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Association of *Hebeloma radicosum* with a Nest of the Wood Mouse *Apodemus*

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SUMMARY: *Hebeloma radicosum* appeared from the soil (presumed latrine sites) in the close vicinity of an underground nest of *Apodemus* sp., a wood mouse. This is the first known case of an association of this fungus with a non insectivorous mammal.

RÉSUMÉ: *Hebeloma radicosum* a été trouvé fructifiant près du nid d'un mulot (*Apodemus* sp.), probablement issu de la latrine de cet animal. C'est la première fois que ce champignon a été trouvé associé avec le nid d'un mammifère non insectivore.

ZUSAMMENFASSUNG: *Hebeloma radicosum* wurde in der Nähe eines Nestes der Waldmaus *Apodemus* sp. gefunden, aus deren Latrinenhöhlen der Pilz wahrscheinlich ausgewachsen ist. Es ist das erstmal, dass dieser Pilz mit einem nicht insektenfressenden Säugetier vergesellschaftet angetroffen wurde.

In Japan *Hebeloma radicosum* (Bull.:Fr.) Ricken appears on deserted latrines near the nests of moles and shrew moles (Sagara 1978, 1980, Sagara & al. 1981). We report here a new case in which the same fungus is associated with a nest of the wood mouse *Apodemus* sp. in Switzerland.

Locality, Vegetation and Date

One fruit body of *Hebeloma radicosum* was collected on September 2, 1986 (Fig. 1) and another fruit body on October 1, 1986 (Fig. 2) at the same spot in a mixed forest of *Fagus sylvatica*, *Picea excelsa* and *Abies alba* near Servion VD in Switzerland. The exact position of the second fruit body was marked with a stick (Fig. 4).

The site was located on the upper side of a forest road (Fig. 3), about 2 m above the road level and about 2.5 m in from the road. On October 30, 1986 a hole was carefully dug in the soil around the growing site of the fungus. This allowed the nest to be found and its surroundings examined.

Excavation and Observations

Digging and preparation of soil profiles from one side failed to unveil the nest before reaching the position of the fruit body. However, it revealed tunnels measuring 4 × 3 cm and 4.5 × 3.8 cm in cross section, and small aborted fruit bodies, probably of *Hebeloma radicosum*, together with thick mycelia colonizing the soil just below the position of the fruit body. This part of the soil was considered to be former latrine sites, as had been in the case of the mole and the shrew mole (Sagara 1978, 1980, Sagara & al. 1981).

So as not to destroy the marking of the position of the fruit body, the soil was dug from the other side, and eventually a nest was found (Figs. 4, 6). The tunnel met in this digging measured 3.2 × 2.8 cm, 3 × 3 cm and 3.5 × 2.5 cm at the different cross sections made. At some points in the soil, at a depth of 30–45 cm, we found thick heaps of beech seed coats (Figs. 4, 7), which appeared to greatly exceed the volume of one litre. In the soil, at a small distance away from the nest, very young and perhaps aborted fruit bodies were found (Fig. 5), which seemed to be those of *Hebeloma spoliatum* (Fr.) Karsten. It was not surprising to find this fungus in such a place (Sagara 1978, 1980, Sagara & al. 1981, Sagara & al. 1985).

The nest chamber was located at a depth of between 25 cm and 35 cm (Fig. 4). The nest measured about 12 cm across and was 8 cm high (Fig. 6). It did not have a definite structure, and it might have lost its original shape. The nest material consisted of wet, not very fresh leaves. The bottom of the nest and the nest chamber were densely colonized by fine roots. No fresh latrines were found, but at some points in the tunnels and even in the periphery of the nest, old and black droppings were detected. From these observations we conclude that the nest was old and not in current use.

Identification of the Nest

Rodent hairs were found in the nest, in the piles of beech seed coats, and at the presumed latrine sites (Fig. 8). They were identified as being those of *Apodemus*, on the basis of data given by Day (1966).

The guard hairs which were found were covered with a lanceolate scale pattern (Fig. 9). The major part of their shield region had one concave side and a kidney-shaped cross section (Fig. 10). The distal part of the shield and the proximal part of the tip region had three concave sides (Figs. 11, 12). These characters indicate the animal to be *Apodemus*, the wood mouse, though the species cannot be determined.

Since most of the hairs had not lost their basal part (Fig. 8), we think that they had fallen off naturally while the animal still inhabited the nest. Thus, the nest is considered to be that of *Apodemus* sp.

Other observed features also support this conclusion. The nest was neither spherical nor subspherical, thus differing from those of moles. The leaves

used as the nesting material were mostly broken, suggesting that they might have been shredded. This is not so in the case of moles. In moles' nests, "bolt-holes" (Godfrey & Crowcroft 1960) or tunnels are often found below the nest chamber, but these were lacking in the present case. The droppings contained undigested exoskeleton fragments of invertebrates, but their size and amount were smaller than those found in moles' faeces, and the presumed latrine sites did not contain as many of these fragments as the latrine sites of moles do. The habitat, size of the tunnels and the food reserves fit the descriptions given for *Apodemus* (Corbet & Southern 1977, Montgomery & Gurnell 1985).

Discussion

Nineteen cases of *Hebeloma radicosum*, studied by one of the authors (N. S.) in Japan and one in Britain were connected with the latrine sites and nests of insectivorous moles and shrew moles (Sagara 1978, 1980, Sagara & al. 1981, and unpublished observations). Therefore the association of this fungus with *Apodemus* is a new case.

Apodemus species are known to eat large amounts of invertebrates under certain circumstances (Tatsukawa & Murakami 1976, Hansson 1985) and hence it is probable that they also excrete considerable amounts of nitrogen. This could be the reason of colonization by *Hebeloma radicosum*, as in the nests of insectivores. However, it is strange that such a case has not been found in Honsh u, Japan, where related *Apodemus* species occur together with moles and shrew moles. The record of *Hebeloma radicosum* from Hokkaido, Northern Japan (Imai 1938), where neither moles nor shrew moles occur, may be important in this respect.

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Figures 1-3: *Hebeloma radicosum* and its habitat.

Fig. 1: Fruit body collected at Servion VD, Switzerland, Sept. 2, 1986. (x 0.8)

Fig. 2: Fruit body found at the same site, Oct. 1, 1986. (x 0.6)

Fig. 3: The site where the fruit bodies were found (arrow) and the surrounding vegetation. (Oct. 30, 1986)

Coloured Plate No 17

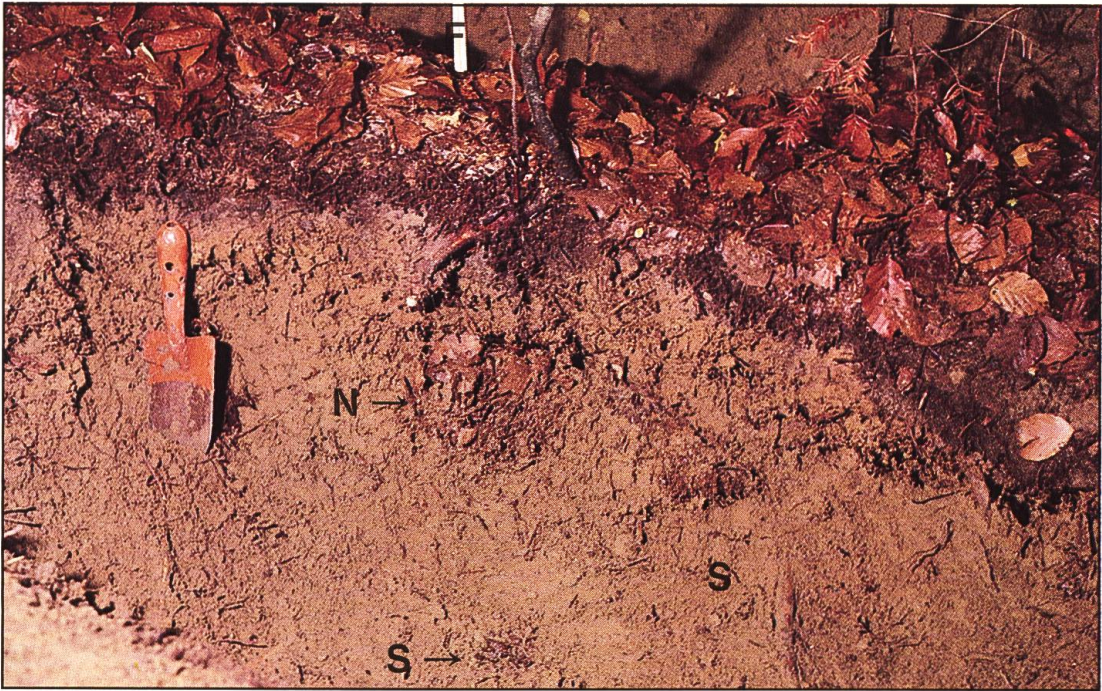
Figures 4-7: Excavation at the site of *Hebeloma radicosum*.

Fig. 4: Position of the fruiting (F), of the nest located in the soil (N), and of the beech seed coats (S) accumulated in the soil.

Fig. 5: Young fruit bodies, possibly of *Hebeloma spoliatum*, found in the soil at a distance of about 15 cm from the nest at a depth of ca. 30 cm. (nat. size)

Fig. 6: Excavated and collapsed nest in top view. (1:3)

Fig. 7: Part of the beech seed coats. (1:2)



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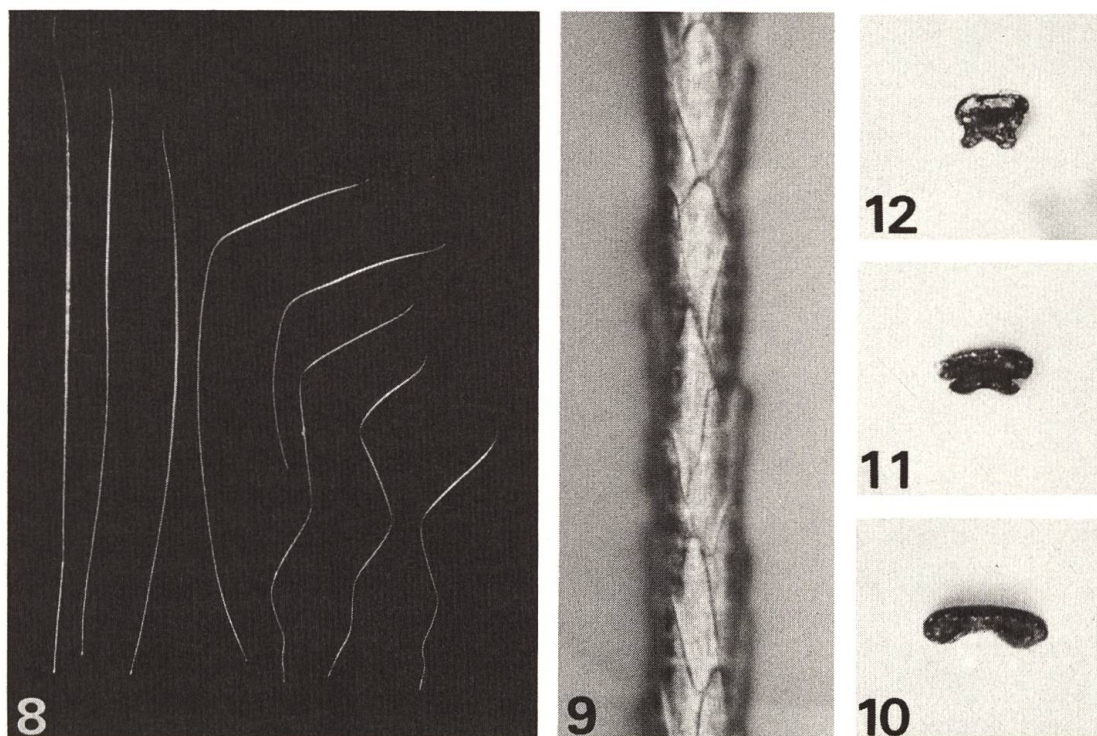
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Figures 8-12: Material for the identification of the animal.

Fig. 8: Hairs collected from the nest. The three hairs on the left are guard hairs. (x 7.4)

Fig. 9: Lanceolate scale pattern of the central part of the guard hair characteristic of *Apodemus* mouse. (x 450, incident light microscopy)

Fig. 10-12: Cross sections of guard hairs of *Apodemus*. 10: central part of the shield region; 11: distal part of the shield region, 12: proximal part of the tip region. (x ca. 230, incident light microscopy)

