

Species diversity in Switzerland 50,000, 70,000 or 500,000?

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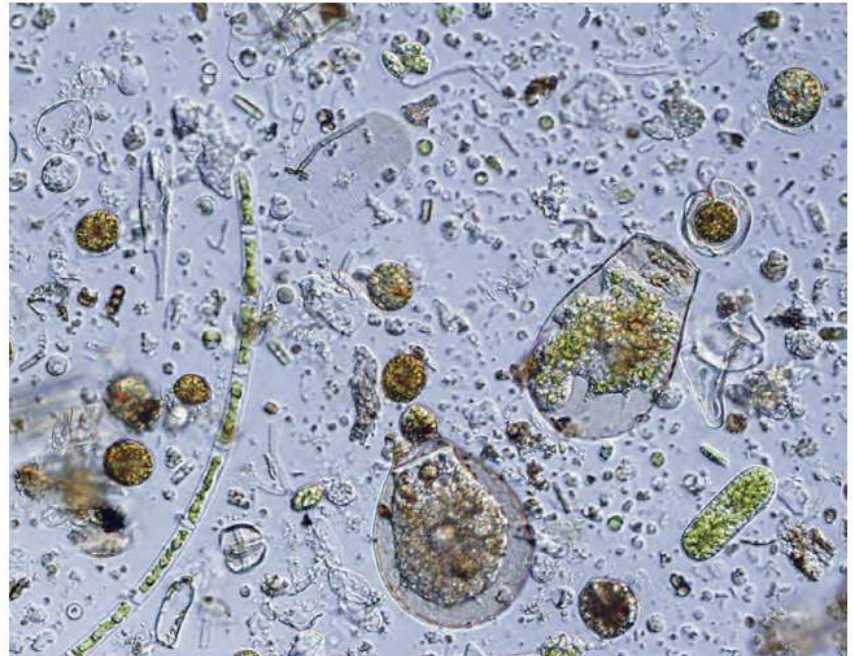
It has been estimated that Switzerland hosts between 50,000 and 70,000 species (Baur et al. 2004). But just how reliable is this estimate? We are of the opinion that species diversity is greatly underestimated, as current inventories neglect many groups of organisms.

In estimating species diversity, the first challenge concerns the definition of the biological concept of “species”. The classic definition is not applicable to the greater part of the phylogenetic tree of life. Many micro-organisms are considered to reproduce asexually – undoubtedly an incorrect generalization (Lahr et al. 2011). Their life cycles are rarely the subject of scientific research, whether they reproduce sexually or not. The molecular approach circumvents this problem, though it does not preclude errors.

The first step in determining the genetic diversity of organisms is to select a marker (entire gene or gene fragment) which is sufficiently variable to allow for differentiation between species but which, if at all possible, also occurs in all living organisms. As there is no one ideal marker gene, different genes are used for different groups of species. An arbitrary range is defined, termed the molecular taxonomic unit. Numerous studies have shown that each morphological species represents a number of “molecular” species (often as many as several tenths or hundreds!).

Especially in the case of parasites it is likely that the actual diversity in existence is hugely underestimated. If each animal species hosts on average at least two specific species of parasites or symbionts (unicellular organisms or bacteria), higher animals (the parasites’ hosts) can not constitute more than one third of the global biodiversity.

Parasites are in general less well researched than other species (with the exception of human parasites as well as plants and animals of economic significance). There is a similar shortfall when it comes to micro-organisms. It is highly probable that there are numerous species that have not been described for Switzer-



Micro-organisms are the poor relations in biodiversity research. Photo credit: Edward A. D. Mitchell

land. This raises the question: Is this number low ($<10^4$) or quite high ($>10^5$)?

Nineteenth-century naturalists were very interested in free-living organisms but research progress on these microbes was very slow. Micro-organisms are clearly the poor relatives in biodiversity research today. The emergence of the molecular methods however now offers new research prospects. They allow for investigations into the diversity, biogeography, temporal dynamics and ecological role of these micro-organisms.

But what about viruses? Are they living organisms? This is a contentious issue as they lack proper metabolic activity and depend on hosts for reproduction. Should viruses therefore be included in biodiversity inventories? If the answer was yes, on which of the species concepts would their inclusion be based? These are questions of both a biological and philosophical nature.

And where should this search for these new species begin? Soil micro-organisms have thus far been given particularly little

attention, especially unicellular organisms and the mesofauna; comparatively more research has been devoted to bacteria, fungi and macro-invertebrates. Taxonomists who are specialised on unicellular organisms and mesofauna are few and far between.

References

biodiversity.ch/index.en.php > Publications

SwissBOL: Creating an inventory of Swiss biodiversity

The Swiss Barcode of Life (SwissBOL, www.swissbol.ch) project was established in order to capture more accurately the diversity of life in Switzerland. It is the project's aim to create a complete inventory of all living organisms in Switzerland in the long term. As a first step, a number of pilot projects have been established, covering a broad range of different groups of organisms – microscopic and macroscopic, parasitic, well-known and lesser known groups.