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On *Litosiphon yezoenris* YAMADA et NAKAMURA

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This paper deals with the geographical distribution, phenology and morphology of *Litosiphon yezoense*. This plant is distributed from Muroran to Nosappu on the Pacific coast of Hokkaido affected by the cold Oyashio Current. It grows on the old blade of *Laminaria* spp. and *Arthrothamnus bifidus* from February to early June. Most of the erect filaments produce unilocular sporangia throughout the growing period. Plurilocular sporangia, which have not been previously known in this species, are sometimes found throughout the growing period on different filaments from those with unilocular sporangia or on the same filaments.

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The genus *Litosiphon* was established by HARVEY (1841) based on two species, *L. pusillus* (CARM. ex HOOK.) HARVEY and *L. laminariae* (LYNGB.) HARVEY. Since then, seven species have been added to the genus (BATTERS 1902; LEVRING 1937; YAMADA 1944; ROSENVINGE & LUND 1947; LUND 1959). All the species except for *Litosiphon yezoense* are distributed on the coasts of the North Atlantic and Arctic Oceans. *L. yezoense* has been reported from Muroran and Akkeshi in Hokkaido in the western part of the North Pacific Ocean by YAMADA (1944) and YAMADA & TANAKA (1944). YAMADA (1944) described the occurrence of unilocular sporangia in *L. yezoense,* but there has been no description of the formation of plurilocular sporangia in this alga. In this paper, the occurrence of plurilocular sporangia is reported and details of the geographical distribution, phenology and morphology of this alga are described.

Matreials

The specimens used in this study were collected during 1969-1977 by various workers including the author at the following localities: Muroran (17 April 1975, K. MIYAJI; 19 February 1976, Y. SAKAI; 10 March 1977, K. MIYAJI); Aburakoma, Hidaka (27 May 1975, T. YOSHIDA & M. MASUDA); Hiroo, Tokachi (29, 30 March and 26 May 1975, M. KUROGI & M. OOTA); Kushiro (23 May 1970, M. KUROGI & K. NAGATA); Akkeshi (25 April 1972, K. MIYAJI); Hamanaka, Kushiro (15 April 1972, M. KUROGI & K. MIYAJI; 22, 23 March 1973, K. MIYAJI); Ochiishi, Nemuro (12 May 1969, M. KUROGI); Nosappu, Nemuro (18 May 1969, M. KUROGI). The plants were fixed and preserved in 10% formalin in sea water. Voucher specimens and slides from these collections are preserved in the Herbarium of the Faculty of Science, Hokkaido University (SAP). In addition, the author also referred to the specimens deposited in the Herbarium: Muroran (6 May 1943, Y. NAKAMURA, SAP 025334-025336) and Erimo, Hidaka (7 June 1944, Y. YAMADA SAP 025348).

Results

Distribution and phenology: *Litosiphon yezoense* has been collected by various workers from Muroran to Nosappu on the

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Pacific coast of Hokkaido from *Laminaria angustata, L. angustata* var. *longissima, L. coriacea* and *Arthrothamnus bifidus* and grows densely to cover the soral portion of the old blade of the regenerated host plants. Rarely, the plant is found on the sterile portion of the old blade. After June or July, this alga disappears with the decay of the old blade of the host plant, and it does not reappear until the next spring. Fertile plants of this species are few in the early season of growth but abundant in the late season.

Morphology: Vegetative structure: The plants are filamentous, densely tufted on the host and light to dark brown in color. The filaments arise from uniseriate creeping filaments, being unbranched, cylindrical, solid, up to 3 cm high and 140 μm (rarely 190 μm) in diameter at the broadest part and composed of up to 10 or more multiseriate cells in surface view. In the basal part the filaments are narrow and 1-3 cell wide (**Figs. 1, 2**), gradually becoming broader and more multiseriate upward. The filaments are broadest in the middle part and again become attenuated toward the apex. The apical part is uniseriate and 10-20 μm wide in young filments (**Fig. 4**) with cell seriation in surface view in the middle part of 5-7 or less. When the plant becomes old, the attenuated apex is lost. The apical part of old filaments becomes nearly the same in the diameter as the middle part (**Fig. 7**). The diameters in the basal, middle and apical parts of some young filaments are shown together with their lengths and cell seriations in **Table 1.** As the length and cell seriation increase, the diameter of the filaments becomes larger.

The cells in surface view are irregularly quadrate to polygonal in shape and 10-50 μm × 10-30 μm in size throughout the whole length. The size generally varies according to the age or the part of the filament (**Figs. 1-10**). Cells of the lower uni-diseriate part of the filaments (**Figs. 2, 3**) are larger than in other parts. Sometimes, cells of the middle part of young filament, become very small through repeated divisions. In old filaments, cells are comparatively large and frequently protruded to give the surface of the filament an uneven appearance (**Figs. 15, 16**). The chloroplasts are small and discoid and number a few to 10 or more in each cell according to the size of cell (**Figs. 2-6**). In the uniseriate apical cells, the chloroplasts are in contact with each other to give a parietal plate like appearance (**Fig. 4**).

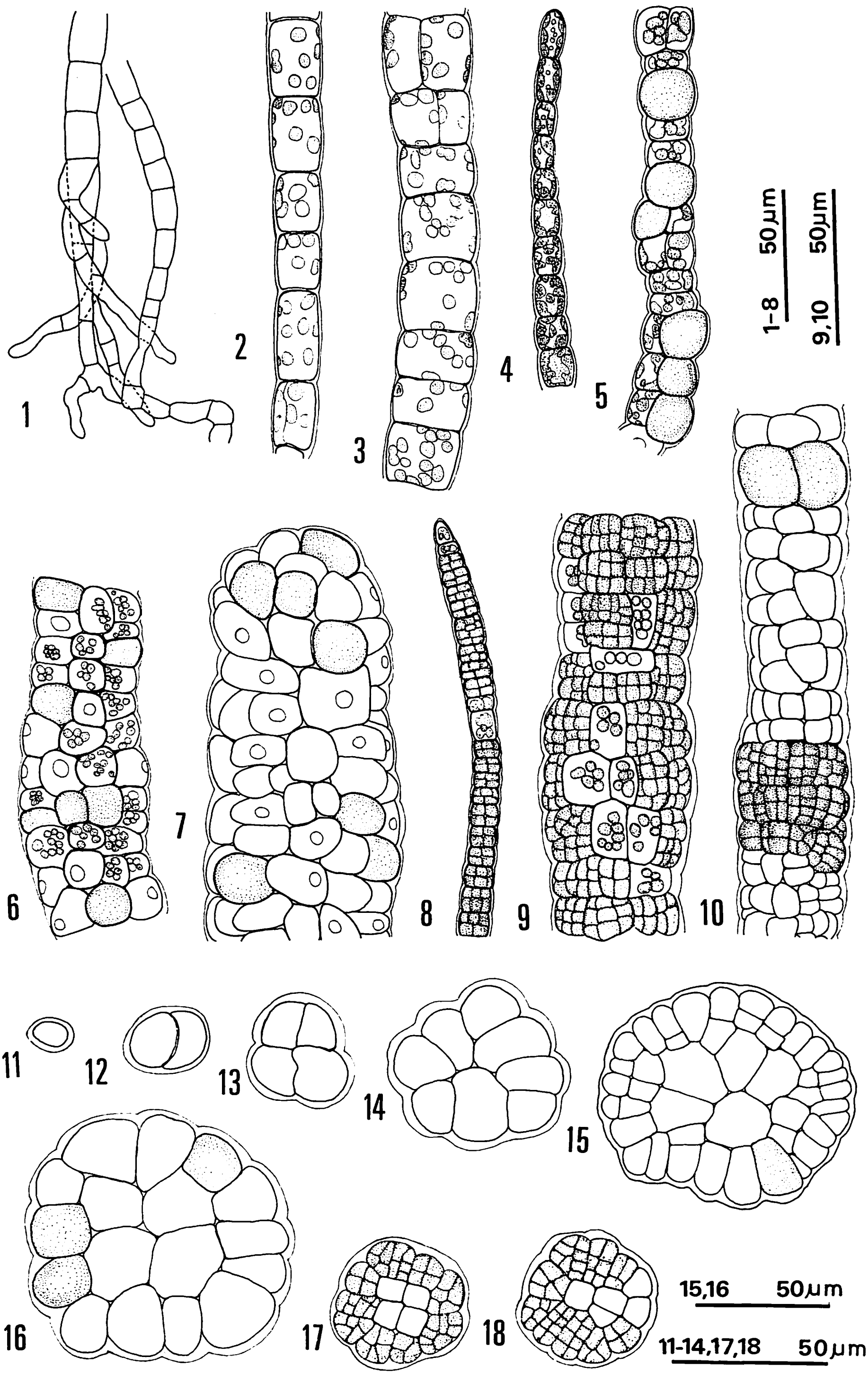
In cross section the filaments show a parenchymatous structure (**Figs. 11-18**) with no special differentiation between outer cells and inner ones in size and shape (**Fig. 16**) except for the occasional occurrence of small cells in the outer layer (**Fig. 15**).

Hairs were not found on the material examined.

Uniseriate rhizoidal filaments are produced from the lower cells of erect filaments, irregularly branched, 5-13 μm in diameter and include a few discoidal chloroplasts in each cell (**Fig. 1**). They are able to issue new erect filaments. These filaments and the creeping filaments are frequently indistinguishable from each other later. Both filaments creep within the empty sori of the host plant or rarely on

Table 1. Diameters of basal, middle and apical parts of young erect filaments with different lengths and cell seriations in surface view.

Length of filament(mm)	Cell seriation in middle part	Diameter (μm)		
		basal part	middle part	apical part
0.7-2.5	1	10-18	12-25	8-15
1.7-8.0	1-2	15-25	25-40	10-20
3.0-12.0	2-3	18-28	28-60	10-20
3.5-15.0	3-5	23-38	40-75	15-25
5.0-10.0	5-7	30-40	70-75	lost



Figs. 1-8. *Litosiphon yezoense*. 1. Basal part of thallus showing creeping filament and basal part of erect filament issuing rhizoidal filaments. 2-4. Basal (2), lower (3) and apical (4) parts of multiseriate filament. 5-6. Unilocular sporangia in 1-2-seriate (5) and multiseriate (6) filaments, empty ones with zoospore liberation pore also seen in 6. 7. Apical part of old multiseriate filament with unilocular sporangia. 8-9. Plurilocular sporangia in apical (8) and middle (9) parts of multiseriate filments. 10. Unilocular and plurilocular sporangia in the same filament.

Figs. 11-18. *Litosiphon yezoense*, shwing cross section of erect filaments. 11-14. Various stages in development. 15. Occasional differentiation into large inner cells and small outer cells. 16. Unilocular sporangia. 17-18. Plurilocular sporangia.

the surface of the sterile part of the host, but do not penetrate into the cortical layer.

Reproductive structures: Unilocular and plurilocular sporangia are formed on different erect filaments or on the same filaments (**Fig. 10**) throughout the growing period. The filaments with plurilocular sporangia, however, are few and generally smaller than those with unilocular sporangia. The former filaments measure 15-60(-100) μm in diameter and 1-5 mm in height, while the latter filaments are 30-140(-190) μm in diameter and 1-30 mm in height. Both the sporangia are formed from the transformation of surface vegetative cells of erect multiseriate and sometimes uniseriate filaments (**Figs. 5-10**), but not from inner cells (**Figs. 15-18**).

Unilocular sporangia are scattered all over the erect filament except for the lower part. They protrude a little and measure 20-37 $\mu m \times 20$-34 μm in surface view. The sporangia formed in the uniseriate filament are few in number and intercalary or occasionally terminal. The liberation pore for zoospores is circular (**Figs. 6, 7**).

Plurilocular sporangia also occur all over the erect filament except for the lower part. They are 10-20 $\mu m \times 9$-17.5 μm in surface view. Their size seems small compared with that of the unilocular sporangia and their borders are frequently difficult to determine because of the close arrangement. They frequently form an expanding or seriate sorus sometimes mixed with sterile cells (**Figs. 8-10**).

Discussion

This species is similar to *L. filiformis* (REINKE) BATTERS* in the absence of hairs (REINKE 1892; PRINTZ 1926; ROSENVINGE & LUND 1947; LUND 1959) as mentioned by YAMADA (1944). However, *L. filiformis* differs from *L. yezoense* in the occurrence of a distinct basal disc composed of adherent creeping filaments on which plurilocular sporangia are formed in addition to occurring on the erect filaments (KUCKUCK 1917; HAMEL 1937; ROSENVINGE & LUND 1947; LUND 1959; JAASUND 1965).

The unilocular sporangia of this species were described by YAMADA (1944), but the plurilocular sporangia are newly reported in this paper. The plurilocular sporangia appear throughout the same growing period as the unilocular sporangia, but the former are very few and the latter abundant. As to the occurrence of plurilocular and unilocular sporangia in other species of *Litosiphon*, *L. filiformis* growing from late winter to spring in the Europe forms plurilocular sporangia abundantly, but rarely unilocular ones (KUCKUCK 1917; PRINTZ 1926; NEWTON 1931; ROSENVINGE & LUND 1947; LUND 1959). In *L. pusillus*, with a growing peroid from spring to autumn, plurilocular sporangia are abundant in the early part of the growing season, while unilocular sporangia are abundant in the latter part of the growing season (SAUVAGEAU 1929; KYLIN 1933; HAMEL 1937; ROSENVINGE & LUND 1947).

This alga was collected only on the old blade, especially on the soral portion, of regenerated perennial *Laminaria* and *Arthrothamnus*. It was not found on the new blade of 2 or 3- year old plants. There seems to be a connection between the growth of this alga and its host. According to HASEGAWA (1962), *L. angustata* begins to form sori from November in first year plants and form August in second year plants. KAWASHIMA (1972) reported also that *L. angustata* var. *longissima* begins to form sori from November in first year plants. According to both authors, both kinds of *Laminaria* begin to form a new blade at the distal end of the stipe from November and retain the old blade with its sori until April or May of the following year. According to our observations, nearly the same growth and maturation patterns are seen in the other hosts, *L. coriacea* and

* The genus of this species has been recently returned to original genus, *Pogotrichum* from *Litosiphon* by PEDERSEN (1978). He differentiate *Pogotrichum* from *Litɔsiphon* by formation process of plurilocular sporangis and absence of hair.

Arthrothamnus. From these observations it appears that *Litosiphon yezoense* occurs in the latter half of the existence of the old soriferous blade of second and third year host plants. The host specificity of *Litosiphon* has been also variously discussed for *L. pusillus, L. laminariae, L. filiformis* by LEVRING (1937), JAASUND (1957), SAUVAGEAU (1929), PRINTZ (1926), HAMEL (1937) and ROSENVINGE & LUND (1947).

Since this alga has not been found in the field from summer to winter, it is necessary to elucidate the habitat of this alga during its period of absence on the host plants. This may be resolved by field observation and culturing study.

As to the distribution of the species of *Litosiphon*, it is noteworthy that one species, *L. yezoense*, is reported from only Hokkaido on the west coast of the North Pacific and the other species are distributed on the coast of the Atlantic and Arctic Oceans. The distribution of *Litosiphon yezoense* or other species of *Litosiphon* on the western coast of the Pacific north of Hokkaido can be expected by field investigations during the spring.

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宮地和幸：コブノヒゲについて

褐藻類，コブノヒゲの形態及び生態の観察結果を報告した。本種は寒流の影響する北海道太平洋沿岸の室蘭から納沙布まで分布している。本種は数種のコンブ属及びネコアシコンブの再生葉体の上部にある，前年の古い葉体の主に子嚢班の部分に着生し，2月から6月上旬まで採集されており，宿主の古い葉状部が消えるとともに消失する。今回初めて本種の複子嚢を観察した。複子嚢は従来記載された同属の他の種のそれと同様に表層の栄養細胞から作られる。単子嚢・複子嚢はいずれも生育期間中常に観察されるが，複子嚢形成体は単子嚢形成体に比べて極端に少量しか観察されない。単子嚢・複子嚢はそれぞれ別の体に形成されるが，時には同じ体にも形成される。(274 船橋市三山2丁目 2-1，東邦大学理学部生物学教室)

千原光雄：フェルドマン先生の思い出
Mitsuo CHIHARA: Jean Feldmann, 1905-1978

フェルドマン先生 Poof. Jean Feldmann が9月18日にお亡くなりになったとの知らせをパリ大学から受けた。享年73歳であった。先生は二度来日された。一度目は第11回太平洋学術会議が東京で開かれた1966年で，二度目は第7回国際海藻会議が札幌で開かれた1971年である。最初の来日の夏の二ケ月程前にフェルドマン先生から一通の手紙をいただいた。会議の始まる少し前に日本に着き，あなたのいたことのある下田臨海実験所に一週間程滞在して海藻採集をしたいのでよろしく配慮を願いたいとの趣旨であり，なお夫人を同伴する予定で，できれば日本式の生活を味わってみたいので，和室のある旅館を世話してもらえると有難いがとの希望が添えられていた。よく知られているように，夫人もまた藻学者で，とくに紅藻イギス科の海藻について秀れた研究をされている。羽田には，フランスでお知り合いになられた三輪和雄先生も出迎えられた。

フェルドマン先生の下田での海藻採集は実に精力的であった。あいにく，この年の8月は台風が日本近海に長逗留で，海は必ずしも静かではなかったが，先生は殆ど毎日採集に出かけられた。ある時は雨合羽を着て，また傘をもっての採集もあった。先生は恵まれた体格で，それに若い頃から海で鍛えておられるせいもあって，波のある中を胸まで浸かって小島に渡ることなども再々で，既に60歳を越しておられたが，少しも年を感じさせるところがなかった。先生は沢山海藻をとられ，それからつぎつぎと海藻の名前を私に尋ねられた。第一日目の採集を始めて間もなくアミジグサがとれた。問われるままに *Dictyota dichotoma* と学名を答えた。すると先生は首をかしげて，地中海のものと少し違うように思うがと言われた。私ははっとして，それからはヨーロッパに *type locality* をもつとされる海藻についてとくに注意して採集し，逐一意見をいただくように努めた。このことは私にとって貴重な体験であり，種の階級の分類を全世界的な視野で行うことの重要性を改めて強く感じさせてくれた。採集中の先生は楽しそうで，須崎半島で無節サンゴモのサビモドキ (*Yamadaea* SEGAWA) を見つけられたときの嬉しそうなお顔，白浜海岸で波のぶつかる岩壁に生育するハチノスイシ (*Lithophyllum tortuosum*＝*Tenarea tortuosa*) を，打ち寄せる波しぶきを避けながら幾枚も写真をとられたときの後姿などは今も鮮かに私の脳裏に浮ぶ。ハチノスイシは生育の様子が先生がお若い頃に研究された Albéres の海岸のそれによく似ていたので，とくに興味をもったとのことであった。

フェルドマン先生ご夫妻は下田での日常生活も楽しんでおられた。夜はゆかたにうちわで畳の上でくつろがれた。ときに，臨海実験所前では赤いいちご水のかき氷を註文して舌鼓を打たれ，また具合よく時期であった下田名物の夏祭を楽しまれた。

先生は採集物を沢山とられたが，その後始末は実に丹念であった。標本の一つ一つを手にとり，顕微鏡で見るべきものはその都度セクションをつくり，ノートにメモをとり，それから袋にしまわれた。遅くなっても大抵はその日のうちにすまされたが，時には夕食を遅らせることもあった。私は採集物の整理の仕方を改めて学ぶ思いがした。その後，太平洋学術会議の会期中に，日本藻類学会主催の海藻採集会が一日江の島で行われ，多数の外国人学者が参加され，その採集物の整理が宿泊所のホテルニューオタニに近い上智大学で行われたが，この時も多くの人々が帰った後に遅くまで残って採集物の整理に精を出す数名の中にフェルドマン先生の姿があった。

フェルドマン先生は若くして Albéres の海岸の海藻について大冊の研究論文をまとめ (1937-1942)，さらに *Gelidiella* を初めとする多数の新属，新種の記載，カギノリ科を含め，多くの藻類の生活史の研究，管状緑藻や褐藻あるいは紅藻全般に亘る分類系の提唱など，秀れた研究論文を多数発表された。また先生は永年パリ大学の海洋植物学の教授として多数の研究者を育成され，さらに創始者の一人として国際藻類学会，フランス藻類学会などの設立にも尽力され，両学会の会長の要職を経るなど，藻学の発展に大きい足跡を残された。謹んでご冥福をお祈り申上げる。

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