ANATOMY AND SYSTEMATIC POSITION OF CAMPYLAEA COERULANS.

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(With 2 figures.)

The question of the systematic position of *Campylaea coerulans* C. Pfr. has repeatedly formed a subject for discussion. For the purpose of deciding the matter I have examined the organs which are important in regard to the system, i. e. the jaw, the radula and the reproductive system. The result of my researches is as follows.

1. *Jaw.* The jaw (fig. 1) is to be found in a groove behind the opening of the mouth, and is composed of two coalesced, thin, flexible, quite smooth, yellowish chitin-plates. The larger of this two plates is arcuated, while the smaller one is as it were a tongue-shaped appendix of the larger to which it is coalesced on the arcuated side. The other edge of the smaller plate curves freely back brimlike, and therefore inclines in the direction of the arcuated edge of the larger. These are the two gnawing edges. The motor-muscles being fastened to the two plates in the intervening place. It is well known that the jaw of the *Campylaeae* is always a thick, strong, scarcely flexible, dark-brown chitin-lath, upon which 4—11 ribs are to be found. The jaw of *C. coerulans* differs therefore considerably from that of the *Campylaeae*.

Fig. 1.
Jaw of *H. coerulans*.

2. *Radula.* The radula of *C. coerulans* or rather its teeth are of a quite peculiar structure, and there is among the *Helicidae* only one species which has such radula-teeth, i. e. *Allognathus Grateloupi* Graëlls, as is known from the researches of Schuberth. The teeth of the radula of *C. coerulans* are uniform in shape and they are narrow, strap-shaped, sicklelike curved backwards, and their ends are rounded off. The teeth are arranged in wavy-lines; their number is not even approximately determinable though in any case there are many thousands.

3. *Reproductive system. C. coerulans* has genitalia of the

same type as the *Campylaeae*. The chief characteristics of the genitalia of the *Campylaeae*, as is well known, is seen from the spermatheca, the mucus glands, and the dart. Fig. 2. shows the whole reproductive system of *C. coerulans*, but here I only discuss those parts which have a systematical importance.

The most peculiar and permanent characteristic of the reproductive system of the *Campylaeae* is that it possesses either two simple or at

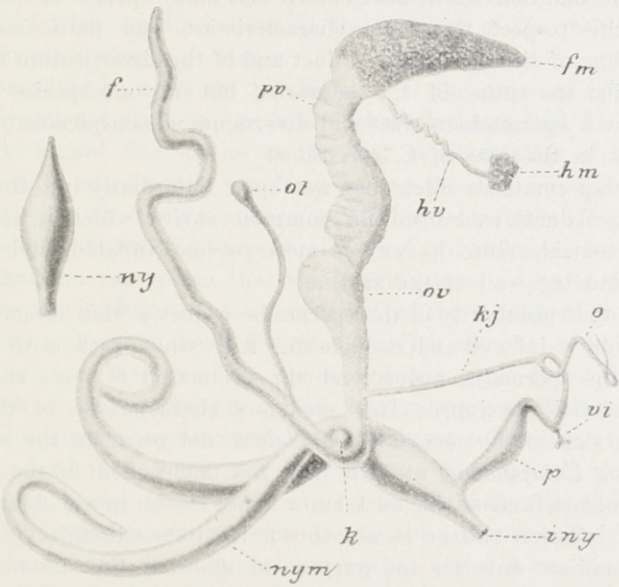

Fig. 2. Reproductive system of *H. coerulans*.
fm = albumen gland, *hm* = hermaphrodite gland, *hv* = hermaphrodite duct. *pv* = oviduct, *ov* = prostate, *kj* = vas deferens, *nym* = mucus glands, *p* = penis, *o* = flagellum, *vi* = penis retractor muscle, *ot* = spermatheca, *f* = diverticulum, *iny* = generative orifice, *f* = sacklike appendix of the spermatheca duct, *ny* = dart.

the end forklike ramified mucus glands. *C. coerulans* has also two very strongly developed, not ramified, cylindrical mucus glands, the ends of which are curled. These are at least as long as the oviduct, though frequently longer. The dart sack is to be found between the two mucus glands and opens into the vagina under the place of union of the ovisperm duct and of the spermatheca duct. The dart is spearheaded and thickened in the whole length of its middle part, thinned at the edges, i. e. double-bladed. All the *Campylaeae* have such double-bladed darts.

The construction of the spermatheca duct is very interesting. Its chief characteristic is that the diverticulum is many times thicker than the spermatheca duct itself, furthermore it is very long and many times curved. The under part of the duct under the ramification is as large as the diverticulum, and since the latter is the direct continuation of the under part of spermatheca duct, therefore the upper part of the spermatheca duct appears to be the appendix. The researches of A. SCHMIDT and SCHUBERTH have shown that many species of *Campylaeae* have in this respect the same characteristics, and particularly is the construction of the spermatheca duct and of the diverticulum of *C. confusa* similar to those of *C. coerulans*, but no one species is known which has a spermatheca duct and diverticum so conspicuously different in size as in the case of *C. coerulans*.

The spermatheca duct does not open immediatly into the oviduct, but the two ducts lead into one common cavity, which is also visible from the outside since its wall is more or less inflated, and gradually merges into the wall of the vagina.

Another peculiarity of the spermatheca duct is that its end close to the opening is inflated and sacklike (fig. 2, *b*), which sack is to be found between the spermatheca duct and the oviduct, it is never absent, and is always well developed. This sack is a characteristic of the reproductive system of *C. coerulans*, and does not occur in the other species of the *Campylaeae*, at least it is not mentioned in the literature on this subject, and as far as I know is not shown in any figures either. What its function can be is not shown from its structure.

I mention only for the purpose of showing the character of the genitalia that the penis is sharply defined from the epiphallus, further the flagellum is very short as also is the penis retractor muscle which letter is generally cospicuously long in the *Campylaeae*.

It is quite clear from what has been said above that *C. coerulans* in respect of his reproductive system should be placed among the *Campylaeae*, because its organs differ from those of the typical *Campylaeae* only in a slight degree. We get, however, quite a different result if we look also at the construction of its gnawing apparatus. A slug which has sicklelike teeth and a smooth (oxygnath) jaw composed of two plates, can not be regarded as a representative of the genus *Campylaea*. In these two systematically very important characteristics *C. coerulans* differs not only from the *Campylaeae* but also from all the *Helicidae*, except the *Allognathus Grateloupi* mentioned above. It differs from *A. Grateloupi* again in the characteristics of its reproductive system. Though the reproductive system of *A. Grateloupi* is

some respect similar to that of the *C. coerulans* since it has two mucus glands ramified at the ends, yet it is in general more related to the genus *Helix* (s. str.), which is proved principally by its four-edged dart.

Not less important are the differences in the shells of the two species. Those of *C. coerulans* are the most similar to those of the *Campylaeae*, while the shell of *A. Grateloupi*, as is known, is most closely related to that of the *Maculariae*, I therefore regard *C. coerulans* as a representative of a distinct genus. In naming this new genus «**Hazaya**» I wish to do honour to the memory of the most excellent Hungarian malacologist J. HAZAY.

KOBELT[1] looks upon the peculiarities of the gnawing apparatus of the *A. Grateloupi* as such important characteristics that he would be inclined to regard this species as the last representative of an extinct family, and to take it quite out from among the *Helices*, and set up a new family for it. In accordance with this conception *H. coerulans* should be placed into the same family as *A. Grateloupi*, but the case of *H. coerulans* has shown that this placing into a separated family is not sufficiently justified. The construction of the reproductive system of *H. coerulans* shows undoubtedly that this species was developed from the *Campylaeae*, therefore the genus *Hazaya* must be regarded as a side-branch of the genus *Campylaea*, the gnawing apparatus of which has been transformed by accomodation to changed conditions of existence, to the changed food, which can be concluded from the fact that *H. coerulans* lives under quite other circumstances than the *Campylaeae*. The *Campylaeae* lives in places more humid and richer in vegetation, *H. coerulans*, however, on the driest rocks, where it can find nothing else except dry, or in rainy weather saturated mosses and lichens. Why this gnawing apparatus, the radula of which is provided with sicklelike teeth, and a jaw not ribbed but only striated, is more convenient for gnawing mosses, is a question which for the present can not be answered. It is possible that similar conditions separated the direction of development of the *Maculariae* and *Allognathus*, I therefore regard the resemblances of the gnawing apparatus of *Allognathus* and *Hazaya* as the result of a convergent development.

In the «Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft» (1908, Vol. 40., No. 3, p. 132) Mr. P. HESSE published a paper intitled «Kritische Fragmente». A part of this paper was devoted by the author to the criticism of my article published in the Hungarian

[1] Helix Quedenfeldti von Martens. (Nachrbl. d. Deutsch. Mal. Ges. XXIII., 1891, p. 140.)

language,[1] to which I also added a short resumé in the German language. — HESSE is of the opinion that the characteristics adduced by me, i. e. the characteristics of the radula and the jaw do not form a basis sufficiently strong for taking out *C. coerulans* from the subfamily *Campylaeinae*. As a ground for his objection HESSE refers to the fact that species possessing smooth (aulacognath) jaw, and a radula provided with aberrant teeth also occur among the *Murellae*.

I consider that the objections given by HESSE are not sufficiently weighty to justify me in changing my point of view. The jaw of *H. coerulans* is not a simple oxygnath jaw, but it represents a quite peculiar type of jaw, since it consists of two smooth plates instead of one as I have described above, and therefore in this respect the *H. coerulans* differs from all the *Helicidae* known up to the present, the variations on the contrary which are to be found in the jaw of the *Murellae* are always less significant, because however I regard the figures given by HESSE and WIEGMANN[2] I can not find one among them which differs even approximately to such a degree from the species with odontognath jaw as does *H. coerulans* from the *Campylaeae*, and for instance as HESSE writes the ribs of the jaw of the *Murellae* have a tendency to be flatter, while on the jaw of the specimens of Setubal «the 3—4 ribs were found to have become flattened and to have almost disappeared»,[3] i. e. transitions are to be found between the oxygnath and the smooth (aulacognath) jaws.

Still less convincing do I consider the second objection of HESSE which is based upon the fact that some species of *Murella* also have aberrant teeth. The teeth of the *Murellae* exhibit variability from the point of view that the teeth are shorter or at the most of the same length as the basal plate, but those of the aulacognath forms are considerabely longer. — Here again therefore we see a variability having such a systematical value as we have seen above in the case of the jaw. On the contrary *H. coerulans* has teeth which are not connected by transitions with those of the *Campylaeae*. The valuation of the characteristics is naturally a matter of individual conviction, but I am of opinion that the characteristics adduced above are in any case quite sufficient to justify the separation of *Hazaya* from *Campylaea*.

It is true, as I have also emphasised, that the construction of

[1] A Campylæa cœrulans anatomiája és rendszertani helye. (Állattani Közlemények, VII, 1908, p. 21—25.)

[2] ROSSMÄSSLER's Iconographie, N. F. XIV. Bd., 1908.

[3] Ibid., p. 31.

the reproductive system shows all the peculiarities which characterise the *Campylaeae*, but this fact does not give sufficient reason for regarding *H. coerulans* as a *Campylaea*, since the construction of its gnawing apparatus proves that the directions of development of *Campylaea* and *Hazaya* have separated. That in spite of this the reproductive systems of that two genuses do not show more marked differences can be explained from the well known fact that those organs are always the first to change, which are more exposed to the transforming power of the conditions of life.

According to HESSE «*Hazaya*» is a superfluous name, because BRUSINA employed the name «*Vidovicia*» for *H. coerulans* five years ago. But «*Vidovicia*» is a simple name without any description, a «nomen nudum», which according to the international rule of zoological nomenclature[1] can not be used, therefore the new genus must be named «*Hazaya*».

[1] Règles internationales de la Nomenclature zoologique. Paris, 1905, p. 21 (French text), p. 35 (English text), p. 49—50 (German text), Art. 25.