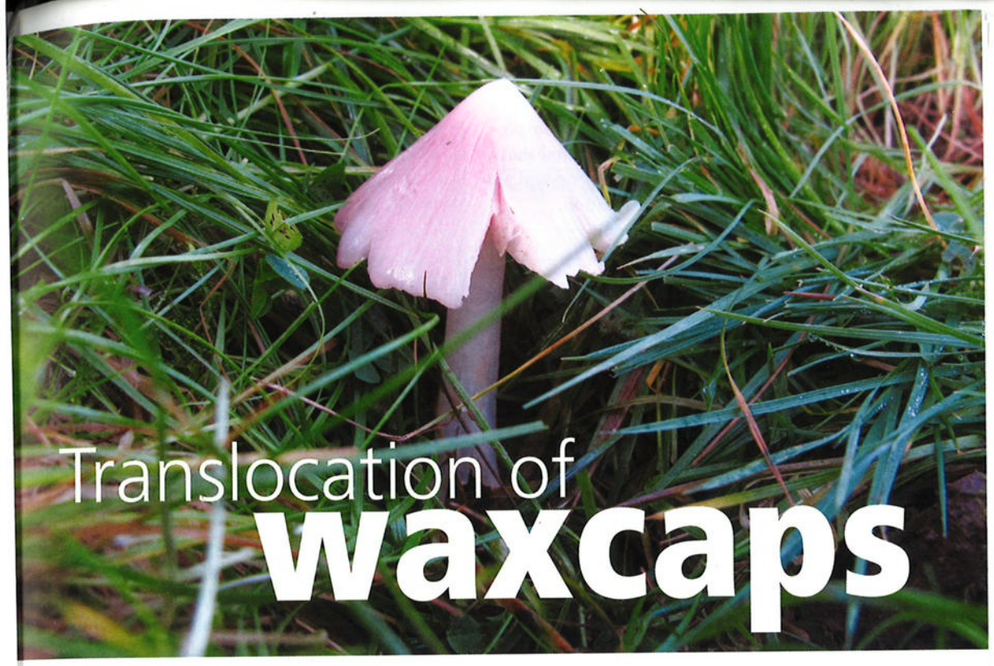

Translocation of waxcaps

Barry Wright

Pink Waxcap *Hygrocybe calyptriformis*. Barry Wright

A new method for translocating fungi has been trialled in Lancaster. Here, the author reveals why it was necessary, and how it took place.

When surveys for the construction of the Heysham to M6 link-road scheme in Lancaster by Lancashire County Council were completed in 2004, it was shown that it would affect an important site for waxcap fungi. Waxcap fungi are a group largely confined to grasslands, and occur most frequently in pasture where the turf is kept short by grazing or, in the case of some amenity-mown examples, areas such as golf courses and church burial grounds. Some UK waxcap species are regarded as rare and listed as Species of Principal Importance, formerly known as UK Biodiversity Action Plan (BAP) species.

Among these rare species is the Pink Waxcap *Hygrocybe calyptriformis*, which was discovered on the site of the proposed link road and, at the time, listed as a British Red Data List species (Ing 1992). To mitigate the loss, it was proposed that all waxcap species that were adversely affected by the development be translocated to an alternative site in the same field complex, which had been acquired by management agreement as a mitigation area. Although the Pink Waxcap was subsequently removed from the Red List when it was found to be more widespread than initially thought, Lancashire County Council continued to honour the translocation attempt. Following a public inquiry in 2007, it had been agreed that all waxcap-rich meadows were biologically important and were in decline owing to ploughing and other agricultural improvements.

There were, however, some problems. First, the translocating of grassland fungi such as waxcaps has no proven track record of success, previous attempts involving the moving of large turves having so far failed to display evidence of success (Griffith *et al.* 2004). This may be due to the fact that underground mycelia can take more than 20 years to reappear after disturbances (Griffith *et al.* 2004) to the extent that they can once again produce fruiting bodies.

Secondly, as the mitigation land was organically farmed, the owner was reluctant to allow potentially damaging machinery access to the land. With these two matters in mind, it was felt that

traditional waxcap translocation methods involving the transferring of turves were not suitable. As consultant to the project, I therefore proposed an alternative approach: spore translocation.

Translocation by means of spores

Previous surveys had identified locations within the management-agreement mitigation area with similar vegetation to the waxcap-rich site that would be lost, but where there had been no evidence of fruiting waxcaps found since surveys began, in 2003. The supposition was that these vacant locations could theoretically be colonised by transferring spores from donor areas.

This approach is based on the premise that waxcaps tend to nestle in the grass, which gives limited opportunities for the wind to carry their spores farther afield. Therefore, the vacant areas may have no waxcaps because wind dispersal has been restricted. Subsequently, it was considered likely that, by moving fertile caps into these vacant areas and allowing spores to be shed directly into the receptor areas, new waxcap colonies would be created, particularly given the vegetational similarities between the sites.

Method

During 2014, donor sites were visited weekly from the beginning of September into early December, at which time the frosts halted any cap production. These searches made use of initial surveys previously undertaken in order to identify species presence within the donor and receptor areas.

At each session the candidate donor areas were slowly walked in a zig-zag pattern, with each route approximately 5m from the next. As some caps were very small and difficult to spot among the turf, the practice of keeping the survey legs close together ensured good detection rates. The path taken was repeated weekly, using a GPS track-back function to follow the previous route as closely as possible.

A typical mixed collection of caps in a trug. Barry Wright

The location of each donor cap or caps (often small colonies of five to 20 caps were found close together) was recorded as a waypoint on a GPS device, and the number of caps and their species recorded. The caps were collected by cutting the stalk with scissors and placing them in a garden trug in species groups. There is debate as to whether pulling a cap out of the ground damages the mycelia below, and so, as a precaution, it was decided in this instance to cut the caps. The caps were separated into species groups to

Typical receptor location showing the GPS and scissors used to cut the caps. Barry Wright

make it easy to apportion representative numbers of each species collected to each receptor location.

At the donor sites, all sporulating fruiting caps of any waxcap species visible were collected, varying in number from tens to hundreds on each occasion. Confirmation of the sporulation of caps was carried out by making spore prints during fruiting in 2013 of caps at different stages of expansion in order to judge the optimum size that would indicate ripeness and spore-shed. On each collection, only those caps estimated to be at optimum expansion were taken. Because waxcaps develop caps mainly during the autumn, collections were made between 19th September (before the first caps emerged) and 4th December (when the caps had declined to very low numbers owing to the cold weather). This was timed to ensure that early species and specimens were not missed. During the collection period, the number of caps of each species varied on the collection days. Generally, species gradually increased in number and tailed off slowly. Some species occurred on only one or two occasions; *H. calyptriformis* and *H. splendidissima*, for instance, were found on only two and one occasions, respectively.

Translocation was carried out by moving sporulating waxcaps to receptor sites, where they were placed gill-side down to allow them to shed their spores naturally into the receptor turf.

The total number of caps (of all species) available changed across the collection period. The peaks for individual species showed that some species, such as *H. conica*, began fruiting late, fruited well, and then declined rapidly over the next few weeks.

Box 1 Total number of caps collected each week, 19th Sept to 4th Dec 2014.

Collection date	Total caps collected
19 Sept	5
24 Sept	2
1 Oct	1
10 Oct	3
17 Oct	17
22 Oct	59
28 Oct	164
4 Nov	332
13 Nov	242
20 Nov	353
24 Nov	140
4 Dec	60

Box 2 Number of locations from which caps were collected, and the numbers of individual caps collected for each species, during the collection period, which ran from 19th September 2014 to 4th December 2014.

Species	No. of locations	Total caps collected
H. calyptriformis	2	2
H. chlorophana	17	79
H. coccinea	8	19
H. conica	27	185
H. irrigata	5	13
H. pratensis	31	47
H. psitticina	182	546
H. splendidissima	1	1
H. virginea	166	480
Totals	**439**	**1,372**

Depending upon the number of caps collected at the donor site each week, between one and five receptor spots were used. These were spaced about 3–5m apart within the receptor area. At each receptor point, a proportion of each waxcap species collected was placed gill-side down.

The caps were carefully set down within an area of roughly one square metre, with a distance between caps of around 10–15cm. Only two caps of Pink Waxcap were found, and both were translocated.

Pink Waxcap *Hygrocybe calyptriformis* and, in a *British Wildlife* first, the author's 'Scale Bear', which is 10cm high when sitting down (as shown here).
Barry Wright

The future

Since this translocation was carried out in autumn 2014, success cannot yet be judged. The site will be monitored for the next 20 years of the management plan, and funding for future eDNA analysis is hoped for. Success of translocation attempts can now be assessed by 'barcoding' soil samples, using eDNA for the presence of waxcaps in grassland. This can be utilised to demonstrate successful translocation prior to fruiting bodies being produced by the colonies. We know that waxcaps can form new colonies from spores (Griffith *et al.* 2004) and, as we are depositing concentrations of spores into comparable receptor areas, we feel that the probability of success is high.

Eventually, our aim is to eDNA-barcode the donor areas, the receptor areas, and the remaining vacant areas that have not received the ripe caps and compare them for waxcap presence. We hope to answer questions such as: Are the vacant areas truly vacant? Did they already have the full suite of species which we translocated into the receptor site? Have the spores deposited from the donor site germinated and, if they have, can they be detected in the receptor sward yet?

This analysis will allow us to detect success or failure in advance of any colonies becoming established sufficiently to produce fruiting bodies, which can take more than 20 years. While it is still too early to draw conclusions regarding the future potential of this novel approach to waxcap translocation, it is hoped that the technique can become an accepted approach in the future.

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