in Figs. 5-9 ..... Microchordeum scutellare

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