NOTES ON THE "APPLE BARK-LOUSE,"

(*Lepidosaphes conchiformis*, Gmelin sp.)

With a description of a supposed new Acarus.

BY HENRY SHIMER, A. M., M. D.

I have made the Apple Bark-louse an object of very careful study for several years, for the purpose of becoming better informed of its natural history; and to determine, if possible, upon some feasable plan of destroying these highly injurious insects; or to gain any information that might be learned regarding its natural enemies, &c.

The leading practical Entomologists of our country, have given very poor satisfaction regarding the natural history of this very important insect. Dr. Harris assures us that the young Bark-lice wander about on the tree for ten days, and then attach themselves; and that there are two broods of them in a season. Dr. Fitch states that "these scales are the relics of the bodies of the gravid females, covering and protecting their eggs." (1st and 2nd *Report Noxious Insects, New York*, p. 32.) Others state that the eggs are laid in a sack or pouch, &c.

My observations contradict these statements, and I therefore give a synopsis of them, extracted from my Notes of the present year, with the dates of such of the observations as appear useful in defining the *true* natural history of this insect.

June 9, 1867.—A delightful, sunny morning, following several beautiful days; thermometer at noon, 86° Fahr. At 9 o'clock, A. M., I saw, by the aid of a pocket-lens, millions of young bark-lice running about briskly over the limbs of the apple-trees, and on the leaves and their petioles. This is the first day of their appearance on the bark; whether they were hatched and remained a few days under the scale, or not, I cannot say; but I believe that they were just hatched this morning.

Description of the young "Apple Bark-louse."

Form ovoid. Length .01; breadth .005; thickness .0025 inch.

Color pale yellow, with a reddish-orange spot near each extremity. Two long, pliable, tapering hairs project backward from the posterior extremity of the abdomen; these taper to a very slender point, and as

they drag over the slide, are seen greatly to impede their motion, on account of the precipitation of a very slight film or moisture on the slide. Six short spines are seen to project from the forehead, and many all around the body. *Feet* one-jointed. Two finger-like organs. —*digituli*—(*Proc. Acad. Nat. Sciences, Phil.*, Jan. 1867,) are readily seen projecting beyond the extremity of the tarsi, with enlarged extremities, but which are not globular, as in the *Dactylosphæridæ*. These extremities appear much like *arolia* or *pulvilli*, which I am convinced they are, from various observations.

But upon a closer examination of the feet, we find four of these digituli, the upper pair being apparently longer, as seen from above, the under pair is set somewhat farther back on the tarsi beneath, and usually, when walking, both these lower digituli are directed forward to aid in locomotion, when they appear bent forward; sometimes, however, when the leg was not in vigorous motion, or when it was injured somewhat, I saw them closed on the foot beneath, very much like the thumb in the palm of the hand; and then the movements of the insect were very awkward, manifestly lame. I have frequently seen under close examination, with a one-twelfth inch objective, that the insect, when walking naturally and in possession of its full powers of locomotion, invariably projects the two inferior digituli obliquely forward, and that it supports its weight upon them; the upper digituli frequently bend into quite a curve in walking, thus proving that they are coreaceous or membranaceous, and not corneous.

These digituli are, without doubt, of the same material as the leg. Repeating my examinations of these tarsal organs, on the following days, I have noted that the tarsal segment is very short, almost inconspicuous as to its separation from the tibia; the digituli almost appear to sprout out of the lower end of the tibia, so short and undeveloped does the tarsal segment appear under the microscope.

In form, all the digituli are somewhat tapering towards the distal end, and terminated by an enlargement or disk; the two digituli beneath present the most conspicuous disks, which, under the micrcosope, appear blackish. The lower digituli are invariably directed forward when the insect walks. This bending forward is caused by the muscular exertion of the insect as it pushes its body onward, giving thereby, sufficient backward pressure on the foot to make the digituli, on which its weight is sustained, to bend forward as already described.

This proves two things:—1st. That these organs beneath are true digituli, or organs, at all events, that are sufficiently pliable to bend

readily, and are not horny claws. 2d. That whatever they may be, they sustain the weight of the body. I am sure that they sustain the entire weight; no part of the tarsal joint or tibia rests on the slide, and consequently are of greater proportional strength than hairs could be presumed to have; for two *hairs* on the sole of each foot would not support the weight of any animal, at least in larger animals where we are better capable of examining hairs and other dermal appendages. We never find *hairs* thus capable of producing such support. Whoever may think that these organs are hairs, will find them of a different structure, and by such examinations and reflections will see that they are out of all proportion, for hairs, when compared with the minute size of the body itself; moreover, the disks, or suckers, on the extremity, is another argument against regarding them as hairs.

I breathed upon the glass plate, and the precipitated moisture caused the setæ of the abdomen to adhere to the slide, and thus prevent the usual rapid locomotion of the insect or retard its progress entirely; but like a good ox it pulls and struggles faithfully, sometimes backing up, taking a fresh start, or turning in the opposite direction; thus it perseveres perpetually while life lasts. This manipulation gives an excellent opportunity to view the tarsal appendages, for it uses every means in its power to aid locomotion, and thereby spreads apart all the organs nature has provided, so that they can all be seen with entire satisfaction.

These methods of examination are infinitely superior to any method of examining the dead specimen, for by no possible contrivance can we manipulate these delicate organs so well as the animal itself, when placed in the proper conditions.

The anal setæ are more than one-half the length of the body, of cappilary fineness, and at the distal end so slender as to appear as a fine point under the one-twelfth inch objective.

Prolonged and repeated observations confirm what has been stated above; the more I examine the feet, the more I am convinced of the brevity of the tarsal segment. The tarsus here is composed, probably, of but one primitive segment or ring, while the longer tarsal joints of other insects are composed of many, and the tibiæ of scores of rings as I have shown in the *Proc. Acad. Nat. Sciences, Phila., Jan.* 1867.

I succeeded in crushing several of these little insects very slightly, just sufficient to cause them to lie on the side (an operation easier spoken of than performed), by which manipulation I saw the four digituli more nearly equal than in any other field of view. The tarsi, there-

fore, are terminated at the extremity by four finger-like organs,—are split up into four parts, the lower pair of digituli appearing farther back by virtue of the obliquity of the extremity of the tarsi. These are the only organs of prehension or locomotion, the claw being so undeveloped as to be useless, so far as I could learn from the living animal in every possible field of view under the microscope. Indeed, I am not able to see any claw-like organ, in even the most imperfect state of development, on any part of the foot, although I tried faithfully, by crushing the insect in every possible manner, so as to bring the foot into every view in the field of the microscope; yet, reasoning from analogy, we can hardly believe that it is without ungues; but, scientifically, how can we assign a place to a thing that cannot be seen? for in anatomy we can only know by seeing.

Antennæ with about seven joints, five subequal, the last two smaller, terminated by two short branches, or forking into two parts; two spines on the distal end of the fifth joint, about as long as one of the joints; color same as that of the body and legs.

At 3 o'clock, P. M., I went to a cool cellar and brought out an apple limb that I had deposited there in the morning, well stocked with young Bark-lice; they were all quiet—no signs of a change into the scale-like state; they had the same pale yellowish-white appearance, with an orange-yellow spot near either extremity, as observed this morning; they were all motionless, but after a few minutes' exposure to the warmth of the outside atmosphere, they began to move as they were doing in the morning. I then went to the orchard, and found more than one-half of the lice located, many of them already presenting a very complete scale-like appearance; others were but just locating, and yet capable of moving their limbs,

The transformation from the moveable to the fixed or scale-like state, after anchoring themselves by the proboscis to the bark, is effected by the operation of moulting or shedding their skins, which must be done by rupturing it either along the sides or beneath, for at this time the scale can be removed, and the free insect can be isolated beneath in a memberless state. I carefully detatched some of these insects, and, by microscopic examination, could detect the form of an independent being, but no motion. In those most recently moulted, I can plainly see the legs, even the digituli in the skins, but in somewhat of a curled or distorted condition, and in a little while they become fully dry, when they are found to have lost all trace of their limbs and former appearance.

The insects lie motionless beneath the scales, with their backs humped up, and the belly a little concave, presenting some resemblance to a menicus glass. The sharp-pointed proboscis may be seen, in some cases, projecting a little downward and into the bark, if we are sufficiently fortunate to separate the scale properly.

The insect is now perfectly free from its outer garment, and in casting it off it has pulled off its legs, antennæ, &c.; henceforth it lives beneath it as under a roof, and having no more use for legs it has amputated them.

Evening.—Very few are free and moving. Strangely to me, after reading from reputable Authors that they fix themselves in about ten days, I behold so great a change, in one beautiful, warm, summer day. None of those on the apple limb in the cellar have located themselves, and I am not able, at least, to detect any in the scale form.

June 10th.—I examined the apple-trees this morning, and found a very few larval Bark-lice crawling about on the limbs. Afternoon and evening very showery.

June 11th.—I find a very few larval Bark-lice running on the apple limbs. I re-examined the feet of these insects and find the same appearance as above noted.

July 1st.—The young Bark-lice have grown considerably. The scale has received an enlargement by a second addition to the posterior extremity of the first, or original scale over the head, which is in its primative location and of a yellow color. The insect, by growing, extends backward from the primative point of attachment. The color of this second addition to the scale is hoary cinereous or incanus. The first, or old scale, can readily be separated from the second; the attachment has not yet grown firm.

This scale, which so much resembles a waxy exudation, is really the cast-off skin of the insect, cemented, by some kind of an exudation, to the bark, and the several pieces of separate moultings are cemented into one roof-like habitation. What this exudation may be, is a matter open to reflection and examination. Is it an exudation from the whole surface of the body, from the anus, or from secreting tubes in the abdomen, as the honey-tubes in some of the Aphidians? That it is not a surface secretion, we know, from the fact that the integument is always free from the scale, and the body is as strictly articulate as that of any other insect. The absence of honey-tubes prove that it is not secreted by such organs. I have not seen this secretion being deposited, and presume that it will be difficult to detect; but as it is deposited

gradually during the summer, it must be a secretion of some kind from the posterior end of the abdomen; and as I was not able to detect any excrement inside of this habitation at any time during the summer, I believe it to be excrementitious matter, deposited in a semi-liquid state, which, upon drying, is the impervious tenement of the insect. This idea may appear ridiculous to many, that an insect should use its own dung to patch its old cast-off garments and thus construct a comfortable house. Instead of being absurd, however, it is an example of unparalleled economy. Neither is it without a partial example, for the larva of *Lema (crioceris) trilineata* Olivier (the Three-lined Leaf-beetle, see *Harris' Inj. Ins.* p. 119,) which covers its back with its own dung to protect it from the sun and injurious insects.

But in this Apple Bark-louse we have one of the most wonderful examples of the economy of nature—a naked insect anchored on the limb of a tree, exposed to all the inclemency of the elements, too poor to secure the labor of others more favored by the Goddess of Fortune, doomed to remain fixed to the spot for life, without limbs to help itself, unable to rob some poor sheep of the fleecy covering on its back, or to secure the products of a cotton-field: not provided with the silk of the caterpillar, nor yet able to employ a weaver or tailor. In such a deplorable condition it does not despair, but diligently uses the only means at its command—its cast-off exuviæ and excrement, by which it constructs a shelter that protects, not only itself, but also its eggs from the sun and rains of summer, and the piercing blasts of winter, with the thermometer 20°, 30°, and even 40° below zero. Truly, the works of nature are infinitely variable, wonderful in their extremes, and remarkable in adapting means to ends.

July 7th.—Examined the Bark-louse microscopically. They are easily separated from their scales. They present at this time a flattened flask or jug-shaped appearance, in profile, obovate. The abdomen is very large, the sides crenate, the abdominal extremity with a distinct notch, the segments plainly visible, the neck and head narrow. Color yellow. A few short hairs are visible around the margin of the abdomen. Is is motionless, appearing pupa-like, except in wanting marks of developing legs and wings. Length .04, breadth .02 inch. Concave beneath, convex above. At this time a few of them appear to be dead and drying up, but mostly when crushed a reasonable quantity of liquid juice is seen. The accidental arrest of development in this state has led some, erroneously, to think that these small scales are male producing.

July 21st.—The Bark-louse has grown much, has moulted again, and its scale now presents three parts, distinct divisions, and consequently is becoming thicker and stronger from day to day. Each new skin cast and its cement are light ashen-grey, which together make an addition to the scale at its posterior end, for by several such increments is the scale constructed, somewhat simulating shell growth in Mollusca, but the upper older portion of the scale is reddish-brown. The insects beneath are white, instead of yellow, as noted on the 7th, evidently having just moulted; now, if the scale be turned up carefully with a fine instrument, the insect will be found attached by the thread-like organ (proboscis) which arises out of a groove towards the anterior extremity of its ventral surface; this groove is formed by two ridges, by this slender proboscis it holds on to the tree with great tenacity; if the scale is entirely removed the insect hangs fluttering in the breeze. I have noticed a similar trembling or jerking motion of the insect when protected from the wind, probably a muscular effort expressive of dissatisfaction at the loss of its covering. When thus exposed for a few days it invariably falls off and is lost; its house is, therefore, necessary to its life.

July 31st.—I now find the Bark-louse scale of nearly full size and normal color; the insect snugly enclosed; the edges of the scale much thickened and turn in under the body, firmly glued to the tree. The insect no longer presents the jug-shaped form, but is oblong-ovate and very suculent, and when crushed the eggs can be seen.

Here and there, over the tree, I observe one out of about five hundred scales, that present an abnormal form and color. They are papery-white, and much longer than the usual dark-colored scales, but I am not able to discover any difference in the insect beneath the scales, that is between this and those of the normal scales.

Aug. 11th.—I observe that they are beginning to lay their eggs, and from one to a dozen can be found under each scale, towards the posterior extremity. The form of the insect is now oblong-ovoid, flattened, cylindrical, instead of obovate, as observed during the progress of development. The insect is attached by the same thread-like organ, which is about as long as the body, and produces the same jerking motion after the scale is removed. It may now be seen, when the scale is removed, by the naked eye at the distance of a yard or more, shaking and jerking as if agitated by the wind.

Aug. 17th.—I observe that the egg-laying season is progressing rapidly; most of the scales are filled with white eggs, posteriorly and

along the sides, where she can reach with her abdomen to deposit them. A few have already finished laying eggs, and are dead and contracted into the anterior part of the scale. I also observe, that the parent becomes gradually smaller as she deposits her eggs, so that when she is finishing she is not more than one-third the length she was when she commenced, and then she dies, as I already begin to observe in a few instances.

Of a vast number of scales examined, all that arrive to full size are inhabited by fertile egg-laying insects. Occasionally I find a young scale aborted in its origin or at half development; these are found empty, the inhabitants having died from some unobserved cause, most likely from the parasitic insect presently to be noticed. I have not been able to find separate sexes, although I have sought diligently during the entire summer with this object especially in view.

Aug. 18th.—I made a microscopic examination of the thread-like proboscis of this insect, and was able to separate it into three parts at the point of attachment, but did not thus separate it during the entire length.

On the parent insect and among the eggs, I saw an eight-legged parasite* by the aid of a pocket lens. This Acarus has short, stubbled legs, with long hairs on the tarsi; head appearing something like that of a turtle, projecting forward of the body.

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* Having made a microscopic examination of this Acarus, and believing it to be a highly important and interesting insect, as well as new and heretofore undescribed, I suggest for it the following name:—

ACARUS? MALUS, n. sp.

Body pale or whitish; two long, hair-like spines behind the abdomen; posterior extremity of the abdomen emarginate, as seen from beneath. Head and anterior legs ochraceous, the latter having the spines from the lower part of the tibia longer than the limb itself; femur short, much swollen, scarcely projecting beyond the body; tibia swollen above, tapering towards the tarsus; tarsus abruptly smaller than the lower end of the tibia, linear, terminated by a disk—*arolia* or *pulvillus*, the appearance under the microscope being that of the former, without a claw or any other tarsal appendages. The two pairs of anterior legs are well forward, encroaching close upon the head, the two pairs behind the middle of the body somewhat more distant than the anterior pair.

A few long hairs on the abdomen, those especially springing out of the prominences, one on each side of the centre of the posterior extremity of the abdomen are longer than the body itself. The hairs on the posterior legs are much longer than those on the anterior. From the extremity of the snout the mouth organs can be seen as short spines projecting forward. Length .003—.005—.008 inch: breadth half the length.

Sept. 15th.—The egg-laying season is drawing to a close; many of the scales are full of eggs, the females drawn up towards the head; some of them brown, dry and so shriveled up as not to be observable without close search. The eggs are placed somewhat irregularly, more so at the posterior extremity.

When examining a great number of scales, I find about one-fourth of the eggs in a damaged condition; they are brown, or of a ferruginous color. In some of this year's scales all the eggs are thus brown. A close examination proves them to have been dispoiled of their contents, the brown remnants being the dry shells; the parasitic Acarus, above noted, is among them, and sucking the eggs. These insects are very small, and are lying quietly among the eggs, and about the same apparent size as the eggs. Hence, without close examination, may be overlooked when exploring with a pocket-lens; but close search will prove them quite abundant, one or more under every scale thus being dispoiled. They always begin to work among the eggs in the posterior extremity of the scale, hence, I conclude that they enter from without, at the opening at this extremity, left for the exit of the young Bark-louse in the following summer.

Oct. 13th.—I made a careful examination, and find many of the Acari traveling slowly around on the bark of the tree—having dispoiled all the eggs in one scale they are out searching for others. Having greatly multiplied during the last month, I can now find a hundred where I found one a month ago. It is very interesting to behold this great, and heretofore unheard-of, enemy of the Apple Bark-louse; truly, every noxious insect has its enemies, although, like this, they may be hard to discover.

Oct. 22d.—I spent a long time in examining the eggs of the Apple Bark-louse, and exploring the bark of the trees for the Acari; they are

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When this insect is thrown over on its back on a glass plate, it is not able to turn over. These Acari may readily be mistaken for young Bark-lice by the naked eye or through a pocket exploring-lens, because each are very small, whitish, slow-moving animals, and each have long, projecting, abdominal filaments; but the detection of eight legs and the snout-like form of the head in the Acarus, will be diagnostic marks, without a microscopic examination; and the season of appearing is another feature. The color of the head and anterior legs being about the same as that of the empty egg-shells, has raised the inquiry in my mind—may not this color be derived from the juices of the eggs while it is eating? This, however, will remain mere supposition, for the Acarus is rather too small to justify an attempt at "washing his face and hands." There is a bare possibility that the natural color of the head and fore legs is whitish, like the rest of the body.

not so abundant on the bark, traveling around, as during the fine sunny days just passed. They are mostly remaining quiet under the scales, but here and there one may be seen on the bark, although it is quite cool for insect comfort. The careful observer will not confound this Acarus with another yellowish-white mite-like insect, that I find here on the bark of the trees; this runs much more rapidly than my Acarus; its body is, in proportion to its size, much longer, as it appears under my exploring glass. What more might be determined of its habits by careful observation, although very interesting, I have not taken the time to do, neither have I made a microscopic examination. I dont find it under any of this year's scales, therefore I do not believe that it is an egg-eater, like my Acarus; it may be a vegetable feeder, or possibly feeding on the decomposing matter of the scales of former years.

I raised up a great number of the new, this year's—scales, for they are easily distinguished from the old, last year's, scales—and I found that in nine-tenths of them, all, or nearly all, the eggs were destroyed; they are all shriveled skins of a ferruginous color. Of the remainder, only a few, perhaps one-hundredth of this year's scale, are in the possession of all perfect eggs. In the others, at least one-half of the eggs have been destroyed where I conducted my observations; regarding this, I am not able to speak of many different localities.

I have no doubt that the Pomologist, who has not already seen this Acarus, will hail its discovery with great joy; for in this insect I behold the most, and indeed the only efficient, insect-enemy of the Apple Bark-louse that I have been able to discover, during the entire course of my investigations. From my observations it can be seen that, although it may not entirely exterminate the Apple Bark-louse, yet it is exerting a wholesome, restraining influence, doing much more than man could do, without great trouble and expense, with a thousand washes—an unobserved microscopic object of deep interest.

Of methods for destroying the Bark-lice, I observed that, when they are just hatched, a strong, common, soft soap-suds is as effectual as anything; when wet with it, the insect dies in a moment; but after the scale is formed the case is more difficult, and soon the strongest washes will not affect them. A hint to the wise is sufficient—watch for the hatching of the young Bark-lice a few days after the appearance of the blossom. This year here it occurred about ten days after.

Mt. Carroll, Ill., November 1, 1867.

NOTE

The structure of the feet above noted, is very peculiar and interesting, and in a measure, appears to separate this insect from the *Coccidæ* proper. Its scale-like habitation would appear, from casual observations, to be the insect itself, and, therefore, to retain it in that family; but a thorough examination proves the insect to be distinct from the scale, which it only uses for a habitation; therefore, truly, also appears to separate it from the *Coccidæ* of former authors, which is a *scale-like* insect, and this a *scale-making* insect. In that, the scale is the body of the female, while in this the scale is a constructed roof or habitation, and is as distinct from the insect that lives beneath, as our houses are distinct from ourselves.

If this insect is never found in the winged state, (and after the most diligent search for years I have never found a winged insect, or a male of any description, and I am entirely convinced that the females were fertile this year without copulation)—we can only have these larvæ for examining the tarsi, the females being footless, maggot-like bodies.

The older Authors were men of close research and untiring observation; against them we have nothing to say, but it is proper to infer, that the characters of the *Coccidæ* were correctly established; however, I am free to confess that my research has not been sufficiently extended to verify *their* results. Their observations were conducted in a different quarter of the globe. For me to condemn them by changing the characters they established for *Coccidæ*, so as to make it so different a thing as to admit this "Apple Bark-louse," would be sacrilege. They created the family *Coccidæ* for the reception of *scale-like* insects, although in *Aspidiotus* the female is fixed and immoveable, yet in other genera she may be moveable. But the characters which are permanent are, tarsi with *one* joint and *one* claw. To this I can find no exception in the old landmarks of this family. Here we have a scale-building insect, but the insect itself is no more scale-like, than is a dipterous larva; neither has this insect any tarsal claw.

In classification, then, how can we retain this insect under the *Coccidæ?* To do so is a manifest error, without making additions to the characters of this family. Can we change the characters of a genus without examining all its species, and determining that they all harmonize with the change? The observer cannot do this, widely diffused as they are, in the four quarters of the world; closet observation here is useless, the insect *must* be studied in its living, active state, in its native haunts, daily, for at least an entire season.

If we have a right, from examining a single species, to add to the characters of a genus, we have a right, also, to deduct therefrom. And such licence would evidently undermine the very foundations of science.

Hence, our only remedy is to construct a genus with characters that will admit the insect in question. Some may argue that this insect for ages, by the most profound entomologists, has been esteemed a typical representative of the *Coccidæ*. What matters that? If we have been six thousand years in arriving at a true knowledge of the natural history of this otherwise well known insect, shall we, therefore, on account of a veneration for time-honored names, among the cob-webs of error and obscurity, continue in error, by retaining it in a family whose characters no more accord with its true anatomical structure, than they do with that of a dipterous larva? We have a plain and simple remedy, and but one—to the classical mind a demonstrated truth.—Create a new genus,

and if needs be a new family, for its reception, however slow the scientific world may be to adopt it, and however loth I may be to genus manufacturing.

In this case it appears necessary, at least, to place this insect in a sub-family *Coccinæ;* even in this step there is a manifest defect, failing to reach out far enough.

We have in the section *Monomera* already two families, *Dactylosphæridæ,* (*Proc. Acad. Nat. Sciences Phil., Jan.* 1857,—tarsi with one joint and *two* claws,) and *Coccidæ,* (tarsi with one joint and *one* claw.)

May we not, with equal propriety, construct a new family for this insect—Tarsi with one joint and *no* claw? If these views are justifiable in the minds of the scientific world, we, therefore, have here a new genus, which may be named *Lepidosaphes* (from λεπις, a scale, and σαφης, distinct), the principal characters of which, differing from the two families of the *Monomera,* are: *Four digituli terminated by pulvilli or arolia, and no claw, and the female living beneath a scale or shell-like habitation of her own constructing,* and with equal propriety a new Family, *Lepidosaphidæ,* may be formed.

I do not introduce these ideas out of a desire to be heard, or to engage in Family-making. This insect has been under observation a long time, according to Authors, both in Europe and America.

Westwood informs us that the females of *Cocci* and *Aspidioti* lose all traces of articulations in the body as well as losing their limbs, becoming motionless and apparently senseless objects of animal matter, resembling, in a measure, the vegetable excrescences called galls.

My observations, in part, subjoined with day and date, for the purpose of giving more complete assurance, and to enable any other observer to verify them, find in the case of this insect a very different state of things. The body of the female is distinctly articulate during the entire period of her existence, and, without doubt, is fully as sensative as other articulates. The absence of limbs is nothing more than an evidence of the economy of nature; limbs are furnished these insects, as others, while they need them, when they are no longer needed, they are lost; this loss is no evidence of "degeneration" "as they approach the imago state." Indeed, legs would only be an incumbrance to the animal, in the state of life it leads beneath its little shell-like habitation.

Nor do I introduce these views in opposition to those of *Linnæas, Goeffroy, Fabricius, Burmeister, Curtis, Réaumer, Westwood,* and other great leaders and close observers in natural science. I have nothing to say about what they saw, but I simply give a brief history of what *I* saw, with some reflections upon the results which I conceive derived therefrom.

If these views are justifiable, we have characters sufficient for a new Family differing from the *Coccidæ.*

Family LEPIDOSAPHIDÆ, Shimer.

Genus **LEPIDOSAPHES**, Shimer.

Lepidosaphes conchiformis, Gmellin sp.

Coccus conchiformis, Gmellin, Ed. Syst. Nat. i, 4, 2221.

Coccus arborum linearis, Modeer, Act. Gothenb. i, 22. Geoff., Ins. Par. i, 509. Réaum., Ins. iv, 69, pl. 5, figs. 5—7. Kirby and Spence, Int. Ent. i, 201. Harris, Inj. Ins. (new ed.) 252, fig. 96.

Coccus Pyrus Malus, Kennicott.

Diaspis linearis, Costa, Faun. Regn. Nap. Gallinsetti, 21.

Aspidiotus conchiformis, Ruricola, Gard. Chron. iii, 735. Fitch, N. Y. Rep. I, p. 31; III, p. 13. Walker, Cat. Homop. B. M. iv, p. 1067. Walsh, Prac. Ent. II, pp. 31, 81.

Aspidiotus linearis, Walker, Cat. Homop. B. M. iv, p. 1067.

Tarsi with one joint; this joint may be very indistinct—a single primative organic ring—so that the digituli almost appear to sprout directly out of the tibia and without ungues, but splitting up into four digituli, which are arranged in their origin subquadrangularly. Female living beneath a scale or shell-like habitation of her own constructing and of a coreaceous consistency; this shell, or house, increasing in size in a direction opposite to the apex or head at several distinct intervals during the summer; and laying her eggs beneath this shell, by extruding them from her body, as any other egg-laying insect does.

Male unknown.

The lamented Robert Kennicott, believing this insect to be new, named it *Coccus Pyrus Malus*. Dr. Fitch assures us that this is identical with that at the East; of this I am convinced, so far as I can be, by examining the habitations filled with eggs, in the winter and spring time, both East and West. About its being distinct from the European species, I am not able to say anything, having never visited Europe. Dr. Fitch sent specimens of this Apple Bark-louse to Mr. Curtis, the distinguished English Entomologist, for determination, and in reply, he says, that it is identical with *Coccus arborum linearis*, Geoffroy.

Now, in the condition the specimens must have reached Mr. Curtis, he had only the shell or habitation for examination, and, therefore, he could hardly speak understandingly regarding the animal itself; moreover, this opinion does not appear correct, as the *C. arborum linearis* was described from the Elm. Certainly, if the Elm is the natural food of this insect, it has been badly neglected in this country—a very improbable thing for an insect of this order, to leave the Natural Family *Ulmaceæ* and locate on a species of the *Rosacea*, differing so widely, botanically, as they do. Mr. Curtis assures Dr. Fitch that he is right in placing this insect under the genus *Aspidiotus*. Could Mr. Curtis judge impartially by examining mere shells? The recorded observations of Dr. Fitch do not show sufficient research in the *field*, to entitle his opinion to any weight. It is an easy matter to fill pages by collecting the writings and loose observations of irresponsible parties, which usually are unreliable, and in the main utterly worthless. The foundations of all correct reasoning and deductions in

Natural History, and especially in Entomology, are deeply laid in *thorough, untiring observation and investigation*, and he that departs from this *rock*, builds his castle on the sand; hence, it will not endure the storms of time.

These points of difference, between this insect and the typical *Coccidæ*, are very important, in that the tarsus is terminated by one claw—in this, by none, but having four digituli instead; in that the body of the female becomes transformed into a scale, in this the female lives beneath the scale, a distinct and separate thing throughout the entire period of her existence.

In view of this combination of facts, I am persuaded that all close investigators will discover in this, an insect comprising the characters of a new Family, or at least a Sub-Family *Coccineæ* under the *Coccidæ*. The weight of the testimony is emphatically in favor of a new Family for the reception of this apparently new Genus. The only argument that can, scientifically, be brought to bear against these views, regarding the classification of this insect are, that the examinations of the feet have been derived from the larval state; to this I can but reply, that I appreciate the importance of having a winged imago for description, and to this end made every possible effort to obtain one, and could find no evidence or sign of the existence of such a state, and hence I do not see the propriety of waiting longer for a state, that has never been seen by any one in this country, among the many observers of the present century, and may, and probably will, never be seen, perhaps having no existence whatever. And furthermore, I never find any difficulty in determining the tarsal characters of any of the numerous Aphidians, from examining them in the larval state; the same is true of the *Dactylosphæridæ*. Like these larvæ, this has six true legs, having femur, tibia and tarsus, with true joints, as have other insects; these, therefore, are manifestly no prolegs, and are entitled to our regard in classification.

Apparently imperfect and peculiar as are these feet, they appear well adapt to the wants of the insect. I have taken up the young larval "Bark-louse" on the end of a fine needle, and was surprised to witness its ability to retain its footing on so hard and smooth a surface, and it is jarred off of the needle with great difficulty. This proves that the digituli are terminated by a suction or vacuum-producing aparatus—*pulvilli*, or more probably *plantuæ*, or perhaps *arolia*—and, therefore, much better adapted to travel with safety over the hard, smooth surface of the bark of the tree, without being blown away by the sweeping winds of spring. A fall to the ground would be fatal to the life of the insect, and if it ventures upon the downy young limbs and leaves, the digituli serve them as well as in the case of the "Grape Leaf-louse," as I have already observed, in my paper on the *Dactylosphæridæ*.

Mt. Carroll, Ill., November 1, 1867.