CHAPTER V

CONCLUSION

The objective of this research is to identify the species of Genus Padina. The work was done by studying the speciemens, both personally collected and those provided from the Faculty of Fisheries, Kasetsart University, and the Department of Botany, Chulalongkorn University. The specimens were examined the whole fertile plant first, with the un-aided eyes or the binocular microscope, then minute pieces from various parts of the frond were sectioned, both radial and transversely by freehand method and examined under a compound microscope.

The characteristics used for examining are:

- sizes of the whole plant,
- calcification of blade,
- length and stupa of the stipe,
- branching of the blade,
- development of piliferous zones,
- width of the glabrous zones,
- bearing of reproductive organ,
- distribution of sori,
- present of indusia,

- number of cell layers forming the blade,
- size of superficial cells,
- size of reproductive organs, and
- occurring of hairs and rhizoids.

Eight species of Padina were found from this study, three of them are new record for Thailand. They are

Padina australis Hauck

P. boryana Thivy

P. distromatica Hauck, new record.

P. gymnospora (Kütz.) Vickers.

P. japonica Yamada, new record.

P. minor Yamada, new record.

P. pavonica (Linn.) Thivy

P. tetrastromatica Hauck

The key to these species are shown in pages and the distribution are shown in Table II. on page 46.

Table II Distribution of Padina spp. in Thailand.

Localities	P. australis	P. boryana	P. distromatica	P. gymnospora	P. japonica	P. minor	P. pavonica	P. tetrastromatica
Chon Buri Prov.:								
Patthaya								
Patthaya Tai Beach	+	+	−	+	−	+*	−	−
Sattahip								
Ao Dong Tan	+	−	−	+	+	−	−	−
Sri Racha								
Laem Tao Thewa	+	−	−	+	−	+*	−	+
Rayong Pro.:								
Ban Phe								
Suan Son			+*					
Marine Fisheries Station	+	+	+**	+	+	+*	+	+
Hard Hin Khao[1]								
Trat Prov.:								
Koh Chang	−	+	−	+	−	+*	−	−
Koh Mak	−	+	+	−	−	−	−	−
Laem Ngob								
Ao Tan	+	+	−	+	−	−	−	+
Surat Thani Prov.:								
Koh Samui	+	−	−	+	−	+	−	−
Sila Ngu	+	−	−	−	−	−	−	−
Phuket Prov.:								
Ao Makham	−	+	+	−	−	+	−	−
Ban Patong								
Laem Sing	−	−	−	−	−	+	−	−
Laem Panwa	−	+	−	−	−	−	−	−
Songkhla Prov.:								
Koh Nu	+	−	−	−	−	+	−	−
Koh Yaw	−	+	−	−	−	+	−	−

1 Only young thalli occur.
* rare
** abundant

Padina spp. usually found cast ashore almost all year round, but have not been utilized. If they can be used as a fodder or fertilizer like in other countries, they will turn to be valuable algae.


THAILAND
CONIC PROJECTION
SCALE OF MILES
0 50 100 150 200
SCALE OF KILOMETRES
0 50 100 200 300
International Boundary
Capitals of Countries
© Copyright HAMMOND INCORPORATED, Maplewood, N. J.
CHINA
BURMA
LAOS
CAMBODIA
NORTH VIETNAM
SOUTH VIETNAM
FEDERATION OF MALAYSIA
MALAYA
MALAY PEN.
GULF OF SIAM
GULF OF TONKIN
ANDAMAN SEA
SOUTH CHINA SEA
Gulf of Martaban
Strait of Malacca
Isthmus of Kra
BANGKOK
(Krung Thep)
Thonburi
RANGOON
Hanoi
Haiphong
Vientiane
Luang Prabang
Phnom Penh
SAIGON
Hue
Da Nang
Chiang Mai
Chiang Rai
Lampang
Phitsanulok
Nakhon Sawan
Nakhon Ratchasima
(Khorat)
Ayutthaya
Lop Buri
Udon Thani
Khon Kaen
Ubon
Nong Khai
Songkhla
Hat Yai
Nakhon Si Thammarat
Phuket
Mergui
Moulmein
Battambang
Angkor Wat
Sihanoukville
Penang
Kota Bharu
Ipoh
Mekong
Phanom Dang Raek
Plateau des Bolovens
Plain of Jars
Longitude East 100° of Greenwich
100°
104°
108°
20°

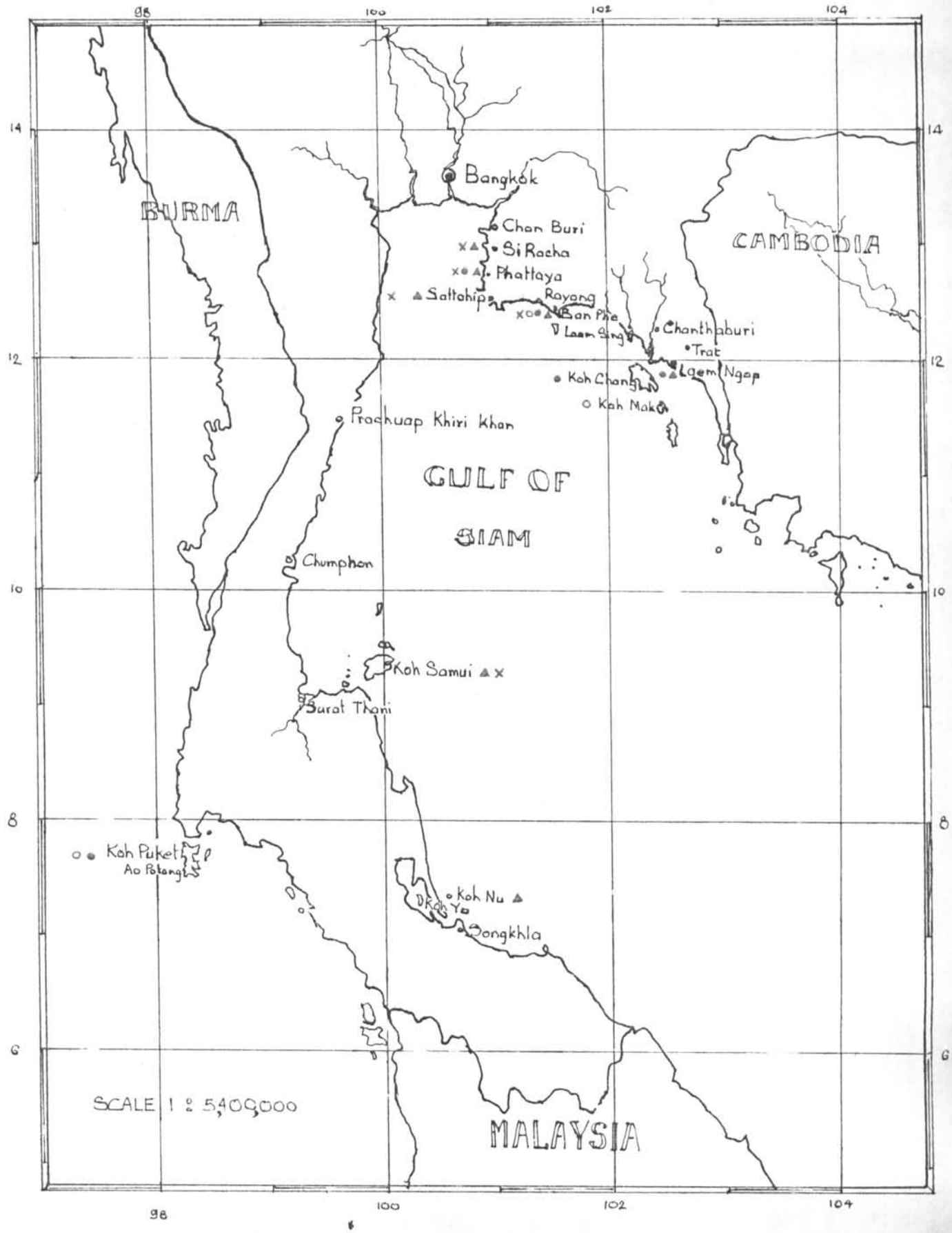
Plate II Map of the Gulf of Thailand showing the distribution of:-

▲ *Padina australis* Hauck,

● *P. boryana* Thivy,

○ *P. distromatica* Hauck,

x *P. gymnospora* (Kütz.) Vickers.


98
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102
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14
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10
8
6
BURMA
CAMBODIA
Bangkok
Chon Buri
Si Racha
Phattaya
Sattahip
Rayong
Ban Phe
Laem Sing
Chanthaburi
Trat
Koh Chang
Laem Ngop
Koh Mak
Prachuap Khiri Khan
GULF OF
SIAM
Chumphon
Koh Samui
Surat Thani
Koh Phuket
Ao Phang
Koh Nu
Yo
Songkhla
SCALE 1 : 5,400,000
MALAYSIA

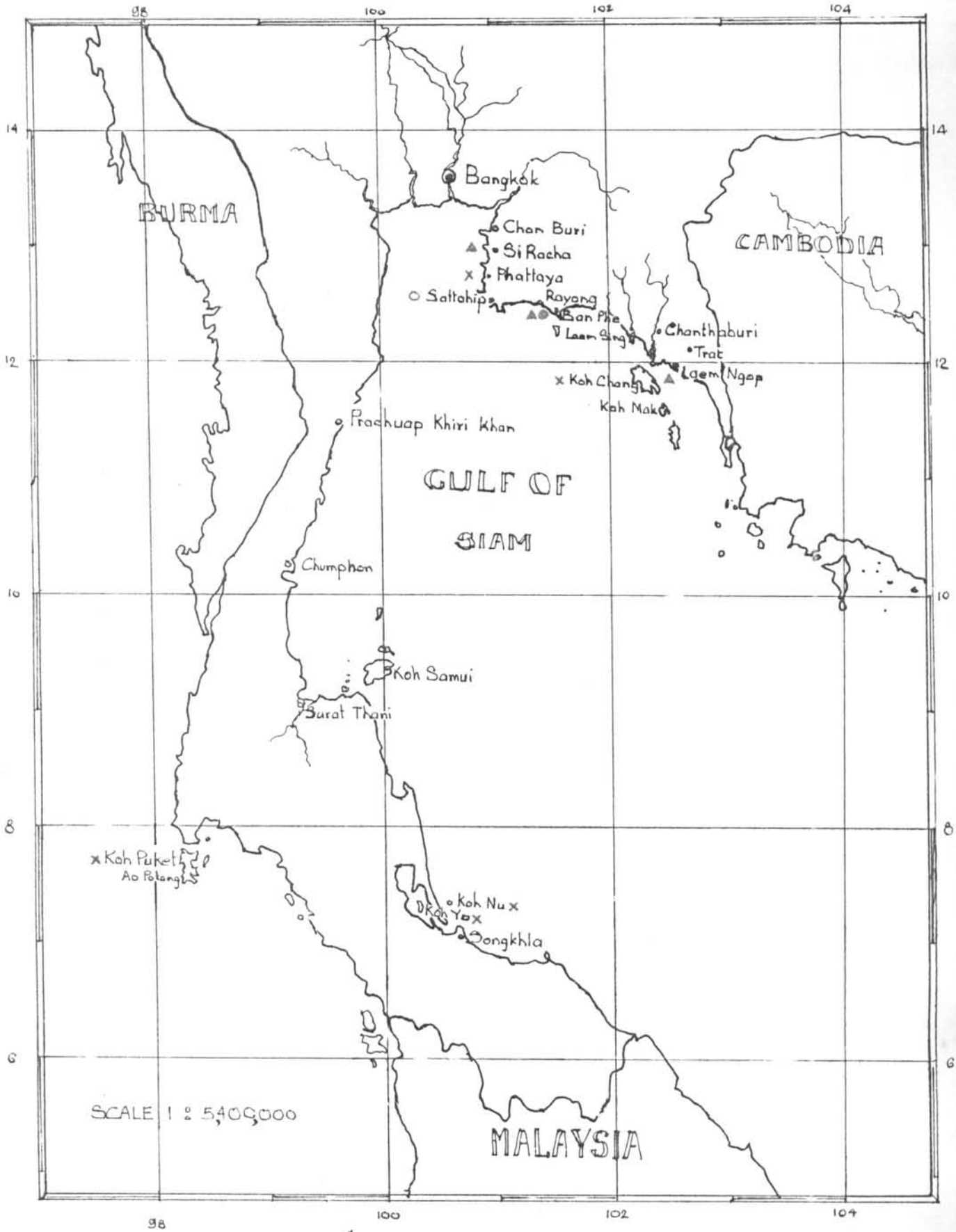
Plate III Map of the Gulf of Thailand showing the distribution of:-

o *Padina japonica* Yamada,

× *P. minor* Yamada,

• *P. pavonica* (Linn.) Thivy,

▲ *P. tetrastromatica* Hauck.


98
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BURMA
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Bangkok
Chon Buri
Si Racha
Phattaya
Sattahip
Rayong
Ban Phe
Laem Sing
Chanthaburi
Trat
Laem Ngop
Koh Chang
Koh Mak
Prachuap Khiri Khan
GULF OF
SIAM
Chumphon
Koh Samui
Surat Thani
Koh Phuket
Ao Phang-nga
Koh Nu
Yao
Songkhla
SCALE 1 : 5,400,000
MALAYSIA

Plate IV

Figure 1. Padina australis Hauck, sporophyte plant, showing lower surface which is moderately calcified, and tetrasporangial sori on the upper surface. (x 0.4).

Figure 2. Padina boryana Thivy, sporophyte plant showing both surfaces, piliferous lines and sori on the upper. (x 0.45).

Figure 1

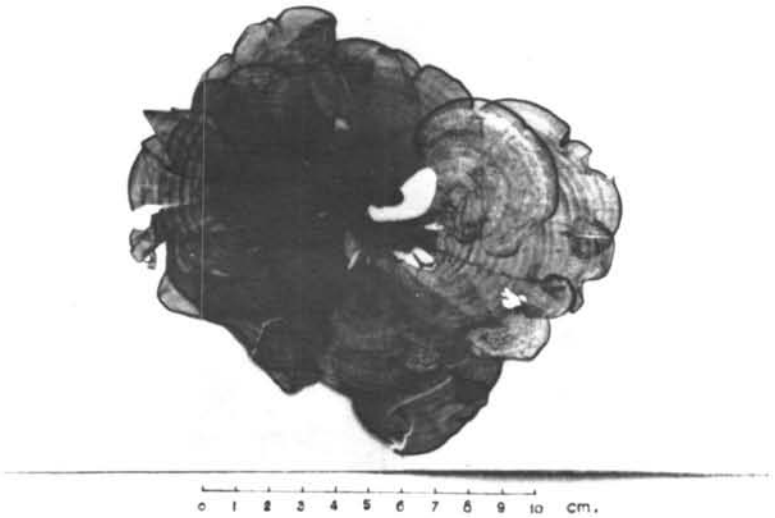


Figure 2

Plate V

Figure 1. *Padina distromatica* Hauck, sporophyte plant showing non-calcified blade, piliferous lines and tetrasporangial sori on the upper surface. (x 0.38).

Figure 2. *Padina gymnospora* (Kütz.) Vickers, sporophyte plant showing upper and lower surfaces; with piliferous lines and tetrasporangial sori on the upper. (x 0.38).

Figure 1

Figure 2

Plate VI

Figure 1. Padina japonica Yamada, showing piliferous lines and a band of tetrasporangial sori. (x 0.5).

Figure 2. Padina minor Yamada, showing upper and lower surfaces, with concentric lines of sori. (x 0.63).

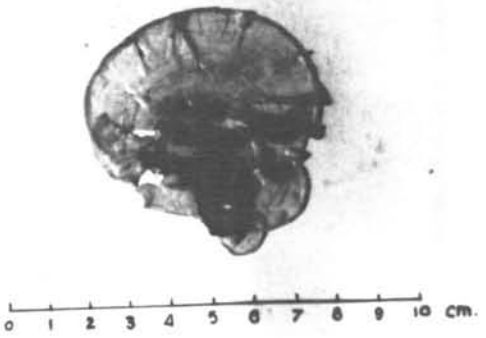


Figure 1

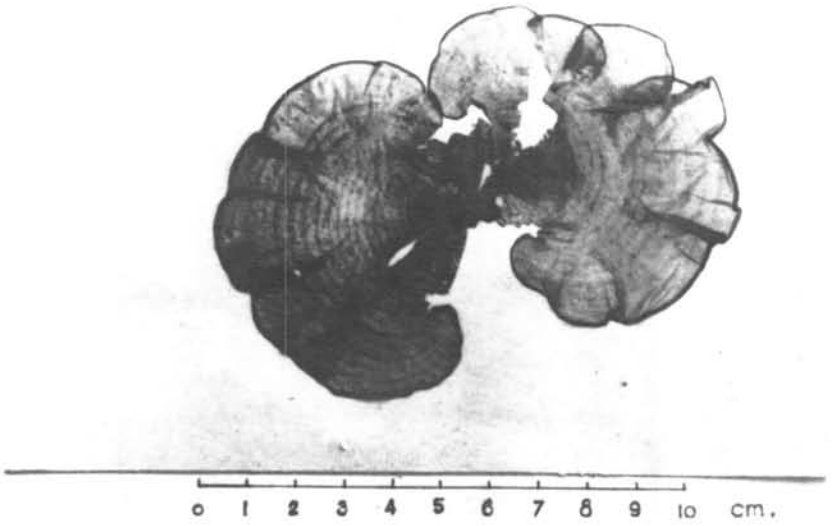


Figure 2

Plate VII

Figure 1. *Padina pavonica* (Linn.) Thivy, sporophyte plant showing piliferous lines and bands of tetrasporangial sori. (x 0.5).

Figure 2. *Padina tetrastromatica* Hauck, showing irregular branching lobes and concentric lines of tetrasporangial sori. (x 0.46).

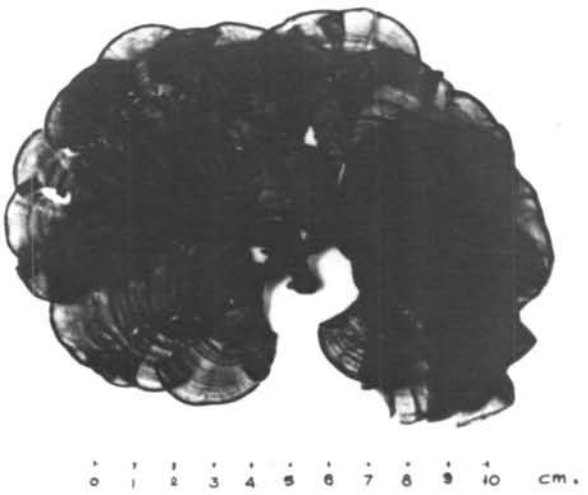


Figure 1

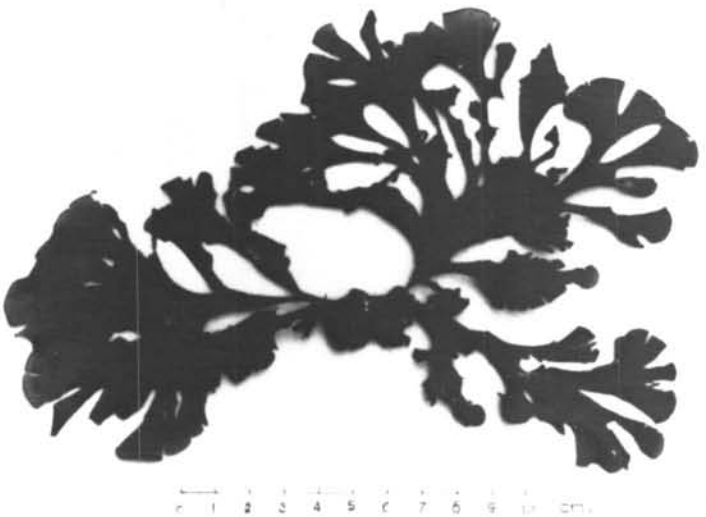


Figure 2

Plate VIII

Figure 1. Early developing plant of Padina sp., showing: f = young frond; l = uniseriate lateral branch; rh = rhizome. (x 2).

Figure 2. Surface view of margin of developing fan of Padina sp. showing position of original apical cell (a) and marginal initials, 1-5 segments of the apical cell (After Reinke, 1878).

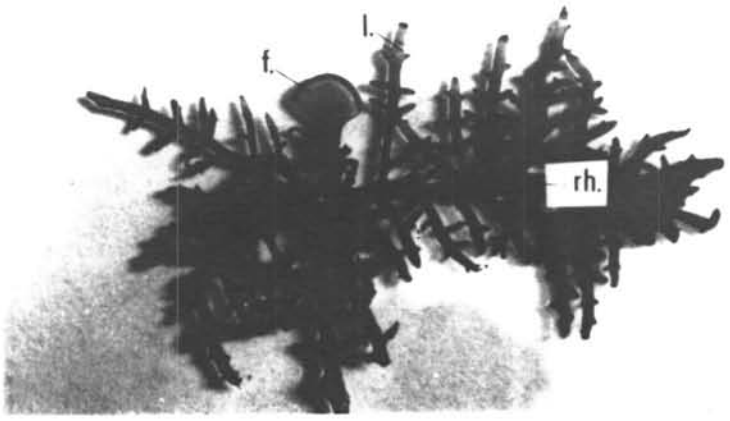


Figure 1

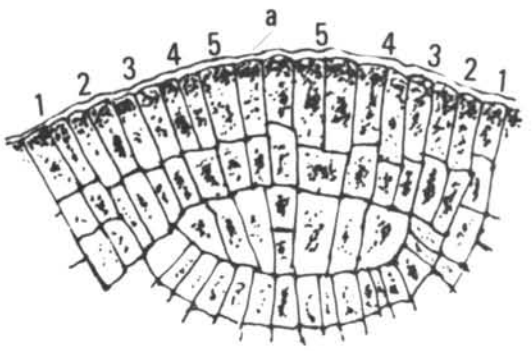


Figure 2

Plate IX

Figure 1, a-c. Germlings of tetraspores of *Padina sp.* showing a = apical cell, e = erect shoots, n = nodule, and rh. = rhizoid. (After Carter, 1927).

Figure 2. *Padina pavonica* Linn. showing formation of tetrasporangium and tetraspores

a. Sporangial initial before formation of stalk cell.
b. Sporangium and stalk cell.
c. Sporangium preceding meiosis.
d. Sporangium containing four spores, showing chromatophores disposed around the nuclei. (After Carter, 1927).

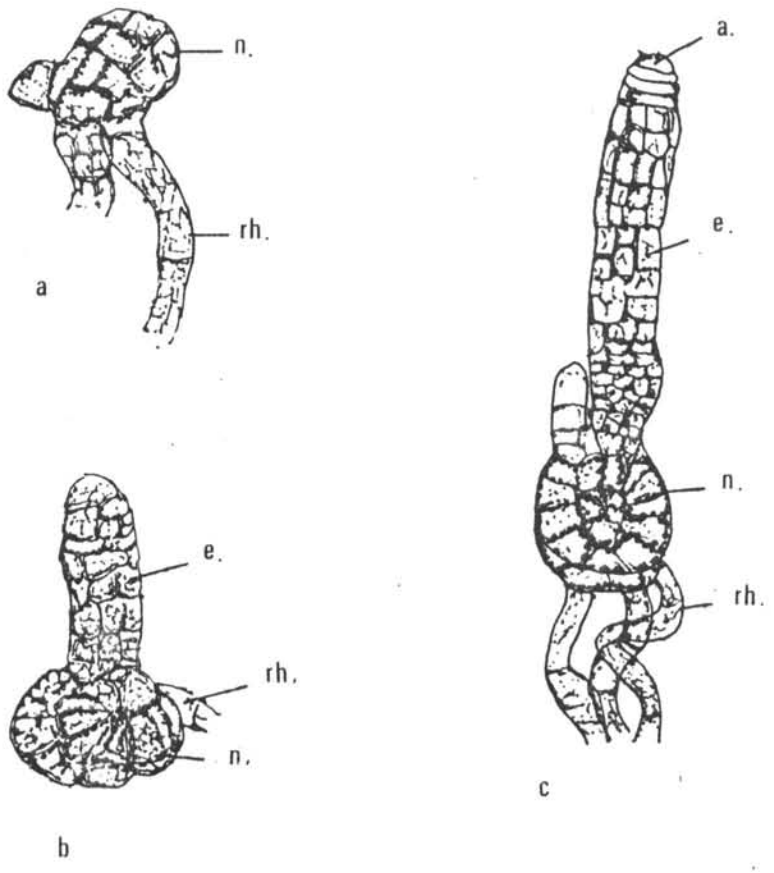


Figure 1

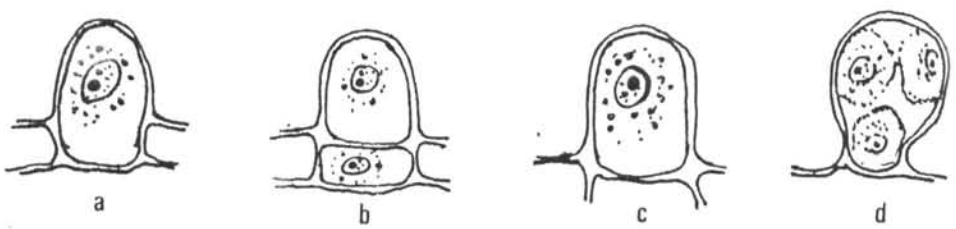


Figure 2

Plate X

Figure 1. The basal portion of Padina tetrastromatica Hauck, showing 4 celled-layer, covering on both sides with hair-like rhizoids. (x 180).

Figure 2. Upper surface of Padina australis Hauck, showing the young non-indusiate tetrasporangial sori. (x 175).

Figure 1

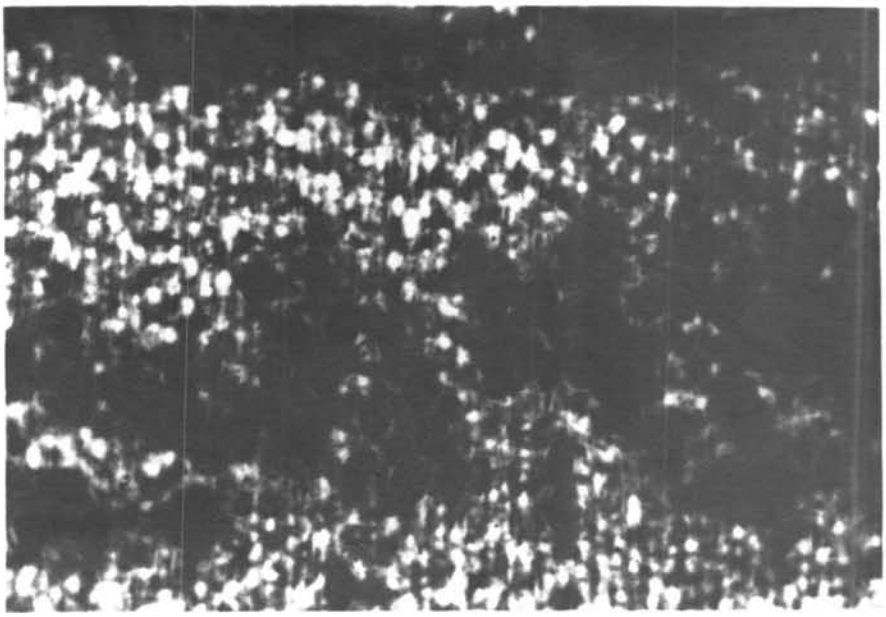


Figure 2

Plate XI

Figure 1. Padina gymnospora (Kütz.) Vickers, upper surface of frond showing a portion of indusiate oögonial sori. (x 240).

Figure 2. A piece of frond of Padina boryana Thivy, showing a radial section of the fan-shaped oögonial sori. (x 350).

Figure 1

Figure 2

Plate XII

Padina gymnospora (Kütz.) Vickers

Figure 1. Upper surface of frond showing a part of antheridial sori. (x 200).

Figure 2. The same as figure 1. (x 480).

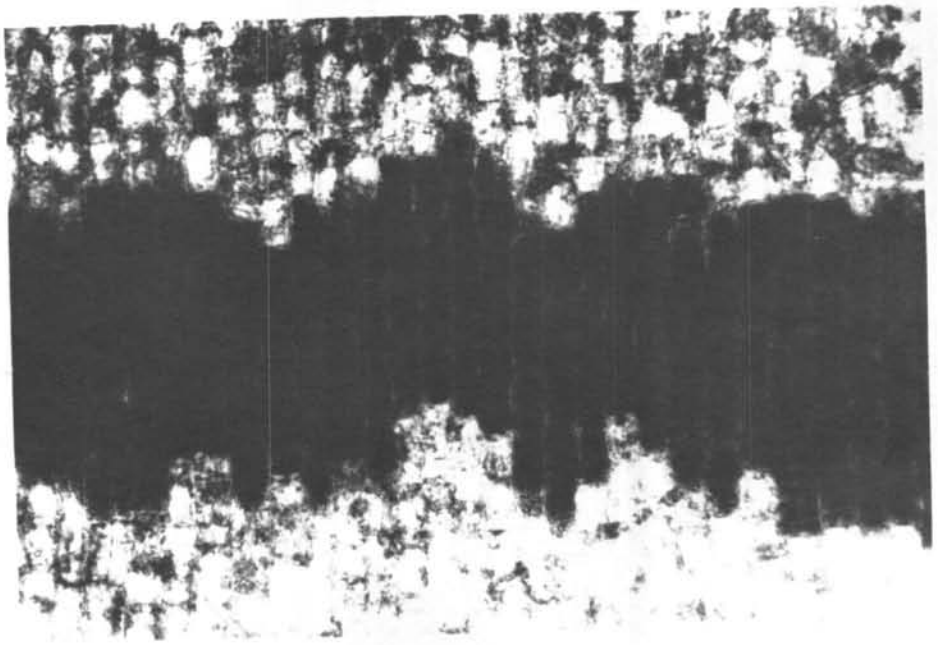


Figure 1

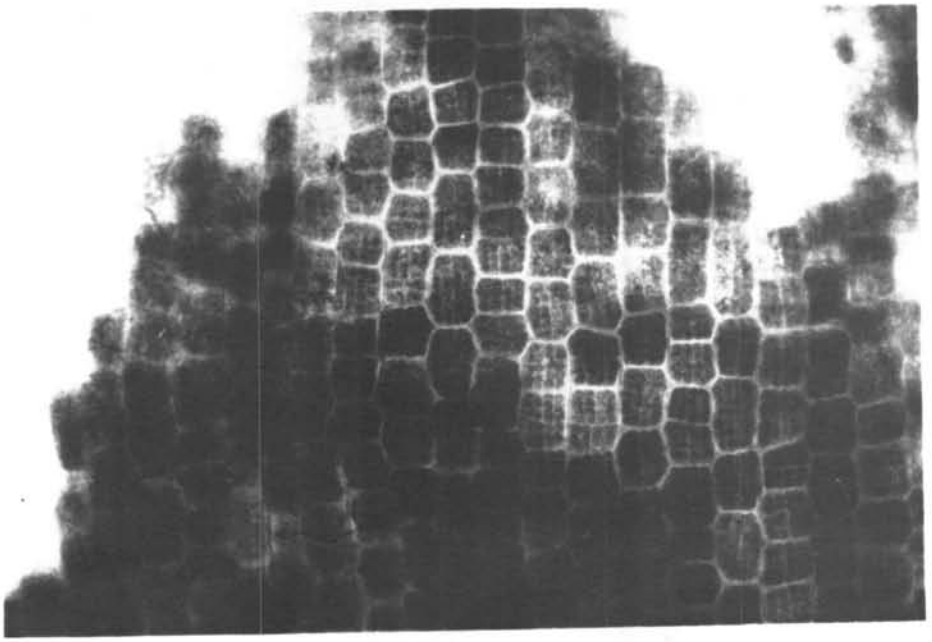


Figure 2

Plate XIII

Figure 1. A piece of frond of Padina boryana Thivy, showing a radial section of antheridial sori. (x 350).

Figure 2. Padina australis Hauck, gametophyte plant showing young intermixed sorus; band of oögonial sori (o) interrupted by vertical pattern of antheridial sori (a). (x 240).

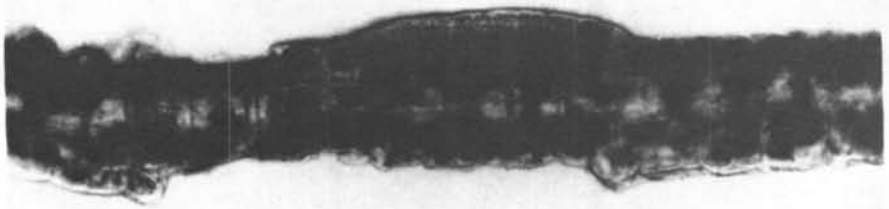


Figure 1

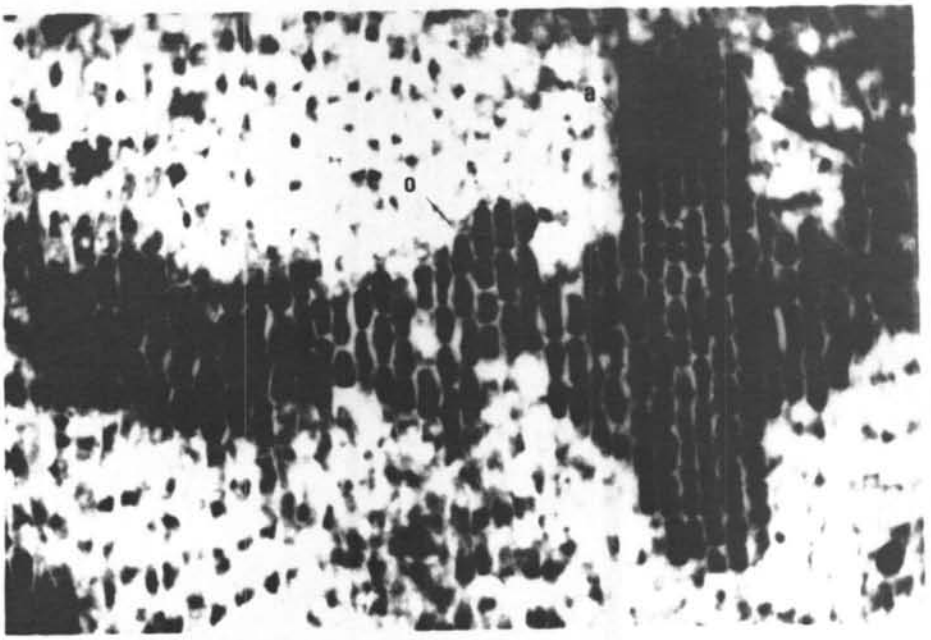


Figure 2

Plate XIV

Padina australis Hauck

Figure 1. Upper portion of frond showing the mature intermixed sori. (x 110).

Figure 2. The same as figure 1. (x 280).

Figure 3. Intermixed sori showing mature oögonia and antheridia. (x 240).

o = oögonial sori,

a = antheridial sori,

p = piliferous line.

Figure 1

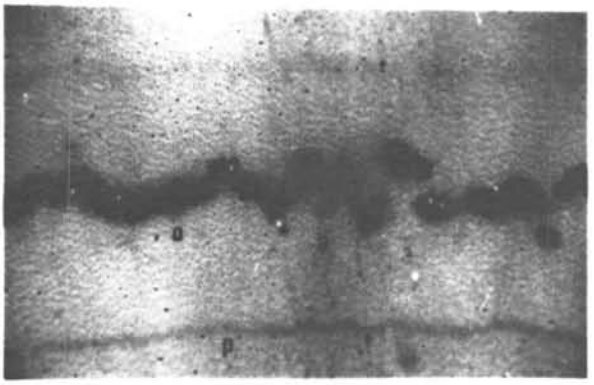


Figure 2

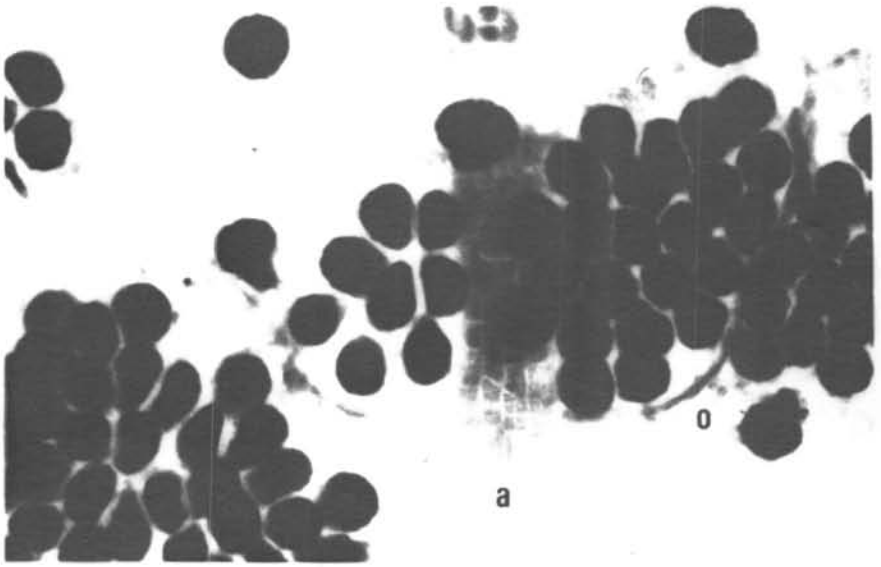


Figure 3

Plate XV

Padina tetrastromatica Hauck

Comparison of the three kinds of sori

Figure 1. Tetrasporangial sori. (x 110).

Figure 2. Oögonial sori. (x 110)

Figure 3. Antheridial sori. (x 110).

Figure 4. The same as figure 2. (x 180).

Figure 5. The same as figure 3. (x 180).

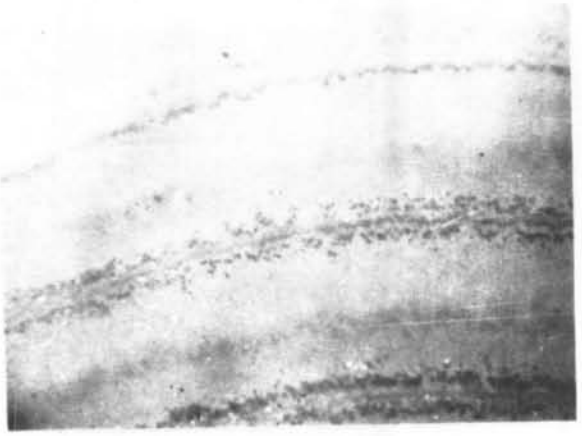


Figure 1

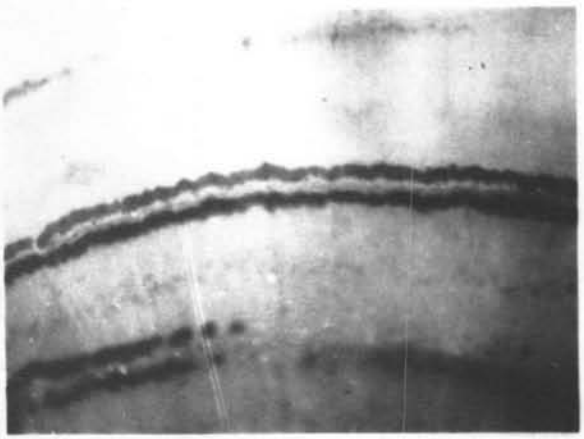


Figure 2

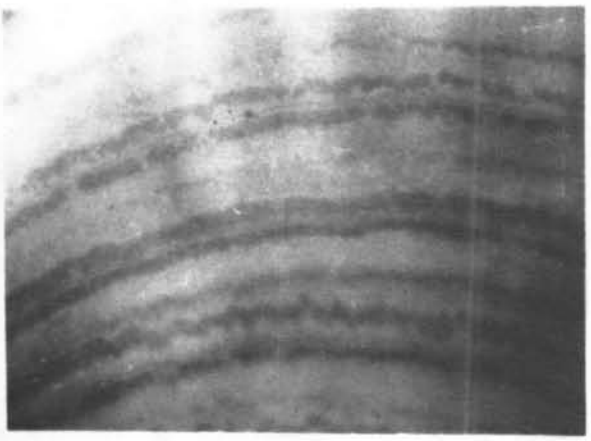


Figure 3

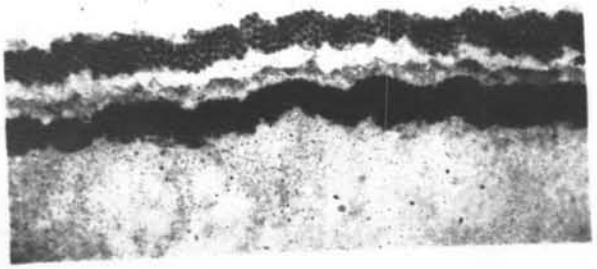


Figure 4

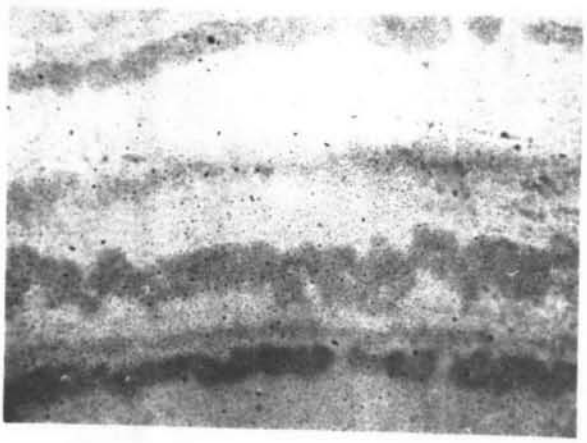


Figure 5

Plate XVI

Padina australis Hauck

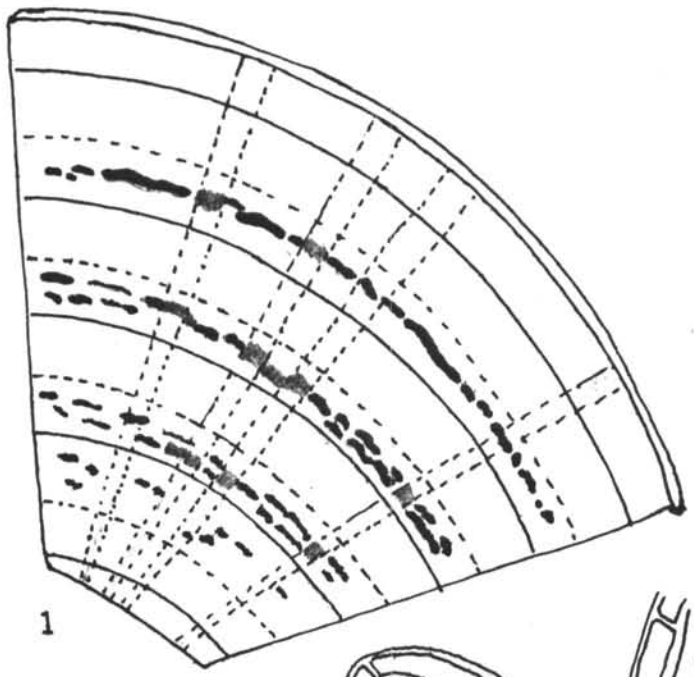
Figure 1. Blade showing piliferous lines of the upper (solid lines) and lower surfaces (stipple lines), enomalous development of antheridial sori (a) in successive glabrous zones, and rays of cells with darker contents (between vertical stippled lines); Oogonial sori (o) in part in consecutive glabrous zones (x 2)

Figure 2. Radial section of the blade showing relationship of the cells of the upper (u) and lower surface (l). (x 300).

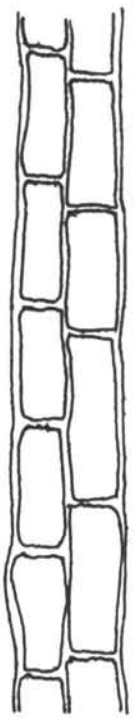
Figure 3. Transverse section of the basal region of the blade showing the bistratose feature and the rhizoids of the upper surface. (x 300).

Figure 4. Transverse section of young intermixed sori with two groups of oogonia (o) basal cells, and indusia over the oogonial and antheridial sori (a) (x 500).

Figure 5. Radial section of a mature bisexual plant showing an oögonial sorus. (x 500).



1



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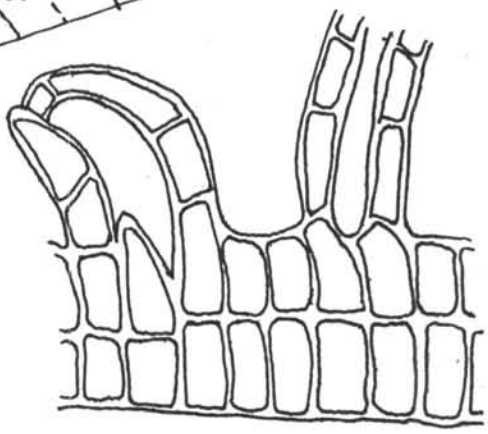

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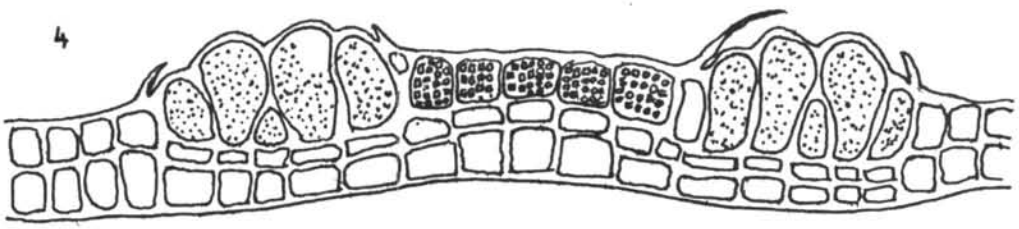

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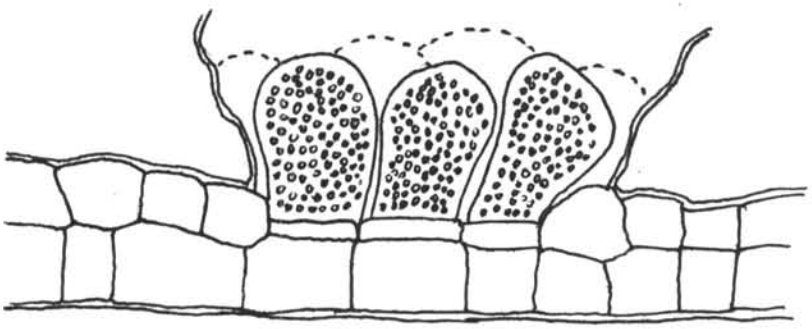


5

Plate XVII.

Padina boryana Thivy

Figure 1. A portion of blade showing piliferous zones only on the upper surface, and tetrasporangial sori above every piliferous zone. (x 4).

Figure 2. Lower surface of blade dyed with 2% Safranin O, showing piliferous zones of the upper surface (stippled lines) and scattered hairsof the lower surface in the median portion between two piliferous zone of the upper surface. (x 4).

Figure 3. Upper surface of a female gametophyte showing the band-like oogonial sori in the middle portion of blade and fragmented sori in the lower portion. (x 4).

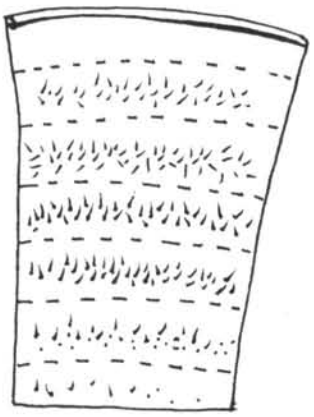
Figure 4. Radial section of blade showing 2-celled layer and non-indusiate tetrasporangial sorus. (x 600).

Figure 5. Transverse section of the lower portion of blade showing the thick-walled hair-like rhizoids. (x 400).

Figure 6. Radial section of the mid-blade showing the piliferous zone on the upper surface. (x 600).

1

2



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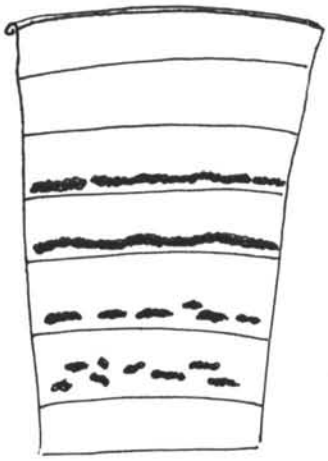

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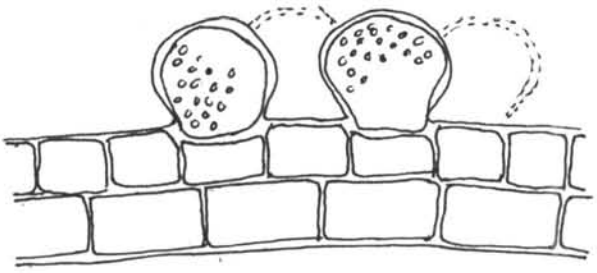

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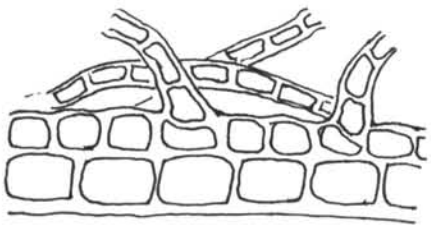

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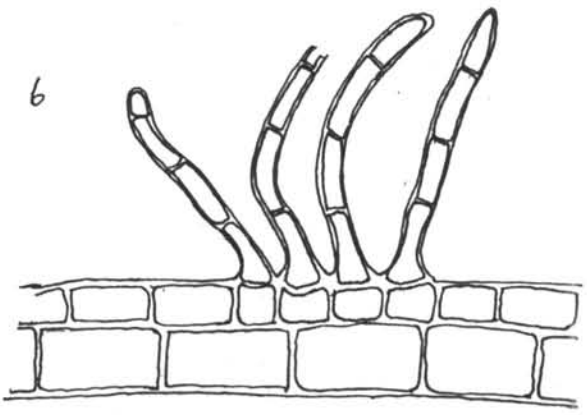


Plate XVIII.

Padina distromatica Hauck

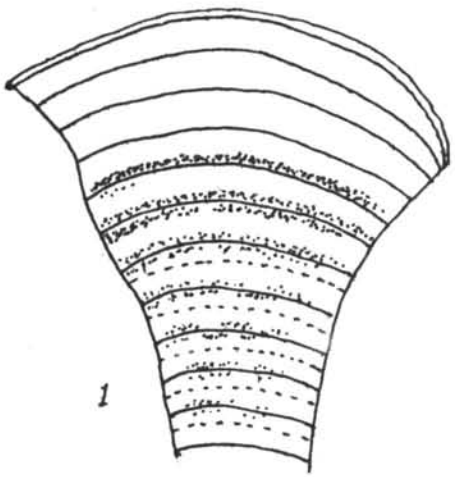
Figure 1. A portion of blade showing the upper surface piliferous lines, those of lower surface (stippled) also be seen in the proximal portion, and tetrasporangial sori on either side of the piliferous lines on upper surface. (x 3).

Figure 2. Transverse section of median region showing the cells of two layers and hairs. (x 500).

Figure 3. Radial section of blade showing a non-indusiate tetrasporangial sorus. (x 400).

Figure 4. A portion of an antheridial sorus. (x 500).

Figure 5. Radial section of blade showing an antheridial sorus. (x 500).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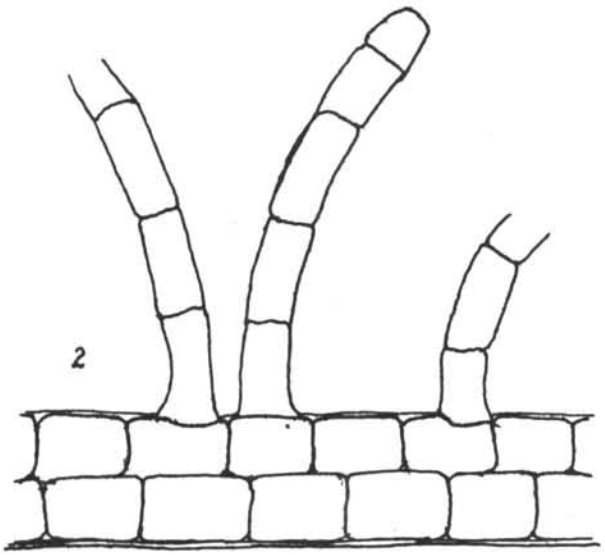
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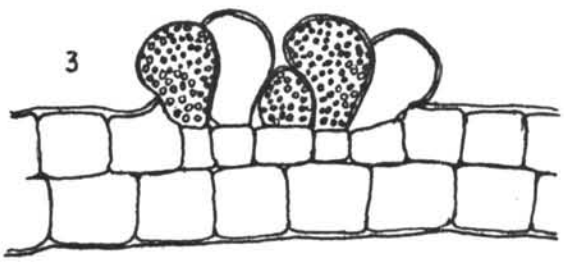
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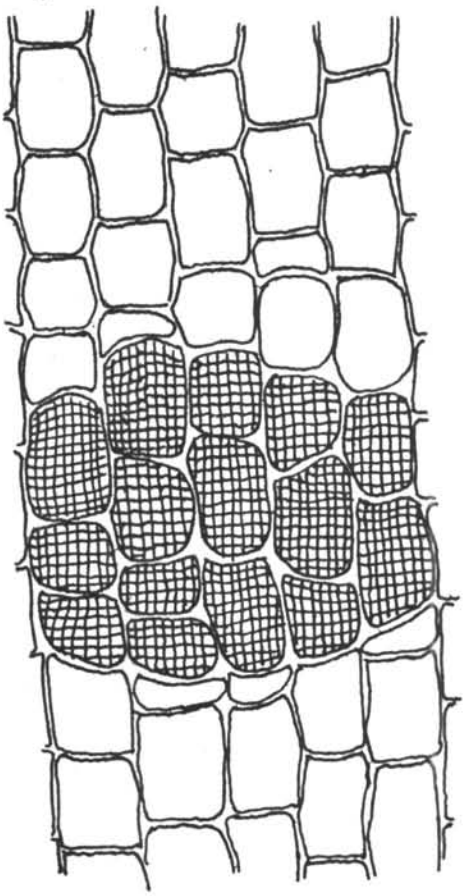
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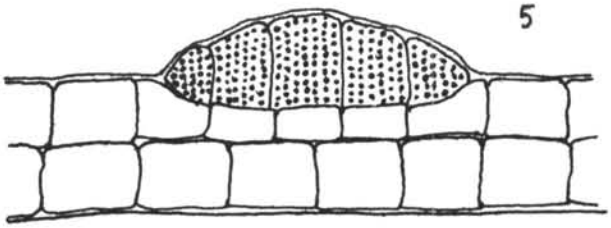

5

Plate XIX.

Padina gymnospora Kutz.

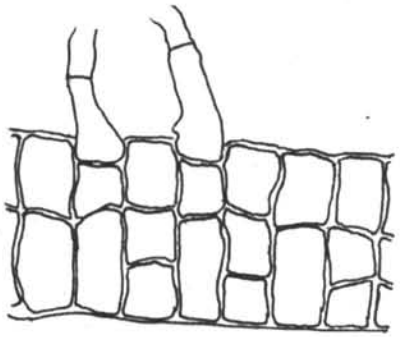
Figure 1. A portion of sporophyte blade showing piliferous zones of the upper surface (solid) and lower surface (stipples line), and distribution of tetrasporangial sori (stippled areas). (x 2).

Figure 2. Transverse section of the lower part of the blade showing the cell layers and hair-like rhizoids on the upper surface. (x 200).

Figure 3. Radial section of blade showing non-indusiate tetrasporangial sorus. (x 230).

Figure 4. A portion of upper surface of blade showing the tetrasporangial sori. (x 65).

1



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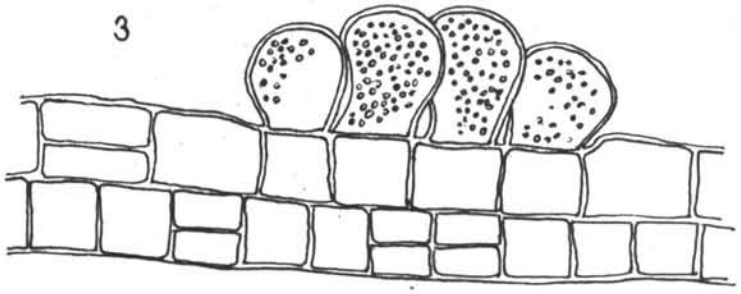
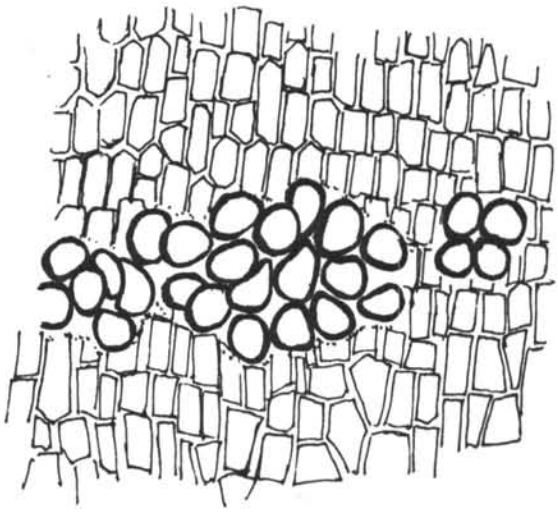




4

Plate XX.

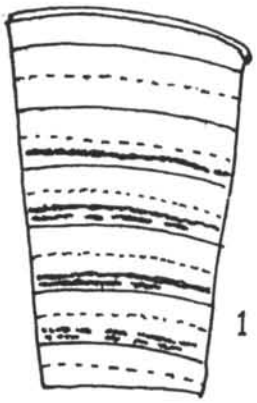
Padina japonica Yamada

Figure 1. A portion of blade showing the upper surface with two bands of tetrasporangial sori in some fertile glabrous zones. (x 2).

Figure 2. Transverse section of the lower part of the blade showing rhizoids, and cells of upper and lower surfaces. (x 200).

Figure 3. Transvers section of the basal portion of the blade showing a tier of cells and rhizoids. (x 230).

Figure 4. Radial section of a tetrasporangial sorus showing the persistent indusium. (x 250).



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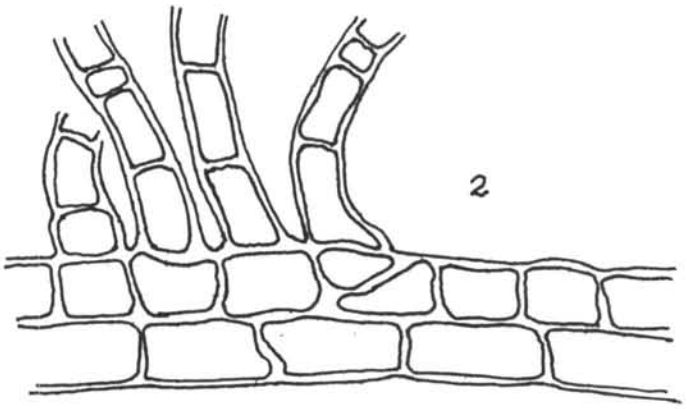

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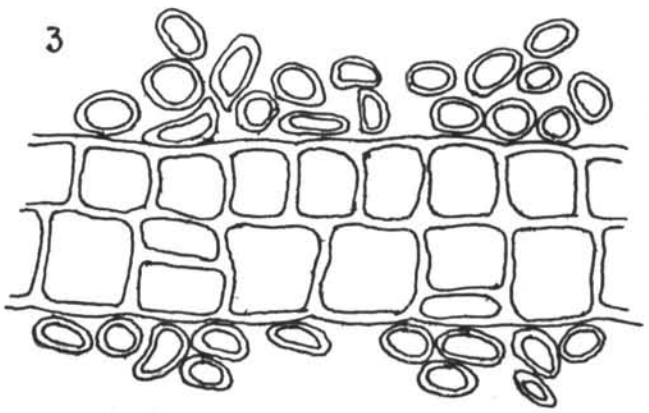

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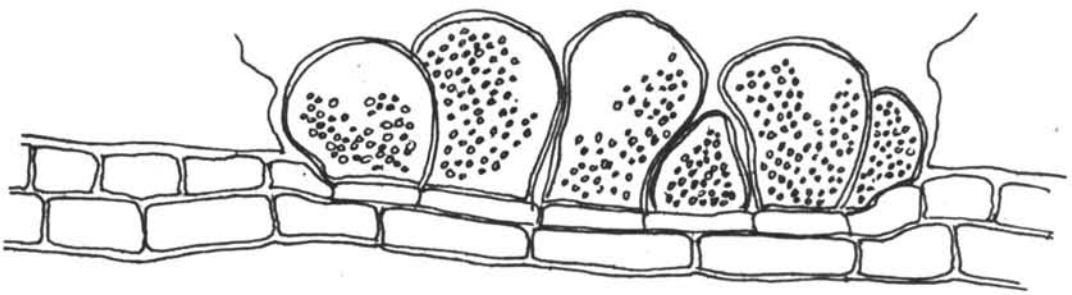


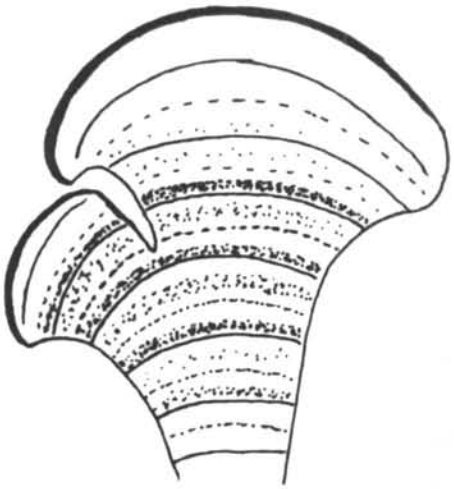
Plate XXI.

Padina minor Yamada

Figure 1. Upper surface of a segment showing piliferous zones of the upper and lower (stippled lines) surfaces and tetrasporangial sori in every glabrous zones. (x 3).

Figure 2. Tranverse section of the lower portion of blade showing 2 celled layer, covered with hair-like rhizoids on the upper surface. (x 100).

Figure 3. Radial section of blade showing a tetrasporangial sorus with the deciduous indusium. (x 250).



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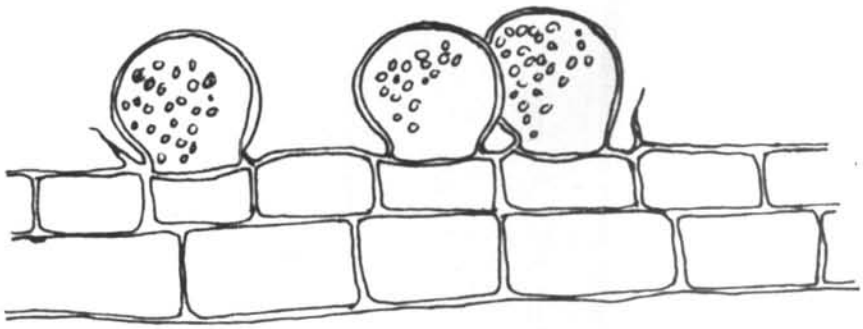

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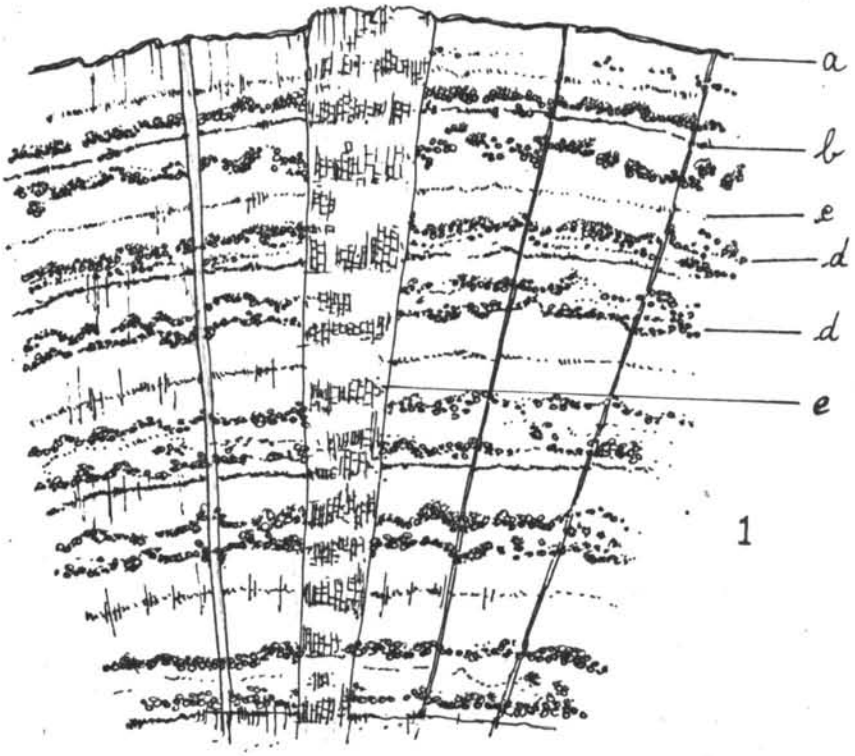
Plate XXII.

Padina pavonica Linn.

Figure 1. Upper surface of frond of the monoecious gametophyte showing: margin of blade (a), piliferous zones of the upper surface (b), piliferous zones of the lower seen from the upper (c), oögonial sori (d), and the antheridial sori (e), distributed in radial pattern (x 2.5).

Figure 2. Transverse section of the lower portion of the blade showing 3 layers of cell and the hair-like rhizoids. (x 200).



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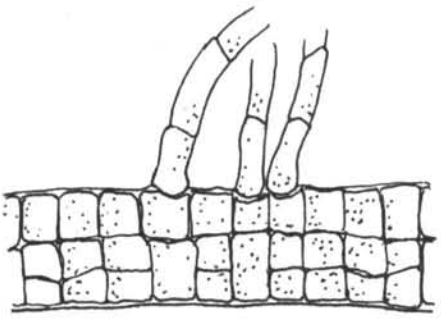

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Plate XXIII.

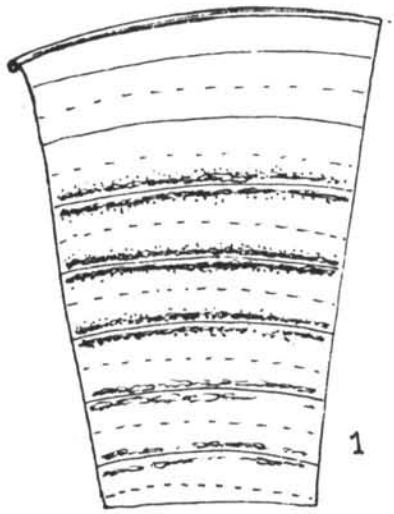
Padina tetrastromatica Hauck.

Figure 1. A portion of upper surface of blade showing the piliferous zones of the upper and lower (stippled line) surfaces and the tetrasporangial sori on both sides of the former. (x 3).

Figure 2. Transverse section of the lower portion of a blade showing 3 celled layer and in part 4 celled layer. (x 300).

Figure 3. Upper surface of blade showing the tetrasporangial sori (t) on both sides of the piliferous zones (p). (x 75).

Figure 4. Radial section of the middle portion of blade showing 3 celled layer and tetrasporangial sori (t) on both sides of a piliferous zone (p) (x 350).



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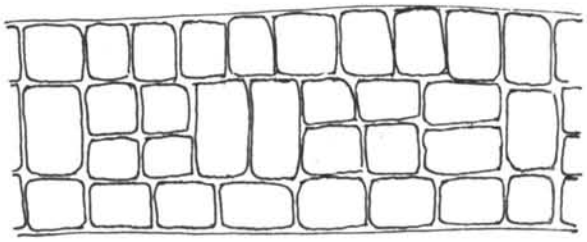

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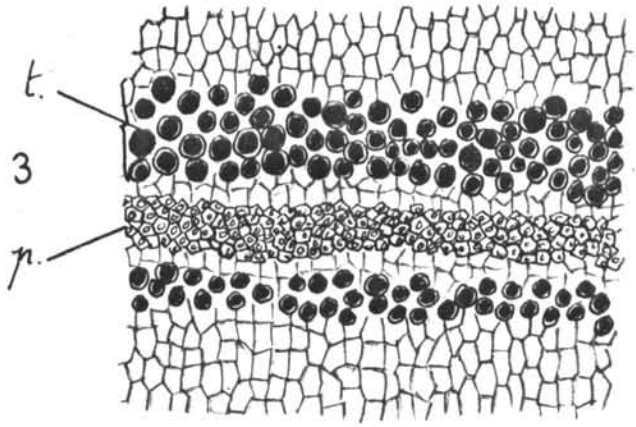

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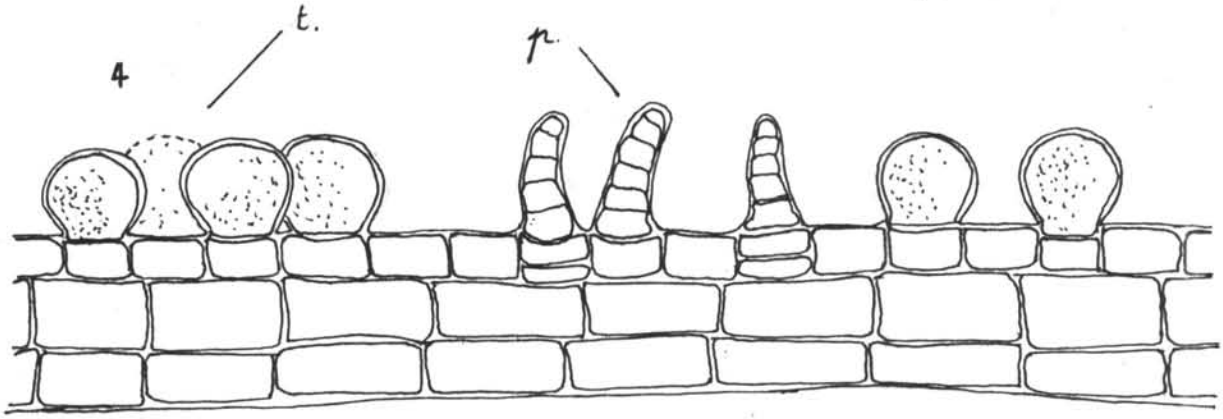

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