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The utility of ^{13}C and ^{15}N isotopes to characterize the feeding ecology of wireworms in Central Europe: laboratory experiments and field data.

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Wireworms, the larvae of click beetles (Coleoptera: Elateridae), are severe pests on agricultural crops like potatoes and maize[1]. Additionally, they might also feed on weeds[2], detritus[3] and soil organic matter[4]. Some species are carnivorous[5]. Moreover, an analysis of their dietary choices in the specific environment they occur in has to precede any risk assessment of potential wireworm damage to agricultural crops, as well as any control strategy.

Stable isotope analysis has been used successfully to investigate trophic relationships under field conditions. Here, we present a stable isotope analysis of food selection in wireworms, including laboratory experiments which provide the basis to interpret the isotopic signatures of the wireworms collected in the field with its natural complexity.

Based on the laboratory experiments, we established the relationships between the isotope ratios of carbon (^{12}C and ^{13}C) and nitrogen (^{14}N and ^{15}N) of wireworms and their standardized food sources. Thereby, we were able to determine the trophic shift between the food and the wireworms' tissue of four different species, ranging from herbivorous (*Agriotes obscurus*[5], *A. sputator*[5]) to omnivorous (*Hemicrepidius niger*[5]) and carnivorous (*Agrypnus murinus*[5]). For δ ^{15}N we found considerable variation for individuals from the same species. The magnitude of this variation can assign two randomly picked individuals to two different trophic levels. Therefore, conclusions on a certain trophic level of a species should preferably be done using a large sample size to avoid false assignments, and are only save if based on feeding experiments.

Additionally, we determined the isotopic turnover rate of *A. obscurus* by switching it

from one standardized food source to another one, differing in its isotopic signature. The isotope values of *A. obscurus* started to change after four days and rise continuously over the next weeks towards the level set by the new diet.

We used the results of these experiments to interpret the isotopic data, from wireworms, plants, litter, manure and soil organic matter gathered in the field. The fields were cultivated with potatoes (*Solanum tuberosum*) or maize (*Zea mays*), or were grassland sites dominated by clover (*Trifolium sp.*) and several grasses (*Dactylis glomerata, Poa sp.*). We sampled fields from 35 locations in Central Europe to track the influence of environmental parameters (e.g. humus content) on the dietary choices of wireworms. First results indicate that the trophic position and pest status of some wireworm species must be reconsidered. Furthermore, the detailed analysis of a population of *A. obscurus* in a maize field in Kolsass (Tyrol, Austria) showed that the individual wireworms fed either on maize, or on weeds, or on both food sources. An analysis of seasonal and stage-specific differences in the feeding patterns of wireworms will be presented as well.

In order to identify the diet consumed several months ago as imprinted in the wireworms' fat component, we developed a fat extraction method suitable for a subsequent analysis of the isotope ratio of carbon (^{12}C and ^{13}C). First results were obtained from a field which had been switched from grassland to maize cultivation five months prior to the collection of the wireworms. The $\delta^{13}C$ values of the fat component of all individuals investigated was still identical with those of the grassland vegetation, showing no shift towards the $\delta^{13}C$ values of maize.

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