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DEGLI STUDI
DI URBINO
CARLO BO

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DIPARTIMENTO DI
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Review of the Doctoral Thesis of Malgorzata Kolicka

Subject matter and purpose of the research

The Doctoral Thesis of M. Kolicka aims at enhancing the general knowledge of the freshwater species of the Gastrotricha, a small animal *phylum*, widely spread in aquatic environments: the specific object of the study is the family Chaetonotidae (Gastrotricha, Chaetonotida).

The faunistic main aim of this study is combined with that of applying this knowledge for building an integrated natural systematics of the family, which led the candidate to study the geographical and ecological diversity of the family through morphometric and molecular data on many species from various geographical areas.

The study was especially focused on the evolutionary aspects of character diversification, also taking into account new approaches to gastrotrich taxonomy in the context of the International Code of Zoological Nomenclature.

The topic of this Doctoral Thesis is of great interest for the specialists of the *phylum* Gastrotricha, but more generally for scholars of meiofauna, a faunistic and ecological aquatic component still too little known, especially in freshwater environments.

The candidate was trained in a Polish research group that can boast an extensive and authoritative experience both in systematics and ecology on Gastrotricha: Prof. J. Kisielewski and Dr. T. Nesteruk have been basic points of reference for gastrotrich research for many years.

The Doctoral Thesis is made up of eight scientific contributions that were published during the Doctoral Research period (2016-2019), all strictly related to the subject matter of the thesis and mostly published in scientific journals with high impact and wide diffusion.

All but one of these publications describe new freshwater species, and almost all apply an integrative study approach (morphological and molecular), which is the one currently generally applied in the gastrotrich research and more generally in taxonomical studies.

One new genus (*Bifidochaetus*) and 15 new species of freshwater Chaetonotida are described, to which one new marine species of Macrotrasyda is added.

Taxonomic descriptions are extremely thorough and completed by detailed schematic drawings and a set of tables that report numerous measurements of many morphological characters. Discussion about the taxonomic position of each new species is mostly done through a comparative table in which the state of single characters of the new species and of the species considered as related by the Author are reported for comparison. Two new indexes are proposed as routine work tools in order to enable an objective determination of the stage of development of the examined specimen and to make the interspecific distinction easier, respectively.



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The Thesis provides interesting data about freshwater gastrotrichs from quite different environments, all still unexplored. Three papers (1,3,4) deal with gastrotrich diversity from Arctic (Svalbard Archipelago), where 11 new species were found, one paper describes a new species from a cave in Montenegro (2), two papers report the diversity observed in Greenhouses (Poland, Austria) (6,7) where 3 new species were found, and finally a paper reports a new (brackish) species from subsaline coal minesettling ponds (Poland).

Thus, with the results reported in this Thesis, the overall knowledge of gastrotrich fauna now includes 15 new freshwater species, one from brackish waters and one marine, almost all described in detail with an integrative morphological-molecular taxonomic approach.

Remarks

The candidate's scientific production during the Doctoral research period was significant and abundant: her research was very active and generally published in scientific prestigious journal with high impact and large audience.

All but one of the articles presented show the candidate as the first author (1-7) and the half of them show the candidate as the only Author (3,5,6,7).

Collaboration mainly refers to molecular analyses of the examined species, that, however, in the last article presented (7) were carried out only by the candidate, so proving her acquisition of autonomy also on this respect.

Content of the Thesis

The interest of the candidate in the faunistics and systematics of freshwater gastrotrichs is declared and developed in the description of many new species from undescribed habitats.

The results of the presented studies allow to a general significant increase in the overall number of the known freshwater gastrotrich species, and also in the report of gastrotrichs from unusual or unexplored habitats, like Arctic biotopes, greenhouses or caves, that have thus proven to be suitable for hosting gastrotrich species.

The interest in the gastrotrich diversity is seen by the candidate in a phylogenetic context with the aim of coming to a future, updated systematization of the polyphyletic order Chaetonotida.

That approach is commendable but implies a clear categorization of morphological characters used for taxonomical purpose. The candidate shows a great knowledge of them, even if in some cases perhaps she exceeds in their number and application, wishing to take their determination also to every single smallest morphological element.

That can be an added value to a species description intended for specialists of the group, but it risks confusing the state of the main essential morphological characters to be considered by a researcher in the identification phase. Furthermore, the intraspecific variability of many gastrotrich species should be taken into account, so that a very detailed description of one specimen may not be exactly applied to other specimens.



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Text style

As already mentioned, the description of all the species is extremely detailed, and is expressed through a very long and verbose text and a very large number of photographs to show every morphological detail. That explains the considerable length of most candidate's papers compared to that of most faunistic and taxonomic papers published by other specialists of the group.

As for the text, I note that the precision and measurement in the description of all even the finest details can certainly be important for the purpose of a complete description, especially in the case of a new species: in fact, many taxonomic problems relating to species described in past centuries derive precisely from lack of data in the original descriptions, with consequent difficulty or impossibility of performing a taxonomic comparison.

However, I also note that such a description, when it goes as far as coding individual morphological finest elements and measuring them with ranges of values and standard deviations, possibly even divided between adult and juvenile specimens, becomes a tool dedicated exclusively to specialists in the group taxonomy, but certainly it is not easy to use for them either.

Iconography

The quality of photographic images of the papers included into the Thesis has greatly improved over time, especially through DIC optical micrographs in support of those in bright field and phase contrast, of lower quality, which initially were the only ones supporting the descriptions.

The accompanying schematic drawings made through a graphic software have become much more precise and detailed over time, also illustrating the smallest morphological details detected on each species with the help of targeted colours.

It should be acknowledged that such a precise schematic drawing completes the description in detail, but in the identification phase also the intraspecific phenotypic variability well-known in the group must be taken into account so that it should be specified that the representation model provided for the species may not be exactly applicable to other specimens.

References

The References' section of the Thesis is complete and updated.

Final Remarks

Overall, I believe that the research carried out by the candidate during her PhD program has been extremely active and productive.

The publications produced during her PhD program were numerous and published in scientific journals with high impact and wide diffusion.

The results led to a significant increase in the knowledge of the freshwater gastrotrich fauna, also highlighting the presence of this *phylum* in habitats not yet explored.



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As a specialist of Gastrotricha I followed the candidate's activity carefully from the beginning and I could see the progressive improvement in the style of texts of her papers as well as in the autonomy in carrying out her research.

The candidate shows autonomy in writing a scientific work and has demonstrated over time a gradual ever better acquisition of microscopic and molecular techniques on this animal group, placing herself among the few specialists who currently deal with Gastrotricha.

In recognizing the precision and meticulousness shown by the candidate in all her faunistic and taxonomic papers, my only suggestion is to recommend that this search for precision in defining every morphometric detail of a given species remains within the limits useful for the use of these data by interested scholars. An excess of details and measures may perhaps be useful at a specialist level but it risks confusing the individuation of the main really important taxonomic characters useful for a correct identification especially at species level.

I therefore confirm that in my opinion the candidate is allowed to continue with further steps of the PhD procedure in consideration of the commitment shown during the Doctorate work and the important and promising results obtained with this work.

Urbino, 17 February 2020

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