

SUBERITES DOMUNCULA (OLIVI): ITS SYNONYMY, DISTRIBUTION, AND ECOLOGY

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INTRODUCTION

THE names *Suberites domuncula* and *Ficulina ficus* have appeared almost consistently side by side in the literature for nearly 200 years. At times they have been treated as synonyms, and on such occasions *Suberites domuncula* has sometimes been given priority, at other times *Ficulina ficus*. Several major attempts have been made (Lendenfeld (1897), Topsent (1900), and Vosmaer (1933)) to put the histories, synonymies, and affinities of these two species in order. Each has failed for one reason or another. The present work is a comprehensive survey, made in the hope of achieving a reasonable stability.

Since the earliest of the two names, *Ficulina ficus*, is here accepted as a synonym of *Suberites domuncula*, a restatement of its history is a first requisite. In the following pages are included, among other things, notes on individual references to the two species in question, as well as to their numerous synonyms, and this is followed by their arrangement in the usual synonymy list. The first of these tasks was, in fact, done by Vosmaer (1933) very completely, so that to all appearances its repetition is unnecessary. It is, therefore, essential to point out in what manner Vosmaer's work has failed. To begin with, while he justifiably, as I think, regarded *Suberites domuncula* and *Ficulina ficus* as synonyms, and included other names such as *F. lütkenii* within the scope of the species, he went too far. For example, he included *Tethya prunum* Costa, which is quite unrecognizable. He also included *Suberites montiniger* Carter, which belongs more properly to the genus *Pseudosuberites*, and *Suberites concinnus* Lambe, which is a *Hymeniacidon*. Secondly, he did not have the advantage of Topsent's (1933) analysis of the early history of the specific name *ficus*. Thirdly, he included in his list every possible reference to any of these names, and many of them are so trivial that to include them in the synonymy list, already unwieldy, makes it completely overburdened. For example, if an author mentions one of these names merely in passing the name figures in his list of synonyms. I have checked carefully Vosmaer's pages and have eliminated all such trivial entries. Finally, he included certain other references without any justification. These are now given below.

Alcyonium ficus, Hatchett, 1800: 355: this is an account of certain simple chemical tests carried out on a marine organism. There is no information from which the organism could be identified, and nothing to suggest that it is a sponge. From the reactions obtained by the use of some at least of the chemical reagents it would appear to be an Ascidian (probably the Sea-fig as then understood, either *Polyclinum* or *Aplydium*).

Suberites compactus, Crivelli, 1863: 297 (sep. pag. 14), pl. vi, figs. 4-6: this is a

Suberites too inadequately described for the characters of the species to be determined with accuracy.

Halichondria virgultosa. Under this title Vosmaer, 1933: 441 lists Esper (1798), Lamarck (1813), Lamarck (1816), Lamouroux (1816), Blainville (1819), Lamouroux (1824), Lamarck (1836), Johnston (1842), Gray (1848), Duchassaing and Michelotti (1864). None of these authors is dealing with the species later described by Bowerbank as *Hymeniacion virgultosa* and recognized by subsequent authors as a synonym of *Suberites ficus*.

THE EARLY HISTORY OF *FICULINA FICUS*

The early history of the sponge species, known today as *Ficulina ficus* and known for nearly 200 years under various generic (and often specific) names, is one of unusual confusion. This arose largely from the fact that the 'sea-fig' of the Mediterranean is a sponge, and the 'sea-fig' in English usage is a Tunicate. The shape in both is very similar, and so long as the description of animal species depended on external appearances the mistake was bound to be perpetuated. An attempt was made to straighten out this early confusion by R. Hartmeyer (*J. Mar. Biol. Ass.* **10** (2): 262-282, 1914). This comprehensive paper seems to have escaped the attention of those working upon the taxonomy of sponges, chiefly because it was not included in the Zoological Record under Section III (Porifera or Spongida). According to Hartmeyer's analysis (*l.c.*: 264), the species *ficus* was for the first time 'used in a binomial combination with the generic name *Alcyonium*, so that Pallas must be regarded as the author of that species, which must bear the name *ficus*'. Pallas takes the *Alcyonium tuberosum forma ficus* of Imperato (1599, Ital. p. 599, lat. p. 839), as the first representative of *Ficulina ficus* (Pallas) Autt., and presumably Imperato's description must serve as the type of the species.

Topsent (1933: 27), in analysing the history of *F. ficus*, takes a very different view; but before proceeding to his main argument it is necessary to note what he says concerning *Spongia ficiformis* Poiret, which writers of the late eighteenth and early nineteenth centuries have accepted as a synonym of what we have later known as *Ficulina ficus*. It will be convenient, therefore, to dispose of *Spongia ficiformis*. Here, in tabular form, are Topsent's views:

Alcyonium pulmonaria Ellis and Solander, 1786 = Ascidian.

Spongia ficiformis, Poiret, 1789 = *Petrosia ficiformis* (Poiret). [Topsent points out that the sponge recorded by Guettard (1789, pl. iii), and which Poiret took to represent the same species, was rightly named *Spongia usitatissima* by Lamarck.]

Spongia ficiformis, Gmelin, 1791 = *Petrosia ficiformis* (Poiret).

Spongia ficiformis, Esper, 1794: 282 = *Petrosia ficiformis* (Poiret).

Spongia bulbosum (partim), Esper, 1798, pl. xx, fig. 4 = *Petrosia ficiformis* (Poiret).

Spongia ficiformis, Lamarck, 1816: 47 = *Petrosia ficiformis* (Poiret).

Spongia ficiformis, Lamouroux, 1824 = *Petrosia ficiformis* (Poiret).

Topsent (*op. cit.*) then goes on to remark: 'Aucune confusion n'était permise entre *Spongia ficiformis* Poiret et les animaux qui furent appelés *Alcyonium ficus*. Ce que les auteurs anciens, comme Marsilli et Ellis, ont décrit, et dont Pallas et Linné ont

fait *A. ficus*, était une *Synascidia*, la Pulmonelle figure de de Blainville, et Lamouroux l'a fort bien reconnu, en la rapportant aux genres *Polyclinum* Cuvier ou *Aplydium* Savigny. Mais il semble que l'Éponge lisse, grisâtre à l'extérieur, spongieuse, jaune pâle à l'intérieur, avec oscule au sommet, qu'il prit pour la *Spongia ficiformis* Poiret, était plutôt une *Ficulina*, et ce qu'on appelle *Ficulina ficus* devrait peut-être se nommer *F. ficiformis* (Lamouroux).' In other words, Topsent takes the view that all references to the so-called *Ficulina ficus* prior to Lamouroux (1824) are concerned with either *Petrosia ficiformis* Poiret or an ascidian. If this be so, then *Alcyonium tuberosum forma ficus* of Imperato must belong to one or the other, also. The only opinion opposed to this is the one expressed by Hartmeyer (*l.c.*: 264) that it is 'without doubt a sponge and has been identified by the spongologists as *Ficulina ficus*'. This has practically no value. It certainly is not 'without doubt a sponge'; and if 'the spongologists' have identified it as *Ficulina ficus*, they have merely done so by implication, by copying without question the earlier writers. And these Topsent has shown to be wrong in their identifications.

It is proposed here to accept Topsent's view, which best accords with my re-examination of the evidence. Moreover, as I hope to show, there is good reason to regard the so-called *Ficulina ficus* as a synonym of *Suberites domuncula* (Olivi). Since Olivi's publication antedates the use of *Spongia ficiformis* by fifty years, the ultimate name of the species can no longer be in doubt.

This earlier confusion is, however, paralleled by the subsequent history of the species, though this time in a different sense. *Ficulina ficus* is obviously a close relative of *Suberites domuncula* (Olivi). Indeed, broadly speaking, the latter is a *Ficulina ficus* growing commensally with a hermit crab, and I have long held the opinion that the two species cannot be separated generically and may even be conspecific. It is in order to assess the value of this opinion that the following analysis is undertaken.

CHRONOLOGICAL LIST OF REFERENCES TO *FICULINA FICUS* AND *SUBERITES DOMUNCULA* AND THEIR SYNONYMS, WITH BRIEF NOTES ON THEIR TAXONOMIC VALUE

Alcyonium ficus, Pallas, 1766: 356: the species is established in a binominal combination, and is said to occur in the Mediterranean and on the English coast. [Topsent (1933: 27) accepts Pallas's specimen as an ascidian.]

Alcyonium domuncula, Olivi, 1792: 241: the species is based on the figure 104 in Ginnani 1755. So far as a drawing of this kind can be relied upon, this would appear to be the well-known *Suberites domuncula* of subsequent authors. Presumably Ginnani's figure must be accepted as the holotype of the species. [The doubt implied here results from Topsent's (1900) diagnosis of *Ficulina ficus*. Under this name, as well as under *Suberites domuncula*, he includes specimens growing round mollusc shells inhabited by a *Eupagurus*. In other words, the sponge which everyone else has accepted as *Suberites domuncula* Topsent assigns partly to that species and, in company with the free-growing forms, partly to *Ficulina ficus*. In doing this he gives a very restricted description of *Suberites domuncula* and recognizes its restricted distribution (i.e. to the Mediterranean only). On the other hand, he does not make it precisely clear what differences he finds between the forms he recognizes as *Ficulina*

ficus growing on the *Eupagurus*-shell and *Suberites domuncula*. After studying his words closely it seems that his method of distinguishing between them rests on the characters of the ectosome, in addition to the absence of microscleres. In my opinion these are poor characters to be used in this connexion, but were their use to be upheld by subsequent investigation, then it would be impossible to say if Ginnani's figure represented *Ficulina ficus* or *Suberites domuncula* (*sensu* Topsent (1900) et seq.)]

[*Spongia suberosa*, Esper, 1794: 266, pl. xli, figs. 1-2: has been accepted by some authors as a synonym of *Suberites domuncula* (Olivi), but it has nothing to do with either *Alcyonium ficus* or *A. domuncula*. Ehlers (1870) does not mention it, and although it has the habit of *Halichondria bowerbanki*, its identity is at present uncertain.]

Alcyonium domuncula, Draparnaud, 1801: 169: notes on the living sponge, in which it is assumed that the specimens growing in association with a hermit crab (*Suberites domuncula* Autt.) belong to the same species as those growing on a *Dromia* (i.e. the *Ficulina ficus* Autt.).

Alcyonium domuncula, Renier, 1804: xxv: nothing new.

Alcyonium bulbosum, Esper, 1806: 41: typical examples of Olivi's species are figured and described, but without information on the internal structure.

Alcyonium tuberosum, Esper, 1806, pl. xx: it seems that the author regarded this as a form of the preceding species.

Alcyonium domuncula, Renier, 1807, pl. iii: nothing new.

Spongia domuncula, Bertoloni, 1810: 103: nothing new.

Acyonium [sic] *domuncula*, Lamarck, 1815: 76: nothing new, except to reaffirm that the Mediterranean is the type-locality.

Alcyonium compactum, Lamarck, 1815: 166: this is described by Topsent (1933: 40) as *Suberites domuncula* (Olivi) (partim?).

Alcyonium domuncula, Lamarck, 1816: 394: nothing new.

Alcyonium compactum, Lamarck, 1816: 400: from the Atlantic, appears to be *Suberites domuncula* (Olivi). Spicules not mentioned. (See also Topsent, 1933: 40.)

Spongia domuncula, Lamouroux, 1816: 38: nothing new.

Alcyonium ficus, Lamouroux, 1816: 348: the author draws attention to the confusion between the sponge and the tunicate (see Hartmeyer, *l.c.*). Spicules not mentioned.

Alcyonium compactum, Lamouroux, 1816: 354: from the Atlantic. Spicules not mentioned.

Spongia suberia, Montagu, 1818: 100: although the author gives an excellent description of the sponge, he does not say anything of its spicules. It is growing on univalve shells and is orange-yellow in life. It is clearly the animal generally accepted as *Suberites domuncula* (Olivi).

Spongia domuncula, Bertoloni, 1819: 230: nothing new.

Spongia suberia, Blainville, 1819: 130: nothing new.

Lithumena domuncula, Renier, 1820, pl. iv: nothing new.

Spongia suberosa, Gray, 1821: 361: merely gives a brief summary from Montagu (1818).

Alcyonium domuncula, Martens, 1824: 534: 'Auf dem Schlammgrund längs der westlichen Küste häufig.' Found on hermit crabs and also on the carapace of *Cancer dromia*.

Spongia domuncula, Lamouroux, 1824: 337: gives a summary of the literature to date, adding nothing new.

Alcyonium [sic] *ficus*, Risso, 1826: 381: pear- or fig-shaped, up to 45 mm. long, grows in the 'Regions madrèporiques' and is an intense green in life. Spicules not mentioned. Possibly this is the ascidian.

Alcyonium [sic] *domuncula*, Risso, 1826: 380: the author recognizes three varieties—
Var. I. Rubro aurantio, flavo, coeruleo variegato.

Var. II. Albo, poris oblongis, satis magnis et regulariter per superficiem sparsis.

Var. III. Griseo et rubro aurantio variegato. Spicules not mentioned.

¹*Halichondria suberica*, Fleming, 1828: 522: mainly repeats Gray (1821) and adds, 'I have found this species encrusting Corallines in the Firth of Forth.' The spicules are described as 'fusiform and slightly curved', the colour 'yellow'.

Litumena spugnosa, Renier, 1828, pl. v; nothing new.

Anthelia domuncula, Blainville, 1830: 487: nothing new.

Halichondria suberica, Coldstream, 1830: 235: two specimens from Rothesay Bay, on *Turritella terebra*. No colour notes and the only spicule figured is the tylostyle.

Suberites domuncula, Nardo, 1833: 523; nothing new.

Suberites ficus, Nardo, 1833: 523: nothing new.

Anthelia domuncula, Blainville, 1834: 524: nothing new.

Suberites domuncula, Nardo, 1834: 714: nothing new.

Spongia suberica, Lamarck, 1836: 537: nothing new.

Alcyonium domuncula, Lamarck, 1836: 600: nothing new.

Alcyonium compactum, Lamarck, 1836: 606: nothing new.

Halispungia suberica, Blainville, 1837: 532: nothing new.

Halichondria suberica and *Spongia suberica*, Thompson, 1840: 254: from Strangford and Belfast Loughs, 'investing univalve shells'. Spicules not mentioned.

Halichondria suberica, Bellamy, 1840: 268: records the typical specimens, as well as those 'enveloping stems of sea-weed', from Devon.

Halichondria suberea, Johnston, 1842: 139: adds little that is new.

Halichondria ficus, Johnston, 1842: 144: deep water off Scarborough and Hartlepool; pear-shaped or rounded, often growing on shells; greyish-white; no mention of microscleres.

Halichondria domuncula, Gray, 1848: 13: nothing new.

Halichondria ficus, Gray, 1848: 15: nothing new.

Halichondria suberea, Bowerbank, 1858: 287: gives the first good drawing of the megasclere.

Halichondria ficus, Bowerbank, 1858: 298: the strongylote microsclere is figured.

Halichondria compacta, Lieberkühn, 1859: 520: on *Buccinum* and *Murex* inhabited, usually, by *Pagurus callidus*; colour of red-lead; spicules tylostyli.

Halina suberea, McAndrew, 1861: 235: nothing new.

¹ This seems to contain the first mention of spicules, but megascleres only are mentioned. The first mention of microscleres is in Bowerbank, 1858.

Halina ficus, McAndrew, 1861: 235: nothing new.

Hymeniacion subereum, Bowerbank, 1862: 1111: nothing new.

Halichondria ficus, Bowerbank, 1862: 1129: 'An elongated form of *Halichondria ficus* has also been again described as *H. virgultosa*' (i.e. by Johnston, 1842).

Suberites domuncula, Schmidt, 1862: 67: largely reiterates Lieberkühn's notes, but adds that there are two varieties, one from Quarnero which 'hat vorwiegend stumpfe Nadeln' (? = microstrongyla), and the other, from Zlarin which 'hatte eine ganz prächtige Färbung, indem sie auf weissem und rothem Grunde lazurblau gezeichnet war'. Schmidt also described the species as common and well known.

Suberites domuncula, Crivelli, 1863: 286: notes and coloured pictures.

Suberites domuncula, Kölliker, 1864: 71: nothing new.

Halichondria ficus, Bowerbank, 1864: 222 [also as *Hymeniacion ficus* p. 244]: the centrotylote microstrongylote is figured, otherwise nothing new.

Hymeniacion suberea, Bowerbank, 1864: 231: nothing new.

Halichondria (Hymeniacion) suberea, Hughes, 1866: 86: notes on the development of the gemmules.

Hymeniacion virgultosa, Bowerbank, 1866: 193: a number of specimens from the Dogger Bank, erect (?), subcylindrical and substipitate, the base enclosing a *Fucus*, Zoophyte, or *Dentalium*, and ranging from $2\frac{3}{4}$ in. to 15 in. in length and up to $\frac{1}{2}$ in. diameter. The colour, dried, is light buff-yellow.

Bowerbank's specimens do not belong to the same species as ¹*Halichondria virgultosa* Johnston, which is apparently a *Suberites* sp. but of different habit; nor, it may be presumed, to the *Spongia virgultosa* of Lamarck and Lamouroux.

Hymeniacion suberea, Bowerbank, 1866: 200: gives 'Locality.—The whole of the British coast', and 'colour.—Alive, yellow or orange; dried, yellow or brown'. His extensive notes show that he had difficulty in distinguishing between this species and *Suberites carnosa* on the basis of their respective spicules, and between *Hymeniacion suberea* and *Ficulina ficus* on the basis of habitus. He found the species surrounding shells 'of Turbo, Fusus and other univalves', 'based on a Dentalium, a Vermetus, or some other equally ill-chosen locality', as 'large massive specimens', or 'partially enveloping a shell of a Fusus, the mollusc evidently alive at the time'. He also records 'a specimen as large as a hen's egg, attached by a broad base to the side of St. Katherine's Rock, at Tenby, between high and low water mark'. Bowerbank sees in the 'minute inflato-cylindrical' spicules (i.e. microstrongyla) the chief means of distinguishing *Ficulina ficus* from *Hymeniacion suberea*.

Hymeniacion ficus, Bowerbank, 1866: 206: specimens from Scotland, Northumberland, and Hebrides, coloured grey, white, or russet red when alive. The specimens ranged from encrusting on a *Pecten* shell, covering 'a small univalve shell precisely after the manner of *H. suberea*', to bulbous or fig-shaped. Clearly Bowerbank has used the presence of microstrongyla as a distinctive character, but finds some difficulty in distinguishing between *H. ficus* and *H. suberea* on the grounds of habitus.

Halichondria farinaria, Bowerbank, 1866: 269: is encrusting on *Pecten opercularis*, from Belfast Bay, Firth of Clyde and off Hastings, at 5 fathoms. It is scarlet or

¹ See last paragraph of the introduction (above).

reddish-orange in life and seems to have been found in fair numbers in the dredges. *Microstrongyla* are present.

Reniera ficus, Schmidt, 1866: 16: it is (erroneously) suggested that this is a synonym of *R. (Hymeniacidon) caruncula*.

Suberites farinaria, Schmidt, 1866: 16: nothing new.

Reniera virgultosa, Gray, 1867: 518: nothing new.

Halichondria farinaria, Gray, 1867: 519: nothing new.

Suberites suberea, Gray, 1867: 523: nothing new.

Ficulina ficus, Gray, 1867: 523: nothing new.

Suberites domuncula, Marcusen, 1867: 358: from the Black Sea.

Hymeniacidon subereus, Norman, 1868: 331: from the Shetlands. 'Not so common as *M.* [sic] *ficus*, to which it is very closely allied.'

Hymeniacidon ficus, Norman, 1868: 331: from the Shetlands. 'Common, coating univalve shells, and generally inhabited by hermit crabs.'

Suberites suberia, Parfitt, 1868: 12: common along the Devon coast. No other information.

Suberites domuncula, Schmidt, 1868: 14: gives a faunistic record for Algeria, without other comment.

Halichondria farinaria, Bowerbank, 1868: 124: nothing new.

Hymeniacidon suberea, Wright, 1869: 53: nothing new.

Halichondria farinaria, Wright, 1869: 54: nothing new.

Hymeniacidon ficus, Norman, 1869: 297: from Oban.

Halichondria suberea, Carter, 1870: 82: notes on the gemmules. Carter considers the sponge has the property of dissolving shells and places it in the Cloniadae (of Gray).

Suberites heros, Schmidt, 1870: 46: a sponge from the Antilles, with the habitus of *S. domuncula*, '1½ Faust gross', and spicules ranging from styli to subtylostyli or tylostyli.

Suberites lütkenii, Schmidt, 1870: 47: a new species, with microspined microscleres is described, from Denmark and Greenland.

Suberites domuncula, Schmidt, 1870: 76: nothing new.

Suberites ficus, Schmidt, 1870: 76: nothing new.

Hymeniacidon virgultosa, Schmidt, 1870: 76: nothing new.

Hymeniacidon suberea, Schmidt, 1870: 76: the author thinks this the same as *Suberites domuncula*.

Halichondria farinaria, Schmidt, 1870: 77: nothing new.

Alcyonium domuncula, des Moulins, 1872: 342: the taking is recorded of this sponge in large numbers in fishermen's nets in the Gulf of Lyons. The hermit crab is extracted and used as bait. A synonymy list of the species is given.

Suberites lütkenii, Möbius, 1873: 148: nothing new.

Hymeniacidon ficus, MacIntosh, 1874: 143: specimens, growing on *Dentalium entalis*, 'frequent on muddy ground'.

Suberites lütkenii, Schmidt, 1874: 429: nothing new.

Hymeniacidon virgultosa, Bowerbank, 1874: 89: more specimens examined since 1866, growing on univalve shells, and on a flat mass 'so like *H. suberea* that it is only

by microscopical examination that it can be separated from that species'. Microstrongyla present.

Hymeniacion suberea, Bowerbank, 1874: 91: a specimen, from the Shetlands, in about 70 fathoms, of massive form enclosing a shell.

Hymeniacion ficus, Bowerbank, 1874: 92: more specimens, massive or ficiform, growing on bivalve shells or around univalve shells, from Tenby and the Island of Harris. Microstrongyla present.

Halichondria farinaria, Bowerbank, 1874: 177: a small encrusting form, on *Pecten opercularis*, from Strangford Lough. Microstrongyla present.

Suberites domuncula, Schmidt, 1875: 115: specimens from Solsvig, Peterhead, and Portobello, littoral to 50 fathoms. No other information.

Suberites ficus, Schmidt, 1875: 116: a specimen from east of Bamborough, in 36 fathoms on a bottom of sand and small stones. No other information.

Halichondria suberea, Carter, 1875: 197: nothing new.

Halichondria ficus, Carter, 1875: 197: nothing new.

Suberites lütkenii, Lütken, 1875: 190: nothing new.

Suberites domuncula, Carter, 1878: 157: nothing new.

Suberites domuncula, Krukenberg, 1879: 66: notes on the physiology.

Suberites domuncula, Krukenberg, 1879: 705: notes on the physiology.

Suberites domuncula, Krukenberg, 1880: 37: notes on the physiology.

Suberites montalbidus, Carter, 1880: 256: preliminary notice of a sponge from Barents Sea having centrotylote microxea for microscleres.

Suberites domuncula, Czerniawsky, 1880: 236: from the Black Sea.

Suberites domuncula, Leslie and Herdman, 1881: 60: nothing new.

Halichondria suberea, Carter, 1881: 255: nothing new.

Suberites domuncula, Vosmaer, 1881: 4: nothing new.

Hymeniacion virgultosus, Bowerbank, 1882: 83: nothing new.

Hymeniacion subereus, Bowerbank, 1882: 88: nothing new.

Hymeniacion ficus, Bowerbank, 1882: 89: abundant in Shetlands, Durham (Coralline zone), and specimens also from Oban ('on a pebble between tide-marks') and Westport, Co. Mayo.

Halichondria farinaria, Bowerbank, 1882: 114: nothing new.

Suberites domuncula, Klebs, 1882: 295: 'Der Schwamm . . . lebt stets auf Schnecken-schalen, in denen ein *Pagurus* lebt; er umwächst die Mündung der Schale, so dass der Krebs häufig ganz eingeschlossen wird und sterben muss.'

Halichondria suberia, Carter, 1882: 353: nothing new.

Halichondria ficus, Carter, 1882: 353: nothing new.

Suberites montalbidus, Carter, 1882: 353: a specimen from Barents Sea, with microstrongyla and faintly spined microxea, both centrotylote.

Suberites domuncula, Graeffe, 1882: 318: from Trieste, with notes on ecology.

Suberites domuncula, Vosmaer, 1882: 20: nothing new.

Suberites sp., Vosmaer, 1882: 32: a specimen from the Arctic approximating to *S. montalbidus*.

Suberites domuncula, Carter, 1883: 30: 150 specimens dredged 20 miles off Budleigh Salterton, growing on *Turritella* and *Buccinum*, with *Pagurus* or an

annelid inside, had incorporated much debris from the sea-bed in their substance.

Suberites domuncula, Marion, 1883: 65: notes, especially on its abundance, of the sponge off the Marseilles coast.

Suberites domuncula, Vosmaer, 1884: 121: nothing new.

Suberites domuncula, Vosmaer, 1885: 332: nothing new.

Suberites montalbidus, Fristedt, 1885: 19: records from the Swedish coast, in 75 m., of sponges with the spiculation shown by Carter (1882).

Suberites ficus, Fristedt, 1885: 20: specimens from coast of Sweden, pale red in life, from various depths. *Microstrongyla* present.

Suberites virgultosa, Fristedt, 1885: 21: five specimens from the Swedish coast, from unknown depths. *Microstrongyla* present.

Suberites suberia, Higgin, 1886: 86: nothing new.

Suberites domuncula, Vosmaer, 1886: 86: nothing new.

Suberites domuncula, Vosmaer, 1886: 457: nothing new.

Suberites lütkenii, Marenzeller, 1886: 3: the species is regarded as identical with *S. montalbidus*.

Suberites montalbidus, Fristedt, 1887: 428: a number of specimens from Bering Sea and Bering Strait, the Siberian Arctic Ocean, Beaufort's Sea, Kara Sea, Barents Sea, and west of Greenland, in 2 to 40 fathoms, all having centrotylote *microstrongyla* and faintly spined *microxea*.

Suberites domuncula, Ridley and Dendy, 1887: xlv: notes on histology.

Suberites domuncula, Sollas, 1888: 415: notes on the structure of the skeleton.

Suberites compactum, Topsent, 1888: 134: the sponge recorded by Lamouroux is said to be the equivalent of '*Spongia domuncula* (*Suberites ficus*)'.

Suberites domuncula, Topsent, 1888: 134: nothing new.

Suberites ficus, Topsent, 1888: 134: is said to have the same Amphipod symbiont as *S. domuncula*.

Suberites suberea, Topsent, 1888: 150: dredged at Luc and le Quihoc, it is encrusting and a deep orange.

Suberites ficus, Topsent, 1888: 150: not common at Luc, it has the same habitat as *S. suberea*, and though orange-red as a rule, it is subject to 'décolorations partielles' and is often yellow or greyish. The surface is often perforated where an Amphipod, *Tritacta gibbosa*, is living.

Suberites domuncula, Lendenfeld, 1888: 65: similar in habitat to the European forms, but although enclosing a crab the Australian forms do not contain shell with *Pagurus*. Colour bright yellow. Without *microstrongyla*.

Suberites domuncula, Dendy 1889: 23: nothing new.

Suberites domuncula, Lendenfeld, 1889: 798: is usually carried on the carapace of a *Dromia*.

Suberites suberea, Hanitsch, 1889: 158: from Liverpool district.

Halichondria farinaria, Topsent, 1889: xxxviii: nothing new.

Suberites domuncula, Topsent, 1890: 232: nothing new.

Suberites domuncula, Topsent, 1890: 232: 'partout dans la Manche.'

Suberites suberea, Topsent, 1890: 202: from Luc.

Suberites ficus, Topsent, 1890: 202: from Luc.

Suberites farinaria, Topsent, 1890: 203: nothing new.

Suberites domuncula, Hanitsch, 1890: pp. 195, 214: gives records for the estuary of the Mersey, north Wales, Isle of Man, and Puffin Island, and declares that it may be found growing on bivalve shells and other substrata, as well as on univalve shells inhabited by hermit crabs.

Suberites ficus, Hanitsch, 1890: 195: from north Wales.

Suberites domuncula, Hanitsch, 1891: 218: several specimens from 10 fathoms off the west coast of Ireland. Hanitsch draws attention to the presence of microstrongyla, and to so many previous authors having missed them.

Suberites ficus, Hanitsch, 1891: 219: two specimens from off the west coast of Ireland, in 5 to 15 fathoms.

Suberites ficus, Topsent, 1891: 529: dredged at Roscoff.

Suberites ficus, Topsent, 1891: 127: from Arcachon.

Suberites ficus, Topsent, 1891: 14: two specimens from between Dakar and Rufisque, at 25 m., on muddy sand, with microstrongyla that lack a centrum.

Suberites domuncula, Topsent, 1891: 15: a single littoral specimen from Dakar.

Suberites domuncula, Topsent, 1891: 15: from Dakar.

Suberites ficus, Topsent, 1891: 127, 129: from Arcachon.

Suberites ficus, Topsent, 1891: 529: from Roscoff.

Suberites domuncula, Hanitsch, 1891: 218: several specimens from the west coast in 10 fathoms. He mentions the presence of centrotylote microstrongyla.

Suberites ficus, Hanitsch, 1891: 219: from the west coast of Ireland in 5 to 15 fathoms.

Suberites latus, Lambe, 1892: 71: four specimens from British Columbia, lobo-massive, up to 60 mm. across, yellowish-brown in spirit, but without microstrongyla. Lambe (1893: 126) agrees this is conspecific with *S. suberea* (= *ficus*).

Suberites domuncula, Holt, 1892: 239: from Blacksod Bay, in 7 fathoms, on fine sand.

Suberites ficus, Topsent, 1892: 128: four specimens from the Bay of Biscay in depths varying from 63 to 180 m. No mention is made of colour or the presence of microstrongyla.

Suberites ficus, Levinsen, 1893: 410: numerous specimens from the Kattegat. According to the figures given, the spiculation resembles closely that of *S. montalbidus*.

Suberites farinarius, Levinsen, 1893: 412: a specimen from the Kattegat, with centrotylote microscleres.

Suberites montalbidus, Levinsen, 1893: 413: three specimens from the Kattegat in 17½ fathoms, showing the spiculation described by Carter (1882).

Suberites domuncula, Celesia, 1893: 1: extensive notes on the relation between the form of the sponge and the presence of the hermit crab.

Suberites ficus, Topsent, 1894: 21: from the Pas-de-Calais. *Halichondria farinaria* and *H. virgultosa* are regarded as synonyms.

Suberites domuncula, Topsent, 1894: 23: from the Pas-de-Calais.

Suberites suberea, Lambe, 1894: 126: nearly sixty specimens from Alaska. '... the

flesh-spicules are present in the majority of cases, but absent in a few; in some specimens they occur in great abundance, in others only one or two were seen. Evidently the presence or absence of the flesh-spicules cannot be considered of specific value.'

Suberites montalbidus, Lambe, 1894: 127: a single example, 25 mm. across, from the Aleutians, with microscleres as described by Carter (1882).

Suberites ficus, Weltner, 1894: 327: four specimens from the North Sea, including the Dogger Bank, from depths varying from 32 to 50 m. No colour records are given and microstrongyla are not mentioned.

Suberites virgulosa, Hanitsch, 1894: 177: nothing new.

Suberites domuncula, Hanitsch, 1894: 177: nothing new.

Suberites ficus, Hanitsch, 1894: 177: nothing new.

Suberites farinarius, Hanitsch, 1894: 179: nothing new.

Suberites heros, Weltner, 1894: 328: suggests the identity of this species with *S. ficus*.

Suberites suberea, Lambe, 1895: 126: records 60 specimens from Alaska, and points out (p. 127) that his *S. latus*, from Vancouver Island, is identical with *S. suberea*.

Suberites montalbidus, Lambe, 1895: 127: from Alaska.

Suberites domuncula, Heider, 1895: 283: nothing new.

Suberites ficus, Lambe, 1896: 193: two dried specimens from Nova Scotia, with microstrongyla, the one growing on a *Pecten tenuicostata* shell, the other on the inside of a shell of *Cyprina*.

Suberites ficus, Topsent, 1896: 275: several specimens from the Bay of Biscay at 140 to 400 m.

Suberites ficus, Topsent, 1896: 118: from Quiberon (Atlantic coast of France).

Ficulina ficus, Lendenfeld, 1896: 94: an extensive review of previous knowledge, with little additional information.

Suberites domuncula, Lendenfeld, 1896: 118: a review of previous knowledge, with little additional information.

Ficulina ficus, Topsent, 1898: 129: nothing new.

Suberites heros, Thiele, 1898: 37: is probably identical with *S. domuncula*.

Suberites domuncula, Thiele, 1898: 37: the author differentiates between *S. domuncula*, without microstrongyla, and *S. subereus*, with microstrongyla (but see Lambe, 1894: 126).

Suberites lütkenii, Thiele, 1898: 38: is probably identical with *S. domuncula*.

Suberites subereus, Thiele, 1898: 38: several specimens from Japan, some enclosing shells, examined dry. Microstrongyla present.

Suberites placenta, Thiele, 1898: 39: a depressed cake-shaped sponge from Japan, dry, with tylostyli and microstrongyla.

Suberites sericeus, Thiele, 1898: 39: dry incrustations from Japan on a *Pecten* and a gastropod shell, without microstrongyla, probably represent either *S. ficus* or *S. domuncula*.

Prosuberites inconspicuus, Thiele, 1898: 40: a dry encrusting specimen from Japan, in 100 fathoms, with tylostyli as in Thiele's specimen of *Suberites subereus*, but without microstrongyla, is probably a young *S. domuncula*.

Prosuberites exiguus, Thiele, 1898: 40: two dried encrusting specimens from Japan, very like *P. inconspicuus*, probably represent young forms of *Suberites domuncula*. They are without microstrongyla.

Ficulina ficus, Topsent, 1899: 105: recorded for the coast of Belgium without further details.

Ficulina ficus, Topsent, 1900: 203: in a review of the species the author increases the confusion by using the presence or absence of the microstrongyla as a basis for the specific distinction. Consequently, under *F. ficus* are included all forms having microscleres regardless of the external form.

Suberites lütkenii, Topsent, 1900: 213: is regarded as a variety of *Ficulina ficus*.

Suberites domuncula, Topsent, 1900: 225: the species is interpreted in a narrow sense, depending almost entirely on the absence of microscleres.

Suberites suberea, Lambe, 1900: 161: nothing new.

Suberites ficus, Lambe, 1900: 161: nothing new.

Suberites montalbidus, Lambe, 1900: 162: nothing new.

Suberites montalbidus, Lambe, 1900: 24: from Hudson Bay and Strait.

Suberites montalbidus, Lambe, 1900: 277: nothing new.

Suberites domuncula, Cotte, 1901: 1: chemico-physiological notes.

Suberites domuncula, Cotte, 1901: 95: physiological notes.

Suberites domuncula, Bidder, 1902: 380: the author suggests that texture is a result of ecological conditions.

Ficulina ficus, Rousseau, 1902: 18: the author treats *Suberites domuncula* as a synonym of this species and records it from the coast of Belgium.

Suberites heros, Thiele, 1905: 415: nothing new.

Suberites domuncula, Thiele, 1905: 416: nothing new.

Suberites domuncula, Swartschewsky, 1905: 35: the species is recorded from the Black Sea.

Suberites heros, Swartschewsky, 1905: 35: is accepted as a synonym of *S. domuncula*.

Suberites montalbidus, Swartschewsky, 1906: 318: from the White Sea.

Ficulina ficus, Lundbeck, 1907: 558: 'Trois petits exemplaires pédunculés'. No other information.

Ficulina ficus, Lundbeck, 1909: 453: one specimen, 100 mm. across, from East Greenland, in 25-40 fathoms. No other details.

Ficulina ficus, Stephens, 1912: 21: the author accepts the identity of *Suberites domuncula* with this species and gives records for south-west Ireland from between tide-marks down to 8 fathoms. Massive specimens were found in littoral zone, and dredged specimens were growing on *Pecten* or on gastropod shells containing *Eupagurus cuanensis*.

Ficulina ficus, Topsent, 1913: 25: from Norway; a score of specimens 'enveloppant des coquilles et abritant des Pagures'.

Ficulina lütkenii, Topsent, 1913: 25: from Norway.

Ficulina ficus, Müller, 1913: 291: the author treats *Suberites domuncula* and *Ficulina ficus* as one and the same thing. He gives notes on the gemmules in 373 specimens from the Barents Sea, taken in 60-67 m. in August. Of this total 261 were on bivalve shells, 6 on gastropod shells, and 36 on stones. The rest were

without point of attachment. Colour notes are not given, but microstrongyla are figured.

Ficulina ficus, Stephens, 1915: 35: the author lists many records from Ireland.

Suberites domuncula, Babić, 1921: 14: merely records the species for the Adriatic.

Suberites domuncula, Babić, 1922: 272: several specimens, on *Turritella*, from the Adriatic, the largest 90 mm. in diameter. No colour records are given and no mention made of microstrongyla.

Ficulina ficus, Ferrer, 1922: 269: nothing new.

Suberites domuncula, Topsent, 1925: 633: records the species as common at Naples and varied in colour. He gives the opinion that the specimens at Naples do not attain such large proportions as those at Banyuls.

Suberites domuncula, Dembowska, 1926: 163: an account of the habits of *Dromia vulgaris* and its use of the sponge.

Ficulina ficus, Broch, 1927: 5: from Norway, Lindesness, in 20–24 m., growing on black mud. No other information.

Ficulina ficus, Topsent, 1928: 156: specimens recorded from the Bay of Biscay and the Azores, from depths of 130 to 1,331 m. No colours are mentioned, and as to external form the author merely says, of the specimens from Stn. 3660, that they are enveloping the shells of Gastropods. As to the specimen from a depth of 1,331 m., the author speaks of it as 'bien typique, à microstrongyles centrotylotes, lisses, abondants'.

Suberites domuncula, Topsent, 1928: 154: the species is recorded from off Toulon, in 20 m., with no other comment.

Ficulina ficus, Arndt, 1928: 33: treats this species and *Suberites domuncula* as synonyms, and summarizes the characters of the species.

Ficulina ficus, Hentschel, 1929: 928: nothing new.

Ficulina lütkenii, Hentschel, 1929: 928: nothing new.

Suberites domuncula, Burton, 1932: 201: a single specimen from Japan, in 10 fathoms, enclosing a hermit crab. The synonymy of this species and *Ficulina ficus* is suggested.

Suberites domuncula, Vosmaer, 1933: 426: a very extensive review of the species, but more confusion is caused by ascribing too wide limits to the species.

Suberites domuncula, and *Ficulina ficus*, Burton, 1934: 313: the two species are compared.

Ficulina lütkenii, Burton, 1934: 14: from East Greenland, at 3–191 m.

Suberites domuncula, Topsent, 1934: 14: from Monaco.

Ficulina ficus, Topsent, 1934: 16: in his specimens from Monaco, Topsent finds the occurrence of microstrongyla variable. In 'des cas embarrassants' he succeeded 'par grattage du pourtour de l'osculé' in finding a few in specimens which should otherwise be assigned to *Suberites domuncula*.

Suberites domuncula, Arndt, 1935: 39: a summary of our knowledge of the species is given.

Suberites ficus, Arndt, 1935: 39: in a summary of our knowledge of the species, Arndt returns to the orthodox method of distinguishing between this species and *S. domuncula* (i.e. basing his distinction solely on the presence or absence of microstrongyla).

Suberites domuncula, Burton, 1935: 77: from the Sea of Japan, in 10-35 m.

Suberites domunculus, de Laubenfels, 1949: 20: from Wood's Hole. The author appears to accept the identity of *Ficulina ficus* with *Suberites domuncula*.

It would seem unnecessary to go into such minute detail, but for the confusion which has arisen independently of that caused by the early authors. In the main, authors since Lamouroux have treated as *Ficulina ficus* those specimens, with tylostyli and centrotylote microstrongyla, growing with their bases implanted on a shell or other substratum. They have treated as *Suberites domuncula* any specimen of comparable structure completely enclosing a gastropod shell containing a hermit crab. Yet both species have the same two categories of spicules arranged in the same way, have a similar texture and colour, and have a similar geographical range and bathymetric distribution. These things have been recognized by Martens, Stephens, Arndt, and Müller, who have regarded the two forms as conspecific. Admittedly these four authors form a minority, but it is worth recalling that Müller examined 373 specimens in a single investigation, and Stephens, whose work is of a uniformly high standard, must have handled more than this number in the course of a few years. I am the more inclined to accept their verdict since it coincides with my own (1934) arrived at independently. Against this we must set the views of many authors of limited experience, as well as those of Lendenfeld and, more especially Topsent, both workers of wide experience. Moreover, Arndt (1935) subsequently reverted to this view, apparently. The value of Lendenfeld's opinion can, however, be judged from his most extensive work on these two supposed species. In 1897 he set forth their characters in great detail and his figures show in each case that he was dealing with specimens enclosing a gastropod shell containing a hermit crab. In other words, he clearly had accepted the presence or absence of the microstrongyla as of specific importance. In Topsent's (1900) main study of the two supposed species it is evident that he has adopted a similar plan. Lendenfeld, at least, seems to have based his action on Bowerbank (1866), who, while admitting the difficulty of distinguishing between the *Ficulina ficus* and *Suberites domuncula*, adopted the presence or absence of microstrongyla for their separation. It will be possible to show, not only that the presence or absence of the microstrongyla has no taxonomic value, but that at the most these two supposed species are probably no more than ecological varieties, if indeed there is that much separation.

The history of the microstrongyla is quite remarkable. Although *Suberites domuncula* was first described in 1792, it was not until 1828 that any mention of its spicules is made. Then Fleming described them as 'fusiform and slightly curved'. It was not, however, until 1834 that Coldstream figured a recognizable tylostyle. These are, however, the megascleres. No mention was made of the microscleres until much later, when Bowerbank (1858, p. 298) mentioned the finding of an 'inflato-cylindrical' in *Halichondria ficus*, and figured what is now called the centrotylote microstrongyle on pl. xxiv, fig. 25. In 1862 Schmidt wrote of 'stumpfe Nadeln', which may or may not refer to microstrongyla, and it was left to Lambe (1894), who examined nearly sixty specimens to show that they are present in *Suberites domuncula* as well as in the so-called *Ficulina ficus*. He found those microscleres present in varying numbers. In

only a few cases did he find them lacking in the typical *Suberites domuncula*. He presumed, therefore, that 'the presence or absence of the flesh-spicules cannot be considered of specific value'. Experience leads me to endorse Lambe's view; and we may be reasonably sure that this is true also for workers such as Stephens and, possibly, Arndt.

Another distinction that has been made between *Suberites domuncula* and *Ficulina ficus* is that the first is typically orange or red and the second typically green or greenish. Nobody has specifically stated this in print, but I have found it a prevalent opinion. If we summarize the colour records from the chronological list of references given above, we find that there is little to choose between them. Considering the number of times the two species have been referred to in the literature, colour records are meagre. They may be summarized as follows:

Suberites domuncula: orange-yellow (Montagu); orange-red, white, grey and orange-red (Risso); yellow (Fleming); yellow or orange (Bowerbank); colour of red-lead (Lieberkühn); white and red with blue patches (Schmidt); deep orange (Topsent); bright yellow (Lendenfeld); varied in colour (Topsent); usually orange, often white or white marbled with red and blue (Topsent); orange-yellow (Lendenfeld).

Ficulina ficus: greyish-white (Johnston); scarlet or reddish-orange (Bowerbank); pale red (Fristedt); usually orange-red, often greyish or yellow (Topsent); orange-yellow (Lendenfeld).

It seems there is little to choose between the two forms in the matter of colour.

The external form appears to have constituted a further barrier to recognizing the identity of *Ficulina ficus* with *Suberites domuncula*. In the former it is typically fig- or pear-shaped, with more or less of a stout peduncle, but variations are recognized up to the long, almost strap-shaped sponges seen in Bowerbank's *Halichondria farinaria*. The typical form in *Suberites domuncula* is oval or spherical with, on one side, an opening showing the presence of a hermit crab. What has not been recognized are the various intermediates between the two, and the fact that the association between the *Suberites* and the hermit crab is not a specific commensalism. To take the form first, *Ficulina ficus* has been recorded as growing on seaweeds and on bivalve and gastropod shells. It will, from my own observations, also grow on pebbles or rock surfaces. It may be encrusting, cushion-shaped, irregularly massive, lobose, ficiform, or elongated (*farinaria*-form). The base may surround to a varying extent the object to which it is attached. *Suberites domuncula* is normally encrusting, or spherical or subspherical, but may also be irregularly massive or lobose. The absence of the ficiform or elongated shape is almost certainly the result of the shell, on which the sponge is seated, being in a state of more or less continuous motion due to the presence in it of a hermit crab.

That there is no specific commensalism between *Suberites domuncula* and a hermit crab may be shown by the following:

The sponge has been found associated with:

1. A wide variety of gastropod shells, which may often be without a hermit crab;
2. Several different species of *Eupagurus*;

3. The carapace of a *Dromia*;
4. A *Fusus*, with the mollusc still alive.

The evidence is markedly in favour of following the opinion of Arndt, Stephens, and others. There is, however, one point on which a reasonable doubt may be felt. This concerns the nature of *Suberites montalbidus* Carter. In the holotype its microscleres are microspined and centrotylote microxea in addition to the smooth centrotylote microstrongyla. It seems, however, that this sharp distinction is not always maintained. Fristedt (1887), for example, also found both kinds in his Arctic specimens, but the microxea were but faintly spined and apparently not centrotylote. It is significant, nevertheless, that the recorded specimens of *S. montalbidus* are from Barents Sea (Carter), Bering Sea and Strait, the Siberian Arctic, Kara Sea, Barents Sea, and west of Greenland (Fristedt), Barents Sea (Levinsen), and the Aleutians (Lambe), so that there is reasonable ground for suspecting that it constitutes a northern form. In the northern limits of its range *Suberites domuncula* (+*Ficulina ficus*) has also been recorded from Alaska, East Greenland, and Barents Sea. There is not, therefore, a clear line of geographical separation between it and *S. montalbidus*, and added to this Fristedt (1885) has recorded the latter from the coast of Sweden also. It may be that authors, such as Stephens, who have wide experience of *S. domuncula*, and have accepted *S. montalbidus* as one of its synonyms, have found microspined microxea in southern individuals and have not considered it sufficiently important to draw attention to the fact. Under the circumstances, it would be better to follow the example set by experienced authors and regard *S. montalbidus* as a synonym of *S. domuncula*, at least for the present.

REVISED LIST OF SYNONYMS OF *SUBERITES DOMUNCULA*, WITH A DESCRIPTION OF THE SPECIES, INCLUDING ITS DISTRIBUTION

Suberites domuncula (Olivi)

Alcyonium domuncula, Olivi, 1792: 241; Draparnaud, 1801: 169; Renier, 1804: xxv; *A. bulbosum*, Esper, 1806: 41; *A. tuberosum*, *idem*, *l.c.*, pl. xx; *A. domuncula*, Renier, 1807: pl. iii; *Spongia domuncula*, Bertoloni, 1810: 103; *Acyonium* [sic] *domuncula*, Lamarck, 1815: 76; *Alcyonium compactum*, *idem*, *l.c.*: 166; *A. domuncula*, *idem*, 1816: 394; *A. compactum*, *idem*, *l.c.*: 400; *Spongia domuncula*, Lamouroux, 1816: 38; *Alcyonium ficus* (partim?), *idem*, *l.c.*: 348; *A. compactum*, *idem*, *l.c.*: 354; *Spongia suberia*, Montagu, 1818: 100; *S. domuncula*, Bertoloni, 1819: 230; *S. suberia*, Blainville, 1819: 130; *S. suberosa*, Gray, 1821: 361; *Alcyonium ficiforme* (partim?), Lamouroux, 1821: 29; *A. domuncula*, Martens, 1824: 534; *Spongia domuncula*, Lamouroux, 1824: 337; *Alcyonium domuncula*, Risso, 1826: 380; *Halichondria suberica*, Fleming, 1828: 522; Coldstream, 1830: 235; *Anthelia domuncula* Blainville, 1830: 487; *Suberites ficus*, Nardo, 1833: 523; *S. domuncula*, *idem*, *l.c.*: 523; *Anthelia domuncula*, Blainville, 1834: 524; *Halispongia suberica*, *idem*, *l.c.*: 532; *Suberites domuncula*, Nardo, 1834: 714; *Spongia suberica*, Lamarck, 1836: 537; *Alcyonium domuncula*, *idem*, *l.c.*: 600; *A. compactum*, *idem*, *l.c.*: 606; *Halichondria suberica*, Bellamy, 1839: 268; Thompson, 1840: 254; *H. suberea*, Johnston, 1842: 139, pl. xii, figs. 5-6; *H. ficus*, *idem*, *l.c.*: 144, pl. xv, figs. 4-5; *H.*

domuncula, Gray, 1848: 13; *H. ficus*, *idem*, l.c.: 15; *H. suberea*, Bowerbank, 1858: 287, pl. xxiii, fig. 25; *H. ficus*, *idem*, l.c.: 298, pl. xxiv, fig. 25; *H. compacta*, Lieberkühn, 1859: 520; *Halina suberea*, McAndrew, 1861: 235; *H. ficus*, *idem*, l.c.: 235; *Hymeniacion subereum*, Bowerbank, 1862: 1111; *idem*, l.c.: 1129; *Suberites domuncula*, Schmidt, 1862: 67; Crivelli, 1863: 286, pl. iii, figs. 1-5; Kölliker, 1864: 71; *Hymeniacion ficus*, Bowerbank, 1864: 222; *H. suberea*, *idem*, l.c.: 231, pl. i, fig. 23; *H. virgultosa*, *idem*, 1866: 193; *H. suberea*, *idem*, l.c.: 200; *H. ficus*, *idem*, l.c.: 206; *H. farinaria*, *idem*, l.c.: 269; *Halichondria suberea*, Hughes, 1866: 86; *Reniera ficus*, Schmidt, 1866: 16; *Hymeniacion farinaria*, *idem*, l.c.: 16; *Reniera virgultosa*, Gray, 1867: 518; *Halichondria farinaria*, *idem*, l.c.: 519; *Suberites suberea*, *idem*, l.c.: 523; *Ficulina ficus*, *idem*, l.c.: 523; *Suberites domuncula*, Marcusen, 1867, p. 358; *S. suberia*, Parfitt, 1868: 12; *Halichondria farinaria*, Bowerbank, 1868: 124; *Suberites domuncula*, Schmidt, 1868: 14; *Hymeniacion ficus*, Norman, 1869: 297; *H. subereus*, *idem*, l.c.: 331; *H. ficus*, *idem*, l.c.: 331; *H. suberea*, Wright, 1870: 225; *Halichondria farinaria*, *idem*, l.c.: 226; *H. suberea*, Carter, 1870: 82; *Suberites heros*, Schmidt, 1870: 46; *S. lütkenii*, *idem*, l.c.: 47, pl. v, fig. 7; *S. domuncula*, *idem*, l.c.: 76; *S. ficus*, *idem*, l.c.: 76; *Hymeniacion virgultosa*, *idem*, l.c.: 76; *H. suberea*, *idem*, l.c.: 76; *Halichondria farinaria*, *idem*, l.c.: 77; *Alcyonium domuncula*, Moulins, 1872: 342; *Suberites lütkenii*, Möbius, 1873: 148; Schmidt, 1874: 429; *Hymeniacion virgultosa*, Bowerbank, 1874: 89, pl. xxxv, figs. 1-5; *H. suberea*, *idem*, l.c.: 91, pl. xxxvi, figs. 1-4; *H. ficus*, *idem*, l.c.: 92, pl. xxxvi, figs. 10-17; *Halichondria farinaria*, *idem*, l.c.: 177, pl. lxx, figs. 5-8; *Hymeniacion ficus*, M'Intosh, 1874: 143; *Halichondria suberea*, Carter, 1875: 197; *H. ficus*, *idem*, l.c.: 197; *Suberites domuncula*, Schmidt, 1875: 115; *S. ficus*, *idem*, l.c.: 116; *S. lütkenii*, Lütken, 1875: 190; *S. domuncula*, Carter, 1878: 157; Krukenberg, 1879: 66, pl. i, figs. 3-4; *idem*, 1879: 705; Czerniawsky, 1880: 236; Krukenberg, 1880: 37; *S. montalbidus*, Carter, 1880: 256; *S. domuncula*, Leslie and Herdman, 1881: 269; Vosmaer, 1881: 4; *Halichondria suberea*, Carter, 1881: 255; *Hymeniacion virgultosa*, Bowerbank, 1882: 83; *H. subereus*, *idem*, l.c.: 88; *H. ficus*, *idem*, l.c.: 89; *Halichondria farinaria*, *idem*, l.c.: 114; *H. suberia*, Carter, 1882: 353; *H. ficus*, *idem*, l.c.: 353; *Suberites montalbidus*, *idem*, l.c.: 353; *S. domuncula*, Graeffe, 1882: 318; Krebs, 1882: 295; Vosmaer, 1882: 20; *S. sp.*, *idem*, l.c.: 32, pl. i, figs. 22-23, pl. iv, figs. 140-144; *S. domuncula*, Marion, 1883: 65, 68; Carter, 1883: 30; Vosmaer, 1884: 121; *idem*, 1885: 332; *S. montalbidus*, Fristedt, 1885: 19, pl. iii, fig. 3; *S. ficus*, *idem*, l.c.: 20; *S. virgultosa*, *idem*, l.c.: 21; *S. suberia*, Higgin, 1886: 86; *S. lütkenii*, Marenzeller, 1886: 3; *S. domuncula*, Vosmaer, 1886: 457; Thomson, 1887: 241, pl. xvii; Ridley and Dendy, 1887: p. xlv; *S. montalbidus*, Fristedt, 1887: 428; *Alcyonium compactum*, Topsent, 1888: 134; *Suberites domuncula*, *idem*, l.c.: 134; *S. suberea*, *idem*, l.c. 150; *S. ficus*, *idem*, l.c.: 150; *idem*, 1888: 1299; *S. domuncula*, Lendenfeld, 1888: 65; *S. domunculus*, Sollas, 1888: 415; *S. suberea*, Hanitsch, 1889: 158; *S. ficus*, *idem*, l.c.: 195; *S. ficus*, *idem*, l.c.: 195; *Halichondria farinaria*, Topsent, 1889: xxxviii; *Suberites domuncula*, Dendy, 1889: 56; Lendenfeld, 1889: 798; Topsent, 1890: 232; Hanitsch, 1890: 195, 214; *S. ficus*, Hanitsch, 1890: 195, 216; *S. suberea*, Topsent, 1890: 202; *S. ficus*, *idem*, l.c.: 202; *S. farinaria*, *idem*, l.c.: 203; *S. ficus*, Topsent, 1891: 14; *idem*, 1891: 127, 129; *idem*, 1891: 529; *S. domuncula*, Hanitsch, 1891: 218; *S. ficus*,

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DESCRIPTION OF SPECIES: Encrusting in young stages, later may assume one of two forms, either massive or globular, rarely lobate, and growing round an empty gastropod shell containing a hermit crab, or massive, globular, ficiform, clavate, or irregularly lobate; surface even, finely hispid or harsh to touch; texture firm; oscules few, large, apical; colour, alive, white, greyish-white, white and red with blue patches, white marbled with blue and red, and various shades of yellow, orange, and red;

skeleton a dense, irregular reticulation of tylostyli, 0.09 to 0.45 by 0.008 mm., with microstrongyla or microxea for microscleres, smooth or microspined, often sparingly present, 0.015 to 0.05 mm. long.

DISTRIBUTION: Throughout the Arctic Ocean, in the Atlantic Ocean north of 0° latitude, and in the Pacific Ocean north of approximately 35° latitude. Bathymetric range from low-water springs to 1,331 m. (the optimum probably 0 and 90 m.).

ECOLOGY: Almost any kind of habitat, but more particularly on sandy or muddy bottom (presumably where gastropods or shells are likely to be present).

APPENDIX

THE ECOLOGY OF *SUBERITES DOMUNCULA*

Although *Suberites domuncula*, as now understood, has received so much attention in the literature, the data on bathymetric range and ecology are singularly meagre. This is true even where, as has happened several times, an author is reporting on a collection containing hundreds of specimens. There is, however, a series of observations, given by Massy (1912), but as these are scattered over 215 pages and obscured by a wealth of faunistic data relating to other marine organisms, it has been thought worth while to abstract these and publish them in tabular form as an appendix.

The identifications given in Massy (*l.c.*) were by Miss Jane Stephens, and one of the more interesting points to emerge is that in this series of trawlings off the coast of Ireland, comprising over 500 stations, sponges were obtained at more than 100 stations, and the vast majority of these belonged to *Suberites domuncula*. Only a half-dozen other species were represented in the hauls, with a total of a dozen or more specimens. This substantiates the impression left by a study of the literature, as well as by personal experience, that the species is widespread over the continental shelf throughout its range and its population figures are comparatively high. It is, however, unfortunate that Massy should have been so indefinite on this last point. In describing 'number of specimens taken' the words 'few', 'several', 'moderate', 'many' are far too indefinite. Had actual numbers been included, the list would have been so much more valuable.

Summary of catches of Suberites domuncula recorded by Anne L. Massy off the coast of Ireland

Page	Station	Number of specimens taken	Depth in fathoms	Nature of bottom	Commensals
3	12	1	12-14	sand and shells	<i>Eupagurus</i> sp.
15	43	few	17-23	fine sand	<i>E. cuanensis</i> ?
16	44	moderate	25-27	sand	"
17	45	"	40-60	"	—
21	57	1	48-60	fine sand	<i>E. cuanensis</i>
26	70	several	25-26	fine sand and mud	—
28	77	2	27-30	sand and mud	<i>E. sp.</i>
29	80	few	12-17	mud and sand	—
31	83	moderate	14 $\frac{3}{4}$ -15 $\frac{1}{2}$	sand and shells	—
35	102	few	12-16	—	<i>E. sp.</i>

Page	Station	Number of specimens taken	Depth in fathoms	Nature of bottom	Commensals
35	104	1	14-16	—	<i>E. sp.</i>
36	107	few (10+)	20-23	—	<i>E. sp.</i>
37	108	few	13-14	—	<i>E. sp.</i>
38	113	8	21	—	<i>E. sp.</i>
38	114	19	21-25	—	2 with <i>E. bernhardus</i> ; 17 on <i>Dentalium</i>
39	116	1	16	—	<i>E. sp.</i>
40	118	1	21-23	mud and sand	<i>E. sp.</i>
41	122	2	11-13	—	<i>E. sp.</i>
42	126	12	43-60	—	10 with <i>E. sp.</i> ; 2 on <i>Dentalium</i>
42	125	1	12-14	—	<i>E. sp.</i>
43	129	few	13-15	—	<i>E. sp.</i>
44	131	6	21-28	—	<i>Dentalium</i>
45	135	12+	9-10	—	"
46	139	2	14-16	—	"
47	143	3	17-20	—	<i>E. sp.</i>
49	146 bis	1	13½-16	—	<i>E. sp.</i>
53	165	1	19-20	sand and gravel	<i>E. sp.</i>
55	173	3	13-16	—	<i>E. sp.</i>
62	198	2	48	—	<i>E. sp.</i>
62	199	many	18-24	—	<i>E. bernhardus Aequipecten</i>
64	203	2	—	—	<i>E. bernhardus</i>
66	206	1	11	—	—
69	216	2	12-19	—	<i>E. sp.</i>
69	217	3	32-50	—	<i>E. sp.</i>
71	222	1	15-16½	—	<i>E. cuanensis</i>
72	224	few	44	sand	1 with <i>E. cuanensis</i>
80	248	2	10-12	—	" "
83	253	3	13	—	—
85	258	1	21-23	mud	—
86	261	very scarce	28	fine sand and shells	—
87	262	1	35-43	sand	—
88	264	4	17-23	—	—
88	265	few	24½-25	sand and shells	<i>E. bernhardus</i>
93	280	1	8	sand	—
96	287	6	22	fine sand and shells	<i>E. cuanensis</i>
96	288	9	12½-13½	"	—
97	289	2	22-23	mud and sand	—
97	292	2	19-22	sand and shells	<i>E. cuanensis?</i>
104	313	1	—	—	—
106	318	1	13	coarse sand, gravel	—
107	322	moderate	23	sand	<i>E. cuanensis</i>
107	323	"	21½-23½	fine sand	<i>E. cuanensis</i> and <i>E. bernhardus</i>
109	328	2	10¾	fine sand, shells	—
112	336	3	14½-17	fine sand	<i>E. bernhardus</i>
119	357	1	—	—	—
124	374	1	24-25	sand	—
124	375	1	23½-24	fine sand	—
136	414	2	16¾-19¼	"	—
138	418	4	23-23½	fine sand, shells	<i>E. cuanensis</i>
142	438	1	8-8½	"	—
143	439	few	19½-23½	mud and sand	<i>E. bernhardus</i>
144	443	1	13-19	sand	"
145	444	8	22½-24	fine sand, shells	<i>E. sp.</i>
145	445	many	25-26	sand	—
146	447	2	5-6	"	—
147	451	2	40-66	mud, sand, shells	<i>E. bernhardus</i>

Page	Station	Number of specimens taken	Depth in fathoms	Nature of bottom	Commensals
149	455	1	14-15½	fine sand, shells	—
153	465	1	10	fine sand	—
157	476	few	23	sand and shells	<i>E. sp.</i>
157	477	1	24-25	fine sand	<i>E. sp.</i>
161	484	1	14-21½	fine sand, shells	<i>E. bernhardus</i>
163	487	1	19-23	fine sand, mud	—
164	491	1	7½-9	fine sand	—
168	500	1	10-11½	„	—
168	501	1	35-37	mud	—
169	504	few	42-46½	mud and sand	—
171	507	1	13-14½	fine sand, shells	—
173	513	1	23½-25	„	—
173	514	several	22-24	sand	<i>E. bernhardus</i>
174	515	1	22-26	fine sand, shells	—
174	516	1	19-22	sand and shells	—
178	526	2	7-7½	sand	—
178	527	1	10-13½	„	—
180	532	1	14-14½	fine sand	on shell
181	535	2	21-22½	sand and shells	<i>E. sp.</i>
186	545	2	16½-18½	mud	—
189	553	2	41-52	sand and shells	<i>E. bernhardus</i>
190	554	2	14-19	„	—

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