

## AlgaeBase: a global database for algae

AlgaeBase was established in 1996 to provide taxonomic, nomenclatural and distributional information on algae in one accessible, reliable, online location. While some excellent online sources of nomenclatural information are now available such as *Index Nominum Genericorum* (ING) and *Index Nominum Algarum* (INA), no other online source of taxonomic, bibliographic and distributional information for algae as a whole is currently available. ING covers all generic names published under the International Code for Nomenclature (ICN) whereas INA provides nomenclatural information on the names of algae compiled by P. C. Silva (1922–2014) of the University of California at Berkeley and his colleagues, notably R. L. Moe.

AlgaeBase compiles taxa from national lists and checklists, monographs and other taxonomic literature. Over the past 25 years, we have accumulated details of 8,075 generic names (of which some 5,942 are in current use), 160,960 species and infraspecific taxa of which 66,992 are considered currently by the worldwide taxonomic community including 52,218 species, 256 subspecies, 11,012 varieties and 3,772 formae currently recognized as taxonomically current. For 102,809 of the names, a full and direct reference to the place of publication is provided and for these publications, 21,216 PDFs are freely available for researchers to check that the information provided by AlgaeBase is correct.

In addition, distributional information is provided for 70,695 species and infraspecific taxa, all of which have been extracted from identified sources. The distributional data currently online is from 703 countries, states, islands and sea areas aggregated into 19 regions world-wide. To date 473,191 records have been accumulated.

To take India as an example, 12,276 records of 9,513 algae (marine, freshwater and terrestrial/aerophilic) have been accumulated, partly from the excellent checklist series *Algae of India* published by the Botanical Survey of India, the most recent of which is the exhaustive *A Checklist of Indian Diatoms* (2020) from which we were able to extract 2,649 currently accepted names, most of which are now linked to the place of original publication of the name.

This brings us to the widespread confusion between nomenclatural validity and taxonomic validity. The rules of the ICN are proposed and approved by the International Botanical Congresses that take place every four years, the most recent of which was held in Shenzhen, China in July 2017. The ICN and its sister Zoological and Bacteriological Codes are unique in the worldwide acceptance of the rules governing the naming of organisms. These codes have saved the world from a Tower of Babel-like confusion of organism naming. They, however, only govern the naming of organisms and the hierarchical placing of these names. They only regulate the naming of names, and do not provide any rules for deciding on the current taxonomic name or position for an organism. Unfortunately (or fortunately), there is no code of regulations for establishing a correct taxonomy for organisms.

In the past, taxonomic methods were learnt from mentors and from the printed taxonomic literature. Those with ready access to libraries and museums in large and rich countries (notably in western Europe) were at a considerable advantage over those in poorer or less well-endowed countries. The advent of the Internet has been instrumental in offsetting these disadvantages and researchers in most countries now have access to literature and information that was previously only available by expensive and time-consuming overseas travel to the great libraries and museums of Europe and North America. Taxonomy has also benefitted greatly from the development of cheaper and easier gene sequencing to provide hypotheses on the relationships of organisms.

Despite all these developments, researchers can still search in obscure and often ancient literature. AlgaeBase helps researchers to search for names and literature. AlgaeBase is freely available at no small personal cost. Google Analytics shows that there are 1,500–3,000 accesses each day and up to 70 concurrent users. During 31 March 2020 to 1 April 2021, India was the third largest user (after the USA and Indonesia) with 19,642 user accesses, obviously there are many repeats.

Thus, I was surprised by the publication<sup>2</sup> which claims that AlgaeBase ‘...

covers only 14,843 diatom taxa, which is far from complete. Also, AlgaeBase uses raw data from various sources throughout the world without checking their proper systematic alignment.’ Both these assertions are untrue: AlgaeBase currently (April 2021) includes 53,051 ‘diatom taxa’ at the species level and below. Of these, there are 16,698 accepted species, 36 subspecies, 3,652 varieties and 927 formae, and each has a ‘systematic alignment’ that reflects a current opinion. One could argue, of course, that there is no such thing as a ‘proper [my emphasis] systematic alignment’ since all taxonomy is based on hypotheses and for many genera of diatoms there is not a consensus.

The database with which Keshri and Roy make a comparison is DiatomBase (<https://www.diatombase.org>). On 8 April 2021, the online DiatomBase claim is of ‘1,660 accepted species, of which 41% checked [and] 8,596 species names...’. Whereas DiatomBase, like the Catalog of Diatom Names, is currently not a source of current names as implied by Roy and Keshri<sup>2</sup>; it does, admittedly, have the potential to become a superior source of taxonomic and nomenclatural information on diatoms, currently comprising one-third of all algae species, and species of which may eventually outnumber all other algae<sup>3,4</sup>.

AlgaeBase was never intended to compete with specialist databases such as DiatomBase but aims rather to provide a ‘one-stop-shop’ for basic taxonomic, bibliographic and distributional information on all algae. Even the most fundamental questions such as ‘how many species of algae are there?’ (currently some 53,000) were wholly uncertain prior to its compilation. Nevertheless, AlgaeBase is, like the other algal databases listed by Roy and Keshri, a work in progress. To date (April 2021), it has been cited in the peer-reviewed literature 5,700 times (vide Google Scholar) and reached 750 citations in 2020.

1. Gupta, R. K. and Das, S. K., *Algae of India Volume 4. A Checklist of Indian Diatoms*, Botanical Survey of India Ministry of Environment, Forests and Climate Change, Government of India, Salt Lake, Kolkata, 2020.

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2. Roy, S. and Keshri, J. P., *Curr. Sci.*, 2019, **116**(5), 703.
  3. Guiry, M. D., *J. Phycol.*, 2012, **48**(5), 1057–1063.
  4. Mann, D. G. and Vanormelingen, P., *J. Eukaryotic Microbiol.*, 2013, **60**, 414–420.
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### *Response:*

We recommend all the students to use DiatomBase<sup>1</sup> to check the recent and correct name of diatoms before publication. Detail entries of diatom taxa in DiatomBase are done by taxonomic editors after

proper checking. AlgaeBase<sup>2</sup> is one of the pioneer sites for compilation of algal taxa details, most often we follow the database and DiatomBase editors also compile data of diatoms from the AlgaeBase. We mentioned<sup>3</sup> that ‘AlgaeBase covers only 14,843 diatom taxa’ and we got the details from the AlgaeBase taxonomic browser page under phylum Bacillariophyta on 5 March 2018. On the taxonomic browser page of AlgaeBase, we have seen 16,779 taxa records under the phylum Bacillariophyta at the time of writing this reply. We give here the link to the page saved on 11 June 2021 <https://www.algaebase.org/browse/taxonomy/?id=139141>. But we are unable to trace the claim of Guiry that AlgaeBase currently (April 2021) includes 53,051 diatom taxa in total. In an online ‘Catalogue of Diatom Names’ by the California Academy of Sciences, USA, 64,000+ diatom taxa have been included and the same

has not been updated regularly, so the dire need of a new and reliable resource was felt for long time that could be updated frequently.

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1. Kociolek, J. P. *et al.*, DiatomBase, 2021; <http://www.diatombase.org>
  2. Guiry, M. D. and Guiry, G. M., AlgaeBase, World-wide Electronic Publication, National University of Ireland, Galway, 2021; <http://www.algaebase.org>
  3. Roy, S. and Keshri, J. P., *Curr. Sci.*, 2019, **116**(5), 703.
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