

VII.—On the Origin and Development of *Periphyllus testudo*,
Van der Hoeven. By C. RITSEMA*.

IN the sixth volume (for 1863) of the 'Nederlandsch Tijdschrift voor Entomologie,' Professor Jan van der Hoeven called attention to a small Hemipterous insect which frequently occurs on the leaves of *Acer campestre* and *A. pseudoplatanus*. He named it *Periphyllus testudo*.

It was observed in 1852 by J. Thornton, who gave it the name of *Phyllophorus testudinatus*, and regarded it as the pupa of a new species of *Aphis*, for which probably a new genus would have to be established†. Subsequently (1858) Lane Clarke mentioned the same little animal under the name of *Chelymorphe phyllophora*, and regarded it as the pupa of a form occupying a position between the genera *Aphis* and *Coccus*‡. These two writers, however, only give a short account of it. It was afterwards more fully described and also figured by Van der Hoeven as *Periphyllus testudo*§. This zoologist was of opinion that it belonged to the Hemiptera Homoptera; but he could not determine whether it would be better referred to the Aphididæ or to the Coccina, although he thought it was scarcely to be united with the former.

It was only in 1867 that something with regard to the origin of the animal in question was brought to light, when MM. Balbiani and Signoret presented to the French Academy of Sciences some communications upon it, which, under the title of "Note sur le Développement du Puceron brun de l'érable," were published in the 'Comptes Rendus' for the

* Translated from the Dutch by W. S. Dallas, F.L.S., from a separate impression communicated by the author, from the Mededeelingen der Kon. Akad. van Wetenschappen, 2^{de} Reeks, Deel iv.

† Trans. Ent. Soc. London, 1852, n. s. vol. ii. Proc. p. 78.

‡ 'Objects for the Microscope, being a popular Description of the most instructive and beautiful subjects for exhibition,' by L. Lane Clarke. London, 1858. A second edition of this work was published in 1863.

§ As a reason for the rejection of the generic names which had been proposed by Thornton and Lane Clarke, Van der Hoeven states that both had been previously employed, *Phyllophora* having been made use of for genera of Crustacea, Coleoptera, Orthoptera, and Diptera; whilst a genus of Coleoptera had been established by Chevrolat under the name of *Chelymorphe* as early as 1834. I cannot, however, see clearly why Van der Hoeven changed the specific name of *testudinatus*, given by Thornton to this animal, into *testudo*, and I believe that there is no reason for so doing. But, as it will appear that in this case a larval form of a long-known and described insect has received a distinct name, which therefore must sink, I have thought it better to abstain from a strict application of the law of priority, and to adopt Van der Hoeven's name in this paper, than to increase still further the number of synonyms.

17th June in that year *. As the result of their investigation, they state that *Periphyllus testudo*, Van der Hoeven, of which neither a new genus nor even a new species is to be formed, is nothing more than an abnormal infertile form of *Aphis aceris*, Linn., and that this form is produced from individuals identical with those from which normal larvæ, capable of further development and of reproduction, originate; nay, they sometimes even ascertained that the same mother produced both forms.

Hence we can only regard the *Periphylli* as a constant variation from the specific type, produced by normal generations.

Bearing in mind the observations of Landois † concerning the law of sexual development of insects, from which we learn that in them the sexes simply depend upon the conditions of nutrition to which the larvæ have been subjected, the authors come to the conclusion that, although the abnormal plant-lice (*Periphylli*) are entirely destitute of the power of propagation, either by sexual reproduction or by any other means, we must not conclude that their conditions of nutrition might not subsequently be so modified that with the sexual characters they might acquire the power of unlimited direct propagation; so that these abnormal individuals would then in their turn become the origin of a new species, produced by variation from one specific type.

In the spring of 1868, whilst still unacquainted with the investigation just noticed, I had made some passing observations upon the same subject. The results of these investigations, continued and completed in 1869, will be stated in order in the following pages.

As early as the beginning of February, I observed upon a tree of *Acer pseudoplatanus* (Linn.) young larvæ of a species of plant-louse; and on closer examination of a small branch, I also found on the bark, especially in the axils and at the base of the buds, the glistening, black, oval eggs from which they had issued.

These larvæ were about 0·5 millim. in length, and of a dark green or nearly black colour. After changing their skins five times, they had become developed, at the end of March, into wingless nurses 3 millims. in length, strongly inflated and of a dark-green or brown colour, which quickly began to produce light-green larvæ; and these, in the latter half of April, after

* This memoir is translated into English in the 'Annals and Magazine of Natural History,' ser. 3. 1867, vol. xx. pp. 149–152, and is transferred from this without change, but with the addition of a figure of *Periphyllus testudo*, into Hardwick's 'Science Gossip' for Sept. of the same year.

† Comptes Rendus, February 4, 1867.

changing the skin only four times, attained their adult state. In this state some of them were winged, others wingless.

With the first generation, by means of Walker's "Descriptions of Aphides" (Ann. & Mag. Nat. Hist. ser. 2. vol. i. *et seqq.*), I had already determined the species to be *Aphis aceris* (Linn.); and this was confirmed by the comparison of the winged individuals of the second generation with Kaltenbach's and Koch's descriptions of this species.

After the nurses of the second generation had brought forth many young which perfectly agreed with the first life-phases of their mothers, I saw, in accordance with Balbiani's results, that individuals were born which I immediately recognized as *Periphyllus testudo*. The ordinary larvæ were further developed, and about the middle of May had become winged and wingless nurses, whilst the *Periphylli* had remained unaltered.

The third generation, again, in their turn gave birth at first to ordinary larvæ and afterwards to *Periphylli*, the latter even in greater number than had been produced by the second generation. I was now much surprised by finding among these larvæ examples which distinctly formed a transition between the two larval forms (the ordinary larvæ and the *Periphylli*), as in them the leaf-like appendages were fewer in number and more narrowly lanceolate, and, indeed, in some of them passed gradually into hairs. All these transitional forms were destitute of the regular figures which occur upon the back of the *Periphylli*, but possessed the two rows of setigerous tubercles and the two honey-tubes which we find on the dorsal surface of the ordinary larvæ, but which are wanting in the *Periphylli*. These individuals became further developed, and, after the first change of skin, were exactly like the ordinary larvæ.

The members of this fourth generation, except the *Periphylli*, had become perfect nurse-individuals in the latter part of May, and began to propagate as such, but not, as in the case of the two preceding generations, at first by ordinary larvæ and afterwards by *Periphylli*, but *vice versâ*, first by a number of *Periphylli*, then by a few transitional forms, and finally by a comparatively small number of ordinary larvæ.

These larvæ, however, died by a neglect on my part; so that I was unable to acquire certainty as to a conjecture which had occurred to me—namely, that the nurses of this fifth generation would propagate solely by *Periphylli*.

Nevertheless I did not omit to continue the careful observation of the *Periphylli* of different generations. Up to the end of August I could not detect even the smallest change in them. At that time, however, they became thicker in the body, and on both sides of the back some darker contents

began to show through the integument. After this, in the beginning of September, I found *Periphylli* changing their skins.

After this first moult they agreed exactly with the second life-phase of the ordinary larvæ, while a fortnight later they had attained their perfect state, in which they were all wingless. These nurses began immediately to propagate by light-yellow ordinary larvæ, which at the end of September changed their skin for the last time, and remained wingless like their mothers. The larvæ born from these nurses agreed very nearly with those of the preceding generation, and became developed before the middle of October into winged male and wingless female imagos, which quickly paired, after which the females attached about eight brownish-yellow eggs to the bark of the maple tree. These eggs slowly became black, and in the beginning of February 1870 will again furnish the first generation of *Aphis aceris* (Linn.).

Having reached the end of my memoir, I will briefly run over the results to which the investigation described has led.

In the first place, it is proved that *Periphyllus testudo* (V. d. Hoev.) is not a distinct species, but a peculiar larval form of *Aphis aceris*, occurring in the earliest period of its life.

In the second place, that this larval form is not, as has hitherto been supposed, incapable of further development, but that it is merely subjected to a long-continued cessation of development in its first stage, by which the multiplication of the above-mentioned species of *Aphis* is greatly limited.

In the third place, that it is produced only by the generations in which both winged and wingless individuals occur.

In the fourth place, that it is produced both from the winged and wingless nurses, in association with the ordinary larval form which undergoes a rapid development, and with individuals which form a sort of transition to the latter. And in the fifth place, that in the successive generations the *Periphylli* continually increase in number, whilst the number of the ordinary larvæ diminishes, and, indeed, to such a degree that the fourth generation (that is to say, the third from which *Periphylli* are born) only produces a few ordinary larvæ. From this I think we may conclude that nothing but *Periphylli* are produced from the fifth generation, which, in my case, unfortunately died. Should this actually prove to be the case, it would serve especially to prevent any very great increase of this species during the summer.