

On cohabitation of ants and songbirds

The main function of bird nests is to provide protection for the young against predation and less favourable ambient conditions, such as dampness and extreme temperatures. Yet, bird nests, as newly created structures, can also become habitats for other organisms; they are used by many insects, which feed on the blood of the chicks (ectoparasites), hunt other invertebrates inhabiting the nests, or forage on the nest materials themselves.

The presence of ant larvae of the species *Myrmica ruginodis* and *M. rubra* in the nests of the wood warbler *Phylloscopus sibilatrix*, a small ground-nesting songbird, is a newly discovered phenomenon that is so far unpublished, but one that has been systematically recorded in the Białowieża Forest, Poland. The appearance of ant larvae inside walls of wood warbler nests shows that the ants colonise these new sites following their construction by the birds. However, the mechanism of this colonisation process is unknown, as are the ecological implications of the coexistence of ants and birds for both parties in the system.

Due to the synchronisation of ants and birds in their timing of breeding, and their similar nest-site selection in the forest, the occupation of wood warbler nests by ants could be coincidental, or it may be deliberate in order to give advantages to one or both species. Wood warblers arrive from their wintering grounds in equatorial Africa to the breeding grounds in the Białowieża Forest around mid-April, and immediately begin building their dome-shaped nests of leaves, moss and grasses on the forest floor. At this time, the larvae of the *Myrmica* ants can be found in 'solaria', which are parts of the ants' underground nests that are located above the ground surface. The location and structure of these solaria resemble the nests of wood warblers. Moreover, the wood warbler nests are frequently placed in the vicinity of tussocks of vegetation, near or under fallen logs or branches, and on well-drained slopes or low hillocks, which are also locations that may be often occupied by the *Myrmica* ants. The wood warbler nests could provide the ants with warmth and protection against heavy rain and extreme temperatures, thereby enhancing the development of the ant larvae, and also with easy access to protein-rich food from other insects that are present in the nest. In return, the presence of ants in their nests could be advantageous for the hosting wood warblers if it resulted in a reduction of the ectoparasites that feed on the blood of their chicks, which could improve the young birds' growth rate and survival, thereby enhancing the parent warblers' brood productivity.

This project will focus on identifying the character of the newly discovered association between *Myrmica* ants (as inhabitants of bird nests) and wood warblers (the hosts) to determine whether their cohabitation results from interspecific attraction, and, if so, does this cohabitation give advantages for one or both parties in the system.

The research will focus on observing ants and birds under the primeval conditions of the Białowieża Forest, where human impact has been negligible. We aim to check whether wood warblers build their nests in the vicinity of ant nests more often than by chance, as a way to enhance the colonisation of their nests by ants, and whether the presence of ants and their larvae in wood warbler nests benefits the hosts. We will test the hypothesis that the presence of ants reduces the infestation of nest parasites, and this has positive effect on the growth rate and survival of wood warbler chicks. Also, the project will establish the factors affecting the frequency of warbler nest colonisation by ants. If the ants gain benefits from utilizing the warbler nests, they should colonise most often the bird nests that might provide the conditions most suitable for the development of ant larvae. It could be presumed that such nests would be the most efficient insulators from ambient conditions, with greater amounts of specific nest materials, e.g. leaves, grass or moss, and would be positioned with the optimal amount of direct sunlight or would be warmed from within by the birds' body heat. Additionally, due to the hazards related to the ants' relocation of their larvae, we expect that ants will occupy most frequently the warbler nests that are closest to their initial location, and that the colonisation of warbler nests by ants will be most common in cold springs with heavy rainfall, when the conditions in the nests heated by wood warblers are relatively more favourable for larval development than other potential sites. Also, we expect that the frequency of bird-nest colonisation by the ants will increase with the length of the time the nests will remain in the forest.

These investigations, among others, will help to explain the occurrence and characteristics of previously unknown relationships between the species, and therefore will enrich our general knowledge of the intricate details of how forest ecosystems function. Our observations, which are going to be carried out in the primeval forest, will also be essential to establish to what degree human transformation of woodlands may disturb the inter-relationships between different forest organisms.