CHAPTER IV

Results

The fresh specimens were collected from October 1973 to December 1976 from various parts of Thailand. Dried specimens were also studied. Among 55 specimens examined, 4 genera and 25 species were identified. They are as follow:

Chara	baueri	A. Br., em.
Chara	braunii	Gm.
Chara	canescens	Desv. & Lois in Lois.
Chara	corallina	Klein ex. Willd., em.
Chara	ecklonii	A. Br., ex. Kutz., em.
Chara	fibrosa	Ag. Bruz., em.
Chara	globularis	Thuill., em.
Chara	hornemanii	Wallm., em.
Chara	zeylanica	Klein ex. Willd., em.
Nitella	acuminata	A. Br. ex. Wallm., em.
Nitella	allenii	Imah., em.
Nitella	dualis	Nordst. in T.F.A.
Nitella	duthieae	J. Gr. & Steph., sp. dub.
Nitella	flexilis	(L.) Ag.
Nitella	furcata	Ag., em.
Nitella	heteroteles	J. Gr. & Steph.,
Nitella	hookeri	A. Br.
Nitella	lhotzkyi	A. Br., em.

Nitella	mirabilis	Nordst..Ex J. Gr., em.
Nitella	penicillata	A. Br., em.
Nitella	stuartii	A. Br.
Nitella	translucens	Ag., em.
Nitellopsis	bulbilifera	C. Dont.
Nitellopsis	sarcularis	Zanev.
Tolypella	intricata	Leonh., em.

Key to the genera of Characeae of Thailand

1a. Coronula of 5 cells in 1 tier; coronula large; branchlets undivided ---------- (2)

2a. Stipulodes developed in 1-2 tiers; 1-2 per branchlet; bract-cells normally 4 or more at a node and including both anteriors and posteriors; branchlet segment 3 or more; corticate or ecorticate; oogonium above antheridium - ---------- Genus (1) Chara

2b. Stipulodes absent or rudimentary; bract-cells normally 2 at a node; anterior only; branchlet segments 2-5; ecorticate; ---------- Genus (2) Nitellopsis

1b. Coronula of 10 cells in 2 tiers; coronula small; branchlets divided, furcate or if monopodial then with lateral ray of 2 cells or more ---------- (3)

3a. Branchlets furcate (occasionally with central ray); rays verticillate; antheridia terminal on the end of branchlet rays or at base of whorl ---------- Genus (3) Nitella

3b. Branchlets monopodial, not furcately divided; ray bilat-

eral, with lateral differential from ab- or ad- axial rays; antheridia lateral on adaxial side of branchlet nodes or at base of whorl ---------- Genus (4) Tolypella

Key to the species of Genus Chara

1a. Stipulodes essentially in 2 tiers; one or both of which may be reduced ---------- (2)

2a. Axial cortex essential 1 corticate ---------- Chara canescens

2b. Axial cortex essential 3 corticate ---------- (3)

3a. Cortex of basal branchlet segment normal --- Chara globularis

3b. Cortex of basal branchlet segment absent ---- Chara zeylanica

1b. Stipulodes essentially in 1 tier ---------- (4)

4a. Totally ecorticate ---------- (5)

5a. Stipulodes and bract-cells well formed; gametangia absent from base of whorl, monoecious ---------- Chara braunii

5b. Stipulodes and bract-cells generally rudimentary; gametangia at base of whorl and or at branchlet nodes, monoecious or dioecious ---------- Chara corallina

4b. Only axes corticated ---------- (6)

6a. Branchlets corticate; without terminal corona of reduced bract-cells ---------- (7)

7a. Stipulodes and bract-cells tapering; stipulodes 1-2 per branchlet, alternate ---------- Chara fibrosa --(8)

8a. Stipulodes elongate, often 10 times longer than wide; medium to small unspecialized, monoecious or dioecious --- ---------- Chara fibrosa v. fibrosa

8b. Stipulodes short, to 3 times longer than wide; medium to large ---------- Chara fibrosa v. hookeri

7b. Stipulodes and bract-cells large and cylindrical; stipulodes 1 per branchlet, opposite ---------- Chara ecklonii

6b. Branchlet ecorticate with or without terminal corona of reduced bract-cells ----------(9)

9a. With terminal corona of reduced bract-cells ---- Chara baueri

9b. Without corona; plants robust ---------- Chara hornemanii

Key to the species of Genus Nitellopsis

1. Stipulodes absent or rudimentary; bract-cells normally 2 at a node; anterior only; branchlet segments 2-5; ecorticate ----------(2)

2a. Sterile branchlets with 3-4 segments; without terminal mucro; 1 bract-cell at a branchlet node ---------- Nitellopsis sarcularis

2b. Sterile branchlets with 4-5 segments; with short terminal mucro; 1-2 bract-cells at a node; --- Nitellopsis bulbilifera

Key to the species of Genus Nitella

1a. Dactyle 1 celled ----------(2)

2a. Dactyle obtuse or acute, not acuminate ---------- (3)

3a. Without mucus; gametangia 1-2 at branchlet node, sessile ---------- Nitella flexilis

3b. With mucus; gametangia 2-3 at branchlet node, also stipitate at base of whorl ---------- Nitella mirabilis

2b. Dactyle extended into prolonged, gradually tapering point, acuminate ---------- (4)

4a. Branchlets 1 furcate ---------- Nitella acuminata

4b. Branchlets 2 furcate ---------- (5)

5a. Dactyle obtuse or acute ---------- Nitella stuartii

5b. Dactyle acuminate ---------- Nitella allenii

1b. Dactyle 2-5 celled; of which end cells are cylindrical ------ ----------(6)

6a. Branchlets 1-2 furcate; dactyle 2-5 celled, end cells allantoids to mucronate ---------- Nitella hookeri

6b. Branchlets 2-3 furcate ---------- (7)

7a. With dense mucus, dactyle 2-3 cells ---------- Nitella dualis

7b. Without mucus, dactyle 2-3 cells -------- Nitella heteroteles

1c. Dactyls 2-3 celled of which the end cell is different from other cells and is not allantoid, end cell small, tapering point cell ---------- (8)

8a. Medium to large, plant homoclemous ---------- (9)

9a. Monoecious, branchlet uniform in whorl, without mucus, head not form ---------- (10)

10a. Gametangia at the branchlet node, dactyle 2-3 cells elongate, end cell mucronate ---------- Nitella furcata

10b. Gametangia at the branchlet node and at the base of whorl, dactyle 2 cells, end cell mucronate, narrower at the base ---------- Nitella duthieae

9b. Dioecious, branchlet uniform in whorl, head not form, with mucus, dactyle 2 cells mucronate -------- Nitella penicillata

8b. Medium size, plant heteroclemous ---------- (11)

11a. Dioecious, with mucus when young, branchlet 2-3 furcate, dactyle 2-3 cells end cell conical, tapering from near the base, general much shorter than other cells, dactyle single, without extra point ---------- Nitella lhotzkyi

11b. Monoecious, without mucus, plant robust, sterile branchlet often appearing undivided terminal with tiny corona of reduced dactyle, head compact ---------- Nitella translucent

Key to the species of Genus Tolypella

Branchlets monopodial, not furcately divided; ray bilateral; antheridia lateral on adaxial side of branchlet nodes or at base of whorl; end cells of rays not allantoid, small, conical, sharp pointed; coronula persistent; oogonial convolution not swelling below coronula ---- Tolypella intricata

Description of the Species

Chara canescens Desv. & Lois indois. Fig. 1

Plants monoecious, 10-30 cm high, unincrusted to moderately incrusted. Axes moderately slender or stout, internodes 1-6 times as long as the branchlets, the length of internode of the same plant varies from 2-6 cm long; cortex 1 corticate, short secondaries occasionally present and only rarely extending part way between primaries; spine-cells abundant, in fascicles of 2-3 cells, occasionally in whorls. Stipulodes in 2 tiers, 2 sets per branchlet, upper similar to or longer than lowers, 1-3 times as long as the axis diameter, rarely small and globose, commonly as long as lowest branchlet segment. Branchlet undivided; 6-10 in a whorls, 0.4-1.7 cm long, convinent or rigidly straight; segments 4-6 of which 3-5 are corticated; and segment 1 celled, naked. Bract-cells 4-7, verticillate, usually exceeding segment, to 5 times as long as the branchlet diameter anteriors similar to postteriors. Bracteoles 2, 2-3 times as long as mature oogonium generally longer than anterior bract-cells. Gametangia conjoined, rarely sejoined at 3-4 lowest branchlet nodes. Oogonia solitary, rarely geminate, oogonia above antheridia; coronula large, 5 cells in 1 tier. Oospore black,

Habitat In swamp beside the main road, no shadow, water depth 50-100 cm transparency clear.

Distribution Nakhon Pathom.

Chara globularis Thuill., em. Fig. 2

Plants monoecious, 10-20 cm high, slightly to heavily incrusted. Axes moderately slender to stout, internodes 1-2 times as long as the branchlets, to 3-4 cm long; cortex 2 corticate, isostichous to slightly tylacanthous, spine-cells obscure, solitary to well developed and becoming 1-2 times longer than axis diameter. Stipulodes in 2 tiers, sets per branchlet, uppers similar to or longer than lower, 1-2 times as long as the axis diameter. Branchlets undivided; 6-11 in a whorl, to 2 cm long, segments 5-9 of which 1-7 are 2 corticate, sometimes irregularly corticate, occasionally entirely gymnophyllous; end segment 1-5 celled, naked; basal segment sometimes shortened. Bract-cells 4-8, verticillate to somewhat unilateral, fewer at more distal nodes; anteriors longer, 1-2½ times longer than oogonium; posteriors 1/4-1/2 times as long as oogonium, Gametangia conjoined at the 1-4 lowest branchlet nodes; oogonia above antheridia, coronula large, 5 cells in 1 tier. Oospores golden brown, dirty brown, dirty brown or black.

Habitat no record.

Distribution Chon Buri.

Chara zeylanica Klein ex Willd., em. Fig. 3

Plants monoecious or dioecious, small to large, 8-60 cm high, slightly incrusted; with or without cortication. Axes usually moderately slender, internodes longer or shorter than branchlets to 6 cm long; cortex essentially 3 corticate, partly 2 corticate, isostichous to slightly tylacanthous, rarely entirely absent; spine-cells solitary, variable, rudimentary to elongate, reaching 2-3 times as long as axes diameter, occasionally in transverse rows, often sparse or absent on lower axial internodes. Stipulodes in 2 tiers, well developed, 1/4-2 times as long as axis diameter, uppers 1-4 times longer than lowers; 2 sets per branchlet, sometimes irregular in placement and possibly in number. Branchlets undivided, 8-13 in a whorl, 0.6-0.8 cm long, straight or slightly incurved, spreading or ascending; segments 5-10 of which the basal and terminal ones are invariably ecorticate and of which more or less of the intercallary ones are 2-3 corticate, rarely branchlet entirely naked; basal segment frequently different from second, often abbreviated, 3/4-4 times longer than wide, often obscured behind the stipulodes, end segment 1 naked, distal segments 1-4 although occasionally 1 more branchlets partly to completely naked. Bract-cells 5-8 unilaternal to verticillate, anteriors equal to or longer than posteriors. Bracteoles 2, shorter to 1/4-2 times longer than mature oogonium. Gametangia conjoined or sejoined on separate plants at 2-7 lowest branchlet nodes, oogonia above antheridia in con-

joined strains, gametangia sometimes absent from lowest node; in sejoined strains, coronula large, 5 cells in 1 tier; oospore dark brown to black.

Habitat In canal along roadside, pool and natural lake, no shadow to soft shadow, water depth 50-200 cm, transparency clear.

Distribution Bangkok (Don Muang), Nakhon Pathom, Prachuap Khiri Khan (Hua Hin), Phang Nga (Takuapa), Songkhla.

Chara braunii Gm. Fig. 4

Plants monoecious, 6-60 cm high, often tufted in growth, sometimes slightly and occasionally annularly incrusted. Axes moderately stout, internodes as long as branchlet of 2 cm long, cortex none; spine-cells none. Stipulodes in 1 tier, 1 per branchlet, alternate, acuminate. Branchlets undivided; 8-11 in a whorl, straight or somewhat incurved; segments 4-5 of which the lower 3-4 are somewhat elongate, end segment reduced to tiny cell surrounded by bract-cells forming a small terminal corona. Bract-cells variable, 4-5 unilateral to verticillate, often absent from upper sterile nodes. Bracteoles resembling anterior bract-cells, shorter than to as long as mature oogonium. Gametangia conjoined, oogonia above antheridia, frequently geminate, at lowest 1-3 branchlet nodes. Coronula large, 5 cells in 1 tier. Oospores dark brown to black.

Habitat In irregation canal beside the road, no shadow, water depth 50-150 cm, transperancy clear.

Distribution Chiangrai (Mae Sai).

Chara corallina Klein. ex. Willd, em. Fig. 5

Plants monoecious or dioecious, 10-30 cm high, relatively slender. Axes moderately stout, internodes 1-2 times branchlet length; cortex none; spine-cells none. Stipuloides rudimentary in 1 tier, 1-2 times as numerous as the branchlets undivided, 4-8 in a whorl, 3-6 cm long; 3 segments, swollen constricted at nodes, with a reduced mucronate end cell. Bract-cells 3-4. Bracteoles 2, similar to bract-cells often shorter. Gametangia conjoined or sejoined on the same plant, 1-2 at base of whorl and at branchlet node. Oogonia convolutions, coronula large, 5 cells in 1 tier. Oospores black.

Habitat In reservoir, no shadow, water depth 50-150 cm, transparency clear.

Distribution Bangkok (Bang Khen), Ubon Ratchathani, Sakon Nakhon, Chon Buri, Chanthaburi, Phuket.

Chara fibrosa v. fibrosa Ag.ex. Bruz.,em. Fig. 6

Plants monoecious or dioecious, 5-40 cm generally unincrusted. Axes moderately stout, internode 1-4 times as long as the branchlets; cortex 2 corticate, commonly slightly tylacanthous; spine-cells solitary, variable. Stipuloides in 1 tier, 1-2 per branchlet, elongate, acuminate. Branchlet undivided, 8-16 in whorl, ecorticate; segments 3-6. Bract-cells 4-10 generally verticillate, 2-4 times as long as the oogonium. Bracteoles 2, similar to the bract-cells. Gametangia sejoined at 2-3 lowest branchlet nodes, or on separate plants. Oogonia small 2-3 times longer than wide, coronula large, 5 cells in 1 tier, oospores golden brown.

Habitat In paddy field and irregation canal, water depth 30-50 cm , no shadow, transparency not clear.

Distribution Surat Thani, Phuket.

Chara fibrosa v. hookeri (A.Br.), R.D.W. Fig. 7

Plants monoecious, probably large, slightly incrusted. Axes moderately stout, internode 1/2-1 times as long as the branchlets to 2.3 cm long; cortex 3 corticate, isostichous; spine-cells obscure, solitary, globular. Stipulodes in 1 tier, 2 per branchlet, short, 3 times longer than wide, conical. Branchlets undivided, 10-12 in a whorl, to 2.5 cm long, ecorticate; segments 4; end segment 1 cells, reduce, acute; bract-cells 8, verticillate, 6 times as long as the branchlet diameter. Bracteoles 2, slightly shorter than the

bract-cells 2 times as long as mature oogonium. Gametangium conjoined at lowest 2-3 branchlet nodes. Oogonia solitary, above antheridia, coronula large 5 cells in 1 tier, oospore black.

Habitat In paddy field and irregation canal, no shadow, water depth 30-150 cm , transparency not clear.

Distribution Nakhon Pathom, Ubon Ratchathani, Surat Thani.

Chara ecklonii A.Br.,ex. Kutz., em. Fig. 8

Plants monoecious. Axes with internodes 2-6 times as long as the branchlets; cortex apparently 2 corticate; spine-cells solitary sparse, acute. Stipulodes in 1 tier, 2 per branchlet, large and cylindrical, often shorter than the axis diameter. Branchlet undivided 6-8 in a whorl, ecorticate; segments 4-5, of which 3-4 are elongate. Bract-cells large verticillate, slightly inflated, accuminate. Gametangia conjoined, oogonia above antheridia at lowest 1-3 branchlet nodes and occasionally at base of branchlets. Coronula large, 5 cells in 1 tier, oospores black.

Habitat In canal along roadside, no shadow, water depth 50-100 cm , transparency clear.

Distribution Prachuap Khirikhan (Hua Hin).

Chara baueri A.Br., em. Fig. 9

Plants monoecious, 8-10 cm high, moderately incrusted. Axes moderately stout, internodes 3/4-1 times as long as the branchlet; cortex 3 corticate, isostichous; spine-cells solitary 1/4 as long as axis diameter. Stipulodes in 1 tier, 1 per branchlet alternate. Branchlet undivided, 8-10 in a whorl, 1.5 cm long, ecorticate, terminated by a corona of reduced bract-cells 4-5, unilateral, anteriors somewhat longer than posteriors. Bracteoles 2, similar to the anterior bract-cells, slightly exceeding mature oogonium. Gametangia conjoined at 1-2 lowest branchlet nodes, after geminate, occasionally aggregate. Oogonia above antheridia, coronula large, 5 cells in 1 tier, oospores black.

Habitat In pond beside the road, soft shadow, water depth 50-150 cm , transparency clear.

Distribution Bangkok, Nakhon Pathom.

Chara hornemanii Wallm., em. Fig. 10

Plants monoecious, 12-40 cm. high, coarse, occasionally incrusted. Internodes 1-1½ times as long as the branchlets; cortex 3 corticate, somewhat irregular, tylacanthous; spine-cells conspicuous, solitary. Stipulodes in 1 tier, 2 per branchlet. Branchlets undivided 8-11 in a whorl, 1-7 cm. long gently or sharply incurved, ecorticate; segments 4-6 commonly constricted at nodes; end cell mucroniform. Bract-cells 4-6 anteriors longer than posteriors. Bracteoles 2-5, 1 slightly exceeding anterior bract-cells, 2-4 times longer than mature oogonium. Gametangiumconjoined, oogonia above antheridia at each branchlet nodes. Oogonia incrusted, coronula large, 5 cells in 1 tier; oospores black.

Habitat In paddy field, no shadow, water depth 30-100 cm., transparency not clear.

Distribution Bangkok (Minburi), Samut Prakan (Bangple).

Nitellopsis sarcularis Zanev. Fig. 11

Plants dioecious, up to 20 cm. high. Axes moderately slender, internodes 1/2-1 times as long as the branchlet, to 4-6 cm. long; cortex none; spine-cells none. Stipulodes rudimentary or absent. Branchlets undivided, fertile 6 in a whorl, about 1 cm. long occuring in loose heads, ecorticate; segments 3-4; end cell acuminate to short conical; segments 3-4; end cell acuminate to short conical; sterile 5-7 in a whorl, to 4 cm long, segments 2-3. Fertile heads loose. Bract-cells 2, variable in size, solitary or paired; elongate at lowest branchlet node, papillate distal nodes. Gametangia, male solitary geminate at all branchlet nodes. Antheridia commonly geminate at all branchlet nodes. Oogonia 2, geminate at the first and second branchlet nodes and at the base of the whorl. Coronula large, 5 cells in 1 tier. Oospores brown to black.

Habitat In small pond beside the road, no shadow, water depth 50-100 cm., transparency clear.

Distribution Phuket.

Nitellopsis bulbilifera C.Dont. Fig. 12

Plants dioecious to 11 cm high, bright to olive green, annularly incrusted. Axes slender stout, internodes longer than the branchlets 2-3 times, to 4.5 cm long; cortex none; spine-cells none. Stipulodes unseen. Branchlets undivided, 6-8 in a whorl, to 1.5-2 cm long, moderately ascending, ecorticate; segments 4; end segment mucronate, 1 celled; end cell short, conical. Bract-cells 2, irregular, usually short and obtuse, but rarely well developed. Bracteoles none. Gametangia, female one or two at branchlet nodes and aggregates at base of whorl. Oogonia often vertically geminate, convolutions, swollen and elongated near apex, coronula slightly spreading, large, 5 cells in 1 tier. Oospores black.

Habitat In natural lake, soft shadow, water depth 150-250 cm , transparency clear.

Distribution Phatthalung (Lam Pam lake).

Nitella flexilis (L.) Ag. Fig. 13

Plants monoecious, protandrous or dioecious, 30-100 cm high, occasionally lime incrusted, bright green to dark brownish green, occasionally black. Axes slender to stout internodes variable, often abbreviated in fertile regions forming heads, often elongated below forming dendroid structure, most frequently 1-4 times as long as the branchlets. Branchlets furcate, sterile and fertile, similar or dissimilar; fertile 4-8 in a whorl, 1 furcate, normal or abbreviated, to 7 cm long, primary ray variable, often shorter than the secondary ray or to 4/5 of total branchlet length, secondaries 1-3; sterile 3-8 in a whorl, 1 furcate or occasionally appearing simple due to loss of all but one dactyl, short or to 7 cm long, primaries 1/8-4/5 of branchlet length, secondaries 1-3, tertiaries 1. Dactyls 1-3, 1/8-3/4 of total branchlet length, apex blunt, acute, apiculate and rarely acuminate. Heads present or absent, where formed 0.5-3 cm in diameter; commonly whorls or entire upper system become compacted and resemble heads. Gametangia on same or different plants, sejoined at the branchlet node, solitary, occasionally appearing to occur at branchlet nodes where fertile branchlets are excessively reduced. Oogonia 1 at a node, convolution 7-9, swelling distally, the ends becoming inflated; deciduous, generally absent from mature oogonia, upper cells occasionally longer than lowers. Coronula small 10 cells in 2 tiers. Oospores chestnut brown to dark

brown or black. Antheridia solitary at the last node in monoecious plants.

Habitat In clay pot, heavy shadow, water depth 40-50 cm, transparency clear.

Distribution Bangkok.

Nitella mirabilis Nordst. ex. J.Gr., em. Fig. 14

Plants dioecious, 15-30 cm high. Axes moderately slender internodes 1-2 times as long as the branchlets to 6 cm long. Branchlets, fertile 6-8 in a whorl, short or similar to sterile often irregular in length, 2 furcate, primary ray 1/2-2/3 of branchlet length, secondaries 2-4, tertiaries 2-3; sterile 6-8 in a whorl, similar to fertile but elongate, to 4.5 cm long, 2 furcate, primary ray 2/3 of branchlet length, secondaries 2-4 Dactyls 2-4, 1 celled, 1-2 cm long, tapering sharply to acute or apiculate tip. Heads few to numerous, compact or diffuse and abscure, 0.2-0.5 cm across, with mucus. Gametangia on separate plants, aggregate, sessile or stipitate at the nodes of short, uncommon on the long branchlet and at base of whorl. Oogonia 2-3 at a node, convolutions 7-8, swollen distally. Coronula small, 10 cells in 2 tiers; oospores golden or chestnut brown. Antheridia 2-4 at a node sessile or stipitate at base of whorl.

Habitat In reservoir, no shadow, water depth 30-100 cm, transparency clear.

Distribution Chanthaburi.

Nitella acuminata A.Br., ex. Wallm., em. Fig. 15

Plants monoecious or dioecious, to 15-30 cm high, dendroid, bright to dark green with densely compact heads. Axes moderately stout, internodes tiny in fertile heads, but in other parts about as long as the branchlets, to 3.5 cm long, 1 furcate, primary ray 1/5-1/3 of branchlet length, secondaries 2-3; sterile 5-7, to 2-4 cm long, upper branchlets commonly longer than lower, 1 furcate, primary ray 1/3-3/5 of branchlet length, secondaries 2-3. Dactyls fertile 2, 1 celled, tiny, 0.15 cm long, acuminate, terminating with elongated cell-wall. Heads numerous, 2-8 per shoot, 0.3-1 cm in diameter, densely compact, generally sessile, axillary amid elongated sterile branchlets. Gametangia aggregate, conjoined or sejoined at fertile branchlet nodes and at base of whorl. Antheridia 1 above oogonia, 1-3 at a node, coronula small, 10 cells in 2 tiers. Oospores dark reddish brown to black.

Habitat In reservoir and natural lake, no shadow, water depth 50-200 cm, transparency clear.

Distribution Sakon Nakhon, Loei (Nam Pong Dam)

Nitella stuartii A.Br. Fig. 16

Plants monoecious or dioecious, 20-30 cm high, upper fertile whorls heteroclemous occasionally incrusted. Axes moderately stout; internodes shorter or longer than the branchlets. Branchlets, fertile varying in number, usually 5-6 in a whorl, to 2 cm. long, 2 furcate, primary ray 1/3 of branchlet length, secondaries 4-6, often short, tertiaries 2-3; accessory branchlets 2-6 below the fertile branchlets, 0.1-0.2 cm. long, 1-2 furcate usually sterile; sterile branchlets 5-7 in whorl, 2 cm long, secondaries 4-6, tertiaries 2-3. Dactyles 2-3, 1 celled acute or obtuse. Head not form, fertile whorls with accessory branchlets occassionally suggesting heads, 0.4-1 cm in diameter. Gametangia conjoined or sejoined at fertile branchlet nodes, uncommonly at nodes of accessory branchlets. Antheridia 1 above oogonia, oogonia aggregate, 2-6 at a node. Oospores light golden chestnut brown.

Habitat In paddy field and reservoir, soft shadow to no shadow, water depth 50-200 cm , transparency clear.

Distribution Bangkok, Chonburi, Loei, Ubon Ratchathani.

Nitella allenii Imah., em. Fig. 17

Plants monoecious or dioecious, 5-25 cm high, commonly much branched, occassionally annularly incrusted. Axes moderately slender to stout, internodes abbreviated in heads, otherwise 1-3 times as long as the branchlets, to 9 cm long. Branchlets fertile 6-11 in a whorl, 0.1-0.5 cm long compacted into loose heads 2 furcate, primary ray 1/3-1/2 of branchlets occasional at base of upper fertilewhorls, abbreviated 0.08-0.15 cm long, 2 furcate; sterile 6-11 in a whorl, often irregular in length, to 4.5 cm long, primary ray 3/4 of branchlet length, secondaries 3-5, tertiaries 2-3. Dactyls 2-3, 1-2 celled, acuminate or acute. Head 2-5 per shoot, terminal or axillary loose, 0.2-0.8 cm in diameter, with or without mucus. Gametangia conjoined or sejoined at nodes of fertiles branchlets. Antheridia germinate on the last node of branchlet on dioecious, abowe oogonia on conjoined, oogonia 1-5 sessile at a node. Oospores dark brown, coronula small, 10 cells in 2 tiers.

Habitat In paddy field, small pond and reservoir, soft shadow to no shadow, water depth 10-200 cm , transparency clear.

Distribution Nakhon Pathom, Ubon Ratchathani, Prachin Buri, Phuket.

Nitella hookeri A.Br. Fig. 18

Plants monoecious, 8-11 cm high, axes slender, internodes shorter than to as long as the branchlets to 2 cm long. Branchlets fertile similar to or somewhat shorter than sterile; sterile 6-8 in a whorl, to 2.5 cm long, 2-3 furcate primary ray 1/2 of branchlet length, secondaries 3-5, tertiaries 1-2. Dactyls 2-3 celled, end cell variable in size and form from tiny and mucronate to large and allantoid, penultimate cell allantoid, mucro commonly 2 celled. Heads not formed, or consisting of somewhat congested upper whorls. Gametangia conjoined or sejoined at the node of branchlet. Antheridia single above oogonia, oogonia sessile 1-3 at branchlet node. Coronula small, 10 cells in 2 tiers. Oospores very dark red or brown.

Habitat In paddy field and in reservoir, no shadow, water depth 50-100 cm , transparency clear.

Distribution Chachoengsao, Chanthaburi.

Nitella dualis Nordst. in T.F.A. ? Fig. 19

Plants monoecious or dioecious, 5-30 cm high, bright to brownish green, young upper whorls enveloped in dense mucus. Axes slender to moderately stout, internodes 1/2-5 times as long as the branchlets to 1-2.5 cm long. Branchlets fertile 5-9 in a whorl, commonly congested into globular heads, 0.2-2 cm long, 2-3 furcate, primary ray 1/2-2/3 of branchlet length, occasionally very stout, secondaries 5-7, tertiaries 3-5 of which 1 more may be again furcate into 3-4 quaternaries and rarely to 2-3 quinaries; sterile 5-10 in a whorl, 1-3.8 cm long, 2-3 furcate, primary ray 1½-2 as long as branchlet length commonly very stout, secondaries 5-8, tertiaries 3-5, quaternaries 3-4, and occasionally 3-4 quinaries; often sterile and fertile branchlets similar. Dactyls 2-4, 2 celled, and cell allantoid, abruptly pointed, acute or rarely acuminate. Heads few, loose or compact, 0.2-0.8 cm in diameter, enveloped in mucus; generally young terminal whorls rather than true heads. Gametangia sessile, conjoined or sejoined at all fertile branchlet nodes, commonly absent from the lowest branchlet node. Antheridia above oogonia in conjoined, oogonia single convolutions 8-10, occasionally swelling distally. Coronula small, 10 cells in 2 tiers; oospores chestnut brown to black.

Habitat In small pond beside road, no shadow, water depth 10-50 cm , transparency clear.

Distribution Phuket.

Nitella heteroteles J.Gr. & Steph. Fig. 20

Plants sterile, apparently of medium size, 10 cm high. Axes slender, internode 2-3 times longer than branchlet length. Branchlets 5-8 in a whorl, 2-3 furcate, primaries not less than 1/2 of branchlet length, secondaries 4, tertiaries 3. Dactyls 3-4, 2 celled, penultimate cell rounded at apex end cell minute mucro with acute tip. Heads apparently not formed, young whorls without mucus.

Habitat In irregation canal, no shadow, water depth 50-100 cm, transparency clear.

Distribution Phuket

Nitella furcata Ag., em. Fig. 21

Plants monoecious, 10-30 cm high, without heads. Axes moderately slender to stout, internodes 1-5 times as long as the branchlets, 3-8 cm long. Branchlets, fertile 5-8 in a whorl, occasionally fertile parts compacted with branchlets 0.3-1 cm long, 2-4 furcate, primary ray 1/5-1/3 of branchlet length, secondaries 2-6, tertiaries 2-4, quaternaries 2-4, quinaries 2-3; short accessory branchlets rare at base of whorl or central at lowest furcation; sterile generally similar to fertile, or larger and more diffuse, primary ray 1/4-9/10 of branchlet length, secondaries 3-5, otherwise similar to fertile. Dactyls 2-4, 2-3 celled, all elongate, parely with short 1 celled dactyls. Heads generally not formed, without mucus.

Gametangia sessile, conjoined or sejoined at second and third branchlet nodes, antheridia above oogonia, 1 pair at each node, coronula small 10 cells in 2 tiers. Oospores reddish brown, black.

Habitat In stream, natural lake, reservoir; heavy shadow, water depth 50-200 cm, transparency clear.

Distribution Bahgkok, Kanchanaburi, Loei, Sakon Nakhon, Chanthaburi.

Nitella duthieae J.Gr. & Steph., Fig. 22

Plants monoecious of medium size, probably to 20 cm high. Axes moderately slender, internodes 1-2 times as long as the branchlets. Branchlets fertile 6 in a whorl, to 1-2 cm long, 2-3 furcate primary ray 1/2-9/10 of branchlet length, secondaries 3-5 of which 1 may be central, tertiaries 3-4, quaternaries 2-4, quinaries 2; sterile similar to fertile. Dactyls 2-3, 2 celled, rather abbreviated, lower cell tapering; end cell conical, acute. Heads not formed. Gametangia conjoined sessile at node 1 pair at lowest second furcation, without mucus. Antheridia above oogonia, coronula small, 10 cells in 2 tiers, oospores chestnut brown.

Habitat No record.

Distribution Sakon Nakhon.

Nitella penicillata A.Br., Fig. 23

Plants dioecious, male plant, small to large, 12 cm. high. Axes moderately slender, internodes 1-3 times as long as the branchlets to 2 cm long. Branchlets, fertile 6 in a whorl, to 0.7 cm long, 2-3 furcate, primary ray 1/2 of branchlet length, secondaries 6-7 of which 1 is occasionally central and reduced or forming adventitious branch, tertiaries 5-6, occasionally again furcate into 2-3 quaternaries; sterile similar to fertile. Dactyls 2-4, 2 celled, penultimate cell tapering sharply to base of end cell, end cell conical, acute, deciduous, slightly narrower than penultimate cell and thus somewhat mucronate. Heads not formed upper whorls compacted, also young branches compacted; with mucus. Gametangia on seperate plants, solitary, occasionally at fertile branchlet nodes.

Habitat In swamp area, soft shadow, water depth 50-100 cm, transparency not clear.

Distribution Bangkok.

Nitella lhotzkyi A.Br., em. Fig. 24

Plants dioecious male, small 4-10 cm high, whorls isolated or confluent, commonly with mucus when young. Axes slender to stout, internodes elongate, at least 2-4 times as long as the branchlet. Branchlets heteroclemous; fertile 6-7 in a whorl, at least 0.4 cm long, 3 furcate, primary ray 1/3-1/2 of branchlet length, secondaries 4-5, tertiaries 3-5, quaternaries 3-5; sterile similar to fertile; accessory in 1 tier, generally smaller than normal branchlets, 1-2 furcate. Dactyls 3-5, 2 celled, penultimate cell allantoid; end cell variable, generally long and very narrow, mucronate. Heads not formed, but confluent whorls or isolated whorls may resemble heads. Gametangia sessile, solitary at 1-2 lowest branchlet furcations; occasionally with mucus.

Habitat No record.

Distribution Loei (Phukadung National Park)

Nitella translucens Ag., em. Fig. 25

Plants monoecious 15-20 cm high, bright or dark green. Axes moderately stout; internodes 1-2 times as long as the sterile branchlets, to 3-5 cm long. Branchlets fertile 6 in a whorl, in tiny compact heads, to 0.2 cm long, 2-3 furcate, primary ray 1/2 of branchlet length, secondaries 3-4, tertiaries 2-3 of which 1-2 furcate again into 3 quaternaries; sterile 5-7 in a whorl, to 3 cm long, 1 furcate, primary ray comprising the entire branchlet length, stout, secondaries 3-4 and reduced forming a tiny cuspidate corona terminal on the apparently simple branchlets. Dactyls fertile 1-3, 1 celled, nearly as long as penultimate ray, deciouous, basal cell tapering gradually to base of end cell; end cell conical, acute, sterile 2 celled abbreviated forming cuspidate corona. Heads numerous, several at base of whorls, often confluent and commonly appearing to form a circle outside the base of the branchlets; without mucus. Gametangia sessile, antheridia 1 above oogonia 2, at lowest fertile branchlet node. Coronula small, 10 cells in 2 tiers, oogonia 1-2 at base of branchlets, oospores yellowish or brown.

Habitat In man-made lake, soft shadow, water depth 50-100 cm , transparency clean.

Distribution Chonburi (Bang Phra reservoir).

Tolypella intricata Leonh., em. Fig. 26

Plants monoecious or dioecious, 7-50 cm high, slightly to heavily incrusted, rarely unincrusted. Axes moderately slender to quite stout, internodes 1-3 times as long as the branchlets, 2.5-10 cm long. Branchlets, fertile 4-8 in a whorl, in coarse or neat head, 0.3-1.7 cm long, 1 divided, branchlet axis with 1-2 nodes each, basal branchlet cell variable, very short to long, lateral rays 3-6 celled, end segment 3 celled, 1-2 times as long as the laterals, attenuate; sterile 4-6 in a whorl, occasionally deciduous, 2-10 cm long, simple and 3-5 celled, basal segment then 1/4-3/4 of branchlet length, rays and end segment similar, 3 celled. Rays 3 celled, attenuate, end cell conical, acute, narrower than or as wide as penultimate cell, occasionally mucronate. Heads variable, few to numerous, 0.5-1.5 cm in diameter, short or occasionally long stipitate; consisting of 1 more fertile branchlet whorls borne on reduced branches axillary in the upper sterile branchlet whorls; without mucus. Gametangia conjoined or sejoined at fertile branchlet nodes and at the base of the whorls, sessile, usually a central adaxial antheridium with 2 more lateral oogonia. Oogonia 1-4 at node, lime incrusted, coronula small, 10 cells in 2 tiers. Oospores light brown or wine red, chestnut or dark reddish brown.

Habitat In roadside canal and in reservoir, soft shadow, water depth 50-150 cm., transparency not clear.

Distribution Bangkok (Minburi), Chonburi (Bang Phra reservoir).