

Two new species of the diatom genus *Navicula* Bory (Bacillariophyceae) from Vietnam (Southeast Asia)

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Abstract

We present light and scanning electron microscopical observations on two new species of *Navicula* Bory sensu stricto from Vietnam. These new species, *Navicula babeiensis* Chudaev, Glushchenko, Kulikovskiy & Kociolek sp. nov. and *Navicula pseudokuseliana* Chudaev, Glushchenko, Kulikovskiy & Kociolek sp. nov. are described and distinguished from others in the genus on the basis of valve outline and shape of the apices, as well as stria and areola densities. These species possess all the typical morphological features for the genus, including uniseriate lineolate striae covered by internal convex hymenes, median raphe with accessory rib, and external distal raphe ends that are hooked in the characteristic way for the genus. Comparisons with similar taxa are given. Our new data extend the information about the diversity of diatoms in general and for *Navicula* taxa specifically, in Southeast Asia.

<http://dx.doi.org/10.1080/0269249X.2020.1853608>

Keywords

diatoms, morphology, *Navicula*, new species, Southeast Asia, Vietnam

References

- [1] Bazhenova O.P., Glushchenko A.M., Igoshkina I.Yu., Shkilev T.E., & Kulikovskiy M.S., 2019. Plankton diatoms (Fragilariophyceae, Bacillariophyceae) from the middle part of Irtysh River. Novosti sistematiki nizshikh rastenii 53: 207-240. doi: 10.31111/nsnr/2019.53.2.207
- [2] Chudaev D.A., Glushchenko A.M., Blagoveshchenskaya E.Yu., Karthick B., & Kulikovskiy M.S., 2018. Morphology and taxonomy of *Navicula escambia* and *N. simulata* (Bacillariophyceae). Nova Hedwigia, Beihefte 147: 43-57. doi: 10.1127/nova-suppl/2018/006
- [3] Chudaev D.A., Jüttner I., Glushchenko A.M., Kulikovskiy M.S., Gurung S., & Williams D., 2020. On the geographical distribution of *Navicula nielsfogedii* J.C. Taylor & Cocquyt. Diatom Research 35: 185-192. doi: 10.1080/0269249X.2020.1758794
- [4] Cox E.J., 1999. Studies on the diatom genus *Navicula* Bory. VIII. Variation in valve morphology in relation to the generic diagnosis based on *Navicula tripunctata* (O.F. Muller) Bory. Diatom Research 14: 207-237. doi: 10.1080/0269249X.1999.9705467
- [5] Glushchenko A.M., & Kulikovskiy M.S., 2015. The genus *Luticola* (Bacillariophyceae) in water ecosystems of South-Eastern Asia. Botanicheskij Journal 100: 799-804. (In Russ.).
- [6] Glushchenko A.M., & Kulikovskiy M.S., 2017a. *Amphipleura vavilovii*: a new diatom species of the family Amphipleuraceae from Laos. Inland Water Biology 10: 17-21. doi: 10.1134/S1995082916040064
- [7] Glushchenko A.M., & Kulikovskiy M.S., 2017b. Taxonomy and distribution of *Eunotia camelus* Ehrenberg (Bacillariophyta) infraspecific taxa from South-East Asia. Botanicheskij Journal 102: 329-339. (In Russ.).
- [8] Glushchenko A.M., & Kulikovskiy M.S., 2017c. Taxonomy and distribution of the genus *Eunotia* Ehrenberg in aquatic ecosystems of Vietnam. Inland Water Biology 10: 130-139. doi: 10.1134/S1995082917020055

- [9] Glushchenko A.M., Genkal S.I., & Kulikovskiy M.S., 2016. *Aulacoseira konstantinovii* sp. nov. and *Aulacoseira krylovii* sp. nov.-two new centric diatoms from South-East Asia. *Diatom Research* 31: 367-378. doi: 10.1080/0269249X.2016.1253617
- [10] Glushchenko A.M., Kulikovskiy M.S., Okhapkin A.G., & Kociolek J.P., 2017a. *Aneumastus laosica* sp. nov. and *A. genkalii* sp. nov.-two new diatom species from Laos (Indochina) with comments on the biogeography of the genus. *Cryptogamie, Algologie* 38: 183-199. doi: 10.7872/crya/v38.iss3.2017.183
- [11] Glushchenko A.M., Kulikovskiy M.S., & Kociolek J.P., 2017b. New diatom species from the *Gomphonema subtile* group in Southeast Asia. *Phytotaxa* 329 (3): 223-323. doi: 10.11646/phytotaxa.329.3.3
- [12] Glushchenko A.M., Kulikovskiy M.S., & Kociolek J.P., 2017c. New and interesting species from the genus *Luticola* (Bacillariophyceae) in waterbodies of SouthEastern Asia. *Nova Hedwigia, Beihefte* 146: 157-173. doi: 10.1127/1438-9134/2017/157
- [13] Glushchenko A., Kulikovskiy M., Kuznetsova I., Dorofeyuk N., & Kociolek J.P., 2018. New species and combinations in the genus *Eunotia Ehrenberg 1837* (Bacillariophyceae: Eunotiaceae) from waterbodies of Southeastern Asia. *Nova Hedwigia, Beihefte* 147: 69-103. doi: 10.1127/nova-suppl/2018/009
- [14] Glushchenko A.M., Kociolek J.P., Kuznetsova I.V., Kezlya E.M., & Kulikovskiy M.S., 2019a. *Neidiomorpha gusevii*-a new diatom species (Bacillariophyceae: Neidiaceae) from Southeast Asia. *Phytotaxa* 415: 279-285. doi: 10.11646/phytotaxa.415.5.4
- [15] Glushchenko A., Kociolek J., Kuznetsova I., Kezlya E., & Kulikovskiy M., 2019b. *Prestauroneis genkalii*-a new diatom species (Bacillariophyceae: Stauroneidaceae) from Southeast Asia. *Phytotaxa* 414: 156-164. doi: 10.11646/phytotaxa.414.4.1
- [16] Gusev E.S., & Kulikovskiy M.S., 2014. Centric diatoms from Vietnam reservoirs with description of one new *Urosolenia* species. *Nova Hedwigia, Beiheft* 143: 111-126.
- [17] Hustedt F., 1949. Süsswasser-Diatomeen aus dem Albert Nationalpark in Belgisch-Kongo. *Exploration du Parc National Albert, Mission H. Dumas* 8: 1-199.
- [18] Kapustin D.A., & Kulikovskiy M.S., 2018. Transfer of *Stenopterobia* and *Surirella* taxa (Bacillariophyceae) described from the insular Southeast Asia to the genus *Iconella*. *Nova Hedwigia, Beihefte* 147: 237-245. doi: 10.1127/nova-suppl/2018/019
- [19] Kapustin D.A., Kulikovskiy M., & Kociolek J.P., 2017. *Celebesia* gen. nov., a new cymbelloid diatom genus from the ancient Lake Matano (Sulawesi Island, Indonesia). *Nova Hedwigia, Beihefte* 146: 147-155. doi: 10.1127/1438-9134/2017/147
- [20] Kapustin D.A., Kociolek J.P., Glushchenko A.M., & Kulikovskiy M.S., 2019. Four new species of *Cymbella* (Bacillariophyta) from the ancient Malili lakes (Sulawesi Island, Indonesia). *Botanicheskij Journal* 104: 766-780.
- [21] Kociolek J.P., Glushchenko A., & Kulikovskiy M., 2015. Typification, valve ultrastructure, and systematic position of *Gomphonema gomphopleuroides Amossé ex Kociolek*, Glushchenko & Kulikovskiy, an endemic diatom from Southeast Asia. *Diatom Research* 30: 247-255. doi: 10.1080/0269249X.2015.1072583
- [22] Kociolek J.P., Kapustin D.A., & Kulikovskiy M.S., 2018. A new, large species of *Gomphonema Ehrenberg* from ancient Lake Matano, Indonesia. *Diatom Research* 33: 1-11. doi: 10.1080/0269249X.2018.1464522
- [23] Kociolek J.P., Blanco, S., Coste M., Ector L., Liu Y., Karthick B., Kulikovskiy M., Lundholm N., Ludwig T., Potapova M., Rimet F., Sabbe K., Sala S., Sar E., Taylor J., Van de Vijver B., Wetzel C.E., Williams D.M., Witkowski A., Witkowski J., 2020. DiatomBase. Available from: <http://www.diatombase.org> [Accessed 18 August 2020].
- [24] Kulikovskiy M.S., 2008. The species composition and distribution of diatoms in Sphagnum bogs of European Russia: ecosystems of the Volga Upland. *Inland Water Biology* 1: 347-355. doi: 10.1134/S1995082908040068
- [25] Kulikovskiy M.S., 2009. The species composition and distribution of diatom algae in Sphagnum bogs in European Russia: the Polistovo-Lovatskii land tract. *Inland Water Biology* 2: 135-143. doi: 10.1134/S1995082909020059
- [26] Kulikovskiy M.S., Lange-Bertalot H., Metzeltin D., & Witkowski A., 2012. Lake Baikal: hotspot of endemic diatoms I. *Iconographia Diatomologica* 23: 1-861.
- [27] Kulikovskiy M.S., Glushchenko A.M., Genkal S.I., & Kuznetsova I.V., 2016. Identification book of diatoms from Russia. Filigran, Yaroslavl. 804 pp.
- [28] Kulikovskiy M.S., Glushchenko A.M., Dorofeyuk N.I., & Kociolek J.P., 2018a. Morphology and distribution of *Ninastrelnikovia laosica* sp. nov.-a new species in a previously monospecific genus. *Nova Hedwigia, Beihefte* 147: 119-126. doi: 10.1127/nova-suppl/2018/011
- [29] Kulikovskiy M.S., Glushchenko A.M., Kuznetsova I.V., & Kociolek J.P., 2018b. Description of the new freshwater diatom genus *Okhapkinia* gen. nov. from Laos (Southeast Asia), with notes on family Sellaphoraceae Mereschkowsky 1902. *Fottea* 18: 120-129. doi: 10.5507/fot.2017.021
- [30] 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., & Kroth 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. doi: 10.1111/jpy.12810

- [31] Kulikovskiy M.S., Chudaev D.A., Glushchenko A.M., Kuznetsova I.V., & Kociolek J.P., 2020a. New diatom species *Navicula davidovichii* from Vietnam (Southeast Asia). *Phytotaxa* 452: 83–91. doi: 10.11646/phytotaxa.452.1.8
- [32] Kulikovskiy M.S., Chudaev D.A., Glushchenko A.M., Kuznetsova I.V., Krivova Z.V., & Kociolek J.P., 2020b. *Navicula gogorevii*-a new, large-celled diatom species from Vietnam (Southeast Asia). *Phytotaxa* 428: 60–66. doi: 10.11646/phytotaxa.428.1.6
- [33] Kulikovskiy M.S., Kapustin D.A., Glushchenko A.M., Sidelev S., Maltsev Ye.I., Gusev E.S., Kezlya E.M., Shkurina N.A., Kuznetsova I.V., & Kociolek J.P., 2020c. Morphological and molecular investigation of *Gomphonema longissimum* and related taxa from Malili lakes (Indonesia) with comments on diatom evolution in ancient lakes. *European Journal of Phycology* 55: 147–161. doi: 10.1080/09670262.2019.1664771
- [34] Kützing F.T., 1844. Die Kieselschaligen. Bacillarien oder Diatomeen. W. Köhne, Nordhausen. 152 pp.
- [35] Lange-Bertalot H., 2001. *Navicula* sensu stricto. 10 Genera separated from *Navicula* sensu lato. *Frustulia. Diatoms of Europe* 2: 1–526.
- [36] Liu Y., Kociolek J.P., Glushchenko A.M., Kulikovskiy M.S., & Fan Y., 2018. A new genus of Eunotiales (Bacillariophyta, Bacillariophyceae: Peroniaceae), Sinoperonia, from Southeast Asia, exhibiting remarkable phenotypic plasticity with regard to the raphe system. *Phycologia* 57: 147–158. doi: 10.2216/17-21.1
- [37] Maltsev Ye.I., Andreeva S.A., Kulikovskiy M.S., Podunay J., & Kociolek J.P., 2018. Molecular phylogeny of the diatom genus *Envekadea* (Bacillariophyceae, Naviculales). *Nova Hedwigia, Beihefte* 146: 241–252. doi: 10.1127/1438-9134/2017/241
- [38] 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.
- [39] Radhakrishnan C., Pardhi S., Kulikovskiy M.S., Kociolek J.P., & Karthick B., 2020. *Navicula watveae* sp. nov. (Bacillariophyceae) a new diatom species from the Western Ghats, India. *Phytotaxa* 433: 20–26. doi: 10.11646/phytotaxa.433.1.3
- [40] Rimet F., Gusev E., Kahlert M., Kelly M., Kulikovskiy M.S., Maltsev Ye.I., Mann D.G., Pfannkuchen M., Trobajo R., Vasselon V., Zimmermann J., & Bouchez A., 2019. Diat.barcode, an open-access curated barcode library for diatoms. *Scientific Reports* 9: 15116. doi: 10.1038/s41598-019-51500-6
- [41] 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: 1–673.
- [42] Rybak M., Solak C.N., Noga T., Glushchenko A.M., Williams D.M., & Kulikovskiy M.S., 2019. *Nupela brevistriata* sp. nov.-a new, terrestrial diatom species from Southeast Asia. *Diatom Research* 34: 251–258. doi: 10.1080/0269249X.2019.1698467
- [43] Sabbe K., Vyverman W., Ector L., Wetzel C.E., John J., Hodgson D.A., Verleyen E., & Van de Vijver B., 2019. On the identity of *Navicula gottlandica* (Bacillariophyta), with the description of two new species *Navicula eileencoxiana* and *Navicula bergstromiana* from the Australo-Pacific region. *Plant Ecology and Evolution* 152: 313–326. doi: 10.5091/plecevo.2019.1607
- [44] Simonsen R., 1987. Atlas and catalogue of the diatom types of Friedrich Hustedt. J. Cramer, Berlin & Stuttgart 3: 1–525.
- [45] Taylor J.C., Cocquyt C., & Mayama S., 2016. *Navicula nielsfogedii* J.C. Taylor & Cocquyt sp. nov., a new diatom (Bacillariophyta) from tropical and sub-tropical Africa. *Fottea* 16: 201–208. doi: 10.5507/fot.2016.015
- [46] Witkowski A., Kulikovskiy M.S., Nevrova E.L., Lange-Bertalot H., & Gogorev R.M., 2010. The genus *Navicula* in ancient basins. I. Two novelties from the Black Sea. *Plant Ecology and Evolution* 143: 307–317. doi: 10.5091/plecevo.2010.421