

und dem Direktor des Museums, Herrn Prof. Dr. Brauer, meinen aufrichtigen Dank für ihr gütiges Entgegenkommen auszusprechen; besonders bin ich den beiden Herren für ihre Erlaubnis sehr verpflichtet, die reiche Bibliothek des Zoologischen Instituts und die gleichfalls reichen Aufstellungen des Museums frei zu benutzen, höchst wesentliche Hilfsmittel für die Anfertigung meiner vorliegenden Arbeit, welche eine der von Japan halbfertig mitgebrachten ist. Auch bin ich zu besonderem Dank dem Abteilungsvorsteher, Herrn Dr. Berndt, für seine Freundlichkeit verpflichtet, durch dessen Bemühung ich die für meine Arbeit erforderlichen Hilfsmittel erhielt.

## 5. Preliminary Note on the Bright Spots of the Antheraean Larvae.

By Yoshimaro Tanaka.

(Ass. Prof. of Zoology, Imperial University, Sapporo.)

eingeg. 1. August 1913.

It is a well known fact that the larvae of the Japanese Oaksilk-worm (*Anthraea yamamai*) and the larvae of the Chinese Oaksilkworm (*A. pernyi*) are provided on their body-surface with peculiar spots of bright metallic lustre. These spots will conveniently be called the »bright spots«.

According to the positions in which they are found, the spots are grouped into two series: the dorsal and lateral. The spots of the dorsal series are found on the outer side of the subdorsal tubercles, and those of the lateral series are situated between the stigmata and the supraspiracular tubercles. The dorsal spots are, as a rule, circular or ellipsoidal in outline, whereas the usual form of the lateral ones is somewhat triangular. The spots of either series vary in size from one which is perceptible only with difficulty by the naked eye, to a considerable dimension attaining several mm. in diameter. The dorsal spots are generally smaller than the lateral.

The spots in question are not of constant occurrence; in some individuals there is found a considerable number of well developed spots, and in others only a few of small ones, while in certain individuals are entirely destitute of the structure. In their relation to the respective body-segments, the spots are likewise variable. The lateral spots occur mostly on the fifth and sixth segments, and the dorsal spots are found in majority of cases on the fourth and fifth. In the case of abundant occurrence, however, the lateral series may be extended from the fourth to the ninth, and the dorsal spots are distributed from the second to the tenth. In the other words, the lateral spots are never met with on the segments in front of the fourth and on those behind the tenth, and the

dorsal series invariably ranged to the first segment in front, and to the eleventh and twelfth segments behind. The spots or a certain spot on one side of the body may often be decidedly larger than those of the other side; furthermore they may be present on one side only, — the spots are in this way not always symmetrical in occurrence.

The actual cause of the variation above stated is not known to me at present. The occurrence of spots shows, it appears to me, not secondary sexual character, as I have found spotted as well as non-spotted individuals may occur among the both sexes. On the other hand, a racial difference seemingly exists with respect to the spot-character. On the pernyan larvae hatched out from the newly imported eggs from China, the bright spots were found more developed than in our native race. The hereditary behaviour of the spot character, will, therefore, interesting to be made out.

As early as the first stage of the larval life there is detected no trace of the spots; they come into view only in the second stage, and are added hence forward by each succeeding moult in their dimension, as well as, as it occasionally happens, in their number.

Microscopical observations can be made in the following way. Pieces of the cuticle are cut off in such a way as to contain in each piece a bright spot and its surrounding parts, while anything adhered to their inner surface is cleaned off. Under a low power these two parts, the spots and its environs, reveal some characteristic differences. Seen in transmitted light, the cuticle is, in the region of the bright spot, almost transparent, only slightly coloured, and is quite smooth on its free surface; in the surrounding parts it differs from that of the spot, not only in being semitransparent, but in showing a somewhat conspicuous colour of yellowish green. In this latter part the cuticular surface is not smooth, but is, as in the other parts of the general body-covering, produced into numerous papillae which are thickly covered with minute hairs; and between these papillae, there are in addition large club-shaped papillae and long stout bristles.

On the series of sections into which the pieces were divided, more detailed structure are made out. The cuticle of the spot is, as the sections show, composed of two distinct layers, the outer and the inner. The outer layer is about  $10\mu$  in thickness and homogeneous in structure, while the inner layer is as several times thick as the outer, and shows, through its whole thickness, a great number of fine striations running parallel to the surface. In the surrounding parts, on the other hand, the cuticle is thicker than the inner and outer layers of the spot taken together, and is characterized by its homogenous structure. Though, as it often happens when the knife edge is not finely sharp enough, the homo-

geneous cutends of sections show a fracture which is peeled off; in this way we can see that the direction of cleavages is never parallel to the cuticle surface.

The cuticle of the spot as well as that of the surrounding parts show almost equal staining affinity against haematoxyline. On the other hand congo-red, ruby, acid-green, etc. stain the cuticle of the spot more intensely than that of the other parts. This latter series of the staining fluids is therefore to be utilized for staining differentiation of the two parts under consideration. I can not say at present with certainty whether this staining distinction between these two parts is due to certain chemical differences of one from the other, or merely physical difference in structure.

Although quite free from the large processes, the cuticular surface of the spot is sometimes provided with numerous papillae, which are nearly equal in size with one another, and are so minute that they have no effect upon the brightness of the spot. The inner layer of the cuticle is composed of a large number of thin lamellae laid in layers parallel of the surface, and owing to this lamellar structure, an appearance of fibrous striations is always revealed on sections passed through in any given directions. A single lamella is sometimes not broad enough to cover a bright spot to which it belongs, but several lamellae compose a lamellar layer, overlapping on each other at their edges.

All the subcuticular elements, such as the epidermic cells, tracheal tubes, musculature, etc. which underlie the cuticular coat, are not particular to the part of bright spot, but are by no means discernable from those in other part.

The metallic lustre is undoubtedly produced by reflection of light which takes place at the surface and within the structure of the spot cuticle. The colour of spot is due partly to the »dermal (cuticular) colour« (as called by Hagen) of the spot and the interference colour which can be possibly assumed to result from the layered structure of the spot, and partly to the pigment contained in the epidermic cells. To attest the polarizing power of the spot-cuticle, I made use of polarization-microscope; but the result was negative.

In both the species of the Oak-silkworms and in both the lateral and dorsal series, the spot presents during a few hours after an ecdysis a colour all alike, i. e. milky white, closely resembling a piece of white porcelain. But the spots soon assume colours according varying the species as well as positions. In *A. yamamai*, all bright spots are almost silvery white, while in *A. pernyi* the spots of the dorsal series are golden yellow, and those of the lateral series are copper-red in colour. The colour divergence above mentioned is possibly due to the difference



of the pigments contained in the cuticle and epidermic cells. An important influence of the epidermic pigment upon the spot-colour is to be observed by the fact that the bright spots of the pernyan larvae which shine in a golden or copper-like lustre, are gradually turned into silvery white when the body is after death converted into dark colour by putrefaction setting in.

The results of experimental studies on the bright spots are not without interest. I would be permitted here to mention a case of regeneration. A pernyan larva in the fourth stage of growth, of which I made use in experiments, had two dorsal pairs of spots found respectively on the fourth and fifth body-segments and two lateral pairs on the fifth and sixth segments. I bored with a needle the anterior of the left lateral spots to break the cuticle lining it, and then dropped collodium on the injured spot in order to prevent blood flowing out. Within a few days, the larva passed into the moult. After the ecdysis gone over; I found that while all other spots were found in normal conditions and markedly added in their dimension, the new cuticle of the spot operated lost its characteristic lustre at most parts of spot area. This individual was killed, and the operated spot was divided into serial sections. Microscopical examinations of the sections show that the outer surface of the cuticle is provided with numerous irregular, considerably large processes, — a fact which has never been seen in the cuticle of the normal spots. The regular arrangement of the fine striations which are characteristic to the cuticle of spot becomes much disturbed, and the sharp boundary between the spot and its surrounding area is obliterated in its greater extent. By this experiment it is evident that a bright spot undergoes, when injured, some histological alterations and is no longer regenerated into its previous feature. The regeneration-experiments are as it seems not uninteresting; I prepare to make further experiments.

In conclusion I express my deepest thanks to Prof. S. Hatta for his kindness in looking through the manuscripts and in giving numerous valuable advices.

#### Literature.

- Baer, M., Über Bau und Farben der Flügelschuppen bei Tagfaltern. Zeitschr. f. wiss. Zool. Bd. LXV. 1899. p. 50—64.
- Biedermann, W., Die Schillerfarben bei Insekten und Vögeln. Jenaische Denkschriften. XI. Festschrift Ernst Haeckel. p. 217—300.
- Folsom, J. W., Entomology with Special Reference to its Biological and Economic Aspect. 1906. p. 193—215.
- Grobben, K., Die Bindesubstanzen von *Argulus*, ein Beitrag zur Kenntnis der Bindesubstanz der Arthropoden. Verhandl. VIII. Internat. Zool.-Kongr. Graz. 1912. p. 512—516.
- Hagen, Hermann A., On the colour and pattern of insect. Proc. Amer. Acad. Arts and Sc. 1882. p. 234—267. Extracts in Packard's Text-Book of Entomology. 1903.

- Leidig, Franz, Bemerkungen über Farben der Hautdecke und Nerven der Drüsen bei Insekten. Arch. f. mikr. Anatomie. XII. 1876. p. 536—550.
- Sasaki, C., Some Observations on *Antheraea (Bombyx) yamamai*, G. M., and the Methods of its Rearing in Japan. Bull. Coll. Agric. Tokio Imp. Univ. Vol. VI. 1904. p. 43—49.
- Urech, F., Beobachtungen über die verschiedenen Schuppenfarben und die zeitliche Succession ihres Auftretens. Zool. Anz. XIV. 1891. p. 466—473.
- , Beiträge zur Kenntnis der Farbe von Insektenschuppen. Zeitschr. f. wiss. Zool. LVII. 1893. p. 360—384.

## 6. Ein neues Hydracarin-Genus aus dem Bodenschlamm von Bandaksvand in Norwegen.

Von Dr. Sig Thor, Norwegen.

(Mit 3 Figuren.)

eingeg. 5. August 1913.

Bei einer Untersuchung von Bandaksvand, einem 72 m ü. M. liegenden See im südlichen Norwegen, fand ich in einem Bodenfang aus 20—30 m Tiefe ein Tierchen, das einer neuen Gattung anzugehören scheint. Das Tier ist eine Nymphe, mit Genusnamen nach dem Fundorte.

*Bandakia* gen. nov.

Die systematische Stellung ist nicht leicht mit Genauigkeit festzulegen, scheint jedoch in der Nähe von oder in der Familie Atractideidae Sig Thor zu sein, mit Anklängen sowohl an die Arrenuridae als an die Lebertiidae. Körperumriß fast zirkelrund, niedergedrückt; Haut besonders auf der Bauchseite halb panzerartig mit feinen verzweigten Poren ungefähr wie im Epimerenpanzer von *Lebertia*. Auf dem Rücken weichere fein liniierte Haut mit 2 nacheinander in der Mittellinien liegenden Rückenschildern; keine paarige Rückenschilder. Feine Hautdrüsenporen, sonst unbehaart.

Epimeren (3—4) hinten in der Mittellinie breit getrennt, vorn seitlich mit den zwei vorderen verwachsenen Paaren zusammenhängend, hinten und seitlich mit einer Erweiterung.

Genitalorgan eine umgekehrt herzförmige Platte mit 2 Paar runden äußeren Genitalnäpfen und wenigen feinen Poren.

Maxillarorgan kurz, mit kurzen dicken Palpen, fast ohne Borsten; auf dem zweiten Palpengliede (median und distal) ein gezahnter Höcker; auf dem 4. Gliede ventral einige haartragende Höcker und distal (und dorsal) ein Chitinzapfen; das 5. Glied hat eine lange Endkrallen (Fig. 3). Mandibeln hinten sehr breit (Fig. 2).

Beine kurz, ohne Schwimphaare, mit wenigen Borsten und dünnen, fast einfachen Krallen.

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Zoologischer Anzeiger](#)

Jahr/Year: 1913/14

Band/Volume: [43](#)

Autor(en)/Author(s): Tanaka Y.

Artikel/Article: [Preliminary Note on the Bright Spots of the Antheraean Larvae. 36-40](#)