

OEDOGONIUM IN PESHAWAR VALLEY

By

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Abstract

Twenty two taxa of *Oedogonium* have been described from Peshawar Valley of N.W.F.P., Pakistan. A new species, *O. ahmadii*, and a subspecies, *O. crassiusculum* subsp. *peshawarensis*, have also been described. All these taxa are new records from Pakistan.

Introduction

The fresh-water algal flora of Pakistan is being worked out extensively in the Department of Botany, University of Peshawar and this study is a part of the programme.

The taxa collected are as under:—

O. undulatum, *O. mitratum*, *O. decipiens*, *O. ahmadii*, *O. hirnii* ssp. *africanum*, *O. magnusi*, *O. cryptosporum* ssp. *vulgare*, *O. rufescens* ssp. *exiguum*, *O. franklinianum*, *O. varians*, *O. dictyosporum*, *O. hirnii*, *O. crassum*, *O. scrobiculatum*, *O. argenteum*, *O. wyliei*, *O. hystrix*, *O. semiapertum*, *O. braunii* ssp. *zehneri*, *O. crassiusculum* ssp. *peshawarensis*, and *O. cyathigerum*.

Out of these taxa a species viz: *O. ahmadii* and one new subspecies, *O. crassiusculum* ssp. *peshawarensis* are new while the description of an incomplete species *O. pusillum* has been completed.

Material and Methods

The collection of *Oedogonium* was made from the semi-permanent and permanent ponds, pools of rain water and springs by hand picking, plankton-net, squeezing and scrapping the aquatic vegetation.

The specimens were examined in fresh condition and were preserved in 3% formalin. Immature specimens were cultured in soil extract (Faridi 1964, 1971). To clear the specimens 2% potassium hydroxide or 5% acetic acid solutions were used. The drawings were made by Camera Lucida. The numbers of the specimens are those of Shahid Farooq. All the specimens have been deposited in the Department of Botany, University of Peshawar.

Ecology

The genus *Oedogonium* is fairly common in Peshawar Valley and found in almost all types of waters. They are common in turbid ponds, permanent ponds, ditches, puddles, semi-permanent ponds and rarely in springs. The species of the genus are mostly attached to water weeds and sticks. They are also found rarely floating.

The sexual reproduction of *Oedogonium* in Peshawar Valley mostly takes place in late Winter and early Spring unlike the U.S.A. The small-sized species have generally shorter vegetative period and mature earlier than the large-sized ones as also reported by Tiffany (1930).

It was reported (Islam and Srma, 1964), that *Lemna* does not encourage the growth of *Oedogonium*. This statement does not seem to be universal as *O. crassiusculum* ssp. *peshawarensis* was collected from a pond where *Lemna* was dominant. It is true that other taxa of *Oedogonium* were not collected from such localities where *Lemna* is dominant, but it is probably not due to any antagonism between the two. Aquatic angiosperms curtail light to a minimum and the growth of *Oedogonium* probably suffers because of the lack of light.

Since this study is based on collection made in Winter, Spring and early Summer only, no conclusion can be drawn about the periodicity of the species in Peshawar Valley for the whole year.

The soil of Peshawar Valley is basic with a pH ranging from 7.00 to 9, rarely upto 9.6 with an annual average rainfall of 13.6 inches. The total area of the Valley is 6,053 sq. miles and is surrounded by high mountains. The Valley is rich in springs.

Taxonomy

Filaments single, unbranched; vegetative cells uninucleate, cylindrical, or capitellate, nodulose or undulate; chloroplast reticulate, with numerous pyrenoids at large intersections of reticulum; basal cell with hold fast; apical cell obtuse, apiculate or hyaline; vegetative cells, except the basal one, capable of division; oogonia and antheridia produced by direct division of vegetative cells; zoospores multiflagellate.

KEY TO THE SPECIES

- | | | |
|--|---|----|
| 1. Cells undulate | <i>O. undulatum</i> | |
| 1. Cells distinctly capitellate | | 2 |
| 1. Cells cylindrical | | 5 |
| 2. Without dwarf male | <i>O. mitratum</i> | |
| 2. With dwarf male | | 3 |
| 3. Oogonium 28-35 μm wide | <i>O. decipiens</i> | |
| 3. Oogonium 35-66 μm wide | | 4 |
| 4. Oospore not filling oogonium | <i>O. ahmadii</i> | |
| 4. Oospore filling oogonium | <i>O. hirnii</i> subsp. <i>africanum</i> | |
| 5. Without dwarf male | | 6 |
| 5. With dwarf male | | 15 |
| 6. Oogonium opening by a lid | <i>O. pusillum</i> | |
| 6. Oogonium opening by pore | | 7 |
| 7. Pore median | | 8 |
| 7. Pore supra median | | 10 |
| 7. Pore superior | | 11 |
| 8. Spore wall scrobiculate | <i>O. magnusii</i> | |
| 8. Spore wall smooth | | 9 |
| 9. Monoecious | <i>O. cryptoporum</i> subsp. <i>vulgare</i> | |
| 9. Dioecious | <i>O. rufescens</i> subsp. <i>exiguum</i> | |
| 10. Vegetative cell 8-12 μm thick. | <i>O. franklinianum</i> | |
| 10. Vegetative cell 12-16 μm thick. | <i>O. varians</i> | |

11. Spore wall reticulate.....	<i>O. dictyosporum</i>	
11. Spore wall smooth		12
11. Spore wall scorbiculate.....		13
12. Oogonium 28-31 μm thick.....	<i>O. hirnii</i>	
12. Oogonium 60-75 μm thick.....	<i>O. crassum</i>	
13. Suffultory cells enlarged	<i>O. scorbiculatum</i>	
13. Suffultory cells not enlarged		14
14. Oogonium 45-53 μm thick.....	<i>O. argenteum</i>	
14. Oogonium 51-64 μm thick.....	<i>O. wyliei</i>	
15. Pore median		16
15. Pore superior		18
16. Spore wall spiny	<i>O. hystrix</i>	
16. Spore wall smooth		17
17. Vegetative cell 9-12 μm thick	<i>O. semiapertum</i>	
17. Vegetative cell 12-24 μm thick.....	<i>O. braunii</i> subsp. <i>zehneri</i>	
18. Oospore wall smooth	<i>O. crassiusculum</i> subsp. <i>peshawarensis</i>	
18. Oospore wall longitudinally ribbed ..	<i>O. cyathigerum</i>	

1. *Oedogonium undulatum* (Breb.) A.Br. 1854.
Tiffany, 1930: p. 118, pl. 42, fig. 407.

Dioecious, nannandrous, gynandrosporous or idioandrosporous; oogonium 1-2, subglobose, or ellipsoid-globose, operculate, division inferior, wide; oospore globose or subglobose, quite filling oogonium, spore wall smooth, some times thick; androsporangium to 7 seriate; vegetative cells undulate; terminal cell (some times oogonium) apically obtuse; dwarf male elongate-obconic, usually on suffultory cell, rarely on other vegetative cell near oogonium; antheridium inferior; vegetative cell 15-22 x 45-110 μm ; oogonium 48-56 x 50-75 μm ; oospore 42-50 x 42-52-(60) μm ; androsporangium 15-21 x 7-14 μm ; dwarf male 8-10 x 48-65-(70) μm . (fig. 1).

Locality: Peshawar, (M.A.F. Faridi, Dec. 1964.)

Distribution: U.S.A., China, Austria, England, France, Bangladesh, Pakistan.

2. *O. mitratum* Hirn. 1895.
Tiffany, 1930: p. 105, pl. 36, fig. 334-335.

Dioecious, macrandrous; oogonium 1-4, globose or subglobose, operculate division superamedian or superior, narrow but distinct; oospore globose (rarely subglobose), filling oogonium, spore wall smooth; antheridium 1-5, subepigynous, sperms 2, division horizontal; vegetative cells often broadly capitellate, vegetative cell 5-10 x 18-80 μm ; oogonium 18-24-(27) x 20-28 μm ; oospore 17-23 x 17-22 μm ; antheridium 6-9 x 6-8 μm . (fig. 2).

Locality: Karamar Hills, (Sardar Hussain Shah No.1, 1964.)

Distribution: U.S.A., Austria, Finland, Sweden, Pakistan.

3. *O. decipiens* Wittr. 1870.

Tiffany, 1930: p. 145, pl. 45, fig. 520.

Dioecious, nannandrous, gynandrosporous; oogonium 1-3, subdepressed or depressed-globose, operculate, division median, rather narrow; oospore subdepressed

or depressed-globose, almost filling the oogonium, spore wall smooth: suffultory cell not swollen: androsporangium 1-6, subepigynous, hypogynous, or scattered; dwarf male unicellular usually on the oogonium; vegetative cells evidently capitellate, 8-11 x 25-65 μm ; oogonium 28-35 x 23-38-(40.7) μm ; oospore 23-34 x 21-30 μm ; androsporangium 8-9 x 6-10 μm , dwarf male 5-6-(12.1) x 11-14-(17) μm . (fig. 3).

Locality: Mardan, Fazle Khaliq, No. 90, 2.5.75

Distribution: U.S.A., France, Sweden, England, Africa, Pakistan.

4. *O. ahmadii* Farooq & Faridi sp. nov.

Species monoecia, macrandra; oogonium unicum: subglobosum ad subovoideum, porus superior; oospora globosa, oogonium non complens; membrana oosporae levis; antheridia duo, subepigyna; spermata duo, divisione horizontali; cellula vegetativa late capitellata, 13-17.7 x 33-74.8 μm ; oogonium 39-50.6 x 38-52.6 μm ; oospora 33-49.5 x 33-49.5 μm ; antheridium 13-22.1 x 8-22.2 μm ; filamentum masculinum nanum 6.6-17.7 μm .

Monoecious, macrandrous; oogonium 1, subglobose to subovoid; pore superior; oospore globose, not filling oogonium; spore wall smooth; antheridium horizontal; vegetative cells broadly capitellate, 13-17.7 x 33-74.8 μm ; oogonium 39-50.6 x 38-52.6 μm ; oospore 33-49.5 x 33-49.5 μm ; antheridium 13-22.1 x 8-22 μm ; dwarf male 6.6 x 17.7 μm . (fig. 4).

Habitatus:- Mardan, Holotype No. T 121. (Fazle Khaliq No. 92, 25.2.75.)

This species is named after Dr. Sultan Ahmad, Government College, Lahore. The type specimen is deposited in the Herbarium of Department of Botany, University of Peshawar.

5. *O. hirnii* ssp. *africanum* G. S. West.

Tiffany 1930: p. 73, pl. 14, fig. 138.

Monoecious, oogonium 1 subglobose-obovoidglobose, with superior pore; oospore filling oogonium, spore wall smooth; antheridium 1-2, sperms 2, division horizontal; vegetative cell cylindrical (sometimes slightly capitellate) 16-22 x 51-77 μm ;

Oogonium 32-66 x 35-60 μm ; Oospore 30-64 x 34-58 μm ; antheridium 13-14 x 5-6 μm . (fig. 5).

Locality: Mardan, (Fazle Khaliq No. 90(a), 15-4-75.)

Distribution: U.S.A., Africa, Pakistan.

6. *O. pusillum* Kirchner 1878 emend.

Tiffany 1930: p. 161, pl. 34, fig. 316.

Oogonium 1 (rarely 2), subbiconic-ellipsoid or subbiconic-globose, seen from above circular, margin even, operculate, division wide; oospore ellipsoid or globose, generally constricted at the middle, not quite filling oogonium, spore wall smooth; basal cell sub-hemispherical; terminal cell obtuse or obtusely conical; vegetative cell-3-6-(6.6) x 10-60 μm ; oogonium 14-16 x 15-25 μm ; oospore 11-13 x 13-15 μm ; basal cell 7-8 x 7-8 μm ; male filaments 11-18.7 x 19.8 μm . (fig. 6).

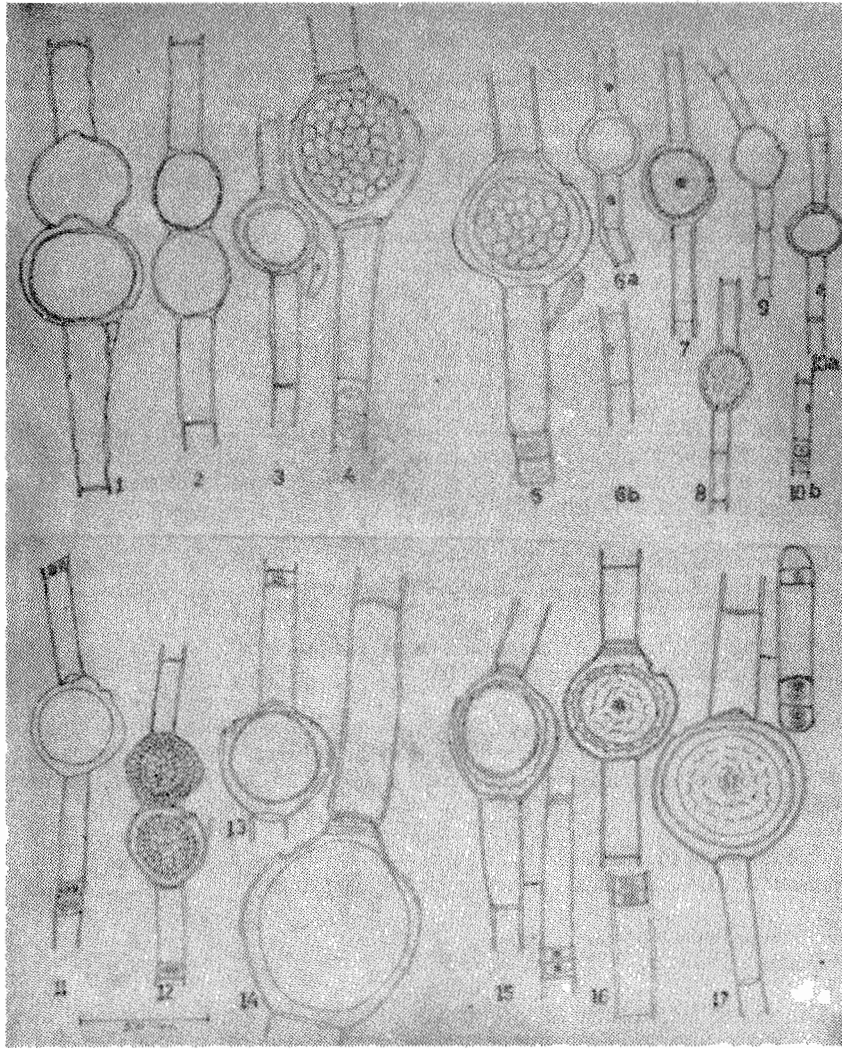


Plate I. Fig. 1 *O. undulatum*, 2 *O. mitratum*, 3 *O. decipiens*, 4 *O. ahmadii*, 5 *O. hirtii* sussp. *africanum*, 6 *O. pusillum* 7 *O. magnussi*, 8 *O. erytoporum* subsp. *vulgare*, 9 *O. frufescens* us sp. *exiguum*, 10 *O. franklinianum*, 11 *O. varians*, 12 *O. dicryosporum*, 13 *O. hirtii*, 14 *O. crassum*, 15 *O. scordiculatum*, 16 *O. argenteum*, 17 *O. wyliei*,

Locality: Karamar Hills, Sardar Hussain Shah No. 2, 1964.

Distribution: U.S.A., Austria, France, Africa, Bangladesh, Pakistan.

This species was incompletely known as male plants were unknown. In this collection male plants are also present.

7. *O. magnusii* Wittr. 1874.
Tiffany 1930: p. 68, pl. 12, fig. 115.

Dioecious, macrandrous, (perhaps monoecious also); oogonium 1-3, depressed-globose, pore median, rimiform; oospore depressed globose, quite filling oogonium, spore wall of three layers: outer layer smooth, middle layer scrobiculate, inner layer smooth; antheridium to 8 seriate; sperm 1; vegetative cell 7-10 x 12-40 μm ; oogonium 24-27 x 12-26-(33) μm ; oospore 22-25 x 18-23 μm ; antheridium 8-10 x 5-11 μm . (fig. 7).

Locality: Peshawar University Town (S. Farooq No. 64(a), 12-3-1975).

Distribution: U.S.A., Europe, Pakistan.

8. *O. cryptoporum* Wittr. subsp. *vulgare* Wittr. 1872.
Tiffany 1930: p. 65, pl. 11, fig. 101.

Monoecious; oogonium 1, subdepressed-obovoid-globose, or subdepressed-globose, pore median; oogonium quite filling, spore wall smooth; antheridium 1-7, scattered or subhypogynous or subepigynous; sperms 1; vegetative cell 5-8x15-48 μm ; oogonium 1- ; oogonium 18-25 x 18-25 μm ; spore wall pitted, oospore 16-23 x 16-19 μm ; antheridium 5-7 x 9-12 μm . (fig. 8).

Locality: Peshawar, S. Farooq No. 8, 1-2-1975.

Distribution: U.S.A., Sri Lanka, Europe, Pakistan.

9. *O. rufescens* Wittr. ssp. *exiguum* (Elfvig) Tiffany 1930.
Tiffany 1930: p. 66, pl. 11, fig. 106.

Dioecious, macrandrous; oogonium 1-3 obvoid or depressed-obvoid-globose, filling oogonium or nearly so, spore wall smooth; antheridium 1-3; vegetative cell 5-9 x 22-88 μm ; oogonium 22-24 x 20-28 μm ; oospore 20-22x 17-28 μm ; antheridium 5 x 10-12 μm . (fig. 9).

Locality: Peshawar (S. Farooq No. 7, 1-2-1975.)

Distribution: U.S.A., Albania, France, China, Pakistan.

10. *O. franklinianum* Wittr. 1880.
Tiffany, 1930: p. 71, pl. 13, fig. 131.

Dioecious, macrandrous; oogonium 1, subglobose with a suprmedian pore: oospore globose, almost filling oogonium, spore wall smooth; antheridium 1-4; sperms 2, division horizontal; female vegetative cell 9-12 x 30-95 μm ; male 8-10 x 25-90 μm ; oogonium (22) -26-31 x (18)-29-44 μm ; oospore)24-30 x 24-30 μm ; antheridium 8-9 x 5-7 μm . (fig. 10).

Locality: Peshawar University, S. Farooq No. 63, 2-3-75.

Distribution: U.S.A., Brazil, Australia, Pakistan.

11. *O. varians* Wittr and Lundell 1874.
Tiffany, 1930: p. 69, pl. 12, fig. 120.

Monoecious, (or sometimes dioecious); oogonium 1, or rarely more, depressed- or subdepressed-pyriform-globose, pore nearly superior; oospore globose, not filling

oogonium, spore wall smooth; antheridium to 9-seriate, scattered; sperms 2, division horizontal; basal cell elongate; terminal cell apically obtuse; vegetative cell (8.8)-12-16 x 35-144 μm ; oogonium (32)-34-50 x 34-55 μm ; oospore 31-41 x 31-41 μm ; antheridium (8)-11-15 x 5-7 μm . (fig. 11).

Locality: Peshawar University Town, (S. Farooq No. 64(b), 12-3-1975.)

Distribution: U.S.A., Europe, Pakistan.

Peshawar specimens are smaller in dimension than the type.

12. *O. dictyosporum* Wittr. 1874.
Tiffany, 1930: p. 94, pl. 28, fig. 246.

Monoecious; oogonium 1-2, dark brown, obvoid globose with superior pore; oospore globose to ellipsoid-globose, usually not filling oogonium; outer wall of the oospore is reticulate, inner smooth; antheridium 1-3, subepigynous; sperms 2; vegetative cell 11-16 x 25-95 μm ; oogonium (29.7)-33-40 x 38-46 μm ; oospore 28-39 x 30-40 μm ; antheridium 8-13 x 5-10 μm . (fig. 12).

Locality: Tarujabba, (S. Farooq No. 11, 3-2-75.)

Distribution: U.S.A., Africa, Pakistan.

Oogonium is smaller than the type and becomes dark brown in colour at maturity.

13. *O. hirnii* Gutwinski 1896.
Tiffany, 1930: p. 73, pl. 14, fig. 136-137.

Monoecious; oogonium 1, subglobose or subovoid, with superior pore; oospore globose, not filling oogonium, spore wall smooth; antheridium 1-2, subepigynous; sperms 2, division horizontal; vegetative cell cylindrical, (sometimes slightly capitate) 8-13 x 28-30-(33) μm ; oogonium 32-37 x 32-39 μm ; oospore 28-31 x 28-31 μm ; antheridium 8-11 x 4-9 μm . (fig. 13).

Locality: Akbarpura, (S. Farooq No. 13, 7-3-1975).

Distribution: Austria, Ireland, Bangladesh, Pakistan.

The oospore is broad and almost equal in length to the length of vegetative cell.

14. *O. crassum* (Hassall) Wittr. 1872.
Tiffany 1930: p. 88, pl. 23, fig. 202-203.

Dioecious, macrandrous; oogonium 1-2, ovoid to obovoidellipsoid, pore superior; oospore ellipsoid to globose, filling or not filling oogonium. spore walls smooth; antheridium 2-25; sperms 2, division vertical; female vegetative cell 36-50 x 72-340 μm ; male 30-36 x 72-260 μm ; oogonium 60-75 x 85-120 μm ; oospore 58-76 x 75-96 μm ; antheridium (20.7)-28-32 x 10-20 μm . (fig. 14).

Locality: Pabbi, (S. Farooq No. 9, 15-3-1975.) and Tarujabba. (S. Farooq No. 5, 3-2-1975).

Distribution: U.S.A., Austria, Europe, Africa, Pakistan.

The male filaments are very thin (about few microns). The oogonium is more urn-like than the type specimen.

15. *O. scrobiculatum* Wittr. 1893.
Tiffany, 1930: p. 95, pl. 29, fig. 258-259.

Dioecious, macrandrous; oogonium 1-3, obovoid or subellipsoid, pore superior; oospore of same form as oogonium and nearly filling it, outer spore wall scrobiculate, inner smooth; antheridium 1-many, sperms 2, division horizontal; female vegetative cell 16-24 x 50-144 μm ; male 15-19 x 45-110 μm ; suffultory cell 21-30 x 34-90 μm ; oogonium obovate, 40-48 x 60-88 μm ; oospore 39-45 x 48-57 μm ; antheridium 13-15 x 8-12 μm . (fig. 15).

Locality: Peshawar, (S. Farooq, No. 3, 4-4-1975.)

Distribution: U.S.A., Denmark, Pakistan.

16. *O. argenteum* Hirn. 1900.
Tiffany, 1930: p. 96, pl. 29, fig. 253-254.

Dioecious, macrandrous; oogonium 1, obovoid-globose to globose, pore superior (rarely suprmedian); oospore ovoid to globose, outer layer of spore wall scrobiculate; antheridium 3-4, sperms 2, division horizontal; basal cell elongate; female vegetative cell (14)-20-28 x 80-160 μm ; male 20-22 x (47)-70-160 μm ; oogonium 44-52 x 48-62 μm ; antheridium 22 x 8 μm . (fig. 16).

Locality: Peshawar (G.T.S. Workshop) S. Farooq No. 14, 7-3-75, and Akbarpura, S. Farooq, No. 16, 7-3-1975.

Distribution: U.S.A., Brazil, Pakistan.

17. *O. wyliei* Tiffany 1926.
Tiffany, 1930: p. 97, pl. 30, fig. 264-267.

Dioecious, macrandrous; oogonium 1-4, globose to ovoid, pore superior; oospore globose to ovoid, filling or not filling oogonium, outer spore wall irregularly scrobiculate; antheridium 1-4; sperms 2, division horizontal; basal cell elongate; terminal cell, often an oogonium, apically obtuse or broadly apiculate; vegetative cell 16-24 x (73)-80-170 μm ; oogonium 52-64 x 68-112 μm ; oospore 48-60 x 52-64 μm ; antheridium 16-19 x 8-18 μm . (fig. 17).

Locality: Pabbi, (S. Farooq No. 67, 15-3-1975.)

Distribution: U.S.A., Pakistan.

The species is first reported from the U.S.A. and it is the first report outside U.S.A.

18. *O. hystrix* Wittr. 1870.
Tiffany, 1930: p. 120, pl. 43, fig. 417.

Dioecious, nannandrous, gynandrosporous, (or possibly idioandrosporous); oogonium 1, ellipsoid, poremedian; oospore ellipsoid, nearly filling oogonium, outer spore wall echinate; androsporangium 1-3; terminal cell obtuse, dwarf male slightly curved, on suffultory cell; antheridium exterior, 1; vegetative cell 17-28 x 30-120 μm ;

oogonium 38-48 x 45-65 μm ; oospore 37-46 x 43-55 μm ; androsporangium 17-18 x 13-18 μm ; dwarf male stipe 10-11 x 22-25 μm ; antheridium 5-8 x 9-14 μm . (fig. 18).

Locality: Tarujabba, (S. Farooq No. 10, 3-2-1975.)

Distribution: U.S.A., Germany, Sweden, Pakistan.

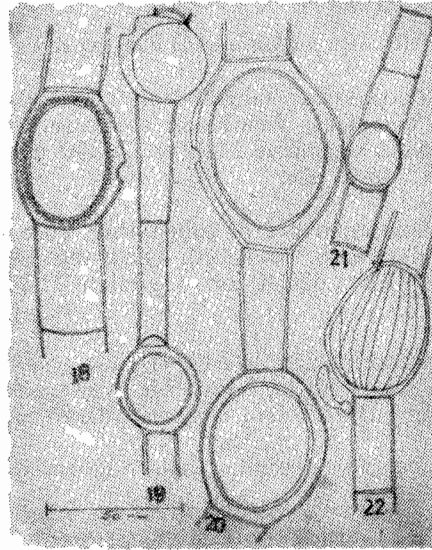


Plate II. Fig. 18 *O. hystrix*, 19 *O. semiapertum*, 20 *O. braunii* subssp. *zehneri*, 21 *O. crassum* sussp. *peshawwarensis*, 22 *O. cyathigerum*

19. *O. semiapertum* Nordst. and Hirn 1900.
Tiffany, 1930: p. 124, pl. 44, fig. 445.

Dioecious, nannandrous, gynandrosporous; oogonium 1 (rarely 2), subhexagonal-globose to subpyriform-globose, pore median, rimiform extending nearly half way round the oogonium; oospore globose or subglobose, not filling oogonium, spore wall smooth; androsporangium 1-3, hypogynous or subepigynous; terminal cell apically obtuse; dwarf male subobovoid, on oogonium; antheridium interior; vegetative cell 9-12 x 38-105 μm ; oogonium 32-35-(36.3) x 33-40 μm ; oospore 25-29 x 25-30 μm ; androsporangium 9-10 x 10-14 μm ; dwarf male 8-9 x 14-15 μm . (fig. 19).

Locality: Peshawar, S. Farooq No. 4, 4-4-1975.
Distribution: France, Guiana, Pakistan.

20. *O. braunii* Kg. ssp. *zehneri* Tiffany 1927.
Tiffany 1930: p. 125, pl. 47, fig. 459.

Dioecious, nannandrous, gynandrosporous; oogonium 1, ovoid to subglobose, pore median; oospore globose to ovoid, not filling oogonium, spore wall smooth; androsporangium 1-2; basal cell elongate; terminal cell apically obtuse; dwarf male usually on suffultory cell, stipe somewhat curved; antheridium exterior, 1; vegetative

cell 12-24 x 34-72 μm ; suffultory cell 21-32 x 48-52 μm ; oogonium 40-50 x 48-60 μm ; oospore 34-44 x 36-50 μm ; dwarf male stipe 8-10 x 16-24 μm ; antheridium 7-8 x 8-12 μm . (fig. 20.)

Peshawar, S. Farooq No. 5, 18-2-1975.

Distribution: U.S.A., Pakistan.

21. *O. crassiuscutum* Wittr. ssp. *peshawarensis* Farooq & Faridi ssp. nov.

Oogonium 1-2, globoso-ovato-subglobosum; porus superior, oospore ellipso-idio-globosa, oogonium complens; membrana oosporae levis, incrassata; cellula suffultoria cylindrica: cellula vegetative 21-29 x 32-110 μm ; oogonium 25.3-31.4 x 42-65 μm ; oospora 23-29 x 40-65 μm .

Oogonium 1-2, globoso-ovoid or subglobose; pore superior; oospore ellipsoid-globose; spore wall smooth, thickened, filling the oogonium; suffultory cell cylindrical: vegetative cell 21-29 x 32-110 μm ; oogonium 25.3-31.4 x 42-65 μm ; oospore 23-29 x 40-65 μm . (fig. 21).

Habitatus: Peshawar (S. Farooq No. 6, 2-12-1974). Holo type No. 12D.

Locality: Peshawar, (S. Farooq No. 6, 2-12-1974) Type specimen has been deposited in the Herbarium of Botany Department, Peshawar University (No. 120).

The subspecies has smaller vegetative cells, oogonia and oospore as compared to the type species.

22. *O. cyathigerum* Wittr. 1870.

Tiffany, 1930: p. 133, pl. 51, fig. 484-485.

Dioecious, nannandrous, idioandrosporous; oogonium 1-3, subvoid or quadrangular-ellipsoid, pore superior; oospore same form as oogonium, filling it, outer layer of spore wall smooth, median layer with 16-25 longitudinal, continuous, rarely anastomosing, often curved, redges-inner layer smooth; basal cell elongate; terminal cell often an oogonium, obtuse; dwarf male goblet-shaped, curved, on the suffultory cell or oogonium; antheridium interior; vegetative cell 21-30 x 40-300 μm ; suffultory cell 42-48 x 75-110 μm ; oogonium 57-56 x 70-100 μm ; oospore 51-62 x 60-75 μm ; androsporangium 23-30 x 12-30 μm ; dwarf male cell 12-15 x 50-58 μm (fig. 22).

Locality: Pabbi, (S. Farooq No. 68, 15-3-1975).

Distribution: U.S.A., Europe, Germany, Pakistan.

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