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Review of the dissertation
"Trends in the evolution of eriophyoid mites (Acari, Eriophyoidea) on plants"
submitted for the degree of Doctor of Biological Sciences
by Filipp E. Chetverikov

Eriophyoid mites (Acariformes: Eriophyoidea) are microscopic, specialized plant feeding mites with a unique, simplified morphology. These mites are particularly specious and occur worldwide. It is notoriously difficult to study them, partly due to their size. Despite their economic importance as agricultural plant pests, vectors of pathogens and use in weed control, very little is known about some vital aspects of their origin, evolution, and interaction with plants. Only meagre knowledge exists on their morphology, and their phylogenetic relationships both between taxa in the superfamily and relationships of the group with other mite groups have hardly been studied before the research reported in this dissertation.

The dissertation is focused on the evolution of eriophyoid mites on plants. Dr. Chetverikov managed to pull together fragmented available information of different fields and fill in knowledge gaps with new data from his own research contributing towards unraveling the evolution of this superfamily. He amalgamated and analyzed the multifaceted, frequently novel, data to draw up a strong foundation of hypotheses about evolutionary trends of eriophyoids which were not previously available to this extent.

Dr. Chetverikov optimized his research by studying relict taxa, species with unusual life cycles and uncommon morphological characteristics. These subjects included, virtually for the first time, the study of endoparasites within tissue of monocotyledonous plants. He also included the comparison and study of different morphotypes of species. He further revised the immensely important Nalepa specimen collection adding much needed morphological information and enabling the re-study and improvement of knowledge on critically important European eriophyoid taxa.

The dissertation is particularly marked by the use of strong and frequently new methodologies and technological new and complex techniques, many applied to eriophyoid mite study for the first time. Using and developing these techniques will definitely be important for advancing progress in the study of mites and other microscopic arthropods in general. The techniques include cutting live micro-arthropods with a laser micro-dissector, 3D-reconstructions, and finding exuviae of parasitic arthropods in herbaria. Especially important is the first use of Confocal Laser Scanning Microscopy (CLSM) and use of Scanning Electron Microscopy (SEM) for morphological study of eriophyoids.

Study of comparative morphology and morpho-function, first extensive reconstruction of embryogenesis, discovering novel morphological structures and novel information on reproductive biology are some of the major contributions by Dr. Chetverikov's research, excellently amalgamated in the dissertation. Some behavioural data were also discovered. In general, data on organization of mouthparts, the reproductive system, musculature, body segmentation and embryonic development were improved, new data obtained, and well integrated to understand and reveal evolutionary trends.

Standing out in importance is the new data found and described for female and male internal reproductive organs, largely using CLSM. New methodologies include a more comprehensive and applicable description of genitalia, creating new terminology in the process and applying morphometrics of internal female genitalia for the first time

in eriophyoids. Additionally, sperm storage in the spermathecae was studied. Information about reproductive organs usually carries a strong phylogenetic signal, and these were already incorporated in phylogenetic studies during the research reported on. Apart from genitalia, musculature, including opisthosomal musculature, was described. Body segmentation, including pseudotagmata, were studied and presented largely the first time for eriophyoids. New, not previously observed structures were found during studies, including a suboral fork of the mouthparts. The variety of frontal lobes and their function were studied and new hypotheses and results put forward. Body shapes and various morphotypes within the Eriophyoidea were studied and placed in context with their ecology.

Morphological data, much found during Dr. Chetverikov's studies, and molecular data were used to construct phylogeny at family level, especially elucidating basal divergence. The found phylogeny was extrapolated and explained by having plant hosts of the large groups of plants, also including biogeography. This lead to hypotheses about major evolutionary trends of eriophyoids on plants. Miniaturization, simplification and specialized adaption to phytophagy were identified and adaptive potential under these constraints were investigated. The extent of evolutionary plasticity of eriophyoid mites were proposed.

The close association of eriophyoid mites with their plant hosts, their general host specificity, and ability to induce abnormal growth is integral to the evolution of eriophyoids. Understanding the mechanism in inducing symptoms on their plants is also very important in applied aspects, including pest control. To address these, studies presented in the dissertation include gallogenesis.

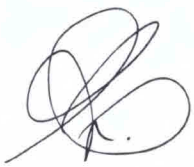
The origin of the Eriophyoidea is uncertain As part of a team of international researchers using cladistic methods to analyze molecular and morphological data, a strong hypotheses was put forward that Eriophyoidea are most closely related to soil Nematalycidae and should resort in a different order than presently accepted. This will fundamentally influence future studies on the origin and phylogenetic relationships of the Eriophyoidea with other mite groups. It also allowed a new hypothesis stating that Eriophyoidea originated from soil living ancestors.

CONCLUSION. Apart from the undisputed important contribution to the knowledge on Eriophyoidea, the dissertation is of wider biological consideration and use. It can be extrapolated to evolution of other miniaturized arthropods with simplified morphology and evolutionary constraints. Research results also contributed towards sorting out the phylogenetic relationships and evolution within the mite Superorder Acariformes. Additionally, results from the research contribute towards elucidating the emergence of phytophagy in acariform mites. The methodology and techniques in particular will certainly generate new research on miniaturized arthropods, and the research can be used as a model for their research.

Available literature on the Eriophyoidea was widely and comprehensively incorporated and clearly understood. The dissertation and content therein successfully address and focus on the main theme and questions.

As a specialist researcher on Eriophyoidea I could find no major fault with the results, interpretation and presentation thereof. I found the typing and spelling errors in the English translation somewhat irritating, but it definitely does not negate the excellence of the content.

I strongly recommend accepting this dissertation for the defense, and after oral presentation and discussion, to award Dr. Filipp E. Chetverikov with the title of Doctor of Biological Sciences.



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