

***Thorea prowsei* sp. nov. and *Thorea clavata* sp. nov.  
(Rhodophyta, Nemaliales) from West Malaysia**

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Two new species of the freshwater red algal genus *Thorea* BORY (Nemaliales) found in West Malaysia are described. They occur as lithophytes in cool, clear, unpolluted hill country streams.

*Thorea prowsei* is dedicated to the late Professor GERALD A. PROWSE. *Thorea clavata*, as the name implies, refer to the characteristic shape of the assimilatory filaments. The occurrence of any other species of *Thorea* in Malaysia is not known.

*Key Index Words:* freshwater algae; Malaysia; Nemaliales; Rhodophyta; taxonomy; *Thorea prowsei* sp. nov.; *Thorea clavata* sp. nov.

Eight species of the genus *Thorea* BORY (1808) are known. They are as follows: *T. ramosissima* BORY (1808), *T. violacea* BORY (1808), *T. gaudichaudii* C. AGARDH (1824), *T. andina* LAGERHEIM et MÖBIUS (1891), *T. zollingeri* SCHMITZ (1892), *T. brodensis* KLAS (1936), *T. okadai* YAMADA (1949) and *T. riekei* BISCHOFF (1965). A concise historical review including the type locality of these species, except for *T. riekei* described later by BISCHOFF, is available in the publication by YAMADA (1949). *T. riekei*, which may grow up to 2 m long, was found attached to stream rocks in Landa Park, Texas (BISCHOFF, 1965). *T. ramosissima*, the only known *Thorea* species from India, was recently reported from the Nakatia river (KHAN 1978) and the Khannaut river (PANDEY and CHATURVEDI 1979) in the state of Uttar Pradesh.

In Malaysia, the occurrence of *Thorea* had not been known until recently. In our studies of the freshwater algae in West Malaysia two species of this genus were found, one in the Tahan River, Pahang State in August 3 and 5, 1971 and the other in the

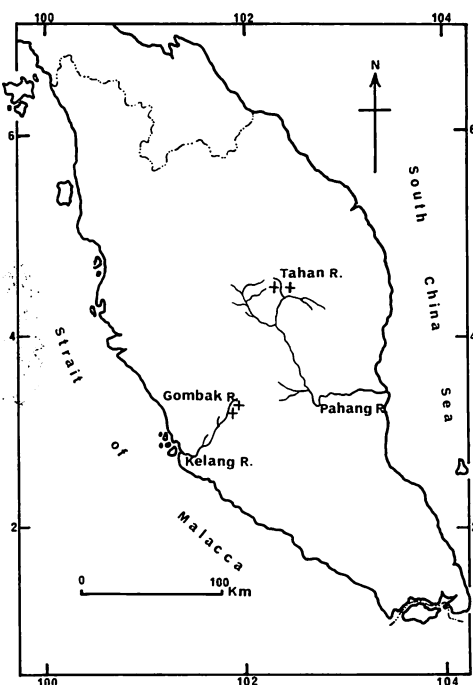


Fig. 1. Map of the Tahan River and the Gombak River in West Malaysia. Cross marks show the localities of *Thorea* spp. .

Gombak River, Selangor State in May 6 and 20, 1978 and May 12 and 26, 1979 (Fig. 1). The morphological characters of vegetative and reproductive organs indicate that these two specimens are clearly different from each other, and moreover represent hitherto undescribed species of *Thorea* (RATNASABAPATHY and SETO, in press). In the present paper we provide the full descriptions and diagnoses of these two new species.

### Material and Methods

The species of the Tahan River grows on downstream surfaces of granitic rocks 10–20 cm below the surface of swift, clear, unpolluted, fresh river water flowing through primary mountain forest valleys. At the points of collection the river was 20–30 m wide and fairly exposed to sunlight, the water temperature at the time of collection (10:00 am) was 24°C. The species of the Gombak River grows on downstream or

upper surfaces of granitic rocks, 5–40 cm below the surface of clear, unpolluted, fresh, relatively fast or slow stream water, flowing through primary hill country forest with overhanging riverine vegetation. The stream at the sites of collection was 2–3 m wide with occasional wide breaks in the vegetation admitting much sunlight. The water temperature at the times of collection (9.30–10.30 am) ranged from 22–22.1°C, with a pH of 6.6. Samples were collected by carefully pulling off thalli with fingers from rock substrata, and placing them in labelled tubes with some river water. Initial microscopical examination of fresh material was done on the same or following day of collection. For detailed work later samples were preserved in 50% SMITH'S solution (1950), a mixture of formalin, acetic acid and alcohol solution. Drawings were made with the aid of a Leitz drawing tube. The mean dimensions were derived from at least 22 to over 250 measurements of the respective

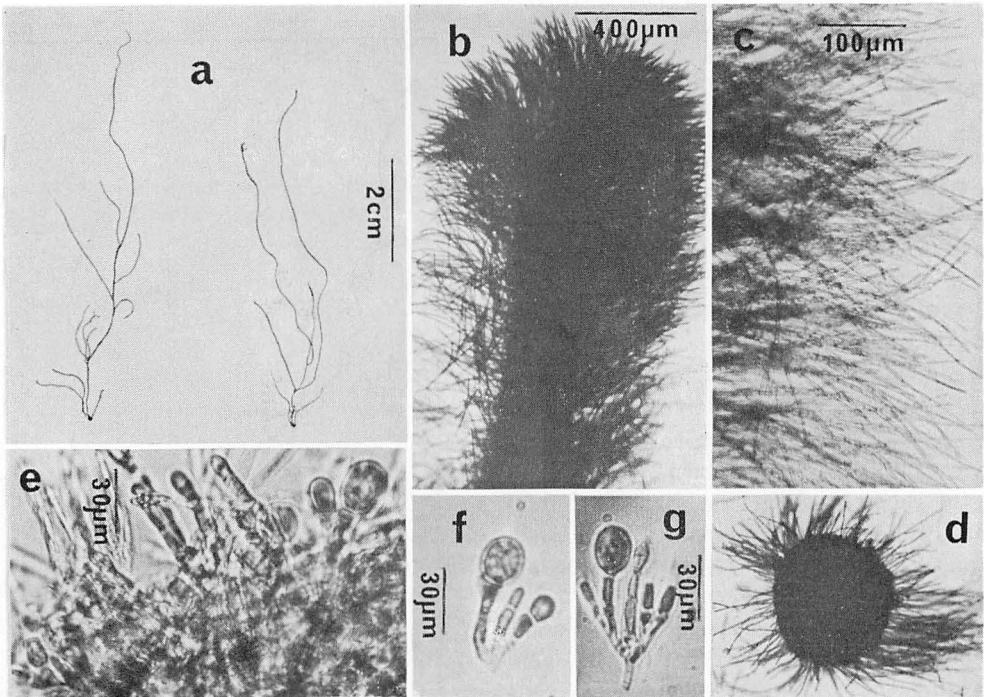


Fig. 2. *Thorea prousei* from the Tahan River. a. *Thorea prousei* RATNASABAPATHY et SETO, sp. nov.; b. Assimilatory filaments and medullary portion of main branch; c. Hair portion and frequently branched filaments; d. Cross section of main branch (b and d are of the same magnification); e–g. Monosporangia.

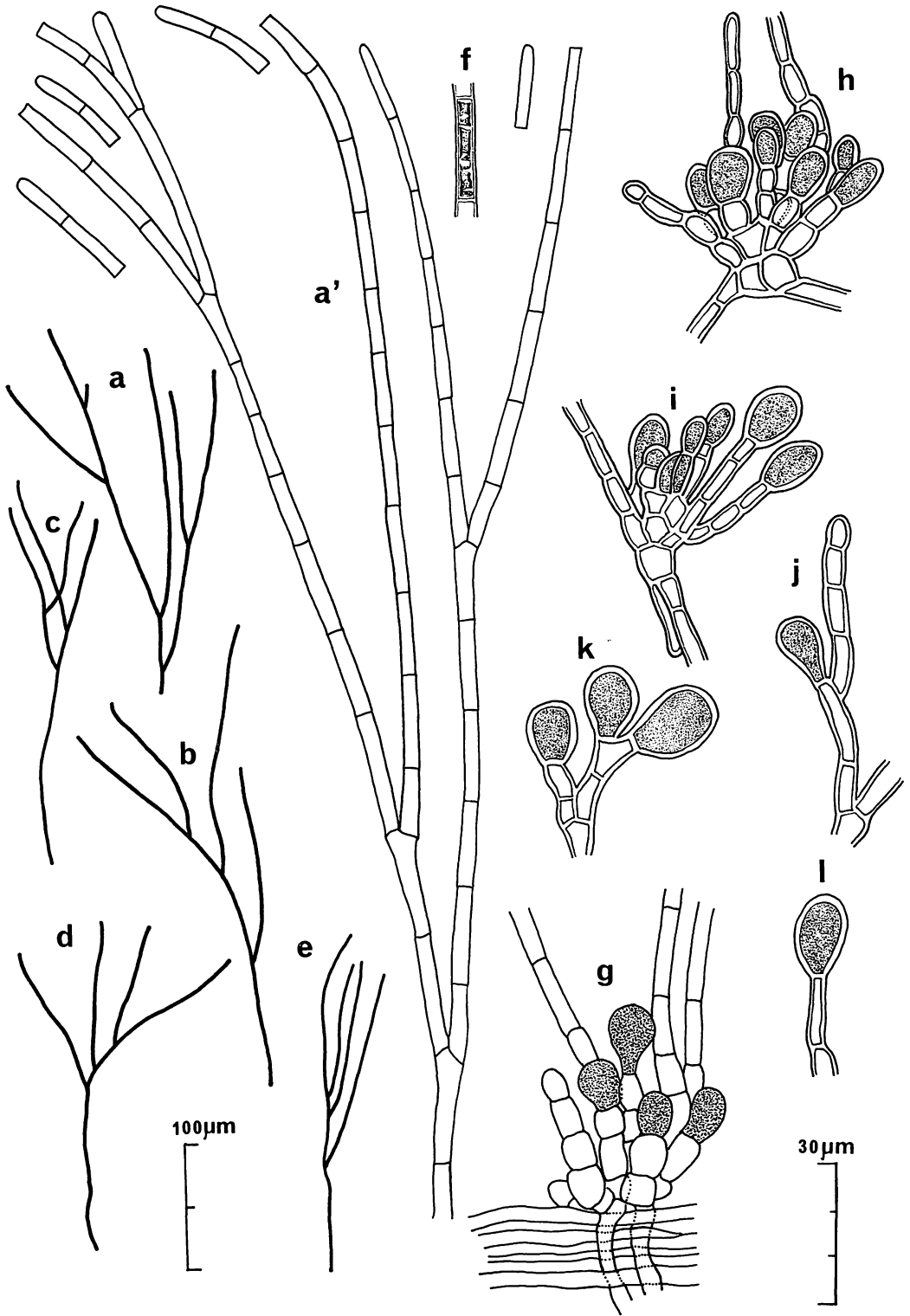


Fig. 4. Hair and basal portions of assimilatory filaments and monosporangia of *T. prowsei*. a—e. Showing frequent branching of hair portion. Magnified figure a is the same material as a. f. Plastids of assimilatory filament cell. g. Basal portion of assimilatory filaments and monosporangia occurring at the base of filament. h—l. Monosporangia.

cells or parts of several thalli.

### Description of the Species

#### 1. *Thorea prowsei* RATNASABAPATHY et SETO sp. nov. (Figs. 2, 4).

Thallus cespitosus, valde gelatinosus, parvus, 5–15 cm longus, brunneus, sparsim ramificans. Ramus principalis (540–) 915 (–1500)  $\mu\text{m}$  in diametro crassus, ex parte medullosa et fillis assimilativis constants; pars medullosa (120–) 262 (–395)  $\mu\text{m}$  lata. Rami laterales alternantes, prope partem basalem saepe orientes. Hapteron generatim discoideum, in diametro 0.7–1.6 mm crassum.

Fila assimilativa e parte basali et parte piliformi constantia; pars piliformis saepe et dense ramosa, ad apicem contractae, (115–) 342 (–605)  $\mu\text{m}$  longa, ex (13–) 18 (–30) cellulis constantia. Cellulae in parte piliformi cylindricae, (11.5–) 21.1 (–40)  $\mu\text{m}$  longae, (2–) 4.1 (–7)  $\mu\text{m}$  in diametro crassae, cellulae apicae subrotundatae; chromatophora irregulariter lobata, parietalia, et laminaria. Monosporangia fasciculata vel solitaria ex parte basali filii assimilativi oriundis, obovata vel clavate vel ovalia, (10–) 15.3 (–24)  $\mu\text{m}$  longa, (7–) 11.3 (–20)  $\mu\text{m}$  in diametro crassa. Reproductio sexualis ignota.

Thallus tufted, very mucilaginous, more

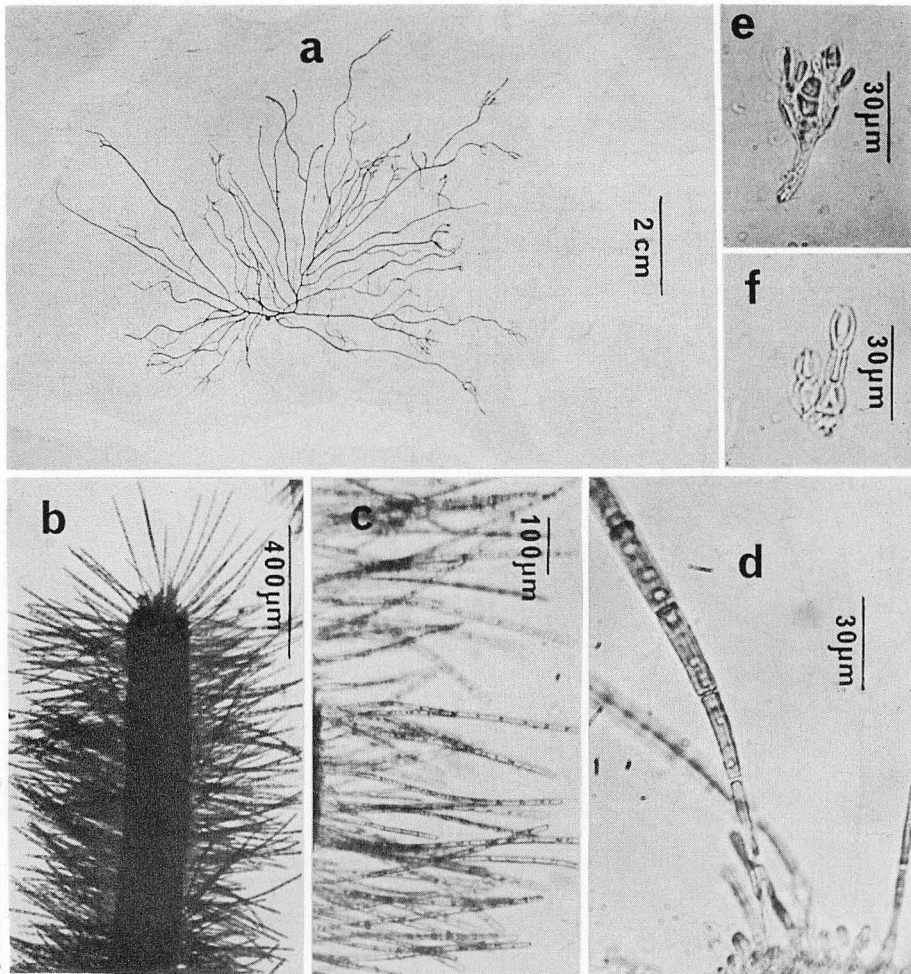


Fig. 3. *Thorea clavata* from the Gombak River a. *Thorea clavata* RATNASABAPATHY et SETO sp. nov.; b. Assimilatory filaments and medullary portion of main branch; c. Hair portion and rarely branched filaments; d. Assimilatory filaments and their base showing their gradual tapering from apex to base; e–f. Monosporangia.

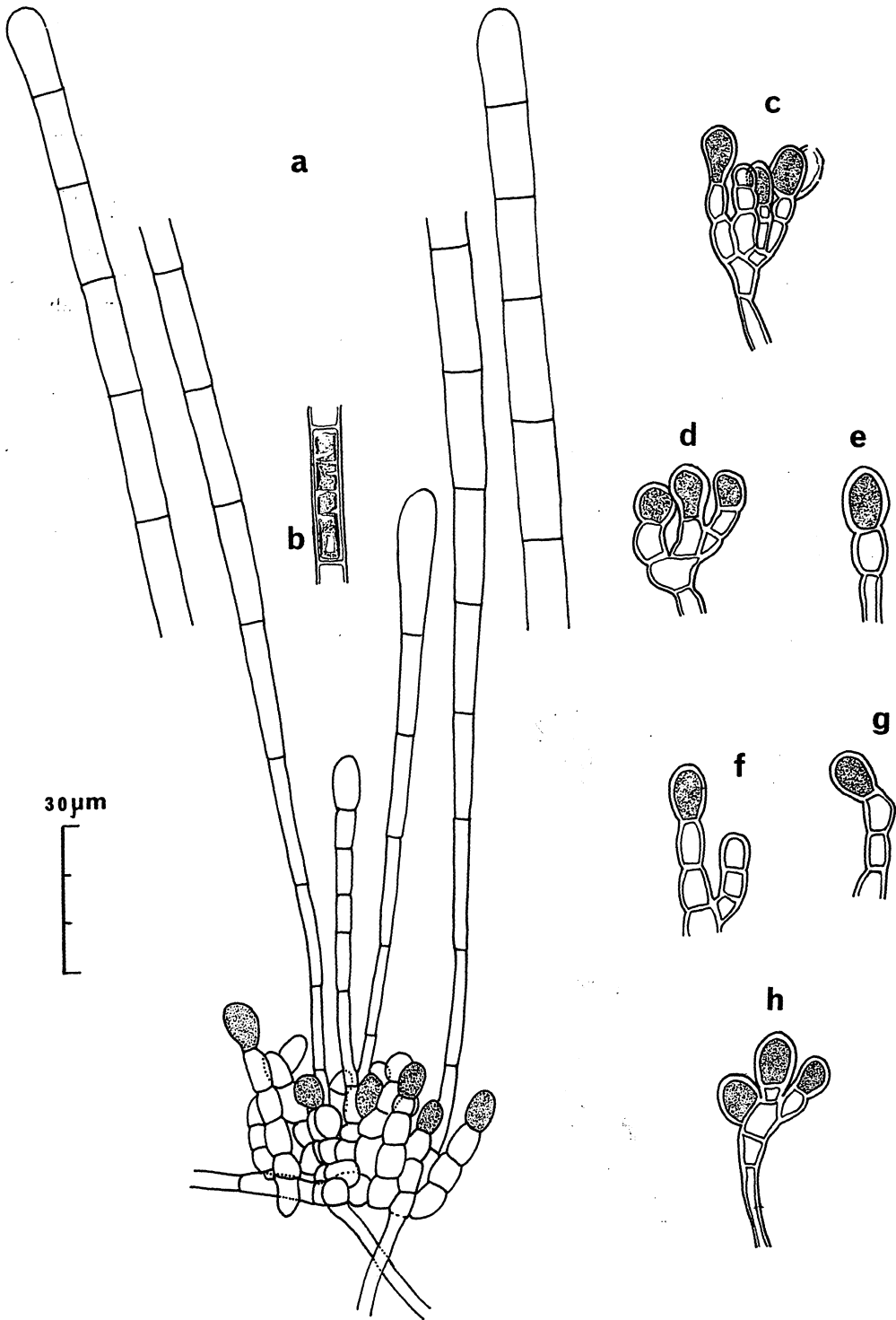


Fig. 5. Hair and basal portions of assimilatory filaments and monosporangia of *T. clavata*; a. Group of assimilatory filaments showing their gradual tapering from apex to base and monosporangia occurring singly at the base of filaments; b. Plastids of assimilatory filament cell; c—h. Monosporangia.

or less small, 5–15 cm in length, deep brown in colour (Fig. 2a), sparsely branching. Main branch (540–) 915 (–1500)  $\mu\text{m}$  in diameter, consisting of both medullary portion and assimilatory filaments; the medullary portion (120–) 262 (–395)  $\mu\text{m}$  in width (Figs. 2b, d). Lateral branches alternate, usually originate near the base of the main branch, occasionally elsewhere. Holdfasts generally discoid, 0.7–1.6 mm in diameter. Assimilatory filaments consisting of the basal portion (Fig. 4g) and the hair portion, the hair portion frequently and densely branched, tapered toward apex (Figs. 2c, 4a a'–e), (115–) 342 (–605)  $\mu\text{m}$  in length, consisting of (13–) 18 (–30) cells; cells of hair portion cylindrical, (11.5–) 21.1 (–40)  $\mu\text{m}$  in length, (2–) 4.1 (–7)  $\mu\text{m}$  in width, apical cells rounded; chloroplasts irregularly lobed parietal, laminate, (Fig. 4f). Monosporangia in thick clusters or solitary, derived from the base of assimilatory filaments, obovate, elliptic or clavate, (10–) 15.3 (–24)  $\mu\text{m}$  in length, (7–) 11.3 (–20)  $\mu\text{m}$  in width (Figs. 2e–g, 4g–i).

Holotype: Monosporangial, Aug. 3, 1971, Peninsula Malaysia, Pahang State, Tahan River, attached to stones in flowing water, collector M. RATNASABAPATHY, (M.R. 21, private herbarium).

Isotype: In herbarium Kobe College, Japan, R. SETO.

*Thorea prowsei* resembles *Thorea brodensis* KLAS (1936) in sparse ramification and assimilatory filaments frequently branching with cells of similar dimensions, but differs from it in shorter frond, narrow medullary portion and large monosporangia derived from the base of the assimilatory filaments. Form and dimensions of monosporangia of *T. prowsei* are also similar to those of *T. gaudichaudii* from Guam and Okinawa described by SETO (1979), but monosporangia of the former occur more thickly in a cluster than the latter.

This species is named in honour of the late Professor GERALD ALBERT PROWSE, formerly Director, Tropical Fish Culture Research Institute, Melaka, Malaysia, for his scholarly and dedicated contributions towards the advancement of freshwater phy-

cology and its applications in Malaysia and for his having been a constant guide in algological studies to M. RATNASABAPATHY.

## 2. *Thorea clavata* SETO et RATNASABAPATHY sp. nov. (Figs. 3, 5).

Thallus parvulus, potius gracilis, cespitosus, valde gelatinosus, 4.5–10–(12) cm longus, hepaticus, in thallo juveniliore vix vel sparsim ramificans, in thallo vetustiore saepe ramificans. Ramus principalis (480–) 864 (–1425)  $\mu\text{m}$  in diametro crassus, ex parte medullosa et filis assimilativa constans; pars medullosa (115–) 236 (–420)  $\mu\text{m}$  lata. Hapteron generatim discoideum 0.38–1.35 mm in diametro crassum. Fila assimilativa e parte basali et parte piliformi constantia; pars piliformis raro ramosa clavata, ex apice ad basem gradatim contracta; (130–) 341 (–840)  $\mu\text{m}$  longa, plerumque ex (8–) 17 (–40) cellulis constantia. Cellulae in parte piliformi cylindricae, (10–) 21.1 (–50)  $\mu\text{m}$  longae, (2–) 5.8 (–9)  $\mu\text{m}$  in diametro crassae; cellulae apice rotundatae; chromatophora irregulariter lobata, parietalia et laminaria. Monosporangia solitaria vel fasciculata ex parte basali filii assimilativi oriundis, ovalia, obovata vel pyriformia, (8–) 11 (–20)  $\mu\text{m}$  longa, (5.5–) 7.9 (–14)  $\mu\text{m}$  crassa. Reproductio sexualis ignota.

Thallus small, rather slender, tufted, very mucilaginous, 4.5–10–(12) cm in length, dull brown in colour (Fig. 3a); none or sparsely branching in younger thalli, often branching in some older thalli. Main branch (480–) 864 (–1425)  $\mu\text{m}$  in diameter, consisting of both medullary portion and assimilatory filaments. The medullary portion (115–) 236 (–420)  $\mu\text{m}$  in width (Fig. 3b). Holdfasts generally discoid, 0.38–1.35 mm in diameter. Assimilatory filaments, consisting of both the basal portion and the hair portion; the hair portion unbranched or rarely branched, clavate, gradually tapered from apex toward base, (130–) 341 (–840)  $\mu\text{m}$  in length, usually consists of (8–) 17 (–40) cells (Figs. 3c–d, 5a). Cells of hair portion cylindrical, (10–) 21.1 (–50)  $\mu\text{m}$  in length, (2–) 5.8 (–9)  $\mu\text{m}$  in width; apical cells clavate with rounded apices (Fig. 5a); chloroplasts parietal, laminate, irregu-

larly lobed (Fig. 5b). Monosporangia solitary or in clusters, derived from the base of assimilatory filaments, oval, obovate or pyriform, (8-) 11 (-20)  $\mu\text{m}$  in length; (5.5-) 7.9 (-14)  $\mu\text{m}$  in width (Figs. 3e-f, 5a, c-h).

Holotype: Monosporangial, May 6, 1978, Peninsular Malaysia, Selangor State, Gombak River (19 mile stone) attached to rocks in flowing water, collector M. RATNASABAPATHY (M. R. 1218, private herbarium).

Isotype: In herbarium Kobe College, Japan, R. SETO.

*Thorea clavata* resembles *Thorea riekei* BISCHOFF (1965) in sparse ramification and length of rarely branched assimilatory filaments, but differs from it in very small frond and the club-like form of the assimilatory filaments. This latter feature, viz. the gradual tapering of the assimilatory filaments from the somewhat swollen apex to base, is very distinctive and has not been known in any other species of the genus *Thorea*.

## Discussion

The results of the present study show that the thalli of these two new species of *Thorea* in West Malaysia are usually very small and sparsely branched. The features shared with both species are 1) their usually gregarious, patchy and erratic occurrence, 2) their secretion of copious mucilage, rendering them slippery to the touch and 3) their possession of parietal, laminate and irregularly-lobed chloroplasts. NAKAMURA (1980) observed a seasonal variation of *T. okadai* in temperate Japan and mentioned that specimens with more branched assimilatory filaments occur in the autumn, their growing season. In the present study, their seasonal occurrence and seasonal morphological variation have not been observed. However, it is noted that their rarity or absence at the sites of collection on subsequent visits appear to be more a reflection of the local habitat rather than due to any seasonal changes. The collection sites are characterized by relatively uniform warm climatic condition, and BISHOP (1973) con-

cluded that water temperatures in the Gombak area were seasonally and diurnally stable at about 24°C. Thus we conclude that our two Malaysian specimens of *Thorea* are hitherto undescribed species.

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#### M. ライトナサバパティ-・瀬戸良三\*\*：西マレーシアにおける紅藻チスジノリ属の2新種

淡水産紅藻類のチスジノリ属の2種が、西マレーシアの北東部ターハン川と、クアラルンプール郊外のゴンバ川で発見された。これはマレーシアにおける本属の最初の報告である。この両種は本属の既知種に比して、藻体がかきわめて小さく、分枝が少ないのが、共通の特徴である。ターハン川の *T. prowsei* は *T. brodensis* に最も類似するが、藻体は一層小さく、髓層の幅がせまく、単胞子嚢が大きく、同化糸の基部に密集して形成される点が著しく異なる。ゴンバ川の *T. clavata* は *T. riekei* によく類似するが、藻体はこれよりはるかに小さく、同化糸が先端から基部に向かって次第に細くなり、全体が棍棒状になっているのが主要な特徴である。この特徴はまた本属の既知種にも見られないものである。この研究の結果から判断して、このマレーシアの2産地のそれぞれの種は明かに異なる新種であると考えられる。(\*Department of Botany, University of Malaya, Kuala Lumpur, Malaysia. \*\*662 西宮市岡田山 4-1, 神戸女学院高校生物学教室)

#### 大野正夫：ラオ博士を悼む Masao OHNO: Palur Sreenivasa RAO (1931-1981)

インド国の国立 Central Salt & Marine Chemicals Research Institute の P. S. RAO 博士が1981年5月26日突然療治先のバローダの大学病院で脳出血のため50才の生涯を閉じられた。Rao 博士は南部インドのハイダー・バードに生れ名門のパナラス・ヒンドー大学で藻類を学び、海藻の分類・生態の研究を続けてきた。

1966年に1年間東海区水産研究所に留学し、須藤俊造博士の指導でテングサ属の生活史に関する研究をし、学位論文はインド産寒天原藻の *Gelidiella acerosa* の分類、生活史、生態に関する研究であった。滞日中は日本語もうまくなり、多くの日本の藻類研究者と接しておられた。彼の仕事は *Gelidiella* 属に関するものが多く31の報文があり、インドにおける寒天原藻の分類・生態から応用分野まで大きな足跡を残した。また Marine Algae 部門のチーフ・リーダーとして海藻の抗菌物質やホンダワラからアルギン酸やメタンガス製造に関する研究を指導していた。

彼の最近の業績は、1979年にインド政府・ユネスコ主催で、インド洋海域の海産藻類に関する国際シンポジウムを開催したことであろう。筆者はこのシンポジ

ウムに参加し、発展途上国の若手研究者の熱意に感動した。さらに昨年11月から3ヶ月国際協力事業団の専門家として再び訪れ、彼とともに日本の海苔網を用いて、インド洋で海藻の養殖試験を行ない、成功して喜びあった。彼の夢は、アジア・アフリカ地区の海藻研究者のための国際共同利用実験所をインドに設置することであった。すでにインド政府やユネスコに働きかけていた。彼は優秀な研究者であったとともに行政的な手腕もあり、インドにおける藻類学研究の推進者の1人であった。彼は再度日本へ訪れることを強く希望し、その手続を進めていた矢先であった。彼は長年にわたり日本藻類学会々員であった。

Mrs. RAO も藻類研究者で、同じ部門の上級技官の職にあり、学位をとる準備をしていた。彼女からの RAO 博士の突然の死を伝える手紙には「私は3人の子供達(大学生と高校生)を育てながらも学位はとるつもりである」と書かれていた。

P. S. RAO 博士のご冥福を心からお祈り申しあげる。

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