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Two similar red algal species, *Melanamansia glomerata* and *Amansia rhodantha* (Rhodomelaceae, Ceramiales), from the north-western Pacific Ocean[1]

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Abstract — Two different entities have been included in the alga passing under the name of *Melanamansia glomerata* (C. Agardh) R. Norris or *Amansia glomerata* C. Agardh in the north-western Pacific Ocean. An alga, which is characterised by the production of two pseudopericentral cells that are cut off from two dorsal pericentral cells towards the centre of the thallus and surround the axial cell together with five pericentral cells, is referred to genuine *M. glomerata*. Another alga, which lacks such pseudopericentral cells, is referred to *Amansia rhodantha* (Harvey) J. Agardh. The two species are also distinguished by two further features: 1) thallus colour, dark brown in *M. glomerata* and dark red in *A. rhodantha*; and 2) the absence or presence of conspicuous midribs, absent in *M. glomerata* and present in *A. rhodantha*. However, diagnostic features between the genera *Melanamansia* and *Amansia* besides the presence/absence of pseudopericentral cells, such as development of serrations, the presence/absence of trichoblast capsules and transverse-sectional profiles of tetrasporangial stichidia, may vary in both genera and overlap each other. The pseudopericentral feature is only a reliable taxonomic criterion that distinguishes these two genera. These facts strongly indicate that *Amansia* and *Melanamansia* are congeneric, at least *M. glomerata* should be put back in *Amansia*, although it is desirable to conduct further studies including molecular analysis for reassessment of the status of the genus *Melanamansia*.

***Amansia glomerata* / *Amansia rhodantha* / Ceramiales / *Melanamansia glomerata* / Pacific Ocean / red marine algae / Rhodomelaceae / Rhodophyta / taxonomy**

Résumé — Deux algues rouges très voisines, de la région nord-ouest du Pacifique, *Melanamansia glomerata* et *Amansia rhodantha* (Rhodomelaceae, Ceramiales). Deux entités différentes ont été incluses sous le nom de *Melanamansia glomerata* (C. Agardh) R. Norris ou *Amansia glomerata* C. Agardh dans l'océan Pacifique nord-occidental. Une algue, caractérisée par la production de deux cellules pseudopéricentrales dérivant de deux cellules péricentrales dorsales vers le centre du thalle et entourant les cellules axiales en même temps que les cinq cellules péricentrales, est attribuée au véritable *M. glomerata*. Une autre algue, qui ne possède pas de telles cellules pseudopéricentrales, est attribuée à *Amansia rhodantha* (Harvey) J. Agardh. Les deux espèces diffèrent aussi par deux caractères supplémentaires : 1) la couleur du thalle, brun foncé chez *M. glomerata* et rouge foncé

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chez *A. rhodantha* ; et 2) l'absence ou la présence de nervures visibles, absentes chez *M. glomerata* et présentes chez *A. rhodantha*. Cependant, outre la présence ou l'absence de cellules pseudopéricentrales, les caractères permettant de séparer les genres *Melanamansia* et *Amansia*, tels que le développement de denticulations, la présence ou l'absence d'enveloppes des trichoblastes jeunes et les contours des sections transversales des stichidies à tétrasporocystes, peuvent varier dans les deux genres et se chevaucher d'un genre sur l'autre. Le caractère des cellules pseudopéricentrales est le seul critère taxinomique fiable qui sépare les deux genres. Ceci indique fortement que *Amansia* et *Melanamansia* ne forment q'un seul et même genre, et que, au moins *M. glomerata* devrait être replacé dans *Amansia*, bien qu'il soit souhaitable de mener des études supplémentaires, dont des analyses moléculaires, pour réévaluer le statut du genre *Melanamansia*.

Algues rouges marines / *Amansia glomerata* / *Amansia rhodantha* / Ceramiales / *Melanamansia glomerata* / océan Pacifique / Rhodomelaceae / Rhodophyta / taxinomie

INTRODUCTION

Norris (1988a) established the red algal genus *Melanamansia* (Rhodomelaceae) for species formerly placed in *Amansia*, chiefly on the basis of the production of two pseudopericentral cells that are formed one from each dorsal pericentral cell towards the centre of the thallus and surround the axial cell together with five pericentral cells. At that time he left *Amansia glomerata* C. Agardh in *Amansia* (Norris, 1988a), but later he transferred it to *Melanamansia* as *M. glomerata* (C. Agardh) R. Norris after examination of the lectotype specimen and specimens from the lectotype locality, Hawaiian Islands (Norris, 1995).

Norris (1995) mentioned that *Melanamansia* occurs in the central to western Pacific Ocean from Australia northwards to Japan except for two South African species, and South Africa's east coast is the only region in which *Amansia* and *Melanamansia* occur. This supposed phytogeographic property of both genera, however, is rejected by the presence of two *Amansia* species in the Pacific Ocean: *A. paloloensis* South *et* Skelton in Samoa (South & Skelton, 1999) and *A. rhodantha* (Harvey) J. Agardh in Malaysian waters (Masuda *et al.*, 2000). The latter discovery requires re-examination of the alga reported as *M. glomerata* (or *A. glomerata*) in the north-western Pacific Ocean (Pham, 1969; Tseng *et al.*, 1983; Silva *et al.*, 1987; Yoshida, 1998), as *M. glomerata* has been confused with *A. rhodantha* because of their gross morphological similarity (Norris, 1995). The purpose of the present study is to elucidate the taxonomic status of the alga passing under the name of *Melanamansia glomerata* or *Amansia glomerata* in the north-western Pacific Ocean.

MATERIALS AND METHODS

Specimens examined were collected at various localities in the Philippines, Vietnam and Japan. The specimens were fixed in 10 % formalin in seawater, and later some were dried as voucher herbarium specimens and deposited in the Herbarium of the Graduate School of Science, Hokkaido University,

Sapporo (SAP). The herbarium specimens of *Amansia glomerata* and *Melanamansia glomerata* in SAP were re-identified in order to check the geographical distribution of these species in the north-western Pacific Ocean. Their exterior morphology was examined with a dissecting microscope. Portions of the specimens (a single or several blades) were detached and rehydrated in detergent for one or two days.

Sections were made by hand using a razor blade and pith stick. These were then stained with 0.5 % (w/v) cotton blue in a lactic acid/phenol/glycerol/water (1:1:1:1 [v/v]) solution and mounted in 50 % glycerol/seawater or 30 % Karo® on microscope slides.

RESULTS

***Melanamansia glomerata* (C. Agardh) R. Norris 1995: 66**
Basionym: *Amansia glomerata* C. Agardh (1824: 247).
Type locality: Hawaii.

Distribution: Hawaii (Norris, 1995; Abbott, 1999), Philippines (present paper) and Vietnam (present paper).

Specimens examined: Philippines: Cangaluyam Island, Bolinao, Pangasinan, 14.i.1990, tetrasporangial (SAP 088569), female (SAP 088570) and male (SAP 088571), *leg.* M. Masuda. Vietnam: (1) Thai An, Ninh Hai, Ninh Thuan Province, 20.i.1993, male (SAP 070554-070556), *leg.* M. Masuda; (2) Son Hai, Ninh Phuoc, Ninh Thuan Province, 21.i.1993, tetrasporangial (SAP 070557), *leg.* M. Masuda.

Plants grow on bedrock, dead coral or *Sargassum* in the lower intertidal to upper subtidal zones in reef flats. The thalli are dark brown, rigid and 20-50 mm high (Fig. 1). Two to four terete axes 1.2-2.5 mm wide arise from a discoid holdfast 5-8 mm in diameter. Each axis has a compact, terminal rosette consisting of ligulate blades and some adventitious axes that are similar in morphology to the primary axis.

Blades are involute at the apices and grow to 9-25 mm long by 1.8-3.2 mm wide excluding the denticulations. Vegetative blades are entire, whereas fertile blades bear alternately arranged denticulations (Fig. 2). These denticulations are 0.2-1.5 mm (sometimes 4-8 mm) long and form reproductive structures except for those of the proximal portion of the parental blades. Young blades consist of two cell-layers, but mature blades form a weakly developed midrib near the proximal portion. Secondary blades are absent on such a midrib. However, several secondary blades may develop along the median line from the middle to the distal region of blades (Fig. 2) and form reproductive structures. In such cases, a slight midrib may later arise near the secondary blades. Secondary blades also arise from the proximal region of serrations.

Vegetative trichoblasts are formed along the dorsal side of inrolled apices of blades and denticulations (Figs 3, 4). Young trichoblasts are light-coloured and enveloped within a capsule (Fig. 3). Trichoblasts are formed singly on each segment and divide five to seven times in an almost dichotomous manner within the capsule (Fig. 3). All trichoblast cells elongate upon rupture of the capsule (Fig. 4), and the trichoblast eventually reaches 900-1100 μm in length, with segments up to 160 μm long. Trichoblasts are deciduous and leave large scar cells.

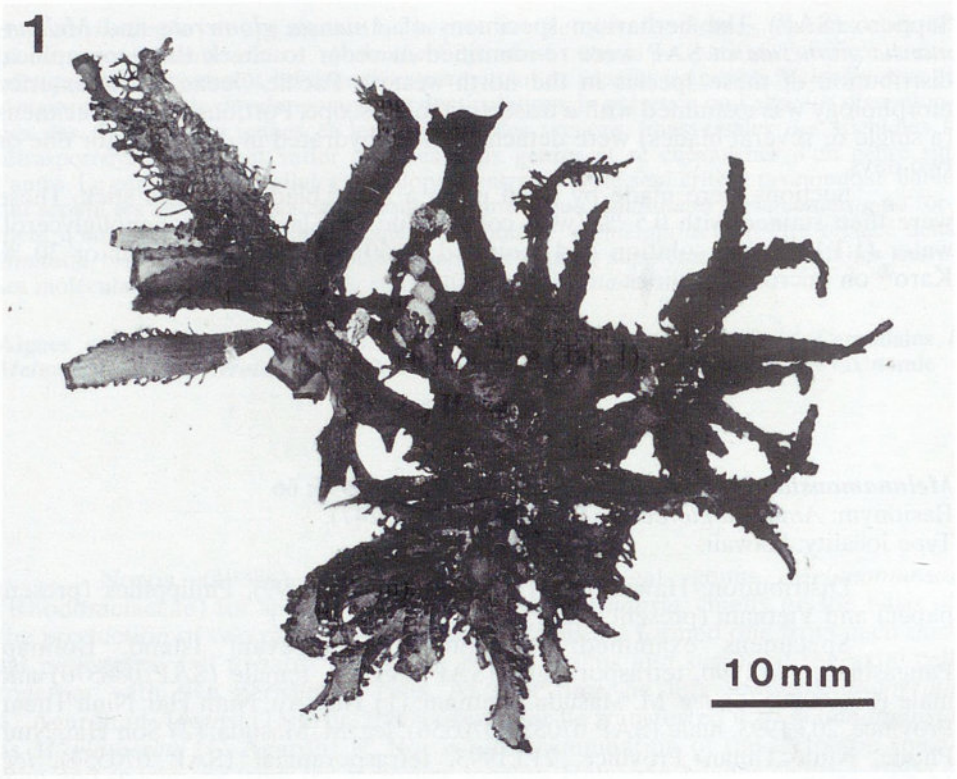
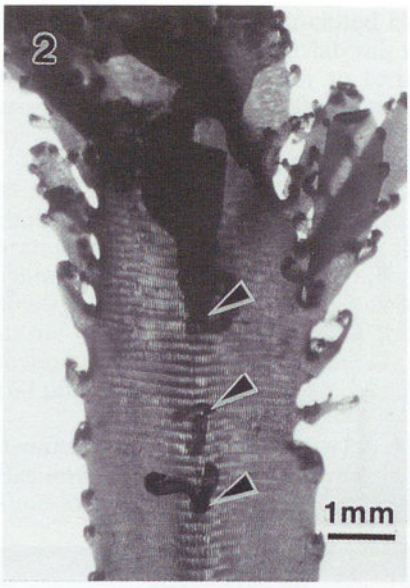


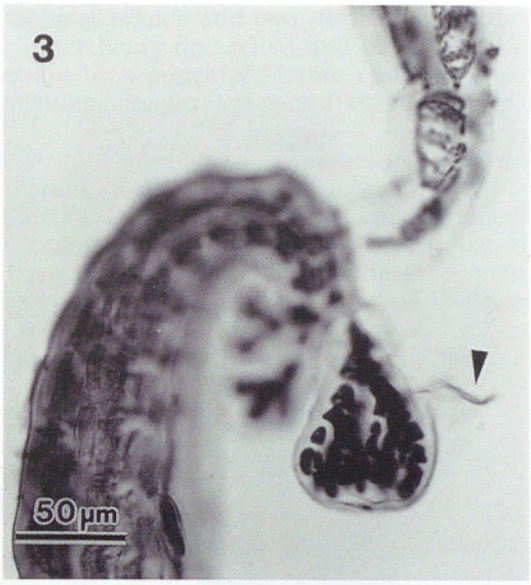
Fig. 1. Herbarium tetrasporangial specimen of *Melanamansia glomerata.* Son Hai, Ninh Phuoc, Ninh Thuan Province, Vietnam (21.i.1993; SAP 070557).

Five pericentral cells are formed in each segment, two on the dorsal (adaxial) side and three on the ventral (abaxial) side. Each dorsal pericentral cell cuts off a pseudopericentral cell towards the centre of the thallus (Fig. 5). Sections of different ages (from 4 mm to 25 mm long) and parts (from apices to bases) of the blades of Philippine and Vietnamese specimens consistently showed the presence of pseudopericentral cells.

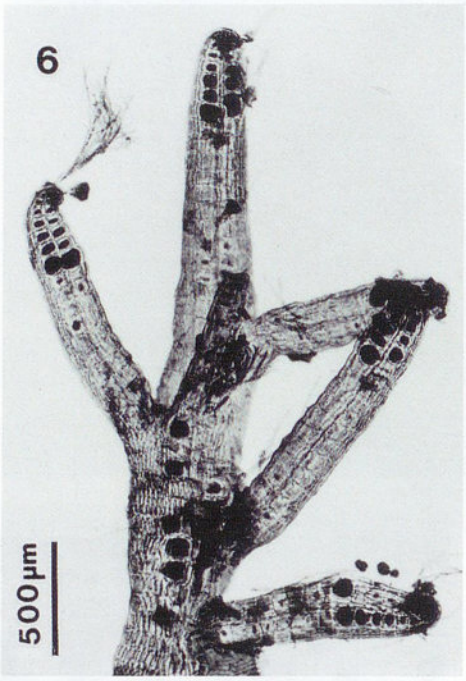
Tetrasporangial stichidia are transformed from marginal denticulations and/or their branches (Fig. 6). Two tetrasporangia were formed in each of 10-35 successive segments of these stichidia that are 500-3000 µm long by 220-500 µm wide. The stichidia produce the dorsal row of vegetative trichoblasts (Fig. 6). Mature tetrasporangia, with tetrahedrally arranged spores, are 90-125 µm high by 100-130 µm wide. The tetrasporangia are associated with two lateral cover cells and lack a basal cover cell (Fig. 7).

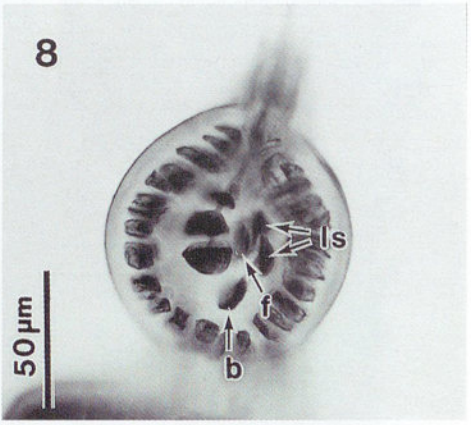
One to three procarpial trichoblasts are formed along the dorsal side of the inrolled apices of denticulations and/or their branches. These trichoblasts are reduced in length and consist of four segments. The basal segment of each trichoblast grows into the stalk of a cystocarp and the suprabasal segment produces a single procarp. The subterminal segment of each trichoblast becomes polysiphonous, but the terminal segment ceases apical growth and may divide once. Each

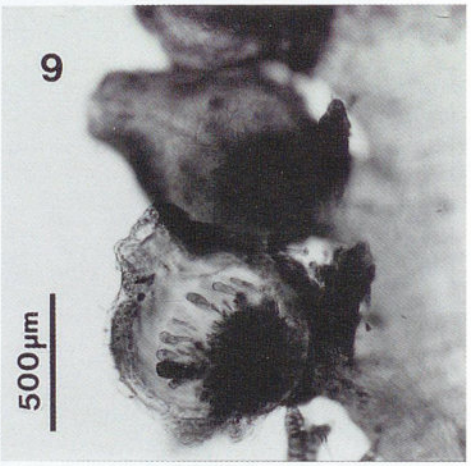


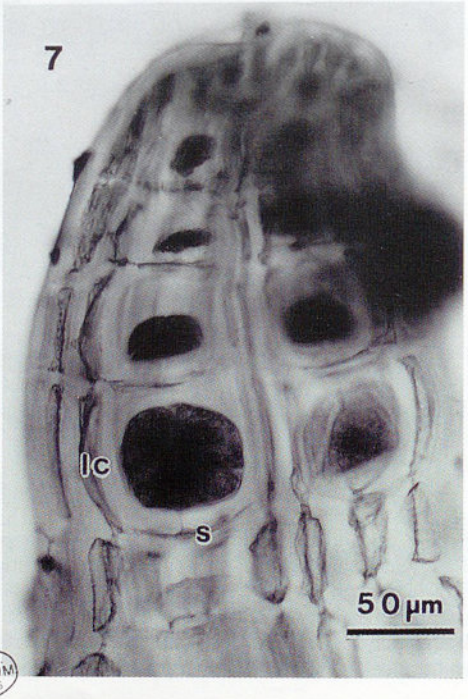


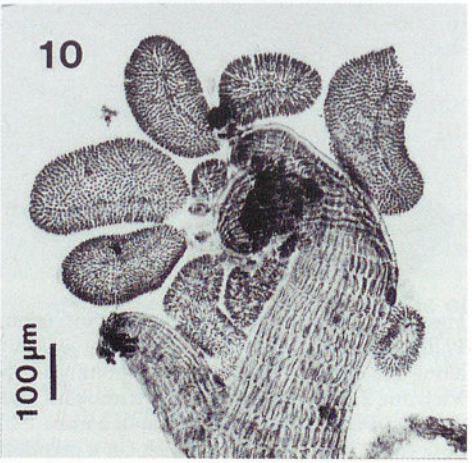
Figs 2-5. *Melanamansia glomerata.* Specimens from Cangaluyam Island, Bolinao, Pangasinan, Philippines (14.i.1990), unless otherwise indicated. Fig. 2. Secondary blades (arrowheads) developing along the median line of a tetrasporangial blade (Son Hai, Ninh Phuoc, Ninh Thuan Province, Vietnam, 21.i.1993). Fig. 3. Young trichoblast with a ruptured capsule (arrowhead). Fig. 4. Mature trichoblast. Fig. 5. Transverse section of a mature blade showing an axial cell (a) pit-connected with five pericentral cells (p), tow of which cut a pseudopericentral cell (arrowhead); the upper side is dorsal.











procarp consists of a four-celled carpogonial branch and two sterile cell groups: one being two-celled and lateral, the other being one-celled and basal (Fig. 8). A procarp is covered prior to fertilization by a pericarp. Mature cystocarps are urceolate (Fig. 9), 800-1100 μm high (including an elevated neck 100-250 μm high) by 700-900 μm wide.

Spermatangial branches (Fig. 10) are produced in positions comparable to those of procarps. After the formation of several to many vegetative trichoblasts (depending on the length of fertile serrations), four to six spermatangial branches are formed successively in a secund manner (Fig. 10) and later replaced again by vegetative trichoblasts. They have a one-celled sterile suprabasal segment 40-90 μm long (the basal segment being embedded in the parental branch) and no sterile tip. The fertile portion of these spermatangial branches consists of three to seven segments and is ellipsoidal, strongly curved, and 200-350 μm long by 100-160 μm wide.

***Amansia rhodantha* (Harvey) J. Agardh 1841: 26**
Basionym: *Delesseria rhodantha* Harvey (1834: 151, pl. 126).
Type locality: Cap Malheureux, Mauritius.

Distribution: South Africa (Norris, 1988a, as *Amansia glomerata* C. Agardh), Mauritius (Harvey, 1834; Falkenberg, 1901, as *A. glomerata*), Malaysia (Masuda *et al.*, 2000), Philippines (present paper), Vietnam (Pham, 1969, as *A. glomerata*; present paper), China (Tseng *et al.*, 1983, as *A. glomerata*), Japan (Okamura, 1901, 1936, both as *A. glomerata*; present paper).

Specimens examined: Philippines: Cangaluyam Island, Bolinao, Pangasinan, 14.i.1990, tetrasporangial (SAP 088573-088575), female (SAP 088576) and male (SAP 088577), *leg.* M. Masuda. Vietnam: (1) Binh Vinh, Ly Son Island, Quang Ngai Province, 26.i.1993, vegetative (SAP 070558), *leg.* M. Masuda; (2) Hon Mieu, Nha Trang, Khanh Hoa Province, 28.iv.1999, vegetative (SAP 088567), *leg.* M. Masuda. Japan: (1) Sonai, Yonaguni Island, Okinawa Prefecture, 1.iii.1999, tetrasporangial (SAP 088580) and male (SAP 088581), *leg.* M. Masuda; (2) Agarizaki, Yonaguni Island, Okinawa Prefecture, 3.iii.1999, tetrasporangial (SAP 088584-088587) and female (SAP 088588), *leg.* M. Masuda; 9.iii.2000, tetrasporangial (SAP 088589), *leg.* S. Kawaguchi & A. Kato; (3) Higawa, Yonaguni Island, Okinawa Prefecture, 8.iii.2000, tetrasporangial (SAP 088590), *leg.* S. Kawaguchi & A. Kato.

Plants grow on bedrock or dead coral in the lower intertidal to upper subtidal zones in reef flats. The thalli are dark red, rigid and 20-80 mm high (Fig. 11). Three to five axes arise from a discoid holdfast 5-15 mm in diameter. Each axis has many compact, terminal rosettes, which consist of ligulate blades. Erect axes may be formed as follows. A primary ligulate blade that first consists of two cell-layers, forms a midrib. From the dorsal side of the midrib secondary blades develop successively in a group (Fig. 12), forming a rosette. All these blades grow like the primary blades. Tertiary blades develop from some (not all) second-

◀ Figs 6-10. *Melanamansia glomerata.* Specimens from Cangaluyam Island, Bolinao, Pangasinan, Philippines (14.i.1990). Fig. 6. Tetrasporangial stichidia. Fig. 7. Tetrasporangia without a basal cover cell: lc, lateral cover cell (another lateral cover cell is out of focus); s, stalk cell. Fig. 8. Procarp: b, initial of the basal sterile group; f, fertile pericentral cell bearing a four-celled carpogonial branch; ls, initial of the lateral sterile group. Fig. 9. Mature cystocarps. Fig. 10. Spermatangial branches.

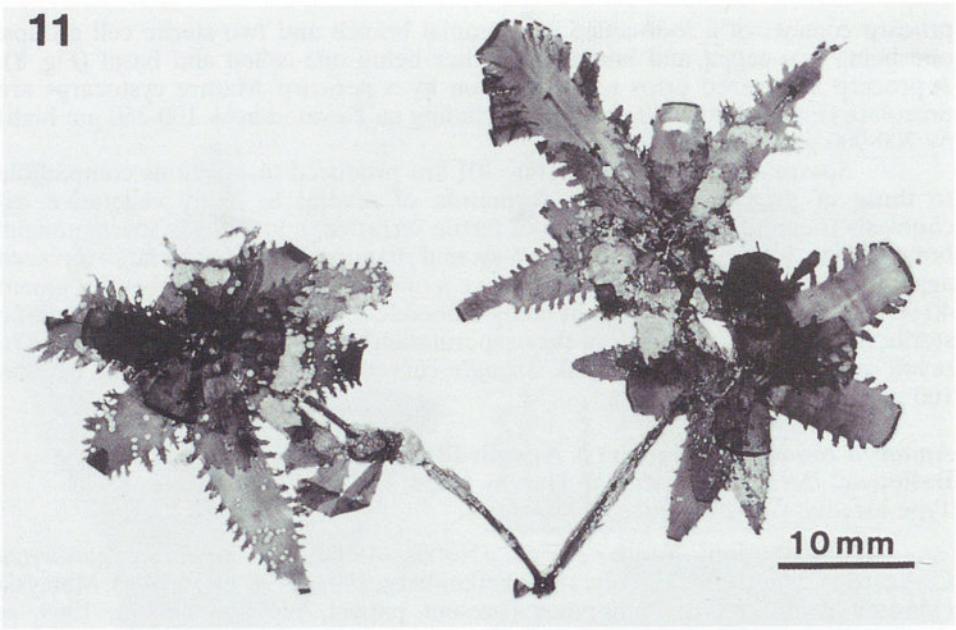


Fig. 11. Herbarium tetrasporangial specimen of *Amansia rhodantha*. Agarizaki, Yonaguni Island, Japan (3.iii.1999; SAP 088584).

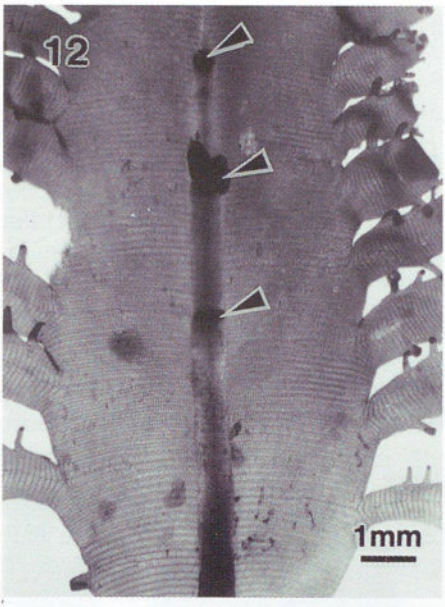
ary blades in a manner similar to that of the secondary blades. This process is repeated several times and results in many rosettes in a single individual (Fig. 11). The midrib develops conspicuously on older blades and the wings frequently become eroded in the proximal portion, resulting in a subterete (1.2-2.5 mm in diameter) stem-like structure from which a few rosettes develop.

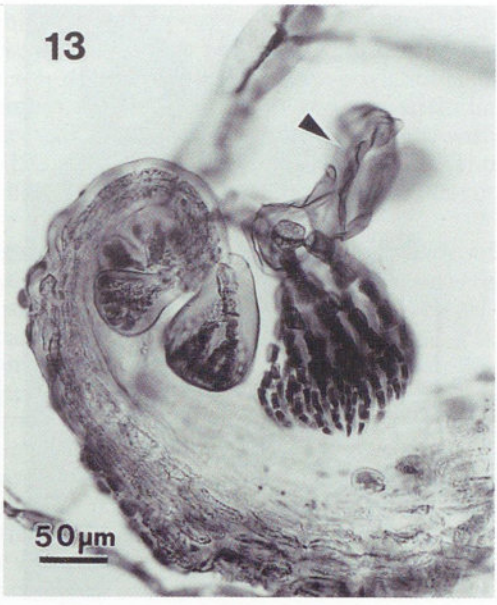
Blades are involute at the apices and grow to 11-25 mm long by 3-7 mm wide excluding denticulations which are alternately formed. These denticulations are simple and 100-400 μm long in vegetative blades, but are branched once or twice and grow to 1-3 mm (sometimes 5-6 mm) long (including tetrasporangial stichidia and fertile portions bearing procarpial trichoblasts or spermatangial branches) in reproductive blades.

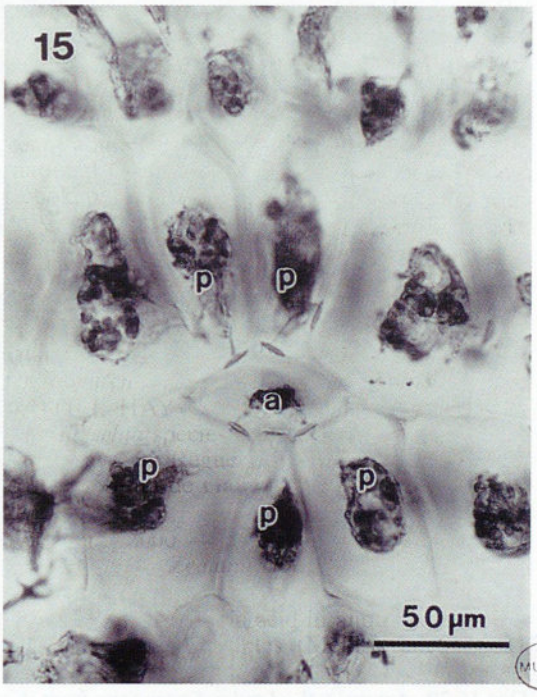
Vegetative trichoblasts are formed along the dorsal side of inrolled apices of blades and denticulations (Figs 13, 14). Young trichoblasts are light-coloured and enveloped within a capsule (Fig. 13). Trichoblasts are formed singly on each segment and divide seven or eight times in an almost dichotomous manner within the capsule. Each cell of the trichoblasts elongates after rupture of the capsule (Fig. 14), and the entire trichoblast grows to 700-900 μm long, with segments up to 120 μm long. Trichoblasts are deciduous and leave large scar cells.

Five pericentral cells are formed in each segment, two on the dorsal (adaxial) side and three on the ventral (abaxial) side, and pseudopericentral cells are absent (Fig. 15). Sections were made from different parts of the Philippine, Vietnamese and Japanese blades of various ages, but no pseudopericentral cells were found.

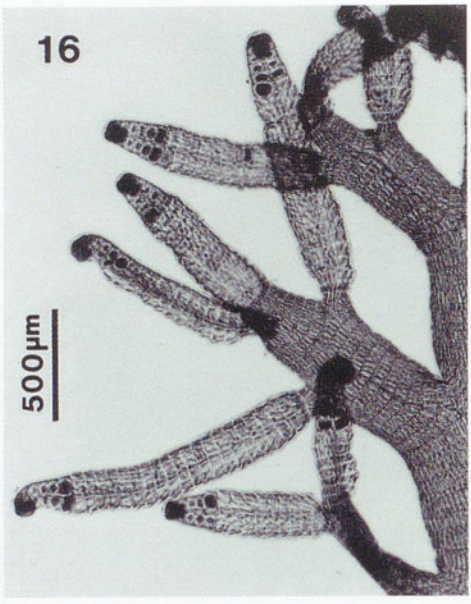
Tetrasporangial stichidia are transformed from marginal denticulations and/or their branches (Fig. 16). The majority of the denticulations, except for some

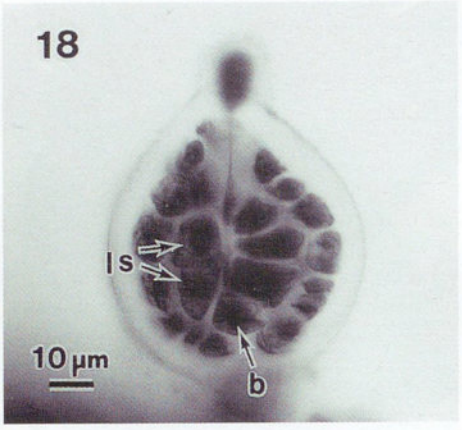


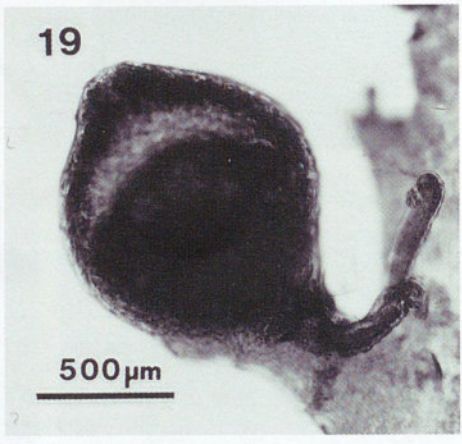


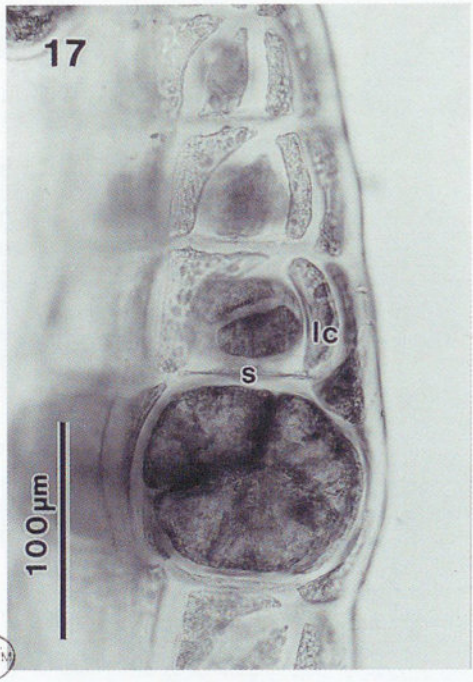


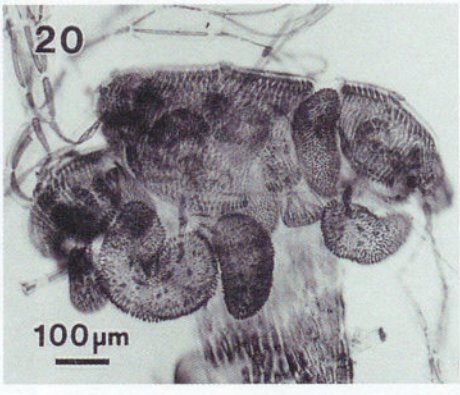
Figs 12-15. *Amansia rhodantha.* Specimens from Agarizaki, Yonaguni Island, Japan (3.iii.1999), unless otherwise indicated. Fig. 12. Primary blade issuing secondary blades (arrowhead) along the midrib. Fig. 13. Young trichoblasts, two of which are envelopped within a capsule and the third one has a ruptured capsule (arrowhead) (Cangaluyan Island, Bolinao, Pangasinan, Philippines, (14.i.1990). Fig. 14. Mature trichoblast. Fig. 15. Transverse section of a mature blade showing an axial cell (a) pit-connected with five pericentral cells (p); the upper side is dorsal.











Figs 16-20. *Amansia rhodantha*. Specimens from Agarizaki, Yonaguni Island, Japan (3.iii.1999), unless otherwise indicated. Fig. 16. Tetrasporangial stichidia. Fig. 17. Tetrasporangia without a basal cover cell: lc, lateral cover cell (another lateral cover cell is out of focus); s, stalk cell. Fig. 18. Procarp: b, initial of the basal sterile group; ls, initial of the lateral sterile group (fertile pericentral cell bearing a four-celled carpogonial branch is out of focus). Fig. 19. Mature cystocarp (Cangaluyam Island, Philippines, 14.i.1990). Fig. 20 Spermatangial branches (Cangaluyam Island, Philippines, 14.i.1990).

proximal ones, bear tetrasporangial stichidia. Two tetrasporangia were formed in each of 8-38 successive segments of these stichidia that are 500-2200 μm long by 220-300 μm wide. The stichidia produce the dorsal row of vegetative trichoblasts that sometimes fall off quickly and cannot be detectable on mature stichidia (Fig. 16) except for young ones and the scar cells. Mature tetrasporangia, with tetrahedrally arranged spores, are 85-100 μm high by 90-120 μm wide. The tetrasporangia are associated with two lateral cover cells and lack a basal cover cell (Fig. 17).

One to four procarpial trichoblasts are formed along the dorsal side of the inrolled apices of denticulations and/or their branches. These trichoblasts are reduced in length and consist of four segments. The basal segment of each trichoblast grows into the stalk of a cystocarp and the suprabasal segment produces a single procarp. The subterminal segment of each trichoblast becomes polysiphonous, but the terminal segment ceases apical growth and may divide once. Each procarp consists of a four-celled carpogonial branch and two sterile cell groups: one two-celled and lateral, the other one-celled and basal (Fig. 18). A procarp is covered prior to fertilization by a pericarp. Mature cystocarps are ovoid (Fig. 19) and 1000-1350 μm high by 900-1300 μm wide with or without a faintly elevated neck 20-30 μm high, or urceolate and 1000-1200 μm high (including an elevated neck 150-200 μm high) by 900-1000 μm wide. These two types of cystocarps may be present on the same individual.

Spermatangial branches (Fig. 20) are produced on the dorsal side of the inrolled apices of denticulations and/or their branches. After the formation of several to many vegetative trichoblasts (depending on the length of fertile serrations), five to seven spermatangial branches are formed successively in a secund manner and later replaced again by vegetative trichoblasts. They have a one-celled sterile suprabasal segment 40-90 μm long (the basal segment being embedded in the parental branch) and no sterile tip. The fertile portion of these spermatangial branches consists of four to six segments and is ellipsoidal, strongly curved, and 250-350 μm long by 100-150 μm wide.

DISCUSSION

The pseudopericentral cells were originally used for two cells (as abaxial pseudopericentral cells), which are cut off from two pericentral cells towards the centre of the thallus in *Sonderella linearis* (Harvey) Schmitz and come to lie above the axial cell (Womersley, 1965) as shown in our figure 5. On the other hand, two cells that are cut off towards wings as shown in our figure 15 are not considered pseudopericentral cells, although they lie in a position as part of the ring of pericentral cells (Norris, 1988a). According to this definition, transverse sections of different ages and parts of blades from the Philippine, Vietnamese and Japanese specimens consistently showed the presence (in *M. glomerata*) or absence (in *A. rhodantha*) of pseudopericentral cells, which indicates that this character might not be influenced by age and environment.

The genus *Amansia* currently includes only four species: *A. multifida* Lamouroux, the type species, known in the tropical western Atlantic Ocean (Taylor, 1960), *A. loriformis* Norris, known in the western Indian Ocean (Norris, 1988a, 1995), *A. rhodantha*, reported from the western Indian Ocean (Norris,

1988a, as *A. glomerata*, 1995) and the tropical western Pacific Ocean (Masuda *et al.*, 2000) and *A. paloloensis*, recently described from the South Pacific Ocean (South & Skelton, 1999). These species can be distinguished from one another by a particular combination of the following features: (1) the presence or absence of pinnate branching; (2) the presence or absence of rosettes that are formed by adventitious blades (branches), when present they are either tight or lax; (3) the midrib being developed either strongly or weakly; (4) the presence or absence of marginal serrations, when present they are either frequent or sparse; and (5) developmental degree of vegetative trichoblasts. *Amansia rhodantha* is characterised by repeatedly formed, tight rosettes, each blade with a strongly developed midrib and frequent serrations and vegetative trichoblasts growing conspicuously. *Amansia paloloensis* has been reported to have loriform blades with weakly developed midribs that form lax rosettes, and an illustration of the holotype specimen about 20 cm high (South & Skelton, 1999, fig. 2) clearly indicates these features. Such-sized plants of *A. rhodantha* may produce conspicuously developed midribs and many compact rosettes. This character might not be influenced by age and environment. The Samoan species is similar in the degree of midrib formation to *M. glomerata*. However, *A. paloloensis* is distinguished from *M. glomerata* by the pale rose-coloured blades and the absence of pseudopericentral cells (South & Skelton, 1999).

The genus *Melanamansia*, on the other hand, currently includes 11 species besides *M. glomerata*, which are known in the tropical to warm-temperate regions of the Indian Ocean and the Pacific Ocean (Norris, 1988a, 1995; Yoshida, 1998): (1) *M. seagriefii* R. Norris, the generitype, endemic to South Africa (Norris, 1988a); (2) *M. daemelii* (Sonder) R. Norris, reported from Australia and Hawaiian Islands (Abbott, 1999); (3) *M. dietrichiana* (Grunow) R. Norris, reported from Australia and some African countries (Silva *et al.*, 1996); (4) *M. fimbrifolia* R. Norris, known in South Africa and Hawaiian Islands (Norris, 1988a; Abbott, 1999); (5) *M. japonica* (Holmes) R. Norris, endemic to Japan (Yoshida, 1998); (6) *M. mamillaris* (Lamouroux *ex* C. Agardh) R. Norris, endemic to Australia (C. Agardh, 1822, as *Amansia mamillaris* Lamouroux *ex* C. Agardh); (7) *M. mitsuii* (Segawa) Yoshida, endemic to Japan (Yoshida, 1998); (8) *M. pinnatifida* (Harvey) R. Norris, endemic to Australia (Norris, 1988a); (9) *M. pumila* (Sonder) R. Norris, known from Australia and Indonesia (Silva *et al.*, 1996); (10) *M. scalpellata* (T. Tanaka) R. Norris, endemic to Japan (Yoshida, 1998); and (11) *M. serrata* (Harvey) R. Norris, endemic to Australia (Silva *et al.*, 1996). These species may be distinguished from one another by a particular combination of taxonomic features as mentioned above for *Amansia*. Among *Melanamansia* species, *M. glomerata* is a very characteristic species that produces tight rosettes and accommodates our alga from the Philippines and Vietnam.

One notable difference is present between the central (Hawaiian Islands) and north-western (Philippines and Vietnam) Pacific plants of *Melanamansia glomerata*. Norris (1995) stated: "No evidence of large trichoblasts that may have been formed within vesicles has been seen in the Hawaiian specimens [of *M. glomerata*], the trichoblasts always being sparse and usually composed of only a few cells". However, our observations showed that vegetative trichoblasts, which are similar to those of *A. rhodantha*, are formed on plants of *M. glomerata* from the Philippines and Vietnam. There is a strong possibility that this difference is due to developmental stages: large trichoblasts are present on young marginal denticulations, but only small ones are present on old denticulations.

Amansia rhodantha and *Melanamansia glomerata* are said to resemble one another in superficial features (Norris, 1995), and therefore the former had

been treated as a synonym of the latter over a century, since J. Agardh (1863) united these species until Norris (1995) resurrected *A. rhodantha*. Besides the anatomical difference (the presence or absence of pseudopericentral cells), two diagnostic features are apparent between the two species: (1) thallus colour, dark red in *A. rhodantha versus* dark brown in *M. glomerata*; and (2) the presence or absence of conspicuous midribs, present in *A. rhodantha versus* absent in *M. glomerata*. Young (less than 5 mm high) to adult (20-50 mm high in *M. glomerata* and 20-80 mm high in *A. rhodantha*) thalli showed the respective characteristic colours independent of localities and growing seasons. This strongly indicate that the thallus colour may not change according to age and environment for these two species. Midribs conspicuously develop for small plants of *A. rhodantha* less than 10 mm high. These two species are sympatric in a locality of the Philippines, north coast of Cangaluyam Island, Bolinao, Pangasinan, where plants of both species grow side by side; individual plants of these species can be distinguished by thallus colour and the presence/absence of conspicuous midribs in the field. These features are also useful for the identification of previously reported algae. Pham (1969) and Tseng *et al.* (1983) clearly showed the presence of midribs, which indicates that their alga is not *M. glomerata* but *A. rhodantha*.

In addition to the specimens cited above, we examined numerous herbarium specimens (including Okamura's collection) identified as *Melanamansia glomerata* (or *Amansia glomerata*) and deposited in SAP, which were collected at various localities ranging from Iriomote Island, Okinawa Prefecture, north to Hachijo Island, Tokyo. These specimens lack pseudopericentral cells as shown by Okamura (1901, pl. 25, figs 7, 8, 1936, fig. 411.2, both as *Amansia glomerata*), but their dark red blades have conspicuously developed midribs. *Amansia rhodantha* is thus widely distributed in the north-western Pacific Ocean. The absence of conspicuously developed midribs in *M. glomerata* may account for the absence of large and highly branched thalli in this species (Abbott, 1999; present paper).

Norris (1988a, 1995) mentioned several features other than the production of pseudopericentral cells, which support the separation of *Melanamansia* from *Amansia*: (1) species of *Melanamansia* have consistently large, more highly branched (their branching often being pinnate) and more darkly coloured thalli; (2) the serration of thallus margins is regularly alternate in *Melanamansia*, but is absent or irregular in *Amansia*; (3) trichoblasts in *Melanamansia* often may be missing and, when present, usually are small and do not develop within a capsule (as vesicle); whereas those in *Amansia* are large and are preformed within a large capsule before being released and expanding to full size; and (4) tetrasporangial stichidia in *Melanamansia* are more or less cylindrical, whereas those in *Amansia* are usually flattened. However, these features may vary in both genera and overlap each other. *Melanamansia glomerata* does not have large and highly branched thalli (Abbott, 1999; present paper). Hawaiian *M. fimbrifolia* has reddish-brown thalli in dried state (Abbott, 1999) which may be similar in colour to our material of *A. rhodantha*. Our specimens of *M. glomerata* from the Philippines and Vietnam do not have serrations except for fertile blades, whereas *A. rhodantha* has regularly alternate serrations on both vegetative and fertile blades. Our *M. glomerata* from the Philippines and Vietnam has well-developed trichoblasts that are enveloped within a capsule when young. Tetrasporangial stichidia of *M. glomerata* from the Hawaiian Islands are flattened (Abbott, 1999) as are our material of *M. glomerata*. These features proposed by Norris (1988a) cannot apply to all members of both genera. Thus, the presence or absence of pseudopericentral cells is the only reliable taxonomic feature that distinguishes the two genera. At present all (ten) species of *Osmundaria* including *Vidalia* (Norris, 1991) and all (two) species

of *Neurymenia* (Tanaka & Itono, 1969, figs 3E, 10A; Norris, 1988b, fig. 5) besides *Melanamansia* are known to possess pseudopericentral cells. Wilson & Kraft (2000), however, reported that pseudopericentral cells are present in only some sections of *Kuetzingia canaliculata* (Greville) Sonder and absent in the remaining species of the genus, *K. angusta* Harvey. Wilson & Kraft (2000) questioned the generic significance of pseudopericentral cells. The inconsistent presence of pseudopericentral cells in *Kuetzingia* and our observations showing that no reliable taxonomic features distinguishing *Melanamansia* from *Amansia* are present other than the presence/absence of pseudopericentral cells make the rationale for separation of these genera weak and strongly indicate that they are congeneric, at least *M. glomerata* should be put back in *Amansia*, although it is desirable to conduct further studies including molecular analysis for reassessment of the status of the genus *Melanamansia*.

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