Materials for Pythium Flora of Japan (IV) Pythium graminicola from rhizosphere soil of zoysia green

Bull. Univ. Osaka Pref., Ser. B, Vol. 43,
大阪府立大学紀要，農学・生物学，1991

Materials for Pythium Flora of Japan (IV) *Pythium graminicola* from rhizosphere soil of zoysia green*

Takio ICHITANI and Tomio KINOSHITA**

Laboratory of Plant Pathology, College of Agriculture and
**Hyogo Women's Junior College

(Received, 1990)

Abstract

Several isolates of *Pythium graminicola* Subramaniam were obtained from rhizosphere soil of a zoysia green. One of the isolates is described and illustrated.

During a study on Pythium diseases of manilagrass (*Zoysia matrella* Merr.), several isolates of *Pythium graminicola* Subramaniam were obtained mainly from rhizosphere soil of a golf green having typical symptoms C[1]. The fungus was maintained as described previously[2].

Pythium graminicola was originally described from *Triticum aestivum* L. in India[3], occurring very commonly there since. In Japan, also it is encountered extensively[1,4].

This paper deals with the description and illustration of the species, following methods described previously[5].

Pythium graminicola (Plates I−VI)

A detailed description of this fungus is as follows.

Colonies on Bacto-CMA forming very little aerial mycelium and having an arachnoid habit of growth, and on Bacto-PDA producing a rosette (Plate I). Main hyphae up to 8 μm wide. Appressoria subspherical. Sporangia intercalary, less frequently terminal; inflated with irregular complexes, rarely filamentous. Zoospores formed at 23−25°C; evacuation tubes up to 250 μm long on CMA; encysted zoospores 10−13 μm diam.. Oogonia globose, mostly intercalary, sometimes terminal, 20−30 μm, average 25 μm diam., smooth. Antheridia 2−6 (−8) per oogonium, originating at various distances from the oogonium, clavate, crook-necked, 1−2 borne on each antheridial stalk, predominantly diclinous, occasionally monoclinous; persistent after fertilization. Oospore plerotic, rarely aplerotic, 17−25 μm, average 21 μm diam.; wall up to 1.5 μm thick; percentage abortion of oospores on CMA*** fairly high.

Cardinal temperatures: minimum 4−10°C, optimum 34°C, maximum 37−40°C. Daily mycelial growth on Bacto-CMA at 25°C 30 mm.

Description: based on UOP 380 (=IFO 32330, MAFF 02-35183)

Isolation: UOP 380 (=IFO 32330, MAFF 02-35183), on Bacto-CMA selectively[1]

* This work was partly supported by a Research Grant of the Japan Plant Protection Association (Tokyo) for the fiscal year 1990.

***20 g corn-meal (sold in the market as a chicken feed containing fish meal), 15 g agar, 1,000 ml distilled water.

from rhizosphere soil of zoysia green, Mure-cho, Kita-gun, Kagawa Prefecture, May 7, 1989, by T. Ichitani.

Host range: This isolate was parasitic on aerial parts of creeping bentgrass (*Agrostis palustris*) seedlings. It was pathogenic on Gibberellin A_3-treated adult plants of *Zoysia matrella*,but not on untreated ones[4]. Seedlings of *Z. japonica* were infected[4], pathogenicity occurring under low temperature conditions, even at 5°C[6].

A length of plasmolyzed protoplasm may extend inside a hypha (Plates II-1, III-37). This mycelium-like filament emerges through the hyphal cell wall [Plates II-2, III-38 (arrow), -39 (shorter arrow)] . The plasmolyzed protoplasm itself also emerges through the hyphal cell wall [Plates II-3, III-39 (longer arrow), -40]. One hypha can penetrate another where they contact [Plates II-4, III-41, -42 (arrows)] . A penetrating hypha extends longitudinally inside the host hypha and then emerges. These phenomena can be seen in young (2−3 day) cultures.

Sex organs were difficult to observe and measure when wheat-germ oil (Japan Impex, Tokyo) was added to CMA because their formation, and that of the hyphae, was unusually uneven (Plate IV-45～47). Appressoria-like bodies were also observed under these conditions (Plate IV-48).

Zoospores were easily formed at 25°C. Inflated zoosporangia [Plates II-6, IV-52 (arrow), V-59～62 (arrows)] , although filamentous ones [Plates II-7, IV-53 (arrow)] were occasionally observed. Differentiation of zoospores, however, ceased on incubation at 32−35°C [Plate V-59 (arrow)] . Zoospores were produced in 90−180 minutes after floating infected grass blades on water and were observed within 4 hr after placing agar discs of 1 month-old CMA culture in water. No zoospores were produced from newly formed hyphal swellings[7] (Plates II-30,31, VI-81～84).

Abortion of oospores on CMA was about 50%. Aplerotic oospores were sometimes found in young cultures, but numbers of plerotic ones increased with age of the culture. Regardless of wheat-germ oil, sex organ production decreased with subculturings.

Drechsler[8] and Middleton[9] examined antheridia as distinguishing factors in the separation of *P.graminicola* from *P.arrhenomanes*. *Pythium graminicola* differs from *P. arrhenomanes* and *P.aristosporum* by having predominantly monoclinous and fewer antheridia, and smaller oogonia, from *P.torulosum* and *P.vanterpoolii* by larger oogonia and more antheridia per oogonium, and from *P.myriotylum* by plerotic oospores and a different incubation temperature for mycelial growth.

Acknowledgements−The authors are indebted to Dr. D.J. Stamps, formerly of the CAB International Mycological Inst., Kew, UK, for critical reading of the manuscript. They are also grateful to Prof. T. Tani and Mr. H. Tanpo of Kagawa University for offering valuable information on the diseases of zoysia greens.

References

1) ICHITANI, T., TANPO, H., UEDA, A. and TANI, T. (1989). Pathogenic *Pythium* spp. found in four different turf damages of zoysia greens. In "*Proc. 6th Int'l Turfgrass Research Conference*" (Ed. by TAKATOH, H.). Japanese Soc. Turfgrass Science, Tokyo, 341−343.

2) ICHITANI, T. and KINOSHITA, T. (1990). Materials for Pythium flora of Japan (III) *Pythium aristosporum* from rhizosphere soil of zoysia green. *Bull. Univ. Osaka Pref., Ser. B*,Vol. **42**, 1−8.
3) SUBRAMANIAM, L.S. (1928). Root rot and sclerotial diseases of wheat. *Bull. agric. Res. Inst. Pusa*,**177**,1−17.
4) ICHITANI, T., TANI, T. and UMAKOSHI, T. (1986). Identification of *Pythium* spp. pathogenic on manila grass (*Zoysia matrella* Merr.). *Trans. mycol. Soc. Japan*, **27**, 41−50. (*in Japanese with English summary*).
5) ICHITANI, T., TAKAMATSU, S. and STAMPS, D.J. (1986). Identification and pathogenicity of three species of *Pythium* newly isolated from diseased wheat and barley just after thawing in Japan. *Ann. Phytopath. Soc. Japan*, **52**, 209−216.
6) TANI, T. TANPO, H. and ICHITANI, T. (1988). A cause of irregular damage, tentative name Fuzoroi-sho, of zoysia green and its control by fungicides. *Journ. Japanese Soc. Turfgrass Science*, **17**, 39−48. (*in Japanese with English summary*)
7) PLAATS-NITERINK, A.J. Van der (1981). Monograph of the genus Pythium. *Stud. in Myc.*, **21**, 1−242.
8) DRECHSLER, C. (1936). *Pythium graminicola* and *P.arrhenomanes. Phytopathology*, **26**, 676−684.
9) MIDDLETON, J.T. (1943). The taxonomy, host range and geographic distribution of the genus Pythium. *Mem. Torrey Bot. Club*, **20**, 1−171.

Explanation of Plates

Plate I Growth habit of *P.graminicola* UOP 380 on Bacto-CMA (left) and Bacto-PDA (right) incubated at 25°C for 2 days (upper), 4 days (intermediate) and 15 days (lower).

Plates II-VI Morphology of *P.graminicola* UOP 380.

1−4, 32−44: Mycelia. 45−47: Pieces of mycelial thread. 48: Appressoria-like bodies. 5, 49: Sporangium. 50, 51: Vesicle. 6−8, 52−54: Vesicle, discharge tube and zoosporangium. 9, 10, 55, 56: Discharge tube. 11, 57: Encysted zoospores. 12, 13, 58: Germinating zoospores. 14−16, 59−62: Empty zoosporangium. 17−20, 63−67: Oogonia and monoclinous antheridia. 21, 68: Oogonium and diclinous antheridia. 22, 23, 69, 70: Plerotic oospore. 24−27, 71−74: Oospores with degenerated oospheres. 28, 29, 75−77: Malformed oospores (or more than 2 oospores within 1 oogonium). 78−80: Propagules in leaf tissues of bentgrass (78: hypha extending through cell wall, 79: hyphal swelling, 80: oospore). 30, 31, 81−84: Hyphal swellings.

Bars (10 μm) on figs. 3, 31, 32, 35, 37 and 63 are applicable to figs. 3−16; 1, 2, 17−31; 32−34, 36, 45−47; 35, 41−44, 49, 52, 55, 57, 58, 60, 78, 81−83; 37−40, 48, 50, 51, 53, 54, 56, 59, 61, 62, 78−80, 84; and 63−77; respectively.

Plate I

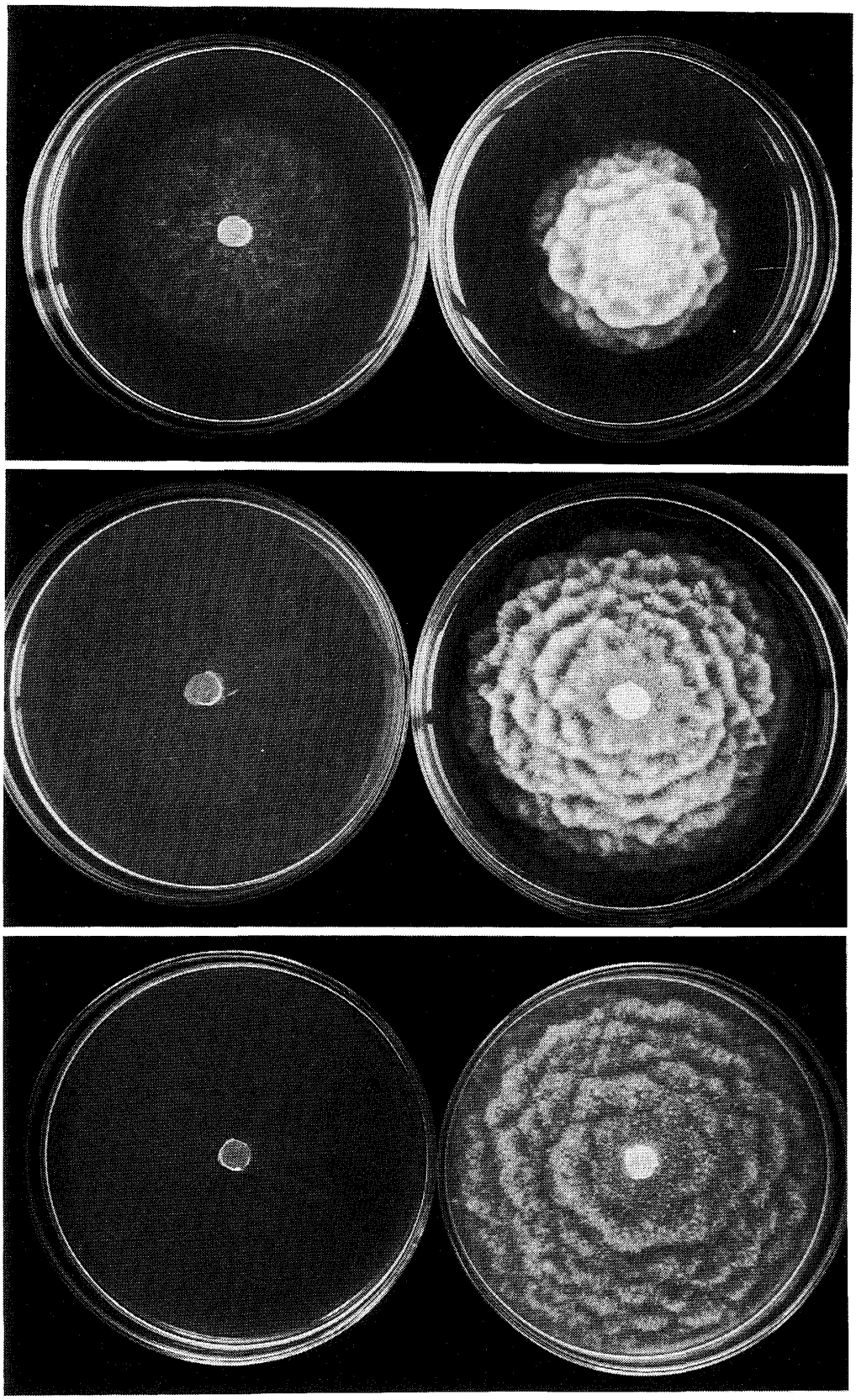


Plate II

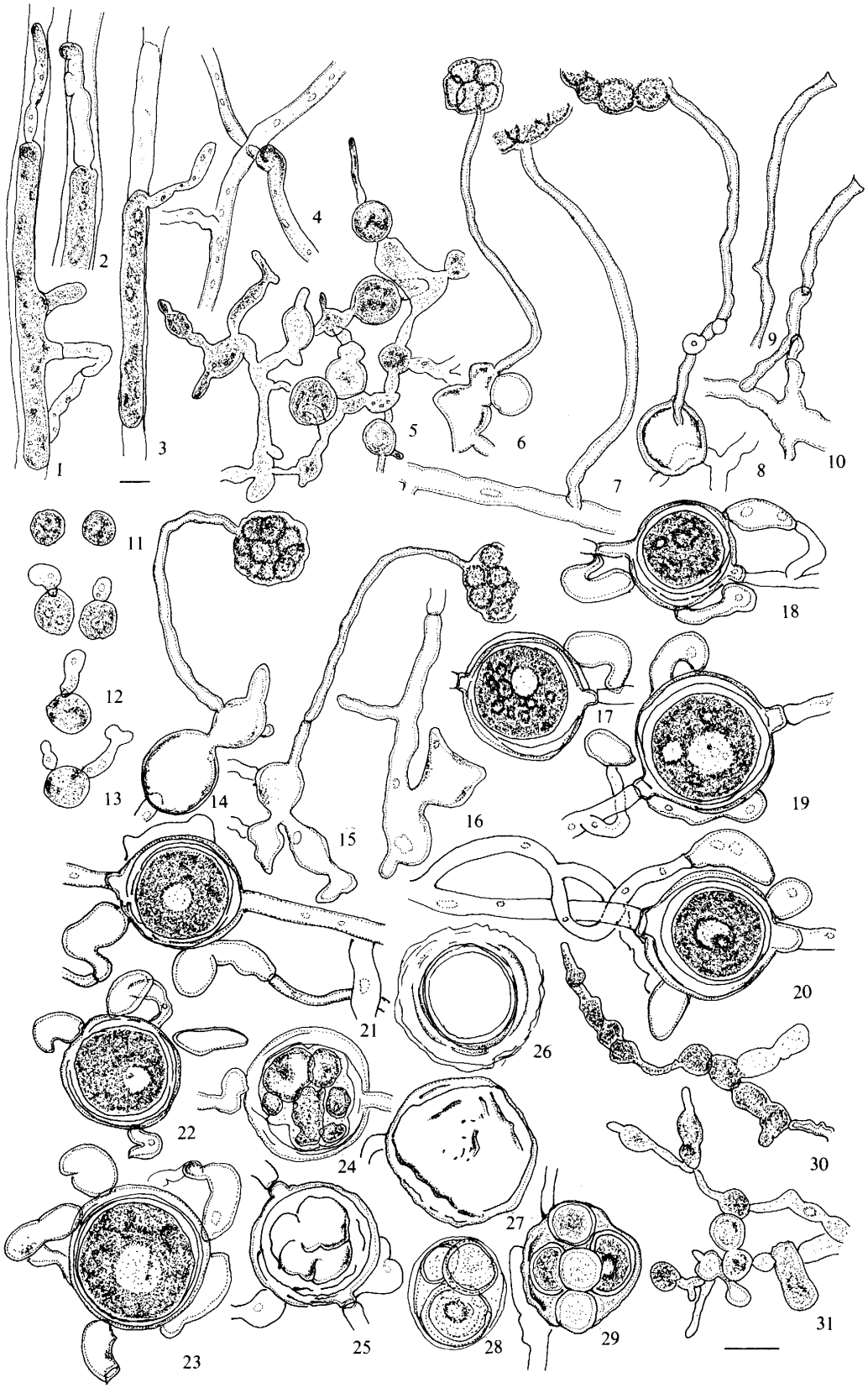
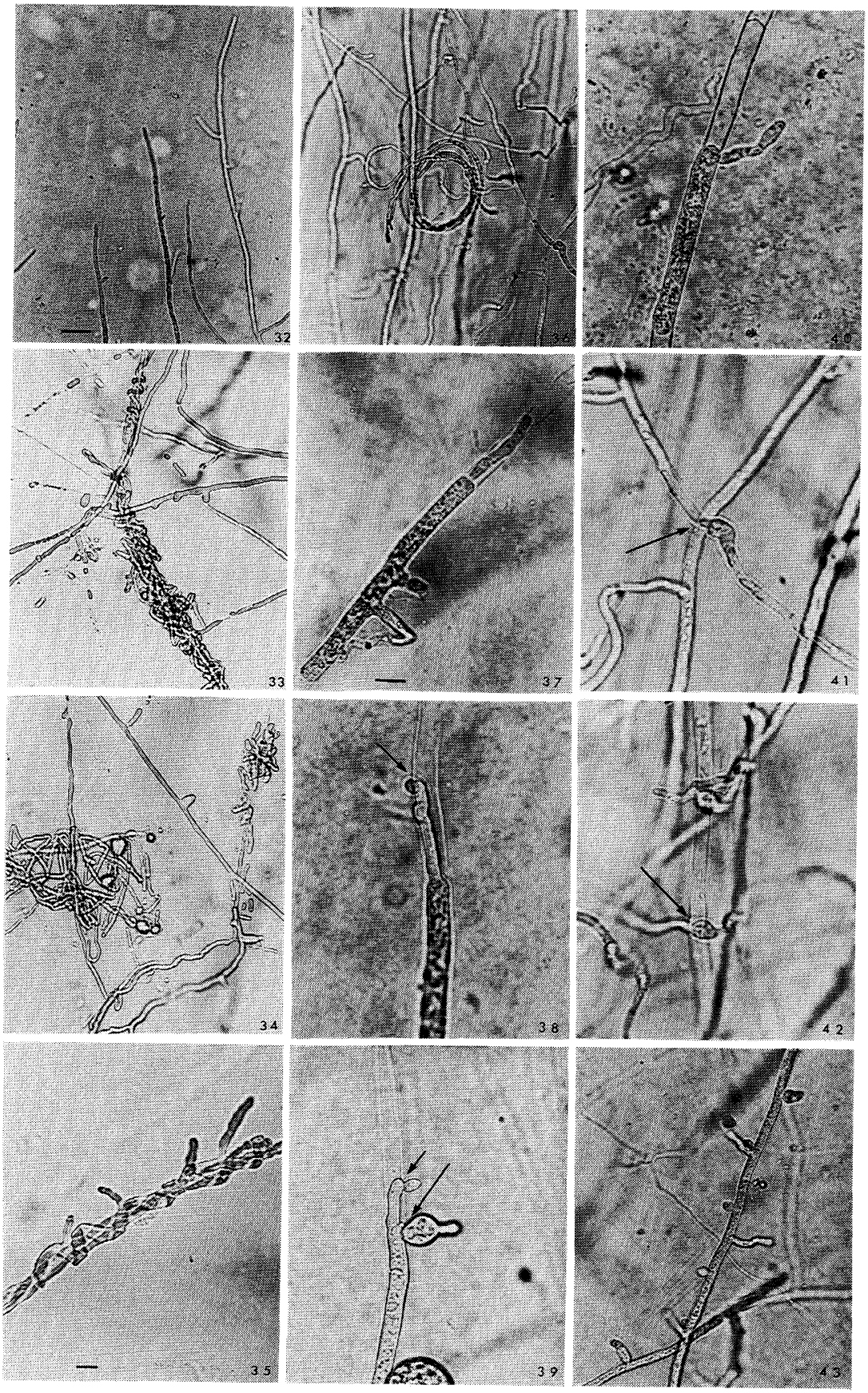

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

Plate III



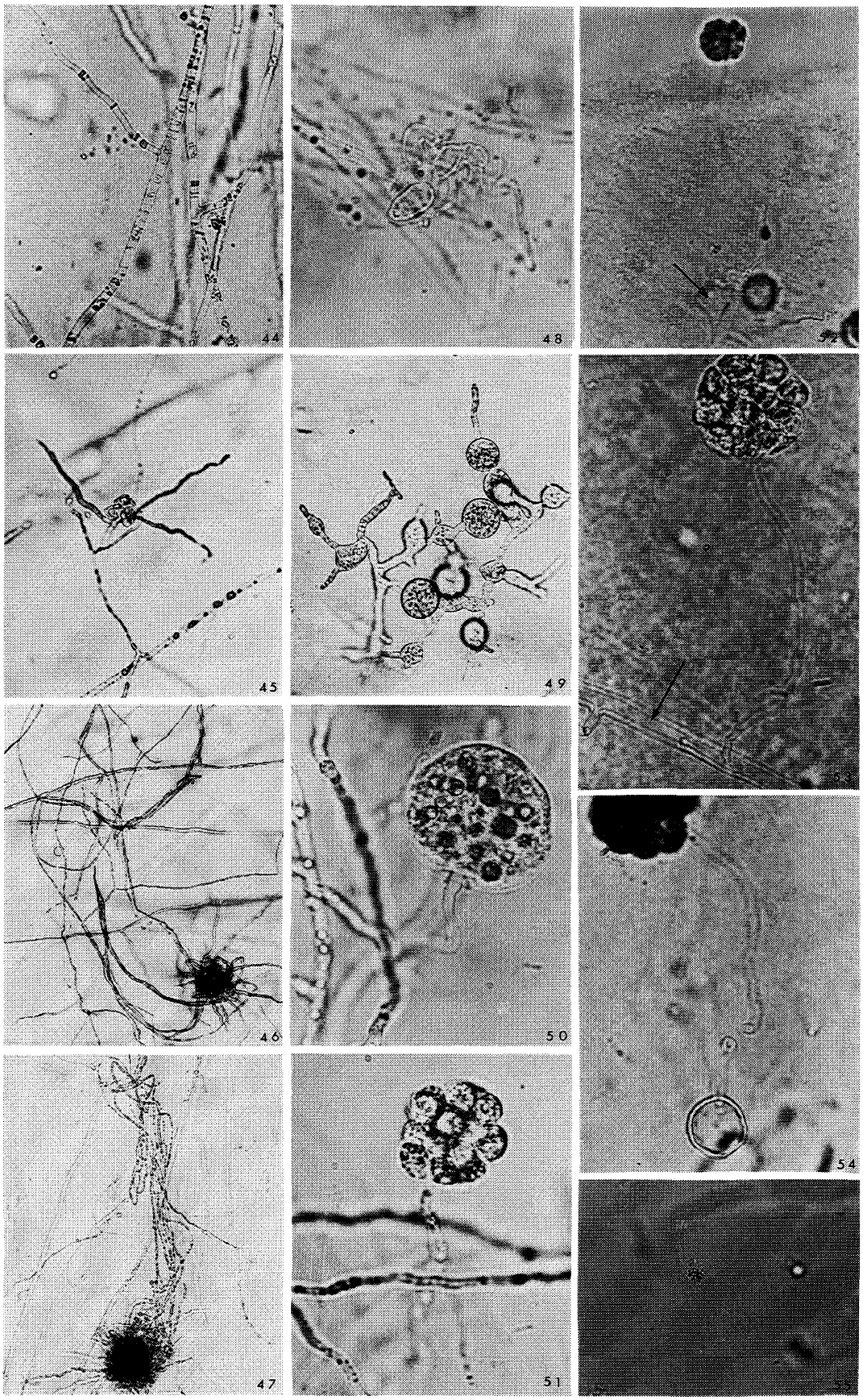

44
48
52
45
49
53
46
50
54
47
51
55

Plate V

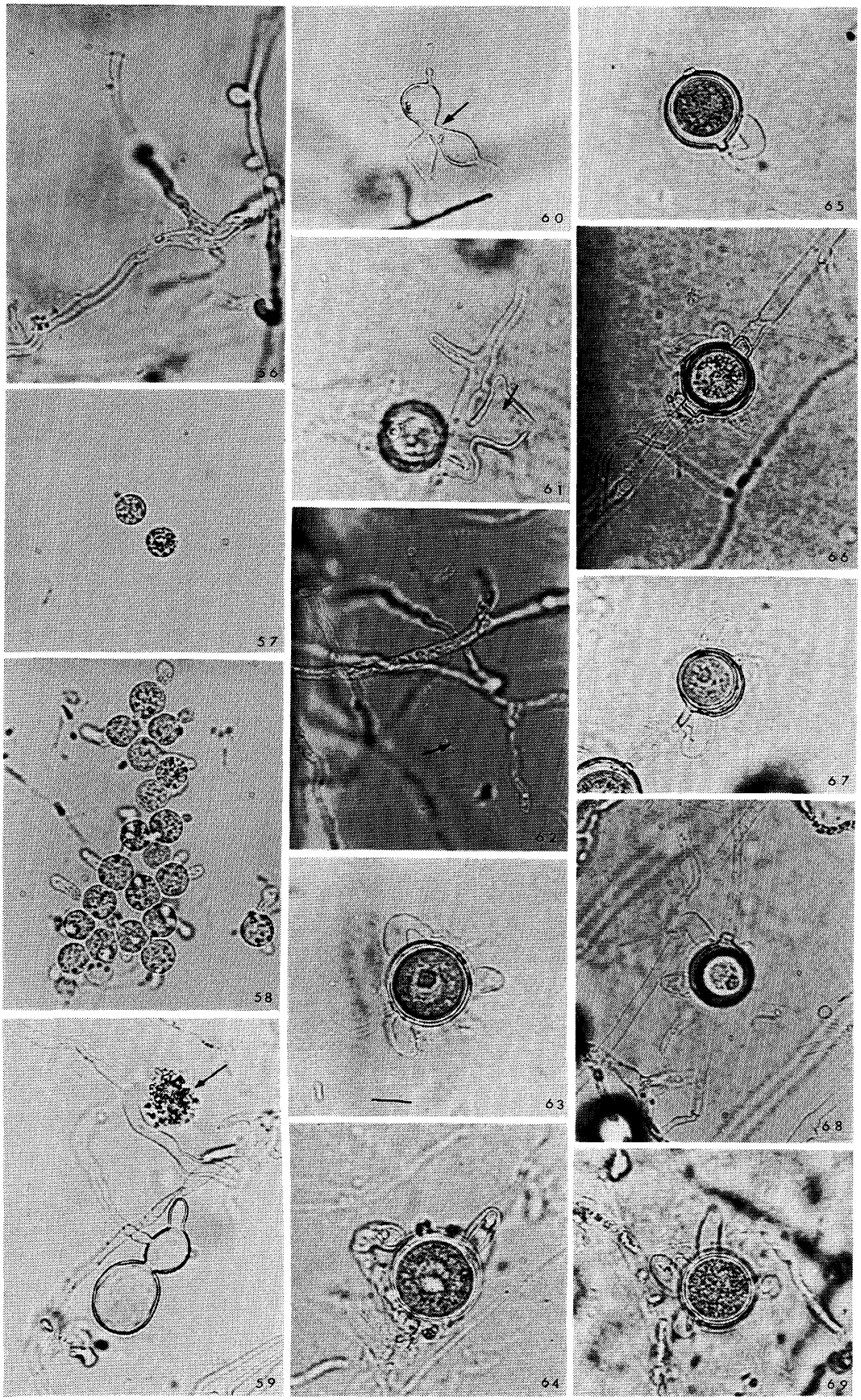


Plate VI