

## XXXI.—THE RAISING OF SPONGES FROM CUTTINGS.

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The Imperial Ministry of Agriculture in Vienna has placed at the disposal of the society a report by Mr. Gregor Buccich, a telegraph-operator on the island of Lesina, in Dalmatia (made in 1876), on the experiments in raising sponges artificially according to Prof. O. Schmidt's method. Mr. Buccich had himself founded his little establishment, and for some time received an appropriation from the ministry; but from various causes the establishment is not in operation at the present time. The above-mentioned report contained a sort of diary, and gave the results of experiments which had been continued for six years. The directors of the society shared the opinion of the Ministry of Agriculture, that it would be useful to publish this report and thus preserve the principles laid down in it, because it had been fully proved that although the hope to create a new source of income for the poor coast population of Dalmatia had not been realized, the principle that sponges can be raised from cuttings had been fully established. The Imperial Ministry of Agriculture cheerfully granted the request of the society to examine all the other documents on the subject, principally original reports of Prof. O. Schmidt, some of which have appeared in the "Austria," a publication which has ceased to appear. With these sources at my command, I wrote the following article with a view of giving a brief guide to any persons, both at home and abroad, who are interested in the culture of sponges.

Regarding the history of sponge-culture in the Adriatic, a few remarks will suffice. After Prof. O. Schmidt in an article in the *Wiener Zeitung*, and in his work on the sponges of the Adriatic, † had expressed the opinion "that if a perfectly fresh sponge is cut into suitable pieces, and if these pieces, properly protected, are again placed in the sea, they

\* *Die Aufzucht des Badeschwammes aus Theilstücken.* Von Dr. Emil von Marenzeller.  
[Translated by HERMAN JACOBSON.]

† "*Die Spongien des adriatischen Meeres.*" Leipzig, 1862, p. 22. See also, O. SCHMIDT, "*Supplement der Spongien des adriatischen Meeres.*" Leipzig, 1864, p. 24, and especially, BREHM, "*Thierleben,*" 2d edition, vol. 10. Lower Animals; by O. Schmidt, 1878, p. 534.

will grow,\* and finally develop into complete sponges," the government and a number of prominent merchants of Trieste had some experiments made during 1863-1872, and established a station on the bay of Socolizza, at the northeastern point of the island of Lesina, which in May, 1867, was placed under the direction of Mr. Buccich. This establishment was closed in November, 1872, as its continuance became impossible, because, in spite of Mr. Buccich's oral and written remonstrances, it was continually disturbed by the fishing-nets and was actually robbed several times. A species of worm which destroyed the wood-work appeared harmless compared to the hostile attitude of the population, which showed an utter want of respect for the property of other persons, and manifested deep-rooted prejudices against any innovations, as well as a reluctance to break with old habits.

The most favorable season for raising sponges from cuttings is winter. It is true that the growth of the sponge and the new formations on the cut sides goes on slower in winter than in summer, but a high temperature of the air often endangers the entire crop on account of the tendency of the sponges to rot. In winter a sponge may remain on the dry land for several hours, while in summer it will perish in a few minutes especially if it has been injured and if it is not constantly moistened with fresh water. Mr. Buccich exposed sponge cuttings to the air in a shady place for eight hours during February, when the temperature of the air was 48° F., and still they all took root.

The best localities are bays where the waves are not too strong but where the surface is not entirely smooth either, with a rocky bottom covered with green algæ and exposed to a gentle current. It is a well-established principle that the mouth of streams and rivers and of subterranean springs should be avoided. The fresh color of the algæ is a sure indication that the choice of locality has been fortunate. The worst enemy of sponge-culture is mud. Under certain circumstances it would be well to close the entrance to the bay to vessels by a chain.

The sponges which are to be cut should be very carefully gathered by

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\* I find that Cavolini was already acquainted with the fact that sponges loosened from their bases and fixed to other objects are able to replace any portions they may have lost; but this interesting fact again fell into oblivion. Filippo Cavolini reports on these experiments on pp. 266-271 of his "*Memorie per servire alla storia de polipi marini*," Naples, 1785, where he endeavors to prove that the sponges are not plants but animals. He took two kinds of *Spugna officinale del Linnæo*, probably a *Euspongia*, also a *Spugna carnosa* ("*poco atta agli usi economisi, perchè difficilmente quella carne colla macerazione si scioglie*," therefore probably a *Sarcotragus*), and a third kind, *Spugna detta alcionio foraminosa dall' Imperato*, put a thread through every one and thereby fastened them to the bottom of simple clay vessels having two holes. These vessels he let down into the sea in the grotto "*ehe tuona*," near Naples, and took them up again after twelve days. Although, as Cavolini says, the sponges had been very much injured in gathering, they had a complete newly-formed base (which Cavolini describes very well), their wounds were healing and decreasing in number. Two specimens of the third kind had been forced into a rather narrow vessel and were found to have grown not only to the sides of the vessel, but also to have grown together.

experienced persons. They are either taken with tongs or with a dragnet. One arm of the tongs is fastened to a long pole and is immovable; the other can be moved and pressed against the former by means of a string which, as well as the pole, is held by the gatherer. Objects coming between the two arms of the tongs are held firmly in this manner and can be raised from the water, of course from such a depth only as can be reached with the eye and the pole. The sponges are brought up either with their base—and this is the most favorable case—or they must be torn from the base, which operation frequently tends to injure them. Wherever the bottom of the sea is suitable I would recommend the use of the dredge-net. In Lussin and Lesina I often saw my people work with the so-called O. F. Müller's or Ball's dredge-net or with an apparatus resembling the trawl of the English and American deep-sea fisheries, and the sponges which were brought up were invariably in excellent condition. In gathering sponges for cutting it is entirely unnecessary to select nice-looking specimens, for misshaped pieces which would be worthless in trade are just as good for this purpose as beautifully rounded ones. These latter should not be cut, but should be reserved for the trade. Fishing for sponges with tongs has this drawback, that, properly speaking, it can only be successful when the surface of the water is perfectly smooth. As the pouring of oil on a gently curled surface does not answer the purpose, Mr. Buccich constructed a simple apparatus. It is a tin-box 32 centimeters square in whose bottom a sheet of glass is inserted. This box is placed on the surface and through the glass bottom the bottom of the sea is examined\*. Mr. Buccich found that it was not expedient to place the sponges as they were gradually gathered into a vessel, to keep them there until they were to be cut, because they are easily injured by pressing against each other or by being shaken too violently. He therefore provisionally fastens them with wooden pegs to the inner side of a sort of fish-box, which is held in tow by the fishing-boat. If the sponges are injured, the injured portions should be immediately removed; the remainder is likewise fastened with wooden pegs, either as it is or subdivided in large pieces.

When the temperature is low during the cold season, the sponges can be prepared for raising as soon as the place is reached where the process is to be carried on, while during the warm season it will be found profitable to wait a little in order to see whether there are any indications of putrefaction. This can be recognized by the darker color and the softening of the respective portions. If anything of the kind is noticed the sponge should be watched to see to what extent the process of disintegration has progressed. Small sponges will almost entirely fall a prey to it, while in large ones the evil may be confined within certain

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\* The Greek sponge-fishers use the same apparatus in the shape of a cylinder 37 centimeters wide and 50 centimeters high made of tin, its bottom being composed of a sheet of glass, which is half let down into the sea. See G. v. ECKHEL, *Der Badeschwamm*." Trieste, 1873, p. 12.

limits. The cutting should be done rapidly either with a common knife or—which Mr. Buccich found to be more advantageous—with a blade resembling a fine saw, which is less liable to be injured by the many foreign bodies inclosed in sponges. In cutting, the sponge had best be laid on a small board moistened with sea water. The size of the cuttings is generally about 26 square millimeters. It is well if every piece has as large as possible a surface of intact outer skin. The cuttings should immediately be fastened to those objects where they are expected to grow.

A healthy piece of sponge soon grows firmly on any object with which it is brought in close contact. Sponges which have been cut will again grow together. Those cuttings which have only a single cut surface will soonest grow fast to their new base, stone, wood, &c. Mr. Buccich thinks that during a calm lasting 24 consecutive hours cuttings could simply be sowed on a rocky bottom and would soon grow. He has seen pieces laid on gently slanting rocks grow fast to them during a perfect calm. Induced thereby, and also by the natural occurrence of sponges, Mr. Buccich tried flag-stones, about 53 millimeters thick, as a basis. He bored holes in them and fastened the cuttings by means of wooden pegs, which were driven into the holes; but it soon became apparent that the mud and sand of the bottom, perhaps also the excess of light, was injurious to the further growth of the sponges. Experience has shown that light and mud are among the worst enemies of the sponge, and their influence must by every possible means be avoided or limited. Stones form the natural basis of sponges; they are cheap and are not attacked by the *Teredo*.

Originally, Prof. O. Schmidt used wooden boxes closed on all sides but perforated, to whose inner sides the pieces of sponge were fastened with metal or wooden pegs. This exceedingly simple arrangement did not prove efficient; because the boxes when let down into the deep water became full of mud, and the holes being stopped up no light whatever could enter. The sponges began to look pale and sickly. It is not good to fasten them with metal pegs, for it seemed to retard their growth. The rust which forms very soon causes the pieces of sponge to become loose, and will ultimately destroy them. Laths or boards placed obliquely, on whose upper side there were floating contrivances in the shape of tables, to whose lower side the sponges were fastened, were likewise used.<sup>4</sup> With the former, the want of covering was keenly felt; and with the latter, the rays of the sun proved injurious, as well as all the different little objects floating on the surface of the water which may be grouped together under the collective name "dirt." Mr. Buccich at first prepared an apparatus consisting of two boards crossing each other at right angles with a third board serving as a sort of lid, and after this had proved unsatisfactory he adopted the apparatus

<sup>4</sup>Prof. O. Schmidt also entertained the idea, which was never carried out however, of merely putting the cuttings on suitably arranged strings.

which I shall now describe, and which he preferred to all others because the cuttings were exposed on all sides to the sea water and assumed the favorite round form. This apparatus consisted of two boards, 63 centimeters long and 40 centimeters broad, one forming the bottom and the other the lid. Both were kept in a parallel position, one above the other, at a distance of about 42 centimeters, by two props about 11 centimeters distant from each other, between which stones may be placed as ballast. On the outer side of the lid there was a handle. Both boards had holes at a distance of 12 centimeters from each other; the total number of holes in each board, therefore, being 24. Mr. Buccich did not fasten the pieces of sponge singly to the apparatus, but he placed several of them on one peg and then stuck the pegs in the holes. For these pegs he used bamboo, whose hard smooth bark defies all attacks of worms. These pegs were 42 centimeters long and perforated horizontally, the holes being at the distance of 12 centimeters from each other, and the lower end was split. Three pieces of sponge were put on each peg and pushed up high enough to be above the horizontal holes, through which a wooden peg was pushed, thus fully securing the sponges.

If the pieces of sponge are simply to be fastened with wooden pegs a three-cornered stiletto will suffice for making the holes in the sponges, but when they are to be strung up on pegs this or any similar instrument cannot be used, because too great a pressure would have to be exercised to make a sufficiently large opening for the passage of the pegs. Any pressure will to some degree injure the sponges, and to limit its extent or force as much as possible should be the first object. Mr. Buccich bored the holes with a trepan 6 millimeters wide, fastened to a vertical turning-table, which was kept in rapid motion by a fly-wheel. One hand pressed the sponge lightly against the trepan, the other turned the wheel, and the operation was finished in a few seconds. The hole in this manner is perfectly smooth, none of the fibers have been pulled out, and none of the sarcode has flowed out. As soon as a peg has been furnished with sponge-cuttings, its split end is stuck in one of the holes of the apparatus and a wedge is driven through the crack. As lid and bottom hold 24 pegs, each with three cuttings apiece, such an apparatus can hold 144 cuttings. During this whole process the sponges should be continually moistened with sea-water, especially during summer. As soon as an apparatus has been filled, it should immediately be let down into the water if the temperature is high, while in winter a delay will not prove injurious. The letting down and raising of the apparatus had best be done by means of a small anchor, and they should be let down to a depth of 5-7 meters. Mr. Buccich does not consider it necessary to have the apparatus suspended from a sort of scaffolding. All the wood-work should be well tarred, as this will prove the only, though by no means always efficient, protection against worms. The *Teredo* does not only cause an increase in the capital to be employed,

because it makes new apparatus necessary from time to time, but it also diminishes the results, because the pegs will gradually get loose and fall off. It would therefore be best to dispense with wood altogether, and either construct the apparatus of stone, taking the necessary precautions against mud and excess of light, or construct Mr. Buccich's exceedingly practical apparatus of iron.

If, after three or four weeks, the sponges have grown firmly to their base, they are sure to develop successfully. Their most characteristic tendency is the desire to grow round. In order to facilitate this in all directions Mr. Buccich strung the sponges on pegs. As regards the development of the sponge-cuttings within certain given periods we have only very imperfect information, as it was impossible to make continued undisturbed observations. Mr. Buccich says that the cuttings grow two to three times their original size during the first year. He also mentions that the cuttings grew better during the first and fourth (?) year than during the second and third. It is his opinion that, although some pieces will grow to a considerable size in five years, it will require seven years to raise completely matured sponges which are fit to become an article of merchandise. I cannot pass by the fact that besides well developed and growing sponges there were some which outwardly looked perfectly healthy but had ceased growing.

In conclusion, Mr. Buccich discusses the question whether the enterprise can, on the whole, be called profitable, and says that he must answer it in the affirmative. He thinks that if all the lessons taught by experience are carefully observed the cuttings will always develop successfully, and that the loss would at most be 10 per cent., taking into account unexpected accidents and the stationary character of some of the sponges. Calculating the expense of an establishment for 5,000 sponges at 300 florins and the loss at 10 per cent., the price realized by 4,500 sponges would indicate the profits. Mr. Buccich calculates the value of 4,500 sponges at 900 florins. This sum is, in my opinion, much too high, as the wholesale sponge-dealers in Trieste receive an average price of 8 and a maximum price of 10 florins per kilogram of Dalmatian sponges. Sponges fetching the price given by Mr. Buccich ought to have a very considerable size, and their slow growth justifies the supposition that even after seven years they will not yet have reached that size. It must also be taken into account that the market value of sponges which have been raised on pegs is one-third less than that of naturally-grown ones on account of the hole in the center. The profitableness of sponge-culture would be far more evident if there was not such a long interval between planting and harvesting; in other words, if the sponges would grow more rapidly. This was certainly looked for when the enterprise was started, but it is dispiriting to have to wait for your crop for seven or eight years. And in order that when that period has been reached there may be crops every year it will be necessary to invest the same annual amount of capital for a period of seven years. The apparatus, more-

over, is not so simple that every fisherman could easily construct it himself, for experience has shown that wood, which would be the easiest material for working, cannot be used on account of the ravages of the *teredo*. As far as our present knowledge goes, it is certain that sponge-culture will not be profitable for poor men, but that it can only be carried on successfully on a very large scale either by wealthy individuals or by joint-stock companies. It would be very encouraging to know more concerning the progressive development of the sponge in its natural condition, and especially to know that this development was just as slow as that of the cuttings. Prof. O. Schmidt inclined to this opinion. But if it should prove erroneous it would be more than questionable whether it is profitable to cut to pieces a sponge which uncut would have quicker reached the same size and weight than all the cuttings together in seven years. Under such circumstances sponge-culture had better be confined to the transformation of flat and therefore worthless sponges into round ones, which, though small, would find a ready market. Possibly several, especially misshaped, pieces of sponge might be made to grow together and form larger and better formed ones. The experiments made by *Cavolini* and Mr. *Buccich's* own above-mentioned experience show that there is no difficulty in doing this.

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