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# SPIDERS IN TOWER HAMLETS CEMETERY PARK LOCAL NATURE RESERVE: A PRELIMINARY REPORT ON STUDIES 2007-2022

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## Abstract

Spiders in the Park have been studied using various methods since 2007, producing a list so far of 165 species. Pitfall-trapping at six grass/herb-rich sward sites has been conducted continuously since 2009, recording 131 of those species. The additional 34 species have been found by searching and sweep-netting but have not appeared in the pitfall catch. Additional species are still being added to the list in most years. Preliminary analysis of the monthly pitfall data from six open-ground sites shows some decline in total numbers over the period but little or no reduction in the species richness (number of species trapped). Most spiders present are those common in London open spaces, the fauna being dominated by *Pachygnatha degeeri* which made up to between 31.2% and 66.0% of the total pitfall catch. The five commonest pioneer species identified in London grasslands occur only in small numbers. Management to reduce disturbance/compacting of grassland habitats appears to be successful in optimising conditions for a diverse spider fauna, with some results suggesting there is a gradual maturing of the ecosystem. Further analysis separating results from individual sites will be reported subsequently.

## Introduction

One of London's 'Magnificent Seven' Victorian cemeteries, Tower Hamlets Cemetery in Southern Grove, Mile End, east London, contains graves where over 350,000 people are buried. The Cemetery was finally closed to burials in 1966 and the site became a designated Park by an Act of Parliament. Before the closure, the Cemetery Company had long neglected management of the site. The Greater London Council owned the site from 1966 to 1986, carrying out major improvements for biodiversity by clearing scrub and opening the tree canopy from 1981-1985, when it passed to the local council: London Borough of Tower Hamlets. The Council responded positively to local interest, leading to the formation of the Friends of Tower Hamlets Cemetery Park in 1990. The Friends gradually became the Park's managers, in partnership with London Borough of Tower Hamlets, which added two further areas adjoining the historic cemetery, and the Park was recognised as a Site of Metropolitan Importance for Nature Conservation and a Local Nature Reserve.

In the years before 1981, when the Cemetery was neglected, it was invaded by Sycamore, a pioneer tree, so that today much of the Park is mixed secondary woodland dominated by Sycamore, together with some London Plane, Ash, Hazel, Lime, Birch, Cherry, Spindle, Elm, Bird Cherry and Holly. Several ponds have been dug, much of the

dense canopy reduced and some open glades created. A 'coppiceable' understorey has now been established in most of the woodland.

The Park offers a range of habitats for wildlife from the secondary woodland and herb-rich swards in part of the existing graveyard (Lodge Graves) and grassy (grave-free) areas such as Scrapyard Meadow and Lockhart/Cantrell Fields (see map), as well as small wet areas fringing the ponds. Mowing and strimming of the meadow grassland is concentrated in the autumn, with anthills protected, refuge areas left and clippings removed, while the unshaded parts of the graveyard are strimmed annually. In some areas where high nutrient levels resulted in the growth of nettles, some recycled demolition material called Crushed Concrete Fines has been spread to encourage a more diverse sward. Since 2002 several loads of chalk have been spread in parts of Scrapyard Meadows to raise the soil pH and encourage botanical diversity.

Spiders have been studied in the Cemetery since 2007. Searching and sweep-netting of bushes (Gorse, Juniper, Ivy and Holly) was used during several spider forays for children, and by the author on numerous other occasions during good weather. Pitfall-trapping began at various sites across the Park in 2007 (Table 1) but mostly only for short periods. Continuous records from the six grassland sites have been gathered on a standardised monthly basis from 2009 to the present time, giving twelve-month data for 13 consecutive years.

Figure 1: Tower Hamlets Cemetery Park compartments.



Figure 2: Site 003 Lockhart Field (May). © Edward Milner

Figure 3: Site 006 Lodge Graves (October). © Edward Milner





Site No.	Location	Original start date	End date	Habitat
001	Green Roof	9/5/07	10/4/08	Green roof
002	Sanctuary Wood	9/5/07	10/4/08	Woodland
003	Lockhart Field	7/6/07	Present day	Rough grass
004	Hurricane Woods	9/5/07	10/4/08	Woodland
005	The Dells	9/5/07	30/4/12	Woodland
006	Lodge Graves	9/5/07	Present day	Grass/herbs
007	Scrapyard Meadow	16/8/07	Present day	Herb-rich grass
009	Circle Grove	10/6/08	Present day	Herb-rich veg.
010	Saone Centre	10/6/08	Present day	Herb-rich grass
011/016	Scrapyard Meadow II	11/11/08	Present day	Rough grass
012/013	New Dells	30/9/11	16/10/13	Woodland
014	Various pond sites	14/11/13	Present day	Pond edge

Table 1: Pitfall trap sites, with history of trapping (trap sites 8 and 15 were abandoned early in the survey).

Most spiders have been identified by the author, with ‘difficult’ specimens confirmed by Dr Peter Merrett. Nomenclature follows the most recent checklist of British spiders (Lavery 2019), except where noted in Table 2.

## Methods

At each site, trios of standard pitfalls (8 cm diameter) were set in a triangle approximately 30 cm apart, with a small plastic grid on top. This is to prevent clogging with cut grass debris or falling leaves, and accidental drowning of small mammals. A small amount of concentrated anti-freeze and a little commercial detergent as a wetting agent is used to kill the catch and prevent it being eaten by predators such as ground beetles. Traps are emptied on a monthly basis, the contents being strained through a bag of stocking material, and the catches sorted in water, then preserved in alcohol.

## Results

In total, 165 species of spider have been recorded from the Cemetery of which 131 have been taken in pitfalls between 2009 and 2021 at least once (Table 2); these are mostly ground-living species although occasionally web-spinners, such as *Argiope bruennichi* and *Araniella cucurbitina*, have been caught. A separate list is given (Table 3) for those species that have not appeared in the pitfall catches. Of these ‘above-ground species’, some are orb web-spinners (such as *Zilla diodia*



Figure 4: Site 016 Scrapyard Meadow (May). © Edward Milner

and *Mangora acalypha*), others are largely restricted to dense vegetation such as Gorse and Juniper (*Macaroeris nidicolens*, *Dictyna* spp., *Nigma* spp. and *Anyphaena* spp.), while some (such as *Zygiella x-notata* and *Pholcus phalangioides*) have only been found in or around buildings.

For the six pitfall sites the total numbers trapped in a 12-month period varied from 6,108 in 2009 down to just 2,124 in 2019 (Table 2), which may be largely influenced by average temperature and quite possibly from annual rainfall. The author has an impression of lower overall numbers especially in cooler, damper summers, possibly due to lower numbers of prey insects; correlation of numbers with average temperature and rainfall in the London area will be explored in a subsequent report.

While total numbers vary considerably, the species richness of the catch from the six sites varies far less from 55 in 2013 and 2014, to 72 in 2011, with a mean of 62. Interestingly the number of species trapped has only reached 50% of the total list (131) in three years out of 13. In other words, in most years less than half the total number of pitfall-recorded species were taken. Does this mean that with more traps the catch would include more species? Is it possible that if, say, double the number of trap-sites were involved the catch would be more representative of the total ground fauna? For a short time, a duplicate set of traps was set at another point on Scrapyard Meadow but when after several months no additional species were found the experiment was discontinued. It is quite likely that there are other species occurring at very low densities, or perhaps only in particular places where the vegetation is marginally different, and so it is perhaps not surprising that the species list for the Park continues to grow even after a decade of trapping and collecting.

Table 2: Pitfall-trapping results; aggregate from six open-ground sites 2009-2021. Species in bold are those occurring every year since 2009. \* denotes species now regarded as one by Lavery (2019).

Species	Year													Mean
	09	10	11	12	13	14	15	16	17	18	19	20	21	
<i>Psilochorus simoni</i>							1		1					
<i>Segestria senoculata</i>					2				1					
<b><i>Dysdera crocata</i></b>	25	16	27	5	6	2	11	4	17	37	21	37	3	16.3
<i>Harpactea hombergi</i>		4				1				1				
<i>Oonops pulcher</i>													1	
<i>Ero cambridgei</i>	1													
<i>Ero furcata</i>		1	3		1			2	1	1		2		
<i>Episinus angulatus</i>	1				1									
<i>Steatoda grossa</i>			1											
<i>Cryptachaea blattea</i>											1		1	
<i>Neottiura bimaculata</i>								1			1			
<i>Paidiscura pallens</i>	1									1				
<i>Enoplognatha ovata</i> s. s.		1				1	3			1	1	1		
<i>Enoplognatha latimana</i>		2		2							1		1	
<i>Enoplognatha thoracica</i>	4	2	13	6		1	5	8	5	4	8	5	7	

Species	Year											Mean		
	09	10	11	12	13	14	15	16	17	18	19		20	21
<i>Robertus lividus</i>												1		
<i>Walckenaeria acuminata</i>	10	8	10	15	17	16	16	24	21	8	12	4	3	12.5
<i>Walckenaeria antica</i>	18	18	15	20	20	11	10	9	19	5	3	6	7	12.4
<i>Walckenaeria atrotibialis</i>	3	3	2		8	3	2	3	6	2				1
<i>Walckenaeria vigilax</i>		1												
<i>Dicymbium nigrum*</i>							1							
<i>Dicymbium brevisetosum*</i>	74	52	41	31	16	12	20	22	32	34	10	24	32	30.3
<i>Gnathonarium dentatum</i>					1									
<i>Dismodicus bifrons</i>					2									
<i>Maso sundevalli</i>			2										2	
<i>Pocadicnemis pumila</i>												4		
<i>Pocadicnemis juncea</i>	3	2	8		2	1		3	2	5	5		1	
<i>Oedothorax fuscus</i>								2						
<i>Oedothorax retusus</i>		1						1						
<i>Pelecopsis parallela</i>				1										
<i>Cnephalocotes obscurus</i>	18	24	15	4	10	3	2	4	4	2	1	1	1	6.8
<i>Tiso vagans</i>	18	21	18	14	5	8	3	21	8	6	4	1	7	10.3
<i>Troxochrus scabriculus</i>	1		1					8	2	2			2	
<i>Tapinocyba praecox</i>											1			
<i>Monocephalus fuscipes</i>	9	10	8	9	1	21	24	107	14	9	30	8	16	20.5
<i>Gongylidiellum vivum</i>	1	5	1	2	1	2	4		2		3		1	
<i>Micrargus herbigradus s. s.</i>	7	8	3	1	10	2	17	29	21	14	6	7	10	11.9
<i>Micrargus subaequalis</i>	23	19	6	14	16	7	6	10	6	17	10	5	3	10.9
<i>Erigonella hiemalis</i>	37	35	13	12	14	15	36	33	45	22	29	14	7	24
<i>Diplocephalus latifrons</i>	31	30	25	8	10	25	23	28	32	13	20	19	24	22.2
<i>Diplocephalus picinus</i>	1	2	1	1			1	3	13	5	7	1		
<i>Araeoncus humilis</i>								1						
<i>Panamomops sulcifrons</i>		6	11	26	7	15	12	31	10	5	13	7	7	
<i>Lessertia denticelis</i>											1			
<i>Erigone dentipalpis</i>	146	84	46	130	34	13	31	22	37	26	24	31	28	49.7
<i>Erigone atra</i>	12	3	3	13	11	3	9	4	8			3	1	
<i>Prinerigone vagans</i>			2											
<i>Mermessus trilobatus</i>												1	2	
<i>Collisia inerrans</i>							2	1						
<i>Ostearius melanopygius</i>								1						
<i>Agyneta decora</i>	1			2										
<i>Agyneta rurestris</i>		4	7	5		4	1				12	1		
<i>Agyneta mollis</i>					1				4		2	1	1	
<i>Agyneta saxatilis</i>	7	6	10	4		4	3	1	19	4	6	13	17	
<i>Agyneta affinis</i>		1	3	3	5	1	6	3	8	6	13	10	23	
<i>Microneta viaria</i>	1	1	2	10	1		2	1	2	1	2			
<i>Centromerus sylvaticus</i>	5	1	3	2			1			1				

Species	Year											Mean		
	09	10	11	12	13	14	15	16	17	18	19		20	21
<i>Centromerus dilutus</i>		1												
<i>Centromerus incilium</i>											2		1	
<i>Centromerita bicolor</i>	509	561	817	688	328	593	405	277	223	158	83	61	207	369
<i>Sintula corniger</i>		1												
<i>Macrargus rufus</i>											1	3	2	1
<i>Bathypantes gracilis</i>	13	5	12	20	12	6	6	10	8	4	3	1	14	8.5
<i>Bathypantes parvulus</i>		1												
<i>Diplostyla concolor</i>	30	28	28	43	40	33	22	47	77	29	24	18	12	34.2
<i>Drapetisca socialis</i>													1	
<i>Tapinopa longidens</i>			2				1	1	3	6		1		
<i>Stemonyphantes lineatus</i>	37	21	47	20	22	27	11	24	11	11	26	41	30	25.2
<i>Megalephyphantes</i>	2	2	5			5	4	7	3		2	1		
<i>cf. collinus</i>														
<i>Lepthyphantes leprosus</i>			1											
<i>Lepthyphantes minutus</i>				1										
<i>Tenuiphantes tenuis</i>	99	72	317	306	123	150	165	311	169	205	287	214	199	201
<i>Tenuiphantes zimmermanni</i>	1		1	5	1	6	9	6	4	2	3		1	
<i>Tenuiphantes mengei</i>	1												2	
<i>Tenuiphantes flavipes</i>	11	22	53	42	24	22	33	18	44	29	64	129	116	46.6
<i>Tenuiphantes tenebricola</i>			1			3		1	2					
<i>Palliduphantes ericaeus</i>	1	2	2	2	1	1	1	1						
<i>Palliduphantes pallidus</i>	2	2	1	1	2	1	3	3	4	2			2	
<i>Linyphia triangularis</i>			1							1				
<i>Linyphia hortensis</i>											1			
<i>Neriene clathrata</i>	8	4	8	11	11	5	3	6	5	8	7	7	3	6.7
<i>Neriene peltata</i>	1				1						1			
<i>Microlinyphia pusilla</i>		1	1											
<i>Tetragnatha montana</i>	1													
<i>Pachygnatha clercki</i>				2		1					1			
<i>Pachygnatha degeeri</i>	3,454	2,241	1,186	952	2,627	1,050	2,073	993	2,216	1,486	728	778	655	1,337.6
<i>Araniella cucurbitina s. s.</i>		4												
<i>Argiope bruennichi</i>		1											1	
<i>Pardosa palustris</i>	1	8	3					37				43	1	
<i>Pardosa pullata</i>	466	286	314	264	256	299	475	267	290	202	178	246	113	281.2
<i>Pardosa prativaga</i>	131	105	74	88	141	160	332	110	231	107	133	229	47	145.2
<i>Pardosa nigriceps</i>		2	16	1	2	1	2	5	7	10	12	14	5	
<i>Alopecosa pulverulenta</i>	430	274	179	129	68	63	173	165	187	111	94	141	155	166.8
<i>Trochosa terricola</i>	232	144	179	72	49	22	56	35	56	31	56	23	54	78
<i>Pirata piraticus</i>										1				
<i>Piratula latitans</i>	1		1											
<i>Pisaura mirabilis</i>	5		5	1	1	1	4	1		1	3	5		
<i>Eratigena duellica</i>										1				

Species	Year													Mean
	09	10	11	12	13	14	15	16	17	18	19	20	21	
<i>Eratigena agrestis</i>		1				1								
<i>Tegenaria domestica</i>				1						1				
<i>Hahnia nava</i>	101	114	92	28	27	4	23	26	56	44	54	42	55	51
<i>Cicurina cicur</i>		2		3	1			20	3				3	
<i>Argenna subnigra</i>			1					2						
<i>Amaurobius similis</i>									1	2				
<i>Amaurobius ferox</i>	4	1	3	7	4	2	3	2	2		3			
<i>Agroeca inopina</i>			2		1	1	3	1	5	9	16	24	34	
<i>Phrurolithus festivus</i>	20	15	14	9	2			3	4	4	2	5	3	
<i>Clubiona reclusa</i>	4		3	1	3	1					3	1		
<i>Clubiona terrestris</i>	4	2		2	3	2	4	1	2	20	5	8	2	
<i>Clubiona comta</i>					1					2				
<i>Zodarion italicum</i>		2	5		1	1	1		1	1	2	7	5	
<i>Drassodes lapidosus</i>											1	1		
<i>Haplodrassus signifer</i>									4					
<i>Zelotes latreillei</i>	18	10	20	7	8	6	11	8	8	8	7	15	11	11.3
<i>Trachyzelotes pedestris</i>									1	1	2			
<i>Drassyllus pusillus</i>	1	2	2	1							1			
<i>Micaria pulicaria/micans</i>	5	1	1	1					1				1	
<i>Zora spinimana</i>			2										1	
<i>Philodromus dispar</i>		1												
<i>Philodromus aureolus</i>									1					
<i>Tibellus oblongus</i>												1		
<i>Xysticus cristatus</i>	11	2	8			1			1	1	2	4	6	
<i>Xysticus kochi</i>	31	37	57	4		3	10	6	10	4	10	11	16	
<i>Ozyptila sanctuaria</i>	2	2	2	1										
<i>Ozyptila praticola</i>	1		1							3			2	
<i>Ozyptila simplex</i>		3	7		14	1	20	4	18	10	12	37	5	
<i>Heliophanus cupreus</i>	1	1					1	1			3	3	4	
<i>Heliophanus flavipes</i>	3		1			1					1	2	1	
<i>Sibianor aurocinctus</i>				1										
<i>Euophrys frontalis</i>	8	7	5		1		1	3	4	5	3	20	17	
<i>Talavera aequipes</i>										1	1	1		
Totals	6,108	4,362	3,780	3,054	3,978	2,644	4,144	2,752	4,007	2,756	2,124	2,303	2,006	
No. of species	63	70	72	57	55	55	57	61	66	63	65	62	60	Mean 62
P. degeeri as % of	56.5	51.3	31.4	31.2	66.0	39.7	50.0	36.0	55.3	53.9	34.3	33.8	32.7	
total catch														
Aggregate of top 3 spp.	4,429	3,088	2,320	1,946	3,311	1,942	2,953	1,581	2,729	1,846	1,193	1,253	1,075	
Top 3 spp. as % of total	72.5	70.8	61.4	63.7	83.2	73.4	71.2	57.4	68.1	67.0	56.2	54.4	53.6	
Remainder total	1,679	1,274	1,460	1,108	667	702	1,191	1,171	1,278	910	931	1,050	931	

Table 3: Spiders recorded 2007-2021. Spiders not trapped at six open-ground sites 2009-2021.

W = recorded in woodland. P= trapped around ponds. \* = trapped at Lockhart Field before 2009. Other methods: S = searching. Sw= sweep net.

Species	Year														
	2006-07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
<i>Pholcus phalangioides</i>															S
<i>Ero aphana</i>					S										
<i>Steatoda bipunctata</i>	S			S						S					
<i>Steatoda nobilis</i>										S					
<i>Anelosimus vittatus</i>	Sw				S						Sw	S, Sw			
<i>Parasteatoda lunata</i>				S							Sw				
<i>Phylloneta sisypbia</i>														S	
<i>Theridion varians</i>					S										
<i>Platnickina tincta</i>	S		S							S					
<i>Gongylidium rufipes</i>	W			S											
<i>Tenuiphantes alacris</i>		W													
<i>Metellina segmentata</i>	S, Sw	S		S										Sw	
<i>Metellina mendei</i>					S										
<i>Araneus diadematus</i>	W, S, Sw	S		S	S										
<i>Agalenatea redii</i>	S, Sw	S													
<i>Zilla diodia</i>	Sw												P		
<i>Zygiella x-notata</i>	S	S		S											
<i>Mangora acalypha</i>													Sw	Sw	Sw
<i>Coelotes terrestris</i>	*	W													
<i>Dictyna arundinacea</i>	SW											Sw	Sw		
<i>Dictyna uncinata</i>	S, Sw	S		S								P	Sw	P, Sw	Sw
<i>Brigittea latens</i>													Sw		
<i>Nigma puella</i>														Sw	
<i>Nigma walckenaeri</i>	S	S		S	W						Sw			Sw	
<i>Anyphaena sabina</i>													Sw		
<i>Anyphaena accentuata</i>	S, Sw			Sw	S										Sw
<i>Clubiona pallidula</i>	S														
<i>Clubiona lutescens</i>												P			
<i>Drassodes cupreus</i>	W														
<i>Philodromus praedatus</i>													Sw		
<i>Philodromus rufus/albidus</i>									S	S			S		
<i>Misumena vatia</i>	S, Sw								S					Sw	
<i>Salticus scenicus</i>												S			
<i>Macaroeis nidicolens</i>													S, Sw	Sw	Sw

### The most abundant species

Variation in total numbers is largely due to fluctuations in populations of just four or five of the most abundant species; the all-year *Pachygnatha degeeri* (see photograph), the

winter-active *Centromerita bicolor* and the three most abundant summer-active wolf spiders *Pardosa pullata* and *P. prativaga* and *Alopecosa pulverulenta*. Numbers of the three most abundant species together has declined since 2009 from over 70% in the first two years down to below 55% in the last two years; indeed, the very high totals trapped in the first few years were almost entirely due to excessive numbers of the two or three commonest species; aggregate numbers of all the others have been far more stable.

The most abundant spider in every year has been *Pachygnatha degeeri* making up between 31.2% and 66.0% of the total catch, but no more than 34.3% in the last three years. In the first eight years studied the second most abundant species was the winter-active *Centromerita bicolor*, but in several of the last five years *Pardosa pullata*, *P. prativaga*, and *Tenuiphantes tenuis* numbers have increased relatively, and in the last complete year (2021) the most abundant three species (which made up 53.6% of the total catch) were *P. degeeri*, *T. tenuis* and *Alopecosa pulverulenta*.

Both the woodland catch and that from pitfalls near the ponds have been unremarkable; this is to be expected as both are fairly new habitats in the Cemetery and have yet to attract more characteristic species. The woodland spiders were particularly limited in diversity, while around the ponds the only marshland species found were occasional *Pirata piraticus* and *Pachygnatha degeeri* individuals. The single specimen of *Gnathonarium dentatum*, normally associated with damp habitats, was trapped at Lodge Graves. No wandering males of the water-spider *Argyroneta aquatica* have been found - the species is apparently absent from all the Cemetery ponds.

Highlighted in Table 2 are the 26 species that have been found in the pitfall-traps in every year since 2009; these must be regarded as the key elements of the spider fauna. While some common grassland spiders like *Pachygnatha degeeri* and pioneers like

*Pachygnatha degeeri* - the most abundant species. © Mick Massie



*Erigone dentipalpis* can be found in similar numbers in all seasons, most of the others are very seasonal. Spiders that depend on insects for their prey are mainly found largely in the summer; among the ground-living species there are hunting spiders like wolf spiders (Lycosidae and Pisauridae), some crab spiders (Thomisidae) and some jumping spiders (Salticidae). The peak in numbers of most species coincides with the breeding season in early to mid-summer, numbers being boosted by extra mature males. Different wolf spiders tend to peak successively so that catches in the Cemetery Park have shown that *Trochosa terricola* peaks before *Pardosa* spp. and *Alopecosa pulverulenta* which peak successively in the early summer, sometimes peaking again in late summer when a second brood is hatched. Other species are winter-active and are rarely seen in summer months. These include by far the most abundant winter spider *Centromerita bicolor*, as well as others such as *Walckenaeria acuminata* and *Agroeca inopina*.

One of the most striking features of the study is the way the numbers trapped vary enormously from year to year; several of those occurring every year vary in numbers by a factor of 25 or more; *Monocephalus fuscipes* 1:107, *Hahnia nava* 4:114, *Micrargus herbigradus* 1:29. The most abundant species varied much less; *Centromerita bicolor* approximately 1:8, the main wolf spiders (*Pardosa* spp., *Alopecosa pulverulenta* and *Trochosa terricola*) no more than 1:10 and *Pachygnatha degeeri* approximately 1:5.

As Table 2 shows, 33 species were only recorded on a single occasion. Some of these, like common web-spinners *Steatoda grossa*, *Linyphia hortensis* and *Araniella cucurbitina*, are clearly accidental victims and others like *Pirata piraticus* and *Pachygnatha clercki* are anomalous; these species are normally associated with damp areas and have been trapped mostly near the ponds. *Gnathonarium dentatum*, also a marshland species, was trapped once at Lodge Graves.

Several of the less common species like *Argenna subnigra*, *Tapinocyba praecox* and *Agroeca inopina*, are generally found in long-established grassland and may represent part of a relic fauna which has existed in the Cemetery from years ago. Others, like *Mermessus trilobatus*, are certainly not part of a relic fauna; this species is a new arrival from the continent and was first recorded in England in 2007. Both *A. subnigra* and *T. praecox* are widespread but scarce in London both on the ground and on green roofs. *Agroeca inopina* is an autumn-active spider that is widespread in London on well-established grassland and is probably under-recorded; in the Cemetery Park its numbers have been increasing quite rapidly in the last three years.

Some of the trapping results are difficult to interpret. *Haplodrassus signifer* is common at Mile End Park not far away and is uncommon in Middlesex as a whole (recorded from at least nine sites). It has occurred in the Cemetery Park just once, when three males and a single female were trapped at Lodge Graves in 2016. A single specimen of *Sintula corniger* was trapped, not around the ponds, but on Scrapyard Meadow in 2010; this is a scarce spider in the south of England, generally found in marshy habitats and this is the only record for the whole of Middlesex. *Lessertia dentichelis* is generally found in damp and humid caves, sewers and the filter beds of sewage works, although it has also been recorded amongst marram grass on sandhills (BAS website); studies have confirmed that humidity is the key factor in habitat selection. In Middlesex *L. dentichelis* has been recorded from just five sites at ground level and also, surprisingly, on one green roof; its occurrence at the Cemetery Park is unexplained. *Trachyzelotes pedestris*, thought



to be usually associated with chalk grassland, is uncommon in the London area, having been recorded from just three other sites in Middlesex none of them near chalk; could this spider or its eggs have been imported together with the chalk? All these scarcer species are characteristic of older, mature habitats and tend to occur in small numbers. They should be regarded as the most 'high-value' species found in the Park, along with *Mermessus trilobatus*, a fairly recent arrival in Britain now established at a number of grassland sites in the Thames corridor.

### Discussion and management implications

Pitfall trapping has a limited but valuable use in assessing ground-living spider populations; being a passive method it can be standardised and is relatively unaffected by the weather (although in particularly wet periods the traps may not function for a time due to flooding). Pitfalls are not a suitable method for trying to make a complete list of species present at a site; at the very least, searching and sweep-netting may be needed to catch spiders such as orb-web spinners and blue-web (or 'lace-web') spiders which tend to stay on or close to their webs. As a means of studying changes in the fauna over time pitfalls provide useful annual data from which trends can be deduced.

The overall conclusions to be drawn from the pitfall trapping are that the open areas of the Cemetery Park do indeed provide a good habitat for a wide range of spiders and, unlike most public parks in London, the fauna is not entirely dominated by a few pioneers and ubiquitous grassland spiders like *Pachygnatha degeeri*; indeed in the last three years, the three most abundant species have made up a smaller proportion of the total than before (Table 2). As most of the grass is not mown in the summer, the Park is an excellent habitat for wolf spiders (*Pardosa* spp. especially). The spider fauna of the shaded areas is fairly impoverished - as would be expected in fairly recent secondary woodland; for example, even the common woodland wolf spider *Pardosa saltans* has not been found. This species is fairly universal in older woodland in the London area.

Taking the five most abundant pioneers in open grassy habitats in London parks where they 'make up the overwhelming proportion of the total catch at the most disturbed sites' (Milner 2000), three (*Oedothorax fuscus* and *O. retusus*, *Milleriana inerrans*) are extremely scarce in the Cemetery while numbers of the other two (*Erigone dentipalpis* and *Bathypantes gracilis*) are low and have even been decreasing over the last few years. It is probably inevitable that small numbers of *E. dentipalpis* will continue to be found but, as the figures in the table show, the aggregate of this species for all six trap-sites is no more than 20-30 in a year. This is a positive finding as it hopefully suggests opportunities for grassland specialists to thrive, without being overrun by dominant pioneers, unlike heavily mown and disturbed grassland in many other London grasslands. The reduction in numbers of the most abundant species as a proportion of the total catch in the last three years is also encouraging as it suggests the fauna is becoming more broadly based. Typically, unstable or immature ecosystems tend to have, if not fewer species, then an assemblage dominated by the commonest species. When the overall dominance of these species is reduced, it allows more space for others and is taken to represent a more mature ecosystem. This appears, from the current data, to be what is continuing to take place in the Cemetery.

In some areas not subjected to machine mowing (Lodge Graves and the eastern end

of Scrapyard Meadow) anthills are developing, although the total numbers of spiders associated with ants is still disappointingly low. The main ant-associated species present are *Phrurolithus festivus*, *Zelotes latreillei*, *Drassyllus pusillus* and *Micaria* spp. Anthills are a good indication of the health of grassland, are often associated with greater spider diversity and are important for carbon retention; like tussocks and minor surface irregularities, they should be encouraged where possible. Three spiders in particular have increased in numbers in the last few years: *Agroeca inopina*, the crab spider *Ozyptila simplex* and the small jumping spider *Euophrys frontalis*. These are all species which appear to thrive on what arachnologists refer to as the greater 'structural diversity' of the habitat - in other words long grass or undisturbed herb-rich sward. The reduced disturbance/mowing regime, protection of tussocks and anthills, should benefit all three and encourage populations of other grassland species. It is hoped that these positive trends will continue under the current sensitive management regime.

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