



CHAPTER IV

RESULTS

From about 600 specimens used in this study, eight species were found. They are: Padina australis Hauck,

P. boryana Thivy,

P. distromatica Hauck,

P. gymnospora (Kütz.) Vickers,

P. japonica Yamada,

P. minor Yamada,

P. pavonica (Linn.) Thivy, and

P. tetrastromatica Hauck.

Three of them; P. distromatica Hauck, P. japonica Yamada and P. minor Yamada have never been reported to be found in Thailand before. From the collection of specimens, it is found that P. japonica Yamada and P. pavonica (Linn.) Thivy are very rare, they can be found only in certain localities. Common species found in all part of the Gulf are P. australis and P. boryana. Those found on the east shose are commonly bigger than those on the west. The distribution of all species are shown in table II, page 39; plate II, page 41 and plate III, page 42.

Description of Species

P. australis Hauck Pl. II; Pl. IV, fig.1: Pl. X, fig.2; Pl. XIII, fig.2; Pl. XIV, figs.1-3; Pl. XVI, figs.1-6.

Plants growing in tuft, reddish brown, 5 to 15 cm. high, 10 to 25 cm. broad, thin (50 - 90 μ thick) with a short stipe about 1 cm. long, stipose on both sides mostly at the basal part of the blade, deeply divided into large flabellate lobes 2 to 8 cm. wide with distinct amphigenous-alternate piliferous lines forming wider sterile glabrous zone (2 to 3 mm. wide), and narrower fertile glabrous zones (1 to 2 mm. wide); blade composed of 2-layered cell from the revolute apex to the stipe, about 65 μ thick in the middle part and 75 μ thick at the basal part; cells 25 to 40 μ wide in both layers, cells of the upper layer shorter (30 to 75 μ long) than the lower (50 to 100 μ long). Lower surface of blade slightly encrusted with lime. Sporophyte with tetrasporangial sori 0.5 to 0.8 mm. wide, usually median in position in the fertile glabrous zones rarely close to the proximal piliferous lines, and non-indusiate; fairly mature tetrasporangia about 100 μ in diameter.

Gametophyte monoecious, sori unisexual, antheridial and oögonial sori occurring intermixed in a median band in the fertile glabrous zones, very seldom in the sterile glabrous zones, oögonial sori 120 to 200 μ wide with persistent indusia, oögonia 45 to 60 μ in diameter; antheridial sori 300 to 500 μ wide, antheridia about 25 μ wide and 15 to 30 μ long.

Okamura, 1932, p. 88; Thivy, 1945, p. 106.

Distribution in thailand

Chon Buri Prov.	: Sri Racha, Pallhaya Tai, Sattahip.
Rayong Prov.	: Ban Phe
Trat Prov.	: Laem Ngob
Surat Thani Prov.	: Koh Somui.
Songkhla Prov.	: Koh Nu.

P. boryana Thivy Pl. II; Pl. IV, fig.2; Pl. XI,
fig.2; Pl. XIII, fig.1; Pl. XVII,
figs.1-6.

Plants 3 - 8 cm. high, 4 - 6 cm. broad, yellowish to greenish brown with a stipe of 2 to 4 mm. long, blade 75 to 100 μ thick with stupa in the basal part of blade near the stipe on the upper surface, blade dividing deeply into few flabellate lobes about 4 cm. wide; blade bistratose from the apex to the basal part, cells of the upper layer 20 to 30 μ wide, 40 to 70 μ long, those of the lower 25 to 35 μ wide, 40 to 115 μ long; piliferous zones of the upper surface moderately developed, forming the glabrous zones 2 to 4 mm. wide, piliferous zones of the lower surface rudimentary or absent, but the hairs scattered in the median portion of the glabrous zones of the upper surface; tetrasporangial sori non-indusiate, band-like, 0.5 to 1.0 mm. wide, occurring above every piliferous line, usually in the lower portion of the glabrous zone, rarely in the median position, mature sporangia 50 to 75 μ in diameter.

Gametophyte dioecious, indusiated obgonial sori 0.4 to 0.8 mm. wide, obgonia about 50 μ in diameter, 70 μ long, antheridial sori linear or wavy, placed about 0.5 mm. above the piliferous zones. In the lower part

of the old plants two bands or scattered groups are found, antheridia about 28 μ wide, 32 to 52 μ long.

The plants found in rock pools of intertidal zones are small, less than 3 cm. high.

Okamura, 1932, p. 89; Thivy, 1945, p. 86; Durairatnum, 1961, p. 36; Misra, 1966, p. 155; Taylor, p. 355.

Distribution in Thailand

Chon Buri Prov.	: Patthaya Tai
Rayong Prov.	: Ban Phe.
Trat Prov.	: Koh Chang, Laem Ngob.
Phuket Prov.	: Ao Makham, Laem Panwa.
Songkhla Prov.	: Koh Yaw.

P. distromatica Hauck Pl. II; Pl. V, fig.1; Pl. XVIII,
figs.1-5.

Plant usually yellowish brown, 8 to 14 cm. high, 10 to 16 cm. broad, with a short stipe about 3 mm. long, 1 to 2 mm. wide, stupose on the upper surface to about the middle of blade, but only a short distance on the lower surface, deeply split with overlapping flabellate lobes of 1 to 2 cm. wide; piliferous lines on the upper surface clear with 1.5 to 3 mm. wide of glabrous zones between them, but weakly developed or rudimentary on the lower surface, occurring alternately with those of the upper surface beginning from the third glabrous zone and placed generally in the upper portion of the glabrous zone and less common in the median portion, blade bis-tratose from the apex to the stipe with cells of both layers 25 to 35 μ wide, cells of the upper layer 30 to 70 μ long, those of the lower 40 to 100 μ , the height of the upper-layer cells two third or slightly less than the lower-layer cells; stipe showing three to five layers, 150 μ thick with stupa 0.5 mm. thick on both sides; tetrasporangial sori non-indusiated forming a band on both sides of the piliferous lines of the upper surface and adjoining them closely (in contact with them); the proximal bands usually 10 to 15 mm. wide and narrower than

the distal but equal to them in parts; mature sporangia at tetrad stage 80 to 120 μ in diameter.

Gametophyte dioecious; the antheridial sori closely adjoining on both sides of all the piliferous lines of the upper surface but here and there, sometimes at some distances from them, but in the youngest fertile zone the antheridial sori occur only on lower side of the piliferous line; antheridia 20 to 40 μ long, 20 to 25 μ wide. The oogonial sori occur in the same manner, oogonia 40 - 70 μ in diameter.

Thivy, 1945, p. 113.

Distribution in Thailand

Rayong Prov. : Ban Phe.
 Trat Prov. : Koh Mak
 Phuket Prov. : Ao Makhham.

Distribution in neighbouring country:

Philippines (Taylor, 1966).

P. gymnospora Kütz. Pl. II; Pl. V, fig.2; Pl. XI, fig.1;
Pl. XII, fig.1, 2; Pl. XIX, figs.1-4.

Plant 8 to 10 cm. high, 5 to 15 cm. broad, greenish brown in color, with a short stipe 0.5 to 1.2 cm. long, 2 to 5 mm. wide, stipose to one third or half of the length of stipe, with stipa better developed on the upper surface; blade moderately encrusted with lime on the lower surface, dividing to its base into characteristically round-flabellate, overlapping lobes, 5 to 7 cm. wide, membranous, adhering to paper when dried, with piliferous zones developed alternately on the upper and lower surface forming broad sterile glabrous zones (1.8 to 2.5 mm. wide) alternating with narrower fertile glabrous zones (1.3 to 1.6 mm. wide); blade bistratose near the margin, 2 to 3-stratose in the rest of blade and varying from 3 to 5-stratose in the stipe; 50 to 60 μ thick in the upper part, 70 to 80 μ thick in the middle, 80 to 100 μ in the basal part and 100 to 200 μ in the stipe; cells of both superficial layers 20 to 38 μ wide, those of the uppermost layer 33 to 85 μ long, those of the lowermost 40 to 100 μ long, cells of the subcortical layer of blade 40 to 115 μ long, 35 to 70 μ wide; tetrasporangial sori band-like, 0.5 to 1.5 mm. wide, often in median position of fertile zones, sometimes occurring a little above or in their lower half or touching the proximal piliferous zones; in

the older part every glabrous zone is fertile, mature tetrasporangia 90 to 130 μ in diameter.

Gametophytes dioecious; antheridial sori forming one or two bands in fertile glabrous zones, antheridia about 15 μ wide, 20 to 35 μ long; oögonial sori forming a band above or below median part of fertile zones, sometimes scattering here and there or occurring in discontinuous double bands in the lower half, oögonia club-shaped 30 to 45 μ in diameter, 40 to 75 μ long.

Thivy, 1945, p. 143; Misra, 1966, p. 156; Ramon, 1966, p. 192.

Distribution in Thailand

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|-------------------|--|
| Chon Buri Prov. | : Sri Racha, Patthaya Tai,
Sattahip |
| Rayong Prov. | : Ban Phe. |
| Surat Thani Prov. | : Koh Samui. |

P. japonica Yamada Pl. III; Pl. VI, fig 1;
 Pl. XX, figs. 1-4.

Plant 5 to 7 cm. high, about 8 cm. broad, thin (about 100 μ thick), light greenish brown in color, with a stipe about 2 mm. long, stupose to a greater length on the upper surface of the basal region of the blade, and flabellately lobed over the entire lower surface, blade moderately encrusted with lime on the lower surface, often split into several segments, sometimes shallowly split at the margin; piliferous lines of upper and lower surface alternate, forming wider fertile glabrous zones (1.5 to 2.0 mm. wide) and narrower sterile glabrous zones (1.0 to 1.5 mm. wide); blade usually bistratose through the whole plant, ^{rarely} 3-stratose which can be found only in some parts, about 60 μ thick in the upper part and 80 to 110 μ in the basal part, cells of both layers 25 to 35 μ wide, those of the upper layer 35 to 60 μ long and the lower layer 55 to 100 μ long, tetrasporangial sori on the upper surface of the blade forming a band 180 to 400 μ wide in the median of the fertile zone or close to the proximal piliferous line of the fertile zone, but sometimes additional, discontinuous irregular line produced along the lower side of the ordinary sori, making incomplete double lines, mature tetrasporangia 70 to 85 μ in diameter.

Okamura, 1932, p. 87; Thivy, 1945, p. 133.

Distribution in Thailand

Chon Buri Prov. : Sattahip

Distribution in neighbouring countries:

Formosa (Yamada, 1925),

Japan (Okamura, 1929 - 1932; Segawa, 1960),

Philippines (Taylor, 1966).

P. minor Yamada Pl.III; Pl.VI, fig.2; Pl.XXI, figs.1-3.

Plant 3.0 to 9.0 cm. high, 3.0 to 10.0 cm. broad, with short stipe of about 5 mm. long, stupose only on the upper surface to half of the height; blade membranous and translucent, light brown to yellowish brown in color, slightly encrusted with lime on the lower surface, sometimes also on the upper surface, blade usually deeply divided into a few flabellate lobes of 3 to 8 cm. wide; piliferous zones of the upper and lower surfaces alternate, blade bistratose throughout the whole plant, cells of the two layers about 25 μ wide, those of the upper surface 36 to 70 μ long and those of the lower surface 56 to 110 μ long; tetrasporangial sori band-like, occurring only on the upper surface just above piliferous lines of both surfaces, rarely occur a little distance from them, sporangia 48 to 76 μ in diameter with deciduous indusium.

Gametophyte dioecious, antheridial sori light brown, 240 to 360 μ broad, antheridia about 28 μ wide, 32 to 52 μ long, oögonial sori about 280 μ wide, dark brown in color with persistent indusia, oögonia 48 to 52 μ in diameter, and 70 μ long.

Okamura, 1932, p. 56; Thivy, 1945, p. 99.

Distribution in Thailand

Chon Buri Prov. : Patthaya Tai
Trat Prov. : Koh Chang,
Phuket Prov. : Ao-Patong, Ao Makham.
Songkhla Prov. : Koh Yaw, Koh Nu.

Distribution in neighbouring countries:

Formosa (Yamada, 1925),
Japan (Okamura, 1929 - 1932; Segawa, 1960).

P. pavonica Linn. Pl.III; Pl.VII, fig.1; Pl.IX, fig.2;
Pl.XXII, figs.1-2.

Plant 5 to 12 cm. high, 4 to 10 cm. broad, brown in color, with a short stipe about 0.8 cm. long, stupose on both surfaces, blade simple or dichotomously divided to the base into flabellate-reniform segments 2.5 to 4 cm. wide, strongly encrusted with lime on the lower surface and less on the upper, sometimes both surfaces slightly encrusted; piliferous lines of both surfaces alternate, those of the lower surface sometimes developing here and there, sometimes absent and slightly seen through the upper surface; glabrous zones 1.7 to 4.0 mm. wide; blade bistratose in the upper part, 2 to 3-stratose in the middle and lower parts; cells of the superficial layers 25 to 40 μ wide; those of the uppermost layer 25 to 80 μ long, those of the lowermost layer 40 to 140 μ long; tetrasporangial sori 0.5 to 0.8 mm. wide, occurring on the upper surface in the older part and commonly on the lower surface, the position of sori are on both sides of the piliferous zones of the upper surface and touching them or just a little distance from them. The sori are band-like or break into segments, with persistent indusia, mature tetrasporangia 100-140 μ in diameter.

Gametophyte typically monoecious, but there are also male and female unisexual plants and finally, predominantly male or predominantly female plant in which gametangia of one sex overwhelmingly dominate, in bisexual plant, sori unisexual, male and female sori intermixed forming a very narrow band of 0.2 to 0.5 mm. wide, on both sides or only on the upper side of the piliferous zones of the upper surface; in unisexual plant, band of sori occurring in the same manner; oogonia 30 to 40 μ in diameter, antheridia 15 to 20 μ wide, 20 to 35 μ long.

Thivy, 1945, p. 172; Durairatnum, 1961, p. 36;
Misra, 1966, p. 154; Ramon, 1966, p. 183.

Distribution in Thailand

Rayong Prov. : Ban Phe.

P. tetrastromatica Hauck Pl.III; Pl.VII, fig.2;
Pl.X, fig.1; Pl.XV,
figs.1-5; Pl.XXIII,
figs.1-4.

Plants 6 to 15 cm. high, 10 to 20 cm. broad, reddish brown, with a short stipe about 0.5 cm. long, stipose on both surfaces in the basal part of the blade to about one fourth or one third of the length, usually divided into a few flabellate lobes in young plants and divided to the base of the blade into many cuneate lobes of about 2 to 4 cm. wide; piliferous zones on both surfaces occurring alternately and well developed with glabrous zones between them, about 1 to 2 mm. wide in the younger part and 2 to 3 mm. in the older; blade bistratose in the upper part, 2 to 3-stratose in the middle and 3 to 4-stratose in the basal part; cells of the superficial layers 20 to 30 μ wide, of the uppermost layer 25 to 45 μ long, those of the lower layer 40 to 80 μ long; tetrasporangial sori occurring on both sides of piliferous zone of the upper surface, placing very close to them, about 200 μ wide, tetrasperangia 80 to 150 μ in diameter;

Gametophyte dioecious, oögonial and antheridial sori arrangement similar to the tetrasporangial sori, oögonial sori about 150 μ wide, oögonia 30 to 50 μ in diameter;

antheridial sori 250 to 400 μ wide, yellowish brown in color, mature antheridia 15 to 25 μ long, 15 to 20 μ wide.

Thivy, 1945, p. 159; Durairatnum, 1961, p. 36.

Distribution in Thailand

Chon Buri Prov. : Sri Racha.

Rayong Prov. : Ban Phe.

Trat Prov. : Laem Ngob.

Key to the Species of Padina

1. Species with 2-layer throughout the blade..... 2
1. Species with 2-3 layer in the middle part
of blade and 3-4 layer in the basal part 6
2. Tetrasporangial sorus covered by an
indusium 3
2. Tetrasporangial sorus not covered by an
indusium 4
3. Indusia deciduous, close to the piliferous
zones; every glabrous zone fertile, pili-
ferous zones well developed on both
surfaces P. minor
3. Indusia persistent, visible with hand lens
or binocular microscope, every other
glabrous zone fertile P. japonica
4. Sori forming a band only above every other
piliferous zone with a distinct space
between those bands of sori and piliferous
zones next below them 5
4. Sori forming a band on both sides of every
other piliferous zone and placed closed
to it, at times the lower band of sori not
developed P. distromatica

5. Piliferous zones of the lower surface of blade rudimentary or absent P. boryana
5. Piliferous zones of the lower surface of blade well developed, gametophyte monoecious
..... P. australis
6. Tetrasporangial sori non-indusiate 7
6. Tetrasporangial sori indusiate, plants encrusted with lime on both surfaces, strongly on the lower surface and less on the upper; gametophyte monoecious or dioecious P. pavonica
7. Sori forming a band on both sides of every other piliferous zone and placed close to it, at times the lower band of sori not developed P. tetrastromatica
7. Sori forming a band only above every other piliferous zone, usually at a distance from them, commonly encrusted with lime on the lower surface of blade P. gymnospora