Conserving the midas tree-weaver spider (*Midia midas*): survey and research in Epping Forest

Final report to the Whitley Wildlife Conservation Trust

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Executive summary

1. The midas tree-weaver (*Midia midas*) is an internationally rare spider associated with ancient trees. In the UK, it is listed as nationally endangered and is a BAP priority species. Very little is known about its distribution or ecological requirements, either in the UK or elsewhere.

2. The aims of this project were to confirm the current status and distribution of *M. midas* in Epping Forest, to advance our understanding of the ecology of this species and to develop suitable sampling methods for future survey and monitoring of the species.

3. Two sampling methods were tested in Epping, artificial bird nests constructed from twigs and litter in net bags and bottle traps for spiders moving on the trunks of trees. 150 nests were placed in pollarded oak, hornbeam and beech trees throughout the central forest area. Bottle traps were tested on trunks of pollarded oak and hornbeam trees in two areas of the forest.

4. *Midia midas* was captured in two artificial nests, both placed in pollarded oaks in the Fairmead Bottom area of the forest and collected in June 2010. This is the first time this species has been recorded in Epping in the past eight years and is welcome confirmation of its continuing presence there.

5. Bottle traps placed on trunks of pollarded hornbeam and oak trees captured very few spiders and, in the light of the time and effort needed to deploy and service them, it was decided that they were unlikely to be appropriate as a survey tool for *Midia*.

6. Although too few *Midia* were trapped to draw firm conclusions about its ecology, the artificial nests did provide considerable insight into the community of spiders living on ancient pollards in the Forest. The community was dominated by *Harpactea hombergi, Lepthyphantes minutus*, *Tenuiphantes spp*. and *Amaurobius* spp. A further 20 spider species were recorded from the artificial nests, most widespread species associated with trees in general.

7. A comparison between the community composition of spiders taken from natural nests in 1980 and artificial nests in 2010 suggests that the former may have been located in drier and darker niches than the artificial nests and this may have contributed to the higher abundance of *Midia* in the natural nests.

8. A strategy for future research and monitoring of *Midia* is proposed. The UK has one of the greatest concentrations of ancient trees in Europe. Because, at present, there are no known populations in the UK where it is sufficiently abundant for effective ecological studies to be conducted, priority will be given to locating new populations in sites with suitable ancient trees. Either in concert with or subsequent to this survey work, research will continue at Epping to compare further sampling techniques and better define the exact microhabitat requirements of this species.

***Mida midas* in Epping Forest. Surveying for an exceptionally rare spider species.**

A. Russell-Smith

1. Background

The midas tree weaver, *Midia midas* (Simon, 1884) is a rare money spider associated with ancient trees throughout its range in Western Europe. In the UK, it is listed as nationally endangered and is a BAP priority species. It is equally rare in continental Europe, where it has been recorded from Denmark (Fortuens Indelukke State Forest, Frijsenborg), France (Fontainebleau Forest, Haute Vienne), Czech Republic (Trebon Basin), Poland (Swietokrzskie N.P.) and Romania (Retezat Mountain). In all these sites other than Frijsenborg, it has only been collected as single or very few individuals. In the UK, it has been recorded from just five localities, Sherwood Forest (Notts.), Donington Park (Leics.), Epping Forest (Essex), Hainault Forest (Essex) and Windsor Forest (Berks), where it is always associated with ancient trees, either in forest or ancient wood pasture settings.

Much of our limited knowledge of the habitat and biology of *M. midas* in the UK comes from the work of the late John Crocker (Crocker, 1979; Crocker & Daws, 1996) and of Russell-Smith (Russell-Smith, 2002). In Sherwood Forest, a single male was originally collected from a jackdaw's nest in 1912 (as *Lepthyphantes carri*) and a single female was rediscovered there in 1978, taken from an "artificial nest" in an ancient oak by L. Bee (Crocker, 1979). At Donington Park, an ancient wood pasture, some 12 specimens of both sexes were collected between 1971 and 1979 by J. Crocker from inside and at the base of a single ancient hollow oak. It was not collected in any of the other ancient oaks at this site and since the particular tree has since almost collapsed, it is possibly extinct at this site. In Windsor Forest, a single male was collected by Donisthorpe in 1928 (as *Lepthyphantes carri*) from a jackdaw's nest but it was not found again there during a survey carried out by BAS members in 1978. At Epping Forest, also an ancient wood pasture, a single female was collected in a pigeon nest in August 1971. Subsequently, a small survey was conducted throughout Epping Forest from May to July 1980 when a further 18 specimens were collected from bird nests and squirrel dreys (Russell-Smith, 2002). Further details of this survey are provided below. At the same time, a visit to the adjacent Hainault Forest produced a sub-adult male *M. midas* from a thrush nest in a pollarded hornbeam. Since 1980, there have been only two further records of *M. midas* from Epping, one in June 1996 (D. Carr) and one female from a squirrel's drey in Little Monk Wood in July 2002 (P. Harvey).

<u>The 1980 survey in Epping</u>

This survey, carried out between May and July 1980, targeted spiders in bird nests, squirrel dreys and other accumulations of litter in pollarded trees in the forest. During this period, 10 visits to the forest covered the area between Chingford in the South to Wintry Wood in the North. Full details of the sampling method are provided in Russell-Smith (2002). Among 53 individual samples taken, *M. midas* was found in 14 (26.5% of the total). A majority of specimens were found in pollarded hornbeams but this was probably because the crowns of these trees, being lower than those of most oak or beech pollards, were more easily accessible. The spider was found to be restricted to an area of the central forest, particularly in the region of Loughton and was totally absent from samples taken further South or from Wintry Wood at the northern end of the forest. It was collected in 55% of the 9 bird nests collected, 28% of the 18 squirrel dreys and 4% of the 26 litter accumulations, suggesting that bird and mammal nests are an important micro-habitat for the species in the forest. It was suggested that the occurrence of *M. midas* in these micro-habitats might be a result of the abundant presence of springtails (particularly of the genus

Orchesella) which are potential prey for the spiders. However, another factor may be that the accumulation of twigs and other material in the nests could provide ideal sites for the spider to spin its small sheet-webs. Bird nests and squirrel dreys also produced a wide range of associated fauna including 23 spider species, of which *Harpactea hombergi* accounted for approximately half of all individuals. Other groups that were well represented in nests included Isopoda (woodlice), Diplopoda and Chilopoda (millipedes and centipedes) and Coleoptera (beetles).

While these studies clearly show a strong connection between *Midia* and bird nests and squirrel dreys, they leave many questions unanswered. Principal among these is whether the apparent association with ancient trees is a real one or simply an artefact of selective sampling. Because of their importance for specialised saproxylic invertebrates, ancient trees have been the focus of intensive entomological survey work for more than a century. By contrast, while there has been some work on both foliage fauna, using insecticide fogging and other techniques, and invertebrates living on and under the bark of trunks of younger trees, there have been hardly any studies on the specialised niche that bird and squirrel nests represent.

1. Organisation and objectives

The project is a collaboration between three organisations, the British Arachnological Society (BAS), Buglife (The Invertebrate Conservation Trust) and the Corporation of London (CoL), who owns Epping Forest. Initially, it had been hoped that a M.Sc. student could be identified to carry out much of the field work and preliminary sorting of spiders. However, in the event this proved impossible and the project was staffed by three BAS members, all experienced arachnologists, together with two ecologists from the CoL team based at The Warren near Loughton. The CoL provided vital laboratory facilities for preparation of sampling devices and sorting of samples as well as vehicles and ladders, without which the project would have been impossible. Buglife provided administrative support for the project as well as publicising the importance of the species and the results.

The project has three aims:

- To confirm the current status and distribution of *M. midas* in Epping Forest.
- To advance our understanding of the ecology of this species.
- To develop suitable sampling methods for future survey and monitoring of the species.

2. Methods

It was originally envisaged that the principal sampling procedure would be to collect spiders from natural bird nests and squirrel dreys in pollarded trees, as was done during the 1980 survey. However, a preliminary survey carried out in 2009 showed that the numbers of nests and dreys in the central area of the forest (where most *Midia* specimens were collected) had declined drastically in the intervening 30 years. Such was the paucity of nests that it was considered unlikely that sufficient could be found to support a systematic survey and it was therefore decided to use artificial nests as a potential method for trapping *Midia*.

a) Artificial trap nests

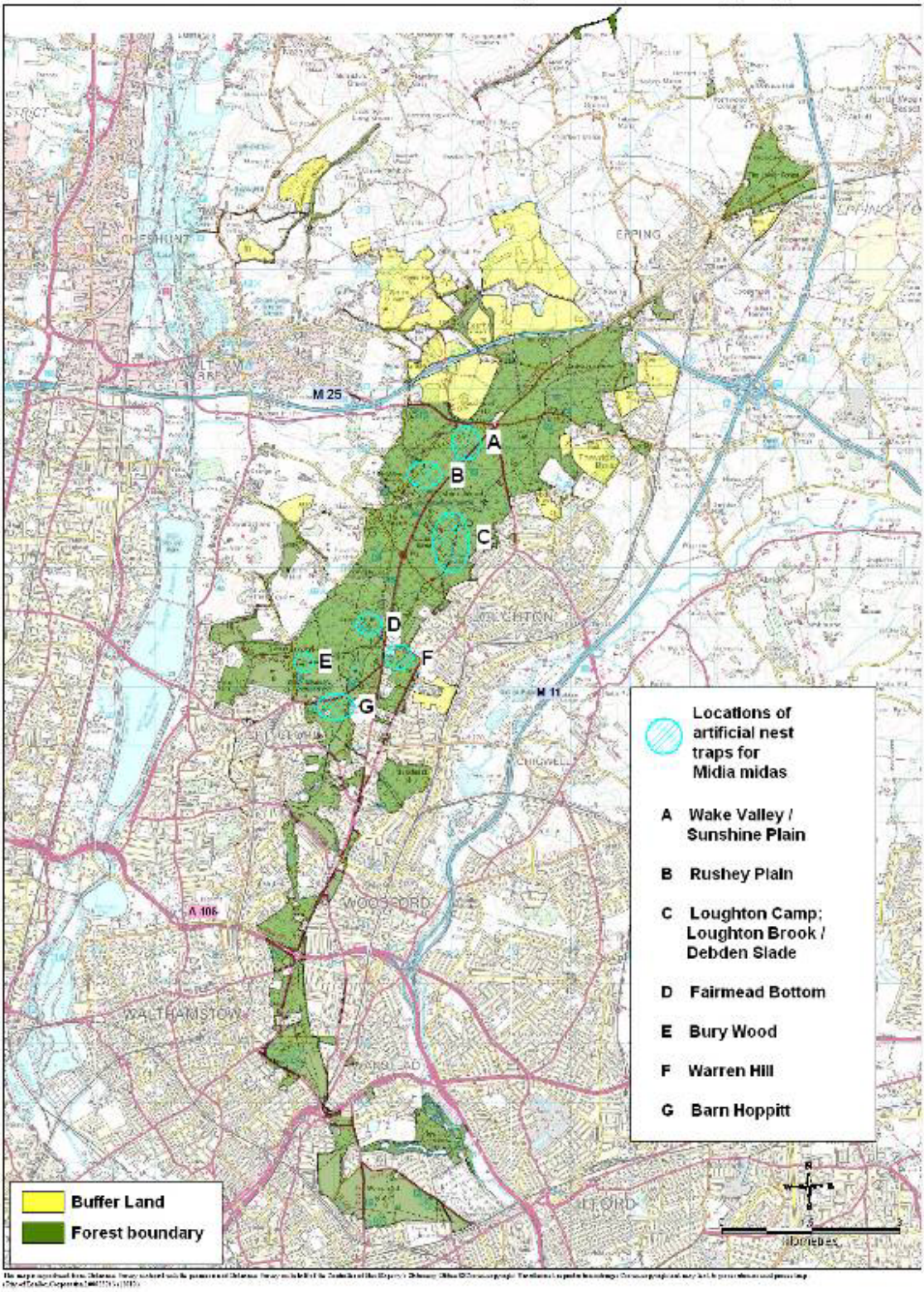
In this survey, trap nests constructed of twiggy material similar to that found in, for example, natural pigeon nests or squirrel dreys were used. 150 artificial trap nests were constructed from bundles of birch twigs together with leaf litter of a standardised volume, retained in wide-mesh nylon bags which allow free

movement of fauna into and out of the bags (Fig. 1). Half the traps included twigs and litter alone while the other half had a small quantity of organic chicken manure added, to simulate the accumulation of bird droppings in natural nests. It was hoped that this might stimulate the growth of fungi in the traps which, in turn, could encourage colonisation by springtails, an important food item for many linyphiid spiders. The faunal composition and presence of *M. midas* were compared in the two trap types. Traps were carefully placed in suitable pollarded trees at the beginning of the survey. Fifty traps were placed in hornbeam pollards, 50 in beech and 50 in oak pollards. The traps were located in eight areas in the central forest, Fairmead Bottom, Warren Hill, Loughton Brook/Depden Slade, Loughton Camp, Barn Hoppitt, Bury Wood, Wake Valley/Sunshine Plain and Rushey Plain (Map 1). The location of each tree was recorded using a hand-held GPS sensitive to ± 3m and, where available, the CoL tag numbers affixed to many of the ancient pollards.

Figure 1. Artificial bird nest constructed from birch twigs and leaf litter contained in a mesh bag.

On each of five successive monthly sampling occasions from June to October, trees were relocated and 30 trap nests were collected, 10 from each of the three tree species. The artificial nests were carefully transferred to sealed polythene bags in the field for return to the laboratory. The contents of each artificial nest was transferred to a large white tray in the laboratory and all arachnids larger than ca 1.5 mm length carefully collected with pooters and transferred to pre-labelled tubes of 70% ethanol. Subsequently, all arachnids were identified and recorded. In addition, examples of all other macro-fauna species were retained for identification by suitable specialists. These included primarily woodlice, millipedes and centipedes but also a small number of beetle and bug species.

Map 1. Locations of Midia midas study sites within Epping Forest



b) Bottle traps

Bottle traps are designed to capture invertebrate moving on the bark of trees. They consist of polyethylene milk bottles, the bottom third of which is cut off. The inverted top of the bottle is strapped to the trunk of the tree with waterproof tape (Fig. 2) and filled to a quarter of its depth with a preservative fluid consisting of saturated salt solution to which a small quantity of liquid detergent is added. 18 traps were set up on 9th June 2010, 9 on hornbeam pollards and 9 on oak pollards, all in the Fairmead Bottom and Warren Hill areas of the Forest. The traps were retrieved on 30th June and their contents transferred to wide mouthed plastic jars for return to the laboratory. Here, all invertebrates caught were transferred to tubes of 70% ethanol for subsequent identification.

It had originally been hoped to include two other sampling techniques, bark traps (corrugated paper or bubble wrap) and a suction sampler for extracting spiders from rot holes and crevices in trunks. Unfortunately, neither resources nor time were available to test these techniques in the current project.

Figure 2. A bottle trap for bark inhabiting spiders strapped to the trunk of a hornbeam pollard in Epping Forest.

3. Results and discussion

Artificial nests

a) Midia midas

Females of *Midia* are immediately recognisable even with a hand lens by the massive projecting scape of the epigyne (female genitalia) on the underside of the abdomen (Fig. 4). Two female specimens of *Midia* were collected on 9th June, both from Fairmead Bottom. The artificial nests from which they were collected were located in adjacent pollarded oaks, one of which is shown in Fig. 3. Interestingly, neither of these oaks appears to be of particularly great age, certainly by comparison with those at Barn Hoppitt which were of much greater girth and height. This agrees well with the findings from the earlier survey in Epping Forest in 1980 where the majority of the specimens collected were from relatively small hornbeam

and oak pollards. However, at other sites, notably in Sherwood Forest in Nottingham and Frijsenborg in Denmark, the species has been recorded in massive ancient oaks.

Figure 3. Pollarded oak in Fairmead bottom in which *M. midas* was trapped. Note relatively small girth.

Although confirmation of the presence of *Midia* in Epping Forest after a gap of eight years since it was last found there is an important output from the project, numbers recovered were well below those found in 1980. The trap nests used in this study only revealed *Midia* in 1.4% of the artificial nests recovered, hardly justifying the labour of constructing, deploying and sorting them. Reasons for this low return could include:

a) The way the nests were either constructed or deployed did not provide a very suitable micro-habitat for *Midia.*
b) The nests were placed in trees too late in the year to coincide with the peak of adult activity of *Midia*.
c) There are large inter-annual variations in population size in this species and 2010 was a particularly unfavourable year.
d) There has been a genuine decline in abundance of the species since it was last surveyed in Epping Forest 30 years ago.

At present, there is no way of knowing which, if any, of these factors played a role. Although nest construction or location in the trees could have reduced their attractiveness to *Midia*, the fact that two specimens were found (one in each nest type) suggests this species is able to colonise them.

Figure 4. Female of *Midia midas* in web, taken from below. Note the enormous projecting scape of the female epigyne. Specimen from Frijsenborg, Denmark. Photo © Jorgen Lissner.

Furthermore, casual survey of 10 natural nests and dreys in the forest in 2009 and 2010 revealed similar numbers of spiders to those in the artificial nests but no *Midia* specimens. Possibly a more likely explanation for the low numbers found is the fact that the nests were not placed out in the forest until mid-May and the first collection of nests was in mid-June. In the earlier survey in 1980, over 60% of the 19 specimens collected were found in May, although six of these were sub-adult. Certainly, in any future project, efforts should be made to ensure that survey is carried out from the beginning of May at the latest and that the sampling effort is concentrated in May and June. The data available from this project simply do not allow us to decide whether there are large inter-annual variations in populations of *Midia* nor whether there has been a genuine decline of the species in Epping over the past 30 years. A programme of continued monitoring for this spider in Epping is needed, possibly in concert with monitoring of saproxylic beetles in ancient pollards.

b) The spider community in trap nests

Among nests placed in the three different tree types, spider abundance was greatest in hornbeam pollards, and least in beech pollards but the difference between tree species was not statistically significant (Fig. 5).

The addition of chicken guano to the nests apparently reduced the number of spiders in the nest by about 25%, the difference being statistically significant at $P = 0.01$ (Figure 6). This was contrary to what was originally expected and the reasons for it are unclear but it is possible that the amount of added guano was too great and the high phosphoric acid content of the chicken droppings actually inhibited fungal growth in those nests to which it was added.

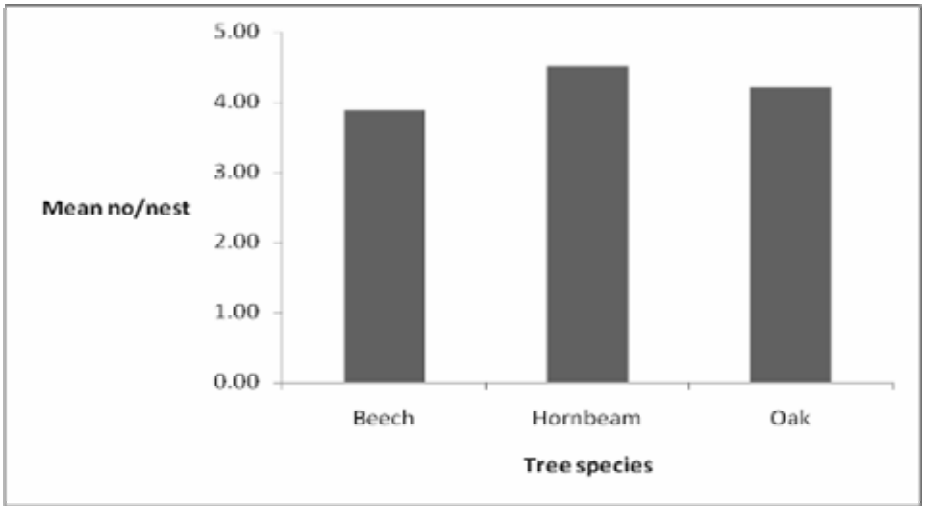


Figure 5. Mean number of spiders per nest placed in beech, hornbeam and oak pollards in Epping Forest, 2010.

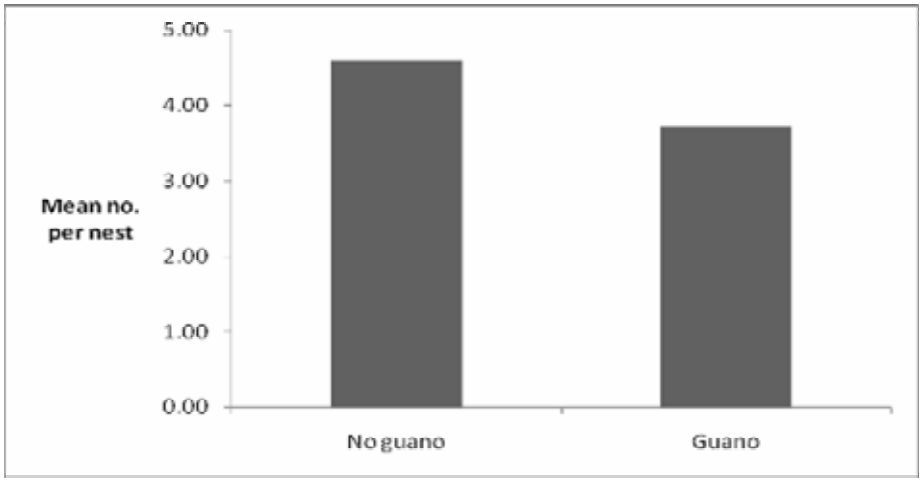


Figure 6. Mean number of spiders per nest in nests with and without added chicken guano.

The overall spider community composition in the artificial nests is shown in Figure 7. *Harpactea hombergi, Lepthyphantes minutus* and immature lepthyphantines accounted together for almost 60% of all 603 spiders recovered from the nests. *Amaurobius* spp. (adults and immatures) accounted for a further 14% and *Tenuiphantes* species for 9% while *Midia* accounted for less than 0.5% of the total. It should be noted that while it is possible to identify *Midia* as a sub-adult, earlier instars are not distinguishable from other lepthyphantines and some of the immature specimens included could represent individuals of *Midia*. Among these species, *H. hombergi* and *L. minutus* are very characteristic of trees generally, the former preferring dry situations. *Amaurobius* species are found in a variety of micro-habitats where they can build their tubular retreats including tree trunks, walls, rock faces and among logs on the ground. The two *Tenuiphantes* species are more characteristic of leaf litter but are also occasionally taken on trees. The

remaining spiders comprised a further 20 species, the majority of which were widespread and could be expected to be found on trees.

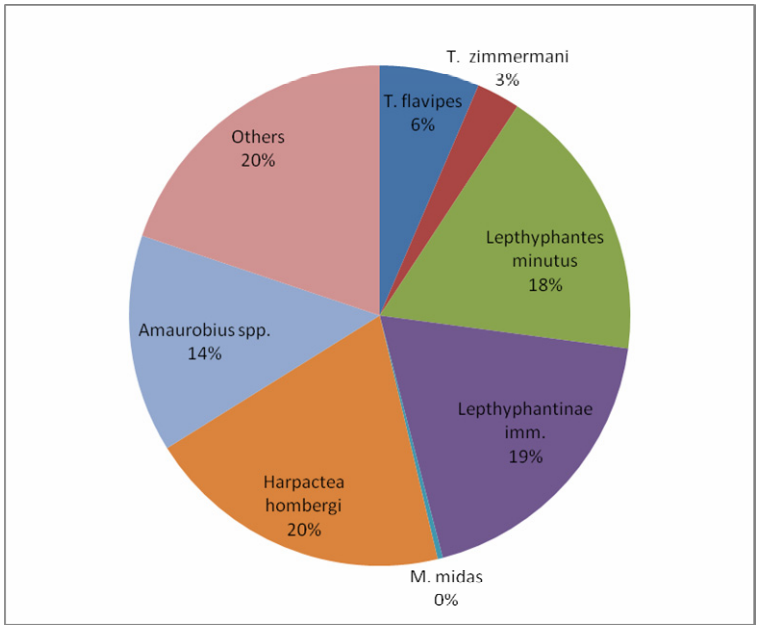


Figure 7. Community composition of spiders in artificial nests in Epping Forest (2010).

For comparative purposes, the community composition of spiders collected from natural nests and squirrel dreys in 1980 is shown in Fig. 8. Although the spider community is similar to that in artificial nests in terms of the most abundant species present, there are clearly large differences in the proportional representation of different taxa in the community. In natural nests, *Harpactea hombergi* represented 55% of the 677 spiders recovered, almost three-fold the number in artificial nests. *Amaurobius* spp. and immature lepthyphantines accounted for a similar proportion as in artificial nests. By contrast, *Lepthyphantes minutus* was virtually absent from natural nests (a single individual taken) and the two *Tenuiphantes* species were represented by about half the numbers found in artificial nests. The most significant point is that *Midia* was very much more abundant in natural than in the artificial nests. While both inter-annual and seasonal variations may have affected the differences between the two data sets, the fact that *H. hombergi* was so much more abundant in the natural nests does at least suggest that they were situated in much drier (and possibly darker) micro-habitats than the artificial nests. If this is the case, it may be that this also represents the preferred micro-habitat for *Midia,* a possibility that should inform future survey and monitoring work for this species.

c) Spiders in bottle traps

The 18 bottle traps set up in June 2010 and left out for 3 weeks caught a total of only 23 spiders, an average of 1.28 per trap. Five of the traps contained no spiders and one could not be relocated. The most common species in bottle traps were *Segestria senoculata* (8), *Clubiona corticalis* (3) and *Harpactea hombergi* (5), all common species on trees.

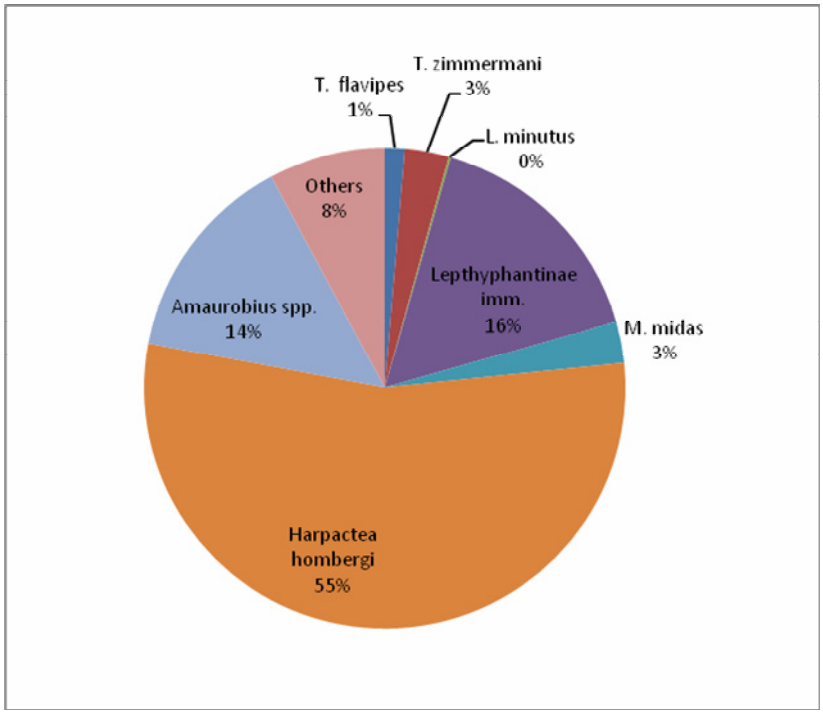


Figure 8. Community composition of spiders in natural bird nests and squirrel dreys in Epping Forest, 1980.

Given the time and labour involved in setting up and servicing the bottle traps, it was decided not to continue deploying them, as the return to effort hardly justified their use.

4. Developments – A strategy for future studies on *Midia*

Future studies on this species will depend on obtaining suitable funding. The inability to find populations of adequate size on which to base statistically reliable conclusions represents a serious difficulty in studying the ecology of extremely rare invertebrates. In the case of *Midia*, it is not yet clear whether the low numbers recorded in Epping are due to a lack of suitable sampling techniques or to inherently low population densities.

Because conservation of endangered spiders depends in part on ensuring survival of many separate populations, future work will concentrate on finding new populations of the spider in sites with large numbers of ancient trees (e.g. New Forest, Hants. and Hatfield Forest, Essex). It is hoped that at these sites sufficient natural bird nests and squirrel dreys can be located to obviate the need for trapping devices. In concert with this, studies will continue in Epping to assess various sampling techniques including, suction sampling, sieving rotting wood and using aerial pitfall traps as well as attempting to better define the exact micro-habitat requirements of this species. In future, field work will focus particularly on the spring and early summer period (April-June)

A project already funded in collaboration with Dr Sara Goodacre (Nottingham University) will develop molecular techniques for identification of *Midia* in the juvenile stages which should allow much more thorough surveys in future.

Acknowledgements

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References

Crocker, J. 1979. The Sherwood Forest arachnid survey. *Newsletter of the British Arachnological Society*. **25:** 4-8.

Crocker J. & Daws, J. 1996. **Spiders of Leicestershire and Rutland**. Loughborough Naturalists' Club & Kairos Press, Newton Linford.

Russell-Smith, A. 2002. *Midia midas* (Simon, 1884) in Epping Forest, Essex. *Newsletter of the British Arachnological Society*. **95:** 13-14.