Status assessment survey for springtails (Collembola) in Illinois caves: the Salem Plateau

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Introduction

In Illinois, cave-inhabiting springtails have been recorded from four of the state’s five karst regions. A detailed assessment of the literature shows that 85% of the species are known from single caves and more than 88% are restricted to caves in a single karst region. This suggested that knowledge of the springtail fauna of Illinois caves was limited, with opportunities for new discoveries.

The primary goal of this study was to survey the springtail fauna of caves in the Salem Plateau of southwestern Illinois using structured sampling protocols to provide semiquantitative abundance data and to assess the completeness of our knowledge of Illinois cave springtails.

Methods

Field sampling

In 2009, eight caves in Monroe and Saint Clair counties, Illinois, were sampled for springtails. Samples were collected by both a one-person and a two-person team using pitfall traps, hand collections, Berlese funnels, and examination of drip funnels and examination of drip pools in other cave habitats. Cave visitation data were compiled from Illinois Natural History Survey records. We compared a combination of methods, including pitfall traps, Berlese funnel processing of leaf litter and other plant litter, and hand collections by quadrant, on drip pools, free standing basins, and drip funnels. Of the single methods allowed us to evaluate the most effective sampling protocols for this group of arthropods.

Results

In total, 49 species of springtails were found. 7 are new to science, 8 others represent new records for Illinois and 16 are new cave records for the species. The primary goal of this study was to survey the springtail fauna of caves in the Salem Plateau region.

More than half (29) of the species reported are ranked as rare at the state level (i.e., 51-52). For a few of these species, this ranking is probably an artifact of the relatively poor knowledge of the state’s fauna. Some species which are probably truly rare and endemic to the region.

Pitfall trapping, hand collections and Berlese funnel extractions accounted for more than 85% of the specimens counted and nearly 45% of the species collected. Examination of drip pools produced only 2% of the counted specimens, but 30% of the species reported. Three species accounted for 71% of all individuals collected and almost half (49.0%) of the species represented by only one or two specimens.

It is possible to rank caves in order of the number of additional springtail species recorded by adding each cave, using a “simple greedy” algorithm to highlight caves for which protection might provide the greatest impact for the investment. When the eight caves are ranked by this method, six of the eight caves need protection to secure 95% of the species. However, protecting only three of the caves – Wanda’s Waterfall Cave, Stemler Cave, and Wizard Cave – would achieve protection for 75% of the species. The two caves with the least conservation value in the sense of this particular analysis are those which have the heaviest visitation – Illinois Caverns and Hidden Hand Cave.

Conclusions

Pitfall traps, Berlese funnels and examination of drip pools and hand collections in other cave habitats are the four most effective ways to sample for cave springtails. The total number of springtail species in Salem Plateau caves could be more than twice what we have recorded in the present study. The data suggest that more new species and state records will be found once caves in other Illinois karst regions are more thoroughly examined.

Comparison to Previous Studies

Previous reports of cave Collembola from the Salem Plateau list 18 species (Peck and Lewis 1978, Lewis et al. 2003). We did not find eleven of the species previously reported, but nine of these were from caves we did not visit. Of the eight caves we surveyed, seven were previously sampled by Peck and Lewis (1978) and Lewis et al. (2003). In all instances, caves sampled in the present study yielded more species than previously reported. In most cases, the species reported by Lewis et al. (2003) were collected again.

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