

# Preliminary molecular phylogeny of the diatom genus *Nupela* with the description of a new species and consideration of the interrelationships of taxa in the suborder neidiineae d.G. mann sensu e.j. cox

Kulikovskiy M.S., Maltsev Y.I., Glushchenko A.M., Gusev E.S., Kapustin D.A., Kuznetsova I.V., Frolova L., Kociolek J.P.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

---

## Abstract

© Czech Phycological Society (2020). Molecular investigation of genera *Nupela* and *Brachysira* is conducted using strains from Indonesia and Vietnam. New species from the genus *Nupela* *indonesica* sp. nov. is described using combined approach. *Nupela* *lesothensis* (Schoeman) Lange-Bertalot is investigated using molecular data too. Phylogenetic analysis shows that *Nupela* and *Brachysira* are not closest genera. Morphology of *Nupela* and its differences from *Brachysira* is discussed. The genus *Nupela* differs from all other diatom taxa by having coalescent hymenes outside of areolae but not inside. Facultative development of raphe between different *Nupela* species is discussed.

<http://dx.doi.org/10.5507/fot.2020.009>

---

## Keywords

Brachysira, Diatoms, Molecular investigation, Morphology, *Nupela*, Phylogeny, Taxonomy

## References

- [1] Bahls, L.L. (2011): *Nupela potapovae* sp. nov. (Bacillariophyta), a lentic alpine species from North America - *Diatom Research* 26: 167-174.
- [2] Buczkó, K.; Wojtal, A.Z. & Magyari, E.K. (2013): Late quaternary *Nupela* taxa of Retezat Mts (S. Carpathians), with description of *Nupela pocsii* sp. nov. (Bacillariophyceae). - *Polish Botanical Journal* 58: 427-436.
- [3] Cox, E.J. (2006): Raphe loss and spine formation in *Diademesma gallica* (Bacillariophyta) - an intriguing example of phenotypic plasticity in a diatom. - *Nova Hedwigia Beihefte* 130: 163-76.
- [4] Cox, E.J. (2015): Coscinodiscophyceae, Mediophyceae, Fragilariophyceae, Bacillariophyceae (Diatoms). - In: Jaklitsch, W.; Baral, H.O.; Lücking, R.; Lumbsch, H.T. & Frey, W. (eds): *Syllabus of Plant Families. Adolf Engler's Syllabus der Pflanzenfamilien. Part 2/1. Photoautotrophic eukaryotic Algae: Glaucocystophyta, Cryptophyta, Dinophyta/Dinzoa, Haptophyta, Heterokontophyta/ Ochrophyta, Chlorarachniophyta/Cercozoa, Euglenophyta/ Euglenozoa, Chlorophyta, Streptophyta*. - pp. 64-103, Borntraeger Verlagsbuchhandlung, Stuttgart.
- [5] Falasco, E.; Bona, F.; Isaia, M.; Piano, E.; Wetzel, C.E.; Hoffmann, L. & Ector L. (2015): *Nupela trogliphila* sp. nov., an aerophilous diatom (Bacillariophyta) from the Bossea cave (NW Italy), with notes on its ecology. - *Fottea* 15: 1-9.
- [6] Fourtanier, E. & Kociolek, J.P. (2011): *Catalogue of Diatom Names*. - California Academy of Sciences, Online Version, accessed 19 Sep 2011. <http://researcharchive.calacademy.org/research/diatoms/names/index.asp>.

- [7] Genkal, S.I. & Vekhov, N.V. (2007): Diatoms of the reservoirs of the Russian Arctic; archipelago Novaya Zemlya and Vaigach Island. – pp. 1-64, Nauka Press, Moscow.
- [8] Guiry, M.D. & Guiry, G.M. (2020): AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. [https://www.algaebase.org/search/genus/detail/?genus\\_id=43732-session=abv4:AC1F05EC161332C951pg97CE630A](https://www.algaebase.org/search/genus/detail/?genus_id=43732-session=abv4:AC1F05EC161332C951pg97CE630A), searched on 5 March 2017.
- [9] Kociolek, J.P.; Williams, D.M.; Stepanek, J.; Liu, Q.; Liu, Y.; You, Q.-M.; Karthick, B. & Kulikovskiy, M. 2019. Rampant homoplasy and adaptive radiation in pennate diatoms. – *Plant Ecology and Evolution* 152: 131-141.
- [10] Kulikovskiy, M.S.; Glushchenko, A.M.; Kuznetsova, I.V. & Genkal, S.I. (2016): Identification book of diatoms from Russia. – pp. 1-804, Filigran, Yaroslavl. (In Russ.).
- [11] Kulikovskiy, M.S.; Lange-Bertalot, H. & Witkowski, A. (2009): *Nupela matrioschka* sp. nov., *Nupela thurstonensis* comb. nov. and *Nupela neogracillima* comb. & nom. nov. (Bacillariophyceae): critical analysis of their morphology. – *Polish Botanical Journal* 54: 13-20.
- [12] Kulikovskiy, M.S.; Maltsev, Ye.I.; Andreeva, S.A.; Glushchenko, A.M.; Gusev, E.S.; Podunay, Yu.A.; Ludwig, T.V.; Tusset, E. & Kociolek, J.P. (2019): Description of a new diatom genus *Dorofeyukea* gen. nov. with remarks on phylogeny of the family Stauroneidaceae. – *Journal of Phycology* 55: 173-185.
- [13] Lange-Bertalot, H. (1993): 85 neue taxa und über 100 weitere neu definierte Taxa ergänzung zur Süßwasserflora von Mitteleuropa. – *Bibliotheca Diatomologica* 27: 1-454.
- [14] Lange-Bertalot, H. & Genkal, S.I. (1999): Diatoms from Siberia I. Islands in the Arctic Ocean (Yugorsky-Shar Strait). – *Iconographia Diatomologica* 6: 1-292.
- [15] Lange-Bertalot, H. & Moser, G. (1994). *Brachysira*. Monographie der Gattung. – *Bibliotheca Diatomologica* 29: 1-212.
- [16] Lowe, R.L.; Kociolek, J.P.; Johansen, J.R.; Van de Vijver, B.; Lange-Bertalot, H. & Kopalová, K. (2014): *Humidophila* gen. nov., a new genus for a group of diatoms (Bacillariophyta) formerly within the genus *Diademesis*: species from Hawai'i, including one new species. – *Diatom Research* 29: 351-360.
- [17] Liu, Y.; Kociolek, J.P.; Wang, Q. & Fan, Y. (2014): Two new species of monoraphid diatom (Bacillariophyceae) from South of China. – *Phytotaxa* 188: 31-37.
- [18] Metzeltin, D. & Lange-Bertalot, H. (1998): Tropical diatoms of South America I: About 700 predominantly rarely known or new taxa representative of the neotropical flora. – *Iconographia Diatomologica* 5: 1-695.
- [19] Metzeltin, D. & Lange-Bertalot, H. (2007): Tropical Diatoms of South America II: Special Remarks on Biogeographic Disjunction. – *Iconographia Diatomologica* 18: 1-877.
- [20] Monnier, O.; Lange-Bertalot, H. & Bertrand, J. (2003): *Nupela exotica* species nova: une diatomée d'un aquarium tropical d'eau douce. Avec des remarques sur la biogéographie du genre. – *Diatom Research* 18: 273-291.
- [21] Moser, G.; Lange-Bertalot, H. & Metzeltin, D. (1998): Insel der Endemiten. Geobotanisches Phänomen Neukaledonien. – *Bibliotheca Diatomologica* 38: 1-464.
- [22] Nakov, T.; Beaulieu, J.M. & Alverson, A.J. (2019): Accelerated diversification is related to life history and locomotion in a hyperdiverse lineage of microbial eukaryotes (Diatoms, Bacillariophyta). – *New Phytologist* 219: 462-473.
- [23] Potapova, M.G. (2011). New species and combinations in the genus *Nupela* from the USA. – *Diatom Research* 26: 73-87.
- [24] Potapova, M.G. (2013): Transfer of *Achnanthes decipiens* to the genus *Nupela*. – *Diatom Research* 28: 139-142.
- [25] Potapova, M.G.; Ponader, K.C.; Lowe, R.L.; Clason, T.A. & Bahls, L.L. (2003): Small-celled *Nupela* species from North America. – *Diatom Research* 18: 293-306.
- [26] Round, F.E.; Crawford, R.M. & Mann, D.G. (1990): *The Diatoms. Biology and morphology of the genera*. – pp. 1-747, Cambridge University Press, Cambridge.
- [27] Rumrich, U.; Lange-Bertalot, H. & Rumrich, M. (2000): Diatoms of the Andes from Venezuela to Patagonia/Tierra del Fuego and two additional contributions. – *Iconographia Diatomologica* 9: 1-671.
- [28] Sala, S.; Vouilloud, A.A.; Plata-Díaz, Y.; Pedraza, E. & Pimienta, A. (2014): *Nupela* species (Naviculales: Bacillariophyceae) from Colombian lowland waters including *N. acaciensis* nov. sp. and *N. catatumbensis* nov. sp. – *Revista de Biología Tropical* 62: 241-255.
- [29] Schoeman, F.R. (1973): A systematical and ecological study of the diatom flora of Lesotho with special reference to the water quality. – pp. 1-355, V & R Printers, Pretoria.
- [30] Siver, P.A.; Hamilton, P.B. & Morales, E.A. (2007): Notes on the genus *Nupela* (Bacillariophyceae) including the description of a new species, *Nupela scissura* sp. nov. and an expanded description of *Nupela paludigena*. – *Phycological Research* 55: 125-134.
- [31] Siver, P.A.; Wolfe, A.P. & Edlund, M.B. (2010): Taxonomic description and evolutionary implications of Middle Eocene pinnate diatoms representing the extend genera *Oxyneis*, *Actinella* and *Nupela* (Bacillariophyceae). – *Plant Ecology and Evolution* 143: 340-351.

- [32] Tremarin, P.I.; Straube, A. & Ludwig, T.A.V. (2015): *Nupela* (Bacillariophyceae) in littoral rivers from south Brazil, and description of six new species of the genus. – *Fottea* 15: 75-93.
- [33] Vyverman, W. & Compère, P. (1991): *Nupela giluwensis* gen. & spec. nov. A new genus of naviculoid diatoms. – *Diatom Research* 6: 175-179.
- [34] Wojtal, A.Z. (2009): *Nupela marvanii* sp. nov., and *N. lapidosa* (Krasske) Lange-Bertalot in Poland with notes on the distribution and ecology of the genus *Nupela* (Bacillariophyta). – *Fottea* 9: 233-242.
- [35] Yu, P.; You, Q.; Kociolek, J.P.; Lowe, R. & Wang, Q. (2017): *Nupela major* sp. nov., a new diatom species from Maolan nature Reserve, central-south of China. – *Phytotaxa* 311: 245-254.