

STUDIES ON THE MITE *RICCARDOELLA EWERI* (LAWRENCE)
PARASITIC ON THE EGYPTIAN TOAD *BUFO REGULARIS* REUSS

BY

R. G. LUTFY

M. Sc., Ph. D., F.R.M.S.

(Department of Zoology, Faculty of Science, A'in Shams University).

Introduction and historical.

The writer came across the mite *Riccardoella eweri* while dissecting out the brain of a specimen of the Maculated Egyptian Toad — *Bufo regularis* Reuss. Further dissections were tried until it was realised that the mite lives inside the nasal cavities of the toad and that one has to remove the nasal bones immediately after killing the host to be able to get the live mite. Without failure, every single toad examined proved to harbour at least one (very rarely), and sometimes up to thirty-seven parasites in its nasal cavities.

The Egyptian toad has, for years, been the vertebrate type studied in our junior classes, and it seems extremely surprising, taking into consideration the number of toads being dissected every year, that the mite has hitherto escaped notice. This, however, becomes quite understandable if one considers the way the toads are being killed for dissection. Chloroform, which is usually used for this purpose, must have an effect on the mite itself which is either killed or anaesthetised inside the nasal cavities of the host, and so does not manage to escape through its external nares. Granting that the mite could recover from the effect of chloroform after some time, it still does not manage to make its way out as it becomes invariably entangled in the mucus secreted by the nasal epithelium of the dying host. Looking up the literature, the writer came across Lawrence's brief description of this species.

It was LAWRENCE (1952) who first described and named the mite which was handed to him by Drs. D. W. and R. F. EWER and hence the name *eweri*. The mites had been collected from the nasal cavities of the South African Toad *Bufo regularis*. He placed the mite under the genus *Riccardoella*, which had hitherto contained two species, namely: *R. limacum* [Shrank, 1776] and *R. crassipes* [Berlese

& Trouessart, 1889]. In 1924, BERLESE suggested *Riccardoella* as a subgenus to accommodate the slug mite [*R. limacum*], which had a number of synonyms before him. Sig THOR (1929) adopted « *Riccardoella* » as a generic name, and was followed in this by OUDEMANS (1929 & 1931) and by VITZTHUM (1931 *a* & *b*).

TURK & PHILLIPS (1945) discussed the different synonyms which were given to *R. limacum* by the different authors. They were of the opinion that *R. crassipes* seems to be a distinct and good species and that it was rightly removed from the genus *Ereynetes* under which it was originally described by its authors [BERLESE & TROUESSART, 1889] to the genus *Riccardoella*.

The original description of *R. crassipes*, by BERLESE & TROUESSART (1889), has not been available either to LAWRENCE (1952), or to the present author.

Material and methods.

Starting from the month of October 1958, toads were brought in, in lots, from different localities in the vicinity of Cairo. A number of toads have been examined every month, and every toad examined had the mite in its nasal cavities. The toads were killed by decapitation, the nasal bones were quickly removed and the underlying pigmented membrane covering the nasal cavities torn. The mites were easily picked on the wet tip of a dissecting needle and placed on the surface film of a small amount of water in a Petri dish. On this film they moved freely and actively. Examination under the binocular microscope was either carried out directly on the live mite or after anaesthetization with chloroform.

For making mounted preparations, the specimens were killed either in 70 % alcohol, or in Carnoy's fixative, dehydrated and mounted in balsam, or directly transferred to Berlese's mixture which proved the best mountant for the mite. Occasionally glycerin was used for mounting some preparations.

The dissection of a large number of toads gave a good deal of statistical information about the relative numbers of larvae, nymphs and adults in different months of the year. This information, with observations on the different stages in the life history of the mite, will be published in a separate work.

The mite belongs to the family Ereynetidae of the suborder Trombidiformes.

Body form.

LAWRENCE (1952) was evidently right in stating that the body outline, in mounted preparations, showed considerable variations. Nevertheless, he still seemed to rely on mounted preparations in describing the body form. The present writer had the opportunity of making mounted preparations using different mounting media and thus was able to notice the effect of the mountant, and of the solution from which the parasite has been transferred, on its body form. Carnoy-fixed specimens which were later mounted in Berlese's or dehydrated and mounted in

balsam retained their outline without much distortion. It is the non-fixed specimens, or the ones fixed in alcohol and transferred directly to Berlese's mixture or to glycerine that suffer severe shrinkage at first, but later, as they become gradually infiltrated by the mountant, they become so turgid with it that they usually lose some of their outlines' details and become generally oval, the form under which they were described by LAWRENCE (1952).

Better observations, as far as the outlines of the body are concerned, were made out under the binocular microscope [eye-piece, x 6, objective, x 10], from specimens

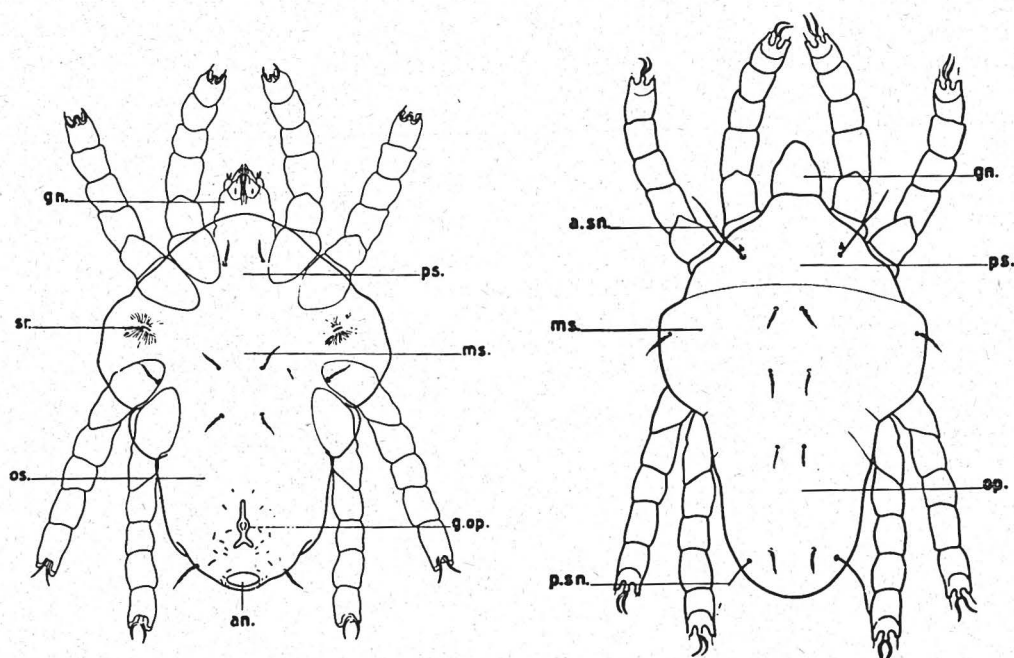


FIG. 1. — Ventral aspect of *R. eweri* as drawn from a mounted preparation. (Striations shown only in the area of the scars [sr.]) ; FIG. 2. — Dorsal aspect of the mite as drawn from an anaesthetised specimen placed under the binocular microscope.

which were freshly picked up from the host, anaesthetised with chloroform and placed on a surface film of a small amount of water in a watch glass or a small Petri dish.

The outline of the body would much better be described as pear — or heart-shaped than oval — or egg-shaped, terms which have been used by LAWRENCE (1952) for the same species and by TURK & PHILLIPS (1945) for *R. limacum* respectively. The broadest part of the pear is formed by the metapodosoma, the narrower tip by the opisthosoma, and the base by the propodosoma. The body is definitely broader than high which could be realised by comparing figs. 2 and 3. The gnathosoma is usually « bullet-shaped » but sometimes it is a bit short and approaches a triangular outline.

The pear-shaped outline could be depicted both ventrally and dorsally. One of LAWRENCE'S (1952) drawings (Venter of female), depicts the pear-shaped outline.

The fact that the metapodosoma is broader than the propodosoma, and much more so than the opisthosoma, stands out in every specimen examined and in many cases it is so exaggerated that the animal looks as if it has broad « shoulders ».

The length of the opisthosoma differs in the different stages and sometimes in the different individuals of the same stage. The binocular examination also affords a chance to make out lines and furrows existing on the integument. There is a clear posteriorly curved line demarcating the propodosoma from the metapodosoma. On the dorsal surface, this line separates the clearly triangular propodosoma from the metapodosoma. Passing to the sides the line referred to

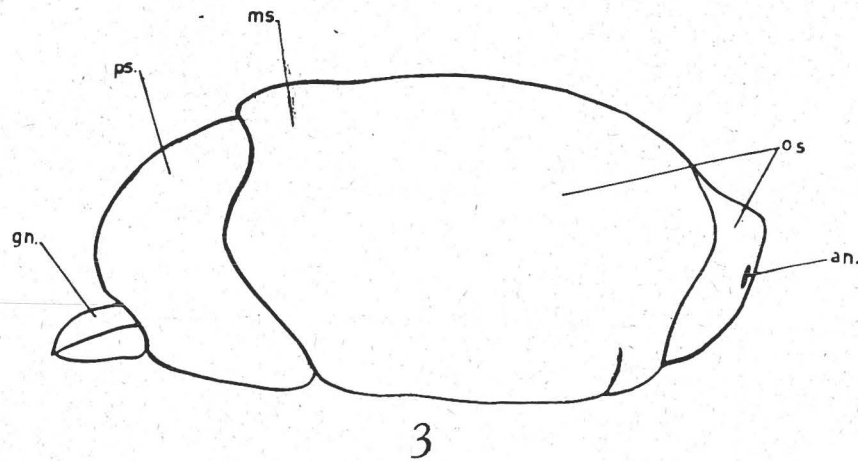


FIG. 3. — Outlines of the lateral aspect of the mite
(drawing made from binocular microscope ; legs are omitted).

moves gradually backwards in a curved course, passes on the ventre of the animal into a straight line of a slightly more posterior level [figs. 2 and 3]. This clear demarcation of the propodosoma could never be seen in mounted preparations.

The posterior limits of the metapodosoma, as mentioned above, could be made out by the fact that it is the broadest part of the body and that there is a sudden narrowing of the body just behind it. Besides, there are, on the dorsal surface, two oblique lines demarcating the metapodosoma from the opisthosoma, one on each side of the body. These two « lateral furrows » do not reach the middle line, i. e. they do not meet each other in the later nymphs or the adult females, and thus the demarcation is not complete. Posterior to these lines, two other similar lines extend to the inside, to fade away before the middle region of the body, in the same way the first two lines do [fig. 2]. These lines could be seen only with difficulty on the mounted preparations.

In the protonymph (early nymph), however, these lines are continuous and with other ones, give the opisthosoma a segmented or annulated appearance.

The posterior part of the opisthosoma, carrying ventrally both the genital aperture and the anus, is sometimes seen to have the capacity of being very slightly telescoped inside the anterior part. In specimens just recovering after anaesthesia, this posterior region is seen being moved slightly inside the anterior region of the opisthosoma. In the lateral view [fig. 3], the demarcation between anterior and posterior portions of opisthosoma could, only in some cases, be seen.

Integument and body-hairs :

The whole integumentary surface of the mite is marked by striations reminiscent of finger-prints. The lines forming the striations, when examined under an oil immersion lens, could be seen to be formed of closely arranged dots. The spaces between the lines, on the other hand, are perfectly smooth. The presence of these striations holds true except for the following parts of the body, where the integument is dotted instead of striated : the chelicerae, the very distal regions of the segments of the legs, a very small area at the very anterior end of the propodosoma (at the base of the gnathosoma) ventrally, and in areas lateral to the male genital aperture.

On the ventral surface, and posterior to the 2nd coxa on each side, there is a conspicuous, inclined, slit-like marking on the integument. The striations or lines in this region all converge towards this marking. As to the significance of this structure, nothing could be stated at the moment [fig. 1].

Dorsal hairs : [fig. 2].

Two pairs of long sensory hairs which stand out as a generic characteristic could be seen on the dorsal surface of *R. eweri*. The anterior pair lie on the dorsal surface of the propodosoma, between the regions of the first and 2nd coxae. They point upwards, outwards and anteriorly. The posterior pair lie on the lateral sides of the opisthosoma, they point upwards, outwards and posteriorly. These sensory hairs were mentioned by LAWRENCE (1952) for *R. eweri*, and similar and corresponding ones were mentioned for *R. limacum* by TURK & PHILLIPS (1945). LAWRENCE mentioned that they are sometimes « roughened », an observation which the present writer failed to confirm. In all the preparations examined for this work, these hairs were noticed to be perfectly smooth. Their length reaches 50 μ , in 460 μ specimens.

Just anterior to, and to the outside of the sockets of each of the anterior pair of sensory hairs, there lies a short and stumpy process arising from a rather small, inconspicuous socket. Sometimes these stumpy and very short « hairs » [4 μ] show signs of being roughened. These short processes could be easily missed.

Besides the above-mentioned hairs there are five other pairs of dorsal hairs, all of which are of the type found on the legs and which carry secondary hairs on a considerable part of their length, but have smooth distal portions. Their arrangement is shown on fig. 2. One pair lie outside above the region between

the coxae of the second and third legs. The other four pairs lie more to the inside along the length of the body.

Ventral hairs : [fig. 1].

There is one hair on the ventral side of the third coxa. More to the inside, the first pair of hairs on the ventral surface lie to the inside of the bases of the first coxae. The second pair lie opposite the third coxae close to the middle line, with the third pair posterior to them and opposite the fourth coxae. The fourth pair of ventral hairs lie opposite and to the outside of the anal opening, one on each side and nearer to the outer margins of the opisthosoma.

Apart from these medium sized hairs, about fourteen other pairs of hairs lie around the anus and genital aperture as shown in figs. 1 and 6, *a* & *b*.

Gnathosoma.

This anteriormost region of the mite's body is triangular in general outline, with its broad base attached to the next region of the body or propodosoma. Laterally, or in vertical section, the gnathosoma appears flattened and slightly ventrally directed distally.

In the following is given a description of the mouth parts constituting the gnathosoma.

1) "*Mandibles*" : [fig. 4, *a* & *b*].

The most dorsal constituents of the mouth parts are in the form of two triangular plates, with broader bases and narrower apices. Their inner straight edges, facing each other, are more chitinated and leave a very narrow space between them. It is at the proximal end of this straight edge of each plate that the trachea of each side opens. The corresponding plates of *R. limacum* were referred to by the term "*mandibles*" in TURK & PHILLIPS' monograph (1945).

Each of the two plates or "*mandibles*" has a ventral concavity on its distal extremity, and from this concavity arises a fine, sharp-pointed chitinous tooth. The two teeth point slightly ventralwards and seem to be among the main piercing organs.

Slightly ventral to the mandible, a shorter median triangular plate extends from the anterior end of the propodosoma and reaches halfway along the mandibles' length. It is a very thin or dorso-ventrally flattened plate, and the larval tracheae seem to run along its margins.

The mandibles carry striations running along their length on their dorsal surface.

2) *Chelicerae* : [fig. 4 *b*].

Two triangular massive structures, with thicker bases and pointed apices which carry teeth. The ventral, and exposed, surface of each of the chelicerae is not striated but dotted and carries a basal hair.

Distally each chelicera carries two chitinised teeth, a broader, longer and more dorsal one, and a shorter more ventral one.

The inner edges of the chitinised teeth, as well as those of the basal portions of the chelicerae are concave forming a half cylinder, which, when applied to the corresponding inner edge of the opposite chelicera, form a tube that leads to the pharynx.

The very ventral inner margins of the chelicerae are more strongly chitinised than the bulk of these organs, and the chitinisation is continuous with the endosternites of the gnathosoma.

3) *Hypopharynx* : [fig. 4, *a* & *b*].

Projecting from the anterior end of the tube formed by the chelicerae, there is a style-shaped cylindrical structure, with a conical sharp-pointed tip, extending slightly further than the anterior ends of the chelicerae formed by the longer pair of teeth.

Halfway along the tube formed by the chelicerae, the tube dilates, and lodges a club-shaped structure which occupies its lower half and this has the appearance of a sort of tongue.

4) *Pedipalps* : [fig. 4, *a* & *b*].

These lie lateral to, and slightly more dorsal than, the chelicerae. Each pedipalp is formed of three segments of which the basal is long while the middle and distal ones are much shorter. The distal segment or tarsus of pedipalp carries two hairs of the pilose type, and a short flattened "blade" which could be made out only by using an oil immersion lens.

Legs.

As figured by LAWRENCE (1952) for this parasite, and as described and figured by TURK & PHILLIPS (1945) for *R. limacum*, the four pairs of legs are arranged in two groups : the first and second coxae being attached to the ventral side of the anterior portion of the body or propodosoma, while the third and fourth legs are attached to the ventral side of the body at a more posterior level, that of the metapodosoma. The four legs are nearly equal in length, with the first pair slightly longer than the rest, and the last or fourth pair slightly shorter than the 2nd. and 3rd. In this, *R. eweri* differs from *R. limacum* as described by TURK & PHILLIPS (1945), where the last pair of legs is the longest. The two anterior pairs of legs are directed forward, while the 3rd. and 4th. pairs are backwardly directed.

Each leg is formed of six segments of which the coxa is the largest and is attached to the undersurface of the body with the result that only a very small part of its distal portion could be seen dorsally. The proximal portions of the coxae contain a complicated network formed by the chitinous skeleton or endosternite,

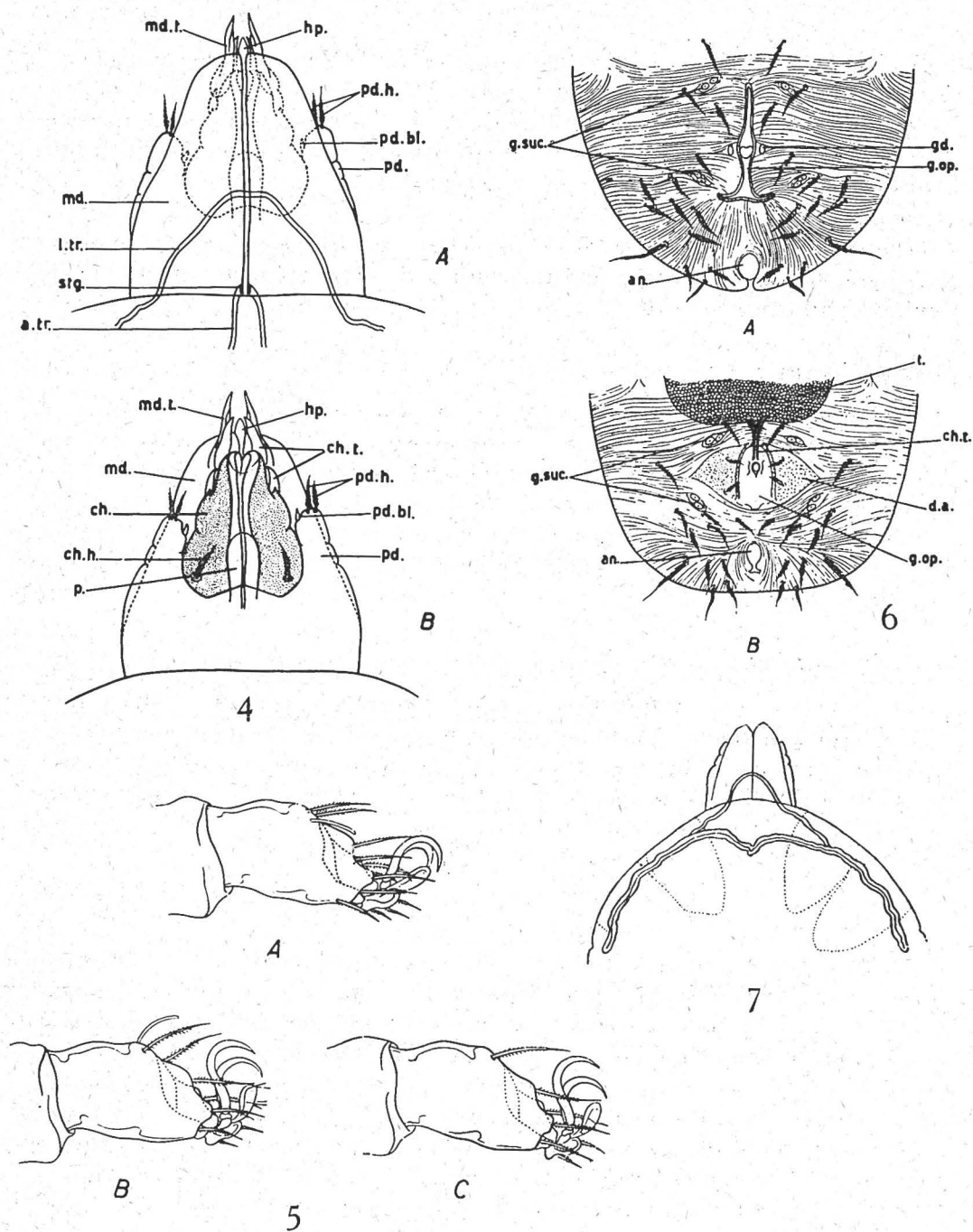


FIG. 4. — The gnathosoma drawn from the dorsal aspect, A ; and from the ventral aspect, B ; FIG. 5. Lateral aspects of distal ends of the legs showing the tarsal hairs, claws and pulvillus : A, of 1st. leg ; B, of 2nd. leg ; and C of 3rd. and 4th. legs ; FIG. 6. — Ventral aspect of the posterior ends of the abdomens of A, the female ; B, the male ; FIG. 7. — Larval tracheal system.

which at the same time, define the outline of these coxae in mounted preparations. The chitinous endosternites of the other segments of the legs are less complicated than the network referred to for the coxae.

Apart from the coxa of the third leg, the coxae of the other legs carry no hairs. As referred to above, the inner or proximal part of the third coxa carries a medium sized hair.

In the following is given a table of the hairs of the four segments of each leg excluding the coxae, and the tarsi which will be described in detail further on.

Leg	Trochanter	Femur	Genu	Tibia
1 st. leg.....	0	2	4	4
2 nd. leg.	0	2	4	3
3 rd. leg.	0	2	3	2
4 th. leg.	0	0	1	2

The hairs on these podical segments are "feathered" like most of the body hairs, and have a simple apical portion which is nearly of the same length as the feathered portion. In this way, they present a difference from the tarsal hairs which will be described later.

Close to the socket or base of one of the tibial hairs of Leg 1, there is a conspicuous socket which lodges a very short process very similar to the one existing on the propodosoma close to the anterior sensory hair. There is no evidence of the presence of similar structures on the tibiae of other legs.

The Tarsi and their hairs :

The tarsi differ from the other leg segments in the fact that they are only cylindrical at their proximal halves, while their distal portions contain a dorsal cavity into which the claws could be withdrawn. In other words, the ventral and lateral edges of the tarsus extend distally more than does its dorsal portion. On the dorsal surface, the tarsus is nearly half as long as it is on the ventral one. The lateral extensions have prominences on which are carried lateral hairs. In this manner a sort of pocket is afforded which receives the claws and pulvillus and into which they could be drawn upwards and backwards.

The tarsal hairs are carried on the distal half of the tarsus and in close proximity to the above mentioned pocket and to the claws. They differ from the body hairs and thus from the hairs carried by the other leg segments in the fact that their smooth distal portions are only very tiny, i. e. the hair is feathery on almost its whole length.

The two sharp and curved claws are carried on the dorsal surface of a ventral, median, finger-like process. And on the dorsal surface of the same process, and between the two claws lies the pulvillus. It is laterally flattened and looks like a median spine when seen from the dorsal side. Its lateral surface, however, has a broader oval outline and from its lateral sides arise three pairs of very fine simple hairs.

The number of hairs carried by the tarsus differs in leg I from that of leg II and this also differs from the number on the tarsi of legs III and IV.

Hairs on the tarsus of Leg I. [fig. 5, *a*].

1. Dorsal hairs.

Two asymmetrically arranged hairs, one of which lies at the middle line of the tarsus while the other lies to one side of the tarsus (towards the inside of the animal). Towards the outside, and in a position corresponding to that of the latter hair, there is a simple, curved, claw-like process of uniform diameter and blunt tip.

2. Lateral hairs.

Of these there are three pairs, carried on lateral prominences. The most ventral pair of these lie on either side of the finger-like median process carrying the claws, with the result that, when looked at from the ventral side, the tarsus shows three "fingers".

3. Ventral hairs.

These are represented by two pairs of hairs which are shorter than the dorsal and lateral ones. The anterior pair of ventral hairs lie very close to the median "finger" carrying claws and pulvillus. Thus the total number of feathery hairs on tarsus 1 is six pairs.

Tarsal hairs of 2nd. Leg. [fig. 5, *b*].

1. Two dorsal hairs which are symmetrically arranged on either side, with the simple claw-like process lying between them exactly in the middle and not on the outside like the case in tarsus 1.

2. Two pairs of lateral hairs.

3. One pair of ventral hairs.

The total number of feathery hairs on tarsus 2 is thus four pairs.

Tarsal hairs of 3rd. and 4th. Legs. [fig. 5, *c*].

The tarsi of the 3rd. and 4th. legs are exactly similar to each other and differ from that of leg 1 in the following.

1. The claw-like simple process is completely missing.

2. Its place is taken by a median feathery hair.

3. There are two lateral pairs of hairs only.

4. One pair of ventral hairs.

The total number of feathery hairs on each of legs III and IV is three pairs plus one median dorsal.

Genital apertures :

LAWRENCE'S (1952) description of the genital aperture of *R. eweri* was very brief and obscure. He wrote : " The genital opening is small and not clearly defined in the different specimens mounted : in some of them it appears to be T-shaped, in others, oval with a thickened chitinous rim ".

From the observations made in the present work, it could be stated with certainty that the T-shaped genital opening is that of the female specimen as it has always been noticed to coincide with the presence of ova or developing young inside the specimen. On the other hand, and as will be shown further on, the oval opening with a thickened chitinous rim belongs to the male form.

In the following is given a description of both openings and the area of integument in their immediate vicinity.

Female genital aperture, [fig. 6, *a*].

This opening is in the form of an inverted T, with the median limb pointing towards the anterior end of the animal. This median limb, however, is divisible into two segments of equal length : a basal, usually broader segment attached to the posterior transverse limb of the T ; and a more anterior and narrower, slit-like segment. Between these two segments, the genital opening widens and presents a lozenge-shaped pore. The shutter-like valves closing the female genital aperture in *R. limacum* described by TURK & PHILLIPS (1945) are completely missing.

The integumentary striations of the ventral surface of the opisthosoma proceed right to the very edges of the genital aperture, and they are, everywhere, vertical to these edges.

LAWRENCE (1952) did not describe or figure any genital suckers, but he did not dismiss the possibility of their presence, as he stated : " genital suckers may be present, but if so they are extremely small ". Indeed this was a correct statement inasmuch as the size of the suckers is concerned, especially of *R. limacum* (Turk & Phillips, 1945). In *R. eweri*, it is really difficult to make out the genital suckers as they are of much smaller size, and do not lie as close to the genital aperture as do those of *R. limacum*. Of the genital suckers there are four pairs, two of which lie laterally opposite to the anterior end, and the other two opposite to the posterior end of the genital aperture [fig. 6, *a*]. Besides, two other spots which are free from the integumentary striations could be identified, one on either side of the lozenge-shaped opening already referred to. These should be considered as corresponding to the " genital discs " of *R. limacum* (Turk & Phillips, 1945), and not to genital suckers, as they are too small and do not present any central depressions.

On each side of the genital aperture lie two of the fourteen short hairs mentioned before.

The six-legged larvae and the early or protonymphs have never been noticed

to show anything corresponding to the genital aperture, the only opening discernible in the posterior region of the body being the anus, which opens at the posterior extremity of the opisthosoma. As the nymphs grow older, however, the genital aperture appears. The appearance of the genital aperture seems to be accompanied by a change of the tracheal system from the larval and early nymphal state to that of the adult tracheal system. This will be discussed further on.

Male genital aperture, [fig. 6, *b*].

The shutter-like valves surrounding the male genital aperture of *R. limacum* are also missing in this case. The outline of the male genital aperture of *R. eweri* is nearly oval with well chitinised lateral edges. The anterior margin is nearly leathery, and the posterior margin is only faintly chitinised and shows two indentations. In the central region of the aperture there are chitinous structures reminiscent of the gonopods of insects, and they enclose between them a circular opening with a chitinised rim. To this pore is connected a strongly chitinised, cylindrical structure, which runs anteriorly and inwards, to end inside the animal by a funnel-shaped opening attached to a spherical gland which shows through the integument. The latter gland is made up of very small cells. The anterior half of the chitinised style just described is covered by the integument of the animal, while its posterior half is exposed inside the genital aperture. In no case were individuals having this type of aperture found to possess ova or embryos, which is the rule in case of the female specimens. The spherical gland containing small cells referred to above should be nothing but the testis.

The integumentary striations of the neighbouring region present a clear difference from those of the corresponding regions of the female. On both sides of the male genital aperture the striations diverge leaving a free triangular area next to the strongly chitinised lateral edges of the opening. This striation — free area carries fine dots like those present on the chelicerae and the tips of the leg segments. Four pairs of genital suckers like those described for the female are present in case of the male and in corresponding positions as well. The distribution of hairs in the vicinity of the genital aperture here is the same as in the case of the female, with two pairs of hairs in close proximity to the aperture [fig. 6, *b*].

Tracheal system.

In the six-legged larva, as well as in the early nymphal stages (in which the genital aperture is completely missing), the tracheal system stands out clearly and presents marked differences from that present in the later nymphs and adults.

1. *Tracheal system of larval and early nymphal stages* : [fig. 7].

From a common spot in the centre of the propodosoma, and very close to the dorsal integument, a double series of tracheae proceed on each side laterally and then posteriorly and ventralwards to a point between the 2nd. and 3dr. coxae.

A tracheal branch is given off from each of these loops, and runs very close to the anterior margins of the propodosoma, penetrates through the base of the gnathosoma, and joins the corresponding tracheal branch of the opposite side.

Apparently, at this stage, the system is a closed one, there are no obvious stigmata, nor are there any tracheae supplying the posterior regions of the body.

This description is in accordance with that of LAWRENCE (1952), who, however, records its presence in all the immature forms. In the present investigation, a number of later nymphs undergoing, or just emerging from, ecdysis were encountered, and were found to possess tracheal systems characteristic of the adult or mature forms, and which differ from the larval tracheal system as will be described further on.

The continuity between the two tracheal branches leading from the two loops is so complete, that one is bound to conclude that definite stigmata are altogether missing in the larval and early nymphal stages. In this concern, the species under investigation differs from other prostigmatate forms like *Thyas petrophilus* (Michael, 1895), where there are stigmata in the larva placed in cut away concavities in the basal portion of the mandibles. In *R. limacum* (Turk & Phillips, 1945), there are similarly placed stigmata in the larva. In the latter species the larva possesses a completely different tracheal system, which is in the form of two straight tubes running from the stigmata to the posterior end of the body, where they become connected by a transverse commissure. The authors (TURK & PHILLIPS) gave ample evidence as to the primitiveness of such system. They mentioned that the air sacs so characteristic of the *Acari* are completely missing in the *R. limacum* larva. This certainly holds true for the larva of *R. eweri* as well.

2. Tracheal system of Adult and later nymphs : [fig. 8].

Due to the small number of specimens examined by LAWRENCE (1952), he was not able to identify the faintly chitinised tracheal system of the adult *R. eweri*, and thus he stated that no tracheal system can be seen in any of the adults. In *R. limacum*, HALLER (1912), described an elaborate tracheal system. TURK & PHILLIPS (1945), however, working on the same species were unable to see more than a minute basal piece of trachea leading from the stigmata and opening into a small curved air sac. According to the latter authors, this reduced tracheal system is very little chitinised and extremely difficult to see. They did not exclude the possibility of the presence of a more elaborate system which was difficult to make out.

In the present work, it took a large number of specimens and a few mountants to reveal the presence of a tracheal system in the later nymphs and in the adults. The very slightly chitinised system takes in the mountant soon after the preparation is made, and it usually becomes very difficult to make out any part of the tracheal system a short time after mounting the specimen. Immediately after making the preparation, however, parts of the tracheae stand out very clearly as they still contain some trapped air. This is especially true of the

first parts of the tracheal system into which the stigmata lead. The mountant which gave best results in this concern was plain glycerin.

The stigmata, though missing in the larva, are definitely present in the adult in the form of two fine pores located on the inner edges of the "mandibles" at their posterior extremity. Each stigma leads into a tracheal trunk which proceeds posteriorly, follows a dorsal course for a short distance, and then is directed ventrally again. Each tracheal trunk widens on its way into what may be considered

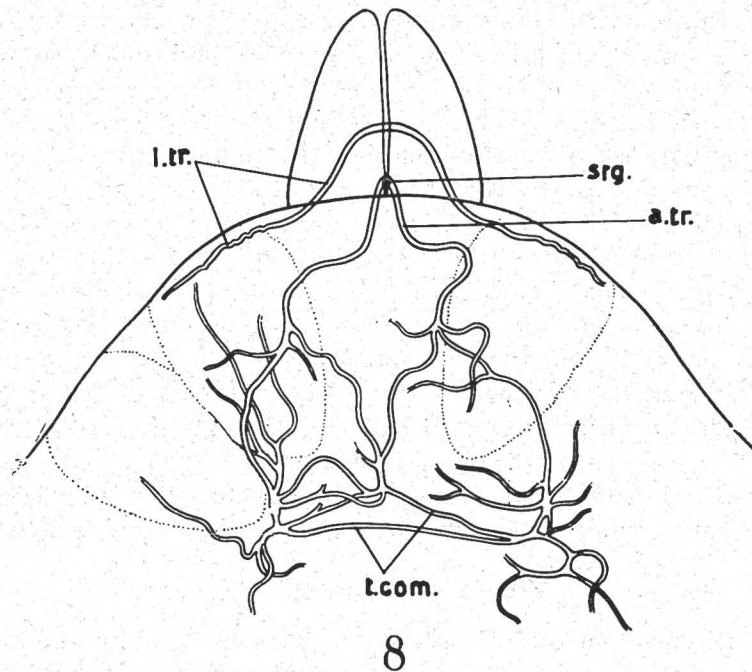


FIG. 8. — Tracheal system of the adult mite.

air sacs. There are about four of these on each side. From each of these air sacs are given off very narrow and faintly chitinised tracheal branches. The two lateral systems are connected together through transverse commissures. The whole system does not extend backwards further than the second coxae, and there is no sign of any tracheal system in the mite posterior than the limit of these coxae.

No traces of the double series of tracheae described for the larvae and early nymphs could be seen in the adult. There is evidence, however, that the tracheal branches leading from this double series into the gnathosoma persist in the adult, although it was not possible to follow their posterior relations, as they are difficult to see and they run very close to the anterior margin of the propodosoma.

Summary.

1. — In the present work, the parasitic mite *Riccardoella eweri*, which was first described by LAWRENCE (1952), is being recorded in Egypt for the first time on the Maculated Egyptian Toad — *Bufo regularis* Reuss.

2. — Observations are made on the general form of the body both from binocular examination of anaesthetised live mites and from mounted preparations. The body is heart-shaped and not oval as mentioned by LAWRENCE (1952).

3. — The different mouth parts constituting the gnathosoma are described in detail.

4. — The number and position of the body hairs of the mite are given.

5. — The legs are described and the number of hairs on their different segments recorded and found out to differ from one leg to the other.

6. — Special attention is given to the tarsal hairs concerning their position and number. In this concern, leg I is shown to present marked differences from leg II, which in turn differs from legs III and IV. The latter two have the same tarsal hairs.

7. — The genital opening and the area of skin in its immediate neighbourhood are described in detail in both sexes.

8. — Such differentiation between the male form and the female form is being carried out for the first time, and is based on the constant occurrence of ova or developing young in the female form, and a testis with tiny sperm cells in the male form.

9. — The tracheal system of the larval and early nymphal stages is examined and found to agree with LAWRENCE'S (1952) description.

A tracheal system in the adult is being described here for the first time and is found to have a pair of stigmata opening on the inner edges of the bases of the mandibles. The two main tracheal trunks give off a considerable number of branches and are connected through transverse commissures. The whole system does not extend backwards further than the region of the 2nd. coxae.

Abbreviations used in Figures.

an.	anus.
a. tr.	adult trachea.
ch.	chelicera.
ch. h.	cheliceral hair.
ch. t.	cheliceral teeth.
d. a.	dotted area next to male genital opening.
gd.	genital disc.
gn.	gnathosoma.
g. op.	genital opening.
g. suc.	genital suckers.
hp.	hypostome.
l. tr.	larval trachea.
md.	mandible.
md. t.	mandibular tooth.
ms.	metapodosoma.
os.	opisthosoma.
p.	tongue-like process inside pharynx.
pd.	pedipalp.
pd. bl.	pedipalp blade.
pd. h.	pedipalp hair.

ps.	propodosoma.
sr.	scar to which striations converge.
stg.	stigma.
t.	testis.
t. com.	transverse tracheal commissures.

LITERATURE

- BERLESE, (A.), 1924. — Acari Nuovi, Centuria Sesta, *Redia*, 15, 121.
BERLESE (A.) & TROUESSART (E.), 1889. — Acari, etc., *Bull. Bibl. Ovest.* 2, 141. [From TURK & PHILLIPS (1945)].
HALLER (B.), 1912. — Über die Atmungsorgane der Arachnoiden. Ein Beitrag zur Stammesgeschichte dieser Tiere. *Arch. Mikr. Anat.* Abt. 1, 79, 1.
LAWRENCE, (R. F.) 1952. — A new parasitic mite from the nasal cavities of the South African Toad, *Bufo regularis* Reuss. *Proc. Zool. Soc. London.* 121, 747.
MICHAEL (A.), 1895. — A Study of the Internal Anatomy of *Thyas petrophilus*, etc. *Proc. Zool. Soc. London.* 1895, 174.
OUDEMANS (A. C.), 1929. — Kritisch historisch Overzicht der Acarologie, etc. *Tijdschr. Ent.* 72. suppl., 254.
— 1931. — Acarologische Aanteekeningen. *Ent. Ber. Amst.* 8, 253.
THOR (Sig.) 1929. — Über die Phylogenie und Systematik der Acarina. *Nyt. Mag. Naturv.* 67, 145.
TURK (F. A.) & PHILLIPS (S. M.), 1945. — A monograph of the slug-mite *Ricardoella limacum* (Shrank). *Proc. Zool. Soc. London.* 115, 448.
VITZTHUM (H. Graf.), 1931 a. — Terrestrische Acarinen, etc. *Arch. Hydrobiol. Plankt.* Suppl. 9, 79.
— 1931 b. — Acari in Hukenthal und Krumbach. *Handbuch der Zoologie*, 3, 2, 123.

ACKNOWLEDGEMENT

The writer wishes to express his gratitude to Dr. Harry Hoogstraal, Head of the Department of Medical Zoology, United States Medical Research Unit No. 3, Cairo, for reading the work and for valuable advice.
