

# SOME NOSTOCACEAE KUETZ FROM BANANA FIELDS OF JALGAON DISTRICT, MAHARASHTRA

A. D. MAHAJAN & NEELIMA MAHAJAN

Botany Department, Science College, Bhusawal 425 201, India

## Abstract

Twelve taxa belonging to five genera of the family Nostocaceae Kuetz collected from the banana fields of Jalgaon District, Maharashtra are described for the first time. Out of them five taxa namely *Anabaenopsis ambigua* Pandey & Mitra, *Cylindrospermum michailovskoense* Elenkin, *Nostoc ellipsosporum* f. *minor* Prasad *et al.*, *Nostoc paludosum* var. *majus* Parsad *et al.*, and *Raphidiopsis indica* Singh have been recorded for the first time from Maharashtra.

## Introduction

The works on Cyanophyceae in Maharashtra are known through Kamat (1963), Thomas and Gonzalves (1965); Marathe (1969); Sardeshpande and Goyal (1981); Bharhate and Tarar (1983) and Mahajan (1986). It is clear from the available literature that no blue green algae have been studied so far from the banana fields of Maharashtra, though it is one of the largest banana growing states in India. The role of blue-greens in nitrogen fixation in paddy filed soils has been accepted all over. The present work was undertaken to find out similar role of blue-green algae in the banana fields. In this paper only the systematic description of the taxa has been given. Experiments are being going on to study the effect of these algae on the productivity of bananas which will be communicated later.

## Material and method

Algae growing on soil, submerged in water as well as floating on the water surface were collected and preserved in 4% formalin. The plants were studied and sketched both from fresh as well as preserved materials. The identification of different taxa is based on the monograph by Desikachary (1959). Some recent publications available are also consulted. (Pandey & Mitra, 1963 ; Prasad *et al.*, 1977) in their identification.

## Systematic description

1. *Anabaenopsis ambigua* Pandey *et* Mitra.

Figs. 1a, b

Plant mass soft, gelatinous ; filaments straight ; trichomes 2.4-3.5  $\mu\text{m}$  broad, up to 50  $\mu\text{m}$  long, constricted ; cells rectangular, 2.5-4  $\mu\text{m}$  long; heterocysts terminal, at both ends of the trichomes, sub-spherical, 3-4  $\mu\text{m}$  broad, 4-5  $\mu\text{m}$  long.

*Habitat*—Along with *Nostoc* species, Sangvi (87).

2. *Cylindrospermum michailovskoense* Elenkin

Fig. 2

Thallus expanded, blue-green ; trichomes aggregated, 3-4.5  $\mu\text{m}$  broad, heterocysts

oblong, 4-5-5  $\mu\text{m}$  broad, 7.5-8.5  $\mu\text{m}$  long ; spores single, oblong, 10-12  $\mu\text{m}$  broad, 20-30  $\mu\text{m}$  long.

*Habitat*—Along with *Anabaena* species, Korpawai (K3).

3. *Cylindrospermum stagnale* (Kuetz.) Born et Flah

Fig. 3

Thallus blue-green, trichomes 3.5-4.5  $\mu\text{m}$  broad, constricted; cells cylindrical, longer ; heterocysts oblong, 5.5-6.5  $\mu\text{m}$  broad, 8-15  $\mu\text{m}$  long; spores cylindrical, 10-15  $\mu\text{m}$  broad, 30-35  $\mu\text{m}$  long.

*Habitat*—On moist soil, Korpawali (K8).

4. *Nostoc commune* Vaucher ex Born. et Flah.

Fig. 7

Thallus mucilaginous, flattened; filaments entangled; trichomes 4-5.5  $\mu\text{m}$  broad; cells short; heterocysts subspherical, 7  $\mu\text{m}$  broad.

*Habitat*—On moist soil, Korpawali (K8).

5. *Nostoc ellipsosporum* (Desm.) Rabenh. ex Born et Flah. f. *minor* Prasad et al.

Fig. 4

Thallus mucilaginous; filaments entangled; trichomes 3.5-4.5  $\mu\text{m}$  broad; cells cylindrical, 3-5  $\mu\text{m}$  long; heterocysts oblong, 4.5-5.8  $\mu\text{m}$  broad, 5-6.5  $\mu\text{m}$  long; spores subspherical, 4.5-6  $\mu\text{m}$  broad, 6.5-9  $\mu\text{m}$  long.

*Habitat*—In running water trench, Sangvi (S5).

6. *Nostoc muscorum* Ag. ex Born et Flah

Figs. 5 a, b

Thallus expanded; seath yellowish; trichomes 4-5  $\mu\text{m}$  broad; cells barrel shaped, as long as broad ; heterocysts spherical, 6-6.5  $\mu\text{m}$  broad; spores long in series, 6-8  $\mu\text{m}$  broad, 9-12  $\mu\text{m}$  long.

*Habitat*—On moist soil, Sangvi (S 10).

7. *Nostoc paludosum* Kuetz, ex. Born. et Flah. var. *majus* Prasad et al.

Fig. 6

Thallus gelatinous; trichomes 4-5  $\mu\text{m}$  broad; cells 3-5  $\mu\text{m}$  long; heterocysts subspherical, 4.5-6.5  $\mu\text{m}$  broad, 6-7  $\mu\text{m}$  long; spores in chains, oblong, subspherical, 3.2-5.5  $\mu\text{m}$  broad, 5-6.6  $\mu\text{m}$  long.

*Habitat*—In standing Water, Sangvi (S7).

8. *Anabaena doliolum* Bharadwaja

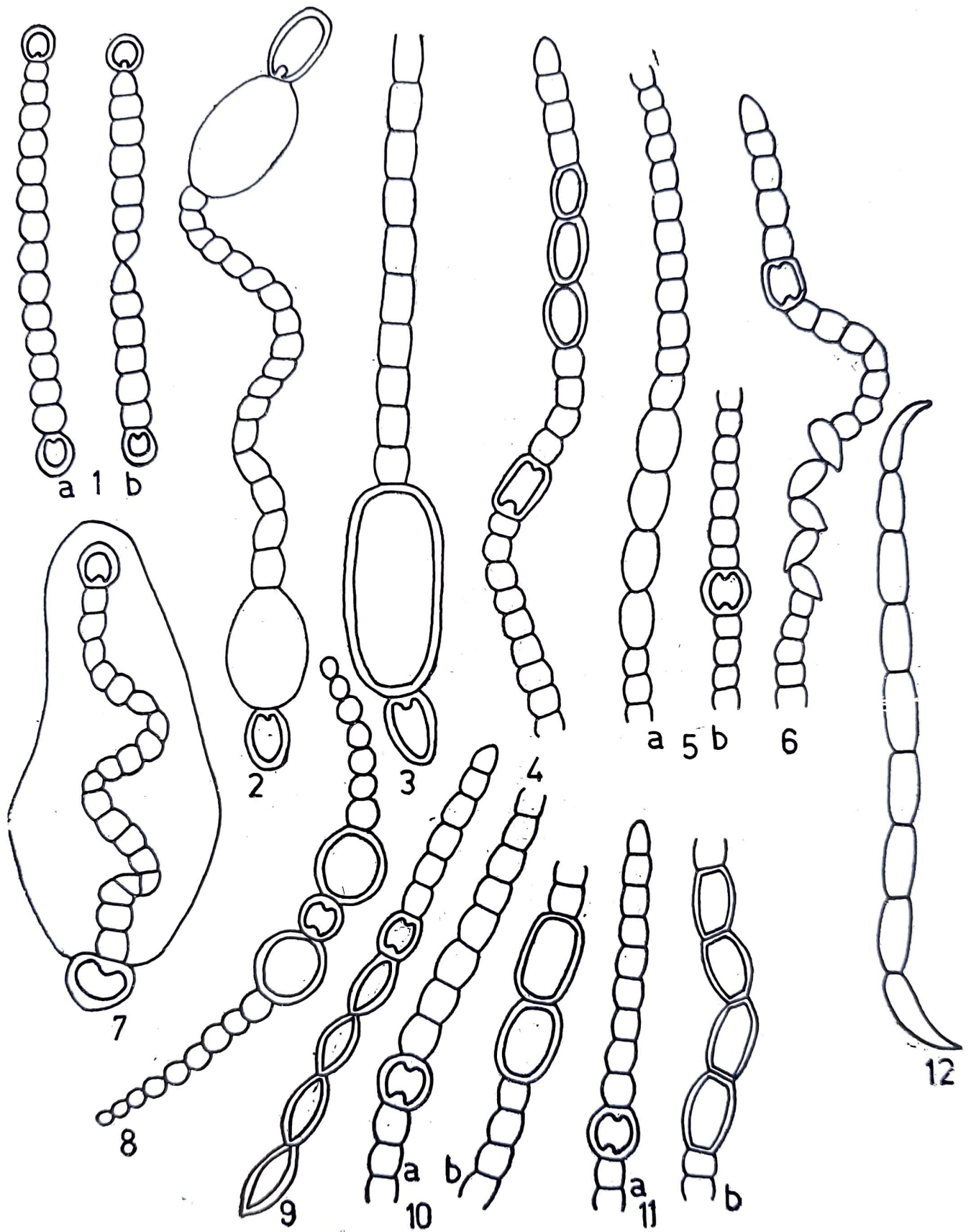
Fig. 9

Thallus mucilaginous; trihomes single, straight; 3.5-4  $\mu\text{m}$  broad; cells barrel-shaped; heterocysts 5-6  $\mu\text{m}$  broad, 6-8  $\mu\text{m}$  long; spores with pointed apices, in chains, 4-6  $\mu\text{m}$  broad, 6-10  $\mu\text{m}$  long; epispore smooth.

*Habitat*—Along with *Oscillatoria*, Sangvi (S8).

9. *Anabaena taxa* (Rabenh.) A. Br.

Figs. 10 a, b



Text-figure 1—1 a, b, *Anabaenopsis ambigu* Pandey et Mitra; 2, *Cylindrospermum michailovskoense* Elenkin; 3, *Cylindrospermum stagnale* (Kuetz.) Born. et Flah. 4, *Nostoc ellipsosporum* (Desm.) Rabenh. ex Born. et Flah. f. *minor* Prasad et al.; 5a, b, *Nostoc muscorum* Ag. ex Born. et Flah. 6, *Nostoc paludosum* Kuetz. ex Born. et Flah. var. *majus* Prasad et al., 7, *Nostoc commune* Vaucher ex Born. et Flah. 8, *Anabaena sphaerica* Born. et Flah. var. *attenuata* Bharadwaja. 9, *Anabaena doliolum* Bharadwaja. 10a, b, *Anabaena taxa* (Rabenh.) A. Br. 11a, b, *Anabaena variabilis* kuetz. ex Born. et Flah. 12, *Raphidiopsis indica* Singh, .R. N.  
Scale bar = 10  $\mu$ m.

oblong, 4-5-5  $\mu\text{m}$  broad, 7.5-8.5  $\mu\text{m}$  long ; spores single, oblong, 10-12  $\mu\text{m}$  broad, 20-30  $\mu\text{m}$  long.

*Habitat*—Along with *Anabaena* species, Korpawai (K3).

3. *Cylindrospermum stagnale* (Kuetz.) Born et Flah

Fig. 3

Thallus blue-green, trichomes 3.5-4.5  $\mu\text{m}$  broad, constricted; cells cylindrical, longer ; heterocysts oblong, 5.5-6.5  $\mu\text{m}$  broad, 8-15  $\mu\text{m}$  long; spores cylindrical, 10-15  $\mu\text{m}$  broad, 30-35  $\mu\text{m}$  long.

*Habitat*—On moist soil, Korpawali (K8).

4. *Nostoc commune* Vaucher ex Born. et Flah.

Fig. 7

Thallus mucilaginous, flattened; filaments entangled; trichomes 4-5.5  $\mu\text{m}$  broad; cells short; heterocysts subspherical, 7  $\mu\text{m}$  broad.

*Habitat*—On moist soil, Korpawali (K8).

5. *Nostoc ellipso sporum* (Desm.) Rabenh. ex Born et Flah. f. *minor* Prasad et al.

Fig. 4

Thallus mucilaginous; filaments entangled; trichomes 3.5-4.5  $\mu\text{m}$  broad; cells cylindrical, 3-5  $\mu\text{m}$  long; heterocysts oblong, 4.5-5.8  $\mu\text{m}$  broad, 5-6.5  $\mu\text{m}$  long; spores subspherical, 4.5-6  $\mu\text{m}$  broad, 6.5-9  $\mu\text{m}$  long.

*Habitat*—In running water trench, Sangvi (S5).

6. *Nostoc muscorum* Ag. ex Born et Flah

Figs. 5 a, b

Thallus expanded; seath yellowish; trichomes 4-5  $\mu\text{m}$  broad; cells barrel shaped, as long as broad ; heterocysts spherical, 6-6.5  $\mu\text{m}$  broad; spores long in series, 6-8  $\mu\text{m}$  broad, 9-12  $\mu\text{m}$  long.

*Habitat*—On moist soil, Sangvi (S 10).

7. *Nostoc paludosum* Kuetz, ex. Born. et Flah. var. *majus* Prasad et al.

Fig. 6

Thallus gelatinous; trichomes 4-5  $\mu\text{m}$  broad; cells 3-5  $\mu\text{m}$  long; heterocysts subspherical, 4.5-6.5  $\mu\text{m}$  broad, 6-7  $\mu\text{m}$  long; spores in chains, oblong, subspherical, 3.2-5.5  $\mu\text{m}$  broad, 5-6.6  $\mu\text{m}$  long.

*Habitat*—In standing Water, Sangvi (S7).

8. *Anabaena doliolum* Bharadwaja

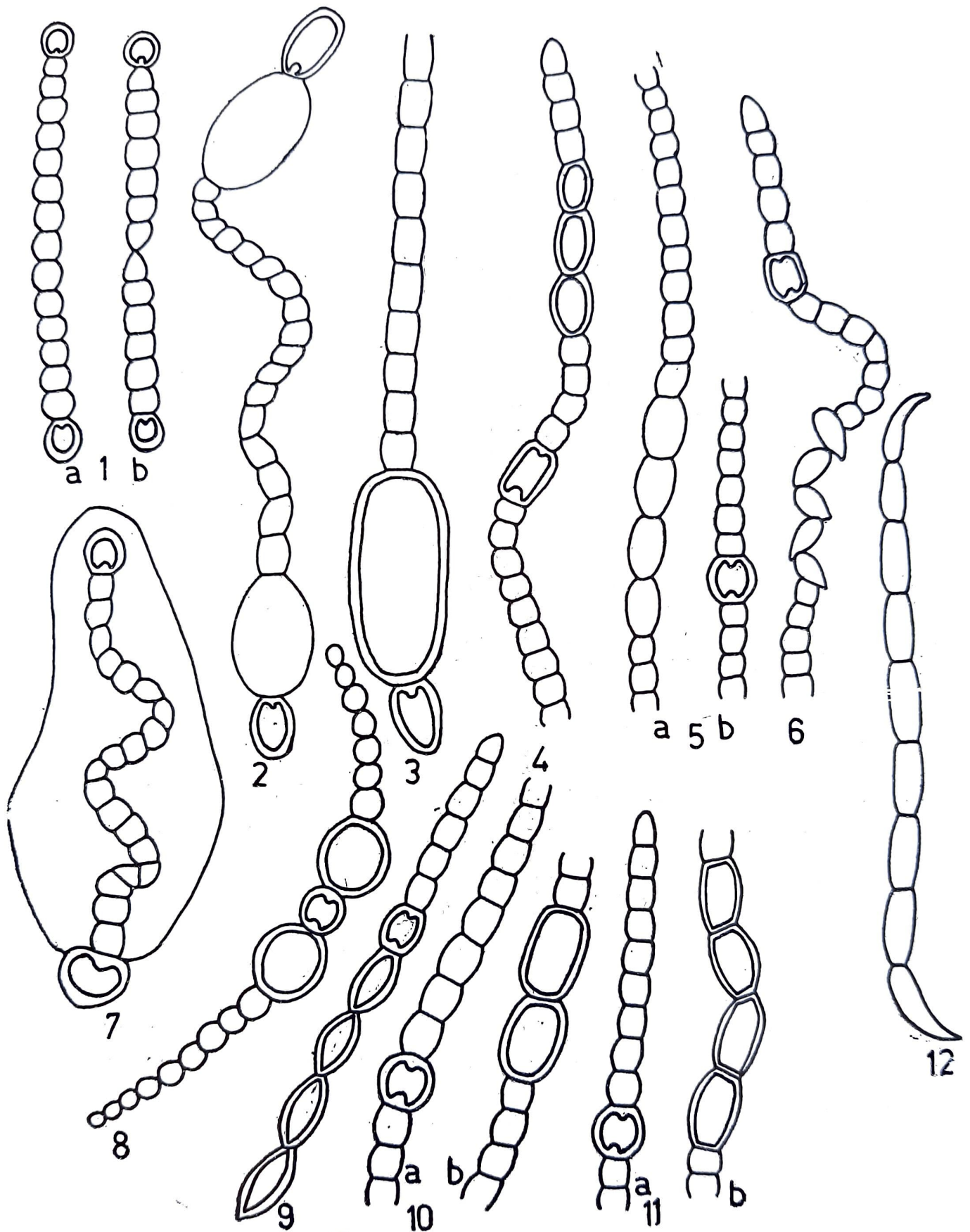
Fig. 9

Thallus mucilaginous; trihomes single, straight; 3.5-4  $\mu\text{m}$  broad; cells barrel-shaped; heterocysts 5-6  $\mu\text{m}$  broad, 6-8  $\mu\text{m}$  long; spores with pointed apices, in chains, 4-6  $\mu\text{m}$  broad, 6-10  $\mu\text{m}$  long; episporium smooth.

*Habitat*—Along with *Oscillatoria*, Sangvi (S8).

9. *Anabaena taxa* (Rabenh.) A. Br.

Figs. 10 a, b



Text-figure 1—1 a, b, *Anabaenopsis ambigu* Pandey et Mitra; 2, *Cylindrospermum michailovskoense* Elenkin; 3, *Cylindrospermum stagnale* (Kuetz.) Born. et Flah. 4, *Nostoc ellipso sporum* (Desm.) Rabenh. ex Born. et Flah. f. *minor* Prasad et al.; 5a, b, *Nostoc muscorum* Ag. ex Born. et Flah. 6, *Nostoc paludosum* Kuetz. ex Born. et Flah. var. *majus* Prasad et al., 7, *Nostoc commune* Vaucher ex Born. et Flah. 8, *Anabaena sphaerica* Born. et Flah. var. *attenuata* Bharadwaja. 9, *Anabaena doliolum* Bharadwaja. 10a, b, *Anabaena taxa* (Rabenh.) A. Br. 11a, b, *Anabaena variabilis* kuetz. ex Born. et Flah. 12, *Raphidiopsis indica* Singh, .R. N.

Scale bar=10  $\mu$ m.

Thallus blue-green; trichomes straight, 4-5  $\mu\text{m}$  broad; cells barrel shaped 4-5.5  $\mu\text{m}$  long; heterocysts spherical, 6  $\mu\text{m}$  in diameter; spores 6-8  $\mu\text{m}$  broad, 12-15  $\mu\text{m}$  long, epispore yellowish.

*Habitat*—On moist soil, Korpawali (K8)

10. *Anabaena sphaerica* Born. et Flah. var. *attenuata* Bharad.

Fig. 8

Trichomes free floating, curved, 3-4.5  $\mu\text{m}$  broad, attenuated, cells spherical; heterocysts 5-6  $\mu\text{m}$  in diameter; spores spherical, on both sides of heterocysts, 10-12  $\mu\text{m}$  in diameter.

*Habitat*—On moist soil, Sangvi (S 10).

11. *Anabaena variabilis* Kuetz. ex. Born et Flah

Figs. 11a, b

Thallus dark green; trichomes 4.5-5.5  $\mu\text{m}$  broad; cells barrel-shaped, 2.5-5  $\mu\text{m}$  long; heterocysts spherical, 6  $\mu\text{m}$  in diameter; spores in chains, 6-8  $\mu\text{m}$  broad, 8-12  $\mu\text{m}$  long; epispore colourless.

*Habitat*—In running water trench, (Korpawali) K9

12. *Raphidiopsis indica* Singh R. N.

Fig. 12

Trichomes straight, slightly curved at apices, constricted, 2.5-3.5  $\mu\text{m}$  broad; cells elongated, 5-15  $\mu\text{m}$  long with gas vacuoles; end cells pointed.

*Habitat*—Free floating, Korpawali (K6).

### Acknowledgements

The authors are thankful to Dr Kolhe, Principal, Science College, Bhusawal for providing the laboratory facilities.

### References

- ANAND, V. K. (1979). Blue green algae of Gadigarh stream (Miran-sah. Jammu-I). *Phykos*, **18**(1/2) : 21-24.
- BARHATE, V.P. & TARAR, J.L. (1983). Thermal algae from Khandesh, Maharashtra. *Trop. Plant Sci. Res.*, **1**: 195-196.
- BENDRE, A. M. & KUMAR, S. (1975). Cyanophyceae of Meerut. *Phykos*, **14**(1-2) : 1-7.
- BONGALE, U. D. (1985). On soil algae from paddy fields of Panjim (Goa) and Ghikkamanchali (Raichur) District, Karnataka, India. *J. Indian bot. Soc.*, **60**(3-4) : 326-329.
- BONGALE, U. D. & BHARATI, S. G. (1980). On the algal flora of cultivated soils of Karnataka State, India. *Phykos*, **19**(1) : 95-109.
- CHATURVEDI, U. K. & PANDEY, U. G. (1976). A list of blue-green algae from Rohilkhand Division, U. P. India-IV. *Phykos*, **15**(1-2) : 127-131.
- DESIKACHARY, T. V. (1959). *Cyanophyta*, I. G. A. R., New Delhi.
- GUPTA, R. S. & KUMAR, H. D. (1968). Blue green algal flora of Udaipur and its neighbourhood. *Rev. Algol.*, **9**(2) : 91-103.
- GUPTA, M. & PANDEY, D. G. (1979). Studies on alkaline (usar) soil algae. Part-II (A). Taxonomic considerations-cyanophyceae. *Nova Hedwigia*, **63** : 239-296.
- KAMAT, N. D. (1963). The algae of Kolhapur, India. *Hydrobiologia*, **22**(3-4) : 209-309.
- KAMAT, N. D. (1974a). Algae of Marathwada, Maharashtra. *Phykos*, **13**(1) : 22-32.
- KAMAT, N. D. (1974b). The Nostocales of the Mysore State *Phykos*, **13**(1) : 33-37.
- KAMAT, N. D. (1975). Algae of Vidarbha, Maharashtra. *J. Bombay Nat. Hist. Soc.*, **72**(2) : 450-476.

- KHAN, M. & MATHUR, A. (1976). Algal flora of the rice fields around Dehradun. *Rev. Algol.*, **11**(3-4) : 333-337.
- KOLTE, S. O. & GOYAL, S. K. (1985). Distributional pattern of blue-green algae in rice field soils of Vidarbha region of Maharashtra State. *Phykos*, **24**(1-2) : 156-162.
- MAHAJAN, A. D. (1986). Some *Oscillatoria* Vaucher and *Phormidium* Kuetz. from banana fields of Jalgaon District, Maharashtra. *Indian bot Repr.*, **5**(1) : 24-26.
- MARATHE, K. V. (1969). Studies on soil algae of India-II Soil algae from the cultivated fields of Jalgaon (M. S.) *J. Univ. Bombay*, **38** : 69-72.
- MARATHE, K. V. (1970). Role of soil algae in water conservation *J. Biol. Sci.*, **13**(2) : 1-8.
- MARATHE, K. V. (1972). Observations on the algae of some Indian arid soils. *Botanique*, **3**(1) : 13-19.
- PAL, S. (1975). A check list of algae from Ghaziabad. *Phykos*, **14**(1-2) : 67-76.
- PAL, S. & YADAV, A. K. (1974). Some Cyanophyceae from Saharanpur District. A taxonomic innumeration. *Phykos*, **13**(1) : 38-47.
- PANDEY, D. C. & MITRA, A. K. (1963). On the morphology and life history of a new species of *Anabaenopsis*, *A. ambigua* n. sp. *Nova Hedwigia*, **4**(3-4) : 345-350.
- PRASAD, B. N. & MEHROTRA, R. K. (1979). Cyanophycean flora of some North Indian crop fields. *Geophytology*, **8**(2) : 147-157.
- PRASAD, B. N. & MEHROTRA, R. K. (1980). Blue-green algae of paddy fields of Uttar Pradesh. *Phykos*, **19**(1) : 121-128.
- PRASAD, B. N., MEHROTRA, R. K. & SINGH, Y. (1977). Some new taxa of *Nostoc* Vaucher from North Indian crop fields. *Geophytology*, **7**(2) : 222-228.
- SAHA, K. C. & MANDAL, L. N. (1979). Distribution of nitrogen fixing blue-green algae in some rice soils of W. Bengal. *J. Indian Soil Soc. Sci.*, **27**(4) : 470-477.
- SARDESHPANDE, J. S. & GOYAL, S. K. (1981). Distributional pattern of blue-green algae in rice field soils of Konkan region of Maharashtra. *Phykos*, **20**(1-2) : 102-106.
- SINGH, K. P. & CHATURVEDI, U. K. (1970). Myxophyceae of the Rohilkhand Division, U. P., India-II *Phykos* **9**(1) : 3f-40.
- SINGH, R. N. (1942). A new species of the genus *Raphiaiopsis* Fritsch *et* Rich (*R. indica* sp. nov.) exhibiting morphological variants. *J. Indian bot. Soc.*, **21** : 239-243.
- SINHA, J. P. & MUKHARJEE, D. (1975). On blue-green algae from the paddy fields of Bankura District of West Bengal—II. *Phykos*, **14**(1-2) : 119-120.
- SRIVASTAVA, P. N. & NIGAM, C. (1980). Soil algae from semiarid regions. *Geophytology*, **10**(2) : 129-136.
- THOMAS, J. & GONZALVES, E. A. (1965). Thermal algae of Western India VI. Algae of the hot springs at Unai, Lasundra and Unapdeo. *Hydrobiologia*, **26**(1-2) : 55-65.
- TIWARI, G. L. & PANDEY, R. S. (1976). Study of the blue-green algae from paddy field soils of India-III, Nostocaceae. *Nova Hedwigia*, **27** : 701-730.