

## Two new species of *Laurencia* (Ceramiales, Rhodophyta) from the Mediterranean Sea: *Laurencia pelagiensis* sp. nov. and *Laurencia verlaquei* sp. nov.

Mario Cormaci, Giovanni Furnari and Donatella Serio

Dipartimento di Botanica, Università di Catania, via A. Longo 19, 95125 Catania, Italy

Cormaci, M., Furnari, G. and Serio, D. 1994. Two new species of *Laurencia* (Ceramiales, Rhodophyta) from the Mediterranean Sea: *Laurencia pelagiensis* sp. nov. and *Laurencia verlaquei* sp. nov. Jpn. J. Phycol. 42: 365–375.

Two new species with compressed axes of the genus *Laurencia* (Ceramiales, Rhodophyta) from the Mediterranean Sea are described: *L. pelagiensis* sp. nov. and *L. verlaquei* sp. nov. The first species, from the Pelagean Islands, shows the following main features: epidermal cells without secondary pit connections, appearing in transverse section radially elongated and palisade-like; tetrasporangia, in parallel arrangement, cut off from the mother epidermal cells laterally; spermatangial branches unbranched, inserted in shallow and broad receptacles with indeterminate arrangement. The second species, from Sausset (Marseille, France), Livorno (Italy) and Capo Colonna (Catanzaro, Italy), shows epidermal cells with secondary pit connections appearing in transverse section neither radially elongated nor palisade-like; tetrasporangia, in parallel arrangement, cut off from the mother epidermal cells laterally; spermatangial branches simple or irregularly branched, inserted in deep receptacles with indeterminate arrangement. Records of *L. undulata* Yamada from the Mediterranean Sea should be referred to either *L. pelagiensis* or to *L. verlaquei*.

*Key Index Words:* *Laurencia pelagiensis*—*Laurencia verlaquei*—*Mediterranean Sea*—*Rhodomelaceae*—*Rhodophyta*—*Taxonomy*.

In the frame of the research on Mediterranean species of the genus *Laurencia* (Furnari and Serio 1993a, b), some specimens with a compressed thallus, collected at the island of Lampedusa (Pelagean Islands), were studied. They were compared with specimens from the island of Linosa (Pelagean Islands, Straits of Sicily) (identified as *L. undulata* Yamada), as well with specimens collected by Dr Verlaque at Sausset (Marseille, France) [labelled as “*L. undulata* de Méditerranée ( $\neq$  celui du Japon)”] and with specimens collected at Livorno (Italy) by Dr Papi (labelled as *Laurencia* sp.) and at Capo Colonna (Catanzaro, Italy) by M. Cormaci (labelled as *Laurencia* sp.). From the comparisons, we concluded that we were dealing with two new distinct species: *L. pelagiensis* sp. nov. and *L. verlaquei* sp. nov. To the first species belong specimens from the Pelagean Islands, to the se-

cond species, specimens from Marseille, Livorno and Capo Colonna (Fig. 1).

### Materials and Methods

The investigations have been carried out on both fluid preserved and herbarium specimens. Herbarium specimens are held at the Department of Botany of University of Catania. For microscopic observations, some specimens of both species were stained on glass slides with 1% aqueous aniline blue acidified with dilute HCl which enhances pit connections. Sections were made by razor blade and freezing microtome. Sections of tetrasporic specimens of *L. pelagiensis* were prepared from material dehydrated and embedded in paraffin. Sections were stained with ruthenium red.

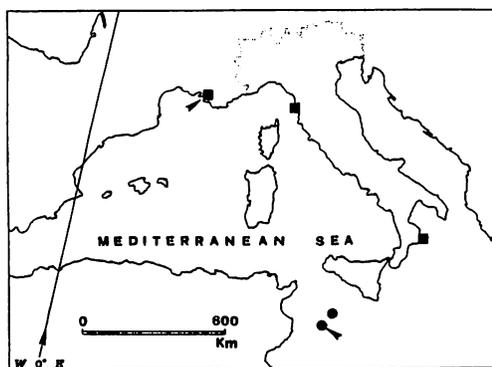


Fig. 1. Map showing the known distribution of *Laurencia pelagiensis* (solid circle) and *L. verlaquei* (solid square). Arrowheads indicate type localities.

### Specimens examined

"*Laurencia undulata*" Yamada: Linosa (Pelagean Islands), 23. v. 1973, midlittoral, male gametophyte, tetrasporophyte, CAT 1115 (ex Giaccone Herbarium), liquid-preserved specimens.

"*Laurencia* sp. = *L. undulata* de Méditerranée (≠ celui du Japon)": Sausset (Bouches du Rhône, France), Verlaque Herbarium University of Aix-Marseille, France: 9. iii. 1983, midlittoral, F1359, tetrasporophyte and male gametophyte, liquid-preserved specimens; H2511 tetrasporophyte; H2512 male gametophyte; 8. iii. 1994, midlittoral, male and female gametophytes, tetrasporophyte, liquid-preserved specimens in unnumbered vials.

"*Laurencia* sp.": Livorno (Italy), 16. iv. 1993, midlittoral, male gametophyte, tetrasporophyte, CAT 1312, specimens sent by Dr Papi, liquid-preserved specimens.

"*Laurencia* sp.": Capo Colonna (Catanzaro, Italy), 20. v. 1982, midlittoral, tetrasporophyte, CAT 1076, liquid-preserved specimens.

For comparison, the following specimen was also examined:

*Laurencia undulata* Yamada: Enoshima (Japan) May 1927, Holotype SAP 13869.

### Observations

*Laurencia pelagiensis* sp. nov. Figs. 2-12 and

26.

**DIAGNOSIS:** Thalli rosei, epilithici, usque ad 10 cm alti, axibus 2-3 mm latis, ex crassa extendenti crusta basali orientibus, complanatis, portione basali tereti excepta, simplicibus vel pauciramosis. Ramuli teretes, vel disticha, vel unilaterali, vel irregulari dispositione, in axium dimidio superiore instructi, usque ad 10 mm longi, irregulariter ramosi, aliquando simplices. Cellulae corticales, externe visae, parum longitudinaliter elongatae prope apices [15-25(18)  $\mu\text{m}$   $\times$  10-20(15)  $\mu\text{m}$ ], multo magis in thalli medianis basalibusque portionibus [20-40(30)  $\mu\text{m}$   $\times$  8-15(12)  $\mu\text{m}$ ], non exstantes, sine conjunctionibus secundariis; in sectione transversa radialiter elongatae atque paliformes. Cellulae interiores sine crassitudinibus lenticularibus. Duae pericentrales cellulae per cellulam axialem. Tetrasporangia, dispositione parallela, ex cellulis corticalibus lateraliter facta. Cystocarpia, 600-700  $\mu\text{m}$   $\times$  700-800  $\mu\text{m}$ , sessilia atque ovoidea, plerumque in ramulorum subapicalibus portionibus disposita. Rami spermatangiales simplices, inserti in non profundis latisque, 600-1800(1200)  $\mu\text{m}$   $\times$  150-750(450)  $\mu\text{m}$ , ramulorum divisione vel prope apicem lateraliter dispositis, depressionibus. Nulla axialium cellularum series ad maturorum depressionum spermatangialium infimum manifesta.

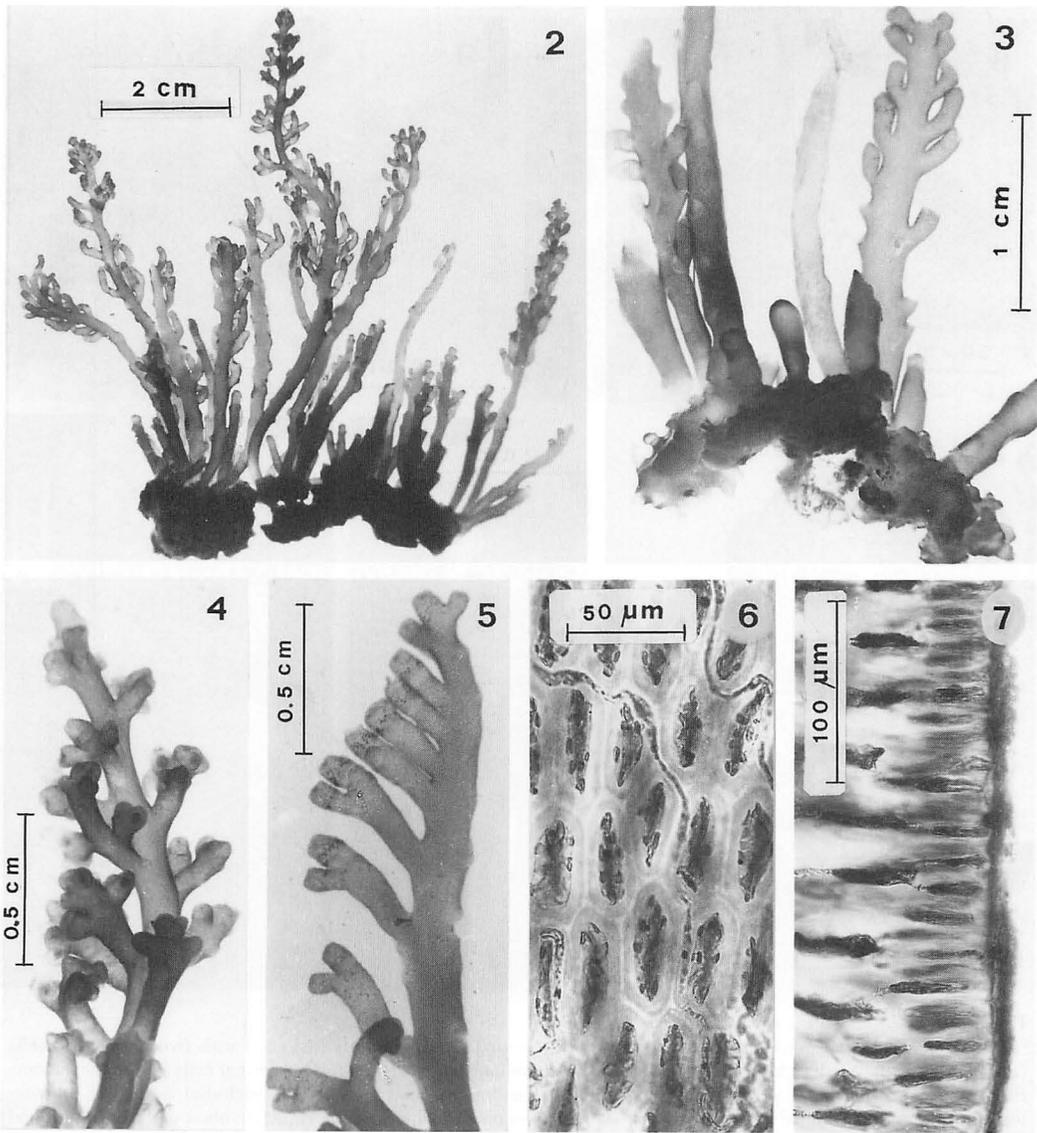
**TYPE LOCALITY:** Lampedusa Island (Pelagean Islands), lower midlittoral.

**HOLOTYPE:** CAT 1234, male and female gametophytes, tetrasporophyte. Collected on 23. vi. 1991.

**DISTRIBUTION:** type locality; Linosa Island (Pelagean Islands) (Fig. 1).

**ETYMOLOGY:** The specific epithet refers to the name of the Pelagean Islands where the species is distributed.

Thalli light red, epilithic, up to 10 cm high (Fig. 2), with axes 2-3 mm broad, arising from a thick, spreading basal crust (Fig. 3), compressed except near the base, simple or scarcely ramified. Branchlets terete, distichously, unilaterally or irregularly arranged, borne in the upper half of axes, up to 10

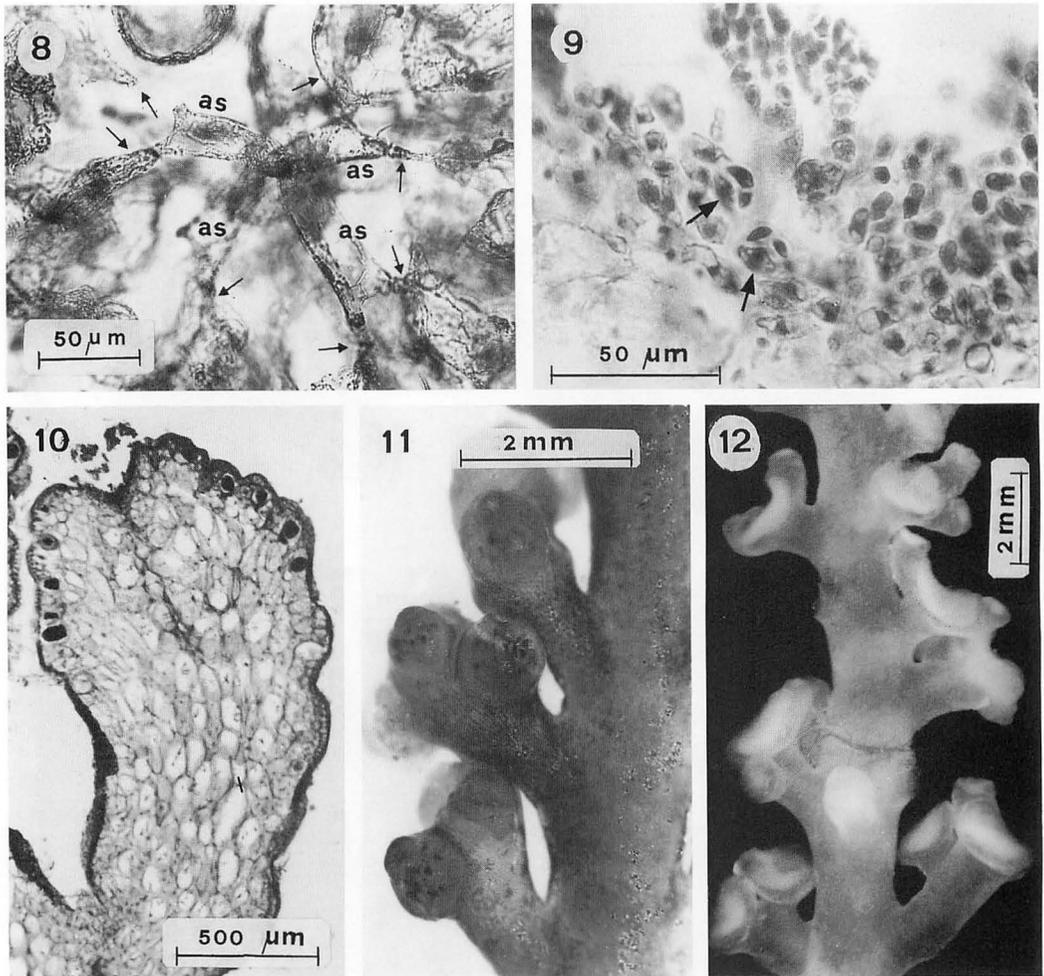


Figs. 2-7. *L. pelagiensis* sp. nov.

Fig. 2. General appearance. Fig. 3. Detail of basal crust. Two axes with simple branchlets distichously arranged are visible. Fig. 4. Axis with ramified branchlets irregularly arranged, bearing cystocarps. Fig. 5. Axis with ramified branchlets unilaterally arranged. Fig. 6. Epidermal cells in surface view. No secondary pit connections occur. Fig. 7. Transverse section of a branchlet showing epidermal cells radially elongated and palisade-like.

mm long, irregularly ramified, sometimes simple (Figs. 3, 4, 5). Epidermal cells in surface view slightly elongated longitudinally near apices [ $15-25(18) \mu\text{m} \times 10-20(15) \mu\text{m}$ ] much more in median and basal portions of the thallus [ $20-40(30) \mu\text{m} \times 8-15(12) \mu\text{m}$ ], not projecting, without secondary pit-connections (Fig. 6); in transverse section radially elon-

gated and palisade like (Fig. 7). Medullary cells without lenticular thickenings. Two pericentral cells per axial segment (Fig. 8). Tetrasporangia, produced from epidermal cells (Fig. 9), are cut off from the mother cells laterally (Fig. 26) and show a parallel arrangement (Fig. 10). Cystocarps,  $600-700 \mu\text{m} \times 700-800 \mu\text{m}$ , sessile and ovoid in shape gener-



Figs. 8-12. *L. pelagiensis* sp. nov.

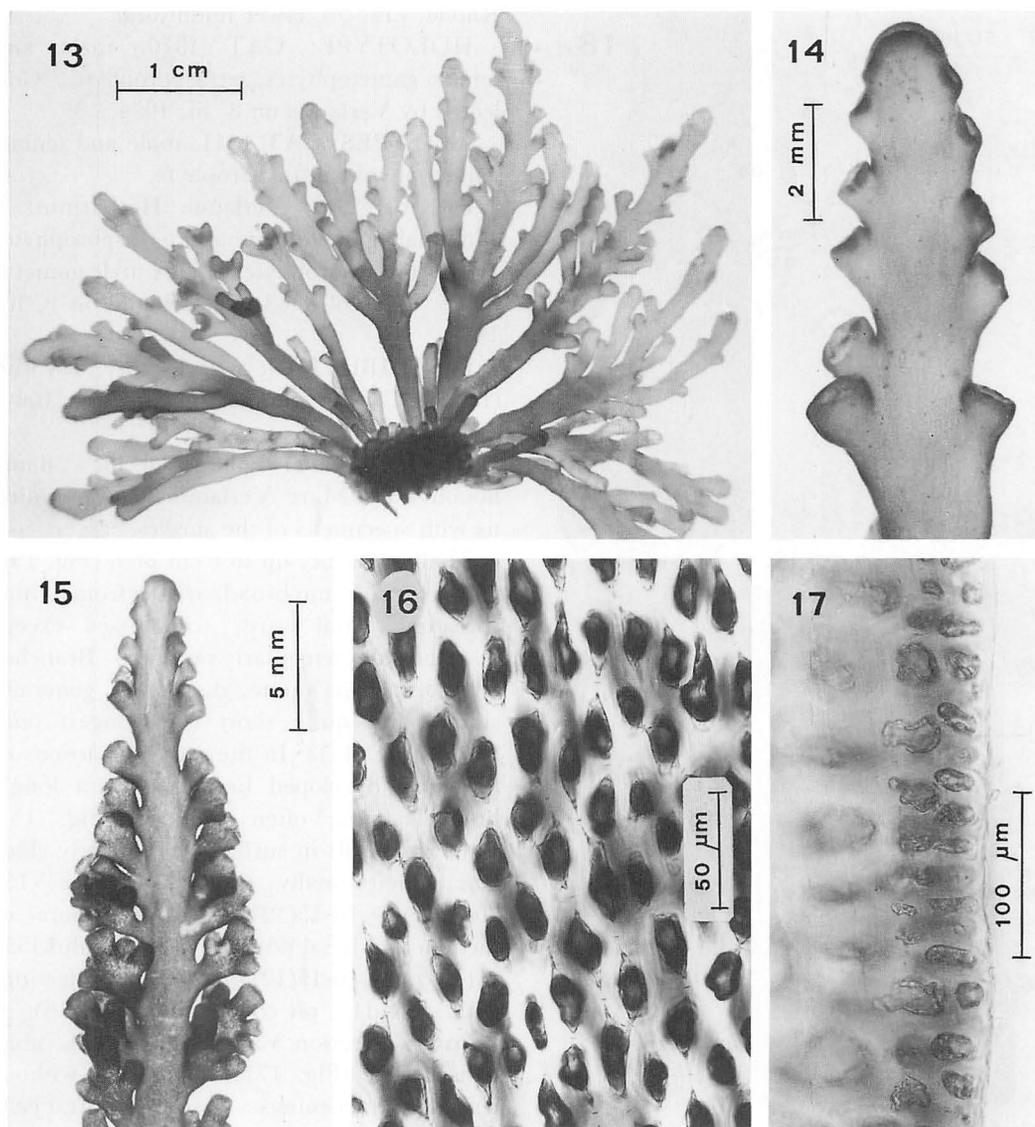
Fig. 8. Transverse section near branchlet apex showing axial segments (as) each with two pericentral cells (arrows). Fig. 9. Median longitudinal section of a stichidial branchlet showing epidermal cells (arrows) each cutting off two presporangial cover cells. Fig. 10. Median longitudinal section of a stichidial branchlet showing tetrasporangia in parallel arrangement. Fig. 11. Cystocarpic branchlets. Fig. 12. Male plant with spermatangial receptacles.

ally disposed in the subapical portions of branchlets (Fig. 11). Spermatangial branches unramified, inserted in depressions broad and shallow,  $600-1800(1200) \mu\text{m} \times 150-750(450) \mu\text{m}$ , located either at the bifurcation of branchlets or laterally near apices (Fig. 12). No rows of axial cells evident on the bottom of mature spermatangial depressions.

*Laurencia verlaquei* sp. nov. Figs. 13-22 and 27.

DIAGNOSIS: Thalli epilithici, usque ad

6 cm alti, axibus 2-3 mm latis, ex tenui extendenti crusta basali orientibus, complanatis, portione basali tereti excepta, irregulariter ramosis. Rami ramulos teretes, distichos, plerumque simplices, admodum breves (longissimos solum 2 mm longos) ferentes; ramuli saepe ramosi in longissimorum ramorum (usque 2 cm) medianis partibus. Duae pericentrales cellulae per cellulam axialem. Cellulae corticales, externe visae, parum longitudinaliter elongatae prope apices [ $15-30(22) \mu\text{m} \times 10-15(12) \mu\text{m}$ ], multo magis in



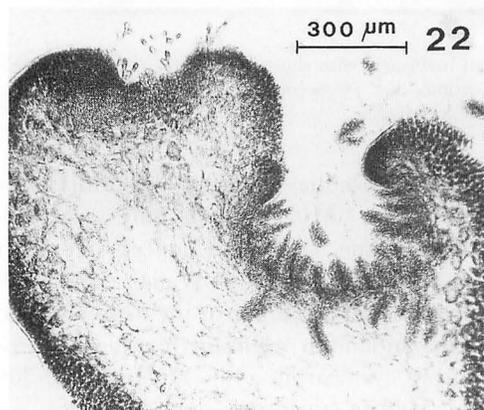
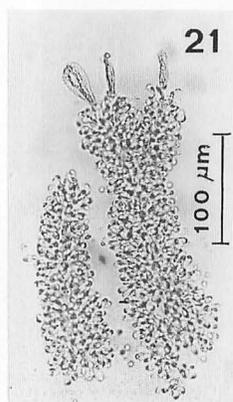
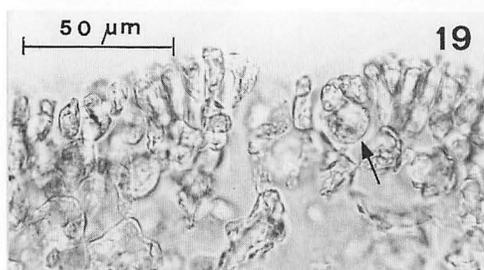
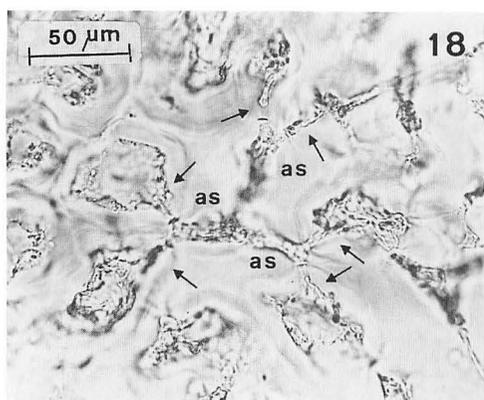
Figs. 13–17. *Laurencia verlaquei* sp. nov.

Fig. 13. General appearance. Fig. 14. Upper portion of main axis with short branchlets. Fig. 15. Well developed branch showing ramified branchlets in the middle portion. Fig. 16. Secondary pit connections between epidermal cells in surface view. Fig. 17. Transverse section of a branchlet.

thalli medianis basalibusque portionibus [35–45(40)  $\mu\text{m} \times 10$ –15(12)  $\mu\text{m}$ ], non exstantes, conjunctionibus secundariis praeditae; in sectione transversa rotundatae vel ovoideae, non paliformes. Cellulae interiores sine crassitudinibus lenticularibus. Tetrasporangia, dispositione parallela, ex cellulis corticalibus lateraliter facta. Rami spermatangiales plerumque simplices (aliquando brevibus

apicalibus ramulis), inserti in profundis [570–900(700)  $\mu\text{m} \times 810$ –1100(900)  $\mu\text{m}$ ], ramulorum divisione vel prope apices lateraliter dispositis, depressionibus. Nulla axialium cellularum series ad maturorum depressionum spermatangialium infimum manifesta. Immatura cystocarpia 160–180  $\mu\text{m} \times 200$ –300  $\mu\text{m}$ . Matura cystocarpia non observata.

TYPE LOCALITY: Sausset (Bouches du



Rhône, France), lower midlittoral.

**HOLOTYPE:** CAT 1370, male and female gametophytes, tetrasporophyte. Collected by Verlaque on 8. iii. 1994.

**ISOTYPES:** CAT 1241, male and female gametophytes, tetrasporophyte.

**PARATYPES:** Verlaque Herbarium, F 1359 male gametophyte and tetrasporophyte; H2511 tetrasporophyte; H2512 male gametophyte. All collected by Verlaque on 9. iii. 1983.

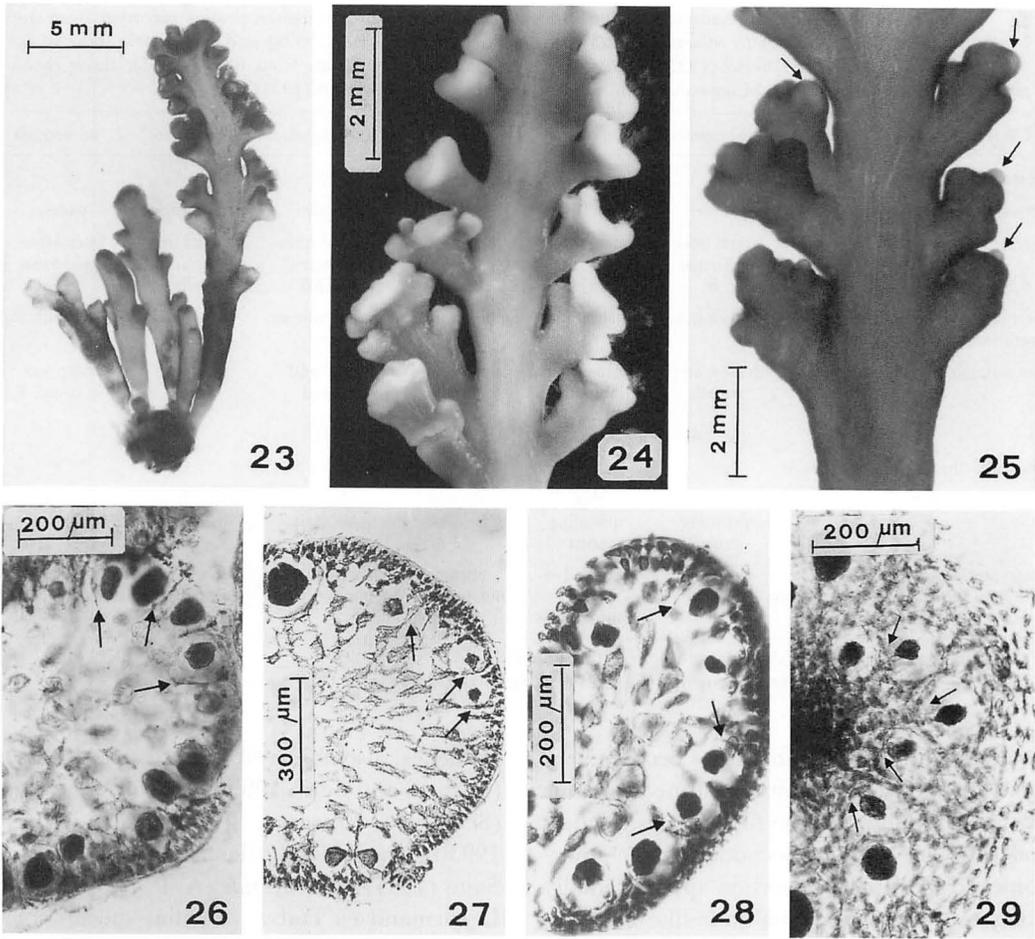
**DISTRIBUTION:** type locality; Livorno (Italy); Capo Colonna (Catanzaro, Italy) (Fig. 1).

**ETYMOLOGY:** the specific name honours Dr Marc Verlaque who provided us with specimens of the species.

Thalli epilithic, up to 6 cm high (Fig. 13), with axes, 2-3 mm broad, arising from a thin, spreading basal crust, compressed except near the base, irregularly ramified. Branches with branchlets terete, distichous, generally simple and quite short (the longest only 2 mm) (Fig. 14). In the median portions of the most developed branches (2 cm long), branchlets are often ramified (Fig. 15). Epidermal cells in surface view slightly elongate longitudinally near the apices [ $15-30(22) \mu\text{m} \times 10-15(12) \mu\text{m}$ ] much more in median and basal portions of the thallus [ $35-45(40) \mu\text{m} \times 10-15(12) \mu\text{m}$ ], not projecting, with secondary pit connections (Fig. 16); in transverse section rounded to ovoid, non-palisade-like (Fig. 17). Inner cells without lenticular thickenings. Two pericentral cells per axial segment (Fig. 18). Tetrasporangia produced from epidermal cells (Fig. 19) in

Figs. 18-22. *Laurencia verlaquei* sp. nov.

Fig. 18. Transverse section near branchlet apex showing axial segments (as) each with two pericentral cells (arrows). Fig. 19. Detail of a longitudinal section of a stichidial branchlet showing an epidermal cell (arrow) cutting off two presporangial cover cells. Fig. 20. Longitudinal section of a stichidial branchlet showing tetrasporangia in parallel arrangement. Fig. 21. Spermatangial branches with short apical branchlets each ending with an elongate apical cell. Fig. 22. Longitudinal section showing a spermatangial depression located laterally near the apex. A row of axial cells is absent on the bottom of the spermatangial depression.



Figs. 23–25. *Laurencia verlaquei* sp. nov.

Fig. 23. General appearance of a male plant. Fig. 24. Detail of a male plant showing the localization of spermatangial depressions. Fig. 25. Detail of a female plant showing immature cystocarps (arrows).

Figs. 26–29. Transverse sections near the apex of stichidial branchlets showing the cut of tetrasporangia. In

Figs. 26–28, mother cells (arrows) appear in the direction of a radius and tetrasporangia are cut off laterally to them clock- or counterclockwise. In Fig. 29, mother cells (arrows) appear perpendicular to the radius and tetrasporangia are cut off in the direction of the radius.

Fig. 26. *L. pelagiensis*. Fig. 27. *L. verlaquei*. Fig. 28. *L. truncata*. Specimen collected at Lachea Island (Catania, Italy) in the infralittoral fringe on 22. iv. 1992 (CAT 1174). Fig. 29. *L. obtusa*. Specimen collected at Capo Passero (Siracusa, Italy) at 50 cm depth on 26. ii. 1994 (CAT 1239).

parallel arrangement (Fig. 20), cut off from the mother cells laterally (Fig. 27). Spermatangial branches simple or irregularly ramified (Fig. 21), inserted in deep depressions (Fig. 22)  $570\text{--}900(700)\ \mu\text{m} \times 810\text{--}1100(900)\ \mu\text{m}$ , located either at the bifurcation of branchlets or laterally near apices (Figs. 23, 24). No rows of axial cells evident on the bottom of mature spermatangial depressions (Fig. 22). Immature cystocarps,  $160\text{--}180\ \mu\text{m} \times 200\text{--}300\ \mu\text{m}$  (Fig. 25). Mature

cystocarps not observed.

## Discussion

*Laurencia pelagiensis* and *L. verlaquei* are two distinct species in both vegetative and reproductive characters (Table 1). In fact, *L. pelagiensis* shows axes not or scarcely ramified with branchlets rather long and irregularly ramified while *L. verlaquei* shows axes irregularly ramified with branchlets

Table 1. Comparison of characters in the species of *Laurencia* with compressed thallus recorded from the Mediterranean Sea. Data of *L. truncata* are drawn from Furnari and Serio (1993a) and this paper; those of *L. pelagosae* from Furnari and Serio (1993b) and this paper; those of *L. undulata* from Saito (1967); those of *L. pinnatifida* from Saito (1982), Maggs and Hommersand (1993), Nam and Saito (1994).

Characters	<i>L. pelagiensis</i>	<i>L. verlaquei</i>	<i>L. truncata</i>	<i>L. pelagosae</i>	<i>L. undulata</i> *	<i>L. pinnatifida</i> **
Secondary pits in epidermis	—	+	+	+	—	—
Arrangement of tetrasporangia	parallel	parallel	parallel	parallel	right-angle	parallel
Origin of tetrasporangia	lateral from epidermal cells	lateral from epidermal cells	lateral from epidermal cells	lateral from epidermal cells	abaxial from pericentral cells	lateral from epidermal cells
Spermatangial receptacle arrangement	indeterminate	indeterminate	indeterminate	indeterminate	unknown	indeterminate
Spermatangial receptacle shape	shallow and broad	deeper than broad slightly sunken	shallow and broad	deep and ovoid	unknown	deep and ovoid
Lenticular thickenings in medulla	—	—	+	+	—	+
Type of attachment	thick spreading crust	thin spreading crust	discoid holdfast	discoid holdfast	stoloniferous holdfast	stoloniferous holdfast
Shape and arrangement of epidermal cells in transverse section	elongate palisade	rounded to ovoid non-palisade	obconic non-palisade	subquadrate non-palisade	obconic non-palisade	obconic non-palisade

\*To be confirmed in the Mediterranean Sea (this paper).

\*\*Not present in the Mediterranean Sea (Furnari and Serio 1993a).

generally simple and short, that become very short apically so that apices assume a sinuous outline (Fig. 14). In the first species, epidermal cells are without secondary pit connections and in transverse section appear radially elongated and with a palisade-like arrangement, while in *L. verlaquei* secondary pit connections occur between epidermal cells which, in transverse section, appear rounded to ovoid. To be noted, that both species show a crustose type of attachment with crusts up to 4–5 cm in diameter with 30–40 axes per cm<sup>2</sup> in *L. pelagiensis* and up to 2 cm in diameter with 50–60 axes per cm<sup>2</sup> in *L. verlaquei*. This type of attachment is quite rare; it occurs only in the two terete species *L. crustiformans* McDermid and *L. flagellifera* J. Agardh (McDermid 1989).

In both species spermatangial branches originate from epidermal cells and spermatangial depressions are indeterminate and cup-shaped, but they are 2–3 times broader than deep with edges turned outwardly in *L. pelagiensis* while in *L. verlaquei* they are 1–1.5 deeper than broad with edges turned inwardly. Epidermal origin of spermatangial

branches, also observed in *L. truncata* Kützting (Furnari and Serio 1993a) and in *L. pelagosae* (Schiffner) Ercegovic (Furnari and Serio 1993b), was recently described by Nam and Saito (1994) in *L. hybrida* (A. P. de Candolle) Lenormand ex Duby. In that species spermatangial branches form directly from both apical and epidermal cells inside apical pits of fertile branchlets. In such branchlets, when spermatangial depressions are completely developed, the row of axial cells becomes unrecognizable. In our species we never observed spermatangial branches originating from apical cells; it seems that spermatangial depressions do not form in correspondence of apical pits. Nevertheless, since we couldn't observe the developmental process of male reproductive structures from the initial stage, the possibility that in our species spermatangial branches originate as in *L. hybrida* can not be excluded at all.

In both species tetrasporangia, in parallel arrangement, are produced from epidermal cells and are cut off from the mother cells laterally. The origin is the same of that described by Nam and Saito (1994) in *L. hybrida*. Their

observations on developmental stages of tetrasporangia are based on median longitudinal sections near apices. Nevertheless, in such sections, as well in surface view, tetrasporangia often appear cut off ab- or adaxially from the mother cells due to a process of distortion in the course of their development. Such process seems to not influence the correct interpretation of the orientation of the cut of tetrasporangia, if the observations are made in transverse sections (Verlaque, personal communication). In fact, in such sections in the species with lateral cut of tetrasporangia from epidermal cells, the mother cells appear in the direction of a radius and tetrasporangia are cut off laterally to them clock- or counterclockwise (Figs. 26–28). On the contrary, in the species with abaxial or adaxial (the latter to be confirmed in the genus) cut of tetrasporangia from pericentral cells, the mother cells appear perpendicular to the radius and tetrasporangia are cut off in the direction of the radius (Fig. 29).

On the basis of Nam and Saito's (1994) paper we re-examined tetrasporophytes of both *L. truncata* (Fig. 28) and *L. pelagosae*. In both species tetrasporangia originate from epidermal cells and are cut off from the mother cells laterally. The abaxial cut of tetrasporangia from the mother cells in *L. truncata* reported by Furnari and Serio (1993a) and Maggs and Hommersand (1993), as well the adaxial cut in *L. pelagosae* reported by Furnari and Serio (1993b), are due to a misinterpretation. Therefore, *L. truncata*, *L. pelagosae* and *L. verlaquei* have the same combination of characters (Table 1) (occurrence of secondary pit connections between epidermal cells, parallel arrangement and lateral cut from epidermal mother cells of tetrasporangia, indeterminate arrangement of spermatangial depressions) but the last species differs from the first two in some external features like habit, branching pattern, type of attachment, greater thickness of the thallus, as well as in the anatomical character of the absence of lenticular thickenings in the inner cells.

Moreover, the above mentioned three

species appear related in both the origin of tetrasporangia and in the arrangement of spermatangial depressions also to *L. pelagiensis* (which, however, does not show secondary pit connections between epidermal cells) and to *L. hybrida* (which has a cylindrical thallus). Nevertheless, we agree with Nam and Saito (1994) that prior to any new infrageneric proposal for these species the infrageneric criteria of Saito (1967, 1969) followed by Furnari and Serio (1993a, b), should be re-evaluated.

Among the other species of *Laurencia* with compressed thallus, only *L. pinnatifida* (Hudson) Lamouroux is reported having tetrasporangia originating from epidermal cells (Nam and Saito 1994). But it differs from *L. verlaquei* mainly in the absence of secondary pit connections between epidermal cells and from *L. pelagiensis* in the type of attachment, shape and arrangement of epidermal cells in transverse section as well in spermatangial receptacle shape (Table 1). In the same paper, Nam and Saito put forward the hypothesis that also in some Californian species of the "Spectabilis Group" tetrasporangia could be produced from epidermal cells. But the species of that "Group" differ from *L. verlaquei* mainly in the absence of secondary pit connections between epidermal cells and from *L. pelagiensis* in the habit, vegetative features and spermatangial receptacle shape.

Finally, since specimens from the island of Linosa [recorded as *L. undulata* Yamada by Cinelli *et al.* (1976)] belong to *L. pelagiensis* and those from France, labelled by Verlaque as "*L. undulata* de Méditerranée (≠ celui du Japon)", belong to *L. verlaquei*, is highly probable that to *L. undulata* were referred specimens having habit and morphology different from both the "Mediterranean *L. pinnatifida*" [to be referred to *L. truncata* (Furnari and Serio 1993a)] and from *L. pelagosae*. In our opinion, *L. undulata* [characterized by absence of secondary pit connections between epidermal cells; rightangle type of tetrasporangial arrangement; epidermal cells neither projecting nor palisade-like in transverse section (Saito 1967)] does not occur in the Mediterranean

Sea and those records should be referred to either *L. pelagiensis* or *L. verlaquei*.

*Laurencia undulata* was firstly recorded in the Mediterranean Sea by J. and G. Feldmann (1942) from Algeria. Afterwards, the species was recorded from Tunisia (Ben Maiz and Boudouresque 1986); France (Augier and Boudouresque 1976); Corsica (Boudouresque and Perret-Boudouresque 1987); Sardinia (Cossu *et al.* 1993); Tuscan Archipelago (Papi *et al.* 1992) and Sicily (Giaccone *et al.* 1985). However, the description reported by J. and G. Feldmann (1942), based only on sterile and male gametophytic specimens, raises doubts on the exact identification of Algerian material. In fact, nothing is said on the occurrence or not of secondary pit connections between epidermal cells nor, due to the absence of tetrasporangial material, on the arrangement and origin of tetrasporangia. Unfortunately, the impossibility to examine J. and G. Feldmann's specimens did not allow us to resolve with certainty these doubts.

According to J. and G. Feldmann's (1942) description, Algerian specimens show a palisade-like arrangement of cortical cells ("...plus ou moins allongées radialement et ainsi disposées en palissade...") that excludes their belongings to *L. undulata* which, on the contrary, shows a not palisade-like arrangement. Moreover, they show a type and disposition of spermatangial branches ("...Les spermatangiophores, très nombreux et groupés parallèlement les uns aux autres sont constitués par un filament central, généralement non ramifié portant un manchon continu de spermatanges...") similar to both *L. pelagiensis* and *L. verlaquei*. But, for the palisade-like arrangement of cortical cells (occurring only in *L. pelagiensis*) as well as for the southern Mediterranean distribution area, it is more probable they belong to *L. pelagiensis*.

### Acknowledgements

We thank the Curator of the Herbarium of Faculty of Science, Hokkaido University, Sapporo, Japan (SAP) for the loan of the type of

*Laurencia undulata*. We also thank Prof. Giaccone (University of Catania) and Dr Papi (University of Pisa) for specimens of *Laurencia* given to us. We are particularly grateful to Marc Verlaque (University of Aix-Marseille, France), for Herbarium material, annotated with personal precious observations, which he kindly sent to us. We wish to thank also Dr K. W. Nam (National Fisheries, University of Pusan, Korea) for his helpful suggestions. This study was supported by a grant from the Italian M.U.R.S.T.

### References

- Augier, H. and Boudouresque, C. F. 1976. Dix ans de recherches dans la zone marine du parc national de Port-Cros (France). *Ann. Soc. Sc. Nat. et d'Archéol. de Toulon et du Var* **12**: 119-173.
- Ben Maiz, N. and Boudouresque, C. F. 1986. Les algues. p. 85-97. *In*: Le benthos marin de l'île de Zembra (Parc National, Tunisie). (Ed. by C. F. Boudouresque, J. G. Harmelin and A. Jeudy De Grissac), pp. 85-97. GIS Posidonie publ., Marseille, France.
- Boudouresque, C. F. and Perret-Boudouresque, M. M. 1987. A checklist of the benthic marine algae of Corsica. GIS Posidonie publ., Marseille, France: 1-121.
- Cinelli, F., Drago, D., Furnari, G., Giaccone, G., Scammacca, B., Solazzi, A., Sortino, M. and Tolomio, C. 1976. Flora marina dell'isola di Linosa (arcipelago delle Pelagie). *Mem. Biol. Mar. e Oceanogr.* **6**: 141-172.
- Cossu, A., Gazale, V. and Baroli, M. 1993. La flora marina della Sardegna: inventario delle alghe bentoniche. *Giorn. Bot. Ital.* (1992) **126**: 651-707.
- Feldmann, J. and Feldmann, G. 1942. Additions à la flore des algues marines de l'Algérie. *Bull. Soc. Hist. nat. Afrique du Nord, Algeria* **33**: 230-245.
- Furnari, G. and Serio, D. 1993a. The distinction of *Laurencia truncata* (Ceramiales, Rhodophyta) in the Mediterranean Sea from *Laurencia pinnatifida*. *Phycologia* **32**: 367-372.
- Furnari, G. and Serio, D. 1993b. The reproductive structures of the Mediterranean alga *Laurencia pelagosae* (Ceramiales, Rhodophyta). *Eur. J. Phycol.* **28**: 141-143.
- Giaccone, G., Colonna, P., Graziano, C., Mannino, A. M., Tornatore, E., Cormaci, M., Furnari, G. and Scammacca, B. 1985. Revisione della flora marina di Sicilia e isole minori. *Boll. Acc. Gioenia Sc. Nat., Catania* **18**: 537-781.
- Maggs, C. A. and Hommersand, M. H. 1993. Seaweeds of the British Isles. Vol. 1 Rhodophyta, Part 3A Ceramiales. Natural History Museum, London.

- XV + 444 pp.
- McDermid, K. J. 1989. *Laurencia crustiformans* sp. nov. (Ceramiales, Rhodophyta) from the Hawaiian Islands. *Phycologia* 28: 352-359.
- Nam, K. W. and Saito, Y. 1994. A re-examination of *Laurencia hybrida* (Ceramiales, Rhodophyta) from the British Isles: vegetative and reproductive morphology. *Phycologia* 33: 34-41.
- Papi, I., Pardi, G., Lenzini, S., Benedetti Cecchi, L. and Cinelli, F. 1992. Benthic marine flora in the Tuscan Archipelago. A first contribution: Isles of Capraia, Elba, Formiche di Grosseto, Giglio, Scoglio d'Africa, Montecristo and Giannutri. *Giorn. Bot. Ital.* 126: 549-593.
- Saito, Y. 1967. Studies on Japanese species of *Laurencia*, with special reference to their comparative morphology. *Mem. Fac. of Fish., Hokkaido University* 15: 1-81.
- Saito, Y. 1969. On morphological distinctions of some species of Pacific North American *Laurencia*. *Phycologia* 8: 85-90.
- Saito, Y. 1982. Morphology and infrageneric position of three British species of *Laurencia* (Ceramiales, Rhodophyta). *Phycologia* 21: 299-306.

Mario Cormaci · Giovanni Furnari · Donatella Serio : 地中海産の紅藻ソゾ属 (イギス目) の  
2 新種, *Laurencia pelagiensis* と *Laurencia verlaquei*

地中海産の紅藻ソゾ属 (イギス目) の扁平な軸を持つ 2 新種, *Laurencia pelagiensis* と *Laurencia verlaquei* を記載した。*Laurencia pelagiensis* は Pelagean 諸島産で次のような特徴をもつ。すなわち表皮細胞は二次的な原形質連絡を欠き、横断面では放射状に伸び、柵状の形状をなす。四分胞子嚢は平行に配列し側生する表皮細胞からなる母細胞から切り出される。精子嚢枝は分枝せず浅くて広い生殖器床に生ずる。*Laurencia verlaquei* は Sausset (Marseille, France), Livorno (Italy), Capo Colonna (Catanzaro, Italy) で採集され、表皮細胞は二次的な原形質連絡を有し、横断面では放射状でも柵状でもない。四分胞子嚢は平行して配列し側生する表皮細胞からなる母細胞から切り出される。精子嚢枝は分枝しないか不規則に分枝し、深い生殖器床に生ずる。地中海で報告されている *Laurencia undulata* Yamada はこれらの 2 種のいずれかに相当すると考える。(Department of Botany, University of Catania, via A. Longo 19, 95125 Catania, Italy)

(Received May 9, 1994. Accepted September 12, 1994)

Note added in proof

While this paper was printing the genus *Osmundea* Stackhouse was resurrected [see Nam, K. W., Maggs, C. A. and Garbary, D. J. 1994. Resurrection of the genus *Osmundea* with an emendation of the generic delineation of *Laurencia* (Ceramiales, Rhodophyta). *Phycologia* 33(5): 384-395].

Since the two new species described in this paper fall within the circumscription of the genus *Osmundea*, the following new combinations are here proposed:

*Osmundea pelagiensis* (Cormaci *et al.*) Furnari comb. nov.

Basionym: *Laurencia pelagiensis* Cormaci *et al.* 1994, *Jpn. J. Phycol.* 42: 366 (this paper).

*Osmundea verlaquei* (Cormaci *et al.*) Furnari comb. nov.

Basionym: *Laurencia verlaquei* Cormaci *et al.* 1994, *Jpn. J. Phycol.*, 42: 368 (this paper).

