

On the occasion of the 45th anniversary of the death of the academician Jovan Hadži (1884-1972): Studies in arachnology by Jovan Hadži, a critical review

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The scientific activities of Jovan Hadži, a member of the Serbian, Slovenian and Czechoslovakian Academies of Sciences and Arts, spread over more than six decades (1906-1972), and covered fields such as evolutionary morphology, evolutionary systematics, arachnology, ontogeny, biogeography, paleontology and the ecology of various groups of animals (marine, fresh water and land). Jovan Hadži's scientific opus includes over 900 scientific studies, monographs, books and publications in foreign and domestic scientific journals. In addition to his scientific work, Jovan Hadži paid special attention to the popularization of biology and biological thinking in numerous popular and scientific articles, lectures and textbooks.



Jovan Hadži (1884–1972)

The scientific research undertaken in arachnology played a distinct and important part in Jovan Hadži's contribution to science. He published a total of 45 scientific studies in the field of arachnology. Most of his scientific articles concentrate on harvestmen (18), different aspects of research on pseudoscorpions were published in 13 papers, while scorpions and spiders were a subject of study in 7 and 2 papers, respectively. Hadži devoted five scientific studies to arachnology.

During the second half of the 19th and early part of the 20th centuries, arachnological investigations on

the territory of Yugoslavia were conducted by foreign scientists such as the Danish entomologist J.C. Shiödte, French arachnologist Eugene Simon, Italian entomologist Miller and others. A common characteristic of the arachnofauna studies carried out by these scientists on the territory of former Yugoslavia was that they were sporadic and dealt largely with the western part of Yugoslavia.

In the early 20th century, Jovan Hadži laid the foundations for arachnology in Serbia, i.e. the Kingdom of Yugoslavia. It can be said that he was the first Serbian arachnologist. His studies in arachnology included several groups of arachnids: harvestmen, pseudoscorpions, spiders and scorpions. The central place in his research was occupied by the study of harvestmen and pseudoscorpions, while a smaller number of papers were devoted to the study of scorpions and spiders.

1929 is an important date in Serbian arachnology. Namely, it was in this year that Jovan Hadži described a new pseudoscorpion species, *Neobisium (Blothrus) karamani*, from southern Serbia. Until then, all known pseudoscorpion species and genera from this area were the result of research conducted by foreign arachnologists. From this point onwards, Jovan

Hadži initiated and successfully carried out important studies of pseudoscorpion fauna in the areas that now comprise Serbia, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Macedonia and Bulgaria. In his study of pseudoscorpions, Jovan Hadži established one new genus, 28 new species and 2 subspecies of pseudoscorpions, mostly from the Dinaric karst but also from Serbia and Bulgaria.

The 29 pseudoscorpion species erected by J. Hadži pertain to the families Chthoniidae (14 species), Neobisiidae (11 species) and Chernetidae (4 species). The largest number of these taxa are cave-dwelling forms and endemic to the Balkan Peninsula. In addition to his pioneering work in the field of pseudoscorpion systematics, Jovan Hadži's studies and papers also greatly contributed to a better understanding of the phylogenetic relations of numerous endemic and relict forms that represent a significant characteristic of the arachnofauna of the Balkan Peninsula.

Although not numerous (13), Jovan Hadži's studies on the pseudoscorpions of this region are highly significant, notably because he was the first Serbian arachnologist to investigate this group of arachnids. Furthermore, Jovan Hadži did not focus his attention only on the study of epigeal pseudoscorpion fauna. He was a pioneer in the study of cave-dwelling pseudoscorpions as well, establishing several new species that are endemic and relicts of the Balkan Peninsula. In his works, Jovan Hadži noted the remarkable biodiversity of the pseudoscorpion fauna of the Balkan Peninsula. The subsequent extensive and intensive study of this group of arachnids in the years to come and that were carried out by Božidar Ćurčić, particularly in Croatia, Serbia, Montenegro, and Macedonia, confirmed Hadži's and Vendel's opinion that this region is characterized by the largest variety of cave-dwelling fauna in the world.

In total, Jovan Hadži erected 29 pseudoscorpion species new to science. Of these, 14 species belong to the Chthoniidae family, while 11 and 4 species pertain to the Neobisiidae and Chernetidae families, respectively.

Hadži established 8 new pseudoscorpion species from Croatia, 12 from Macedonia, 2 from Bulgaria, 3 from Serbia, 2 from Slovenia, and one each from

Montenegro and Bosnia and Herzegovina. Eleven (38%) of the newly erected species are cavernicolous.

Because of his exceptionally wide-ranging scientific activity regarding both the choice of problems as well as the subject, Jovan Hadži limited his studies on pseudoscorpions till 1940.

Although most Jovan Hadži's scientific studies in arachnology are focused on the harvestmen, his first work in the field of arachnology was devoted to spiders. Namely, in 1912 Jovan Hadži published his first scientific paper on spiders entitled "Spiders (*Trachinus*) on the Venetian Lido", published in the journal "Nature" in Zagreb. The following year Hadži published "*Thenus orientalis* (Fabricius) in der Adria" in the Journal of the Natural History Society of Zagreb. Further research in the field of arachnology was then directed to other groups of arachnids.

In 1929, Jovan Hadži published his first scientific papers on scorpions and pseudoscorpions. In his paper "Scorpions in Schmidt's Collection (*Euscorpius italicus polytrichus* and other new genera)", Hadži described a new subspecies of scorpion from western Yugoslavia, and he devoted altogether seven papers to this group of arachnids. He discussed European species of scorpions in a study analyzing the species found in the Zoological Museum in Warsaw. In addition to his papers in the field of systematics and phylogeny of scorpions, Hadži also wrote articles on scorpions intended for the general public. Thus, in 1931 he published "Our Scorpions as Poisonous Animals" in a medical journal in Zagreb.

Bearing in mind the importance of popularization and acquaintance, particularly that of young researchers with arachnids, with what was generally regarded a despised group of creatures, he wrote articles in a clear style in his efforts to bring this group of animals closer to the general public, i.e. readers.

Jovan Hadži published his first paper on harvestmen "Opilions in Schmidt's Collection" in 1927. In this study, Hadži established four new species and a new subspecies of harvestmen. He also pointed out that almost one third of the hitherto known species of harvestmen in our region are endemic. Over the next ten years, Jovan Hadži published the largest number of studies devoted to this group of arachnids. Most

of these papers were focused on the study of the systematics and phylogeny of harvestmen. Jovan Hadži made a significant advance, one might even say a breakthrough, into what was till then the little-known fauna of harvestmen of the Balkan Peninsula. In his subsequent papers over many years of activity, Jovan Hadži described a total of 9 new genera, 1 subgenus, 58 new species and 9 subspecies. Harvestmen, as a subject of scientific research, occupy a central place in Hadži's arachnological studies.

Apart from studying epigeal harvestmen fauna, Hadži also investigated the cavernicolous fauna of this group, particularly in Slovenia, as well as on the Adriatic coast and in Serbia. As an expert in this group of arachnids, Hadži published a study of the cave-dwelling harvestmen from North America (Virginia, USA), in which he established one new genus and one new species (*Cladonychium corii*). In addition to a detailed description of the external morphology of the female of this species, Hadži noted the phenomenon of the helicomery of abdominal sternites in an aberrant specimen.

From Hadži's large opus, one should mention "A Natural Case of Super-Regeneration on Chelicerae of Opilion *Opilio parietinus* (de Geer)". In this study, the author discussed the biology of growth, i.e. teratology of appendages, describing an example of natural super-regeneration of the chelicera of a female of this species from Slovenia. Besides a detailed analysis of this aberrant appendage (the broken finger of the che-

licera), Hadži suggests the probable cause of the origin of this extremely unusual and rare anomaly.

In 1973, the Slovenian Academy of Sciences and Arts in Ljubljana posthumously published "Catalogus Faunae Jugoslaviae – Oplionidea". This significant monograph by the academician Jovan Hadži gives, for the first time, a systematic and thorough review of the hitherto unknown fauna of harvestmen of Yugoslavia. In this catalogue, Hadži lists 164 known species and 24 subspecies of this group of arachnids, classified into 41 genera and 9 families. Hadži also points out a large number of endemic taxa (about 120).

As a token of appreciation for his scientific contribution to not only arachnology, but also biology, in 1973 the Institute of Biological Research of the Slovenian Academy of Sciences and Arts in Ljubljana was named after him.

Three pseudoscorpion species were named after academician Jovan Hadži. In 1938 Max Beier erected *Neobisium hadzii* from Croatia, in 1972 Božidar Ćurčić *Pselaphochernes hadzii* from Bosnia and Herzegovina, and in 1991 Mark Harvey *Balkanoroncus hadzii* from Bulgaria.

Several other invertebrate (arthropod) species belonging to the land and marine taxa of Yugoslavia were also named after Jovan Hadži (*Niphargus hadzii* Rejić, *Cyclopina hadzii* Petkovski, *Astagobius hadzii* Pretner and *Isohypsibus hadzii* Mihelčič).