

The Morphology of *Tettigarcta tomentosa* White, (Homoptera, Cicadidae) ⁽¹⁾

By

J. W. EVANS, M.A., D.Sc., F.R.E.S.

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For a long time great interest has been shown in Australian cicadas belonging to the genus *Tettigarcta* White. This is because of certain primitive features of their structure and their wide divergence from all the rest of the Cicadidae. In spite of this interest their detailed morphology is largely unknown, and only a few specimens are to be found in the museums of the world.

In 1937 a biological survey of the fauna of Tasmania was initiated, and collectors in country districts were asked to keep a special watch for the 'Hairy Cicada'. As a result a few specimens were acquired in 1939, and in the following year nearly fifty specimens were procured, all from one locality. The present study is concerned with those features of the morphology of *Tettigarcta* that are of especial interest from the standpoint of comparative morphology.

NOMENCLATURE AND SYSTEMATIC POSITION

The genus *Tettigarcta* and the genotype *Tettigarcta tomentosa* were described by Adam White (1845) in an appendix to 'Eyre's Expeditions and Discoveries in Central Australia.' Excellent figures of an immature and adult insect accompanied the descriptions, but the only locality recorded was 'Australia'. In the following year, White (1846) re-described in almost identical words, both the genus and the species, on this occasion giving the locality as 'Australia, near Melbourne'.

Many years later Distant (1883) described a second species in the genus, which he named *Tettigarcta crinita*. *T. crinita* differs from the genotype in having the lateral angles of the pronotum rounded instead of pointed. Distant was not aware from what part of Australia his specimen originated. Froggatt in 1903 described a specimen of *T. tomentosa* which he had received from Tasmania, and in the following year with Goding (Goding and Froggatt, 1904) re-described the genus and both species. These authors were of the opinion that *tomentosa* was confined to Tasmania and *crinita* limited to Victoria. Ashton (1924) later extended the range of *crinita* to Mt. Kosciusko in New South Wales. Since the genotype is, as may be seen from the original illustration, clearly the Tasmanian species, and as Eyre did not visit Tasmania, one is forced to the conclusion that White was misled as to the place of origin of the specimens he described.

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Distant (1906) placed the genus in the Division Tettigarctaria of the sub-family Tibicinae. Myers (1929), however, rightly considered it merited sub-family rank and accordingly created the sub-family Tettigarctinae for its sole reception.

DESCRIPTION AND HABITS

Both species are medium-sized, dull or reddish-brown cicadas, with a wing expanse of about three inches. *T. crinita* is slightly larger than the genotype. The fore-wings are suffused with pale brown or reddish-brown and the distal divisions of the veins may be surrounded by dark-brown markings. The most striking superficial characteristics are the extreme hairiness of the body and the small head in relation to the very large pronotum.

Although these cicadas are especially associated with high altitudes, they have also been taken close to sea-level. Ashton caught several specimens of *T. crinita* in February (summer) on Mt. Kosciusko at a height of 5000 feet. Most of the specimens of *T. tomentosa* received by the Tasmanian Biological Survey were from Tarraleah, which is at an altitude of 2500 feet. These were obtained during May and June (winter), being attracted to lights even on cold frosty nights; a few were seen flying at dusk. During the day they shelter under bark. Emergence from nymphal exuviae takes place at night and insects have often been seen early in the morning with their wings not fully developed. With other cicadas it is also usual for transformation from nymphs to adults to occur during nighttime.

MORPHOLOGY (*T. tomentosa*)

The Head

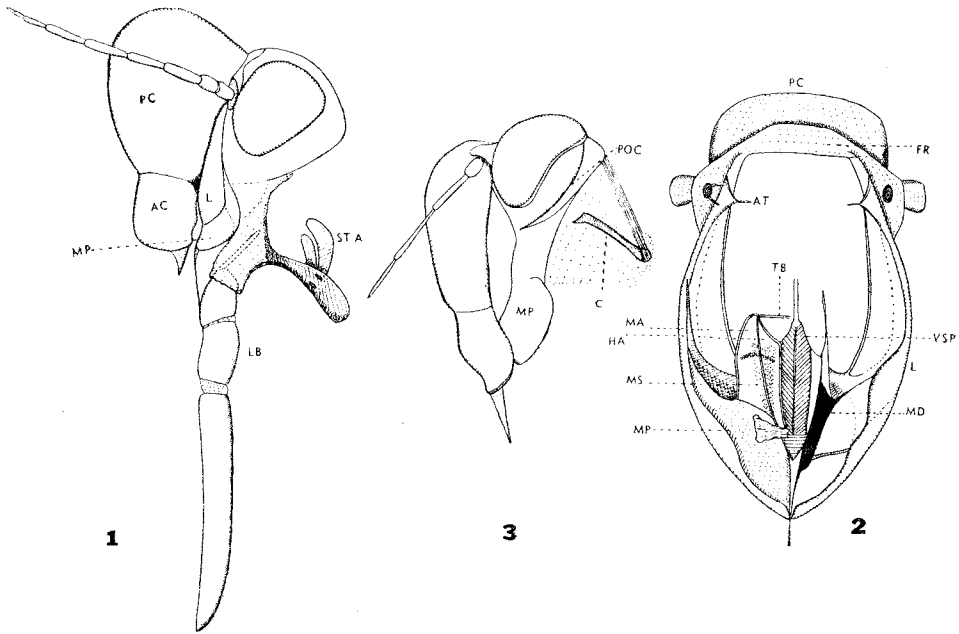
The morphology of the head of cicadas has been dealt with fully by Myers (1928). The present author's interpretation of homopterous head-structure differs from that of Myers in several respects and has been given in an earlier paper, (Evans, 1939).

Fig. 1 represents the head of a mature nymph in lateral aspect. The antennae have nine segments, which is more than possessed by other cicadas. Attention is directed to the attachment of the labium anteriorly to the head just behind the maxillary plates and posteriorly to the floor of the prothorax. The sternal apophyses of the prothorax are shown in the figure.

Fig. 2 illustrates the head of a nymph viewed from behind. The eyes and vertex have been removed, also the maxillary plate and its stylet and apodeme, and the apodeme of the hypopharynx from the right hand side revealing the attachment of the mandible to the inturred margin of the lorum. The adult head (fig. 3) differs from that of the nymph in the reduction of the number of antennal segments to four and the flattening of the clypeus. It remains long and narrow and does not become wide as is usual in cicadas. The labium also remains long and reaches to beyond the hind coxae.

The Thorax

The head and thorax of *T. tomentosa* in dorsal aspect are illustrated in fig. 4. The only part of the pronotum to which muscles are attached is the anterior third immediately behind the eyes; the rest freely overlaps the mesonotum. Myers states that the hypertrophied pronotum of *Tettigarcta* overshadows the much reduced mesonotum. Actually the mesonotum is in no way reduced, only concealed, and the condition in *Tettigarcta* resembles that usual in Homoptera apart from the Cicadidae, where the only part of the thorax that is visible dorsally is the pronotum and the triangular scutellum of the mesonotum.



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- FIG. 1.—Head of nymph in profile. pc., post-clypeus; ac., ante-clypeus; l., lorum; mp., maxillary plate; lb., labium; sta., sternal apophyses.
- FIG. 2.—Head of nymph from behind after the removal of the vertex and the eyes, the maxillary plate and its attachment have also been removed from one side. fr., frons; at., at base of anterior tentorial arms; tb., body of the tentorium; ma., maxillary apodeme; ha., hypopharyngeal apodeme; ms., maxillary stylet; md., mandibular stylet; vsp., ventral surface of the sucking-pump. Other lettering as in Fig. 1.
- FIG. 3.—Head of adult in profile. poc., postoccipital suture; cs., cervical sclerite. Other lettering as in Fig. 1.

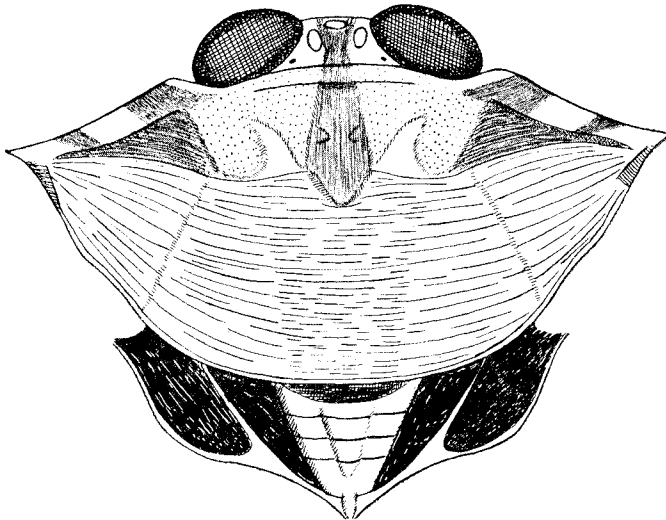


FIG. 4.—*Tettigarcta tomentosa*. Head, pronotum and scutellum in dorsal aspect.

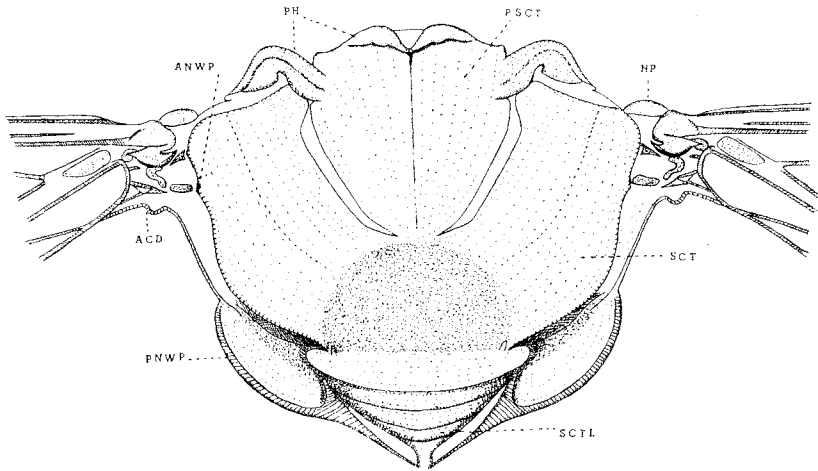


FIG. 5.—*Tettigarcta tomentosa*. Mesonotum and axillary sclerites of the forewing after removal of the pronotum. ph., phragma; psc., prescutum; anwp., anterior notal wing process; hp., humeral plate; pnwp., posterior notal wing process; sct., scutum; sctl., scutellum; acd., axillary cord.

If the pronotum is removed the mesonotum is disclosed, (fig. 5). I am doubtful as to the exact limits of the prescutum. Apart from the apical scutellum, the mesonotum is divided into two parts by wide sutures. These sutures separate the attachments of the median dorsal longitudinal muscles and the tergo-sternal muscles of the fore-wings. Both Myers and Beamer (1928) consider the whole of the central U-shaped area to be the prescutum. Snodgrass defines the prescutum as a narrow transverse strip behind the antecostal suture which may end in pre-alar bridges. Imms (1925) figures the mesotergum of a tipulid, and labels the large anterior area 'prescutum', whilst Rees and Ferris (1939) name the same area in another tipulid 'scutum'.

It is suggested that the narrow anterior thickening of the notum, labelled 'phragma' in fig. 5, is the acrotergite and that the bent lateral ridges, also labelled 'phragma', are pre-alar bridges. These are fused ventrally with the anepisterna of the mesopleuron on each side. The prescutum is then an area behind the acrotergite, between the pre-alar bridges, and is not defined posteriorly; most of the centre of the U belongs to the scutum. The posterior median area of the scutum (shaded in the figure) is depressed and the scutellum is raised and narrows apically. The latter completely conceals medially, not only the metanotum, but also the first and second abdominal segments. From the re-curved apex of the scutellum a large vertical phragma descends; to it are attached the median dorsal longitudinal muscles of the fore-wings. The metanotum, which is reduced, is not figured. The pleural and sternal surfaces of the thorax of a mature nymph are illustrated in figs. 6 and 7. Recent work by Ferris (1940) has added considerably to the comprehension of the structure of the insect thorax, and Ferris' interpretation has been adopted in the present paper.

In fig. 7 the thorax has been cut dorsally and the severed sides flattened out. In the prothorax the sternal apophyses arise from separate pits and are free distally. The pleural apodeme is short, wide, and strong, and bears a long narrow apophysis. The mesothorax retains its primitive structure to a greater extent

than the rest of the thorax. Both the episternum and epimeron are undivided, a trochantin is present, and a meron separated off from the base of the coxa. The sternal apophyses arise from separate pits at the posterior apex of a triangular sclerotized area, the true sternite. In the metathorax the sternal apophyses arise from a single pit.

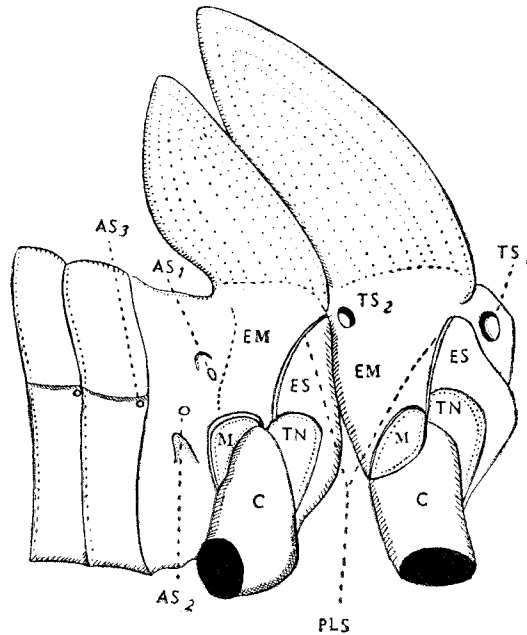
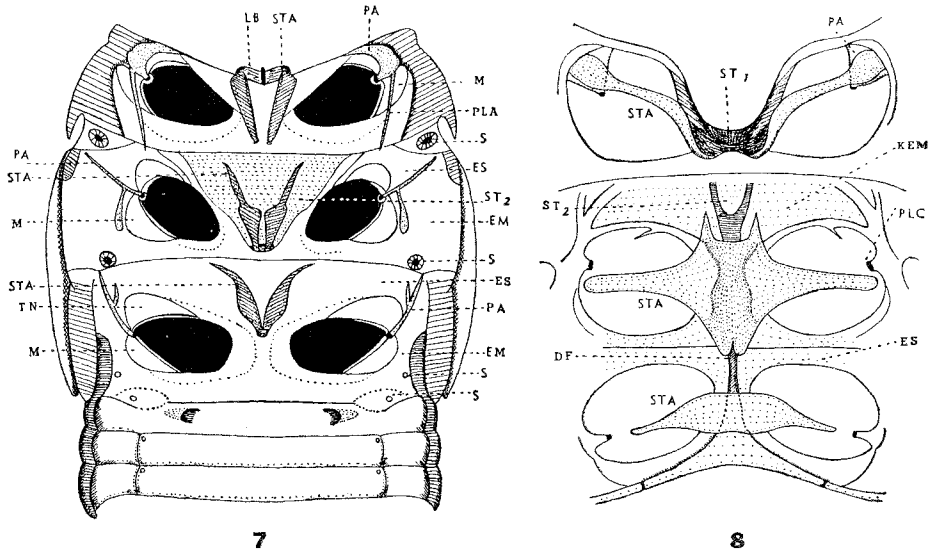


FIG. 6.—*Tettigarcta tomentosa*. Lateral aspect of the meso- and metathorax and anterior four abdominal segments of a nymph; the wing pads are folded back. ts., thoracic spiracle; es., episternum; em., epimeron; tn., trochantin; m., meron; c., coxa; pls., pleural suture; as., abdominal spiracle.

The structure of the thorax of an adult insect is shown in figs. 8, 9, 14, and 15. The sternal apophyses of the prothorax are fused to the anterior lateral margins of the leg-cavities and the pleural apodemes on each side. The sclerotized area between the apophyses is labelled 'Sternum 1', but it is uncertain whether it contains any elements of the true sternum. In the mesothorax the episternum is divided into an episternum, a katepisternum and a pre-episternum. The pre-episterna of the two sides meet mid-ventrally at the discriminal line, leaving anteriorly a small triangular area, the remnant of the sternite of the nymph. Ferris has defined the discriminal line as the line of meeting mid-ventrally of the sub-coxal elements of the two sides of the body. The large sternal apophyses of the mesothorax arise from the posterior continuation of the discriminal fold; they are free apically. Myers recognises and figures a separate 'median division of the episternum' of the mesothorax in cicadas. In *Tettigarcta* there is a partial division of the episternum into three parts, laterally by a cleft or suture and medially by a furrow with an internal ridge. Neither completely divides the sclerite, and it is believed that both are secondary developments. The epimeron is divided into an anepimeron and katepimeron. In the metathorax the episternum

is undivided and the episterna of the two sides meet mid-ventrally at the discriminal furrow. The epimeron consists of an anepimeron and katepimeron and a narrow post-coxal sclerite is articulated with the posterior ventral prolongation of the latter.



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FIG. 7.—Thorax and anterior abdominal segments from above, internal aspect. pa., pleural apodeme; pla., apophysis of pleural apodeme; s., spiracle; st., sternum; other lettering as in previous figures.

FIG. 8.—Internal ventral view of the adult thorax to show sternal apophyses. df., discriminal fold; plc., pleural condyle; other lettering as in previous figures.

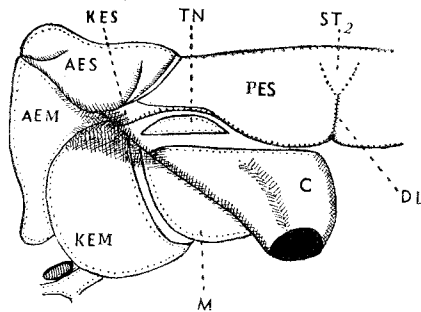
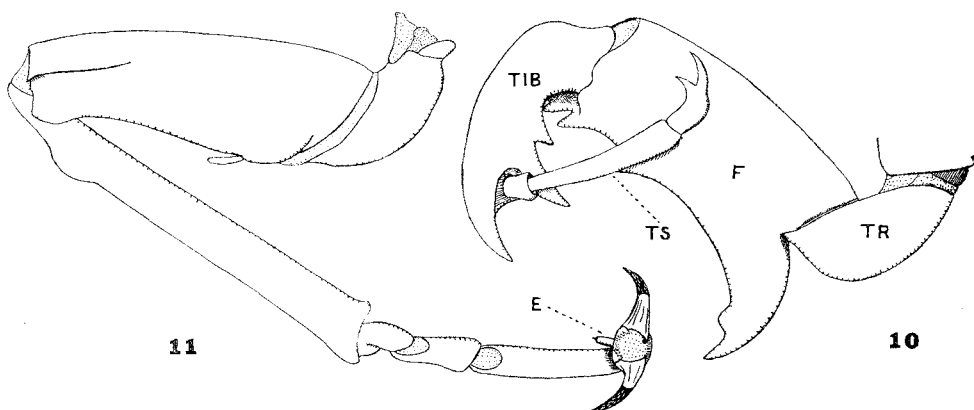


FIG. 9.—*Tettigarcta tomentosa*. Left pleuron and coxa of adult mesothorax. aes., anepisternum; kes., katepisternum; pes., pre-episternum; aem., anepimeron; kem., katepimeron; dl., discriminal line. Other lettering as in previous figures.



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FIG. 10.—Foreleg of nymph. ts., tarsus; tb., tibia; f., femur; tr., trochanter.
 FIG. 11.—Foreleg of adult. e., empodium.

The Legs

The fore-leg of a mature nymph and of an adult insect are figured (figs. 10 and 11). The tarsus of the nymph has two segments and the claws, which are of different sizes, are fused basally. In the adult leg the femur is not so broad as is usual with cicadas and bears a single finger-shaped process. All three pairs of legs are remarkably long and empodia are present.

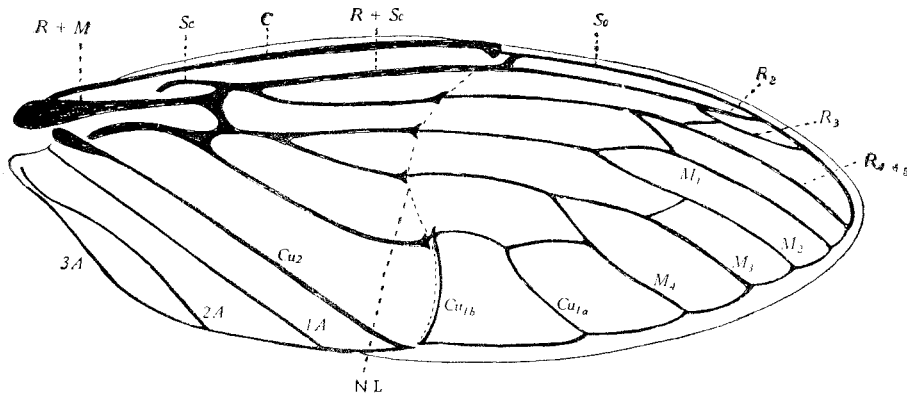


FIG. 12.—*Tettigarcta tomentosa*. Forewing.

The Wings

The wings are steeply tectiform and meet close behind the apex of the scutellum when at rest. The forewings are wrinkled and coriaceous and lack cross-ridgings; the veins are hairy. The venation is of extreme interest. In the fore-wing (fig. 12) the costal vein lies a little below the anterior margin; it is preceded in the nymph by a strong vein containing a trachea. There is a considerable space in the nymphal wing-flap between the costal vein and a group of three trachea that lie below it. The upper of these represents the sub-costal vein. This vein in the adult is convex on the lower surface of the wing proximally, thence it appears on

the upper surface, and is fused with the upper branch of the radial sector as far as the nodal line. From this point it lies just inside the margin of the wing and appears to be continuous with the costal vein. The upward turn of the sub-costal trachea at the nodal line can be seen clearly in the nymph. Accepting Comstock's (1918) statement that R_1 is not present in the Cicadidae, the trachea that immediately adjoins Sc and divides into two well before the nodal line, must represent the radial sector, the upper branch of which, as has already been stated, is fused for part of its length with the sub-costal vein in the adult wing. All four branches of the median vein are developed, and there is a third anal vein. The nodal line consists of a line of weakness that extends across the wing in the position shown. Where the veins cross the line they break and appear re-joined on the ball and socket principle. The significance of the line is discussed in a later section.

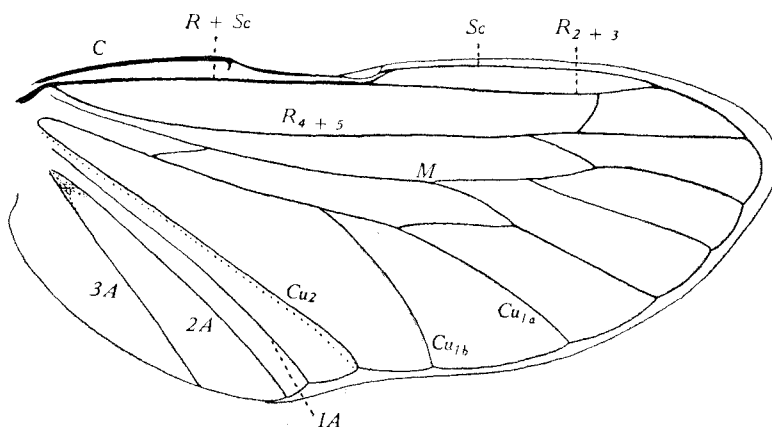


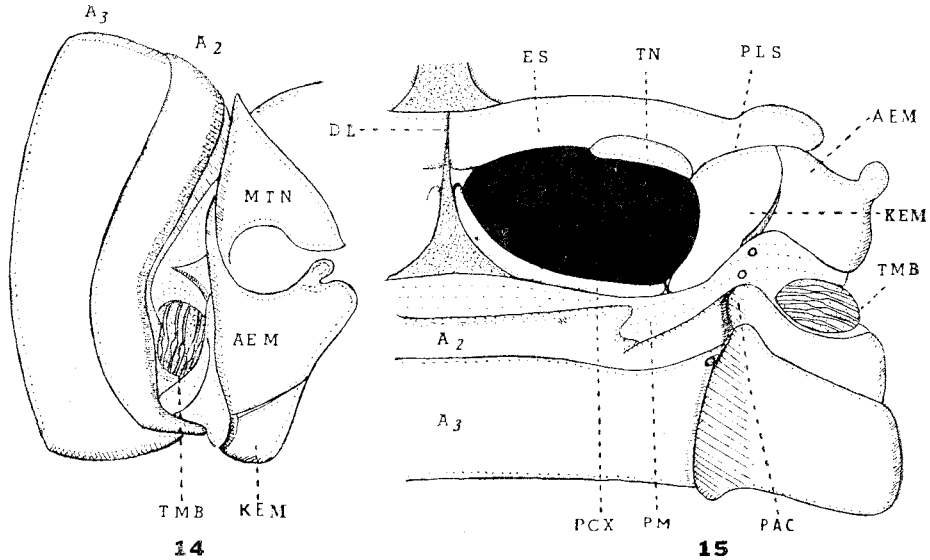
FIG. 13.—*Tettigarcta tomentosa*. Hindwing.

The hind-wing (fig. 13) is pale brown with small hairs on the membrane and slightly longer hairs on the veins. As in the case of the fore-wing, there is in the nymphal wing pad a costal vein and trachea separated by a wide space from a group of three tracheae. The first of these tracheae precedes the sub-costa, and in the adult wing the corresponding vein is fused for its proximal half with the upper branch of the radial sector. Distally it lies close to the fore-border of the wing, but is not joined to the costal vein, being separated from it by the overfolded marginal wing-catch. The second branch of the radial sector meets the other branch close to the base of the wing; this feature and the fusion of M_3 and M_1 into a single vein are the principal characters in which the venation of the hind-wing differs from that of the fore-wing.

The Auditory and Sound-Producing Organs

There is no trace of auditory organs in either sex of *Tettigarcta*. In other cicadas the mirrors or auditory tympana are part of the first abdominal sternite and the auditory capsule part of the second tergite. The positions these organs would occupy if present are indicated in fig. 15. Myers records finding a slight swelling on the ventral lateral angle of the second tergite, but states that there is no external evidence that it is an auditory capsule. There is also no internal evidence on this point.

With respect to sound-producing organs, Tillyard (1926) mentions that the males have no vestiges of such organs, but Myers noticed that the 'first abdominal segment of *Tettigarcta* is greatly reduced and shows laterally a slightly swollen area, free from the long hairs that thickly clothe the rest of this region and furnished with faint ridges'. He continues 'Were not nearly all the other characters of *Tettigarcta* apparently highly primitive, one would be inclined to see in this structure the last vestiges of tymbals lost in the history of the race'.



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FIG. 14.—Lateral view of part of thorax and abdomen. mtm., metanotum; tmb., tymbal; a., abdominal segment. Other lettering as in previous figures.

FIG. 15.—Ventral view of part of metathorax and abdomen. pcx., postcoxale; pm., position of mirror; pac., position of auditory capsule. Other lettering as in previous figures.

Myers was correct in recognizing these swollen areas as tymbals. They lie on each side of the body in the position indicated in figs. 14, 15, and 16, and form part of the first abdominal tergite. Their surface is smooth and marked with a pattern of white stripes on a pale-brown background. The tymbals are not functional and the stripes are homologous with the ridges of fully-developed tymbals. A bundle of muscle fibres is attached directly to the inner surface of each tymbal. These muscles are attached ventrally to a narrow sclerotized plate that lies in the membrane of the first abdominal sternite. Tymbals are equally well developed in both sexes, but the tymbal muscles of the male are stronger than those of the female, though not so large as the huge tymbal muscles of other cicadas. The narrow transverse sclerotized plate from which the muscles arise is homologous with the abdominal furca of cicadas of various authors. Myers correctly stated that the furca was not an endoskeletal structure, but a differentiated anterior part of the first abdominal sternite. The first pair of abdominal spiracles lie close to the apices of this plate.

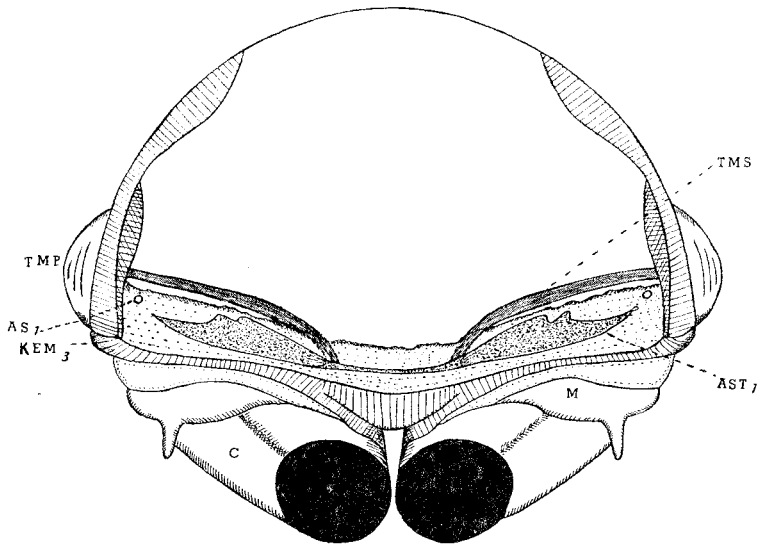


FIG. 16.—*Tettigarcta tomentosa*. Transverse view of part of metathorax and part of first abdominal sternite from behind. ast., sclerotized plate of first abdominal sternite.

The Alimentary Canal

The alimentary canal is illustrated in fig. 17. It resembles in essentials those of other cicadas as described by Myers. The filter chamber into which the oesophagus opens comprises the first ventricle of the stomach (Snodgrass, 1935), and part of the third ventricle, labelled 'mid-intestine' in the figure. The mesenteric sac is the second ventricle. In several fresh specimens of *Tettigarcta* that were examined, the mesenteric sac was found as a small, very wrinkled, and folded sac. In others, including some that had only recently abandoned their nymphal exuviae, it consisted of a thin smoothed-walled sac, distended with air, which occupied fully three-quarters of the abdominal cavity. The remaining quarter contained gonads and fat-body. Such a condition has also been recorded in leaf-hoppers (Evans, 1931).

The Tracheal System

The chief point of interest in the tracheal system lies in the alleged presence of a large tracheal air sac. Snodgrass is of the opinion that most of the abdominal cavity of the cicada *Magicicida septendecim* is occupied by a huge tracheal air chamber that opens directly to the exterior, through the first abdominal spiracles, and has tracheal tubes issuing from its walls. Myers claims that the sac is merely the distended mesenteric sac or second stomach ventricle of the alimentary canal. He was, however, able to trace a trachea from the first abdominal spiracle which, without penetrating the mesenteric sac, formed a tracheal knot on its surface from which tracheae ramified over the wall of the sac.

In *Tettigarcta* it is quite certain that there is no trace of any development of a tracheal air sac. In fig. 17 a trachea is shown which originates from the first abdominal spiracle of the right-hand side. This trachea breaks up into several smaller tracheae, but does not form a tracheal knot such as is described and illustrated by Myers. As, even in freshly-emerged cicadas, the mesenteric sac may fill the greater part of the body cavity, and must therefore become distended further in older insects in which fat-body is reduced, Myers' interpretation would appear to be

correct, in spite of the fact that Snodgrass (1935) gives a figure (fig. 237, p. 449) showing both the second ventricle of the stomach and an air sac in the same insect. The whole body cavity of *Tettigarcta* contains countless small air sacs, the mesenteric sac being especially well supplied with these, two of which are shown in the fig. 17.

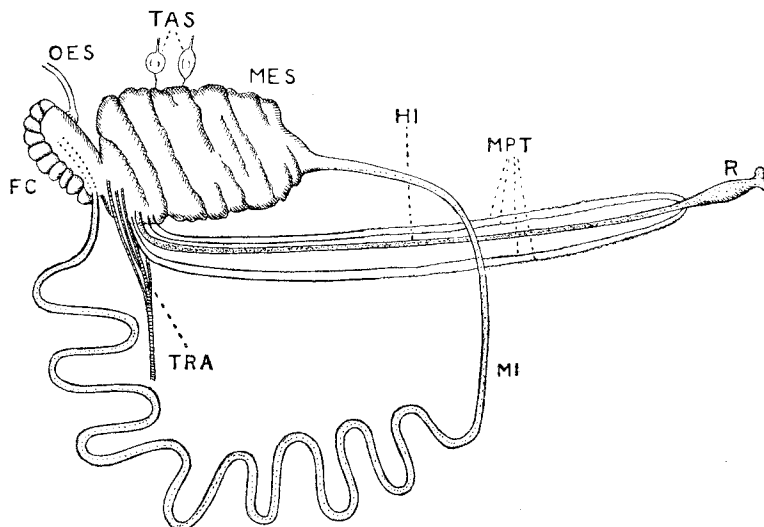


FIG. 17.—*Tettigarcta tomentosa*. Alimentary canal. fc., filter chamber; oes., oesophagus; mc., mid-intestine; hi., hind-intestine; mes., mesenteric sac; mpt., malpighian tubules; tra., trachea; tas., tracheal air sacs; r., rectum.

The anterior spiracles of the nymph are shown in figs. 6 and 7. The two large thoracic spiracles, which are closed by flaps, both occur in the mesothorax. There are eight abdominal spiracles. The two first of these have migrated forward, the anterior lying between the thorax and the segmented portion of the abdomen, the posterior just in front of the margin of the segment to which it belongs. Vogel (1923) believed that communicating longitudinal and transverse tracheae are absent in cicadas. This point has not been investigated, but Myers' statement 'that all the spiracles, without exception, are linked up by a longitudinal trunk on each side, is obvious from an examination of a nymphal exuviae' is open to question. Although superficial examination of a nymphal exuviae would certainly support this view, further investigation discloses that each trachea is distinct from its neighbour, and there is no trace of longitudinal trunks.

The Male Genitalia

The sternum of the eighth segment is produced posteriorly into a more or less flattened rectangular flap that underlies the ninth segment. The ninth segment is narrow dorsally and wide ventrally; from it arise the aedeagus, the prolongation of the fused basal plates and a pair of parameres (fig. 18). The aedeagus seen from above is trough-shaped, the trough forming a basin-like depression at its proximal end. The apex of the aedeagus consists of a fleshy pad with an outer border of large flattened wide-based spines, and an inner border of small inwardly-turned flat spines. Attached to the proximal end of this pad is a tongue-shaped process which serves to close the opening of the ejaculatory duct. The aedeagus is hinged basally with the basal plates; these plates are fused

together and produced into a boat-shaped structure that supports the aedeagus ventrally. The parameres, harpogones, or genital styles of the two sides are joined to each other by a set of transverse muscles, and have also other lateral muscles that are attached to the wall of the ninth segment. Lying immediately below the basal plates is a fleshy pad with an invaginated apodeme. Strong muscles that arise from this apodeme are joined to the posterior up-turned sides of the genital segment. The tenth segment is membranous and concave ventrally, and is separated into a pair of up-turned and in-turned flaps apically. The eleventh segment is ring-like and from it arises the anal segment.

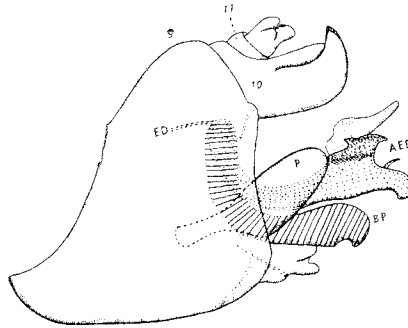


FIG. 18.—*Tettigarcta tomentosa*. Male genitalia. ed., ejaculatory duct; p., paramere; aed., aedeagus; bp., basal plates.

DISCUSSION

The present distribution of *Tettigarcta*, which is confined largely to high altitudes in south-eastern Australia and Tasmania, suggests that it forms one of the components of the cold-climate fauna that was dominant in these regions for periods both in mid and late Tertiary times. It is suggested that *Tettigarcta tomentosa* has retained a climatic rhythm which it acquired during a glacial epoch, since early winter temperatures that prevail between two and three thousand feet in Tasmania at the present day, may well be comparable to those that prevailed at sea-level during the short summer months of a period of intense cold. Further, it is believed that the habit of subterranean existence shared by the nymphs of all cicadas was originally developed as a response to cold climatic conditions.

Both species of *Tettigarcta* differ from all other recent cicadas in the following characters:

The nymphs have nine antennal segments, which is a greater number than that possessed by other cicadas.

The spiracles of the nymphs are not concealed by pleural flaps.

The adult is densely pilose and has an unusually small, narrow head in relation to the pronotum.

The pronotum has very large posterior and lateral expansions which conceal the scutum of the mesonotum.

The mesonotum has a well-developed scutellum that narrows apically and entirely conceals the metanotum.

The fore-wings are without cross-ridgings. The principal veins are evenly distributed and not massed against the fore-border.

The venation is remarkably complete and a nodal line is fully developed.

A separate costal vein is retained in the hind-wing.

The fore-femora are not markedly swollen, empodia are present, and all the legs are longer in relation to the body than is usual in the family.

Auditory organs are absent in both sexes.

Non-functional, but fully developed, sound-producing organs are present in both sexes.

The male genitalia have a true aedeagus, an unusual development of the basal plates, and harpogones are present.

It is proposed to discuss briefly the significance of only two of these characters, the sound organs and the nodal line. With regard to the sound organs, one can assume that the development of these was contemporaneous with, or slightly in advance of, the development of auditory organs. *Tettigarcta* has no trace of auditory organs in either sex, but has tymbals in both sexes, and only slightly less development of tymbal muscles in the female than in the male. Therefore one can reasonably conjecture that it is descended from an early cicadan stock that possessed in both sexes well-developed sound-producing organs and also sound-detecting organs. It is probable that neither set of organs was so complex or efficient as those found in present-day cicadas. For some reason, possibly associated with its nocturnal habits and cold climate environment, for modern cicadas are essentially sun-loving creatures, *Tettigarcta* ceased to be vocal. The sound-organs later lost their power to function and the auditory tympana, which were probably of a rudimentary nature reverted to undifferentiated parts of the segmental membrane of the first abdominal segment. It has been found that the membrane of this segment where it is adjacent to the break and curvature of the second abdominal sternite (fig. 15) is slightly denser than and of a different consistency from the rest of the segment.

Sound production in insects has arisen independently in many groups, and it can be assumed that in all instances it has commenced by simple methods, the actual organs involved never being specially designed for such a purpose. The rubbing of two adjacent parts of the thorax, or of legs together, or of legs against elytra, being the usual initial development. With cicadas, the position would appear to differ, as there is no rubbing action, but part of the dorsal surface of the first abdominal segment is differentiated into a complex tymbal, to which are attached strong tymbal muscles. If any evidence could be obtained to suggest that sound production was originally effected by the pull of certain muscles on to undifferentiated areas of the dorsal surface of the first abdominal segment, then the mystery of the origin of cicada song would be solved.

An examination has been made of the muscle system in the region of the base of the abdomen in *Eurymela fenestrata* Le P. & S.: This is a leaf-hopper, chosen on account of its large size and because preserved material was available. When the greater part of the abdominal segments is removed and the fat-body cleared away, the most noticeable structures are two very large columnar bands of muscles. These arise independently from near the mid-ventral line of a sclerotized ridge situated transversely in the membrane of the ventral surface of the first abdominal segment. These muscle bands are almost vertical, but directed somewhat laterally. They are attached dorsally to the hind margin of the metanotum. Each band is divided mid-way by a transverse circular sclerotized plate. The function of these muscles is unknown, but it needs no great flight of imagination to suppose that their dorsal attachments may have for some reason migrated for a short distance posteriorly. They would thus cease to be intersegmental muscles and become confined to the first abdominal segment. The membrane of this segment is strengthened dorso-laterally by two crescentic bars that form the hind margins of ovals. Part of the

hind border of the metanotum on each side bounds the ovals anteriorly. It is in a corresponding position to the membranous centres of these ovals that the tymbals of *Tettigarcta* are situated. One can conjecture that the gradual backward migration of the muscles resulted in a thickening of the abdominal wall, and that as a result of this thickening slight sound production became possible. The homologous muscles in *Eurymela* resemble much more, both in size and position, the tymbal muscles of modern male cicadas than those of *Tettigarcta*.

The significance of the nodal line has been fully discussed by Myers and earlier authors. It has already been pointed out that it consists of an irregular transverse line of weakness in the fore-wings of *Tettigarcta*. It is also developed to a varying, but less extent, in all other cicadas. Tillyard believed it to represent the beginnings of the division of the wing into a corium and membrane such as occurs in the Heteroptera. Imhof (1905) was of the opinion that it had some relation to the mechanics of flight.

The hemielytral condition of the fore-wings of Heteroptera is directly associated with the apical overlap of the fore-wings when they are at rest. No Homoptera, except certain Fulgoroids (Achilidae), have strongly overlapping fore-wings; they are either steeply tectiform or somewhat flattened, but distinct. The fact that the nodal line persists to such a degree in all cicadas, and that similar breaks in wings occurred in certain Mesozoic Homoptera,* would seem to favour Imhof's interpretation, especially as the wing is readily bent along the line in living specimens of *Tettigarcta*, more especially those that have only recently acquired fully-developed wings. It is further believed that the nodal line is only a parallel development with the condition that occurs in the Heteroptera and that it does not necessarily denote a common origin of the two groups or even a similar evolutionary trend.

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* e.g. *Pseudocossus zemczukovi* Martynov, Family Palaeontinidae, (Martynov, 1928).

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