# THE TAXONOMIC STATUS OF *IRCINIA FASCICULATA, IRCINIA FELIX,* AND *IRCINIA VARIABILIS* (DICTYOCERATIDA, IRCINIIDAE)

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## ABSTRACT

The systematic position of *Spongia fasciculata* Pallas, 1766, *Ircinia variabilis* (Schmidt, 1862) and *Ircinia felix* (Duchassaing & Michelotti, 1864) is discussed and emended, following the study of available type material and specimens recently collected in the Mediterranean Sea, Caribbean Sea and Gulf of Mexico. The decisions and suggestions of previous authors on this topic are also considered and discussed. Our final decision is a validation of *I. felix* and a recombination indicating *I. variabilis* as the type species for the genus *Ircinia* Nardo, 1847.

## KEY WORDS

Porifera, taxonomy, Mediterranean Sea, Caribbean Sea, Gulf of Mexico, type specimens.

## INTRODUCTION

The family Irciniidae Gray, 1867 is the single taxon showing characteristic skeletal filaments within the order Dictyoceratida; the family encompasses three genera: *Ircinia* Nardo, 1833, *Psammocinia* Lendenfeld, 1889 and *Sarcotragus* Schmidt, 1862.

These genera show clearly distinguishable morphological differences in both sponge surface and skeleton morphology (COOK & BERGQUIST, 2002); in particular the genus *Sarcotragus* is lacking inorganic inclusions in skeletal fibres while the primary fibres of *Ircinia* species have a core of foreign debris.

A fourth genus *Bergquistia* from the western Pacific, recently ascribed to the family by SIM & LEE (2002), is very close to *Sarcotragus* but has been established without a comparative study involving materials of *S. foetidus* and/or *S. spinosulus*. The authors claim, as diagnostic character, the presence of fasciculate primary fibres and single secondary fibres in *Bergquistia*; however these traits are well known from all Mediterranean species of the genus *Sarcotragus*. Accordingly, the validity of the genus *Bergquistia* is very doubtful.

The genus *Ircinia* was established by NARDO (1833) without fixation of a type species. A subsequent designation by DE LAUBENFELS (1948) indicated *Spongia fasciculata* Pallas, 1766 (*sensu* SCHMIDT, 1862) as the type of this genus (COOK & BERGQUIST, 2002). This decision was based only on priority rules, without the study

of the obviously unavailable Pallas' specimen and of other available material, including Esper's and Schmidt's.

Successive studies of Mediterranean collections (SCHULZE, 1879; LÉVI, 1952, 1959, 1969; SARÀ 1958, 1961; VACELET, 1959, 1961, 1976; SARÀ & SIRIBELLI, 1960; SARÀ & MELONE, 1963; LABATE, 1965; RÜTZLER, 1965, 1966; BOURY-ESNAULT, 1971; POULIQUEN, 1972; BIBILONI, 1981; LOPES & BOURY-ESNAULT, 1981) recognized *I. fasciculata* as valid. As for *Ircinia* species from the Caribbean Sea and the Gulf of Mexico, DE LAUBENFELS (1948), in his synopsis of horny sponges, proposed the conspecificity of *I. felix* (Duchassaing & Michelotti, 1864) with *I. variabilis* (Schmidt, 1862), *S. fasciculata* Pallas, 1766 and *I. fasciculata sensu* Schmidt, 1862.

The two Mediterranean Schmidt's species and the Caribbean species of Duchassaing & Michelotti were considered junior synonyms of Pallas' *I. fasciculata*; for this last, according to the lack of the holotype, a Caribbean neotype (DE LAUBENFELS, 1948) was designed. Successively PULITZER-FINALI & PRONZATO (1976), WIEDENMAYER (1977), VAN SOEST (1978) and COOK & BERGQUIST (2002) considered the conspecificity of the previously cited eastern and western Atlantic species of *Ircinia* with caution. Notwithstanding the not clear taxonomic status of these species non exhaustive study was attempted in order to solve the problem.

## MATERIALS AND METHODS

To characterise the traits of some species of Irciniidae a morphological analysis was performed on historical specimens (including Duchassaing & Michelotti's, Lamarck's, de Laubenfels' and Schmidt's type materials) and recent sponge collections. We studied over 200 Mediterranean and Gulf-Caribbean (mainly from W-Florida and Belize) specimens. Many of them belong to *I. pipetta* (Schmidt, 1868), *I. oros* (Schmidt, 1864), *I. retidermata* Pulitzer-Finali & Pronzato, 1980 and *Sarcotragus foetidus* Schmidt, 1862 from the Mediterranean area, and *I. campana* (Lamarck, 1813) and *I. strobilina* (Lamarck, 1816) from the Gulf-Caribbean area. These species have a well established taxonomic status, are not reported in the following list of materials and are not considered in the present study.

Acronyms of Institutions refer to *Systema Porifera* (HOOPER & VAN SOEST, 2002).

Mediterranean specimens (*I. variabilis, S. spinosulus*)

*O. Schmidt collection, specimens*

LMJG 15499, Lesina (Adriatic Sea); LMJG 15431/0, Dalmatia (Adriatic Sea); LMJG 15430/54, Quarnero (Adriatic Sea); BMNH 1867:7:26:51, Sebenico (Adriatic Sea); BMNH 1867:7:26:105, Sebenico (Adriatic Sea);

*Museo Civico di Storia Naturale G. Doria Genova, specimens*

LI 14, Limski Canal (Adriatic Sea), 1 - 4 m depth, 29/IX/1971; CRT 14, Crete Island, 2 - 3 m depth, 29/IX/1969; SAL 201, 4 - 10 m depth, 17/IX/1966; PAN 57, Capo Vaticano (Tyrrhenian Sea), 6 m depth, 6/VIII/1974; CAB 1, Castellabate (Tyrrhenian Sea), 6 m depth, 6/VIII/1974; 547, Giannutri Island, 3 - 6 m depth, 10/X/1963; PZ 13, Ponza Island, 2 - 3 m depth, 5/VII/1969;

*Genova University, authors collection, specimens*

KER 62, Ustica Island, 25 m depth, 29/VI/1996; KER 166B, Corsica, stranded, 30/V/2000; KER 259, Portofino (Ligurian Sea), 10 m depth, IX/2001; KER 262, Capo Caccia (Sardinia), 5 m depth, 31/VIII/2001; KER 306a, Capo Caccia (Sardinia), 10 m depth,

VIII/2001; KER 312, Portofino, 5 m depth, V/2002; KER 315, Porto Conte (Sardinia), 1 - 2 m depth, 26/IV/2002.

Gulf and Caribbean specimens (*I. felix*)

*Duchassaing & Michelotti collection, type specimens*
POR 62-63, St. Thomas Island, Turin Museum;

*de Laubenfels neotype*
USNM 22503, West Logger Head Key (Tortuga Island), 3 m depth, 17.VI.1932, Smithsonian Institution Washington DC;

*Genova University, authors collection, specimens*
KER 237-238, Gulf of Mexico (W Florida), 13 m depth, 31/V/1983; KER 274-275, Gulf of Mexico (W Florida), 15 m depth, 8/12/1982; KER 276, Gulf of Mexico (W Florida), 13 m depth, 9/12/1982; KER 278, Carrie Bow Cay (Belize), 22 m depth, VII/2001; KER 279, Carrie Bow Cay (Belize), 3 m depth, 20/VII/2001; KER 280, Carrie Bow Cay (Belize), 25 m depth, VII/2001; KER 282, Carrie Bow Cay (Belize), 20 m depth, VII/2001; KER 283, Carrie Bow Cay (Belize), VII/2001.

Slides for Light Microscopy (LM) were prepared by cutting a thin section (0.2 - 0.5 mm) from the surface to the core of sponges; for each specimen 1 $cm^2$ section of both choanosome and ectosome was macerated for 2 - 3 days in 100 $cm^3$ of fresh-water with addition of 2 - 3 drops of $H_2O_2$ 130 vol.; after the complete dissolution of the cellular matrix, sections where dried by absolute ethanol, clarified with xylene and mounted in Canada balsam. Observations were carried out after a complete desiccation of mounted slides, with a Leitz M20 microscope.

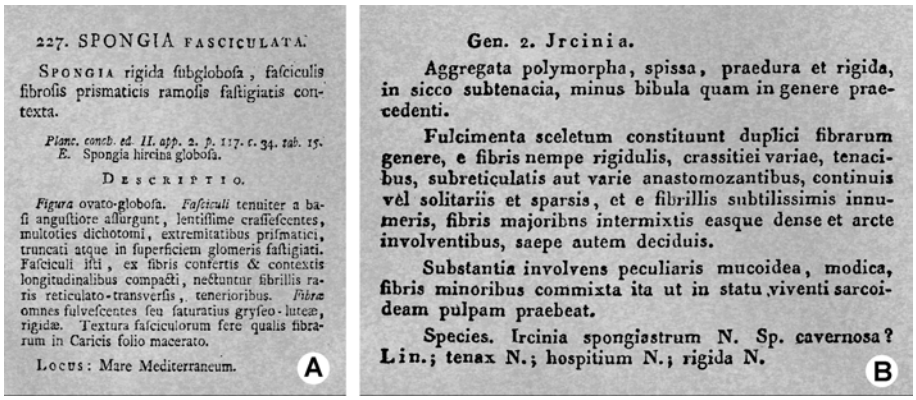
## RESULTS

The type material of *S. fasciculata* is missing, the original description is too short and generic moreover the Mediterranean type locality is unknown (Fig. 1A).

The neotype of *I. fasciculata* (from the Caribbean Sea) is a specimen of *I. felix* , as it agrees in skeleton morphology with DUCHASSAING & MICHELOTTI'S (1864) type and with the material from Florida studied by us (Fig. 2).

The single specimen of *I. fasciculata* belonging to the Schmidt's collection must be ascribed to the genus *Sarcotragus* (*sensu* RÜTZLER, 1965; BOURY ESNAULT, 1971; PULITZER-FINALI & PRONZATO, 1980) according to the presence of very thin filaments and the absence of inclusions (or exclusive presence of spicules) inside the primary fibres (Fig. 3) and on the basis of a comparative analysis with some specimens of *S. foetidus* and *S. spinosulus* of Schmidt's collection and others recently harvested. Conformably *I. fasciculata* (Esper, 1794; Lamarck, 1813) was ascribed to the genus *Sarcotragus* by TOPSENT (1920, 1930).

The lectotype of *I. variabilis,* together with another Schmidt's specimen from the Adriatic Sea, share the diagnostic traits with the specimens of *I. variabilis* collected in different sites of the Mediterranean Sea (Fig. 4).



227. SPONGIA FASCICULATA.

SPONGIA rigida ſubgloboſa, faſciculis fibroſis prismaticis ramoſis faſtigiatis contexta.

*Planc. conch. ed. II. app. 2. p. 117. c. 34. tab. 15. E.* Spongia hircina globoſa.

DESCRIPTIO.

*Figura* ovato-globoſa. *Faſciculi* tenuiter a baſi anguſtiore aſſurgunt, lentiſſime craſſeſcentes, multoties dichotomi, extremitatibus priſmatici, truncati atque in ſuperficiem glomeris faſtigiati. Faſciculi iſti, ex fibris confertis & contextis longitudinalibus compacti, nectuntur fibrillis raris reticulato-transverſis, tenerioribus. *Fibræ* omnes fulveſcentes ſeu ſaturatius gryſeo-luteæ, rigidæ. Textura faſciculorum fere qualis fibrarum in Caricis folio macerato.

LOCUS: Mare Mediterraneum. A

Gen. 2. Ircinia.

Aggregata polymorpha, ſpiſſa, praedura et rigida, in ſicco subtenacia, minus bibula quam in genere praecedenti.

Fulcimenta sceletum constituunt duplici fibrarum genere, e fibris nempe rigidulis, craſſitiei variae, tenacibus, subreticulatis aut varie anastomozantibus, continuis vèl solitariis et sparsis, et e fibrillis subtiliſſimis innumeris, fibris majoribus intermixtis easque dense et arcte involventibus, saepe autem deciduis.

Substantia involvens peculiaris mucoidea, modica, fibris minoribus commixta ita ut in statu viventi sarcoideam pulpam praebeat.

Species. Ircinia spongiaſtrum N. Sp. cavernoſa? Lin.; tenax N.; hoſpitium N.; rigida N. B

**Fig. 1. A**, Pallas' original description of *Spongia fasciculata* does not match the characters of the genus *Ircinia*; **B,** Nardo's original description of the genus *Ircinia* is consistent with the Mediterranean species *I. variabilis*.

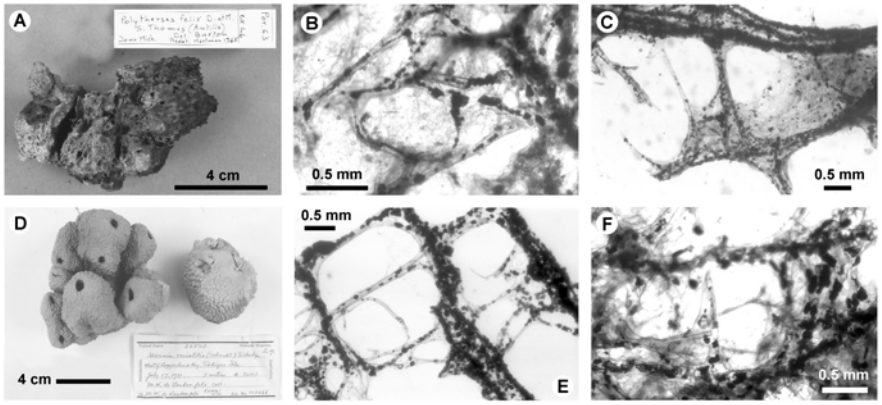



**Fig. 2. A,** The type specimen of *I. felix* from Duchassaing-Michelotti's collection preserved in the Turin Museum; **B-C,** Two different views (LM) of the skeleton network of the type; **D,** de Laubenfels neotype and two images of its skeleton (LM) (**E-F**).

## DISCUSSION AND CONCLUSIONS

Following our results the systematic position of *Spongia fasciculata* Pallas, 1766, *Ircinia fasciculata* (*sensu* SCHMIDT, 1862), *I. fasciculata* (*sensu* ESPER, 1794), *I. fasciculata* (*sensu* DE LAUBENFELS, 1948), *I. felix* (*sensu* DUCHASSAING & MICHELOTTI, 1864) and *I. variabilis* (*sensu* SCHMIDT, 1862) is emended as follows.

The evidence suggesting that Schmidt's and Esper's *I. fasciculata* must be ascribed to the genus *Sarcotragus* opens a taxonomic problem with no easy solution. The lack of Pallas' type material and his very imprecise original description (typical Irciniidae filaments are not evidenced) make his *Spongia fasciculata* unrecognisable and thus unsuitable as type of the genus *Ircinia* that is, in turn, the type of the family Irciniidae. The taxon *Spongia fasciculata* must be considered as a *nomen nudum*.

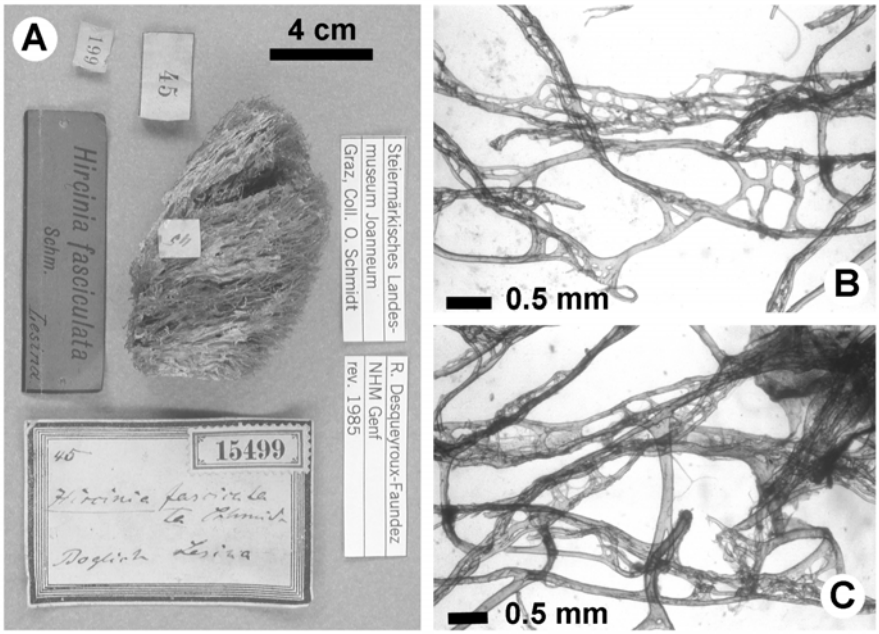



**Fig. 3.** Schmidt's specimen of *I. fasciculata* (**A**), preserved in the Landes Museum Joanneum of Graz is clearly a *Sarcotragus* because of the complete absence of inclusions in the skeleton fibres (**B-C**).

The designation by DE LAUBENFELS (1948) of *S. fasciculata* as type of the genus *Ircinia* is not valid because it is based on a species not originally included in the newly established nominal genus (Article 67.2.1 of the Code). de Laubenfels's Caribbean neotype of *S. fasciculata* is also not valid because it is not from the Mediterranean type locality (Article 75.3.6 of the Code) and other historical specimens such as those indicated by ESPER (1794), SCHMIDT (1862) and SCHULZE (1879) were not considered (Recommendation 75A of the Code). Moreover it clearly belongs to *I. felix*.

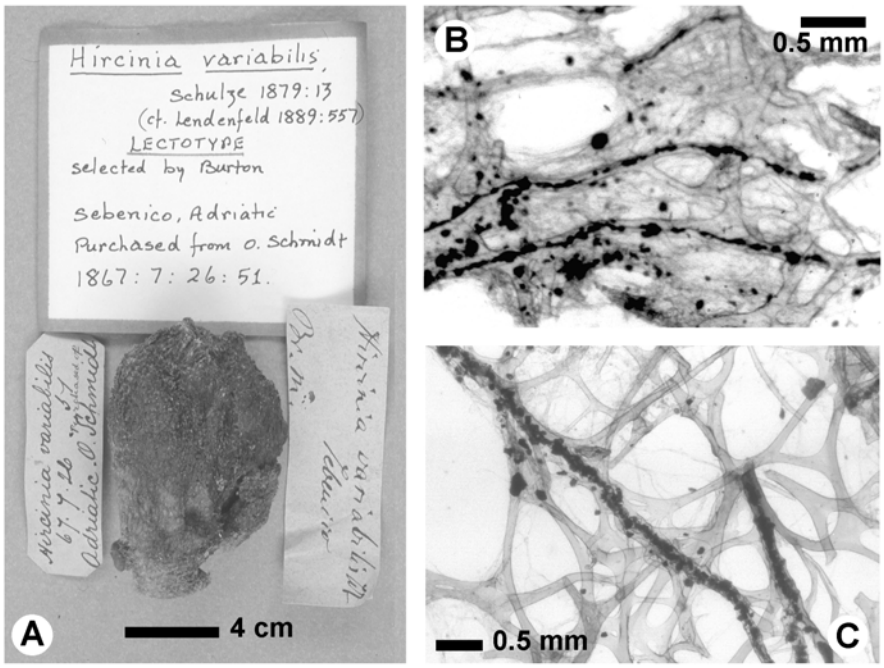



**Fig.4.** The lectotype of *I. variabilis* chosen by Schulze among the specimens collected by Schmidt (**A**) shows a skeletal reticulation (**B**) consistent with many successive descriptions (see text) and many Mediterranean specimens examined for the present paper (**C** = KER 306a).

The original description by NARDO (1833) of the genus *Ircinia* includes 5 species *I. spongiastrum, I. tenax*, *I. hospitum*, *I. rigida*, and *Spongia cavernosa* (Fig. 1B) among which the type species of the genus must be chosen (Article 67.2 of the Code). Here we fix as type species, among the other four species, the first in order of appearance: *I. spongiastrum*.

In the absence of any original description of these species it would be necessary to declare them *nomina nuda* according to a legally correct action (Article 12.1 of the Code) with the consequent disappearance of the nominal genus. However the specimens studied by Nardo where exclusively from Venice, mostly from the canals of the lagoon (NARDO, 1847), consequently all Nardo's *Ircinia* spp. belong to the same restricted geographic area.

PULITZER-FINALI (unpubl. data) reported from Venice a single species of *Ircinia*: *I. variabilis*. Being this species characterized by a high variability of external shape, it is highly possible that all Nardo's *Ircinia* species where different morphotypes belonging to a single taxon.

Therefore we propose the following synonymy: *I. spongiastrum* = *I. tenax* = *I. hospitum* = *I. rigida* = *I. variabilis* = *Spongia cavernosa*.

In addition, we propose that *I. variabilis* should be used instead of *I. spongiastrum* in agreement with Article 23.9.1 of the Code. In fact, this species has been reported as *I. variabilis* by several authors (FELDMANN, 1933; SARÀ, 1962, 1964a,b, 1971; SARÀ & MELONE, 1963; LABATE, 1965; JUNQUA *et al.,* 1974; RÜTZLER, 1976; ALFANO *et al.,* 1979; PULITZER-FINALI & PRONZATO, 1977, 1980; PANSINI & DAGLIO, 1981; DINI *et al.,* 1984; PANSINI, 1987, 1995; MADAIO *et al.,* 1989; CAFIERI & FATTORUSSO, 1990; DE ROSA *et al.,* 1996, 2003; KOUKOURAS *et al.,* 1992; MARTÌ *et al.,* 2003; TSOUKATOU *et al.,* 2002; MERCURIO *et al.,* 2003).

In order to maintain the stability of the very common generic name *Ircinia*, we suggest a new combination indicating *I. variabilis* (Schmidt, 1862) as type species of the genus *Ircinia* Nardo, 1833 and of the family Irciniidae Gray, 1867; the type specimen is the Schmidt's lectotype n° 1867:7:26:105, preserved in the BMNH of London.

*I. felix* and *I. variabilis* are two well recognisable valid species; their major distinctive character is the quantity of mineral granules in the skeleton fibres. The Caribbean *I. felix* bears a large amount of inclusions in both primary and secondary fibres, whereas the Mediterranean *I. variabilis* shows a lower amount of inclusions mainly (or exclusively) inside the primary fibres.

*I. variabilis* is a very common Mediterranean species and several authors have supplied exhaustive descriptions and illustrations (SCHULZE, 1879; VACELET, 1959; PULITZER & PRONZATO, 1977, 1980); also for *I. felix* the literature (WIEDENMAYER, 1977; VAN SOEST, 1978; ZEA, 1987) reports good descriptions and illustrations; new re-descriptions of these two species are, consequently, not necessary.

We add some notes on the external body shape for the two species. The Mediterranean *I. variabilis* shows an extremely variable external morphology as previously reported by PULITZER-FINALI & PRONZATO (1980) who studied a very large collection from many Mediterranean sites, that notwithstanding the superficial conulosity is quite homogeneous. On the contrary the specimens of *I. felix* from Belize and Florida represent two different external morphotypes. In particular, the two geographical varieties are recognizable from conules that are small and dense on the surface of W-Florida's specimens, larger conules a little bit less dense in the samples from Belize. Also in this case the gross body morphs are extremely variable within a more or less regular gradient. In our opinion these differences cannot support a taxonomic separation neither for the Mediterranean *I. variabilis* nor for the Gulf-Caribbean *I. felix*.

Finally it has to be noted that in the title of the original description of Nardo's genus *Ircinia* the first letter is "J" not "I"; few lines after, in the list of species encompassed in the genus, the author writes "I" not "J". The solution of this formal problem is to maintain the stability of the generic name *Ircinia*, according to a very old custom (Article 23.2 of the Code).

## SYSTEMATIC SYNOPSIS OF CONSIDERED TAXA

**Irciniidae Gray, 1867**

***Ircinia*** **Nardo, 1833: 522**
***Psammocinia*** **Lendenfeld, 1889: 579**
***Sarcotragus*** **Schmidt, 1862: 35**
***Bergquistia*** **Sim & Lee, 2000: 283** [this genus is very doubtful and needs a validation after a comparative study involving type materials of *Sarcotragus foetidus* and *Sarcotragus spinosulus*]

Type genus *Ircinia* Nardo, 1833
Type species: *Ircinia variabilis* (Schmidt, 1862)

*Hircinia variabilis* Schmidt, 1862: 34 [= *Ircinia variabilis*]
*Hircinia fasciculata* Schmidt, 1862: 34 [to the genus *Sarcotragus* (present paper); a further study will decide if this species is a good one or a synonym]
*Polytherses felix* Duchassaing & Michelotti, 1864: 72 [= *Ircinia felix*]
*Ircinia spongiastrum* Nardo, 1833: 522 = *Ircinia tenax* Nardo, 1833: 522 = *Ircinia hospitum* Nardo, 1833: 522 = *Ircinia rigida* Nardo, 1833: 522 = *Spongia cavernosa* L., 1789: 3824 [= *Ircinia variabilis*, new synonymy (present paper)]
*Spongia fasciculata* Esper, 1794: 253 [to the genus *Sarcotragus* (Topsent, 1830); a further study will decide if this species is a good one or a synonym]
*Spongia fasciculata* Pallas, 1766: 381 [*nomen nudum* (present paper)]
*Spongia fasciculata* Lamarck, 1813: 372 [to the genus *Sarcotragus* (Topsent, 1920); a further study will decide if this species is a good one or a synonym]

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