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"Zoological Diagnostics of Soils: Imperatives, Purposes, and Place Within Soil Zoology and Pedology"

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Abstract

Zoological diagnostics of soils was conceived by M.S. Ghilarov as a part of soil zoology and intended to be closely related to pedology. He considered zoo-agents as an ecological factor, one among many others, of soil formation. Contemporary soil diagnostics pursues mostly utilitarian goals and is based on conservative properties of the stable part of soil substrate. However, it is admitted that these properties are generated by specific combinations of biological, chemical, and physical phenomena that are called "elementary soil processes" (ESP) and occur nowhere but in soils. Certain ESPs are associated with distinctive combinations of biota, including invertebrates. Pedobionts act as producers of detritus and contribute to humus formation, which is necessary for any ESP starting, thus being its active party. That is why animals, being the most complex and active part of the ESP system, may be treated not only as its indicators but also as its navigators. Monitoring and studying of ESPs in soil is complicated because of inevitable disturbance of soil profile natural composition. Zoo-agents, at the same time, can be registered without habitats changing. Taking into account ecological potency of soil invertebrates that participate in an ESP, spectra of their eco-groups, life forms, and results of their activity, it is possible to diagnose a soil state at different stages of certain ESPs development, with their different combinations, and in different regions or parts of natural environmental gradients.

Keywords

Zoological, pedology., (ESP), soil gradients, eco-groups

Introduction

Zoological diagnostics of soils, a field of soil zoology, utilizes the presence and activity of soil animals (zooagents) to diagnose and assess soil properties and processes. Developed by M.S. Ghilyarov, it examines how zooagents contribute to soil formation, acting as biological indicators and participants in elementary soil processes (ESPs). This approach complements traditional soil diagnostics by considering the dynamic, living component of the soil ecosystem. It can be used for various purposes, including assessing soil quality, understanding the impacts of pollution, and developing sustainable land management practices. Unlike traditional soil diagnostics that primarily examine the stable components, this approach considers the active role of soil fauna in soil formation and the development of ESPs.

Methodology

The material on which taxonomic research is based consists of specimens, i.e. individual
organisms collected in nature and studied in the laboratory. For this purpose, organisms are considered as ‘sign bearers’ or semaphoronts (Hennig 1950), their phenotype being ‘read’ as a ‘message’, i.e. a combination of traits that are considered significant by taxonomists. The most widespread understanding of the term ‘diagnosis’ in taxonomy can be put as ‘list of taxonomic criteria allowing one to distinguish two different taxa’ when the latter are compared. Thus, a discussion of the meaning of this term requires one to first explore several distinct notions, those of‘taxonomic criterion’ and of ‘relationship(s)’, ‘comparison(s)’ and ‘interaction(s) The phenotypes of organisms can be analysed and broken down into more or less comprehensive
subunits or parts (organs, tissues, cells, etc.). If appropriately defined, these different parts may provide information not only on the structure and functioning of the organism, but also on the history and relationships of the lineage to which it belongs. They will therefore be useful in phylogenetic analysis and taxonomy. Various terms can be used to designate these units: traits, features, properties, characters, characteristics, particularities, peculiarities, specificities, attributes, etc. They can be used as criteria allowing one to produce hypotheses on the phylogenetic relationships between organisms and to define, compare and distinguish two or more different taxa. For such purposes it is useful to recognise two main categories of taxonomic criteria based on observable features of organisms, here designated as ‘characters’ (and ‘character states’) and ‘attributes’. In addition, a third category of taxonomic criteria, ‘relacters’, based on the observation of interactions between organisms, must be distinguished. Among the members of a taxonomic group, some of the characters observed in any organism can be identified as homologous to those observed in any other organism of the same group: this will be the basis for the comparisons we will consider below. Both characters and homology are not ‘facts’ but interpretations or theories. The same organism can be analysed in various manners, resulting in different subdivisions of its phenotype into distinct units which are considered significant by taxonomists. Studies and comparisons of the different kinds of homology (topological, developmental, genetic, phylogenetic, etc.) may result in the modification of previous interpretations and subdivisions of the phenotype into ‘characters’.A feature of an organism (e.g., the tympanum in a vertebrate) can occur in different alternative forms in a given taxon or population of organisms: e.g., tympanum absent or present, and, if present, rounded or oval. A terminological problem exists in this respect in taxonomy, as the term ‘character’ has been used to designate either the feature or its alternative manifestations or ‘avatars’

Results

Zoological diagnostics, particularly in the context of captive animals or wildlife, involves a variety of tests and analyses to identify and diagnose diseases and other health issues. These diagnostics can be used to assess the overall health of an animal, determine the cause of illness, and guide treatment plans. Results from these diagnostics are often documented in PDF format for easy sharing and record-keeping. ZSI, an Indian institution, provides a comprehensive report of its activities, including taxonomic studies, wildlife crime control, and marine research. Their findings are often summarized in PDF documents. Some organizations like the WOAH - World Organisation for Animal Health develop and validate diagnostic tests for diseases in animals, and their validation reports are often in PDF format.

Discussion

Validation is a process that determines the fitness of an assay, which has been properly developed, optimised and standardised, for an intended purpose. Ideally, the validation process of tests for wildlife should be conducted in the same way as for tests for domestic animals (presented in the OIE Validation Standard). However, as explained above, wildlife diagnostic testing often meets difficulties, which also place limitations on the prospects for full validation. Therefore, in cases in which full validation is not feasible, the best possible alternative may be to evaluate the wildlife assay's fitness in a reduced number of reference samples. The preliminary estimates of a test's performance may provide sufficient information for government authorities to agree that a test can be provisionally recognised for testing of animals being moved or translocated or for pathogen surveillance within a country. In many cases, pre-existing diagnostic tests validated for one species may be adapted to and evaluated in other species with minimal or no modifications. In other cases, new tests for wildlife may need to be developed. In all cases, the intended purpose(s) and application(s) of the test should be established and defined before it is developed and validated as this may have an impact on selection of appropriate reference samples and ultimately, generalisability of the validation results. The development of rapid and easy to perform field tests (animal-side or pen-side tests) for disease diagnosis in domestic animals has been well received by end users and these tests are becoming increasingly popular for use in wildlife. The use and interpretation of field tests is often the sole responsibility of the veterinary personnel attending to cases in the field without laboratory support. Therefore validation of these tests through Stage 2a by the manufacturer is essential to facilitate correct interpretation of the test results. Test kits used in the field rather than under laboratory conditions should be evaluated for reproducibility of results under different environmental conditions (temperature, humidity, etc.).

Conclusion

Azoological diagnosis concludes by summarizing and distinguishing a new species or taxon from others based on key morphological or biological traits. It provides a concise and definitive description, crucial for accurate identification and classification within the field of zoology. The conclusion highlights the taxonomic importance of the newly described species or taxon, contributing to a better understanding of biodiversity and evolutionary relationships. A diagnosis is a brief summary, while a full description includes a detailed account of all observable traits, including size, color, and other characteristics. The diagnosis is used for quick identification, while the full description provides comprehensive information for more in-depth taxonomic studies.

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