

**Diarthrophallina,
a new group of Mesostigmata,
found on Passalid beetles.**

By

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Amongst the numerous insects harbouring mites none are more interesting from an acarologist's point of view than the great tropical and neotropical family of *Passalidae*. As a matter of fact the number of peculiar mites which occur on these beetles seems to be almost inexhaustible. In a previous paper (1943 b, p. 130) the author has called attention to this fact, at the same time emphasizing that generally only the adult mites are found on the beetles and that it seems safe to assume that the developmental stages of the mites must be looked for in the rotten logs in which the beetles undergo their development. So far the only attempt to study the life history of the passalidophilous mites in the biotope inhabited by the beetles has been made at the Duke University, Durham, N. C., U. S. A. The paper embodying the results of this investigation (1936) contains many new and interesting facts. It is not entirely the fault of the authors but rather due to the deplorable absence of comprehensive and up-to-date surveys of the different species and genera of the very difficult group of *Mesostigmata*, that they have not succeeded in identifying properly all the forms they have managed to capture.

One of the most extraordinary of these is a species which the authors have referred to the genus *Urosejus* Berlese 1888 but which is not at all related to that genus. Fortunately amongst the mites collected by me on the *Passalidae* of the Entomological Department of the Zoological Museum of Copenhagen and kindly lent to me by dr. S. L. Tuxen, was one specimen of this species, a nympha found on *Passalus cornutus* Fabr., thus the same species on which the Americans made their collections. Another specimen which was originally referred to the same species was found on *Protomocerus* no. 12 from New Guinea in the Copenhagen Museum and finally amongst the collections of mites sent to me from the *Passalidae* of the Hope Museum, Oxford, by Prof. G. D. H. Carpenter was another nympha, which belongs to another species.

As soon as it became evident to me, how extraordinary *Urosejus quercus* was, I wrote to dr. Pearse and asked him to send me material. Thanks to his great courtesy I received about half a year later a tube containing numerous specimens of nymphae, males and females, beside other species also captured on *Passalus cornutus*.

This material has enabled me to elucidate some obscure points left by the American authors, to correct some mistakes and to determine approximately the systematic position of the genus.

Diarthrophallus nov. gen.

Diagnosis: Body oval, very flat. Dorsal side covered by a single, smooth shield which leaves a broad margin unprotected. In front of the sternal shield a distinctly demarcated short, transverse praesternal shield which carries legs I. Epigynial shield without hairs, oval, not articulated at the posterior margin which is demarcated from the ventral shield by a semicircular

suture. Male genital armature a large, blunt, biarticulated penis, directed straight backwards and situated in an oval groove between coxae III. Tritosternum of *Gamasides*-type, but flanked at the base by two praesternal hairs. Legs very short and stout; legs I small, without ambulacres or claws, bifurcated at the top; legs II—IV with large ambulacres but no claws. Mandibles short, with edentate chela and an ensiform, ciliated appendage. Palpi without bi- or trifurcate bristle at the base of the terminal joint.

Type: *D. quercus* Pearse & Wharton 1936. (Synonym: *Urosejus quercus* Pearse & Wharton.)

***Diarthrophallus quercus* (Pearse & Wharton).**

Nympha.

Length 450 μ ; width 290 μ . This is the average measurement of the nymphae sent by Pearse; the Copenhagen specimen is larger but this is no doubt due partly to the fact that it was the dried skin considerably flattened. It measured 600 μ by 455 μ .

The nympha is paler than the adult female but agrees with it in all essential details, the only differences being in the structure of the ventral side.

The dorsal side is covered by a single, oval, smooth shield which leaves unprotected a broad marginal band. The shield has numerous, exceedingly small hairs and pores.

The dorsal side has seven pairs of straight, plumose bristles of approximately the same length as the body. They are placed as follows: I at the „shoulders“ on a level with the middle of coxae II just outside the margin of the dorsal shield, II at the margin of the dorsal shield, on a level with the middle of coxae III, III on a level with the middle of coxae IV, close to the margin of the body, IV at the posterior margin of the dorsal shield, the bristles being as far apart from one another

as the distance between each and the corresponding edge of the body. The last three pairs are inserted at or close to the posterior edge of the body, one pair on the anal shield, one pair a little more forwards and laterally and the last pair marginally.

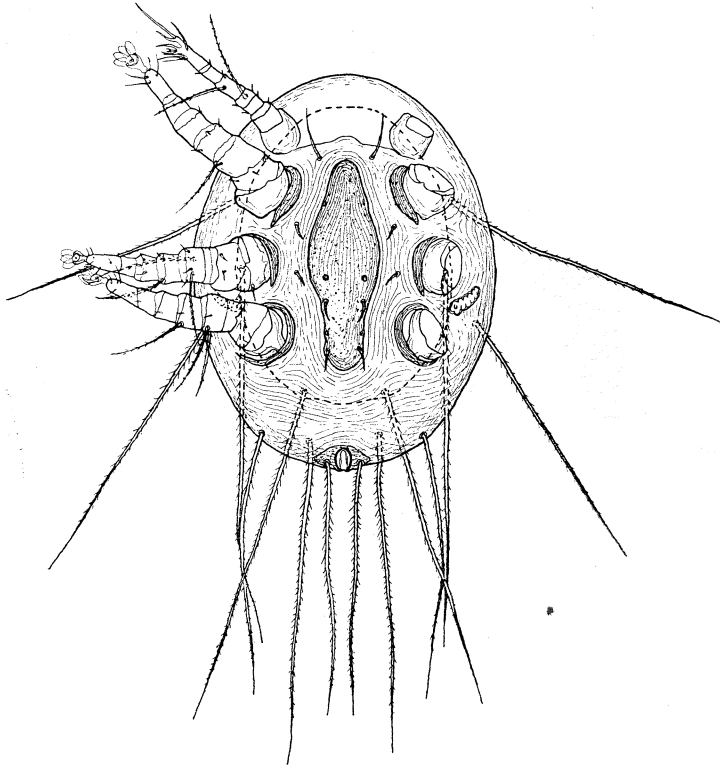


Fig. 1. *Diarthrophallus quercus* (Pearse & Wharton). Nympha, ventral view. Specimen from the Copenhagen Museum. Original.

The gnathosoma (fig. 2 c). It has not been possible to see the shape of the epistoma, because it was completely concealed by the protruding mandibles. Probably it agrees with that of *D. similis* (fig. 7 e) which has a triangular mucro with a fringe of fine hairs. The mandibles are short, with small, narrow and to all appear-

ances edentate chela; digitus fixus with a small, narrow appendage, fringed on one side at the top. Since the mite was collected in dry condition on the beetle it is very likely that the appendage is partly broken off, as it is missing on the other mandible. The nympha of *D. similis* has a large, leaf-shaped appendage on the mandible (fig. 7 d). The palpi are slender, with five free joints, tapering towards the top. Joints I and II short, the latter with a dorsal hair, as long as the entire palpus; joint III almost as long as joints I and II together, slightly tapering, with one small ventral hair near the distal end; joint IV narrow, slightly tapering, as long as joints I and II, with three small hairs on the ventral side and one hair, twice as long as joint V, ventrally near the top; joint V very short, rounded at the top, with two short terminal hairs and three longer hairs near the base.

The palpi differ profoundly from the types occurring amongst the other *Mesostigmata* in one important respect: there is no bi- or trifurcate bristle at the base of the terminal joint.

Hypostoma (fig. 2 c). There are only three pairs of hypostomatic hairs, arranged in two longitudinal rows; the median one of these is only half as long as the posterior one and the anterior hair is three times as long as the median hair. The maxillary plates are narrow and pointed. The maxillary lobes have no fringe and are very long and slender, curved outwards like hooks; between them there is a pair of narrow, lanceolate appendages.

Ventral side. Tritosternum (fig. 2 e) short, rounded at the top. It is flanked at the base by two very slender, slightly curved hairs which are about three times as long as the trunk. This feature is almost unique, being, as far as I know, hitherto recorded only in the *Megisthanina* (comp. Trägårdh

1943 a). The slips are about five times as long as the trunk and finely hairy.

The intercoxal portion (Fig. 1) is covered in the middle by a single, elongated shield which extends forwards to a level with the middle of coxae II, widens between coxae III, tapers again backwards, ending a

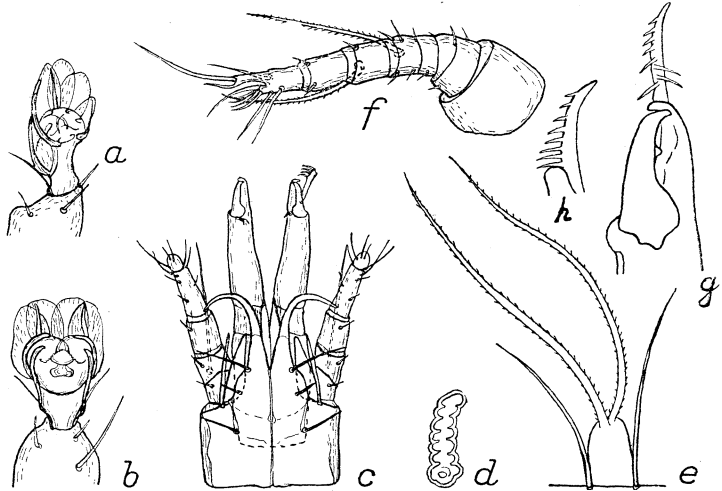


Fig. 2. *Diarthrophallus quercus* (Pearse & Wharton). *a* ambulacra of leg II, lateral view; *b* the same, ventral view; *c* hypostoma; *d* stigma and peritrema; *e* tritosternum and praesternal hairs; *f* leg I; *g* mandible ♀; *h* appendage ♀. *a*—*f* drawn from nymphs from the Copenhagen Museum; *g*—*h* after a female sent by Pearse. Original.

little behind coxae IV, rounded posteriorly. The rest of the cuticle is very finely striated, the striae following the contour of the sternal shield. The sternal hairs are placed as follows: hairs I, which are the longest, are placed on a level with the middle between coxae I and II, hairs II on a level with the middle between coxae II and III and hairs III a little behind the middle of coxae III. Hairs I—III are not inserted on the sternal shield but on the striated cuticle close to the shield. Hairs IV,

on the other hand, are inserted a little behind the anterior margin of coxae IV on the sternal shield and hairs V a little behind the middle of coxae IV on the same shield. A little in front of hairs III on the sternal shield is a pair of small, round pores and between hairs IV and V there is another small, submarginal pore.

Both the shape of the sternal shield and the position of the hairs is very unusual. In many nymphae of *Uro-*

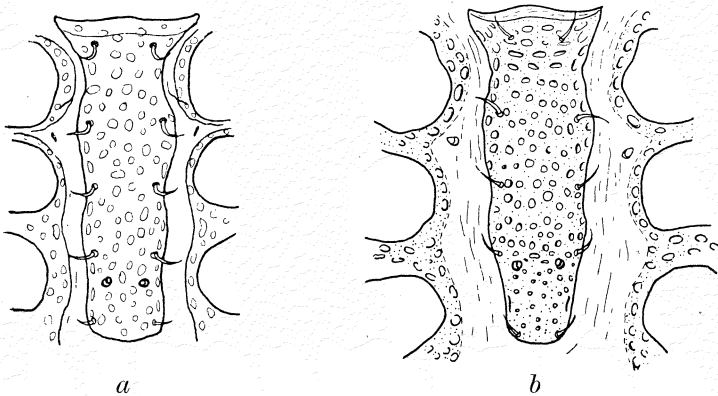


Fig. 3 a. *Urodiaspis tecta* (Kramer). Nympha. Sternal shield. Original.

Fig. 3 b. *Phyllodinychus tetrphyllus* (Berlese). Nympha. Sternal shield. Original.

podina there occurs an elongated sternal shield of a similar shape (fig. 3) but it always extends forwards to the base of the tritosternum and all the hairs are inserted on it submarginally. In *Diarthrophallus*, on the other hand, the sternal shield does not extend forwards to the base of tritosternum and is rounded anteriorly. As regards the hairs the first three pairs of them are not placed on the sternal shield. Thus the shape of the sternal shield and the position of the sternal hairs support the view that *Diarthrophallus* has a very isolated systematic position.

The legs. Legs I (fig. 2 f) are slightly shorter and much more slender than legs II—IV and have neither claws nor ambulacres; trochanter very short, ring-shaped, with 2—3 small hairs, femur divided into basifemur and telofemur, both very short and ring-shaped; on the dorsal side of telofemur, near the distal end a very large, straight, slightly hairy bristle which is almost as long as the rest of the leg; genu of the same length and width as femur, with a large, slightly curved dorsal bristle at the distal end, almost as long as that of femur; tibia cylindrical, slightly slenderer than the genu, with two small hairs of the same length near the distal end; tarsus bifurcate at the top, with one posterior, short and one anterior, cylindrical projection, as long as the undivided portion of the joint; the posterior projection has a terminal bundle of 4 hairs and one longer, curved bristle; the anterior projection has a terminal, acute, slightly curved bristle, as long as tibia and tarsus together, and one subterminal, much shorter hair; besides these there are three acute, straight hairs in the distal half.

The shape of legs I is most extraordinary. It is true that the first pair of legs has no ambulacres and that the tarsus is shaped more like the terminal part of the palpi, with numerous tactile hairs, in many different genera of the *Mesostigmata*. But the anterior legs of *Diarthrophallus* with the long bristles on femur and genu and the bifurcate tarsus are a quite unique feature.

Legs II—IV short, directed straight outwards, tapering gradually towards the top, femur of legs II with a long, plumose bristle, femur of legs III and IV with two similar bristles and genu of legs II and IV with one similar bristle. Ambulacres without claws, with four leaf-shaped superunguinal slips.

The stigmata (fig. 2 d) are situated on a level with a line drawn between coxae III and IV; the peritremata

point obliquely outwards and forwards and are three times as long as they are broad, without any peritrematic shields.

Male.

Length 480 μ ; width 350 μ .

Colour light yellow. Shape oval, rounded anteriorly, more pointed posteriorly.

The dorsal side resembles that of the nympha as regards both the size and shape of the dorsal shield and the number and position of the long, straight, plumose bristles which is seven pairs. The lateral bristles are, however, placed nearer to the margin of the body than in the nympha delineated in fig. 1. But this difference is due to the different state of preservation of the specimens, the nympha being dry and pressed quite flat, causing the width to increase by half the height of the body which makes the bristles appear situated less laterally than they in reality are. In the specimens preserved in alcohol and sent by dr. Pearse the bristles are all directed more or less straight upwards which probably is their natural direction and seems to imply that they are defensive weapons.

Ventral side (fig. 4). In front of the sternal shield there is a transverse, very short but broad shield, distinctly demarcated from the sternal shield by a straight suture. It bears the first pairs of legs and the tritosternum. This shield which I propose to call the "prae-sternal shield" is a quite unique feature not met with in any other *Mesostigmata*. It is very difficult to know how to interpret this character. One would feel inclined to regard it as a primitive feature, because it is associated with the tritosternum which according to Börner's universally accepted interpretation is the only remnant of the true third sternal plate, present in other arachnida. But, on the other hand, it carries the first pair of legs which undoubtedly belong to the first so-

called sternal segment which carries hairs I. If we regard it as the remnant of a primitive segment, associated with the tritosternum, we are forced to assume that the first pair of legs has secondarily moved forwards as to be attached to the praesternal segment. The interpretation of the praesternal shield is bound to remain obscure until more material has been brought

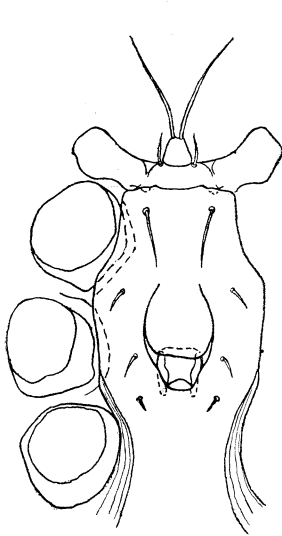


Fig. 4. *D. quercus*. ♂.
Tritosternum and sternal shield
with penis. Original.

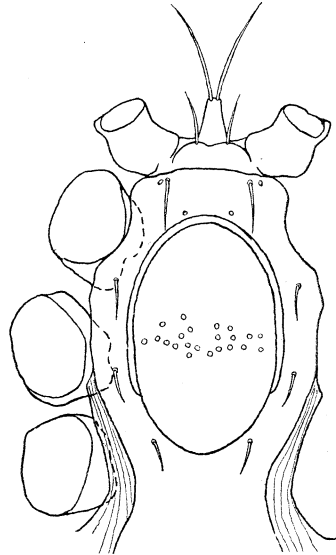


Fig. 5. *D. quercus*. ♀.
Tritosternum, sternal and
epigynal shields. Original.

forward which can throw light on it. The problem is further complicated by the fact that there is no trace of the shield in the nympha.

Sternal hairs I very long, slender and straight, placed in the anterior angles of the sternal shield, near the anterior side of coxae II, hairs II small, placed a little in front of a line drawn between coxae II and III, hairs III are also small and placed on a level with the middle of coxae III, and hairs IV which are even smaller

are placed half-way between the tip of the penis and coxae IV.

The genital aperture and the genital armature is of a quite unique type. Instead of a small aperture placed either at the anterior edge of the sternal shield or in the middle of the shield there is a large, oval groove between coxae III into which a large biarticulated penis is fitted which is not articulated at its base and directed straight backwards. The terminal joint is very short, with an orifice at the top and has two blunt, lateral teeth. The penis is not quite rigid, its top being slightly bent either to the right or to the left side.

In this connection attention must be called to the description of the male given by Pearse & Wharton (l. c. p. 479): "The male aperture is in front of the first legs between a pair of conical, anteriorly directed processes on the sternal plate." One thing is certain, that the authors have failed to recognize the real males and have interpreted the nymphae as males, in which case it must be the tritosternum which is described in the way quoted above. The failure of the authors to interpret correctly the structure of the female genital aperture which is described as a transverse slit in spite of the fact that the authors delineate an oval, tongue-shaped epigynial shield, lends support to the suspicion that they are not very familiar with the organization of the *Mesostigmata*.

The anal aperture is small and placed at the posterior edge of the body.

Female.

Length 480 μ , width 350 μ .

The dorsal side resembles in all details that of the male.

Ventral side (fig. 5). The epigynial shield is large, oval and resembles somewhat that of the *Uropodina*, but presents at the same time a feature which it shares

with no other genera of that group. In the *Uropodina* the epigynial shield is cut off straight at the posterior end where it is articulated to the ventral shield. In *Diarthrophallus*, on the other hand, the posterior margin is almost semicircular and fused with the ventral shield along a fine, but very distinct suture. The anterior and the lateral edges are free and evidently permit the shield to be bent downwards for the purpose of copulation or egg-laying, but there is no articulation.

The tritosternum and the praesternal shield are shaped as in the male. Sternal hairs I very long as in the male, hairs II—IV of the same size as in the male and placed in the same way.

The sternal shield forms a rim round the genital aperture and is fused with the ventral shield which is constricted between coxae IV but widens further back with almost semicircular posterior margin; it has one pair of hairs.

As pointed out above, Pearse & Wharton describe the female genital aperture as a transverse slit. In some females there is a transverse row of small granules at the place where the American authors have drawn a transverse line. It is evidently this line they have interpreted as a slit-shaped aperture.

Locality.

Nymphae, males and females on *Passalus cornutus*, Duke Forest, Durham, N. C., U. S. A.; one nympha found on *Passalus cornutus*, Zoological Museum, Copenhagen.

***Diarthrophallus similis* nov. spec.**

In a large collection of mites found on Passalid beetles in the Hope Museum of the University of Oxford and entrusted to me by Professor G. D. H. Carpenter I discovered another, rather mutilated specimen of another species of the genus. On superficial examination the resemblance between both seemed indeed so great that I

was inclined to believe that it was only a variety of *D. quercus*. But a minute inspection revealed so many differences that the specific distinction is beyond doubt. In the absence of the adult stages it is, however, impossible to know if the species belongs to *Diarthrophallus*.

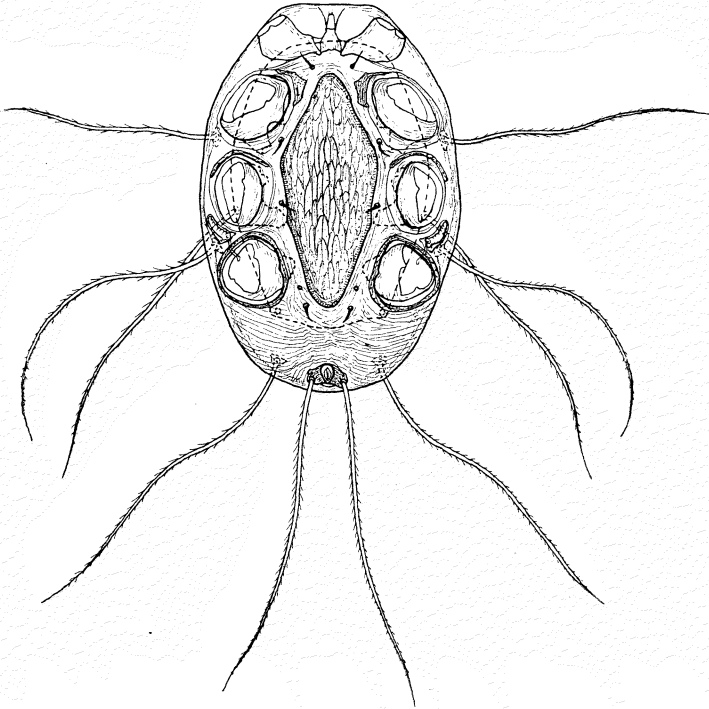


Fig. 6. *Diarthrophallus similis* nov. spec. Nympha. Ventral view. Original.

Nympha. (Fig. 6).

Length 550 μ , width 390 μ . Colour pale yellow.

The shape is more elongated than in *D. quercus*; the greatest width is on a level with the posterior margin of coxae II, the anterior margin is truncated, the posterior margin bluntly rounded.

The dorsal side is covered by a single, oval shield of the same shape as that of the body, leaving unprotected a broad rim along the margin. The cuticle surrounding the shield is finely striated. The dorsal shield has numerous, very minute, perpendicular hairs and five pairs of very large, plumose bristles, placed as follows: one pair at the shoulders, on a level with the posterior side of coxae II submarginally and pointing straight outwards, one pair a little behind the middle of coxae III but further from the margin and pointing straight backwards, one pair on a level with the anterior side of coxae IV and close to the margin, one pair (missing in the specimen, only the pores indicating its position) on the hind margin of the dorsal shield at the posterior angles immediately behind the coxae IV, the 5th pair straight behind the 4th a little from the margin and the 6th pair on the anal shield; the posterior bristles are the longest and almost as long as the body.

The gnathosoma (fig. 7c). The epistoma has a triangular mucro with a very fine fringe. The palpi resemble those of *D. quercus* and the second joint has a long, straight bristle, but the 4th joint is comparatively much narrower and has only one longer hair at the distal end; the 5th joint is smaller, with one longer hair near the top; the relative length of the joints is: 2, 3, 5, 5, 2.

The mandibles (fig. 7d) have no teeth and the digitus fixus has a long, lanceolate appendage with fringes of small hairs. The hypostoma has only three pairs of hairs, placed as in *D. quercus*, the anterior pair being about twice as long as the other hairs. The maxillary plates are very long and slender and acutely pointed, extending forwards to the distal end of joint III of the palpi. The maxillary lobes are very long and slender and curved outwards like hooks, but seem to be divided

into two narrow slips from the base, the median slips being the shortest.

The ventral side (fig. 6). The tritosternum is of the same shape as in *D. quercus*; the exact shape and length of the slips I have not been able to see, but the praesternal hairs are present.¹⁾

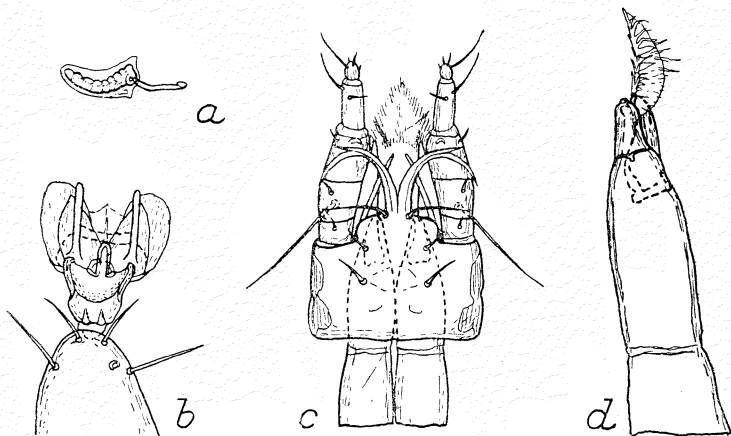


Fig. 7. *Diarthrophallus similis* nov. spec. a peritrema; b ambulacra; c hypostoma; d mandible. Original.

The intercoxal portion is covered by a long, oval shield which extends from the anterior side of coxae II to the posterior side of coxae IV, attaining its greatest width on a level with the anterior side of coxae III, from hence tapering rather abruptly forwards with round anterior end and more gradually towards the posterior, convex end. The shield has a very peculiar texture through the presence of a net-like system of very elong-

¹⁾ The mite being exceedingly brittle the manipulation of removing the cover glass for the purpose of turning the mite upside down was considered too risky. Hence the ventral side has been examined and delineated from the dorsal side, which thanks to the great transparency of the mite was easy to do, except for some minor details.

ated, polygonal areas. The sternal shield has no hairs but one pair of marginal pores near the anterior end. Sternal hairs I inserted in front of the sternal shield, hairs II on a level with the posterior margin of coxae II, hairs III a little behind the middle of coxae III and hairs IV on a level with the posterior end of the shield; a little in front of hairs IV and almost as far from the margin of the sternal shield as from coxae IV a pair of round pores.

The stigma (fig. 7 a) is placed in the angle outside coxae III and IV; the peritrema is directed obliquely forwards and outwards and is slightly longer, narrower and more curved than in *D. quercus*. It is surrounded by a very small shield which sends out a very narrow, curved bar at the posterior angle.

The legs are of almost the same shape as those of *D. quercus* but coxae I are placed closer together. Both legs I were partly broken off, but the two long bristles on femur and genu I were present. The ambulacres have no claws but two pairs of leaf-shaped, superunguinal slips (fig. 7 b).

The anal aperture very small, without circum-anal hairs and surrounded by a small, transverse shield on which one pair of the long, plumose bristles is inserted.

Locality: on *Proculus Goryi* from Mexico, 1915. Hope Museum, Oxford. One nymph.

Brachytremella nov. gen.

Before I received material of *Diarthrophallus* from Pearse and when my only source of information was his and Whartons' paper I believed that the female from the Copenhagen Museum found on *Protomocerus* from New Guinea belonged to the same genus. As a matter of fact the similarity in the shape of the body with its long bristles, the legs and the gnathosoma is very great indeed. The discovery that the female geni-

tal shield of *Diarthrophallus* had been incorrectly delineated by the American authors altered, however, my opinion and made it necessary to establish a new genus for it, because in *Brachytremella* the epigynial shield of the female is not separated from the ventral shield through a suture.

Diagnosis: Body flat, oval, with six pairs of long, plumose bristles of the same type as in *Diarthrophallus*. Tritosternum with praesternal hairs. Legs and gnathosoma of the same type as in *Diarthrophallus*. Epigynial shield not separated from the ventral shield by a suture.

Type: *B. spinosa* nov. spec.

***Brachytremella spinosa* nov. spec.**

Female.

Length 500 μ ; width 400 μ . Legs I 167 μ , II—III 230 μ , IV 360 μ . Colour pale yellow, shape oval.

The dorsal side is quite smooth and has a number of exceedingly minute hairs beside one pair of pores on a level with the middle of coxae III. On the dorsal side there are in the median third two pairs of long, plumose bristles, inserted marginally instead of the three pairs present in *Diarthrophallus*, and four pairs of similar bristles at or close to the posterior edge.

Ventral side (fig. 8). The epigynial shield is large, tongue-shaped, length to width as 7:5, resembling the shield of the *Uropodina*. But there is a very important difference: the epigynial shield of *Brachytremella* is not articulated at the base but is merely an elongated projection from the anterior margin of the ventral shield. From the posterior angles of the epigynial shield two

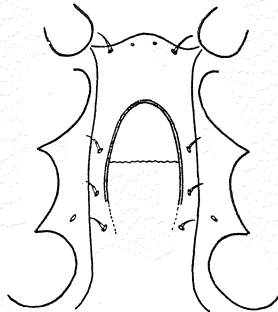


Fig. 8. *Brachytremella spinosa* nov. spec. ♀. Intercoxal part of ventral side. Original.

lines run backwards to a line drawn between coxae III and IV, converging backwards. It has not been possible to ascertain whether these lines are exterior or interior. Across the shield there is a very faint, transverse line which is on the interior side of the shield.

Sternal hairs I not much longer than the others, placed near the anterior margin of the sternal shield and directed straight forwards and outwards. Between them a pair of small, round pores. Hairs II—IV of sub-equal size, placed in two longitudinal parallel rows; hairs II on a line drawn between coxae II and III, hairs III on a level with the middle of coxae III and hairs IV a little in front of a line drawn between coxae III and IV. Halfway between hairs III and coxae IV but a little more forwards a pair of circular pores.

Anal aperture situated at the posterior edge of the body, surrounded by a small shield. The legs agree in all essentials with those of *Diarthrophallus quercus*.

Locality: on *Protomocerus* no. 12 from New Guinea. Zoological Museum of Copenhagen. One female.

***Passalobia quadricaudata* Lombardini.**

G. Lombardini has described a new genus, *Passalobia*, from under the elytra of *Passalidae* from Brazil (1926). The genus is referred to the *Laelaptidae* but a comparison between my drawings of *Brachytremella* and those of Lombardini immediately reveals the fact that *Passalobia* is closely related to *Brachytremella*. The epigynial shield has the same shape and is not articulated at the base, the peritremata are of the same peculiar shape, the first pair of legs has no ambulacres and the posterior margin of the body has long hairs.

It is to be regretted that the description of the genital aperture of the male is too vague to allow us to form any accurate idea of its shape and position. The author writes (l. c. p. 159): "Hiatus sexus minime patet, fissura

transversa in inferiore parte scuti conspicitur, neque alia est fissura in ventre acari istius." To anyone who is familiar with the organization of the *Mesostigmata* it is certainly a great surprise to hear the male genital aperture described as a transverse fissure! It is, however, evident that the fissure has been too small to be

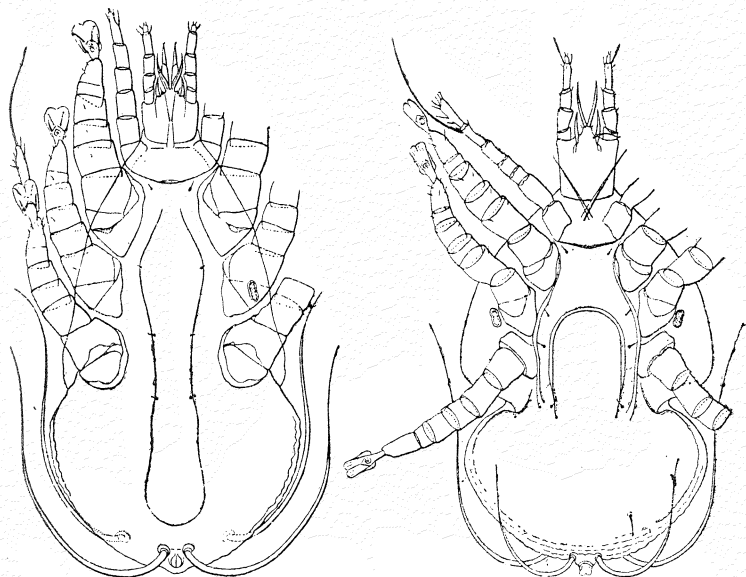


Fig. 9. *Passalobia quadricornuta* Lombardini (after Lombardini).

delineated. Two explanations offer themselves to the peculiar absence of a male genital aperture in the drawing. The specimen delineated is either a nympha or, if it is a male, the author, or at least the delineator, has failed to see the genital aperture. If we compare the figure with the two figures illustrating the ventral side of the nymphae of *D. quercus* and *D. spinosa* the great similarity between them is quite obvious. The sternal shield is of almost the same shape in all three species, tapering as it does gradually forwards and attaining its

greatest width between coxae III. The only difference is that the sternal shield in *Passalobia* is longer.

Considering the unquestionable affinity between *Diarthrophallus* and *Passalobia*, the male genital aperture of *Passalobia* must also be situated in the middle of the sternal shield and very likely the genus has a penis of the same type. But since there is no trace of any such aperture in the drawing I conclude that it is a nympha, not a male, which Lombardini has described and delineated.

Beside this discrepancy between the description and the drawing there is another discrepancy, although of an opposite kind. At the top of the right tarsus IV there is an extra joint with a long, terminal hair which seems to continue beyond the ambulacres! No mention of this most peculiar structure is made in the text and it is evident, that the artist has delineated some broken off part of the mite, very likely the terminal joint of leg I which happened to be placed as the continuation of leg IV.

To conclude the genus *Passalobia* Lombardini belongs to the same cohorts, the *Diarthrophallina*, as *Diarthrophallus* and *Brachytremella*.

On the ecology of the Diarthrophallina.

As is well known (comp. Trägårdh 1943 b) a great number of acarina, belonging to different groups have been found on the *Passalidae*. In some species, as the *Polyaspidae* and the *Uropodina*, only the nymphae occur on the beetles, the adults presumably living in the rotten logs inhabited by the beetles. Other genera as f. i. *Passalacarus* and *Klinckowstroemia* only occur in the adult stages but both males and females. In this instance we may infer that the immature stages inhabit the rotten logs and that the adult climb the beetles in order to

emigrate to other suitable localities. In the *Diarthrophallina*, on the other hand, all stages occur on the beetles and it seems safe to draw from this fact the conclusion that these mites are more adapted to live on the *Passalidae* than the other genera which means that they are able to feed on the beetles. Pearse & Wharton found that, except in the month of June, on an average about five specimens occurred on each of the 110 beetles examined.

Looking for a possible supply of food for the mites one is forced to assume that the nymphae of *Uropodina*, which often occur in great numbers on the beetles, may form the food of the *Diarthrophallina*. As a matter of fact the American authors found on an average 30 nymphae of *Uropodina* on each beetle. It is therefore safe to assume that these form the staple food of the *Diarthrophallina*.

It is to be regretted that the American investigations did not include the fauna of the rotten logs, inhabited by *Passalus cornutus*. Such an investigation would be bound to yield important results, completing the life history of perhaps all the species found on the beetles.

The systematic position of the Diarthrophallina.

From the description given above of the genera *Diarthrophallus*, *Brachytremella* and *Passalobia* it is evident that they can find no place in the groups hitherto recognized. In order to form an opinion about their affinity to the other groups it is necessary to examine their outstanding features. Every genus must, however, be considered as exhibiting a mixture of at least three kinds of characters. It is possible to recognize firstly characters which are of an adaptive nature, rendering the animal fit to live just in the biotope, inhabited by him. These characters are probably recent and may be called "eco-

logical characters". On the other hand there are other characters which are not related to any special function but may be regarded as constitutional features which the genus in question shares with other genera belonging to the same systematic unit. Finally there are characters which must be regarded as more or less rudimentary rests of characters which once served a useful purpose.

The *Diarthrophallina*, in my opinion, is a beautiful illustration of this conception of the diversity of the features which characterize every genus.

1. Adaptive, ecological characters.

a. The long bristles of the dorsal side of both nymphae and adults are undoubtedly very powerful defensive weapons. Such bristles occur in many otherwise defenceless acarina, f. i. in many nymphae of the *Oribatei* and in the nymphae and adults of *Palaeacarus* and *Archeonothrus* (comp. Trägårdh 1932).

b. The development of the first pair of legs as a kind of antennae, devoid of ambulacres but provided with numerous tactile or sensorial hairs. This specialisation has been rendered possible because the ambulacres of the other legs are so powerful that they are sufficient for the mite to cling to the polished surface of the beetles. Such a specialization is common in the *Mesostigmata*.

2. Constitutional characters.

a. The biarticulated penis is, as pointed out above (p. 378), a quite unique feature. In the present state of knowledge it is impossible to form any opinion regarding its nature viz. whether it is a primitive, constitutional feature or a recent, adaptive character correlated with the life of the mites on the beetles. Considering the formidable array of dorsal bristles it would seem to be impossible for the mites to copulate on the beetles. It must rather be assumed that they descend to the

ground for this purpose. It may be that the absence of the species in the month of June, recorded by Pearse & Wharton, is explained by the fact that the mating takes place in the rotten logs during that time. In my opinion it is a primitive, constitutional feature.

b. The very short peritremata are also a very remarkable feature which one would feel inclined to regard as an adaptive character because in other *Mesostigmata*, as f. i. *Paragreenea*, which lives on certain bees, and *Ptilonyssus*, which lives on swallows, and the *Spinturnicidae*, which live on bats, the peritremata are short. Nevertheless it is difficult to imagine that the short peritremata of the *Diarthrophallina* are an adaptive character, because if that were the case it would be difficult to account for the presence of quite normal peritremata in all other *Mesostigmata* which live on the *Passalidae*. For this reason I regard them as a primitive, constitutional character.

c. The structure of the ventral shields of the female gives us the clue to the systematic position of the group. It is large, has no hairs and resembles that of the *Uropodina*. But it is not articulated at the base, nor are the metasternal shields rudimentary, but fused with the other sternal shields and with the ventral shield so as to form a rim round the genital aperture. Until further, intermediate forms have been discovered, the group must be considered as an isolated branch from the *Gamasides*.

3. Rudimentary organs.

a. Amongst the rudimentary organs the praesternal hairs are the most remarkable. Their presence was first demonstrated in the *Megisthanina* (comp. Trägårdh 1943 a) and it was then suggested that on further investigations it would be possible to find them also in other groups. This suggestion soon came true, because in both the nymphae and the adults of the genus *Diarthrophallus*

and in *Brachytremella* they occur as well as in the genus *Euzercon*.

b. The praesternal shield. The interpretation of this has already been discussed above (p. 377). In my opinion it is very doubtful whether this shield is a primitive character. It may be recalled that in several other genera of *Mesostigmata* found on *Passalidae* and other beetles the first sternal shields are developed as fairly large, jugular shields, distinctly separated through a suture from the rest of the sternal shield. As has been suggested in another paper (1946, p. 24—25) this joint is bound to render the ventral surface more flexible, thus enabling the mites to cling more firmly to the smooth surface of the beetles. Their presence in such genera as *Fedrizzia*, *Klinckowstroemia*, *Cercomegistus* a. o. (comp. Trägårdh 1938, figs. 13, 14 & 16) is due to an adaptation. It is possible that the praesternal shield of the *Diarthrophallina* serves the same purpose and is a new departure, but it is equally possible that it represents traces of a primitive organization.

Of all the characters of the *Diarthrophallina* the bi-articulated penis is the most important from a systematic and phylogenetic point of view because it separates the group from all other *Mesostigmata*. Other features, such as the specialization of legs I as a kind of antennae, occurs in many other genera and the same applies to the short peritremata.

For this reason the most logical thing to do would be to establish a separate supercohors for the group, uniting all the other in another supercohors. But, on the other hand, so few *Mesostigmata* have as yet been collected in the tropics and when once the teeming fauna of these vast region has been thoroughly explored we are bound to discover such a host of strange forms that our present conceptions of the system and phylogeny of

this group will surely be profoundly altered. For this reason the group is provisionally regarded only as a separate cohors.

As pointed out previously (p. 390) the biarticulated penis cannot be regarded as an adaptive character because it is unconceivable that the sexes would be able to mate on the beetles, armed as they are with powerful dorsal bristles. This act must be performed in the rotten logs, inhabited by the beetles. For my own part I am inclined to assume that this character is a very primitive one which places the group in the vicinity of the most primitive *Mesostigmata*.

It seem reasonable to assume that on further investigations new forms will be discovered which will bridge the present gap between the *Diarthrophallina* and the other *Mesostigmata* just as the investigation of the genera *Trachytes*, *Polyaspis* and *Polyaspinus* bridged the gap between the *Uropodina* and the *Gamasides*. Even in the forms already described but imperfectly known it will be possible to reveal at least traces of a penis similar to that of the *Diarthrophallina*.

Diarthrophallina nov. cohors.

Diagnosis: Body flat, shield-shaped. Legs very short; legs I without ambulacres, legs II—IV with large ambulacres but no claws. Tritosternum flanked by two praesternal hairs. Mandibles short, chelate. Palpi without bi- or trifurcated bristle at the base of the terminal joint. Peritrema very short. Female epigynial shield large, tongue-shaped, without hairs, not articulated at the base. Metasternal shields fused with the other sternal shields and the ventral shield, forming a rim round the genital aperture. Male genital armature consisting of a large, biarticulated penis fitted into a groove and directed backwards.

Typical genus: *Diarthrophallus* nov. gen.

Key to the genera and species.

1. Body without any constriction behind legs IV. Sternal shield of nympha not extending beyond coxae IV. 2.
 — Body with deep constriction behind coxae IV. Sternal shield of nympha extending almost to the anal aperture *Passalobia* Lombardini.
2. Posterior margin of epigynial shield separated from the ventral shield through a semicircular suture *Diarthrophallus* nov. gen. 3.
 — Posterior margin of epigynial shield not separated from the ventral shield *Brachytremella* nov. gen.
3. Nympha with three pairs of bristles at the posterior margin *D. quercus* Pearse & Wharton.
 — Nympha with two pairs of bristles at the posterior margin *D. similis* nov. spec.

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