

A. hirta, perennis v. suffruticosa, erecta, foliis obovato-oblongis basi longe angustatis cauleque hirsutissimis, bracteis oblongis acuminatis villosis, calycibus amplis coloratis corollisque longe pilosis.—Tota pilis flavicantibus oblecta. Calyces coccinei. Corollæ tubus ultrapollicaris, limbi laciniis acutiusculis.

L.—*Metamorphosis observed in the Small Pipe-fish* (*Syngnathus lumbriciformis*). By PROF. B. FRIES*. With Plate XII.

WHEN I had the honour some time since of presenting to the Royal Academy of Sciences an addition to our knowledge of the Scandinavian species of the genus *Syngnathus*, I did not expect that I should so soon again have further occasion to return to the same genus, and to show in another point of view that it merits the attention of Ichthyologists. Such an opportunity has however been afforded by the unexpected discovery of a kind of metamorphosis which I have observed in the smallest of our pipe-fish, *S. lumbriciformis*. In all probability this is not the only species of the genus which undergoes this metamorphosis, but the same may probably occur in all those belonging to the division of *Syngnathi Ophidii*†. As previously I had had no opportunity of convincing myself of this fact, it may be well to publish the preliminary notice of what I have observed, in order to direct the attention of other naturalists to the subject.

After having satisfied myself by some successful trials of the possibility of keeping species of pipe-fish alive for a short time in reservoirs filled with water—which will not in general succeed with our sea fish—it was my intention to inquire into the relation subsisting between the young of the pipe-fish in their tender age and their parents; that is to say, I wished to learn whether the pipe-fish, also, afford their young the protection and care which, as experience has shown, the marsupial pipe-fish extend to their progeny; and, if it were so, in what manner nature had effected this, as the former are not furnished with the marsupial sac which in the latter affords

* Translated from the Swedish into German by Dr. Gans of Stockholm, and inserted in Wiegmann's Archiv, Part III. 1838, whence this is taken.

† For the terms ophidial pipe-fish and marsupial pipe-fish, see Prof. Fries's paper on the genus *Syngnathus*, a translation of which appeared at page 96 of this Journal.—EDIT.

to the young so sure a place of refuge. That such a relation must exist between the pipe-fish and their young, analogy appeared to require; and another circumstance which I had noticed seemed to indicate the means by which this was accomplished. The marsupial pipe-fish and ophidial pipe-fish exhibit, as is well known, a great difference in their motions and change of positions. The *Marsupiales*, which possess a stiff short tail, provided with a fin, swim like other fish chiefly by the help of the strokes of the tail. The *Ophidii*, on the other hand, with a long roundish tapering and very flexible tail, without any fin, receive little or no help in their progress through the water from this organ, which is generally kept still during swimming, and may rather be regarded as a helm than as an oar. When the marsupial pipe-fish rests, or remains still, it sinks extended to the ground, and lies on its belly with its tail extended, while the ophidial pipe-fish with great dexterity entwines its flexible tail around any object that may be present. We always see them holding fast in this manner, when they find anything that may be encircled; and even when no such object presents itself, but several individuals kept in the same vessel, frequently the tails are seen entwined round one another, and thus forming groups which in a certain degree resemble the old figures we see of the so-named "Rat-kings." This peculiarity in the ophidial pipe-fish suggested the idea that probably the young might possess this property in a still higher degree, and by this means might fix themselves to the male parent when any danger threatened them. In order to learn whether this was really the case, I procured a living male with eggs attached to the vent, placed it in a separate glass vessel filled with fresh water, and resolved to attempt to keep it alive until the eggs should be hatched and the young should have made their appearance. Chance would have it, that it was just our rarest species, *S. lumbriciformis*, which first fell into my hands, in a condition suitable to my intended purpose. It was towards the end of September that the fish was placed in the vessel with water. He appeared at first to thrive very well, although he refused all nutriment of whatever kind that I offered to him. The water was changed twice a day, morning and evening, when I carefully examined my prisoner. At the commencement of the observations, the

eggs were already so far advanced in development, that the embryos might be plainly distinguished with the lens ; but in the course of a few days the outer membrane became so opaque, that the changes, going on within, could not be observed any further ; and since for my purpose I merely had in view and waited for the hatching of the young, I would not venture to disturb the fish and to deprive him of any of the eggs for closer examination.

After six days my little fish was evidently exhausted, and the eggs began in many places to have a changed morbid appearance, so that I entertained some fear for the result. However, it still lived for some days, and as, on the morning of the ninth day of its imprisonment, I performed the usual examination, I was agreeably surprised to find at the surface of the water three hatched young. They swam in an erect position, very little concerned about one another, and had still less to do with the father, who lay quite still at the bottom. Through the whole forenoon I constantly watched all their motions, but could not perceive the least inclination in them to approach or hold on to the father, nor did he pay them the least attention ; in a word, they were all strangers to one another. Somewhat displeased at this coldness of theirs, which destroyed beforehand the whole of my projected theory, I took a lens and observed the young as they were swimming freely about in the water. To my great astonishment I then first perceived that they were provided with locomotive organs quite dissimilar to those which the parents possess. *The entire tail was surrounded by a fin-like membrane*, and *pectoral fins* were distinctly perceivable, which were in a constant vibratory motion, as in the marsupial pipe-fish. As none of our *Ophidii* in their complete development possess any trace of pectoral fins, and are without caudal fins, this discovery that these organs occur in them in their young state came quite unexpectedly upon me ; however the fact itself was clear and undeniable. Hence it follows, that these fish, like tadpoles, lose their tail and throw off caudal and pectoral fins at a fixed, but as yet unknown period ; a circumstance that has hitherto never to my knowledge been observed in the fish tribe. In the course of the afternoon, a fourth young, and

on the following morning a fifth and sixth, made their appearance ; several were not hatched. The whole egg substance exhibited itself in a half dissolved condition, separated itself, together with the adherent cellular substance, from the body, and fell in pieces. The fish died on the same day towards the evening. I now sacrificed two of the young for observation, and endeavoured by constant renewal of the water to retain the others alive, in order to observe their metamorphosis. The experiment, however, did not succeed. On the seventh day of their life they died one shortly after the other. What I observed during the short time they lived was their rapid growth from scarcely three Swedish lines in length to five ; otherwise no change occurred in them.

In the annexed plate, M. W. v. Wright has figured with his accustomed accuracy one of these young. Pl. XII. fig. 1. is a side view of it magnified. Fig. 2. from above, and the intermediate small figure indicates the natural size. The entire body is white and transparent, so that the vertebral column and the intestinal canal in the ventral cavity appear through. The head, very large in proportion to the rest of the body, occupies about a sixth of its whole length, has true and distinct eyes, and also the turned-up snout which characterizes *S. lumbriciformis*. The length of the snout in proportion to the other parts of the head is larger in the young than in the old fish. It is also worthy of remark, that while the border of the gill covering in all older *Syngnathi* is connected by a membrane, and the common epidermal covering with the rings of the shoulder, and leaves behind at both sides of the neck merely a small aperture by which respiration is effected, the young have the same border of the operculum entirely free, by which the gill apertures are greater than is generally the case in fish. Fig. 2. shows it quite distinctly. The anal aperture, which occupies its right position relatively to the dorsal fin, lies, however, somewhat nearer to the caudal extremity than in old individuals, i. e. a portion nearly equal to half the length of the body. This aperture in the young fish is more distinguished by the projecting posterior angle which the ventral line forms at this place. The scale plates which in the form of rings cover the whole body in the old fish appear not yet

to be formed; but when the young is observed from above, along both sides of the body a series of fine serrated teeth are seen to project, which can be nothing else than the *processus transversi* proceeding from the vertebræ, which exist in the old *Syngnathi*, and afford direct points of support for the said rings. I think I could count about eighteen such points between the head and anus, and at least 50 between the anus and caudal extremity. The ventral fins, which occupy the same place as in the marsupial pipe-fish, are very small, but distinct; they have an expanded somewhat rounded termination, and only rudimental rays. The motions of these organs are particularly lively. The dorsal fins may also be plainly distinguished, although their rays appear to be merely indicated; from this fin proceeds as prolongation, both forwards and backwards, a somewhat lower fin-like membrane, without the least trace of rays; the anterior continuation gradually decreases in height, and disappears about half-way between the neck and dorsal fin; the posterior prolongation continues, however, along the entire back of the tail, with the same height unto the extremity of the tail, turns round this, and then extends on the under side of the tail to the anus. The caudal fin in the young *Syngnathi* has also the same formation and shape as in the eel, and forms one of its chief natatory organs.

Such dissimilarly formed locomotive organs as we meet with in the small pipe-fish, as young and as old individuals, are explained by the different kind of locomotion which it employs at these various periods of life, and this again seems to indicate quite a distinct habit. To inquire more accurately into this point, as also to determine the period and kind of the metamorphosis, remains yet for future observations.

I take this opportunity of mentioning that the delicate young *Syngnathi* are perhaps of all things the best suited for microscopical examinations on the circulation of the blood.

LI.—*Information respecting Botanical Travellers.*

AGAIN, on June 8th, Mr. Gardner writes thus from Pernambuco*: "Ever since my return from the Rio San Francisco, I have been anxiously expecting the parcels and letters of which this day has

* In continuation of the extracts given in our last Number, p. 365.