

mals, even in a very small room. The aquarium consists of a tin box one foot square in front and about three inches thick, with a glass front. Over this glass front slips a round-oval picture-frame. If the inside is painted and filled with water the whole looks like a suspended picture of rather unusual thickness. Several such aquaria can be grouped together like so many pictures. If connected by syphons carefully graded, a constant flow of water can be obtained, which produces the necessary current and supplies the needed amount of oxygen. In such aquaria aquatic larvæ and insects can be studied with great convenience. The addition of some water plants adds greatly to the beauty of these aquarial pictures.

Mr. Smith read the following abstract of a paper by Prof. von Dalla Torre, entitled "Die Duftapparate der Schmetterlinge" (*Kosmos*, xvii, pp. 354-364, Nov., 1885; pp. 410-422, Dec., 1885):

THE ODORIFEROUS APPARATUS IN LEPIDOPTERA.

The author starts with a statement of the facts that led to the discovery some time since that the female of many Lepidopterous insects gives out an odor perceptible to the male, and thus induces copulation. Of the anatomy of these organs nothing definite is yet known, but it seems proven that by extending the ovipositor the ♀ can cause the dissemination of the odor which attracts the ♂.

He mentions the discovery by Fritz Müller (*Zeitschr. für wissensch. Zoologie*, xxx, p. 167) that a butterfly, the larva of which feeds on the "maracujá," has in both sexes an organ exhaling a very offensive odor, which he deems protective. In the ♂ this organ consists of two sacs or glands at the inner side of the side-pieces (After-klappen); in the ♀ the glands are situated between the terminal and sub-terminal segments, and are somewhat larger; in addition the female has two very small clavate filaments, the extrusion of which suddenly and strongly intensifies this odor.

These "protective" odors are not further treated of; but he proceeds then to his second group of odor giving organs, which are found on the wings in the form of peculiarly shaped scales.

He credits Baillif, a Frenchman, with the discovery of these peculiar scales; but this author rather considered them as aberrations, and failed to recognize the fact that they were found in one sex only. Deschamps, in 1835, discovered that these peculiar scales are found in the ♂ only, and he especially studied the situations of the scales and the method of their insertion into the wing membrane, evidently deeming them part of the tracheal system.

Watson, in 1865, studied these same scales, and also came to the conclusion

that they were part of the tracheal system. In 1869 he further examined the "battledoor" scales of the *Lycanidae* and other Lepidoptera, and enumerates 131 species in which they occur.

Fritz Müller, in 1877, called attention to these scales and hair tufts, and first asserted their function as odor-giving glands.

Aurivillius in his work on secondary sexual characters of northern diurnals devotes a large space to the discussion of these scales. The author then describes the form of scales in some species, finding them of various shapes, usually very different from the other wing scales, and always striate. In *Thanaos* they are hollow. Many of the scales, especially in the *Lycanidae*, are covered with rows of very minute globules set into the scale by a pedicel. In *Pieris* and some other genera the tip of the scale is furnished with a tuft of fine hair, while the shape is very different from that of the others on the wing. In some species of *Satyris* the tip is densely set with fine hair giving a brush-like appearance.

In some species of *Hesperidae* the scales are articulate, consisting of several joints, which are easily separated.

The distribution of these scales is then treated of, and, while they are, in rare instances, scattered over the wing, they are usually massed into spots, often differing in color from the other parts of the wing. Often, also, they occur on the anterior margin of the secondaries, which is covered by the primaries, or at the inner margin, which is usually more or less folded.

Not only are the ♂ scales often placed where they are more or less shielded, but there are often special structures looking to their protection. In *Pamphila comma* the oblique black dash in the ♂ is composed of such scales, and they are set into a depression of the wing and overlapped by ordinary scales, while in many other Hesperids there is a costal fold, tightly closed, and in which these peculiar scales are massed.

In *Danais* the peculiar raised spot of the secondaries so well known to all collectors forms a sac in which the ♂ scales are concealed. What are the functions of these scales, and why do they need such protection? Fritz Müller says they are odorous, and the author proceeds to cite cases where the odor was intense enough to be perceived by the human sense of smell. In *Callidryas argante* a musky odor was perceptible when the ♂ scales were exposed, and this was observed in all specimens. In *Prepona laertes* the odor is like that of a bat, in *Dircenna xantho*, vanilla like; in both only noticeable at the anterior margin of the secondaries, where the ♂ scales are situated.

In *Papilio Grayi* the odor is as agreeable and intense as in flowers. *Didonis biblis* has also a distinctly odorous spot on the secondaries. That we are unable to perceive a distinct odor in all cases the author does not consider as militating against the idea that the scales give out an odor, for he considers the sense of smell much more highly developed in the Lepidoptera than in man.

The fact that the scales are always more or less shielded is explained by

the statement that the odor is thus retained until the insect desires to disperse it. It is claimed that the insects have the power to open the various sacs or folds containing the scales, and, where the scales are protected only by their compact massing, they can be erected, so as to expose their entire surface. Thus it is calculated that *Pamphila comma* can expose a surface of 160 square mm. from a spot less than one millimeter square! The author cites Weismann for the statement that the wings of the Lepidoptera contain connected and living cells, capable of secreting the odor-giving substance, and claims the presence of minute glands at the base of these scales.

As a separate group of odor-giving organs, the tufts on the feet and body of many species are instanced. A number of these are described; but they all take the form of a pencil of hair capable of expansion and ordinarily concealed in a cavity of the leg. In *Hepialus hecta*, in which the arrangements for protecting the tuftings are very abnormal, Dr. Bertkau has found the cells secreting the odor-giving substance. In many species a distinct odor is perceptible when the leg containing the tuft is crushed. Another group of organs is found in the abdomen, also usually so concealed and protected as to be invisible.

In *Danais gilippus*, *erippus*, and *archippus* there is between the eighth and ninth segments on each side a closed sac, which, opening on pressure, exposes a ball of fine hair that gives out a distinct odor.

Many of the *Glaucoptidæ* have the power of protruding from the abdomen odor-giving filaments, while many *Zygænidæ* have within the side pieces (After-klappen) glands filled with a sweetly-scented fluid. *Didonis biblis* is especially favored with odor-giving glands. Not only have both sexes a sac between segments four and five of the abdomen, which exhales a very unpleasant (protective) odor, but the males have, in addition, a pair of glands or sacs between segments five and six, from which proceeds a very agreeable, heliotrope-like smell. That the Sphingids, or many of them, exhaled a very distinct odor has been long known, and Fritz Müller, in 1876, located it in a tuft of hair at the base of the abdomen, which fits into a groove in the first segment, so as to be ordinarily invisible. Reichenau, in 1880, described at length the structure in *Sphinx ligustri*, and our author summarizes his discoveries.

Mr. Smith added the following remarks:

Prof. Dalla Torre offers little or nothing that is actually new; but he brings together and collates the almost unknown and inaccessible notes of other authors, and produces a decidedly interesting and valuable paper. Within the last year or two a number of structures similar to those cited have been observed by American authors, and one very remarkable structure in *Cosmosoma omphale* was discussed at the late meeting of the Entomological Club of the A. A. S., where none of the gentlemen present were able to give any satisfactory explanation of the structure. Attention was also drawn to a structure in *Lygranthæcia marginata*, which, in some

points, resembled that in the Sphingidæ, and Prof. Riley mentioned that in *Aletia xyliua* there were similar, yet still undescribed organs. In many of the genera of the Deltoids the feet tuftings assume remarkable and startling forms, and quite a number of these have been studied, and will form a chapter strongly confirmatory of the views advanced in this article.

Mr. Mann remarked upon the interesting character of the communication, and the value of such a summing up of the subject as that by Fritz Müller, which formed the basis of Dalla Torre's paper. He called attention to the observations made upon the subject in this country, and to the citations of literature which had been given in PSYCHE. He said he had observed the protrusion of the tufted appendages at the tip of the dorsal surface of the abdomen by the living insect in Brazil, and noticed the strong odor proceeding from these appendages. The species upon which the observation was made seems to be *Heliconius phyllis*. Not having his collection at hand he could not be certain of the species further than to say that if there exists any other common species in Brazil closely similar to *H. phyllis* he cannot make the distinction from recollection; otherwise the determination is good.

Mr. Mann expressed his doubts whether any muscular action could take place on the surface of the wings of Lepidoptera, such as to erect or move the scales individually, or any physiological process go on to replenish the scent scales after their odor had been dissipated.

Mr. Schwarz added that among the many forms of secondary sexual characters in Coleoptera some would likely be found to be analogous in function to the odoriferous apparatus just described. He referred more particularly to the tuft of hair on the mentum in the males of Trogosita, and those on the ventral segments in the males of Dermestes. Differences in the character of the vestiture in the two sexes are known to occur in Coleoptera; *e. g.*, the genus Hoplia, but in this instance it is hardly possible that we have to deal with odoriferous organs.

MARCH 4, 1886.

Eight persons present. President Howard in the chair.

Mr. Howard exhibited specimens of the so-called Jumping gall produced by *Cynips saltatorius*, and of an interesting Chalcid