

## Marine algae published by Savigny in the zoological portion of “*Description de l’Égypte*”

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(Received 25 February 2003, accepted 26 August 2003)

**Abstract** – Illustrations of 14 identifiable marine algae were incorporated in the zoological portion of the second volume of the natural history atlas of *Description de l’Égypte* by Savigny, a member of the scientific staff of the French expedition to Egypt (1798-1801). These illustrations were interpreted by Audouin in the text of this publication, but phycologists have remained unaware of their existence. Savigny collected in both the eastern Mediterranean and the northern Red Sea, but the collecting site for individual species is not always determinable. In the present paper, Savigny’s illustrations are reinterpreted and the possible or probable collecting site of each illustrated alga is discussed. The species described by Audouin from Savigny’s illustrations include *Spongodium parvulum*, which clearly represents a species of *Codium* reported from the Red Sea by Nasr as *C. repens* Crouan *fratr.* and subsequently described as a new species, *C. nasrii*, by Farghaly.

**Bonaparte / *Codium parvulum* / Delile / Description de l’Égypte / Red Sea / Savigny**

**Résumé** – Algues marines publiées par Savigny dans la partie zoologique de la «*Description de l’Égypte*». Savigny, un des naturalistes de l’Expédition française en Égypte (1798-1801) a incorporé dans la partie zoologique du deuxième volume de l’Atlas d’histoire naturelle de la «*Description de l’Égypte*» les illustrations de quatorze algues marines identifiées. Des interprétations de ces illustrations ont été proposées par Audouin dans le texte de la *Description de l’Égypte*, mais sont restées inconnues des phycologues. Savigny a récolté ces algues en Méditerranée orientale et en Mer Rouge septentrionale, mais il n’est pas toujours possible de connaître avec certitude le lieu de récolte de chaque espèce. Le présent article comprend une réinterprétation des illustrations de Savigny et une discussion des lieux de récolte possibles ou probables de chaque algue représentée. Les espèces décrites par Audouin à partir des illustrations de Savigny comprennent *Spongodium parvulum*, représentant clairement une espèce de *Codium* signalée en Mer Rouge par Nasr comme *C. repens* Crouan *fratr.* et ultérieurement décrite comme une espèce nouvelle, *C. nasrii*, par Farghaly.

**Bonaparte / *Codium parvulum* / Delile / Description de l’Égypte / Mer Rouge / Savigny**

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## INTRODUCTION

The French expedition to Egypt (1798-1801) under the command of General Napoleon Bonaparte has inspired hundreds of books and articles written from various points of view. Although the campaign was a military failure, the cultural results were enormously important. The architectural and archeological treasures of Egypt were revealed to an intrigued western world while its hostile climate and topography, so different from that of France, piqued the curiosity of French scientists, who formulated currently accepted explanations of newly encountered natural phenomena. The greatest contribution of the expedition, however, was *Description de l'Égypte*, the monumental publication documenting the work of the scientists, architects, engineers, and artists who accompanied Bonaparte's troops.

The contributions of the designated botanist of the expedition, Alyre [Alire] Raffeneau Delile (1778-1850), have been widely publicized, at least in botanical literature, and phycologists are familiar with *Acanthophora nayadiformis* (Delile) Papenfuss (*Fucus nayadiformis* Delile, 1813: 292; 1826: pl. 56: fig. 1), *Asparagopsis taxiformis* (Delile) Trevisan (*Fucus taxiformis* Delile, 1813: 295; 1826: pl. 57: fig. 2), and *Ulva fasciata* Delile (Delile, 1813: 297; 1826: pl. 58: fig. 5), all of which were described from collections made by Delile during the Egyptian campaign. The fact that one of the designated zoologists of the expedition, Marie Jules-César Lelorgne de Savigny (1777-1851), also made botanical contributions is all but unknown. To our knowledge, the only 19th century author who cited Savigny's phycological work was Bory (1832, p. 329; in Chaubard & Bory, 1838, p. 77), who was a consultant to *Description de l'Égypte*. Aleem (1993), following a visit to Berkeley during which the present authors introduced him to Savigny's phycological contributions, listed six species that he believed had been illustrated by Savigny on the basis of specimens collected in the region of Alexandria.

One of us (PCS) has written an extensive account, to be published elsewhere, of the expedition with special reference to Delile and Savigny. The present paper deals chiefly with the phycological contributions of Savigny. To provide background for this paper, we give only the most important events leading to the collection, illustration, and description of the algae in question.

### Origin of Bonaparte's Egyptian campaign

The threat to Revolutionary France posed by a coalition of neighboring countries was dispelled temporarily by a brilliant military campaign in Italy (1796-1797), led by a young artillery captain, Napoleone di Buonaparte, a Corsican who had previously (1793) led the expulsion of the British from Toulon. As the French army approached Vienna, Austria sued for peace, resulting in the Treaty of Campo Formio.

Having been promoted to the rank of general and using the French spelling of his name, Bonaparte made a triumphant return to Paris. At that time, executive power of the French Republic was wielded by a committee of five Directors, constituting the Directory. Fearing competition from this popular hero, the Directors formulated a plan that would accomplish two important goals simultaneously. They placed Bonaparte in charge of an expeditionary force to be sent to Egypt and adjacent regions of the Mediterranean in an attempt to cut off England's route to India. By doing so, the Directors not only furthered the

interests of France, but also protected their personal political futures by removing a potential rival from Paris. Bonaparte was swept away with the prospect, picturing himself not only as the conqueror of Egypt, but of India as well. He was not content, however, with leading a mere military mission. Being deeply interested in science, arts, and literature and having the utmost respect for men accomplished in those fields, Bonaparte conceived a grandiose project that amounted to a cultural marriage accompanied by military persuasion.

### **Formation of the cultural commission**

Being given a *carte blanche* by the Directory, Bonaparte set about recruiting an elite corps of scientists, mathematicians, engineers, architects, and men of letters, to be assisted by printers and draftsmen. He sought the most accomplished men, but out of consideration for old age, in many fields he had to be satisfied with younger men nominated by their celebrated mentors. At that time there was an assemblage of brilliant naturalists in the Muséum d'Histoire Naturelle, including Lamarck, Cuvier, Geoffroy Saint-Hilaire, Jussieu, and Desfontaines. The zoologist Geoffroy Saint-Hilaire accepted Bonaparte's invitation, but Cuvier declined, nominating a student by the name of Savigny as a replacement. Similarly, the botanist Desfontaines declined in favor of his student, Delile. Compared to Savigny, Delile turned out to be more stable, less imaginative, and less colorful. His role in the expedition will not be detailed in this paper.

Savigny was only 21 years old but already had had considerable experience in natural history, all aspects of which were of keen interest to him. He had camped on the doorstep of the Muséum d'Histoire Naturelle, availing himself of the collections, libraries, lectures, and counsel and friendship of its illustrious staff. He lived in abject poverty in an attic room near the museum. Only a few months before being nominated by Cuvier, he was asked by Lamarck, who had undertaken the preparation of a monumental *Encyclopédie méthodique*, to write certain botanical articles. The first article was written overnight, both astounding and pleasing Lamarck, who naturally gave Savigny more to do. Despite Savigny's superiority in professional experience, Delile was designated as botanist while Savigny was asked to go as an invertebrate zoologist with Geoffroy Saint-Hilaire handling the vertebrates. Lacking zoological experience, Savigny hesitated, but Cuvier expressed confidence in him, and indeed Savigny successfully applied his genius to zoology.

### **From France to Egypt**

The entire expeditionary force assembled at Toulon and was loaded onto 130 transports escorted by 13 warships and various frigates. They sailed on May 19, 1798. After adding several smaller convoys, the force comprised 400 ships and 55,000 men. Discounting a disinformational rumor of imminent invasion of their homeland, the English correctly guessed the French plan and sent a squadron under the command of Horatio Nelson into the Mediterranean. Nelson raced to Alexandria, but failed to find the French because Bonaparte had stopped at Malta to punish the Knight Templars for harboring fugitive royalists. Nelson, puzzled and suspicious, pushed on to Palestine.

Landing of the expedition was made at a fishing village near Alexandria during the first few days of July 1798. Meeting little initial resistance, Bonaparte marched across the desert first to Alexandria, then to Cairo, vanquishing the Mameluke rulers of Egypt at the Battle of the Pyramids on July 21/22. Ten days

later, Nelson found and destroyed the French fleet, which had moved to Alexandria, in an engagement called the Battle of the Nile (August 1/2). Unperturbed, Bonaparte proceeded to establish procedures for seizing Mameluke properties, for collecting taxes, and for operating the mint. He was anxious to find a home for the corps of learned men, which had been designated the Commission des Sciences et des Arts de l'Armée d'Orient. To that end he commandeered a building sufficiently large to house the French and Arabic printing presses, the chemical and physical laboratories, and an observatory. On August 22, he founded the Institut d'Égypte, comprising the most illustrious members of the Commission. A newspaper and a scientific and literary review (*La Décade*) were soon established.

### Botanical exploration

While Bonaparte was undertaking a monumental restructuring of the government and commerce of Egypt, both Delile and Savigny were in the field, exploring the Nile delta. Savigny couldn't resist his botanical impulses and described a new species of water lily (*Nymphaea caerulea*) in a paper read to the Institut in September and published in October in *La Décade*, a journal overlooked by all modern botanists. Delile published an article in the same issue, on the uses of the date palm (*Phoenix dactylifera*). During the following year (1799), Delile explored the valley of the Lower and Middle Nile. Among his collections were seaweeds from both Alexandria and Suez. Savigny was much more adventurous. His insatiable curiosity led to the collection of rock samples, cultural artifacts, insects, and shells. He filled his journal with observations on birds and the weather.

In January 1799, Bonaparte received word that the pasha of Syria, another province of the Ottoman Empire, had seized El Arish, an Egyptian outpost, and so he assembled a small expeditionary force in Cairo and set out for Palestine. He had asked Geoffroy Saint-Hilaire to accompany him, but the latter was ill and suggested Savigny as a substitute. Bonaparte's Palestinian campaign proved to be his undoing. He reached an impasse when he tried to besiege the citadel of Acre. A British squadron commanded by William Sidney Smith was in the harbor, furnishing supplies with impunity, while on land the French forces were being rapidly depleted by the plague. Bonaparte gave up on May 20 and returned to Cairo on June 14, along with the remnants of his army. Throughout the Palestinian campaign, Bonaparte had been favorably impressed with Savigny, who was obsessed with his work and managed to remain in excellent health and to collect various kinds of animals even while his companions were collapsing from fatigue or disease.

Bonaparte, foreseeing military defeat, returned to France in August 1799, leaving the expedition in the hands of Général Kléber. Following Bonaparte's departure, two groups of the Commission were sent to Upper Egypt, Savigny in one group, Delile in the other. This handful of Frenchmen were the first western Europeans to see the great temples of Karnak and Luxor.

Bonaparte had sent two missions to Suez to study the remnants of the ancient canal and to survey new routes. There were no naturalists on those excursions, a shortcoming that was rectified by Général Kléber, who, toward the end of 1799, dispatched a third mission, this one including both Savigny and Delile. Delile wandered along the shore and in the adjacent desert, collecting spermatophytes, while Savigny was wading in the water, collecting molluscs, corals, sponges, urchins, hydroids, and seaweeds.

The Commission continued their work all through 1800, a year of great uncertainty. With the arrival in Egypt of a British fleet on March 1, 1801, evacuation had top priority. The British commander, General Hutchinson, held the Commission for ransom, demanding that they surrender their collections, even though most of their specimens and artifacts would have been considered worthless by laymen. One truly precious object, however, was the Rosetta stone, which one of the engineers had stumbled over while surveying the delta of the Nile River. This basalt tablet was inscribed with a decree by Ptolemy V (196 B.C.) in Egyptian hieroglyphics, Demotic (a simplified cursive style of hieroglyphics), and Greek, thus providing a key to understanding ancient Egyptian culture. Influenced by an impassioned plea by Geoffroy Saint-Hilaire, General Hutchinson agreed on a compromise: the Commission could keep their collections, but the Rosetta stone would accompany him to London.

### **Description de l'Égypte**

Bonaparte's military defeat in Egypt did not dampen his enthusiasm for the scientific and cultural results of the expedition. To the contrary, he was determined to do everything possible to publish these results in a form that would make the nation proud and push the military defeat into historical oblivion. The multi-volume work was to be called *Description de l'Égypte* and was to remain unsurpassed in elegance, elaborateness, and grandeur. The chosen format was elephant folio, approximately  $60 \times 75$  cm. Extremely critical editorial committees were established to insure the highest possible caliber of scholarship. Crews of engravers were kept busy for many years, at enormous cost, both in francs and in eyesight. Vast sums were appropriated periodically by the government, despite frequent national crises.

Delile dutifully worked up his collections and the text was published in 1813, although the plates did not appear until 1826. Savigny was a decidedly different person. He combined the irreconcilable qualities of a generalist and a perfectionist. He had collected everything in sight, but when it came time to publish on these collections, he insisted on doing monographic work. One of his first projects after returning to France was to examine the mouth parts of about 1,500 species of insects. Savigny developed the principle of homology, as did Cuvier, who was working with vertebrates. These two workers thus share the honor of having founded the field of comparative anatomy.

### **Role of Audouin**

Savigny was over-committed to a debilitating degree. He served on 24 editorial committees during the period 1802-1816 while meticulously overseeing crews of engravers who were executing his precise drawings of both whole animals and dissections. He was assigned several taxonomic groups and in addition took upon himself responsibility for groups that were not entrusted to him. He supplied 27 plates of birds, mammals, and reptiles. His monument, however, is the magnificent set of 103 plates of invertebrates, to which are appended two plates of marine algae. The plates are breathtaking. Their large size ( $43 \times 59$  cm) allowed more than a hundred objects to be displayed in great detail. Unfortunately, Savigny suffered a nervous breakdown soon after returning to France, partially incapacitating him for the remainder of his life. He concentrated on the plates at the expense of the explanatory text. As many years passed and the prospects of Savigny completing his

assignments dimmed, the Commission with great reluctance by-passed him and in 1826 appointed someone to write the missing texts. The appointee was a brilliant young entomologist named Jean Victor Audouin (1797-1841), who was only an infant when the expeditionary force departed from Toulon.

Despite his brilliance, Audouin could not be expected to cope satisfactorily with the nearly impossible task of writing explanations of plates in the absence of the original specimens, which by this time were misplaced or lost. He necessarily enlisted the help of specialists, and in the case of Savigny's algae, he sought counsel from Jean Baptiste Geneviève Marcellin, Baron de Bory de Saint-Vincent (1778-1846). Upon being offered a stipend for this otherwise unrewarding work, Audouin requested that it be given to Savigny, who by this time was blind and desperately poor.

The algae collected by Savigny were illustrated primarily on two plates designated "Algues" in the zoological portion of the second volume of the natural history atlas of "*Description de l'Égypte*" (Savigny, 1817). Secondly, algae were illustrated as substrates of invertebrates, mainly bryozoans and hydrozoans, on eight plates designated "Polypes". In addition, a coralline alga was illustrated as a "Polype". The illustrations were drawn by Turpin and Prêtre under Savigny's supervision. Interpretations of the illustrations of "Polypes" and of the eight species of "Hydrophytes" were published by Audouin (1826a, 1826b) as part of the original issue of *Description de l'Égypte*. They were repeated (Audouin, 1828a, 1828b) in the octavo-sized second edition. In the following discussion we shall cite both editions because the second edition (published by C.L.F. Panckoucke) is much more readily available than the extremely rare original edition. The texts are identical.

## PRESENT-DAY INTERPRETATIONS OF SAVIGNY'S ILLUSTRATIONS

One should bear in mind that Audouin, when interpreting the illustrations made by Savigny, did not have voucher material at hand. At the present time we are in a much better position to interpret these illustrations, aided by the collections and information gathered in the northern Red Sea and the eastern Mediterranean during the two centuries that have passed since the French expedition to Egypt. Moreover, one of us (Y.L.) has studied the marine flora of this region for the past 40 years.

### Illustrations on the plates of "Algues"

The illustrations on the plates of "Algues" are accurately detailed and include different magnifications of characteristic structures or show magnified longitudinal and cross sections. Therefore, despite the fact that Audouin lacked vouchers, in most cases he could easily interpret the illustrations. Apparently he did not know the provenance of the illustrated specimens inasmuch as he failed to provide this information.

"Algues", pl. 1, fig. 1 (Fig. 1<sup>1</sup>) was interpreted by Audouin (1826b, p. 246; 1828b, p. 81) as *Cladostephus clavaeformis* C. Agardh. Although the species was correctly identified, this name is an illegitimate homotypic synonym of *Dasycladus vermicularis* (Scopoli) Krasser (*Spongia vermicularis* Scopoli).

1. References to our figures are given in parentheses in normal type, with a capital F (Fig.); references to figures on Savigny's plates are in normal type, with a lower-case f (fig.)

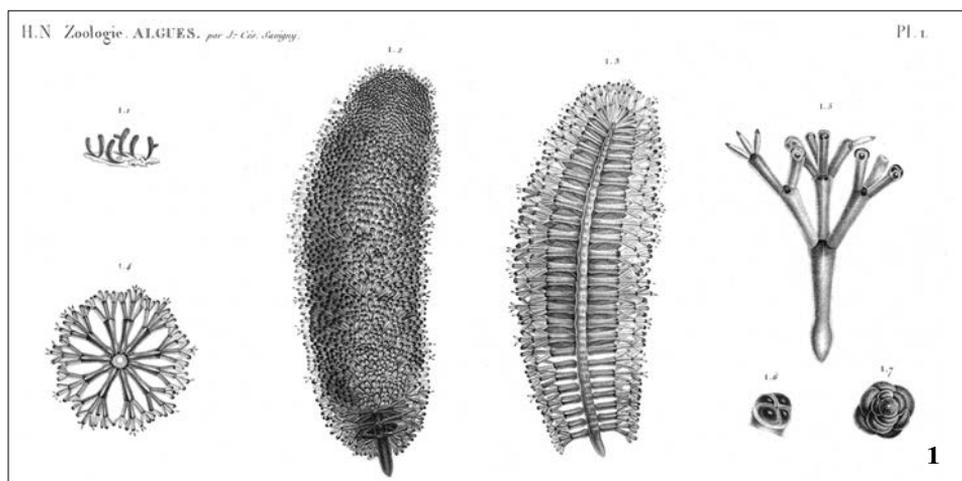


Fig. 1. *Dasycladus vermicularis* (Savigny, 1817, "Algues", pl. 1, fig. 1).

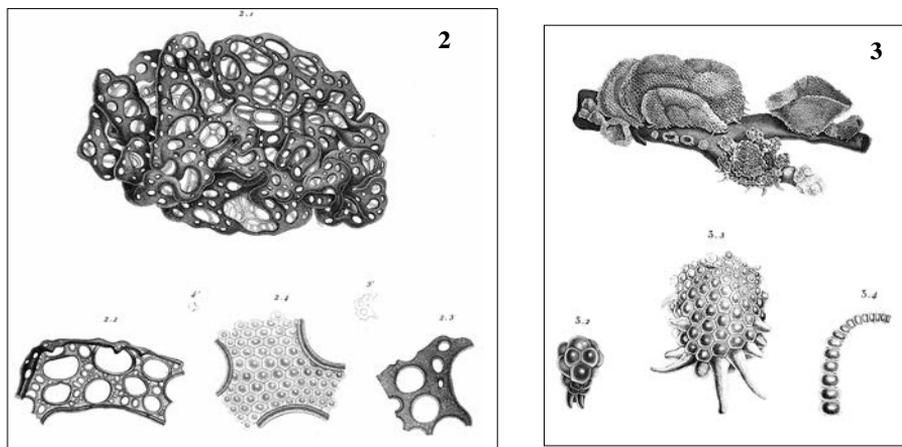


Fig. 2. *Hydroclathrus clathratus* (Savigny, 1817, "Algues", pl. 1, fig. 2)., Fig. 3. *Dictyosphaeria cavernosa* (Savigny, 1817, "Algues", pl. 1, fig. 3).

"Algues", pl. 1, fig. 2 (Fig. 2) was interpreted by Audouin (1826b, p. 246; 1828b, p. 82) as *Hydroclathrus cancellatus* Bory de Saint-Vincent. Again, the species was correctly identified but Bory's name is an illegitimate homotypic synonym of *Hydroclathrus clathratus* (C. Agardh) Howe (*Encoelium clathratum* C. Agardh).

"Algues", pl. 1, fig. 3 (Fig. 3) was interpreted by Audouin (1826b, p. 247; 1828b, p. 83) as an alga close to *Valonia favulosa* C. Agardh. This species, which is now referred to the genus *Dictyosphaeria*, was considered conspecific with *Ulva cavernosa* Forsskål by Børgesen (1932), who made the combination *D. cavernosa* (Forsskål) Børgesen. Audouin remarked that if the alga illustrated in fig. 3 was the same as the one described by Agardh, it very probably should be placed in its own genus. We believe that fig. 3 represents *Dictyosphaeria cavernosa*.

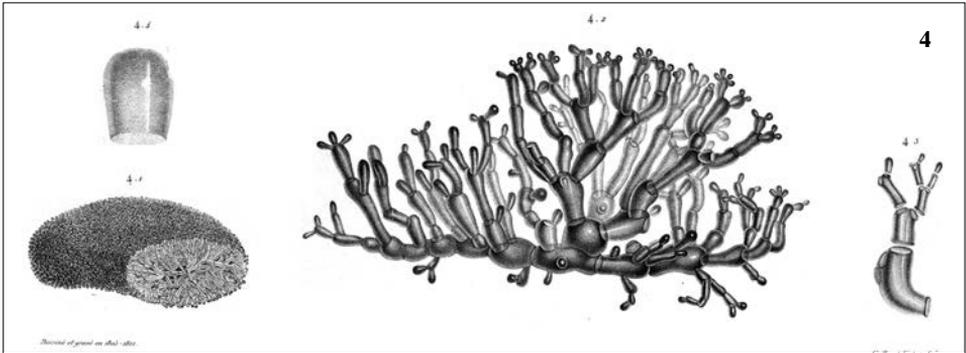


Fig. 4. *Valonia aegagropila* (Savigny, 1817, "Algues", pl. 1, fig. 4).

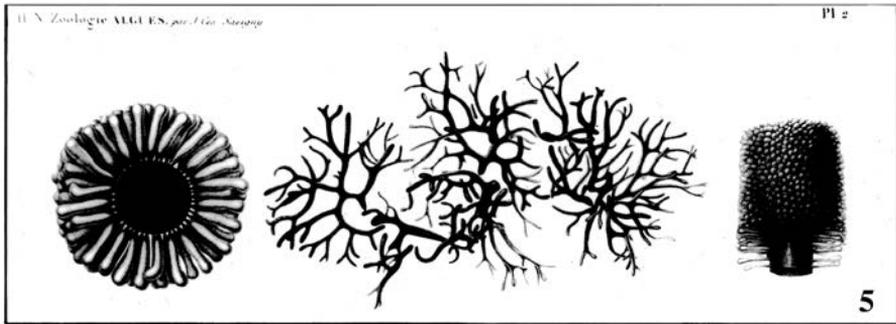


Fig. 5. *Codium parvulum* (Savigny, 1817, "Algues", pl. 2, fig. 1).

"Algues", pl. 1, fig. 4 (Fig. 4) was interpreted by Audouin (1826b, p. 247; 1828b, p. 83) as a previously undescribed species, which he named *Valonia savignyana*. This species was said by Audouin to be close to *V. aegagropila* C. Agardh, but to differ from that species in having a more ramified thallus with more slender segments. These perceived differences fall within the currently recognized range of variability of *V. aegagropila*.

"Algues", pl. 2, fig. 1 (Fig. 5) was considered by Audouin (1826b, p. 248; 1828b, p. 84) to represent a previously undescribed species of *Spongodium* Lamouroux. This generic name is an illegitimate substitute for *Lamarckia* Olivi, the earliest name applied to the alga now known as *Codium*. Olivi's name has been rejected, however, in favor of a later homonym, *Lamarckia* Moench in the Gramineae (Poaceae), so that the correct name for this genus is *Codium* Stackhouse. Audouin (l.c.) solicited the opinion of Bory, who proposed the name *Spongodium parvulum* for the new species. It was said to differ from *Codium tomentosum* [Stackhouse] by its much smaller size, a more ramified axis, and branches that are short, irregular, and open. The illustrated habit clearly shows a repent thallus with anastomosing branches that has been dissected into several irregularly branched portions. This alga was reported from three sites in the Red Sea by Nasr (1947, p. 52) as *Codium repens* Crouan *fratr.* and was described in an unpublished thesis as *Codium nasrii* Farghaly (1980, p. 80, pl. V). It seems likely that *Codium dwarkense* Børgesen (1947, pp. 6, 8, figs. 3-5), originally described from the west

coast of India, will prove to be conspecific with the alga illustrated by Savigny, for which the combination *Codium parvulum* (Bory ex Audouin) P.C. Silva is proposed. Utricles in this species, as in *C. dwarkense*, are constricted close to the apex, a feature that can be discerned in the left-hand figure of Savigny's plate.

"Algues", pl. 2, fig. 2 (Fig. 6) was considered by Audouin (1826b, p. 248; 1828b, p. 85) to be a previously undescribed species of *Lomentaria*, which he named *L. gracilis*. The right-hand figure, however, clearly represents a branch of a janioid coralline alga bearing terminal male conceptacles. We sought the opinion of H. William Johansen, an expert in the taxonomy of articulated corallines. He replied, "Most certainly the entity that Savigny drew was a male *Haliptilon virgatum* (Zanard.) Garb. & Johans." (Garbary & Johansen, 1982, p. 218). The basionym, *Corallina virgata* Zanardini (1840, p. 136), was applied to an alga that grew epiphytically on *Digenea simplex* in the Adriatic Sea. Although *Lomentaria gracilis* Audouin 1826 has priority over *Corallina virgata* Zanardini 1840, Audouin's name cannot be adopted because of the prior existence of *Haliptilon gracile* (Lamouroux) Johansen (1971, p. 243), based on *Corallina gracilis* Lamouroux (1816, p. 288, pl. X: fig. 1) from "Australasie". This is the first record of *Haliptilon virgatum* from the Red Sea. The left-hand figure in Savigny's plate shows the typical habit of this species, which is a compact mat. A few branches have been dissected from the mat and magnified in the middle figure, clearly showing the combination of pinnate and dichotomous branching characteristic of *Haliptilon*.

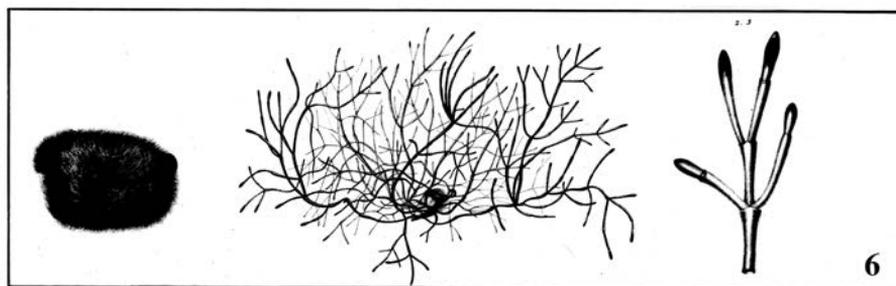


Fig. 6. *Haliptilon virgatum* (Savigny, 1817, "Algues", pl. 2, fig. 2).

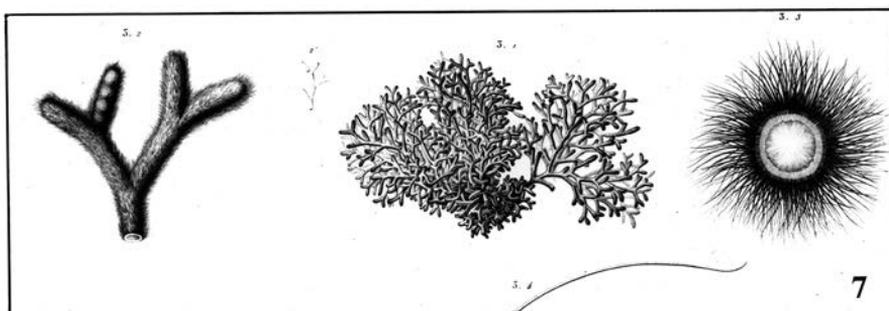


Fig. 7. *Galaxaura rugosa* (Savigny, 1817, "Algues", pl. 2, fig. 3).

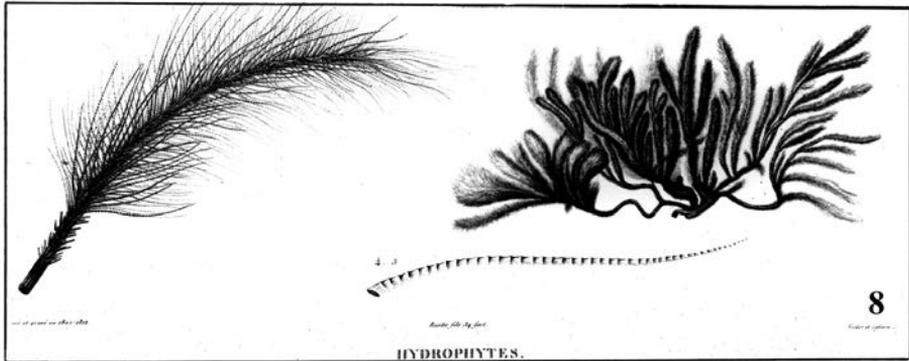


Fig. 8. *Digenea simplex* (Savigny, 1817, "Algues", pl. 2, fig. 4).

"Algues", pl. 2, fig. 3 (Fig. 7) was considered by Audouin (1826b, p. 249; 1828b, p. 86) to be a previously undescribed species of *Digenea*, which he named *D. dichotoma*. In fact, the illustrations in Savigny's fig. 3 look exactly like thoroughly washed *Galaxaura rugosa* (Ellis et Solander) Lamouroux, a species that almost always is heavily silted in the field and thus does not resemble Savigny's figure. The illustrated details of the thin lateral branches also agree with those of *G. rugosa*.

Plate 2, fig. 4 (Fig. 8) was correctly identified by Audouin (1826b, p. 249; 1828b, p. 87) as *Digenea simplex* (Wulfen) C. Agardh.

### Collection sites of Savigny's "Algues"

Audouin failed to give the collection site of these algae and probably did not have this information. The provenance of four of these species can be deduced, however, from their present-day distribution. *Dasycladus vermicularis* is a common species in the eastern Mediterranean but has never been reported from the Red Sea. Conversely, *Dictyosphaeria cavernosa* is very common on coral reefs in the northern Red Sea but has not been reported from the Mediterranean. *Galaxaura rugosa* is also common in the northern Red Sea but has never been reported from the Mediterranean. No *Codium* with a repent anastomosing habit has been found in the Mediterranean, so that *C. parvulum* clearly came from the Red Sea. A fifth species, *Haliptilon virgatum*, may be assigned to the Red Sea on the basis of the distribution of the mussel, *Brachiodontes variabilis* (Krauss), to which it is attached and engulfs. This mussel, which grows most commonly in the mid-midlittoral zone and occasionally in the infralittoral fringe, was restricted to the Red Sea prior to the opening of the Suez Canal in 1869, after which it penetrated and settled in the eastern Mediterranean (Safriel *et al.*, 1980). The provenance of the remaining three species cannot be deduced, however, because they occur in both the Mediterranean and the Red Sea. *Hydroclathrus clathratus* is a common winter-spring alga in both the eastern Mediterranean and the northern Red Sea. *Valonia aegagropila* and *Digenea simplex* are also common in both the Mediterranean and the Red Sea.

### Algal illustrations on the plates of “Polypes”

Additional illustrations of marine algae are found on 8 of the 14 plates of the section on “Polypes” of Savigny’s atlas. Most of these algae were illustrated as the substrates of epiphytic invertebrates, mainly bryozoans and hydrozoans. Only one alga was the primary object of illustration (“Polypes”, pl. 6, fig. 1.1) (Fig. 10), possibly a coralline alga, which would have been referred to the animal kingdom at that time. Audouin (1826a, p. 234; 1828a, p. 58) referred to it as “une coralline de M. de Lamarck, ou amphiroe de M. Lamouroux” and said that it was close to *Corallina tribulus* Ellis & Solander [*Amphiroa tribulus* (Ellis & Solander) Lamouroux]. The illustrated organism, however, is not a species of *Amphiroa*, but it may be *Neogoniolithon brassica-florida* (Harvey) Setchell & Mason, a species originally described from South Africa (as *Melobesia brassica-florida* Harvey) and subsequently reported from throughout the Indian Ocean, including the Red Sea (Penrose, 1996; Silva *et al.*, 1996).

According to Audouin (1826a, p. 235; 1828a, pp. 59-60), “Polypes”, pl. 6, figs. 3.1, 3.2, 3.3 and 3.4) (Fig. 9), represent an undescribed species of the crustose coralline genus *Melobesia* Lamouroux, to which he gave the provisional name *M. radiata*. He wondered whether the organism illustrated by Savigny might be *M. verrucata* Lamouroux (1816, p. 316) (which Audouin miscited as *M. verrucosa*), a species originally described from the Mediterranean. The illustrated organism, however, was recognized as a bryozoan by d’Orbigny (1850-1852, p. 971 [as *Unicavea radiata* (Audouin, 1826)]) and was assigned its currently recognized placement, *Lichenopora radiata* (Audouin, 1826), by Hincks (1880, p. 476).

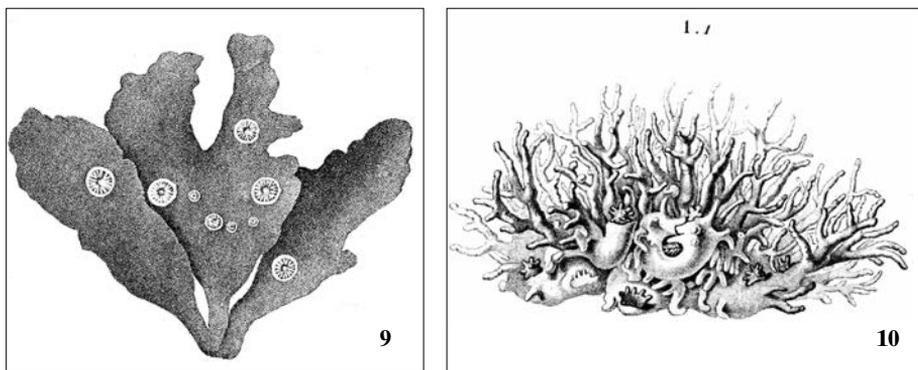


Fig. 9. *Avrainvillea amadelpa* (Savigny, 1817, “Polypes”, pl. 6, fig. 3.1). Fig. 10. *Neogoniolithon brassica-florida* (Savigny, 1817, “Polypes”, pl. 6, fig. 1.1).

The remaining algae illustrated on the plates of “Polypes” served as substrates for invertebrates. Audouin (1826a; 1828a) referred to them in a general way, such as “une espèce d’hydrophite”, “un hydrophite du genre *cystoceira*”, or “une feuille de fucus” (Tab. 1). In only one case is the substrate identified specifically, viz., in “Polypes”, pl. 7, fig. 6.1, for which Audouin cited “une feuille de *sargossum latifolium*”. Nevertheless, in this case, as in many other cases, the excellent illustrations allow easy identification of the algae. The “*sargossum latifolium*” is *Turbinaria elatensis* W.R. Taylor (Fig. 12). Five other species of marine algae could clearly be identified from among the substrates shown on the plates of “Polypes”:

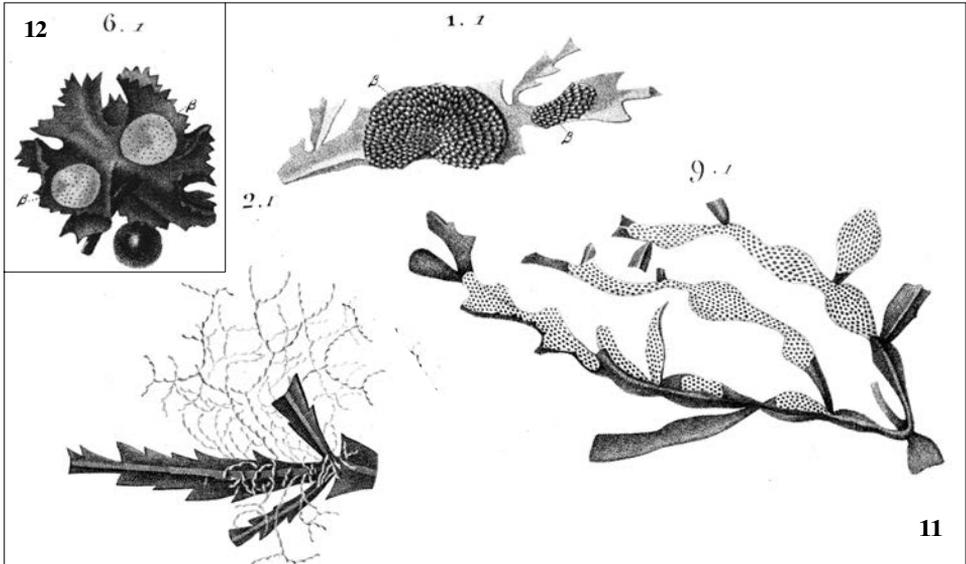


Fig. 11. *Hormophysa cuneiformis* (Savigny, 1817, "Polypes", pl. 8, fig. 1.1; pl. 10, fig. 9.1; pl. 13, fig. 2.1). Fig. 12. *Turbinaria elatensis* (Savigny, 1817, "Polypes", pl. 7, fig. 6.1).

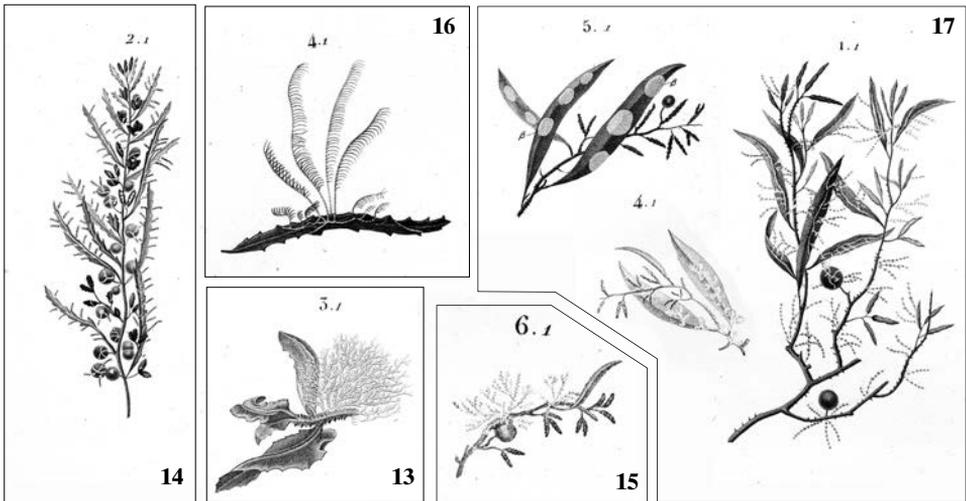


Fig. 13. *Sargassum latifolium* (Savigny, 1817, "Polypes", pl. 12, fig. 3.1). Fig. 14. *S. tenuissimum* (Savigny, 1817, "Polypes", pl. 14, fig. 2.1). Fig. 15. *S. dentifolium* (Savigny, 1817, "Polypes", pl. 6, fig. 6.1). Fig. 16. *S. tenuissimum* or *S. boryanum* (Savigny, 1817, "Polypes", pl. 14, fig. 4.1). Fig. 17. *S. cf. linifolium* or *S. vulgare* (Savigny, 1817, "Polypes", pl. 6, fig. 4.1; pl. 7, fig. 5.1; pl. 14, fig. 1.1).

*Hormophysa cuneiformis* (J.F. Gmelin) P.C. Silva ("Polypes", pl. 7, fig. 1.1; pl. 8, figs. 1.1 and 9.1; pl. 10, fig. 9.1; pl. 12, fig. 2.1; and pl. 13, figs. 1.1 and 2.1) (Fig. 11); *Sargassum dentifolium* (Turner) C. Agardh ("Polypes", pl. 6, fig. 6.1; pl. 7, figs. 2.1, 3.1 and 4.1) (Fig. 15); *S. latifolium* (Turner) C. Agardh ("Polypes", pl. 12, fig. 3.1)

(Fig. 13); *S. tenuissimum* (Endlicher & Diesing) Grunow (“Polypes”, pl. 14, fig. 2.1) (Fig. 14); and *Avrainvillea amadelpha* (Montagne) A. Gepp & E.S. Gepp (“Polypes”, pl. 6, fig. 3.1) (Fig. 9).

The *Sargassum* illustrated on “Polypes”, pl. 14, figs 4.1 and 4.2 (Fig. 16), for which the origin was not given, may represent *S. tenuissimum* if it came from the Red Sea, or *S. boryanum* Richard if it came from the Mediterranean. The hydrozoan growing on it, the plumularid *Theocarpus myriophyllum* (Linnaeus 1758), is considered to be a cosmopolitan species. However, although it is known from the Mediterranean coast of Israel (Picard, 1958, as *Lytocarpia myriophyllum*), it has not yet been reported from the Red Sea. Thus it does not provide a reliable clue to the provenance of the material.

The remaining illustrations of seaweeds all represent *Sargassum*, seemingly a single species. These illustrations are “Polypes”, pl. 6, fig. 4.1; pl. 7, fig. 5.1; pl. 8, fig. 8.1; pl. 9, figs 6.1, 8.1, 9.1, 10.1, 11.1; and pl. 14, fig. 1.1. The algae illustrated on pl. 9, except fig. 6.1, were reported to have come from the Mediterranean, while there is no indication of the provenance of the remainder. These illustrations (Fig. 17) show a *Sargassum* with entire leaves. We know of no species in the eastern Mediterranean with such leaves. The closest form may be *S. vulgare* C. Agardh or *S. linifolium* (Turner) C. Agardh. “Polypes”, pl. 7, fig. 5.1, was said by Audouin (1826a, p. 237; 1828a, p. 64) to have been collected in the Red Sea, but we know of no species in the Red Sea that matches the illustration. Again, its epiphytic bryozoan, *Celloporaria costazii* (Audouin, 1826) does not help determine the provenance of the material because it is widely distributed, including both the Mediterranean and the Red Sea.

Unidentifiable marine algae are illustrated in the section on “Coquilles” of the atlas (pl. 11, fig. 10.1; pl. 12, fig. 8.1; pl. 13, fig. 11.2; pl. 14, figs 2.1 and 8.3; and pl. 15, fig. 11.2).

### Collection sites of the algae illustrated by Savigny in section “Polypes”

The provenance of the material illustrated by Savigny in the section “Polypes” was seldom stated. However, we were able to deduce the provenance of many of the algae, as detailed in the preceding account and summarized in Table 1. The Red Sea was indicated as the provenance of “Polypes”, pl. 7, figs 3.1 and 4.1 (*Sargassum dentifolium*), pl. 7, fig. 6.1 (*Turbinaria elatensis*), pl. 12, fig. 3.1 (*S. latifolium*), and pl. 14, fig. 2.1 (*S. tenuissimum*). Because *Hormophysa cuneiformis* and *Avrainvillea amadelpha* are known from the Red Sea but have not been reported from the Mediterranean, it seems certain that the specimens illustrated by Savigny also came from the Red Sea.

**Acknowledgements.** We express our admiration and gratitude to the numerous writers who conducted assiduous research on various aspects of the French expedition to Egypt and the ensuing *Description de l'Égypte*, and to those less numerous writers who have synthesized these multifarious aspects into an understandable whole, all of whom have contributed to our ability to prepare the present account. We are especially indebted to the work of Charles-Roux (1910, 1936), Elgood (1931), and Herold (1962). Regarding Savigny, we are extremely grateful to Paul Pallary, who undertook the arduous but richly rewarding task of rescuing the name of this remarkable naturalist from oblivion (Pallary, 1926, 1931, 1932, 1933, 1934). Prof. H. William Johansen (Clark University, Worcester, Massachusetts) has kindly identified the janioid alga. We thank Richard L. Moe (University of California, Berkeley) for his sustained help with the electronic files. Elisabeth Fourtanier (California Academy of Sciences, San Francisco) kindly translated our English summary into French. We are grateful to Max E. Chacana (University of California, Berkeley) for his help in preparing the manuscript.

Table 1. Audouin's interpretations of Savigny's illustrations of marine algae, our interpretations, and the reported or deduced provenance of the collections

<i>Savigny's illustration</i>	<i>Audouin's interpretation</i>	<i>Our interpretation</i>	<i>Reported origin</i>	<i>Deduced origin</i>
"Algues"				
pl. 1, fig. 1	<i>Cladostephus clavaeformis</i>	<i>Dasycladus vermicularis</i>		Mediterranean
fig. 2	<i>Hydroclathrus cancellatus</i>	<i>Hydroclathrus clathratus</i>		
fig. 3	close to <i>Valonia favulosa</i>	<i>Dictyosphaeria cavernosa</i>		Red Sea
fig. 4	<i>Valonia savignyana</i>	<i>Valonia aegagropila</i>		
pl. 2, fig. 1	<i>Spongodium parvulum</i>	<i>Codium parvulum</i>		Red Sea
fig. 2	<i>Lomentaria gracilis</i>	<i>Haliptilon virgatum</i>		
fig. 3	<i>Digenea dichotoma</i>	<i>Galaxaura rugosa</i>		Red Sea
fig. 4.	<i>Digenea simplex</i>	<i>Digenea simplex</i>		
"Polypes"				
pl. 6, fig. 1.1	un genre nouveau	<i>Neogoniolithon brassica-florida</i>	Red Sea	
fig. 3.1	une espèce de fucus	<i>Avrainvillea amadelpha</i>		Red sea
fig. 4.1	un fucus	<i>Sargassum cf. linifolium</i>		Mediterranean
fig. 6.1	un fucus	<i>Sargassum dentifolium</i>		Red Sea
pl. 7, fig. 1.1	une espèce de fucus	<i>Hormophysa cuneiformis</i>		Red Sea
fig. 2.1	une espèce d'hydrophite	<i>Sargassum dentifolium</i>		Red Sea
fig. 3.1	un hydrophite du genre <i>cystoceira</i>	<i>Sargassum dentifolium</i>	Red Sea	
fig. 4.1	une branche du <i>cystoceira</i>	<i>Sargassum dentifolium</i>	Red Sea	
fig. 5.1	feuilles du sargosse	<i>Sargassum cf. linifolium</i>	Red Sea	Mediterranean
fig. 6.1	une feuille du <i>sargossum latifolium</i>	<i>Turbinaria elatensis</i>	Red Sea	
pl. 8, fig. 1.1		<i>Hormophysa cuneiformis</i>		Red Sea
fig. 8.1		<i>Sargassum cf. linifolium</i>		Mediterranean
fig. 9.1		<i>Hormophysa cuneiformis</i>		Red Sea
pl. 9, fig. 6.1		<i>Sargassum sp.</i>	Red Sea	
figs. 8.1-9.1		<i>Sargassum cf. linifolium</i>	Mediterranean	
fig. 10.1		<i>Sargassum cf. linifolium</i>	Mediterranean	
fig. 11.1		<i>Sargassum cf. linifolium</i>	Mediterranean	
pl. 10, fig. 6.1		<i>Sargassum cf. linifolium</i>		Mediterranean
fig. 7.1		<i>Sargassum cf. linifolium</i>		Mediterranean
fig. 9.1		<i>Hormophysa cuneiformis</i>		Red Sea
fig. 12.1		<i>Sargassum sp.</i>		
pl. 12, fig. 2.1		<i>Hormophysa cuneiformis</i>		Red Sea
fig. 3.1	une espèce de fucus	<i>Sargassum latifolium</i>	Red Sea	
pl. 13, fig. 1.1	un fragment de fucus	<i>Hormophysa cuneiformis</i>		Red Sea
fig. 2.1	un fragment de fucus	<i>Hormophysa cuneiformis</i>		Red Sea
pl. 14, fig. 1.1	un fucus	<i>Sargassum cf. linifolium</i>		Mediterranean
fig. 2.1	une espèce de fucus	<i>Sargassum tenuissimum</i>	Red Sea	
figs. 4.1, 4.2	une feuille de fucus	<i>S. tenuissimum</i> or <i>S. boryanum</i>		

## REFERENCES

- ALEEM A.A., 1993 — The marine algae of Alexandria, Egypt. Alexandria: published by the author, 138 pp., 55 pls.
- AUDOUIN V., 1826a — Explication sommaire des planches de Polypes de l'Égypte et de la Syrie, publiées par Jules-César Savigny, membre de l'Institut; offrant un exposé des caractères naturels des genres, avec la distinction des espèces. *In: France (Commission d'Égypte), Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, publié par les ordres de sa majesté l'empereur Napoléon le Grand. Histoire naturelle.* Paris : Imprimerie Impériale. Vol. 1, part 4, pp. 225-244.
- AUDOUIN V., 1826b — Explication sommaire des planches d'Hydrophytes de l'Égypte et de la Syrie, publiées par Jules-César Savigny, membre de l'Institut; offrant un exposé des caractères naturels des genres, avec la distinction des espèces. *In: France (Commission d'Égypte), Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, publié par les ordres de sa majesté l'empereur Napoléon le Grand. Histoire naturelle.* Paris : Imprimerie Impériale. Vol. 1, part 4, pp. 245-249.
- AUDOUIN V., 1828a — Explication sommaire des planches de Polypes de l'Égypte et de la Syrie, publiées par Jules-César Savigny, membre de l'Institut; offrant un exposé des caractères naturels des genres, avec la distinction des espèces. *In: France (Commission d'Égypte), Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française.* Seconde édition. Paris : Panckoucke. Vol. 23, pp. 40-78.
- AUDOUIN V., 1828b — Explication sommaire des planches d'Hydrophytes de l'Égypte et de la Syrie, publiées par Jules-César Savigny, membre de l'Institut; offrant un exposé des caractères naturels des genres, avec la distinction des espèces. *In: France (Commission d'Égypte), Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française.* Seconde édition. Paris : Panckoucke. Vol. 23, pp. 79-87.
- BØRGESEN F., 1932 — A revision of Forsskål's algae mentioned in Flora Aegyptiaco-Arabica and found in his herbarium in the Botanical Museum of the University of Copenhagen. *Dansk Botanisk Arkiv* 8(2). 14 pp.
- BØRGESEN F., 1947 — Remarks on some codiums from the Arabian Sea, *In: Sahni B. (ed.), The Indian Botanical Society, Silver Jubilee Session, M.O.P. Iyengar Commemoration Volume.* Bangalore, pp. 1-8
- BORY DE SAINT-VINCENT J.B.G.M., 1832 — Hydrophytes. *In: Expédition scientifique de Morée. Section des sciences physiques. Tome III, 2<sup>e</sup> partie, Botanique.* Paris : Levrault, pp. 316-337.
- CHARLES-ROUX F., 1910 — *Les origines de l'expédition d'Égypte.* Paris: Librairie Plon, 350 pp.
- CHARLES-ROUX F., 1936 — *Bonaparte, Gouverneur d'Égypte.* Paris: Librairie Plon, 383 pp. (English translation by E. W. Dickes, 1937, *Bonaparte: governor of Egypt.* London: Methuen & Co., 374 pp.)
- CHAUBARD L.A. & BORY DE SAINT-VINCENT J.B.G.M., 1838 — *Nouvelle flore du Péloponnèse et des Cyclades.* Paris: Levrault, 87 pp., XLII pls.
- DELILE A.R., 1813 ["1812"] — Flore d'Égypte. Explication des planches. *In: France (Commission d'Égypte), Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, publié par les ordres de sa majesté l'empereur Napoléon le Grand. Histoire naturelle.* Paris: Imprimerie Impériale. Vol. 2, pp. 145-320.
- DELILE A.R., 1826 — Botanique. *In: France (Commission d'Égypte), Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française. Seconde édition. Histoire naturelle.* Planches. Paris: Panckoucke. Vol. 2 [bis]. 62 pls.
- ELGOOD P.G., 1931 — *Bonaparte's adventure in Egypt.* Oxford University Press, 262 pp., XVII pls.

- FARGHALY M.S., 1980 — *Algues benthiques de la Mer Rouge et du bassin occidental de l'Océan Indien (étude taxinomique et essai de répartition, notamment des Udotéacées)*. 274 [+ 25] pp. [Thesis, Université des Sciences et Techniques du Languedoc, Montpellier.]
- GARBARY D.J. & JOHANSEN H.W., 1982 — Scanning electron microscopy of *Corallina* and *Halitilon* (Corallinaceae, Rhodophyta): surface features and their taxonomic implications. *Journal of Phycology* 18: 211-219.
- HEROLD J.C., 1962 — *Bonaparte in Egypt*. New York: Harper & Row, 424 pp.
- HINCKS T., 1880 — *A history of the British marine Polyzoa*. London: John van Voorst. Vol. 1. [xii+] cxli + 601 pp.
- JOHANSEN H.W., 1971 — Changes and additions to the articulated coralline flora of California. *Phycologia* 10: 241-249.
- LAMOUREUX J.V.F., 1816 — *Histoire des polypiers coralligènes flexibles, vulgairement nommés zoophytes*. Caen: F. Poisson. lxxxiv + 559 pp.
- LIPKIN Y. & SAFRIEL U., 1971 — Intertidal zonation on rocky shores at Mikhmoret (Mediterranean, Israel). *Journal of Ecology* 59: 1-30.
- NASR A.H., 1947 — Synopsis of the marine algae of the Egyptian Red Sea coast. *Bulletin of the Faculty of Science, Fouad I University* 26. 155 pp.
- ORBIGNY A.D. d', 1850-1852 — *Paléontologie française. Description des mollusques et rayonnés fossiles. Terrains crétacés*. Paris: Victor Masson. 1192 pp.
- PALLARY P., 1926 — Explication des planches de J. C. Savigny. *Mémoires présentés à l'Institut d'Égypte* 11. VIII + 138 pp.
- PALLARY P., 1931 — Marie Jules-César Savigny. Sa vie et son œuvre. Première partie. La vie de Savigny. *Mémoires présentés à l'Institut d'Égypte* 17. VIII + 106 pp.
- PALLARY P., 1932 — Marie Jules-César Savigny. Sa vie et son œuvre. Deuxième partie. L'œuvre de Savigny. *Mémoires présentés à l'Institut d'Égypte* 20. VIII + 112 pp.
- PALLARY P., 1933 — Les sources d'information concernant les savants et artistes de l'Expédition d'Égypte. *Bulletin de l'Institut d'Égypte* 15: 221-228.
- PALLARY P., 1934 — Marie Jules-César Savigny. Sa vie et son œuvre. Troisième partie. Documents concernant la vie et les œuvres de M. J.-C. Savigny de 1798 à 1845. *Mémoires présentés à l'Institut d'Égypte* 23. VII + 202 pp.
- PENROSE D.L., 1996 — Genus *Neogoniolithon* Setchell & Mason. In: Womersley H.B.S., *The marine benthic flora of southern Australia. Part IIIB*. Canberra: Australian Biological Resources Study, pp. 280-283.
- PICARD J., 1958 — Notes sur une collection d'Hydroïdes provenant des côtes Méditerranéennes d'Israël. *Sea Fisheries Research Station Haifa, Bulletin* 15: 1-3.
- SAFRIEL U.N., GILBOA A. & FELSENBURG T., 1980 — Distribution of rocky intertidal mussels in the Red Sea coasts of Sinai, the Suez Canal and the Mediterranean coast of Israel, with special reference to recent colonization. *Journal of Biogeography* 7: 39-62.
- SAVIGNY J.-C., 1817 — Polypes. Algues. In: France (Commission d'Égypte), *Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française publié par les ordres de sa majesté l'empereur Napoléon le Grand. Histoire naturelle*. Planches. Paris: Imprimerie impériale. Vol. 2. 14 pls [Polypes], 2 pls [Algues].
- SILVA P.C., BASSON P.W. & MOE R.L., 1996 — Catalogue of the benthic marine algae of the Indian Ocean. *University of California Publications in Botany* 79. 1259 pp.
- ZANARDINI G., 1840 — Species algarum novae minus cognitae. *Bibliotheca Italiana [Milano]* 96: 134-137.