Algae from Gunong Jerai (Kedah Peak), Malaysia

by

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Abstract

The author's collection of algae on Gunong Jerai is listed here with brief notes on habitat and existing records in The Malay Peninsula. Structural features of several species are also described. The total collection consists of 32 numbers, the 102 species and varieties are listed under 57 genera.

Introduction

Gunong Jerai or Kedah Peak is a mountain largely composed of sandstone, quartzite, quartz and some haematite (Robinson and Boden Kloss, 1916), and acidic intrusive igneous rocks (Alexander 1962). It rises to nearly 1219 metres (4000 feet) above mean sea level and is a prominent landmark of Kedah state. The vast flat lowlands more or less surrounding the foothills are mainly planted with rice. The sea to the west is only about 8 km (5 miles) away and in the mornings or when the moisture- and possibly salt-laden westerly winds blow, one could notice a thick mist moving across the peak towards the east. Ridley (1916), amongst other workers, has suggested that Gunong Jerai was once an island separated from the Malay Peninsula as in the case of Mt. Ophir, Johore and showed that there is much resemblance between the floras of these two mountains. The physical isolation of Gunong Jerai from the main range of the Peninsula and the absence of neighbouring mountains of any comparable altitude is phytogeographically significant, and the lack of a true Thai element in the flora (see Ridley, 1916) is noteworthy. Though the angiosperms, gymnosperms and especially ferns have been abundantly collected and well documented, no data on algae have been published.

Material and Method

This paper contains the results based on the study of 32 numbers of collections. The algae were collected by the writer at altitudes of about 823–1189 metres (2700-3900 feet) above mean sea level between May 12 and 20, 1969 (see figure 1). The two main sites of collection were (1) a stream near the Government bungalow and (2) the only concrete reservoir situated on the left side of Peak Road one-third the distance from bungalow to peak. On a clear day, temperature readings of the stream between 10.30 a.m. and 12.30 p.m. were found to vary between 21.8 and 22.2°C and pH from 8.0 to 8.3: at the reservoir the pH was 6.2 at 22.5°C. The latter were determined in the field with a Lovibond comparator.

Specimens were first examined fresh, then preserved dry or in solutions of formol acetic alcohol (Smith, 1950, p.34) or 5% formaldehyde. Of the nineteen species of diatoms collected eighteen were obtained as empty frustules from muds, bottom sediments and detrital material. The author consulted Johansen’s “Botanical microtechnique” for staining methods and simple microchemical tests.
Species determination is incomplete due to inadequate reference material and absence of reproductive stages in some samples. For the nomenclature and sequence of major taxa (Divisions and Families), the system of Silva (1962) is largely adopted and to a lesser extent those of Papenfuss (1955) and Smith (1950). Genera are arranged according to systems of the following authors: Desikachary (1959, Cyanophyta), Prowse (1959, Bacillariophyta), Huber-Pestolozzi (1955, Euglenophyta), Randhawa (1959, Zygnemataceae), Scott and Prescott (1961, Desmidiaceae).

Numbers in the list refer to the author’s collection. A complete set (101–133) is deposited at the Botany Division, School of Biological Sciences, University of Malaya, Kuala Lumpur; and 102, 104, 106, 107, 109–130, 132 and 133 are also at the Tropical Fish Culture Research Institute, Malacca.

List of Species of Algae

**CYANOPHYTA**

**CHROOCOCCACEAE**

*Chroococcus turgidus* Näg. Nos 100 & 111.
Collect from washings of *Sphagnum* and sedge growing in reservoir and of moss scraped from submerged concrete sides of reservoir.

Collected from bottom muds, reservoir.

Collected from surface of moist rock.

Colonies of 2 to 8 ovoid cells with rounded ends, daughter colonies with individual sheaths, embedded in clear mucilage of parent envelope.
From bottom muds of reservoir.

*Synchococcus ? aeruginosus* Kütz. No 114.
Planktonic in reservoir and stream.

*Dactyloccopsis acicularis* Lemm. Nos 109, 110.
Collected from submerged moss-covered sides of reservoir.

**OSCILLATORIACEAE**

*Phormidium inundatum* Kütz. ex Gomont Nos 109, 116, 117.
Bright blue-green sheets; hormogonia abundant.
From surface of concrete roadside drain with water trickling over it.

**NOSTOCACEAE**

*Anabaena* sp. Nos 116, 118.
Filaments short, some up to about 500 μ long; heterocysts rectangular, about 1½ times longer than vegetative cells, intercalary, with two polar nodules; akinetes absent.
Planktonic in pool, roadside drain.
SCYTONEMATACEAE

Scytomena sp. Nos 115, 124.
In mass appears as black somewhat shiny patches on wet or dripping rock; abundant.

Tolypothrix sp. No 128.
On submerged rock or mixed in with other algae and vegetation in stream.

STIGONEMATACEAE

Hapalosiphon hibernicus W. et G.S. West Nos 124, 125.
Main axes usually uniseriate, occasionally biseriate, cells shorter or a little longer than broad, sheaths yellowish; branches uniseriate, mostly unilateral, sheaths non-lamellated, colourless, cells 2–6 times longer than broad, apex of terminal cells broadly rounded.

Collected from torrential stream amongst other algae.

Stigonema ocellatum (Dillw.) Thuret No 131.
Scraped from surface of rock in stream.

Reported from Templer Park (Hirano, 1967).

Stigonema paniforme (Ag.) Bornet et Flahault No 129.
Collected from torrential stream.

RHODOPHYTA

BATTRACHOSPERMACEAE

Battrachospermum ? moniliforme Ralfs Nos 101–107, 108, 124. — Plates 1, 2A-B

Thalli macroscopic, 2–10 (–20) cm, moniliform, dark or pale blue-green or purplish brown, mucilaginous, corticated, freely branched. Nodes prominent. Internodes clear; corticating cells 2–6 times longer than broad, with short or long uniseriate filaments at the base; internodal filaments bear globose to obovate antheridial cells. Nodal filaments longer, branched; terminal cell ends in a long hair with dilated base, when fertile may bear clusters of antheridial cells at distal end. Cells of nodal branch citriform to oval, distinctly moniliform; apical cell dome shaped, obscured by upgrowing branches; branches may develop from the fourth axial cell and on the sixth, branches save as many as eight cells; young carpogonia clavate, stalked, develop at end of short but many-celled nodal branch; cystocarp rounded, more deeply pigmented, 1–3, more or less at periphery of nodal branch.

The plants collected showed considerable variation in such features as colour, size, length of internodes, degree of branching, structure of cortical and other cells, and, it is possible that two forms or may be even species are involved here. "Chantansia"-like thalli were not uncommon; these were bluish green, uniseriate, branched, the cells many times longer than broad, without terminal hairs, and vegetative. Some of these thalli resemble Audouinella.

Found attached to rocks or gravel in stream; few specimens found on wet soil of stream bank where seepage water overflowed, very few small plants in the reservoir. Distribution patchy, sometimes gregarious.
PYRRHOPHYTA

PHYTODINIACEAE

*Dinococcus bicornis* (Woloszynska) Fott  
Nos 123–125 — Plates 2C, 3A-B

Cells solitary, dorsal margin in front view convex, sometimes slightly depressed in the middle, showing at each end a short pointed spine; ventral view somewhat angular; vertical view ellipsoid; end view ovate. Stalk short, stout, colourless. Chromatophores obscured by dense accumulation of food reserve including a more or less central area of oil.

Epiphytic on *Oedogonium*, other filamentous algae, and colonial diatoms e.g. *Eunotia* in stream; frequently gregarious.

BACILLARIOPHYTA

EUNOTIACEAE

Collected from stream muds.

In stream muds and epiphytic on other algae.
Recorded in Cameron Highlands and Malacca River (Prowse, 1962a).

*Eunotia lunaris* (Ehrenb.) Grun. No 123.
In stream muds and epiphytic on other algae.
Recorded in Cameron Highlands (Prowse, 1962a).

*Eunotia lunaris* (Ehrenb.) Grun. var. *capitata* Grun. No 122.
Collected from stream muds.
Recorded in Malacca River (Prowse, 1962a).

*Eunotia monodon* Ehrenb. var. *tropica* Hustedt No 122, 123.
Among bryophytes and other vegetation in stream.

Three varieties were recorded from stream, river and fish pond elsewhere in West Malaysia (Prowse, 1962a).

*Eunotia pectinalis* (Kütz.) Rabenh. var. *ventralis* (Ehrenb.) Hustedt No 120.
Collected from stream muds.

The species was recorded at Cameron Highlands (Prowse, 1962a). Var. *minus* (Kütz.) Rabenhorst has been recorded from Perak (Patrick, 1936).

*Eunotia ? pseudoflexuosa* Hustedt No 123.
Collected from stream muds.

*Eunotia robusta* Ralfs Nos 118, 120.
From roadside pool with flowing water and stream sediments.
Recorded in Malacca river (Prowse, 1962a).

*Desmogonium rabenhorstianum* Grun. Nos 120, 122, 123.

Epiphytic on other algae, bryophytes and in sediments of stream. Prowse (1962a) reported this species from various habitats elsewhere in Malaysia, including swamps and coastal streams, at Cameron Highlands in West Malaysia.
ACHNANTHACEAE

Achnanthes sp. Nos 118, 123.
Collected from roadside pool with flowing water; epiphytic on liverwort in reservoir.

NAVICULACEAE

Frustulia rhomboides (Ehrenb.) De Toni Nos 106, 115, 120–123, 126.
Distributed widely and abundantly in various habitats; its common occurrence suggests ecological significance and further studies are warranted.

Recorded from most states of West Malaysia, including Cameron Highlands and Fraser’s Hill (Prowse, 1962a). Very abundant in algal samples collected by the writer in July 1970 at Tasek Bera, Pahang.

Navicula spp. Nos 104, 118, 120.
Many small species, especially common in bottom muds of streams and roadside pools.

Pinnularia biceps Gregory Nos 112, 113.
Collected from bottom sediments and submerged concrete sides of reservoir.

Recorded from padi-fields, Beranang (Johnson, 1970). Var minor (Boye Petersen) A. Cleve has been recorded in Malacca river and fish ponds (Prowse, 1962a).

Pinnularia legumen Ehrenb. No 111.
Collected from stream and reservoir sediments.

Recorded from Perak (Patrick, 1936); Taiping lakes (Prowse, 1962a) and from Templer Park (Hirano, 1967).

Pinnularia maior (Kütz.) Cleve Nos 122, 123.
Collected from stream muds and pools.

Reported from Perak (Patrick, 1936). Var. linearis was recorded in Templer Park (Hirano, 1967).

CYMBELLACEAE

Collected from bottom sediments of reservoir.
Recorded at Cameron Highlands (Prowse, 1962a).

NITZSCHIACEAE

Hantzschia amphioxys (Ehrenb.) Grun. ? var. capitata O. Muller No 126.
Collected from stream mud.
Recorded from stream, Klang Gates (Prowse, 1962a).
SURIRELLACEAE

*Surirella linearis* W. Smith Nos 123, 126.
Collected from stream sediments.
Reported from Perak (Patrick, 1936); from fish ponds at Penang and Malacca river (Prowse, 1962a).

*Surirella spiralis* Kütz. Nos 101, 114, 120.
Collected from stream sediments. Rare.
Reported from various habitats in Malacca (Prowse, 1962a). The writer has collected the species at various times during 1968 to 1970 in the Gombak river, Selangor and in July, 1970 at Tasek Bera, Pahang.

*Surirella ? tenuissima* Hustedt Nos 123–125.
From sediments on bed-rock and liverwort in stream.
Recorded in Cameron Highlands (Prowse 1962a).

CHRYSOPHYTA

MALLOMONADACEAE

Several species of *Mallomonas* were encountered in the stream sediments, reservoir and amongst other algae and bryophytes. Cells were mostly empty and spines usually lacking. The following species appear to be present:

*Mallomonas ? elliptica* (Kisselew) Conrad Nos 110, 111.
*Mallomonas producta* (Zacharias) Iwanoff Nos 112, 113.

DINOBRYACEAE

*Binobryon sertularia* Ehrenb. No 111.
Mostly only empty envelopes were found; solitary or in colonies of up to six cells.
Colonies few-celled epiphytic on filamentous algae, rare in stream; mostly empty envelopes, common in sediments and waters of reservoir.
Recorded from many acid swamps and fish ponds in many states of West Malaysia (Prowse, 1962b).

RHIZOCHRYSIDACEAE

Epiphytic on filamentous algae in stream, sometimes gregarious, fairly common.

*Lagynion ? macrotrachelum* (Stokes) Pascher No 124.
Epiphytic on filamentous algae in stream.

XANTHOPHYTA

STIPITOCOCCAEAE

*Stipitococcus crassistipitatus* Prescott Nos 122, 123.
Epiphytic on filamentous algae in stream.
CHARACIOPSISIDACEAE

Characiopsis sp. No 128.
Epiphytic on liverwort in stream.

TRIBONEMATACEAE

Tribonema sp. No 124.
Cells 1½–3 times as long as broad, slightly swollen in middle and narrowing at cross walls, ‘H’-pieces distinct but rare, chloroplasts many. This species is related to T. viride Pascher.
Tychoplanktonic and in bottom muds of stream; often entangled with other filamentous algae.

Neonema sp. No 124.
Similar in habitat to that of Tribonema; rare.

EUGLENOPHYTA

EUGLENACEAE

Euglena ? mutabilis Schmitz No 120.
Collected from stream muds.
Recorded in Kedah padi fields (Sands, 1934), in carp ponds and stagnant water elsewhere in Malaysia (Prowse, 1957b, 1958) and in Templer Park (Hirano, 1967). The writer has collected it several times between 1968 and 1970 in the Gombak river, Selangor.

Var. minuta Fritsch has been reported from many stagnant waters in West Malaysia (Prowse, 1958).

Trachelomonas volvocinopsis Swirenko No 120.
Collected from stream muds.
Recorded from standing water and fish-ponds in various states of West Malaysia (Prowse, 1962b).

Lepocinclis ? marsonni Lemm. emend Conrad No 120.
Collected from stream muds. Common.
Recorded from Taiping Lakes (Prowse and Ratnasabapathy, 1970).

CHARACIACEAE

Characium sp. Nos 128, 129.
Cells solitary, fusiform, straight or slightly arcuate, poles acute and produced as long fine spines, each spine about half or more cell length; one spine terminating in a small rounded colourless attachment disc; chloroplast single, parietal, almost filling cell.

The specimens were growing attached to the leaves of aquatic liverworts in a torrential stream. This species of Characium closely resembles Schroederia setigera, which however is reported to be always planktonic (see Smith, 1950). The presence of an eyespot and the disc-like ending of the spine in some species of Schroederia was reported. These species may well be attached forms that have become subsequently detached by accident and incorporated into the plankton. Further work on the ecology and taxonomic status of Schroederia with its described species is needed.
ULOTRICHAEE

*Stichococcus ? scopulinus* Hazen Nos 128, 131.
Filaments uniseriate, short, 1 to 4 or rarely 5 cells; cells cylindrical, sometimes up to 9 times longer than broad but usually shorter, ends rounded; chloroplast single, parietal, laminate, encircling about half the cell and usually not extending to the ends, apple-green coloured; pyrenoids lacking.

Epiphytic on leaves of aquatic bryophyte in torrential stream; tends to be gregarious.

*Ulothrix* sp. Nos 120, 132.
Collected from a small pool of Government bungalow; in slow-flowing stretches of stream near bungalow. Rare.

TRENTEPohlIAEE

*Trentepohlia iolithus* (L.) Wallr. Nos 114, 133.
Orange coloured, forming felted patches; filaments much-branched, unilateral at times, cells usually 2-5 times longer than broad, length up to about 90 μ, chloroplast indistinct, reticulate; haematochrome abundant; cell wall fairly thick, lamellated in older cells; sporangia borne terminally or laterally on short or many-celled branch, usually single; spherical, diameter up to 25 μ, stalk cell inflated at base and bent distally.

Epilithic, aerial.

OEDOGONIAEE

*Bulbochaete* sp. Nos 111, 120.
Thallus mostly uniseriate branched, cells 3-7 times as long as broad, length of cells 25-45 μ; cell apex slightly inflated, with laterally placed seta; setae swollen at the base and very long, about 250 μ. No reproductive stages found. Attached to other vegetation and twigs in stream and reservoir.

*Oedogonium* sp. Nos 112, 113, 120.
Only vegetative filaments were encountered, and probably more than one species are involved. Attached to aquatic vegetation, twigs, etc. in reservoir and in streams.

ZYGNEMATAEE

*Mougeotia ? elegantula* Wittr. No 120.
Collected from quieter stretches and pools of streams. Common. Several specimens resembling *Mougeotia* and *Debarya* (No. 115-119) could not be assigned accurately as only the vegetative stages were encountered.

*Zygnema sterile* Transeau No 118.
Cells up to two times longer than broad; cell wall thick, lamellated; chloroplast two, more or less stellate, each with one pyrenoid.
Collected from stream, roadside pools and drains, often mixed in with other filamentous algae. Common.

Several unidentified species of *Zygnema* or *Zygnemopsis* (Nos 115, 117, 120) were collected from the stream; some of these had cells many times as long as broad; reproductive stages were absent.
Spirogyra spp. Nos 120, 127.
At last 3 species of Spirogyra were collected from the streams and one species from the reservoir; they had one to four chloroplasts. One of these (No. 127) was found in abundance in almost a pure stand in small cracks of stream bed-rock with static or gently flowing water, showing recently completed conjugation and young zygosporites. Specific determination was not possible because the sculpture was not clear.

Sirogonium sp. No 120.
A species with four chloroplasts, each making half to three quarters of a turn; all filaments were in vegetative condition.
Collected from quieter edges of stream.

MESOTAENIACEAE

Mesotaenium caldariorum (Lagerh.) Hansgirg No 133.
Cells cylindrical, ends rounded, sides slightly to more or less parallel, length up to two times longer than broad; chloroplast single, axile, laminate, with or without a pyrenoid; mucilage surrounding cells clear, enveloping several cells.
Collected from moist rock of roadside associated with Trentepohlia.

Cylindrocystis brebissonii Menegh. No 115.
Amongst Stigonema, Scytonea and Cosmarium on moist rock. The writer has collected the species in April 1970 in Tasek Bera, Pahang.

Netrium digitus (Ehrenb.) Itzigs. et Rothe Nos 120, 122, 124 — Plate 3C
Collected from slow-flowing stretches of stream. Common.
Recorded in Taiping Lakes (Prowse and Ratnasabapathy, 1970).

DESMDIACEAE

Actinotaenium cucurbita (Bréb.) Teil. No 118, 119.
Collected from pool with flowing water, dripping wall of small iron storage tank, roadside of hill.

Actinotaenium cucurbitinum (Biss.) Teil. No 119.
Collected from dripping wall of small iron storage tank, roadside of hill.

Actinotaenium elongatum (Racib.) Teil. No 119.
Collected from dripping wall of small iron storage tank, roadside of hill.

Actinotaenium grande (Delp.) Teil. No 112.
Collected from small impoundment to reservoir.

Actinotaenium subglobosum (Nordst.) Teil. No 119.
Collected from dripping wall of small iron storage tank, roadside of hill.

Actinotaenium truncatum (Bréb.) Teil. Nos 112, 118.
Collected from pool with flowing water, roadside of hill and small impoundment to reservoir.

Actinotaenium wolfei (Grönl.) Teil. No 119.
Collected from dripping side of small iron storage tank, roadside of hill.

Closterium cynthia de Not Nos 112, 113, 122.
Collected from bottom muds, reservoir.
Recorded in pond, Ampang (Biswa, 1929).
Closterium libellula Focke var. intermedium (Roy et Biss.) G. S. West Nos 111, 112 — Plate 3D

Collected from bottom muds of reservoir.
The species was recorded from the Taiping Lakes (Prowse and Ratnasabapathy, 1970).

Closterium libellula Focke var. interruptum (West et West) Donat Nos 120, 126.
Collected from stream mud.

Closterium parvulum Någ. No 120.
Collected from stream muds.

Reported from Johore (Bernard, 1909); Setapak Lake (Biswas, 1929); paddy fields, Beranang (Johnson, 1970); elsewhere in Malaysia (Prowse, 1957a).

Closterium navicula (Bréb.) Lütkem. No 115.
Scraped from moist rock, grows mixed in with Cosmarium spp., Cylindrocystis and Cyanophyceae. Recorded from Taiping Lakes (Prowse and Ratnasabapathy, 1970).

Collected from muds and vegetation in reservoir.
Recorded in Templer Park (Hirano, 1967).

Closterium tumidum Johnson Nos 104, 123.
Collected from muds overlying bottom rock of stream.
Recorded in pond, Setapak (Biswas, 1929).

Species of Closterium were found in practically all the samples of streams, rock pools, roadside drains and the reservoir. As an adventitious element in the plankton of both flowing and still waters they were not conspicuous. Multiplication by transverse division of cells was evident and appears to be the general method of maintaining the populations. Zygospore formation was lacking. The widespread occurrence, the ability to colonize a variety of ecological niches and fair abundance suggest ecological and economic importance.

Pleurotaenium minutum (Ralfs) Delp. var. minus (Racic.) Krieg. Nos 104, 119, 125.

From rock scraping and mud of stream; dripping side of small iron storage tank, roadside of hill.

Var. excavatum was recorded from Taiping Lakes (Prowse, and Ratnasabapathy, 1970).

Pleurotaenium trabecula (Ehrenb.) Någ. No 120, 122–124.
Collected from stream muds, mixed in with other algae and occasionally in plankton. Fairly common.

Tetramorium laevis (Kütz.) Ralfs Nos 120, 124, 126 — Plate 4C

Cells up to 130 μ long and eight times the breadth, sinus open and conspicuous; semi cell slightly inflated just above base, apex deeply incised with the lobes somewhat rounded and asymmetrical; cell wall finely punctate, four punctae radially arranged at base of apical incision; chloroplast ridged with about six pyrenoids arranged longitudinally.

Collected from stream muds. Fairly common.
Recorded elsewhere in Malaysia (Prowse, 1957a).
Euastrum binale (Turp.) Ehrenb. var. brevius (Bernard) Hirano No 125.
A small species fairly frequently found in waters of streams.
Reported from Templer Park (Hirano, 1967).
Euastrum dubium Wolle No 113.
Collected from small impoundment to reservoir.
Euastrum sinuosum Lenorm. var. dideltoïdes Krieg. Nos 109-111 — Plate 4A
A larger species, up to 75 μ long.
Amongst vegetation and bottom muds, reservoir.
The species was recorded from Taiping Lakes (Prowse and Ratnasabapathy, 1970).
Euastrum gnathophorum W. et G.S. West Nos 106, 107, 120, 124.
Collected from stream muds.
Recorded from Taiping Lakes (Prowse and Ratnasabapathy, 1970).
Euastrum turgidum Wolle No 119.
Collected from dripping side of small iron storage tank, roadside of hill.
Cosmarium contractum Kirchn. Nos 120, 124.
Collected from stream.
Var. Jacobsenii was recorded in a pond, Ampang (Biswa, 1929).
Cosmarium decoratum W. et G.S. West No 18.
Collected from stream muds.
Cosmarium hians Borge forma No 113.
Collected from small impoundment to reservoir.
Cosmarium lunatum Turn. Nos 111, 118, 120.
Collected from pool with flowing water, hill roadside; bottom muds, stream; bottom muds, reservoir. Common.
Cosmarium quadrifarium Lund. No 118.
Collected from bottom muds, reservoir.
Cosmarium taxichondrum Lund. No 118.
Collected from pool, roadside drain with flowing waters. Rare.
Cosmarium sp. No 106 — Plate 4B
Several other species of Cosmarium specifically unidentifiable are not listed.
Staurastrum sp. No 114.
Planktonic in reservoir.
Spondylosium pulchellum Arch. No 127.
Short chains of cells epiphytic on aquatic vegetation in stream.
Hyalotheca dissiliens (J.E. Smith) Brèb. Nos 107, 120, 124, 127 — Plate 4D
Collected from stream, common in samples of other filamentous algae.
Recorded in pond, Setapak (Biswa, 1929); from elsewhere in Malaysia (Prowse, 1957a).
Analysis of Results

Among the algae collected, 57 genera and 102 species including varieties were identified. About 25 species were attached forms, and 72 species occurred in the bottom muds or as tychoplankton. The true planktonic element appeared to be lacking and the few encountered such as Frustulia rhomboides and Hyalotheca dissiliens were largely adventitious, stirred up from the bottom and suspended by the flowing waters. This was inferred from their abundant presence in bottom samples, apart from their features of habit and morphology. There was an abundant population and often a rich variety of species, especially desmids and diatoms, in the shallower, slow-flowing stretches of streams with aquatic phanerophytes, bryophytes and decaying vegetation and where the canopy of trees overhead was less dense. The reservoir, which is a comparatively small habitat, being only about twenty metres square, had some 25 species, though few of these also occurred in the stream.

The number of species in the Divisions of algae represented in these collections were as follows: Cyanophyta 13, Rhodophyta 1, Pyrrophyta 1, Bacillariophyta 19, Chrysophyta 6, Xanthophyta 4, Euglenophyta 5, and Chlorophyta 51. The Cyanophyta, Bacillariophyta and Chlorophyta were also numerous in number of individuals and may be considered as dominant. Among the Chlorophyta, the Zygmenatales formed about 80% of which the Desmidiaceae alone comprised two-thirds. Several of the species of algae are known to occur outside Malaysia, some have been recorded from elsewhere in Malaysia, and some are being recorded for the first time here. The occurrence of the temperate species Dinococcus bicornis Fott here extends its known range of geographical distribution.

The presence of Dinobryon sertularia and species of the related flagellate Mallomonas in the reservoir may be undesirable with respect to the quality of a water source. Population outbursts of Dinobryon and Mallomonas have been reported to impart an obnoxious odour and a fishy taste to the waters of Hoover Reservoir, Ohio and Lake Michigan thus necessitating the treatment of the water supplies (Palmer, 1964).

There are many problems concerning the freshwater algae of Gunong Jerai worthy of further investigation. Species of Closterium, Cosmarium, and Frustulia rhomboides were common and widely distributed; Batrachospernum, though rarer, showed an interesting sporadic occurrence with Audouinella-like thalli which may turn out to be the juvenile stages of the species. Studies on such aspects as their distribution, morphological variation, taxonomy, reproduction and life history should be rewarding. A comparative study of the Gunong Jerai algal flora with similar areas in other parts of Malaysia is not possible owing to the lack of published records. It may be mentioned, however, that about seven of the nineteen species of diatoms listed have been previously recorded at Cameron Highlands (see Prowse, 1962a). There is a wide and exciting field for future investigation of the Malaysian mountain algal floras.

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Plate 1. *Batrachospermum ? moniliforme* Ralfs

*A*: Apex of thallus stained with Phloxine B
*B*: Whorls of lateral branches of limited growth
*C*: Cystocarps at periphery of whorl of lateral branches
Plate 2.

A: *Batrachospermum ? mouliforme* Ralfs, cystocarp terminal on short lateral branch, stained with Phloxine B

B: Idem, spermatia on lateral branches of limited growth

C: *Dinococcus bicornis* Fott, epiphytic on colonial *Desmogonium*, front view
Plate 3.

A: Dinococcus bicornis Fott, epiphytic on filamentous Xanthophyceae, front view
B: Idem, end view
C: Netrium digitus (Ehrenb.) Itzigs. et Rothe
D: Closterium libellula Focke var. intermedium (Roy et Biss.) G. S. West
Plate 4.


B: *Cosmarium* sp.

C: *Tetemosus laevis* (Kütz.) Ralfs

D: *Hyalotheca dissiliens* (Smith) Bréb. stained with methylene blue (oil immersion)
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