MICROBIOLOGY ARCHIVES
Original Research Article | ISSN: 3041-590X
Journal homepage: https://microjournal.researchfloor.org/

Hydrodictyon patenaeforme Pocock: A new report from India

Nida Ziyaul[1], Kuntal Sarma[2], and Rama Kant*[1]

[1]*Department of Botany, Chaudhary Charan Singh University, Meerut- 250004, India*
[2]*Department of Biotechnology, Amity University of Haryana, Gurugram -122051, India*

ARTICLE INFO

Citation: Nida Ziyaul, Kuntal Sarma, and Rama Kant (2026). *Hydrodictyon patenaeforme* Pocock: A new report from India. *Microbiology Archives, an International Journal.*
DOI: https://doi.org/10.51470/MA.2026.8.1.100

Received 21 November 2025
Revised 25 December 2025
Accepted 26 January 2026
Available Online February 23, 2026

Corresponding Author: **Rama Kant**
E-Mail: **ramakant.algae@gmail.com**

ABSTRACT

The Meerut region of India is well-known for its rich bio-diversity of flora and fauna including green algae. Since there are no previous records on the diversity of green alga Hydrodictyon from Meerut and Hastinapur, this study serves as the first documentation from the region. From the present communication we are reporting three species of Hydrodictyon, including H. reticulatum, H. indicum and H. patenaeforme from two natural fresh water biotopes of Meerut region of India, including the Chetawala Ghat, Ganga Khadar, Hastinapur and Cantonment area near the Kendriya Vidyalaya Sikh Lines, Meerut Uttar Pradesh, India. Of the three species, H. patenaeforme is reported from Chetawala Ghat, Ganga Khadar, Hastinapur Meerut (U.P.) is the first report and new addition to the algal flora of India.

Keywords: *Green algae, Hydrodictyon, Ganga Khadar, Chetawala Ghat, Meerut, Uttar Pradesh.*

Introduction

The genus *Hydrodictyon* (Linn.) Lagerheim, a member of division Chlorophyta, family Hydrodictyaceae, order Sphaeropleales, is composed of thousands of cylindrical cells joined by adjacent edges forming various mesh structures, like tri, tetra, penta, hexa, septa and octagonal, etc **(Table-1)**. Resembling a fishing net-like structure, due to which *Hydrodictyon* is famously known as Water Net and is easily visible to naked eyes [1]. This alga is characteristic of warm temperate zone and is widely distributed all over the globe including North Africa, America, Asia, New Zealand and Europe [2].

The genus *Hydrodictyon* has a greater ecological impact on the living biota of agricultural fields or seasonal or temporary water bodies [3]. They are found abundantly in slowly moving water streams, drains, river banks, agricultural lands filled with water and lakes. Till date altogether globally total six species of the genus *Hydrodictyon* are taxonomically accepted and these are *H. africanum, H. indicum, H. majus, H. patenaeforme, H. reticulatum, H. tertiarum* [4], out of which only one species *H. reticulatum* is ubiquitous in occurrence and has been reported from different countries of the world and well characterized.

The colonies of the genus *Hydrodictyon* are three-dimensional and net-like where cells form an interconnected mesh or tube that is defined by the network of cells. The genus *Hydrodictyon* is coenocytic with vegetative and sexual cycles, also producing a polyeder [5]. Pickett-Heaps [6] demonstrated that the germ net of *Hydrodictyon* forms a flat reticulate coenobium with the outer cells possessing two lobes, thus revealing an alliance with *Pediastrum* [7]. Phylogenetic analyses of the 18S data resolved *Hydrodictyon* as a monophyletic group but with bootstrap support less than 70% [7].

The present communication deals with the diversity of the genus *Hydrodictyon* from two natural fresh-water biotopes including the Chetawala Ghat, Ganga Khadar, Hastinapur, Meerut, India and Cantonment area near the Kendriya Vidyalaya Sikh Lines, Meerut Cantonment, Meerut, India.

Materials and Methods

Study sites and sampling:

Total 159 mixotrophic algal growth containing samples were collected from two different biotopes including the bank of Chetawala Ghat, Ganga Khadar, Hastinapur and Cantonment area near the Kendriya Vidyalaya Sikh Lines, Meerut Cantt., Meerut, India from 2018-2025 (Fig. 2A-D). Each sample was assigned with sample number along with the date of collection. Five ml from each sample was preserved in 4% v/v formaldehyde and deposited at the Department of Botany, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India.

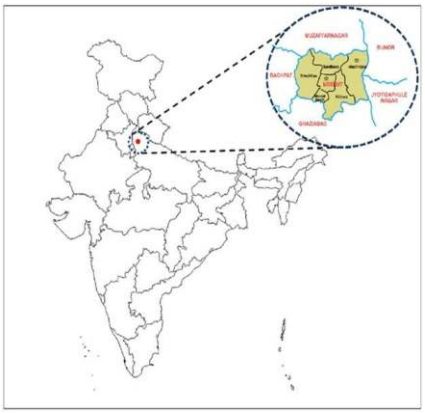

Figure 1: Geographical map of India showing two different sites

Enrichment culturing
Five ml from each sample was inoculated in the solid/liquid nitrogenous Chu-10 medium [8] for enrichment the culturing under controlled conditions (Temperature 28±2ºC, light- 4-6 K Lux, 14:10h light: dark cycle) for seven days, and their unialgal cultures were raised by repeated culturing and sub-culturing methods [9].

Morphological observations
Samples from nature, enriched unialgal cultures were subjected to microscopic observations with the help of a Research Microscope (Olympus, CH21i) fitted with digital Camera (Magnus, Magcam-DC10) and their morphometric parameters were recorded with the help of image analysis software (MagVision). All the isolated strains were identified up to species level with the help of available literatures and monographs [2, 10].

Results

Thallus of the genus *Hydrodictyon* is colonial, forming hollow, cylindrical to sac-like structures that resemble a mesh or net. These colonies are typically free-floating often accumulate in vast quantities frequently to blanket the surface and undergo sudden changes in buoyancy and causing them to disappear only to quickly reappear especially during calmer periods. Free-floating mats of *Hydrodictyon* can vary considerably in size, ranging from a few millimeters to several centimeters in length. The net is composed of regularly arranged polygonal meshes, most commonly pentagonal or hexagonal, which impart a highly organized geometric appearance. Each mesh is formed by elongated cells joined end-to-end at distinct angles, creating a continuous reticulate framework. The colony lacks differentiation into specialized tissues, but its structural organization reflects a high degree of coordination among constituent cells. The macroscopic visibility of the colony, cellular dimensions, quantity, morphology of chloroplasts, and the granule count within each filament were documented for morphological characterization and identification of *Hydrodictyon*.
Total three species of *Hydrodictyon* including *H. reticulatum*; *H. indicum* and *H. patenaeforme*, observed from the Meerut region of Uttar Pradesh, India. Of which *H. reticulatum* was observed from both the biotopes while *H. indicum* was observed only from the drains of Cantonment area near the Kendriya Vidyalaya Sikh Lines Meerut. The genus *H. patenaeforme*, new to the flora of India was observed only from Chetawala Ghat, Ganga Khadar, Hastinapur, Meerut, Uttar Pradesh, India.

Morphological description
Family: Hydrodictyaceae
Genus: *Hydrodictyon* Roth

Key to the species
1. Coenocytes cylindrical and not generally separating at maturity, cell wall 2 layered and uniform, coenocytes up to 250µm broad and up to 1.5cm long……***H. reticulatum***
2. Coenocytes cylindrical and separating at maturity, cell wall thick and lamellated and with knob like projections into protoplasm, coenocytes up to 1000µm broad and 1.6cm long……***H. indicum***
3. Net flattened, younger colonies may show rhombic or triangular meshes, single layered, of several hundred cells, coenocytes cylindrical 800µm -1.2cm……***H. patenaeforme***

***Hydrodictyon reticulatum* (Linn.) Lagerheim (Fig. 3A-D)**
Thallus macroscopic and colonial, grass green and free floating with closed cylindrical sac-like net. Four to seven cells of colony adjoined to each other at the end walls repeatedly forming a tetragonal to septagonal net like structure. Net may vary in sizes from 400-1900cm. Cells elongated, deeply green, cylindrical and very big, about 100-130 µm long and 10-12 µm broad, cell wall very thick and lamellated with numerous short knob-like portions of the cell wall projecting into the thin layer of protoplasm inside with smooth, two layered cell-wall. Chloroplast reticulate, young cells have a band-shaped chloroplast; mature cells have a reticulate (net-like) chloroplast with many pyrenoids; each cell of the net can produce a net asexually.

Location: 29.154966N; 78.078275E & 29.011347N, 77.733588E
Habitat: Chetawala Ghat, Ganga Khadar, Hastinapur and the Cantonment area near the Kendriya Vidyalaya Sikh Lines Meerut, Uttar Pradesh, India

***H. indicum* Iyengar (Fig. 4A-D)**
Thallus macroscopic, deeply green and non-motile colonial. The cells are cylindrical and free-floating. Six cells of the colony are adjoined to each other at the end walls repeatedly forming small hexagonal net like structure. Nets may vary in sizes from 300-720cm. Coenobium forming a hollow cylindrical network. Cells short, elongated, light green, cylindrical about 10-13 µm long and 5.6-7 µm broad united at their corners in groups of three. Cell wall very thick and lamellated projecting into the thin layer of protoplasm. Chloroplast reticulate, young cells contain a single, band-shaped parietal chloroplast with one pyrenoid while mature cells become coenocytic (multinucleate) with a reticulate (net-like) chloroplast with many pyrenoids.

Location: 29.011347N, 77.733588E
Habitat: Cantonment area near the Kendriya Vidyalaya Sikh Lines Meerut, Uttar Pradesh, India

***H. patenaeforme* Pocock (Fig. 5A-F)**
Thallus macroscopic, floating, fragile forming net-like tufts or mats within the water column. Nets bright green and composed of regularly arranged meshes, most commonly pentagonal or hexagonal, with highly organized geometric appearance. Nets very large, reaching several centimeters, and sometimes up to 1 meter in length. Cells elongated, light green, cylindrical about 90-113 µm long and 20-24 µm broad, coenocytic cells are typically linked at their ends to two other cells. Cells mostly pentagonal or hexagonal; some species or younger colonies may show rhombic or triangular meshes. Younger colonies may show rhombic or triangular meshes, single-layered, of several hundred cells, Coenocytes cylindrical linked at their ends to two other cells Cell wall very thick and lamellated. Individual young cells are uninucleate with a single chloroplast, while older cells become coenocytic (multinucleate) with large net-like reticulate chloroplast with numerous pyrenoids.

Location: 29.154854N, 78.076945E
Habitat: Chetawala Ghat, Ganga Khadar, Hastinapur, Meerut, Uttar Pradesh, India.

Table 2: Showing occurrence of Hydrodictyon species and their habitats

Parameters	*H. indicum*	*H. patenaeforme*	*H. reticulatum*
Sample No and Dates of collection	(MTC-058) 27-01-2020 (MTC-097) 19-04-2022 (MTC-128) 07-04-2025	(MTH-071) 10-04-2022 H	(MTH-025) 18-01-2019 (MTH-037) 10-03-2019 (MTH-054) 27-01-2020 (MTC-062) 07-04-2021 (MTC-076) 10-04-2022 (MTH-105) 17-03-2025 (MTH-148) 13-11-2025
No. of times species encountered	03	01	07
Habitat/ Biotope	Drain	Shallow pool	Shallow pool/ Drain
Location	Near Kendriya Vidyalaya Sikh Lines, Kaserukhera, Meerut Cantt., Meerut, India	Chetawala Ghat, Ganga Khadar, Hastinapur, Meerut, India	Chetawala Ghat, Ganga Khadar, Hastinapur and Near Kendriya Vidyalaya Sikh Lines, Kaserukhera, Meerut Cantt., Meerut, India
Geographical location	29.011347N, 77.733588E	29.154854N, 78.076945E	29.154966N, 78.078275E and 29.011347N, 77.733588E
Colony Shape	Macroscopic, deeply green and non-motile colonial	Macroscopic, free floating, fragile forming net-like tufts or mats	Macroscopic and colonial
Colony size	300-720cm	700-1000cm	400-1900cm
Cell shape	short, elongated, light green, cylindrical	elongated, light green, cylindrical	elongated, deeply green, cylindrical
Cell size	10-13 µm long and 5.6-7 µm broad	90-113 µm long and 20-24 µm broad	100-130 µm long and 10-12 µm broad
Tetragonal %ge	13.46%	15.95%	20%
Pentagonal %ge	26.92%	34.04%	25%
Hexagonal %ge	42.30%	39.36%	42.50%
Septagonal %ge	9.61%	9.57%	5%
Octagonal %ge	7.61%	1.06%	2.5%

Discussion

In India, the diversity of the genus *Hydrodictyon* appears limited when assessed solely on species richness, yet its ecological significance and spatial distribution across freshwater habitats are notably substantial. According to available taxonomic databases, the genus is represented globally by six confirmed species and three varieties [4], indicating a modest level of taxonomic diversification. However, within the Indian subcontinent, only two species have been formally documented to date [11-13]. This apparent disparity between global diversity and regional records may reflect under-exploration, taxonomic ambiguities, or limitations in molecular characterization studies in India.

Despite the limited number of species, *Hydrodictyon* demonstrates extensive geographical distribution across diverse aquatic ecosystems in India, including ponds, lakes, reservoirs, wetlands, and slow-flowing rivers. The genus typically thrives in stagnant or slow-moving, nutrient-rich freshwater bodies, particularly during warmer months and monsoon seasons, where it may form dense floating mats [14]. Reports from regions such as Chennai, Uttar Pradesh, West Bengal, Himachal Pradesh, Uttarakhand, and other parts of the Gangetic plains confirm its widespread occurrence [15-19]. Despite the low number of reported species, *Hydrodictyon* plays a crucial ecological role in freshwater ecosystems by contributing to primary productivity, nutrient cycling, and habitat structuring, thereby underscoring the need for more comprehensive taxonomic and ecological investigations in the region [20-22].

From a taxonomic perspective, the apparent low diversity of *Hydrodictyon* in India may be attributed to under-exploration, morphological plasticity, and the lack of integrative taxonomic approaches combining molecular and ultrastructural data [23]. Many floristic surveys report *Hydrodictyon* only at the genus level, suggesting possible cryptic diversity that remains unrecognized [24].

Furthermore, regional studies have often focused on broader algal diversity, leading to insufficient detailed documentation of this genus [25].

The Meerut region of India has been explored by many biologists [26-36] but no such reports on the diversity of *Hydrodictyon* from the Meerut region are available till date. From the present communication we are reporting three species of *Hydrodictyon* including *H. reticulatum*; *H. indicum* and *H. patenaeforme* from the Meerut region of Uttar Pradesh, India. Of the three species, *H. patenaeforme* reported from Chetawala Ghat, Ganga Khadar, Hastinapur, Meerut, Uttar Pradesh is the first report and new addition to the macroalgal flora of India.

Conclusion

From the present communication, it could be concluded that, the Meerut region including Hastinapur of Uttar Pradesh, is rich in diversity of micro and macroalgae including *Hydrodictyon*. The colonies of *Hydrodictyon* are free-floating often accumulate to blanket the surface undergoing sudden changes in buoyancy and causing them to disappear during calmer periods. Of the three species of *Hydrodictyon*, *H. patenaeforme* is reported for the first time from Chetawala Ghat, Ganga Khadar, Hastinapur, Meerut, Uttar Pradesh, India and is a new addition to the algal flora of India.

Acknowledgement

Authors are thankful to the Head, Department of Botany, Chaudhary Charan Singh University, Meerut, India for providing necessary facilities. We are thankful to the Uttar Pradesh Government for financial support. Authors are thankful to Prof. G.L. Tiwari, Ex. Head, Botany Department, University of Allahabad, Prayagraj, India for identification of the algal species.

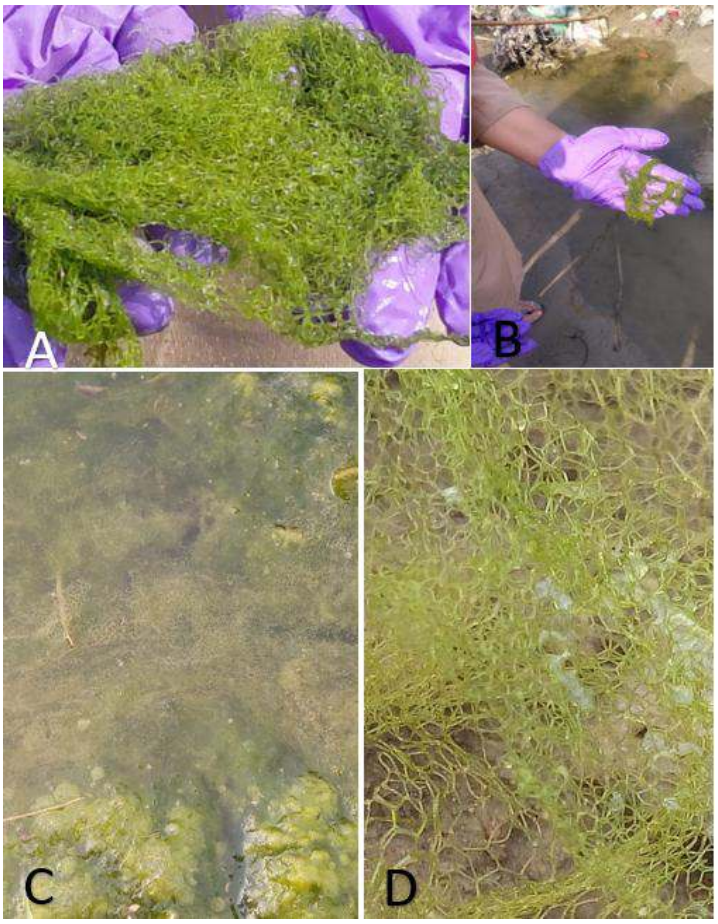

Figure 2(A-D): Figures (A-D) showing collection of Hydrodictyon and their mats in natural habitats

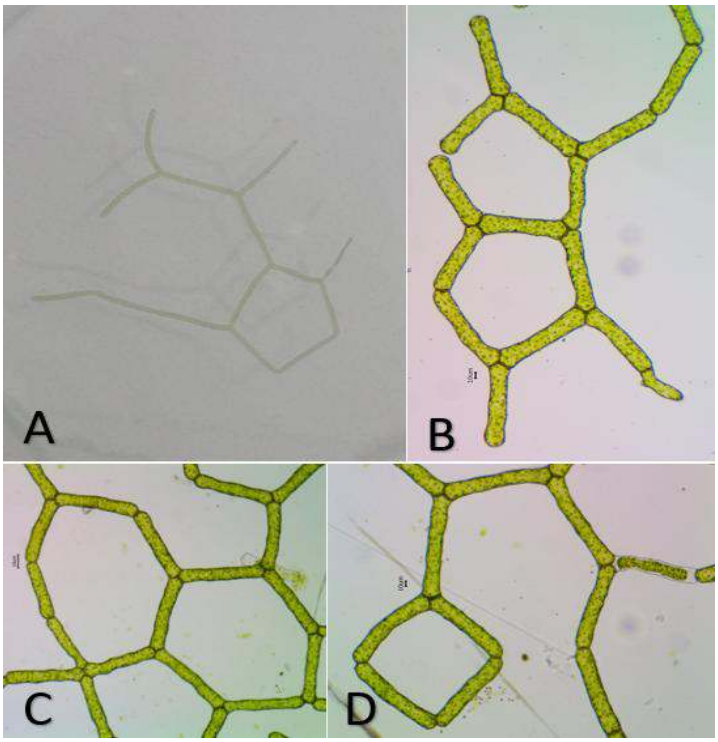

Figure 3(A-D): Figures (A-D) showing microphotographs of H. reticulatum

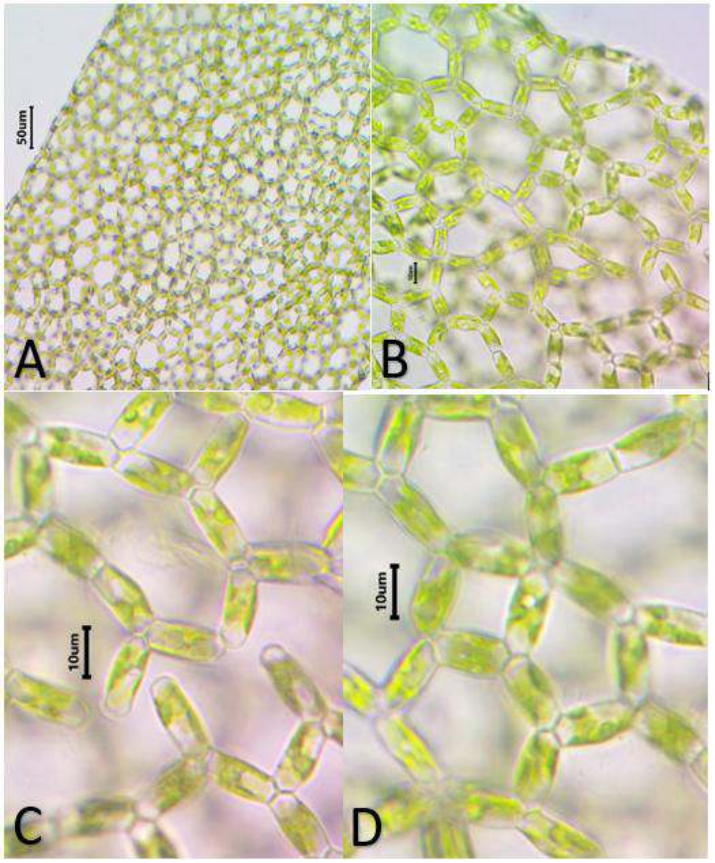

Figure-4(A-D): Figures (A-D) showing microphotographs of H. indicum

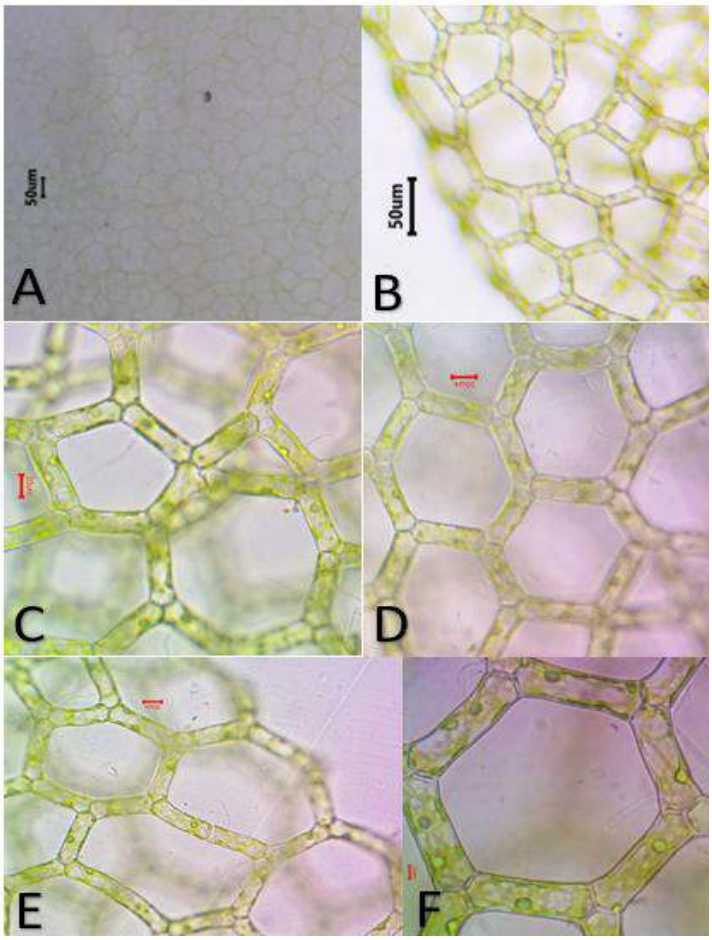

Figure 5(A-D): Figures (A-D) showing microphotographs of H. patenaeforme

Dr. Rama Kant is an Associate Professor and Head, Department of Botany, Chaudhary Charan Singh University, Meerut. India. He earned his D.Phil. from University of Allahabad, Prayagraj, and B.Sc. and M.Sc. from Kanpur University, Kanpur, India. His research focuses on algal biotechnology and taxonomy, and their applied aspects.

Nida Ziyaul is a researcher in Botany and phycology affiliated with the Department of Botany, Chaudhary Charan Singh University, Meerut, India. Her work focuses on green algae and their natural products, environmental applications of algae including phycoremediation.

Er. Kuntal Sarma is primarily an academician and researcher specializing in Biotechnology and Phycology, with a particular focus on the North-East region of India. He completed his post-graduation from SHIATS (Formally Allahabad Agricultural University) and currently pursuing Ph.D. from the Department of Biotechnology, Amity University, Gurugram, Haryana, India. His research expertise includes Cyanobacteria (Blue-green algae), biofuels, biofertilizers, and green nano-biotechnology.

References

1. Mandal, P. (2019). *Hydrodictyon reticulatum* (L.) Lagerheim, A Freshwater macro-algae causing nuisance eutrophication on paddy field of West Bengal, India. *Review of Research* 8(6):1-8.
2. Pocock M.A. (1960). *Hydrodictyon*: a comparative biological study. *Journal of South African botany*, 26: 167– 319.
3. Wells, R.D. and Clayton, J.S. (2001). Ecological impacts of water net (*Hydrodictyon reticulatum*) in Lake Aniwhenua, New Zealand. *New Zealand Journal of Ecology*, 55-63.
4. Guiry, M.D. and Guiry, G.M. (2024). AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. https://www.algaebase.org; searched on 20 March 2026.
5. Davis, J.S. (1967). The life cycle of *Pediastrum simplex*. *J. Phycol*. 3:95–103.
6. Pickett-Heaps, J. D. (1975). Green Algae. Sinauer, Sunderland, MA, pp. 606.
7. Buchheim, M., Buchheim, J., Carlson, T., Braband, A., Hepperle, D., Krienitz, L., Wolf, M. and Hegewald, E. (2005). Phylogeny of the Hydrodictyaceae (Chlorophyceae): inferences from rDNA data. *J. Phycol*. 41(5):1039–1054.
8. Chu, S.P. (1942). The influence of the mineral composition of the medium on the growth of planktonic algae: part I. Methods and culture media. *The Journal of Ecology*, 284-325.
9. Kant, R., Tiwari, O.N., Tandon, R. and Tiwari, G.L. (2005). Growth pattern, structure, reproduction & perennation in *Gloeocapsa decorticans* (A.Br.) Richter. *Bionature*, 25(1&2): 153-157.
10. Philipose, M.T. (1967). Chlorococcales. Indian Council of Agricultural Research, New Delhi. pp. 1-365.
11. Jaffer, M., Ashraf, H. and Shaheen, S. (2021). Phytochemical, antioxidant and antimicrobial activity of biological important algae *Hydrodictyon reticulatum* (L.): Algae act as a potential source as phytochemical, antioxidant and antimicrobial agent. *Biological Sciences-PJSIR*, 64(3): 244-250.
12. Mansore, P. and Chitnis, S. (2021). A Study of Algal Diversity of Choral River with Reference to Chlorophyceae, Bacillariophyceae and Cyanophyceae. *Journal of Plant Science Research*, 37(2): 399-404.
13. Bagauli, R., Bisht, B., Sharma, A. K., Singh, V. B. and Joshi, H.C. (2025). Decarbonization potential of bioethanol fuel blend systems using *Hydrodictyon indicum*: A Life Cycle perspective of algal bioenergy. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 47(2): 2589363.
14. Taş, B. (2011). Bloom and eutrophication of *Hydrodictyon reticulatum* (Chlorophyceae) at civil and Kacalı stream, Ordu, Turkey. *Energy Education Science and Technology Part A: Energy Science and Research*, 28(1): 319-330.
15. Iyengar, M.O.P. (1925). *Hydrodictyon indicum*, A new species from Madras. Journal of the Indian Botanical Society 4(9,10): 315-317.
16. Srivastava, S.C. (1998). Distribution of hepaticae and anthocerotae in India. *Topics in Bryology*, 53-85.
17. Nautiyal, P., Verma, J. and Mishra, A.S. (2013). Distribution of major floral and faunal diversity in the mountain and upper gangetic plains zone of the Ganga: diatoms, macroinvertebrates and fish. In Our National River Ganga: Lifeline of Millions. Cham: *Springer International Publishing*, 75-119.
18. Singh, D.K. (2024). Liverwort and Hornwort Diversity in the Himalayan Biodiversity Hotspot in India. In *Biodiversity Hotspot of the Himalaya*. *Apple Academic Press*, 143-189.
19. Sanju, S., Thakur, A. and Shukla, P.K. (2025). Algal Biodiversity in North Western Region of Indian Himalayas. In Biodiversity of the Himalaya. *Apple Academic Press*. 251-278.
20. Gao, Y. and Yan, X. (2012). Response of *Chara globularis* and *Hydrodictyon reticulatum* to lead pollution: their survival, bioaccumulation, and defense. *Journal of Applied Phycology*, 24(2): 245-251.
21. Henn, C. (2016). Massive occurrence of the invasive alga *Hydrodictyon reticulatum* (L.) Bory in a Brazilian lotic system and variables explaining its biomass in microhabitat scale. *Limnetica*. 35(1): 95-102.
22. Zhang, J. and Luo, X. (2022). Bioaccumulation characteristics and acute toxicity of uranium in *Hydrodictyon reticulatum*: An algae with potential for wastewater remediation. *Chemosphere*, 289-298.
23. Pocock, M.A. (1937). *Hydrodictyon* in South Africa. With notes on the known species of *Hydrodictyon*. *Transactions of the Royal Society of South Africa*, 24(3): 263-280.
24. McManus, H.A. and Lewis, L.A. (2002). Phylogenetic Relationships Among *Pediastrum* sPP. and *Hydrodictyon*. *Journal of Phycology*, 38, 27-28.
25. Radhakrishnan, C. and Karthick, B. (2025). Patterns and process in pseudoaerial diatom communities: impact of local and regional factors in the Eastern Himalayan and Indo-Burma biodiversity hotspot. *Biodiversity and Conservation*, 34(6), 2119-2138.
26. Kumar, H. (1970). Cyanophyceae of Sardhana. *Phykos*, 9: 79-85.
27. Bendre A.M. and Kumar S. (1975). Cyanophyceae of Meerut. *Phykos* 14: 1-7.
28. Singh, J., Sarma, K., Saini, A., Kumar, S. and Kant, R. (2021). Certain commercially interesting taxa of Phormidioideae, Phormidiaceae (Oscillatoriales Cyanoprokaryote) from Polluted sites of Meerut, Uttar Pradesh, India. *Plant Archives.* 21(2): 656-661.
29. Singh, J., Saini, A., Sarma, K., Ziyaul, N., Kumar, S. and Kant, R. (2022a). The genus *Oscillatoria* Vaucher ex Gom. (Cyanoprokaryote) from polluted biotopes of Meerut, Uttar Pradesh, India. *The Journal of Indian Botanical Society*, 102(2): 86-102.
30. Singh, J., Sarma, K., & Kant, R. (2022b). Diversity and Morpho-Taxonomy of the Genus *Phormidium* Kützing ex Gomont (Cyanoprokaryote) from Polluted Habitats of Meerut, Uttar Pradesh. *Indian Hydrobiology*, 21(2): 149-156.
31. Singh, J., Sarma, K., Saini, A., Kumar, S., Kour, N., Gupta, D. and Kant, R. (2023). Certain rare non-heterocystous blue-green algae of Pseudanabaenaceae (Oscillatoriales, Cyanoprokaryote) from polluted habitats of Meerut, Uttar Pradesh, India. *Plant Archives*, 23 (1): 336-342.
32. Doli, Sarma, K. and Kant, R. (2023). Influence of light quality on growth and synthesis of natural products by the diazotropic blue-green alga *Cylindrospermum muscicola* MTC-30602. *Egyptian Journal of Phycology*, 24(1): 194-212.

33. Doli, Sarma, K., Kant, R., Kour, N., Tyagi, A., Sharma, H., Kumar, P., Vashistha, H., Sharma, S., Sharma, Y., Verma, A., Ziyaul, N., Gauri, Pandey, L.K., Chaudhary, S. and Halder, N. C. (2025). Diversity and Phylogenetic Relationships of *Cylindrospermum* Species from the Aquatic and Semi-Aquatic Habitats of Western Uttar Pradesh, Bharat. *Egyptian Journal of Aquatic Biology and Fisheries*, 29(5): 1575-1601.
34. Kumar, S. and Kant, R. (2023). Diversity of the cyanobacterial genus *Nostoc* Vaucher of grassland biotope, Meerut, Uttar Pradesh, Bharat. *Plant Archives* (09725210), 23(2): 320-326.
35. Chaudhary, V., Sarma, K., Chaudhary, S., Gupta, D., Bhardwaj, S., Goswami, V., Tyagi, A., Tiwari, S., Pandey, L.K. and Kant, R. (2024). Exploring the Diversity of the Bacillariophytes from Meerut and Adjoining Areas of Western Uttar Pradesh, India. *Egyptian Journal of Aquatic Biology & Fisheries*, 28(6): 557 – 587.
36. Ziyaul, N., Sarma, K., Doli, Gupta, D., Gauri, Kant. R. (2025). Impact of Nitrogen and Phosphorus on The Synthesis of Carotenoids in *Cladophora glomerata* (Linnaeus) Kützing, A Green Macroalga. *International Journal of Pharmaceutical Sciences*. 3(10): 2376-2382.