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Studies on the Genus *Neurymenia* (Rhodomelaceae) from Southern Japan and Vicinities

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Abstract

Of the genus *Neurymenia* the structures of the frond and the development of the female reproductive organs were put under observation, and the results of which are described in this paper.

Hitherto, the genus *Neurymenia* has been supposed to be consisting of only one species, however, another species which is morphologically different from that of *N. fraxinifolia* was newly collected from Tanegashima, Mageshima, Amami Island and Yoron Island in the southern parts of Japan.

These two species of *Neurymenia* show the typical characteristics allied with the *Amansia* group of Rhodomelaceae.

Neurymenia fraxinifolia (MERT.) J. AGARDH

Spec. Alg. Vol. 2 (1863) p. 1135; Kützing, Tab. Phyc. XIV (1867), t. 99; Harvey, Phycologia australica Vol. III (1960) pl. CXXIV, unnumbered pages between pl. CXXIV and pl. CXXV; Okamura, Illustr. mar. alg. Jap. Vol. I (1900) pp. 37–38, pl. XIII; Falkenberg, Die Rhodomelaceen von Golfes Neapel (1901) p. 444, Tab. 7 Fig. 20–29; Weber van Bosse, Liste Alg. Siboga III (1923) pl. X fig. 9, pp. 374–375; Okamura, Nippon Kaiso Shi (1936) pp. 887–889 Fig. 414; Kylin, Die Gattungen der Rhodophyceen p. 547; Børgesen, Some Indian Rhodophyceae from Bombay III (1933) pp. 137–141; De Toni, Syll. Alg. Vol. IV (1903) p. 1112.

Syn.: *Fucus fraxinifolius* MERT., in Turner's "Hist. Fuc.", Vol. 3 (1811), pl. 193.
Amansia fraxinifolia AGARDH, "Syst. Alg." (1824), p. 247
Delesseria fraxinifolia GREV., "Alg. Brit. Syn." p. XLVII.
Dictymenia fraxinifolia J. AG., "Sym." in Linnaea XV (1841) p. 27; Harvey, Pycol. Australica, (1860) pl. CXXIV.
Epineuron fraxinifolium HARV., in Hook. "Lond. Journ." IV (1845) p. 532; Kütz., "Sp." (1849) p. 849; Tab. Phyc. XIV (1867) t. 99.

Plants bushy, purplish, to ca. 30 cm high, arising from a cushion shaped holdfast, frequently and irregularly branched lower axis denuded, stipe long; blades rigid membranaceous, ca. 15 mm. wide, 165 μ thick, with a prominent midribs on a median line extending to the branch apices, undulate, the margins obscurely crenate, conspicuously aculeatodentate, structurally showing two medullary layers of large cells and a cortical layers of much smaller one on each face; lateral veins delicate but evident ascending alternately from the midrib, extending obliquely to the margins of blades to form the dichotomously

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and repeatedly branched marginal teeth; branches formed by producing similar segments repeatedly from both surface of midribs; trichoblast on the second order branchlets, deci-

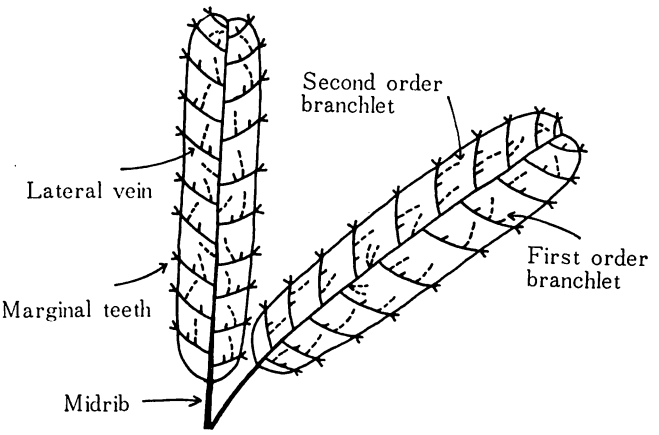

Fig. 1. *Neurymenia spp.* Diagrammatic illustrations of thallus showing the order of branching. The midribs, lateral veins and marginal teeth are homologous to first order branchlets. Structurally the first order branchlets have a radial structure and the second order branchlets are dorsoventral.

duous, colorless, dichotomously branched, covered with a cartilagenous envelop when young, filaments 450 μ high and 18 μ in diameter; stichidia compound, bushy, lanceolate, apices inrolled to the ventral side, shortly stiped or sessile, arising from the nerves and midribs on each surface of the blades, containing a double rows of tetrasporangia, 320–175 μ broad and 500–1750 μ long; tetrasporangia transversely elongated, oblong, 65–75 μ by 50–60 μ, tripartitely divided; numbers of cells scattered over the tetrasporangia on the ventral side 5–18 cells; cystocarps oblong, shortly stiped, ca. 1200 by 1500 μ, pericarps rigid and about 250 μ thick; carposporangia small, long-ovate, 190 μ long and 80 μ broad; antheridial plants unknown.

Japanese name: Iso Basho.

Habitat: Growing on rocks from low tide level to sublittoral zone. Material of this species were collected from Oluanpi, Formosa, in 1965 (*no. 19693*). Additional materials used for this study were those collected at Mageshima (1968), Amami Island (1969), Tokunoshima (1966), Yoron Island (1967), southern part of Japan, and Philippines (1964).

Geographical distribution: Kenya (Isaac, 1967), Ceylon (Børgesen, 1936; W. v. Bosse, 1923), Mauritius (Børgesen, 1945), India (Børgesen, 1933, 1937), Borneo (W. v. Bosse, 1923), Western Australia (Harvey, 1860, as *Dictymenia fraxinifolia*), Philippines (Tanaka, 1964, unpublished), Formosa (Itono, 1965, unpublished) and the southern part of Japan (Yamada and Tanaka, 1938; Tanaka 1960; Itono 1966, 1967, unpublished) etc.

Female Reproductive Structures

The female reproductive organ of *N. fraxinifolia* (MERT.) J. AGARDH was unknown until Cotton (1913: 254) studied them, but later they were observed by Weber van Bosse (192

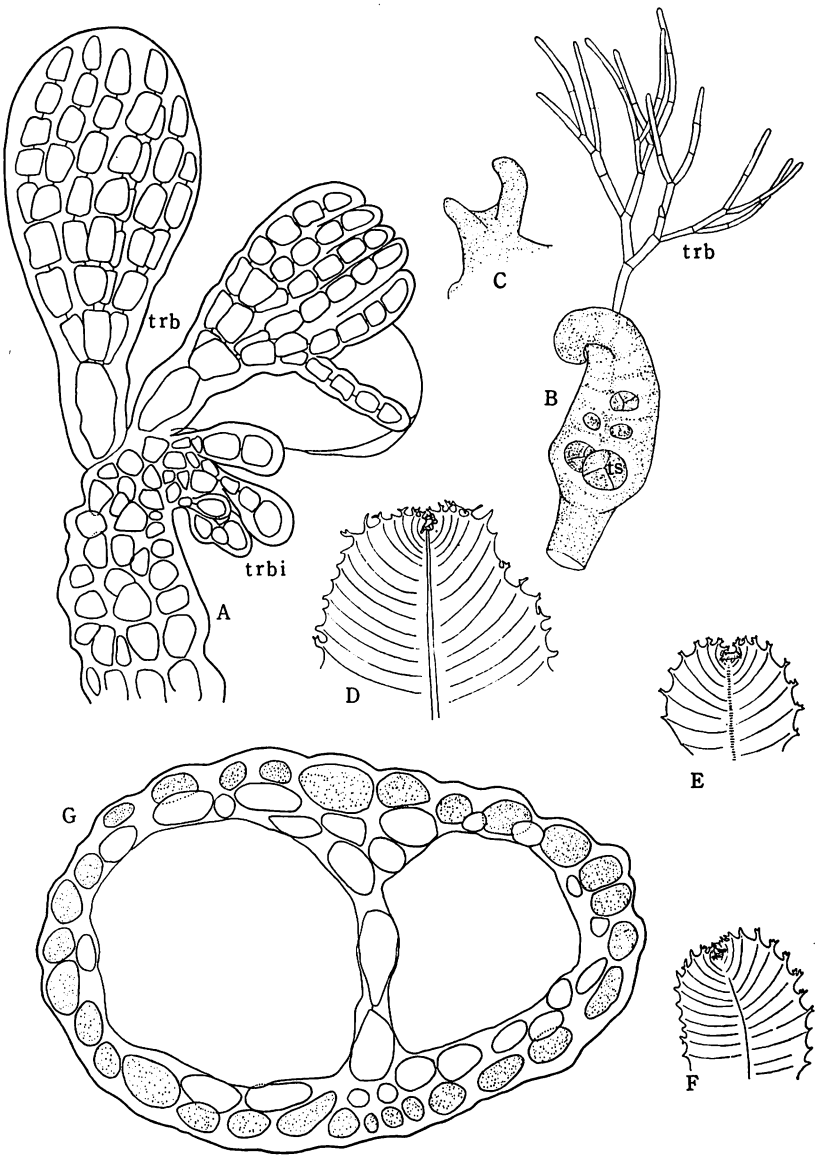

Fig. 2. **A-D, G.** *Neurymenia fraxinifolia* (MERT.) J.AG.; **E-F.** *Neurymenia nigricans* spec. nov. **A,** habit of mature trichoblast on the dorsal side of second order branchlets. ×340. **B,** habit of mature trichoblast on the dorsal side of tetrasporangial stichidium. ×88. **C,** marginal teeth. ×64. **D-F,** frond apices with midribs and lateral veins. ×4. **G,** transverse section of tetrasporangial stichidium. ×340. **trb:** richoblast, **trbi:** trichoblast initial, **ts:** tetrasporangium.

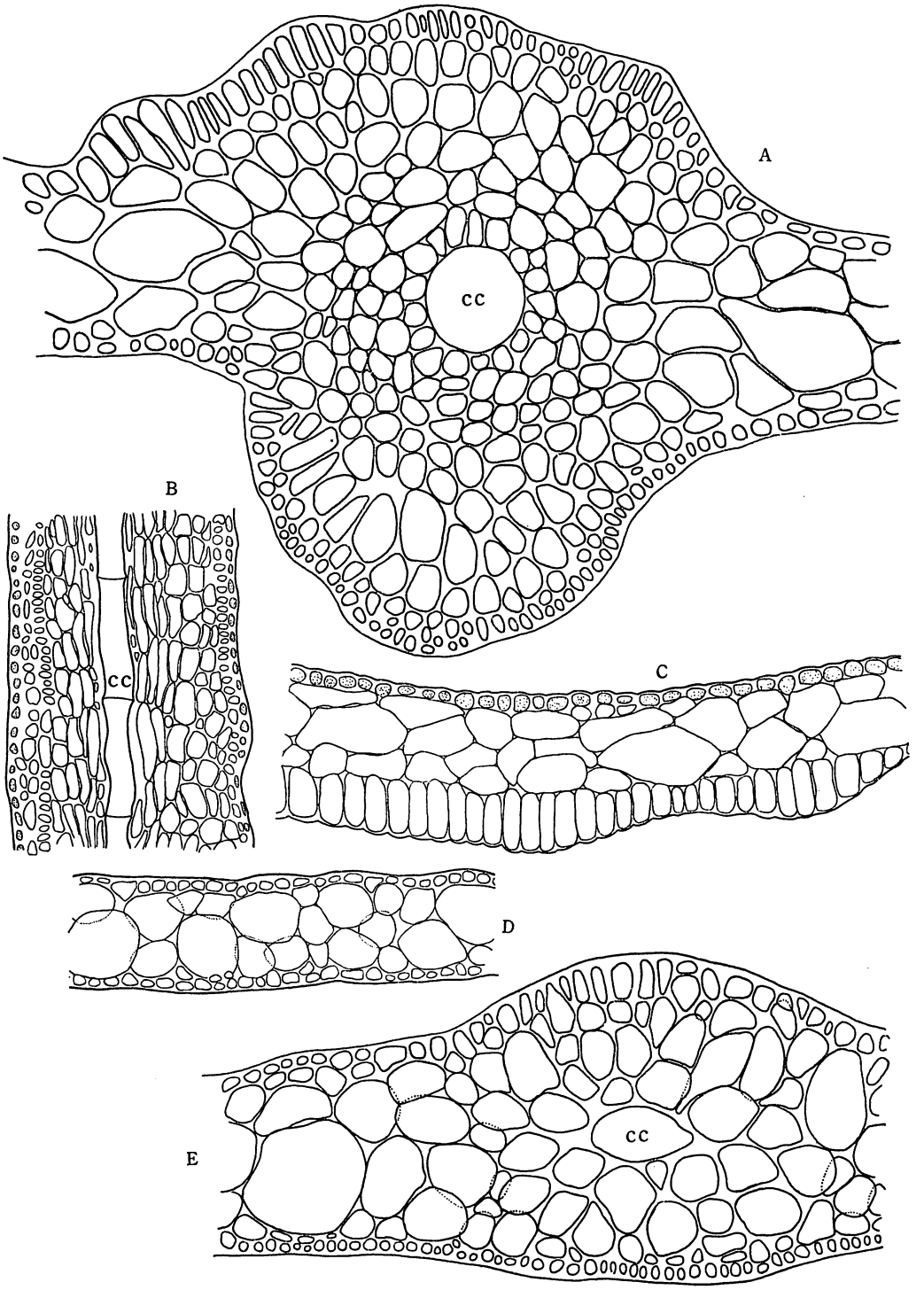

Fig. 3. **A-D.** *Neurymenia fraxinifolia* (MERT.) J. AG., **E.** *Neurymenia nigricans* spec. nov. **A,** transverse section of frond. ×310. **B,** longitudinal section of stipe. ×80. **C,** transverse section of frond where encrusting calcareous alga was attached on (lower side of Figure). The cortical cells where encrusting calcareous algae attached on are much elongated dorso-ventrally. ×310. **D,** transverse section of blade. ×310. **E.** transverse section of frond. ×110. **cc:** central cell.

3: 374) on the specimens from Ceylon, and by Børgesen (1933: 139–140) on the specimens from the vicinity of Bombay. Those descriptions of the female reproductive organs were brief. Female plants have never been described from Japan and its vicinity.

1.) Development of the Procarp

The procarps are formed in a series on the dorsal side of the second order branchlets

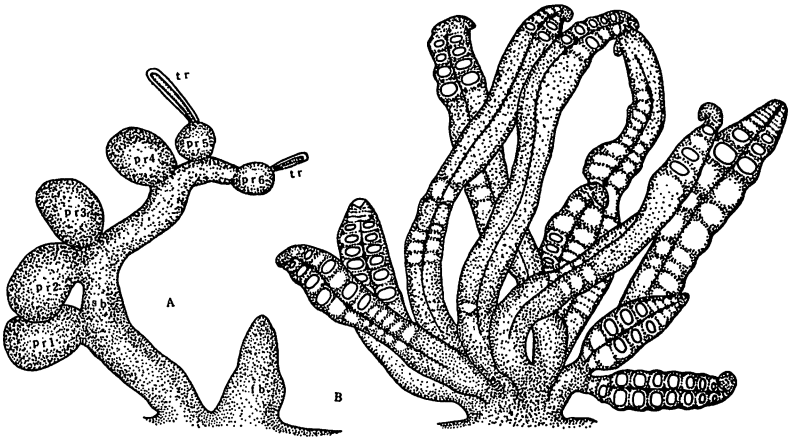

Fig. 4. *Neurymenia fraxinifolia* (MERT.) J. AG. **A,** habit of procarp-bearing-branchlet. ×88. **B,** habit of tetrasporangial stichidia. ×64. **pr:** procarp, **tr:** trichogyne, **fb:** first order branchlet.

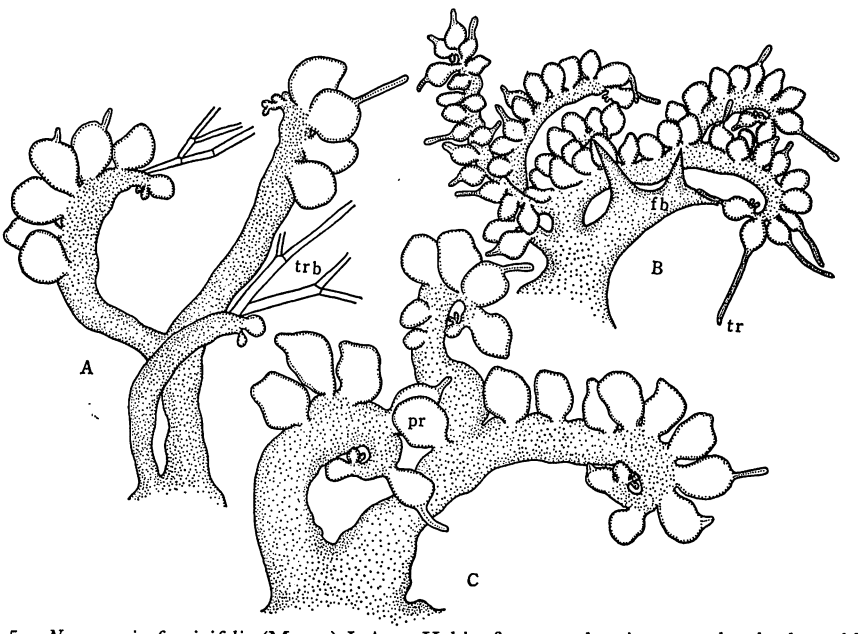

Fig. 5. *Neurymenia fraxinifolia* (MERT.) J. AG. Habit of procarp-bearing-second-order-branchlets on the specimens from several localities. All of these second order branchlets bear the offshoots on the dorsal side of them. **A,** specimen from Formosa. ×73. **B,** specimen from Philippines. ×43. **C,** specimen from Yoron Island. ×73. **fb:** first order branchlets. **pr:** procarp, **trb:** trichoblast.

arising from the first order branchlets such as midribs,marginal teeth and nerves of the frond (Fig. 4 A, Fig. 5 A–C). Generally 1–6 procarps are formed on the same procarpial branchlets in Formosan plants, but the numbers of procarps on the same procarpial branchlets are quite uncertain (Fig. 5 A–C). The differences between the first order branchlets and the second ones are already reported by Børgesen (1933: 137) and the results taken from the observations on the differences in Japanese plants agree quite well with Børgesen's description. No procarps were seen on the first order adventitious branchlets. Furthermore, fertile branches are not formed on vegetative branches of any order except on the second order branchlets, and they bring forth either female reproductive organs or tetrasporangia.

The procarps seem to be homologous to trichoblasts formed on the second order adventitious branchlets, and in their earlier developmental stages these two resemble with each other in the shape. The procarpial branchlets bring out a trichoblast initial near the top of it, and the trichoblast initial which is fixed to be fertile (Fig. 6 A) is usually observed to be supplied with only one undivided segment. Only one or two matured trichoblasts (Fig. 5 A, trb) are formed on the top of some comparatively young procarpial branches, and they soon disappear with the development of the procarps.

Although no constant similarity can be seen through the localities in the external features of the procarp-bearing-branches, the procarpial branchlets bring forth the similar offshoots on the dorsal side of main branchlets. The procarp-bearing-branchlets are conspicuously incurved at the apex ventrally.

The youngest procarps are elongate and rather oblong, being composed of only few cells, measuring about 13 μ in width and 25 μ in length (Fig. 6 A). In this stage, neither lateral sterile cell initial nor carpogonial branch initial is produced. Later, their lateral sterile cell initial (Fig. 6 C, ls) is cut off from the supporting cell (the fertile pericentral cell) in the direction of the ventral surface of the pericentral cell, and then the carpogonial branch initial cell is cut off by a longitudinal septum in the same direction as the lateral sterile cell initial. The first and second divisions of the carpogonial branch initial are at right angles to the long axis and they divide the carpogonial branch initial into three cells of nearly equal size. The three celled carpogonial branch lies in a straight line or in a slightly curved line as if they were surrounding the supporting cell. The supporting cell cuts off the basal sterile cell (Fig. 6 C, bs) proximal to the lateral sterile cell at the three celled stage of the carpogonial branch. The lateral sterile cell initial is situated between the second and the third carpogonial branch cell. And the basal sterile cell initial lies between the first cell of the carpogonial branch and the supporting cell. The distal end of the third cell of the carpogonial branch is elongated longitudinally, and finally the carpogonium with short trichogyne is formed. The procarp, made up of the carpogonial branch, the supporting cell, two sterile cell initials, and the cells of the pericarps, increases gradually in size. Each of the lateral and basal sterile cell groups consist of a single cell in the early stages of procarps and it is not certain whether they divide in the subsequent stages or not.

The procarps rapidly increase in size just before fertilization and are nearly spherical in shape, about 52 by 53 μ in diameter at this stage (Fig. 6 C). The pericarps become one or two layers thick just before fertilization. Just before fertilization, the trichogyne is 7 μ

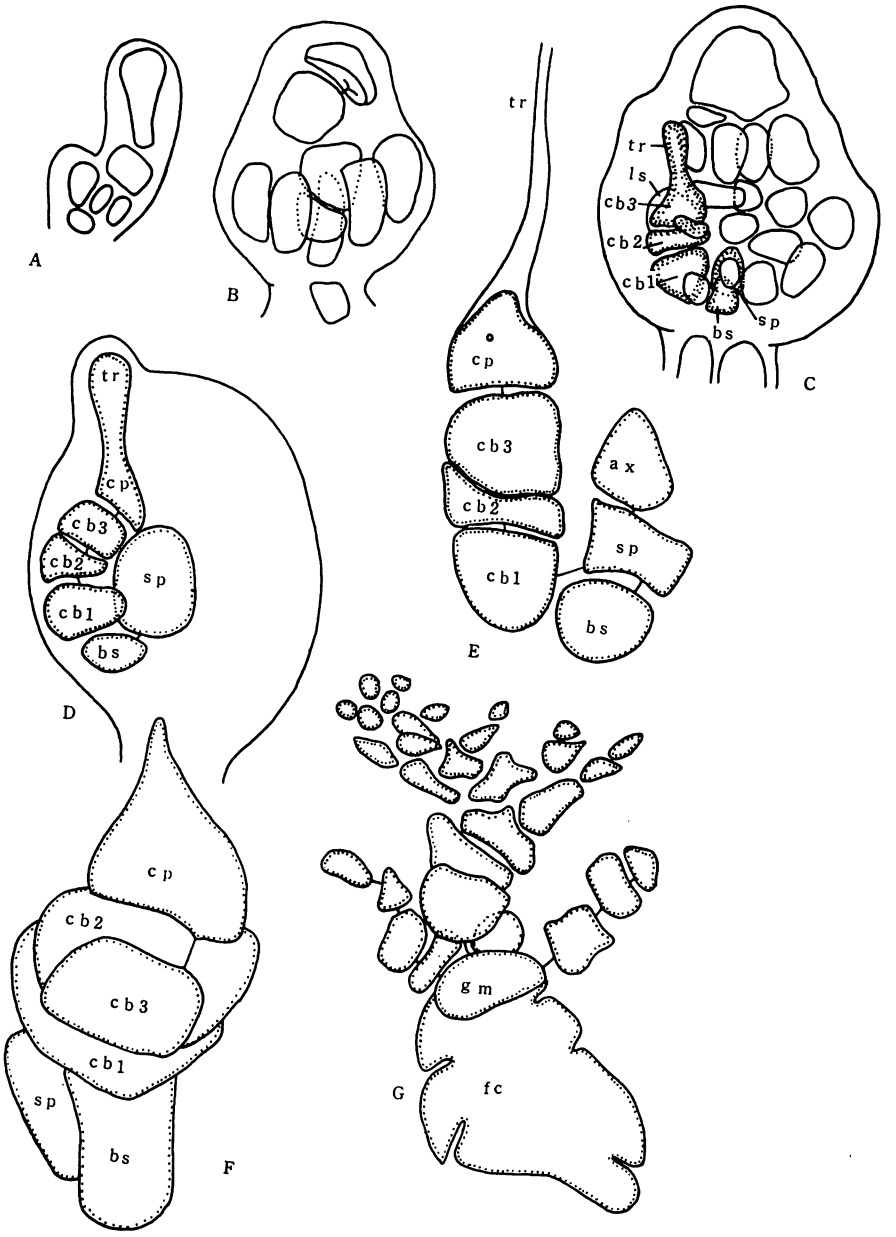

Fig. 6. *Neurymenia fraxinifolia* (MERT.) J. AG. **A,** trichoblast initial destined to be fertile. ×750. **B,** ditto, slightly matured. ×750. **C,** stage in the three celled carpogonial branch with lateral and basal sterile cell initials; the trichogyne was initiated in this stage and the prefertilization pericarps was formed. ×750. **D,** fully mature procarp before fertilization. ×750. **E,** procarp as seen shortly after fertilization. An auxiliary cell has been formed. ×750. **F,** procarp seen from the ventral side, the trichogyne has withered. A lateral sterile cell initial and the auxiliary cell are not shown. ×750. **G,** cystocarp with a young gonimoblast on a gonimoblast initial; the fusion cell has formed. ×375. **ax:** auxiliary cell, **bs:** basal sterile cell initial, **cbl, cb2, cb3:** carpogonial branch cell, **cp:** carpogonium, **fc:** fusion cell, **gm:** gonimoblast initial, **ls:** lateral sterile cell initial, **sp:** supporting cell, **tr:** trichogyne.

broad at the apex and 4 μ broad at the lower portion. Thus, the trichogyne is clavate with obtuse apex and somewhat elongate (Fig. 6 D, tr).

2.) Development of the Cystocarp.

After fertilization, the supporting cell cuts off the auxiliary cell from the upper end (Fig. 6 E, ax). Fertilization appears to promote the growth of pericarpic cells that cover the developing gonimoblast and they become 4–5 layers just after the auxiliary cell is cut off from the supporting cell. The trichogyne gradually withers after fertilization and later it entirely disappears from the top (Fig. 6 F) of the carpogonium. After fertilization, the cells that constitute the carpogonial branch, supporting cell and auxiliary cell fuse with each other, making one large fusion cell (Fig. 6 G, fc). Later a single large gonimoblast initial (Fig. 6 G, gm) is cut off from the upper end of the fusion cell towards the surface of the cystocarp. Gonimoblast initial produces a number of longitudinally elongate cells that give rise to carpospore-bearing filaments, i. e. gonimoblast filaments. These cells that constitute the gonimoblast filaments are about 100 μ long and 60 μ broad, and their cell contents are conspicuously withered (Fig. 7). The gonimoblast filaments are radially formed from the upper half of the fusion cell towards the surface of the pericarps; thus the clumps of the gonimoblast filaments appear as if they were globose. The terminal cells of gonimoblast filaments become carposporangia.

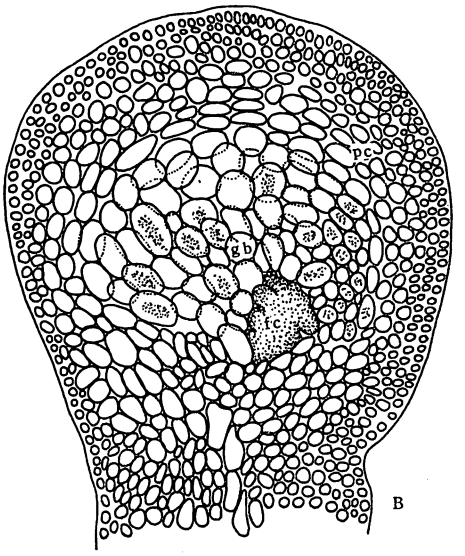

Fig. 7. *Neurymenia fraxinifolia* (MERT.) J. AG. Longitudinal section of young cystocarp showing radially arranged gonimoblast on the fusion cell. ×88. **fc:** fusion cell, **gb:** gonimoblast, **pc:** pericarp.

Young cystocarps are always filled with both sterile and fertile cells but later as they get matured the cystocarps become hollow owing to the decrease in size of the gonimoblast filaments as carpospores are produced and discharged, to the enlargement of the pericarps. Furthermore, some of the inner cells lying next to the fusion cell gradually reduce the thickness of their cell wall and they become inconspicuous and finally disappear. This fact suggest us that it promotes the cystocarp to become hollow (Fig. 8, dotted lined cells in the figure). Longitudinally chained several cells which were supposed to have been originated from sterile cells are formed along the inner layer of pericarps, and most of these cells get together around the ostiole (Fig. 9, es).

A mature cystocarp is covered with a 7–9 cell-layered-pericarp, which is about 250 μ in thickness and rigid. They are ovate, about 1200 μ broad and 1550 μ long with a pedicel about 320 μ in diameter. The ostiole is slightly eccentrically opened at the apex as a spinous

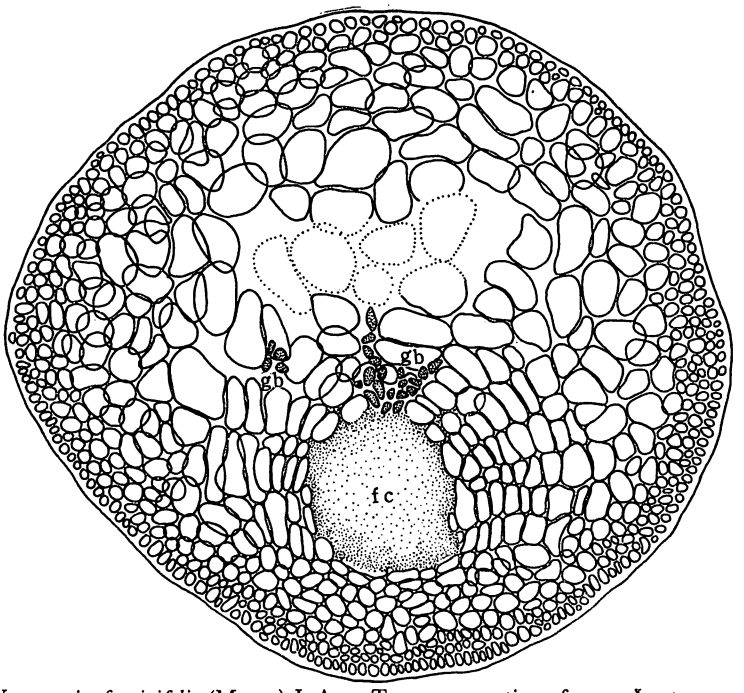

Fig. 8. *Neurymenia fraxinifolia* (MERT.) J. AG. Transverse section of young cystocarp. Some inner cells lying around the fusion cell reduce the thickness of their cell wall and finally disappear (dotted lined cells in the Figure). ×88. **fc**: fusion cell, **gb**: gonimoblast.

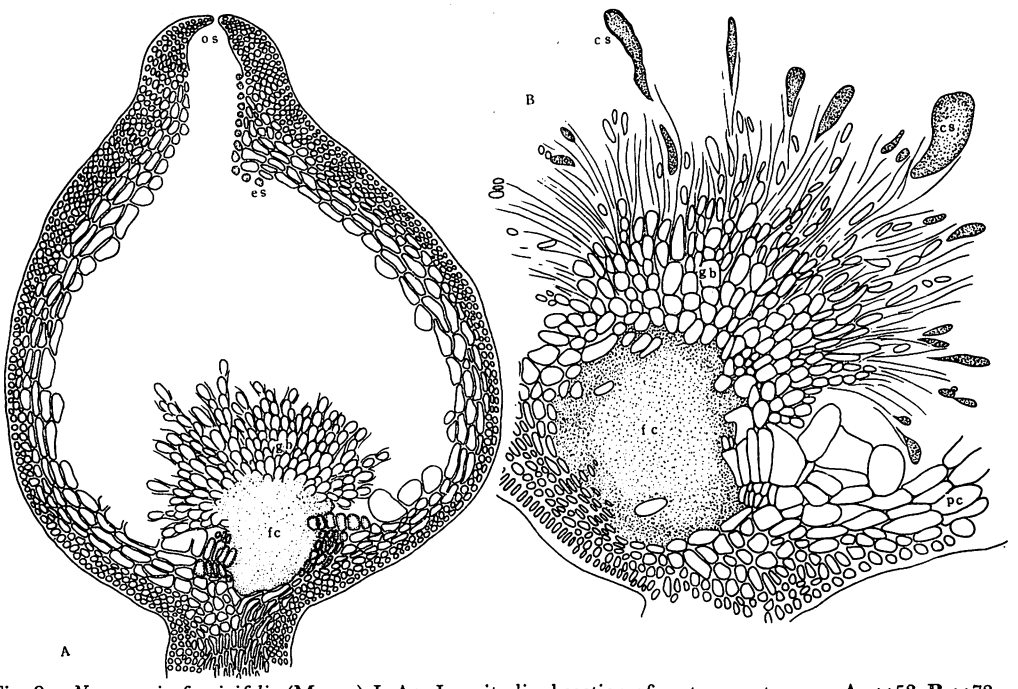

Fig. 9. *Neurymenia fraxinifolia* (MERT.) J. AG. Longitudinal section of mature cystocarp. **A.** ×53, **B.** ×73. **cs**: carpospore, **es**:cells which might have been originated from sterile cells, **fc**: fusion cell, **gb**: gonimoblast. **os**: ostiole, **pc**: pericarp.

protuberance (Fig. 9 A, os). Mature carposporangia (Fig. 9 A and B, cs) are long-ovate, about 190 by 80 μ.

The development of procarps near a mature cystocarp appears to be inhibited because only one cystocarp from each fertile branch matures, and the cystocarp, therefore, appears as if it were terminal on a pedicel. As already noted by Børgesen (1933: 140) the undeveloped procarps are to be seen as remnants near the base of the pedicel. Only once the formation of a "compound" cystocarps was observed to have taken place on the same branch; one of them being mature with carpospores and the other showing that the auxiliary cell had been cut off from the supporting cell.

Neurymenia nigricans spec. nov.

Planta altitudine ad 15 cm., complanata, membranacea, infra stipitata, stipite diviso, divisionibus superioribus, foliacea, costam perspicuam, venas laterales alternatas vel raro opposititas, laminis irregulariter pinnato-flabellata, prolatis a venas laterales formantibus, dentatis marginaribus dichotomo-ramosis; tetrasporangiis stichidiis in partibus fertilibus ramulorum, lanceolatis, aggregatis, involutis ad apicem, oppositis vel alternatis a costatis vel venis lateralibus productis; tetrasporangiis distchiis, elongatis, tripartibus divisis; cystocarpia oblongata, stipite brevi, in partibus costata vel venas laterales gerentibus; antheridia ignota; colore purpureo, nigrito-carneo in exsiccato. Planta typica in loco dicto Mageshima, legit Tanaka, *no. 19694*, Oct. 1948.

Plants bushy, purplish when remove from the water and blackish-red when dried, to 15 cm. tall arising from a cushion-shaped holdfast, branching somewhat irregular, branches formed by the strong extension of the veins; blades rigid, membranaceous, 9–14 mm. broad, 115–187 μ thick; apecies of the blades obtuse, concave and inrolled slightly, undulate, the margins of the frond obscurely crenate in the lower portions, conspicuously aculeato-dentate, blades showing two medullary layers of large cells and a cortical layer of much smaller and nearly equal size one on each surface, medullary cells unequal in size; midribs conspicuous and stout in lower portion and obscure in the upper part, extending to the branch apecies; lateral veins delicate and obscure to the naked eye, alternately or rarely oppositely ascending from the midribs, oblique to the marginal teeth; marginal teeth dichotomously branched; trichoblast on the second order branchlets, deciduous and colorless, dichotomously branched, filaments ca. 1700 μ long and 90 μ in diameter; tetrasporangial stichidia lanceolate, compound, oppositely or alternately branched from both flanks of main branchlets, apices inrolled to the ventral side, stiped arising from the lateral veins and midribs on each surface of the blade, 210–297 μ broad and to 6 mm. long, containing a double rows of the tetrasporangia; tetrasporangia transversely elongated, oblong, 99 by 67 μ, tripartitely divided to form a tetraspores; pericentral cells that produce a tetrasporangia transversely elongated, ca. 100 μ broad and 8 μ long; number of the cells scattered over the tetrasporangia on the ventral side come to 6–9 cells together; cystocarps oblong, shortly stiped, 1050 by 1250 μ; ostiole slightly projected, pericarps soft and thin, ca. 165 μ thick; carposporangia long-ovate, 270 –310 by 130–110 μ; antheridial plants unknown.

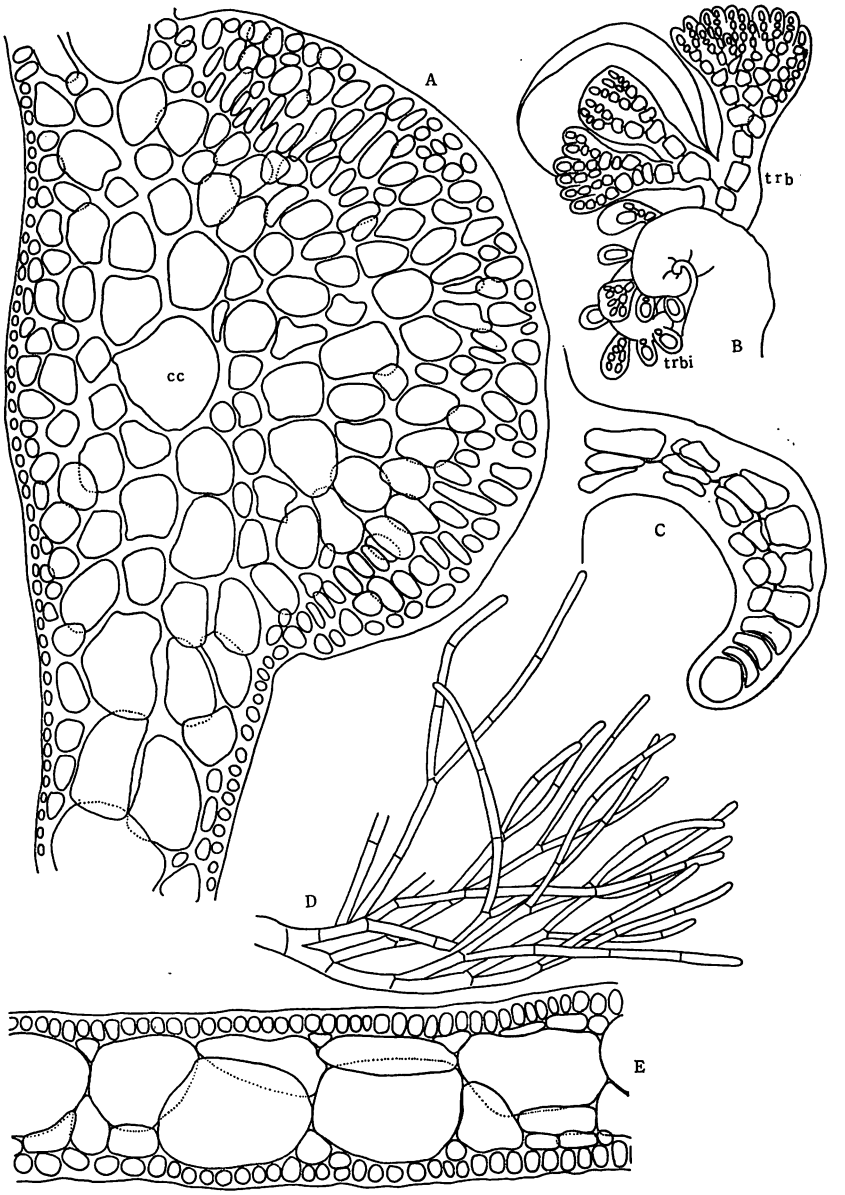

Fig. 10. *Neurymenia nigricans* spec. nov. **A,** transverse section of frond. ×88. **B,** habit of trichoblast on second order branchlet. ×248. **C,** habit of young second order branchlet. ×340. **D,** mature trichoblast. ×88. **E,** transverse section of blade. ×248. **cc:** central cell, **trb:** trichoblast, **trbi:** trichoblast initial.

Japanese name: Kuro iso basho (nom. nov.)

Habitat: Growing on rocks and other hard substrata from about low tide line to a depth of 15 m. Type specimens was collected in Mageshima (Oct. 1948, no. 19694).

Local distribution: Tanegashima (Aug. 1959, June 1967), Mageshima (June 1967), Amami Island (July 1969), Yoron Island (Aug. 1967).

Judging from the habit of the plants, these specimens seem to be similar to *Vidalia obtusiloba* (MERT.) J. AGARDH as shown by Okamura (1936, Fig. 412-1). Closer examination of the present alga shows typical characteristics of *Neurymenia* rather than that of Japanese *V. obtusiloba* in the following points:

in *Vidalia obtusiloba*

(1) The tetrasporangial stichidia are formed on the first order branchlets (marginal teeth).

(2) Tetrasporangia are always covered with two longitudinally elongated rectangular cover cells on the ventral side.

(3) Apecies of the frond are obtuse and inrolled to the ventral side.

(4) Lower axis are not entirely denuded, the remnants of blades on both flanks of the stipe remaining.

(5) Marginal teeth are obsolate in the lower portions of the branches and they are fine and subulate, strongly involuted in earlier stages.

while in case of *Neurymenia nigricans*,

(1) The tetrasporangial stichidia and cystocarp-bearing-branchlets are always formed on the second order branchlets.

(2) Tetrasporangia are not covered with two cover cells on the ventral side as may be seen in case of the Japanese species of genus Vidalia.

(3) Apecies of the frond concave and inrolled to the ventral side.

(4) Lower axis are entirely denuded.

(5) Marginal teeth are spinose and dichotomously branched.

The latter feature is one of the typical characteristics of *Neurymania* and the present specimens should be looked upon as one allied to genus *Neurymenia*. The present plant shows no agreement with *N. fraxinifolia* on many vegetative and reproductive characteristics. In *N. fraxinifolia*, the branches are usually formed directly from the midribs by producing the similar segments repeatedly from both surfaces of the midribs, and as the frond grows in age, lamina of the primary leaf decay and the midribs are transformed into long stipes. Structurally, the frond consists of four layers of cell, i. e. two medullary layers of cells and small outer cortical layers of cells; and of these, two medullary cells are large and are almost equal in size. The procarp-bearing-second-order-branchlets bring forth the similar offshoots in a series from dorsal side of the main procarp-bearing second-order-branchlets (Fig. 5).

On the contrary, the present plant, *N. nigricans*, branches by the strong extension of the lateral veins of the frond to produce similar segments repeatedly and they rarely denud the axis except for only some short stipes. Though the frond structurally consists of four layers of cells as seen in *N. fraxinifolia*, the two dorso-ventrally overlapping medullary cells are unequal in size (Fig. 10 E). The procarp-bearing-branchlets forms a similar offshoots from both flanks oppositely or alternately (Fig. 11 A).

Above mentioned characteristics based on the vegetative grounds are most prominent. Additional characteristics of *N. nigricans* are shown and compared with *N. fraxinifolia* in **Table I.**

Table I. Comparison of diagnostic characteristics between *N. fraxinifolia* and *N. nigricans.**

	N. fraxinifolia	*N. nigricans*
Height of plants	to 30 cm.	to 15 cm.
Thickness of blades	165 μ	187 μ
Mature trichoblast filaments	450 μ high	1700 μ high
	18 μ broad	90 μ broad
Number of procarps on a branchlet	1-6	about to 80
Cystocarps	1200 by 1500 μ	1050 by 1250 μ
Pericarps	250 μ thick	165 μ thick
Carposporangia	190 by 80 μ	270-310 by 130-110 μ
Tetrasporangia	65-75 by 50-60 μ	99 by 65 μ
Procarpial branch	bearing the offshoots on	bearing the offshoots on
	dorsal side	both flanks
Color of plants when dried	purplish	blackish red

* Materials for this studies were collected from Formosa and Mageshima

Female reproductive Structures

1.) Development of the procarps.

Almost every material examined at hand were matured, therefore, it was almost impossible to study the development process of the procarp. But one young procarp-bearing female plant was gathered from Mageshima in 1968. Therefore the external features of procarps and procarp-bearing-second-order-branchlets were shown in this paper. Every procarp is brought forth in a series on the dorsal side of the second order branchlets. About 80 procarps are formed on each of the fertile second order branchlets. The second order fertile branchlets repeatedly, oppositely or alternately branched from both flanks of main branchlets on the upper part (Fig. 11 A, B).

2.) Development of the Cystocarps.

Judging from the mature cystocarps, it is supposed that the development of the procarps and cystocarps are fundamentally in agreement with that of *N. fraxinifolia.*

The results of the observations on mature cystocarps of this species in comparison with those of *N. fraxinifolia* are given as follows:

(1) Mature cystocarps are about 1050 by 1250 μ, almost oblong with a projections

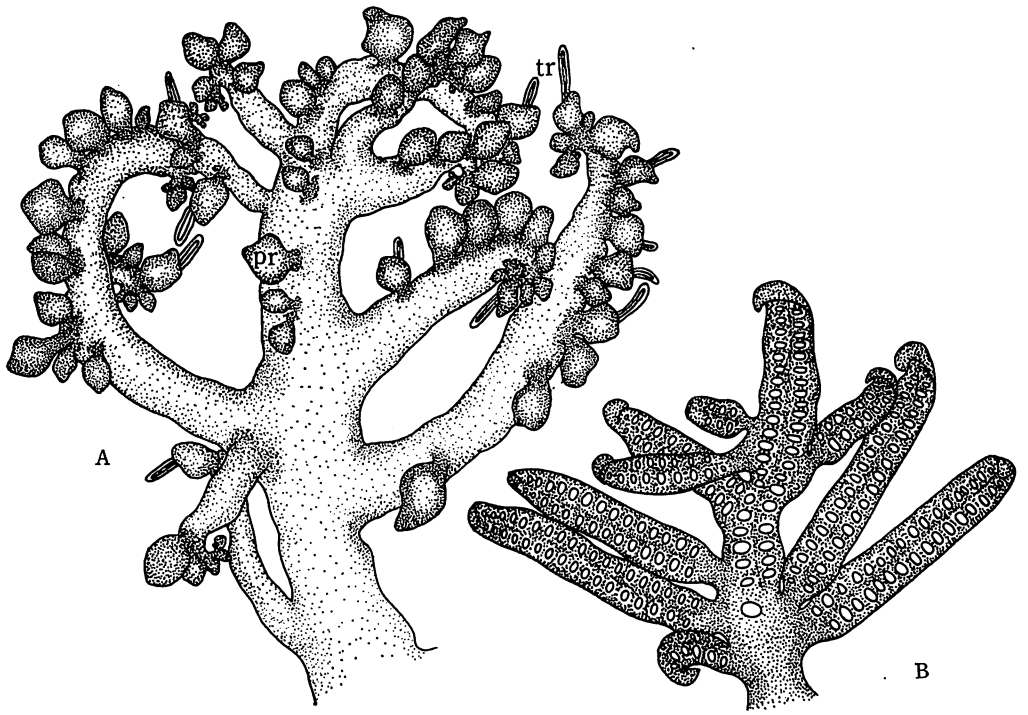

Fig. 11. *Neurymenia nigricans* spec. nov. **A,** habit of procarp-bearing-branchlet. ×69. **B,** habit of tetrasporangial stichidia. ×23. **pr:** procarp, **tr:** trichogyne..

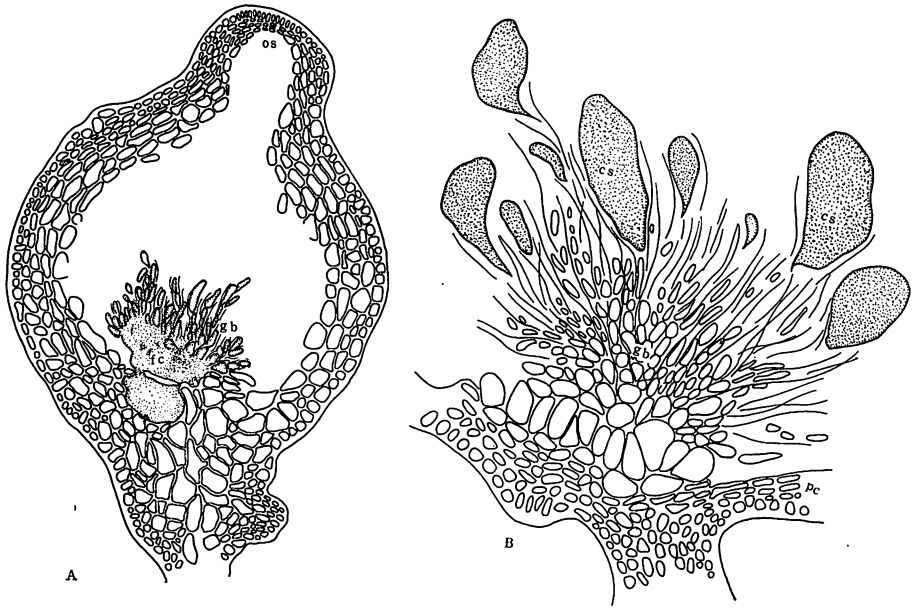

Fig. 12. *Neurymenia nigricans* spec. nov. Longitudinal section of mature cystocarp. **A.** ×53, **B.** ×73. **cs:** carposporangium, **pc:** pericarp, **fc:** fusion cell, **gb:** gonimoblast, **os:** ostiole.

of ostiole and a pedicel about 210 μ in diameter.

(2) The ostiole is slightly eccentric on the top of cystocarp.

(3) The gonimoblast filaments that produce the carposporangia are more slender than those of *N. fraxinifolia*.

(4) Mature carposporangia are 270–310 by 130–110 μ and long ovate.

(5) Pericarps that cover the gonimoblast are several layers of cell, about 165 μ in thickness.

Discussion

From the studies carried out on the female reproductive structures of these *Neurymenia* species, it is clear that these two algae belong to Rhodomelaceae, Polysiphonioideae and are to be associated with Amansia group.

As mentioned in the previous pages, these two algae are apparently different from each other in their morphological characteristics on both vegetative and reproductive structures. *Neurymenia nigricans* differs from *N. fraxinifolia* in having the features mentioned below:

(1) Fertile second order branchlets produce about 80 procarps on the same branchlets.

(2) Procarp-producing-branchlets makes an offshoots irregularly from both flanks of main branchlets.

(3) Cystocarps are slightly small, but the carpospores are much larger than those of *N. fraxinifolia*.

(4) Branches are produced by the strong extensions of lateral veins which are formed from midribs of the frond. Therefore, the plants appear to have been arranged on a same plane.

(5) The present specimen transformed into black in color when dried.

The collection of *N. nigricans* is recorded from only a small area of southern Japan. Plants from Yron Island, the most southern locality, are very small but fertile, which suggests that the plants may thrive better in lower temperature than that fit for *N. fraxinifolia*.

Børgesen described (1933: 138–139) on the tetrasporangial stichidia of *N. fraxinifolia* from several localities and furthermore he alluded that the genus *Neurymenia* has until then been considered monotypic but the differences as to the stichidia perhaps indicated the possibility of its being subspecies or some variety (Børgesen, 1933: 141). A closer examination of *N. fraxinifolia* on the specimens from Formosa and Tokunoshima reveals that the external features of tetrasporangial stichidia and procarp-producing-branchlets are different in every locality. In Formosan specimens tetrasporangial stichidia make an offshoot from the base forming a stichidial clumps and in the specimens from Tokunoshima it makes a branch irregularly from both flanks of the main branch as is to be seen in *N. nigricans*.

In connection with the variability of tetrasporangial stichidia, the present authors examined the procarp-producing-second-order-branchlets on the specimens from several localities (Fig. 5 A–C). Though the structures of procarp-producing-second-order-branchlets fundamentally agree and form a branch from the dorsal side of the main second order

branchlets, their external features differ from each other. Furthermore, the habit of the plants differ respectively and are thus divided into two types. The plants from the Philippines, Yoron Island and Amami Island are small and produces horizontally spreading branches (Pl. II B); and in the materials from Formosa and Tokunoshima, are long and much elongated vertically (Pl. I). Kützing (1867, Vol. 14 tf. 99) had given a figure of the habit of *Epineuron fraxinifolium* as the synonym of *Neurymenia fraxinifolia*, judging from his figures his plant may be included within the latter type.

These facts, i. e. variabilities in the external features of tetrasporangial stichidia, procarp-producing-second-order-branchlets and the habit of plants, reminds us of Børgesen's descriptions on *N. fraxinifolia* recommending its separation from one species into subspecies or variety. But before accepting such separation into subspecies or variety is done, more specimens from several localities should be compared.

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—摘　　要—

日本南海産イソバショウ属の研究

田中　剛・糸野　洋

イソバショウの雌性生殖器については Cotton (1913 : 254) によって初めて報告され，その後 W. v. Bosse (1923 : 374), Børgesen (1933: 139-140) によって簡単な記載が行なわれているにすぎなかった．本稿では筆者等はイソバショウの雌性生殖器の形成，発達過程について明らかにすると共に，形態学的研究を行なった．さらに，馬毛島，種子島，奄美大島，与論島に産する従来より知られているイソバショウとは明らかに異なる植物についてイソバショウと比較を行ない，本種を新種と決定し，乾燥すると色が黒変するところからクロイソバショウ（新称）なる和名を与え，その諸形態について附記した．

Plate I

Neurymenia fraxinifolia (MERT.) J. AGARDH
Habit of a cystocarpic plant. ×1/2.

Plate I

Plate II

A. *Neurymenia nigricans* TANAKA **et** ITONO
Habit of plant of the type collection. ×1/2.

B. *Neurymenia fraxinifolia* (MERT.) J. AGARDH. ×1/2.

Plate II