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Metamorphoses of the Aphis of the Woody Galls of the Black Poplar
(*Pemphigus bursarius*, Linn.). By M. J. LICHTENSTEIN.

By indicating as synonymous with his *Aphis bursaria* the Aphides of which the galls are figured under the nos. 7-11 in pl. xxvi. of Réaumur's third volume, Linné has set his successors a problem to solve; for in this case the choice is embarrassing. Fig. 8 of the great French observer in fact presents, under the letters *h, g, u*, very different galls united on the same branch; and the entomologists who have copied Linné have taken sometimes one and sometimes the other species for *Aphis bursaria*.

Without wishing here to perform a work of criticism, I shall confine myself to saying that I regard as *Pemphigus bursarius* the insect of the gall figured by Réaumur under the letter *h*. It is the only gall that is fixed upon the bark; it is the only one that is of a hard woody consistency; further, it does not fall with the leaves; it is persistent, and may be very readily seen upon the poplars during the whole winter.

Up to the present time we have only known of the insect which forms this gall, the foundress-mother, and the emigrant winged progeny which quit the galls in June and July. No one has yet been able to discover where this emigrant form goes, nor have I been able to fill up this gap; but having placed in a tube these winged emigrant insects, I soon saw them deposit living young, all alike, and presenting a well-developed rostrum, a certain indication that they are destined to take food; only I have not yet been able to find what suited them, and they have all died in my bottles.

Now, in freedom, in the month of August, when the last *emigrants* had quitted the galls, I have seen arriving upon the poplars winged insects which, quite in opposition to the emigrants, seemed to endeavour to enter instead of issuing forth, and this, not only into the already dry galls, but into all the fissures of the bark.

The external appearance of these Aphides is almost the same as that of the emigrant form; I can find no difference between them except in the number and form of the crenulations of the third joint of the antennæ, which run all round the antennæ in the emigrant, and only pass half round in the new comers. But their product is quite different. Placed in tubes the new arrivals deposit what I call *pupæ* in the *Phylloxera*, and pupæ of two sizes, which very quickly free themselves from their envelope, and give origin to small sexual Aphides, male and female, destitute of the rostrum, and furnished with generative organs. Copulation takes place; and soon afterwards the female deposits, between the wrinkles or cracks of the old drying gall, a small yellow egg, surrounded by a white cottony down or secretion.

Is it not marvellous to see instinct thus carry back the *Pupifera* to the dwelling formed by their great grandmother, to bring back to it the young couples which are to furnish the single egg, the germ of the future colony?

Of this egg I have preserved numerous examples in my cabinet

through the whole winter; for if each female furnishes only one egg there are an immense number of females. The egg hatched on the 11th May [March?]; and I placed the little *Aphis* which issued from it, and which is, of course, the larva of the foundress-form, upon a small poplar, which I planted on purpose in my garden. Now, on the 3rd April, I have the satisfaction of seeing my little artisans at work, burying themselves in the tender stalks of the first buds, and beginning to disappear beneath a little elevation which surrounds them like a halo, of a bright carmine tinge.

I had wished to be able to give the complete history of the biological cycle of this *Aphis*; but I hope that what I have seen may facilitate the study of these interesting metamorphoses by other observers. However, the theories which I have already had the honour of presenting to the Academy with regard to *Phylloxera* and other species of Pemphigians are here again fully confirmed: there are four larval forms preceding the sexual forms; and of these four forms two are apterous and two winged.—*Comptes Rendus*, April 5, 1880, p. 804.

Structure of the Eye of Limulus.

By A. S. PACKARD, JUN.

The eyes of the horseshoe or king crab are four in number, consisting of a pair of compound eyes situated on the side of the head, and a pair of small simple eyes on the front of the head. As described by A. Milne-Edwards and Owen, the optic nerves to these eyes are very long and slender. Those distributed to the larger compound eyes are very long, and close to each eye subdivide into an irregular plexus of fine nerves, a branch being, as we have found, distributed to each facet composing the compound eye. The structure of the eye is very unlike that of any other Arthropod eye. The cornea is simply a smooth convex portion of the integument, which is much thinner than the adjoining part of the chitinous skin. There are no facets, the cornea externally being structureless, simply laminated like the rest of the integument. In the internal side of the cornea are a series of solid chitinous conical bodies, separated from one another by a slight interspace and in form resembling so many minié-rifle balls; the conical ends of these solid cones project free into the interior of the body, and are enveloped in a dense layer of black pigment. Within the base of these cones are secondary, shallow, cup-like bodies or shallow secondary cones. It is these primary cones which, seen through the smooth, convex, translucent cornea, give the appearance of a faceted surface to the external eye.

All the parts thus far described, except the pigment layer, are moulted with the rest of the crust; and the large, long, slender cones can be easily seen by viewing a piece of the cast-off eye, the solid cones being seen projecting from the inner surface of the cast-off cornea.

The internal structure of the eye is very simple. *There are no cones and no rods*; but a branch of the optic nerve impinges directly