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Competition between a native and a non-native ungulate – is mouflon an invasive species within Hungarian fauna?

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The impact of mouflon on rock grasses has been a subject of debate in Hungary since the mid-1970s. The damages mouflons cause through grazing and trampling are correlated to its non-native species status. To demonstrate these effects, several exclosure experiments were implemented. However, the interpretation of the results was mainly speculative for several reasons. Firstly, in most cases it is impossible to distinguish the effects of mouflon from that of its sympatric species (e.g. red deer). Secondly, a complete exclusion of ungulates from the control territory cannot reflect a natural process. Finally, and most importantly, the 3-5 year timeframes of the experiments could not provide reliable results because inconstant environmental factors, such as rainfall distribution, can obscure the effect of grazing [1].

Our objective was to gather more information about the ecological role of the mouflon, its impact on the habitat, and thereby determine if it should be considered an invasive species. We estimated mouflon habitat preference with pellet group counts using Ivlev-index [2] and tested for significance with the Bonferroni Z-test [3]. We compared the autumn-winter diet of mouflon by microhistological analysis of the rumen content [4] in two consecutive years with different snow conditions. With the microhistological analysis of the pellet groups, we compared the year-round diets of mouflon and red deer. To test the homogeneity between the samples originating from the two species over the four seasons, we utilised the chi-square test. For the measurement of species diversity, the Shannon index that is sensitive to rare species was used [5]. Differences between the diversities were tested by the Shannon diversity t-test, the bootstrap method, and diversity ordering. Food preference was calculated using an Ivlev-index tested for significance with the Bonferroni Z-test. The dietary niche width of mouflon and red deer was calculated with the Levins' formula [6]. The niche overlap between the two species was determined with the Renkonen index [7]. To calculate competitive pressure, we employed the Levins' formula.

The investigation was performed in the North Hungarian Mountains, where the highest peak is 938 m above the sea level. As for the terrain, beech forests are characteristic on the northern and north-western slopes, while the southern and south-eastern slopes are covered mainly by oak and hornbeam forest stands interspersed with rock grasses.

Our results show that mouflon preferred open grassy areas, old growth turkey oak / sessile oak forests, and young reforestations; all of these habitat types possess dense ground cover vegetation. Mouflon shunned dense thickets and medium-age stands. Mouflon and red deer adapt their feeding habits according to following: the season, changes in their habitat (e.g. snow cover), and their dietary overlap. In the case of mouflon, grasses make up 56% of food intake. The consumption of grasses decreased only during snowy winters when the overwhelming majority of its diet was beech twigs (84%). Due to the scarce food supply of the shrub cover that is characteristic to mountainous habitats, red deer became predominantly grass and roughage eater; more than 50% of its diet was grass. Consequently, there is significant competition for food between red deer and mouflon. The niche overlap between the two species, measured with the Renkonen-index, was the highest in winter (58.17 %). This decreased in spring (54.52%) and summer (52.12%) and was the lowest in autumn (40.78%).

Our results show that the mouflon is a generalist food consumer. Instead of changing its habitat, the mouflon adapts to worsening habitat conditions by narrowing its dietary niche and/or becoming a generalist feeder. Being an intermediate feeder in forested areas, the diet of red deer was mainly composed from twigs, bark and leaves of arboreal plants. However, in high mountainous areas it becomes a grass eater [8]. Although our research site was located a forested area, the shrub layer was very scarce; consequently, there was a high ratio of grass in the diet composition of deer. This shows a relatively large niche overlap with mouflon. The competition for food between the two species was relatively low for most of the year and increased only in late-winter/early-spring when food supply was scarce. The potential competitive pressure of mouflon was higher on red deer then it was the other way around. The most probable reason for this was that the food supply of the territory was more suitable for mouflon than it was for red deer.

In conclusion, our results emphasize that the damages inflicted on rock grasses by mouflon are not a consequence of the non-native status of the species. Although the species is allochthonous, it cannot be considered invasive, as it poses no threat to the native biological diversity (definition by [9]) any more than the native red deer does. The only threat it could possibly pose is overabundance, but this holds true for red deer also. However, the above results do not mean that the mouflon's presence in nature protected areas or in the Hungarian fauna has any justification at all. The role of the mouflon should be considered instead by means of evolutionary biology and the historical evolution of fauna, not on the basis of the damages made to rock grasses.

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