

I. Mackenzie LAMB*: **Structurally unusual types of
cephalodia in the lichen genus *Stereocaulon*
(subgen. *Holostelidium*)****

I. M. ラム*: キゴケ属 *Holostelidium* 亜属の非通常型の頭状体**

In the subgenus *Holostelidium* (Lamb, 1951) of the genus *Stereocaulon* (Schreb.) Hoffm. (*nom. conserv.*; see Taxon 15(7): 286, 1966) the cephalodia are sacculate (Satô, 1941) or protosacculate (Lamb, 1961), bounded externally by a well developed cortex usually of strongly gelatinized structure. Sacculate cephalodia are laxly hyphose internally (loose-cored), while protosacculate cephalodia are compact internally (solid-cored).

The common and typical form of sacculate cephalodium may be described as scrobiculate (Johnson, 1938) or foveolate-scrobiculate (Th. Fries, 1857), consisting of an approximately spherical structure with indented-scrobiculate surface having prominent reticulating folds with depressions in between, and is well represented by the cephalodia of *St. ramulosum* (Sw.) Räscher. (Fig. 1). The earliest stages of their development are more or less smoothly spherical, but they very soon become indented-scrobiculate. Such cephalodia are found in the majority of the species of the subgenus *Holostelidium*.

Protosacculate cephalodia may also finally become indented-scrobiculate, but persist for a longer time (or sometimes permanently) in the smoothly globose condition.

The bounding cortical layer of both sacculate and protosacculate cephalodia is usually of a distinctive gelatinized structure, with the walls of the hyphae completely fused, only the lumina being visible in section in the clear gelatinous matrix. The shape and arrangement of the lumina show considerable variation in different species (cfr. Lamb, 1951, fig. 2). In *St. ramulosum* and a number of other species they are strictly vertically parallel (palisadic), in *St. massartianum* Hue and *St. soreidiferum* Hue partly elongated

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** Contribution in honor of the late Dr. Yasuhiko Asahina

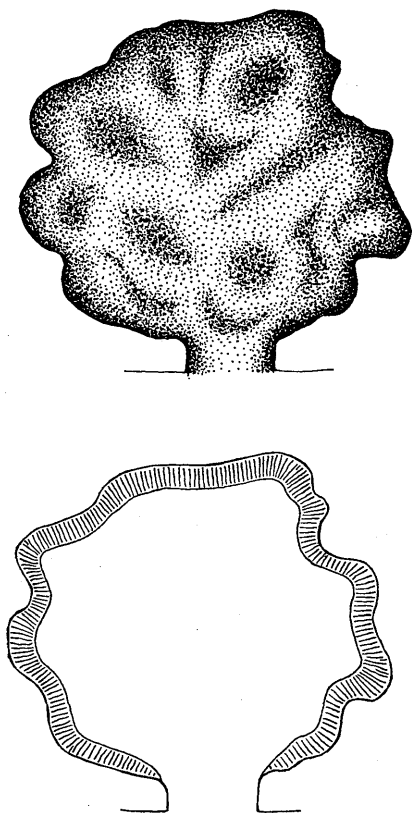


Fig. 1. *Stereocaulon ramulosum* (Sw.) Räsusch.
Form and cortication (schematic) of cephalodia.

woven hyphae or indistinctly pseudoparenchymatous tissue¹⁾. A cortex of this type has also recently been observed in several other species of the subgen. *Holostelidium*, including the Hawaiian endemic species *St. roccelloides* (Th. Fr.) Lamb and²⁾ *St. rubiginosum* Pers.

1) The "distinct, as yet undescribed, New Zealand variety of *St. implexum*" there mentioned as having this type of cephalodial cortex is actually referable to *St. colensoi* Bab.

2) **New comb.** Basionym: *Stereocaulon ramulosum* subsp. *roccelloides* Th. Fries, De Stereoc. et Pilophor. Comment. 13 (1857).

and vertically parallel and partly more or less rounded and isodiametric, and in *St. foliolosum* Nyl. elongated and fistulose, branched, running randomly in various directions, with those near the surface of rounded and \pm isodiametric form.

Lamb (1951, p. 538-540) showed that in *St. caespitosum* Redgr., a species of the section *Redingeria* with primitively developed sacculate cephalodia, the structure of the cephalodial cortex corresponds anatomically to that of the original primary cortex of the pseudopodetium, and suggested that the cephalodia were originally derived by modification of thallus mantle tissue, having undergone further anatomical specialization under the influence of the secondary Cyanophyceous phycobiont which they contain. He also pointed out (op. cit., p. 537) that in rare instances a sacculate cephalodium may have a non-gelatinized cortex of inter-

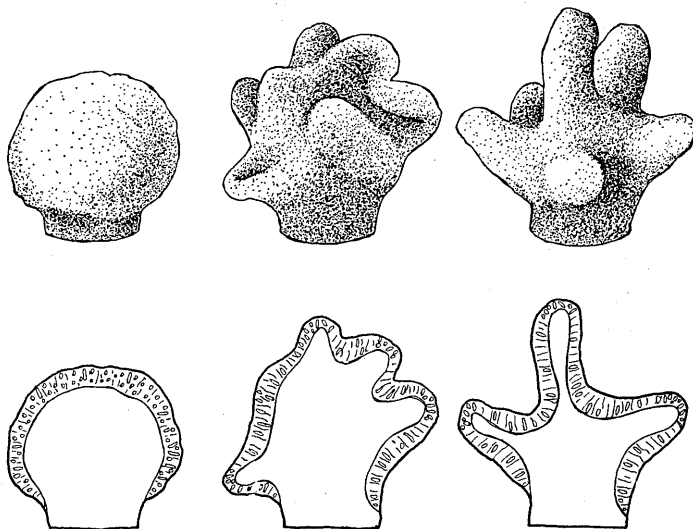


Fig. 2. *Stereocaulon strictum* Th. Fr. Three stages in the development of cephalodia with corresponding cross-sections showing uniform gelatinized cortication (schematic).

The cephalodia of *St. strictum* Th. Fr.³⁾, belonging to the section Dactyloideum Lamb (1951, p. 565) are very characteristic, and unlike those of any other *Stereocaulon* species. Fig. 2 shows three stages in their morphological development (above) with corresponding sections illustrating the cortical structure (below). Of pale color, like the phyllocladia, and initially smoothly subglobose, they soon become variously ridged and finally develop a cluster of shortly digitate outgrowths. They are solid internally (protosacculate) and bounded by a uniform, colorless and transparent, strongly gelatinized cortex with only the cell lumina visible in the gelatinous matrix. On the sides of the lobes the cortex shows a distinctly palisadic structure with narrow, fistulose, parallel lumina; on the apices of the lobes the cortex is thinner, with shorter and broader (isodiametric to ovoid) lumina.

In the subject. *Aciculisporea* DR. ex Lamb (1951), our recent, hitherto unpublished investigations have shown that certain species have peculiar

3) Synonyms of *St. strictum* are *St. explanatum* Lamb, *St. lecanoreum* Nyl., *St. peladense* Vain. and *St. substrictum* Hue. The section Dactyloideum is therefore monotypic, containing but a single species.

features in the gross morphology and/or the anatomy of their cephalodia. Those of *St. corticatulum* Nyl. (syn. *St. corticatulum* subsp. *detergens* Nyl., *St. leptaleum* Nyl., *St. humile* Müll. Arg.) are usually pale colored as in *St. strictum*, and in their full development become either crowdedly verrucose or ridged and scrobiculate-indentured (Fig. 3). The depressions between the verrucae or ridges are frequently of a darker color (aeruginose-glaucous). Intermediate conditions between these two morphological types are often found; the latter corresponds to the foveolate-scrobiculate type generally characteristic of the species of the subsect. *Aciculisporae*, and like these, they are anatomically of loose-cored (sacculate) construction. The structure of their cortical layer as seen in section, however, shows an alternation of two different types of tissue developed at maturity. In young, more or less smoothly subglobose cephalodia the entire cortex is uniform, consisting of a brownish-nubilated, non-gelatinized, indistinctly pseudoparenchymatous tissue, but as folding and indentation of the surface progresses, patches of hyaline gelatinized tissue are developed below this layer in the depressions,

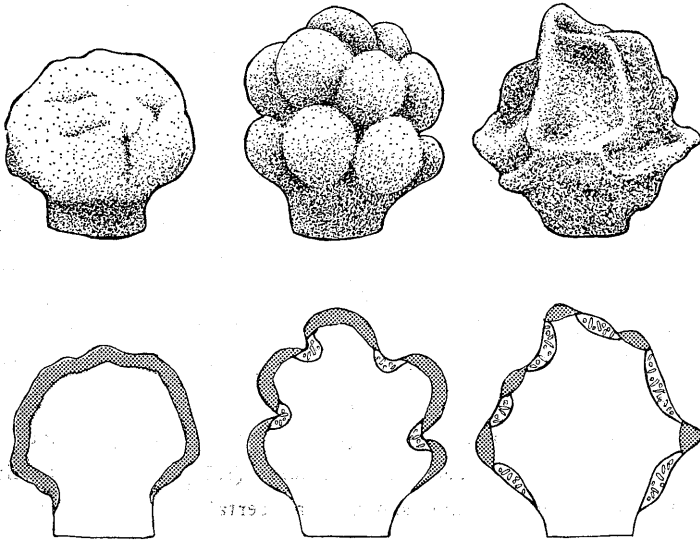


Fig. 3. *Stereocaulon corticatulum* Nyl. Three stages in the development of cephalodia with corresponding cross-sections showing dimorphic cortication (schematic).

and finally become quite extensive; this tissue consists of a hyaline gelatinous matrix with rounded to oblong or fistulose lumina, sometimes in more or less parallel formation but seldom distinctly palisadic. Owing to its transparency, the depressions in which it occurs are, as mentioned above, often darker in color, due to the underlying Cyanophyceous algae. There is thus, in mature cephalodia, an alternation between the two cortical types, so that the cortical layer can be designated as "dimorphic".

In *St. pseudomassartianum* Lamb (ex Frey, 1967, p. 246), also belonging to the subject. Aciculisporae, the cephalodia commence their development as simple, flattened, plate-like structures which then proliferate to produce secondary flattened platelets (Fig. 4). This type of cephalodium may be termed "crustate". In *St. pseudomassartianum* the cephalodia are solid-cored (protosacculate) and have a dimorphic cortex similar to that of *St. corticatulum*. The crests of the plate-like excrescences are paler (whitish) and consist of tissue of the nubilated, non-gelatinized, indistinctly pseudoparenchymatous type, while their sides (glaucous-gray) are covered by a cortex of the hyaline gelatinized type with parallel fistulose lumina in palisadic

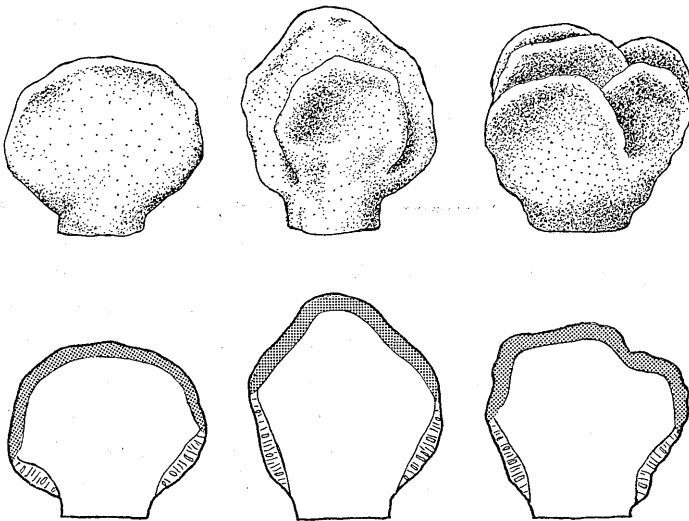


Fig. 4. *Stereocaulon pseudomassartianum* Lamb. Three stages in the development of cephalodia with corresponding cross-sections showing dimorphic cortication (schematic).

arrangement.

A cephalodial cortex of the same dimorphic type is found also in an undescribed species from Indonesia and Malaya in which the cephalodia are foveolate-scrobiculate and solid-cored (protosacculate).

The dimorphic type of cephalodial cortex in species of the subgenus *Holostelidium* appears to represent the persistence of a primitive character; the nubilated, non-gelatinized, indistinctly pseudoparenchymatous tissue being the primary condition characteristic of the general thallus mantle, and the hyaline, gelatinized tissue being secondarily developed from it. This view is supported by the observations made in the case of *St. caespitosum* Redgr. (see above), and it seems plausible to assume that the cortication of the cephalodia in the subgenus *Holostelidium* shows an evolutionary progression from a type similar to that of the thallus mantle to a more specialized, highly gelatinized structure which in most species supersedes and replaces it entirely. In most species the cortex is uniform and of the latter type only, but in *St. colensoi* Bab. (New Zealand) it is uniformly of the primitive thallus mantle type, and in a few others, such as *St. implexum* Th. Fr. and *St. staufferi* Lamb, both tissue types are present but superimposed one on top of the other. In *St. corticatulum*, *St. pseudomassartianum* and the undescribed species mentioned above, the two tissue types alternate on the surface, the cortical structure being therefore dimorphic.

Literature cited

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Holostelidium 亜属に属するキゴケ類はよく発達した皮層で被われた囊状 (sacculate) または原生囊状 (protosacculate) の頭状体をもっている。これらの頭状体の皮層は通常細胞膜が完全に癒合して膠質化した組織からできているが、まれには膠質化しないで擬柔組織からできているものも知られていた。section Dactyloideum に属する *St. strictum*, subsection Aciculisporae に属する *St. corticatulum* と *St. pseudomassartianum* の頭状体の皮層の構造とその発達段階を主として検討した。若い頭状体の皮層は、擬子柄のそれから誘導され、かつそれに類似の擬柔組織からできているが、成熟したものでは特殊化した膠質状の皮層が部分的に前者にとってかわる。このことから大部分の Holostelidium 亜属のキゴケでは二次的に形成される膠質状の皮層だけで被われていると考えられる。

○Materials for the distribution of lichens in Japan (3) 地衣類分布資料 (3)

○*Cladonia acuminata* (Ach.) Norrl. The occurrence of the present species in Japan was first reported by Kurokawa (Journ. Jap. Bot. 34: 23. 1959). The locality was Mt. Yokodake, Yatsugatake Mts., Prov. Shinano. Another specimen of the present species was recently found among lichen specimens collected on Mt. Yubari in Hokkaido.

Cladonia acuminata is considered to be related to *C. macrophylla* (Schaer.) Stenham. In the field, however, it is rather easily distinguished from the latter species by the slenderer podetia and the paler or whitish thalli.

Specimen examined. Mt. Yubari, Prov. Ishikari, Hokkaido, S. Kurokawa 72153 (TNS). (Syo KUROKAWA)

信州、八ヶ岳、横岳で採集した標本によって *Cladonia acuminata* が日本に産することをすでに報告したが、最近北海道夕張岳での採集品を整理した折に第2の標本を発見したのでここに報告する。本種は *C. macrophylla* に近縁のものとされているが、子柄はもっときゃしゃな感じで全体に白っぽいので、野外ではかなりはっきり区別できる。日本では明らかに稀であるが、高山帯で丹念に探せば、さらに発見されるものと思う。(黒川 道)