ART. XXXV.—*On the Habits of* Prionoplus reticularis, *with Diagnoses of the Larva and Pupa.* By Captain T. BROUN.

[*Read before the Auckland Institute, 2nd June,* 1879.]

THE subject I propose dealing with will be rendered more intelligible, and perhaps interesting, if I endeavour to convey something like a clear idea of what is meant by the terms employed by naturalists to designate the metamorphoses of insects. This course will seem all the more advisable when it becomes known that I possess specimens of the larvæ and pupæ of other species of Coleoptera, which I hope to describe in subsequent papers.

A beetle originates from a minute, soft, oblong or oval egg instinctively deposited by the parent in such a situation as will ensure a sufficient supply of wholesome food, the mode, time, and place of deposition being liable to considerable variation, and ordinarily succeeded by the death of the female, whose chief purpose in life would thus appear to have been accomplished.

From the egg, in course of time—varying in extent according to species, climate, or other circumstances—emerges the larva, which frequently passes a period of three, or even five years, in solid wood before it attains its full growth and becomes a pupa. It is chiefly during this stage of an insect's existence, according to the mode of life of the members of the group or genus to which it belongs, that it commits so much havoc, or proves of great service to man. The larva—the state analogous to that of the caterpillar of the butterfly or moth, and the maggot of the common fly—is usually a fleshy grub composed of thirteen segments, of which the first forms the head, the next three the thorax, and the remaining nine the abdomen of the perfect beetle; but two or more of these latter ultimately coalesce in such a manner that not more than five or six can be discovered in many Coleoptera. It is provided with six short legs, which are attached to the second, third, and fourth, or thoracic segments. The head is furnished with a pair of rudimentary eyes; two antennæ, commonly called feelers, situated between or near the mouth or eyes; two pairs of transverse or horizontally-moving jaws, of which the upper are termed mandibles and the lower maxillæ, the latter ordinarily armed with feelers, called palpi; a labrum or upper lip; and a labium or lower lip, having a pair of palpi. These organs, conjointly, close the aperture of the mouth when in repose. Respiration is effected, not through the mouth, but by means of a variable number of small, often almost imperceptible orifices referred to in descriptions as spiracles or stigma; these are placed near the sides of the body, and communicate with internal air-tubes.

In due time the larva assumes the form known to us as the pupa, which corresponds with that of the chrysalis of Lepidopterous insects. In this state the beetle is generally soft, and quite harmless—that is, it does not take

any kind of substantial nourishment, and, though inactive, is in reality undergoing important changes. Now, for the first time, may be seen the result of those marvellous transformations which have occurred since the female laid the egg, as the form and structure of the imago, or perfect insect, can clearly be traced.

The beetle issues from the pupa stage during autumn or spring, in the former case generally remaining quiescent during the winter, and, in the vast majority of cases, is short-lived, appearing, indeed, to exist no longer than is necessary for the propagation of the species. It is evident, therefore, that the imago does comparatively little injury, whilst many of the predaceous ground-beetles, which frequently live throughout the spring and summer, destroy vast numbers of insect pests. We are indebted to the microscope and the investigations of many learned naturalists for our knowledge of the anatomy of Coleoptera, the details of which, however, scarcely come within the scope of this paper. Suffice it to say, that the internal organs consist of a stomach, pouch, gizzard and gullet, for the assimilation of food, several "hearts" united by what may be called veins for the circulation of the blood, and the air-tubes previously alluded to under the heading "larva." The anatomical structure can only be advantageously studied in works specially devoted to that branch of the science; the external form, infinite in variety, may, so far as the indigenous Coleoptera are concerned, be studied in the volume now being published by the Colonial Government.* Many people are under the impression that a beetle "*grows*" considerably; that, however, is a mistake, as the ultimate size of the insect is determined in the larval state, the development depending on the quantity and suitability of the nutriment available.

The foregoing remarks having, I hope, served their purpose, *id est*, enabled those, whose vocations have not permitted them to become entomological students, to realize in their own minds something approaching an accurate conception of the nature of the forms recognized as Coleoptera, I now subjoin descriptions of the larva and pupa of *Prionoplus reticularis*, our largest longicorn beetle.

Larva cream-coloured, sub-cylindrical, attenuated posteriorly, twenty-one lines in length, composed of thirteen very distinct segments, of which the first forms the head; the second is the broadest, measuring 6½ lines across; the next four are the shortest, and about equal in breadth to the second; the others gradually increase in length, and the eleventh is rather broader than the immediately preceding ones. The head is more or less infuscate, the parts of the mouth being pitchy-brown, and is seemingly capable of being retracted within the second segment; it is rounded and densely ciliated in front, the line of demarcation between its anterior and back parts is obvious, the depressed front angles of the latter portion are formed, just behind the lower part of the base of the mandibles, by distinct tubercles; there are four other, but much smaller, elevations

* Coleoptera of New Zealand, by Capt T. Broun.

near the middle of that line, the two anterior distant, the others placed a little further back are only separated by the dorsal groove; behind these there is a curved ridge extending between each antenna and the middle, but not attaining the medial furrow; the space behind is more or less rugose and sparsely hispid, with a few small punctures behind each ridge. The mandibles are large and triangular; the maxillary palpi are robust, four-jointed, abruptly decreasing in bulk, so that the terminal joint becomes quite minute; the labial palpi are tri-articulate, smaller than, but similar in form to the maxillary, but with their apical joint rather less abbreviated; the antennæ are very small, not even as long as the labial palpi, with four joints, of which the last is almost aciculate, and their joints are evidently capable of retraction one within the other. The second segment is larger than the following two united, having near each side a large, slightly-raised, triangular space terminating in a carina, which extends forwards beyond the middle; the disc is rather coarsely rugose, but the sculpture becomes much finer towards the front, where there are some deep wrinkles. On each of the succeeding segments, though less evident on the third and last, there is a large transverse space, slightly elevated, but flattened above, which is distinctly wrinkled; the surface of these segments (3-13) is covered with minute, spine-like elevations, whilst the extremity of the last three is more or less coarsely rugose. The sculpture of the under side of the segments corresponds, more or less, with that of the upper. The spiracles are transversely oval, nine in number on each side, the first, situated on the third segment, is twice as large as any of the others, which are located on the fifth, sixth, seventh, eighth, ninth, tenth, eleventh, and twelfth segments. The legs, attached to the second, third, and fourth segments, are very short, four-jointed, and very similar in structure to the palpi, but having the last articulation more slender and slightly curved.

The larvæ, when immersed in alcohol, become discoloured, so that after the lapse of a few months they become of a pale brown; the size varies, the measurements given above are applicable to full grown examples only.

The *pupa* resembles the larva in colour, is about 21 lines in length by 7 or 8 in breadth in its widest parts, and consists of twelve dorsal segments, the thirteenth being retracted to form the generative organs, whilst the first is represented by the head; it is subject to the modifications observable in the larva when preserved in spirits. The eyes are sometimes discernible, but are covered by a film; the elytra, proceeding from the third segment, are obliquely folded below the body, and, to a great extent, cover the under-wings, which issue from the fourth segment; the antennæ form a curve, and repose on the elytra; the four front legs are folded above these, the posterior pair below the wings.

The second dorsal segment is somewhat similar in outline to the prothorax of the perfect insect, rather uneven, and more or less transversely rugose. The third is about half the length of the contiguous ones, terminates behind in a large, obtuse tubercle, and is also wrinkled. The fourth bears a tubercle near each side, and a median longitudinal row of small tubercular elevations, which, however, become obsolete posteriorly; its surface is a little glossy and exhibits many minute, spine-like tubercles, not, however, so closely congregated as on the remaining segments. The seventh, eighth, ninth, and tenth, bear an obvious discoidal elevation, composed of two almost contiguous tubercles; whilst the last, which might be termed the thirteenth, terminates in two fleshy protuberances.

The information respecting the habits of this insect may be communicated in this way. We will suppose the female to have selected an old

kauri tree, with cracked or damaged bark, or one that has been recently felled, and, by means of her ovipositor, inserted a certain number of eggs which have been duly hatched. On looking at the decumbent log some time afterwards, we simply notice its weather-beaten aspect, but if we examine it more closely we will perceive some small round holes indicating to an experienced eye either the presence or escape of insects. Wishing to ascertain the actual state of affairs we use our axe, or tomahawk, and, owing to the hard external crust, perhaps imagine the log to be quite sound and merely marked superficially, but by dint of a little exertion and perseverance the log is at length cut open, and I venture to assert that the sight which will then meet the eye of the beholder, if not a naturalist, or one accustomed to the ravages of insects, will convince him of the importance of the small animals whose existence, probably, had been altogether ignored. I shall endeavour to describe the condition of such a log, one that I cut open at Parua, near Whangarei harbour. Its external appearance was such as has been indicated, but a little below the surface there were many large cavities about the size of a man's finger, occupied by specimens of the beetle itself more or less mature, all in positions best calculated to facilitate their escape; a little deeper in, I found pupæ and larvæ indiscriminately intermingled in a substance more nearly resembling closely-packed, moist sawdust than anything else, but not at all like the fine timber we would expect to see in a kauri log; on cutting still deeper, or right through, the same scene prevailed, varied only by the absence of the beetle and pupa; here and there might be noticed pieces of what might be termed wood, but with the larvæ assiduously engaged in devouring it; I could almost have kicked the whole to pieces. That log, a settler informed me, had been on the ground some eighteen months, but the eggs must have been deposited, I suspect, about two years previously. Many, no doubt, will exclaim that this is an exceptional case; the sceptic, however, need only do what I have often done, go into the forest and examine a log for himself, and he will return, to use an oft-quoted phrase, "a sadder and a wiser man." It must not be supposed that the ligniperdous proclivities of *Prionoplus reticularis* are confined to the *Dammara australis*, or that its ravages are unmixed evil; I have seen its larvæ at work in *rimu* and *kahikatea* logs, and, in a semi-tropical country, wherein the people, apparently, can afford to allow large quantities of valuable timber to go to ruin, the insect, conjointly with others, devours what would otherwise decay and, during the process, engender serious diseases.

Before leaving this subject, it might not be out of place to direct attention to certain facts showing the wonderful sagacity displayed by the insect. First of all in the deposition of the eggs; then, for the purpose of effectual

concealment, the newly-hatched larva eating its way to the centre of the log; but, when approaching maturity, boring towards the surface again, in order that when it emerges from the pupa state the beetle may readily effect its exit, which, of course, can only be done by *eating its way out.*

I regret my inability to place before you a portion of the log, as I could not have done so without an assistant to cross-cut a section, and it would then have had to be carried a distance of five miles to my house, and very carefully too, to be of much service in illustrating my remarks. Type specimens of the larva and pupa, in alcohol, accompany this paper, so that they may be preserved in the Museum, where the perfect insect also may be seen.

Art. XXXVI.—*Description of the Larva of* Pericoptus truncatus, *with Observations as to Habitat.* By Captain T. Broun.

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The larva of this beetle may be said to be of an elliptically cylindric *form*, being somewhat contracted near the middle, and with its first and anal segments, especially the former, narrower than the adjacent ones. Its upper surface is moderately convex transversely, the lower almost plane, but wrinkled. If preserved in its natural posture, the ventral segments may be seen to be considerably incurved, so that the hinder part of the body appears to be almost at right angles to the anterior. The lateral margins, though uneven, are well defined.

The body is moderately soft, but the head and claws are decidedly corneous.

The *size* varies according to the degree of maturity; my two specimens measure 17 lines in length by 7½ in breadth, and 15 x 6 respectively, but if straightened, the larger must have about 14 lines added to its length.

Its *colour* is uncertain; usually a pale yellow or dirty white, but becoming more or less livid; the head, however, is constantly castaneous, with piceous mandibles, the claws also are pitchy, and the stout bristles borne by the legs and certain portions of the body are of about the same chestnut hue as the head. Sometimes the larva is irregularly spotted with blue, but the colour, as previously indicated, generally degenerates into a brownish white, with livid blotches.

The body is apparently divided into fourteen *segments*, all of which, except the first and three last, are strongly wrinkled transversely, so much so, that some care will be required in determining the difference between the real sutures and the folds; the three terminal are by far the largest; of