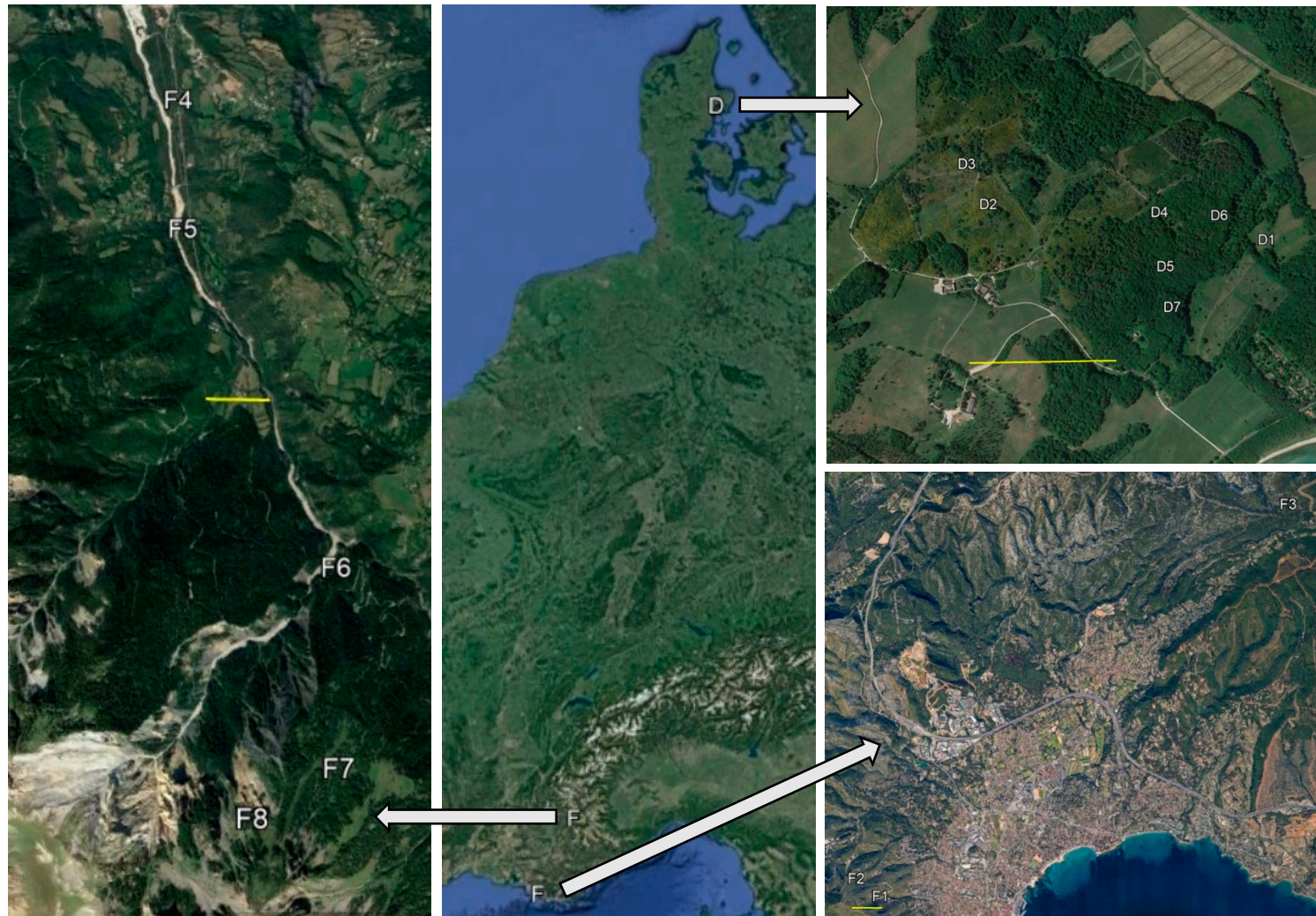


Supplementary Material S1. Summary descriptions of ant functional groups and associated North American taxa, updated from Andersen (1997a).

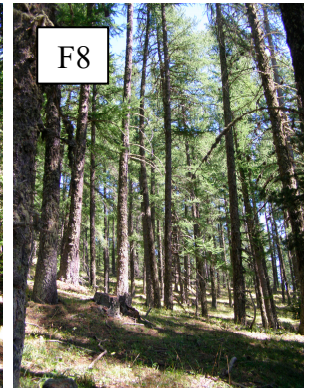
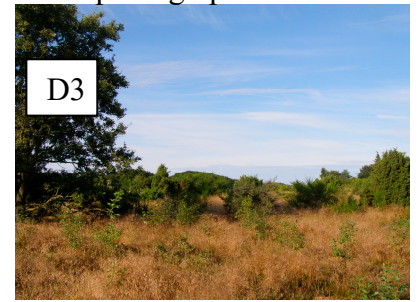
Functional group	Description	North American taxa
Dominant Dolichoderinae	Numerically and behaviourally dominant species that occur widely where temperature stress is mostly low, predominating at the most productive sites for ants with low temperature stress, often positively influenced by disturbance.	<i>Liometopum</i> , <i>Dorymyrmex</i>
Generalised Myrmicinae	Competitively sub-dominant ants, occurring primarily at low elevations and latitudes and predominating at sites experiencing moderate levels of stress or disturbance.	<i>Pheidole</i> , <i>Crematogaster</i> , <i>Monomorium</i>
Opportunists	Unspecialized species occurring widely across environmental gradients and predominating at sites experiencing high levels of stress or disturbance. Uncommon at the most diverse and productive sites for ants.	<i>Myrmica</i> , <i>Formica</i> (subgenera <i>Serviformica</i> , <i>Raptiformica</i> & <i>Neoformica</i>), <i>Nylanderia</i> , <i>Tapinoma</i> , <i>Tetramorium</i> , <i>Aphaenogaster</i> , <i>Odontomachus</i>
Subordinate Camponotini	Behaviourally submissive species that occur widely across environmental gradients. Ecologically differentiated from dominant species through large	<i>Camponotus</i>

	body size and often nocturnal and/or arboreal foraging.	
Hot-climate Specialists	Arid-adapted taxa, occurring predominantly in hot and dry regions, with morphological, physiological or behavioural specializations that reduce their interactions with behaviourally dominant taxa.	<i>Pogonomyrmex</i> , <i>Messor</i> , <i>Myrmecocystus</i>
Cold-climate Specialists	Generalised ants with distributions strongly centred on cool-temperate zones, especially high latitudes, or high elevations at lower latitudes and sensitive to high levels of disturbance.	<i>Dolichoderus</i> , <i>Doronomyrma</i> , <i>Formica</i> (<i>Raptiformica</i>), <i>Formicoxenus</i> , <i>Harpagoxenus</i> , <i>Lasius</i> , <i>Leptothorax</i> , <i>Manica</i> , <i>Myrmecina</i> , <i>Stenamma</i> , <i>Prenolepis</i> , <i>Protomognathus</i> , <i>Temnothorax</i>
Tropical-climate Specialists	Various taxa with diverse life histories, with distributions centred on the humid tropics, typically associated with rainforest habitats experiencing low levels of disturbance.	<i>Acromyrmex</i> , <i>Cyphomyrmex</i> , <i>Labidus</i> , <i>Neivamyrmex</i> , <i>Procryptocerus</i> , <i>Pseudomyrmex</i> , <i>Rogeria</i> , <i>Solenopsis</i> (<i>Solenopsis</i>), <i>Trachymyrmex</i> , <i>Xenomyrmex</i>
Cryptic Species	Hypogaeic species occurring widely across environmental gradients that forage exclusively within soil and litter, which competitively removes them from other ants.	<i>Acanthomyops</i> , <i>Acropyga</i> , <i>Amblyopone</i> , <i>Discothyrea</i> , <i>Hypoponera</i> , <i>Ponera</i> , <i>Proceratium</i> , <i>Solenopsis</i> (<i>Diplorhoptrum</i>), <i>Strumigenys</i> ,
Specialist Predators	Large-bodied and large-eyed species occurring widely across environmental gradients that specialise on live prey and typically occur in small colonies.	<i>Leptogenys</i> , <i>Pachycondyla</i> , <i>Platythyrea</i> , <i>Polyergus</i>

Supplementary Material S2. Map showing the locations of the study sites in Denmark (sites D1-D7) and France (sites F1-F8). The yellow scale bars are 500m.



Supplementary Material S3. Photographs of the study sites. Note that a photograph of site F4 is lost.



Supplementary Material S4. Summary habitat descriptions of the 15 sites distributed along environmental gradients in France (ordered according to elevation) and Denmark (ordered according to cover of woody vegetation), both gradients representing increasing thermal stress for ants.

Site	Description
France	
F1	Low heathland to a height of 50 cm, dominated by <i>Quercus coccifera</i> and <i>Erica multiflora</i> on an exposed slope at 140 m elevation on massif de Canaille, 43° 10' 44.5" N, 6° 35' 4.7" E.
F2	Low heathland dominated by <i>Quercus coccifera</i> , <i>Rosmarinus officinalis</i> and <i>Cistus albidus</i> with scattered <i>Pinus halepensis</i> , on an exposed slope at 230 m elevation on massif de Canaille, 43° 10' 58.2" N, 6° 34' 46.5" E.
F3	Similar to F2, but with more <i>Pinus halepensis</i> and <i>Cistus</i> absent, on an exposed slope at 340 m elevation in Forêt de Font Blanche, 43° 14' 15" N, 5° 39' 56" E.
F4	Low pine woodland at 920 m elevation on Montagne de Mazelière, with the overstorey dominated by <i>Pinus sylvestris</i> to a height of approximately 15 m and providing 50% cover. The understorey was dominated by pine saplings and <i>Juniperus communis</i> , 44° 31' 21.4" N, 6° 26' 55.3" E.
F5	Low pine woodland at 1030 m elevation on Montagne de Mazelière, with the overstorey dominated by <i>P. nigra</i> to a height of approximately 16 m, and providing 40% cover. The understorey was dominated by <i>P. nigra</i> and <i>Quercus pubescens</i> , with a ground layer of sparse grass and moss, 44° 30' 45.4" N, 6° 26' 59.3" E.
F6	Coniferous forest at 1220 m elevation on Montagne de Mazelière, dominated by <i>Abies alba</i> at a height of 25-30 m providing 70% cover. The understorey comprised low fir seedlings with a mossy ground layer, 44° 29' 17.8" N, 6° 27' 54.7" E.
F7	Coniferous forest at 1600 m elevation on Montagne de Mazelière, dominated by <i>Larix decidua</i> at a height of 22-25 m providing 10% canopy cover. The understorey comprised low grass and <i>Rubus</i> spp. to a height of 40 cm, 44° 28' 28.9" N, 6° 27' 54.7" E.

- F8 Coniferous forest at 1830 m elevation on Mont Saint-Guillaume, dominated by *Pinus uncinata* at a height of 20-25 m providing 50% cover, with a low grass understorey, 44° 28' 19.7" N, 6° 27' 22.7" E.

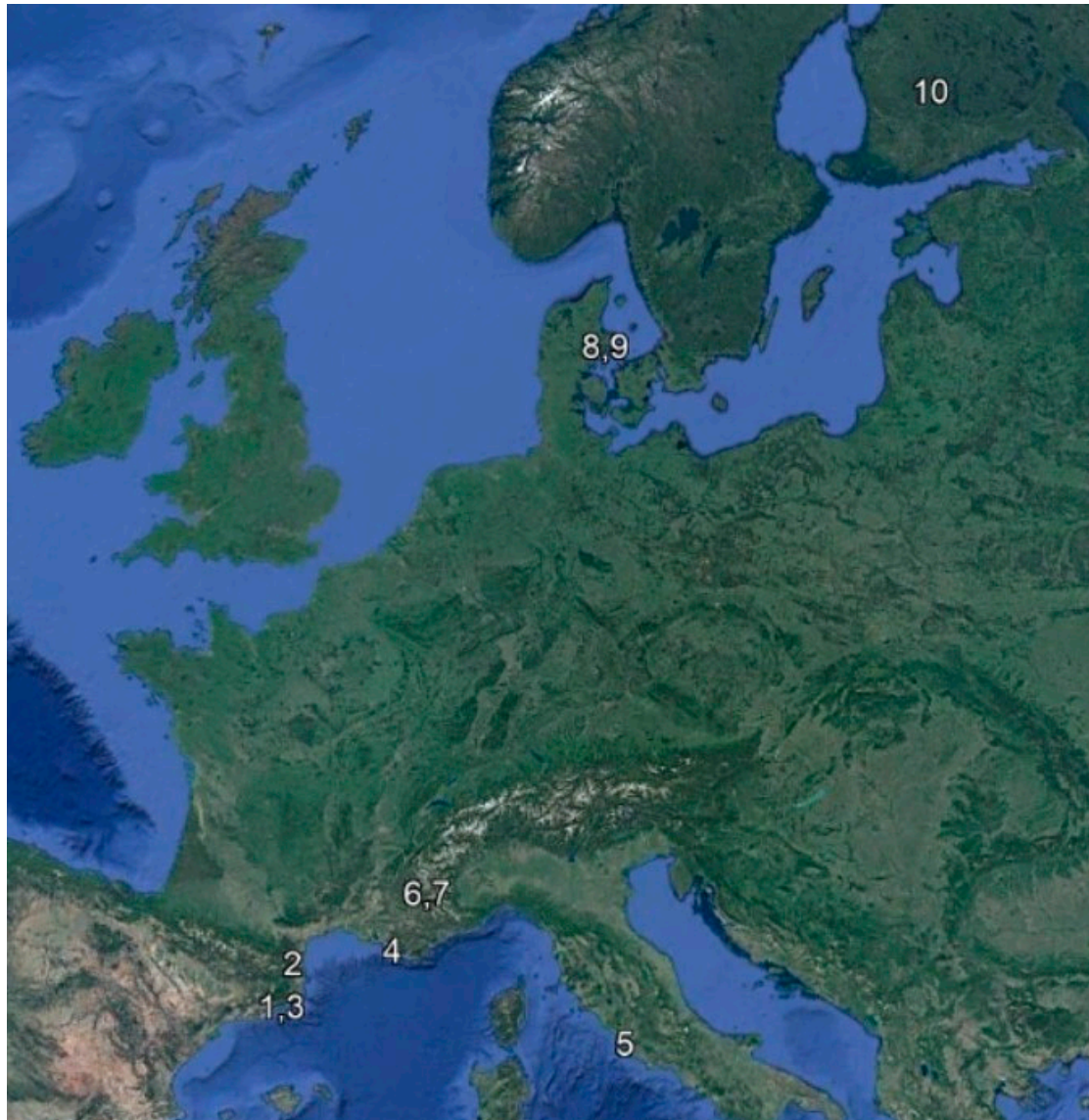
Denmark

- D1 Grazed grassland on valley floor (elevation 4 m) fringed by tall oak *Quercus robur* woodland. Grass matt to 15 cm and seed stalks to 50 cm, 56° 13' 40.1" N, 10° 35' 21.5" E.
- D2 Grazed grassland on the south-facing slope of a low hill (elevation 20 m). Grass matt to 15 cm and seed stalks to 50 cm. Any trees present constantly eaten to ground level, 56° 13' 43.7" N, 10° 34' 28.9" E.
- D3 Ungrazed grassland on hilltop (elevation 20 m). Grass matt to 30 cm and seed stalks to 80 cm. Low and sparse woody vegetation, predominantly Juniper *Juniperus communis* and Oak *Q. robur*, 56° 13' 49.4" N, 10° 34' 23.9" E.
- D4 Low open woodland dominated by Oak *Q. robur* and Pine *Pinus sylvestris*, with Juniper *Juniperus communis* and sparse grass in the understorey (elevation 15 m), 56° 13' 44.4" N, 10° 35' 01.7" E.
- D5 Open Oak *Q. robur* forest with Hazel bush *Corylus avellana* understorey (elevation 15 m), 56° 13' 38.3" N, 10° 35' 02.8" E.
- D6 Ash *Fraxinus excelsior* forest with a Hazel bush *Corylus avellana* understorey (elevation 4 m), 56° 13' 42.2" N, 10° 35' 17.5" E.
- D7 Beech (*Fagus sylvatica*) forest at 15 m elevation, 56° 13' 34.3" N, 10° 35' 08.9" E.
-

Supplementary Material S5. Vegetation and ground-layer characteristics of sites along gradients of vegetation complexity in Denmark (D site codes) and France (F site codes). The height and cover of shrubs and trees are visual estimates, whereas all other data are means of 15 1 x 1 m quadrat samples.

	Site														
	D1	D2	D3	D4	D5	D6	D7	F1	F2	F3	F4	F5	F6	F7	F8
Tree/shrub height (m)	0	0	3-6	8-10	25-30	15-20	25-30	0.5	5	12	8-10	16	25-30	22-25	20-25
Tree canopy cover (%)	0	0	5	55	70	80	95	0	2	10	50	40	70	10	50
Litter depth (cm)	3.1	0.9	9.6	7.3	1.6	5.5	4.2	5.1	12.7	14.5	8.5	9.7	28.3	28.3	19.1
% cover of:															
Litter	3.1	7.9	0.3	49.1	68.9	91.8	98.0	14.3	58.0	45.1	32.1	46.9	33.0	44.0	55.7
Bare rock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.4	20.6	41.6	5.4	1.3	2.1	4.9	8.2
Bare soil	0.0	1.4	0.0	0.0	0.1	0.0	0.0	1.5	2.1	0.0	0.0	0.0	0.0	0.0	0.8
Grass/heath	89.6	83.5	98.3	32.1	25.9	6.5	0.0	4.1	8.9	2.9	16.4	5.6	4.4	42.7	29.3
Dead wood	0.0	0.3	0.1	1.5	4.8	1.7	2.0	1.9	8.1	4.4	15.3	7.3	13.2	7.8	5.9
Moss/lichen	7.3	7.0	1.3	17.3	0.3	0.0	0.0	21.7	2.3	6.1	30.8	38.9	47.3	0.6	0.0

Supplementary Material S6. Map of ten locations where data were sourced for Figure 5, being: 1. Grassland site in Spain [39]; 2. Unburnt heathland site in south west France, summer unburnt 1992 sample [40]; 3. Two Spanish woodland sites [39]; 4. Shrubland sites F1 and F2 of the present study combined; 5. Three Italian woodland sites combined [7]; 6. Woodland sites F3-F6 of the present study combined; 7. Forest sites F7-F10 of the present study combined; 8. woodland sites D2 and D3 of the present study combined; 9. Forest sites D5 and D7 of the present study combined; and 10. Four Finnish forest sites combined (the Control sites of [41]).

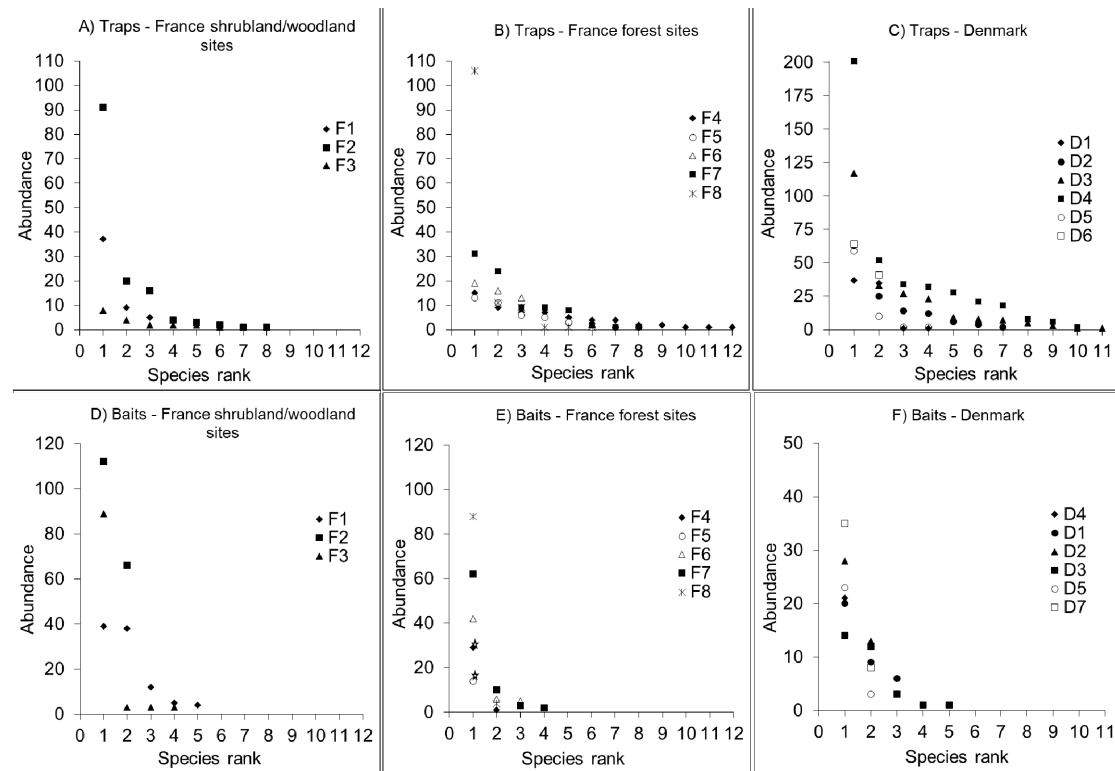


Supplementary Material S7. Ant species found at each study site in pitfall traps (p) at baits (b). Data are total scaled abundance per site. 'h' indicates that the species was found only in hand collections. Functional groups are: SC, Subordinate Camponotini; CCS, Cold-climate Specialists; CRY, Cryptic Species; OPP, Opportunists; and GM, Generalised Myrmicinae.

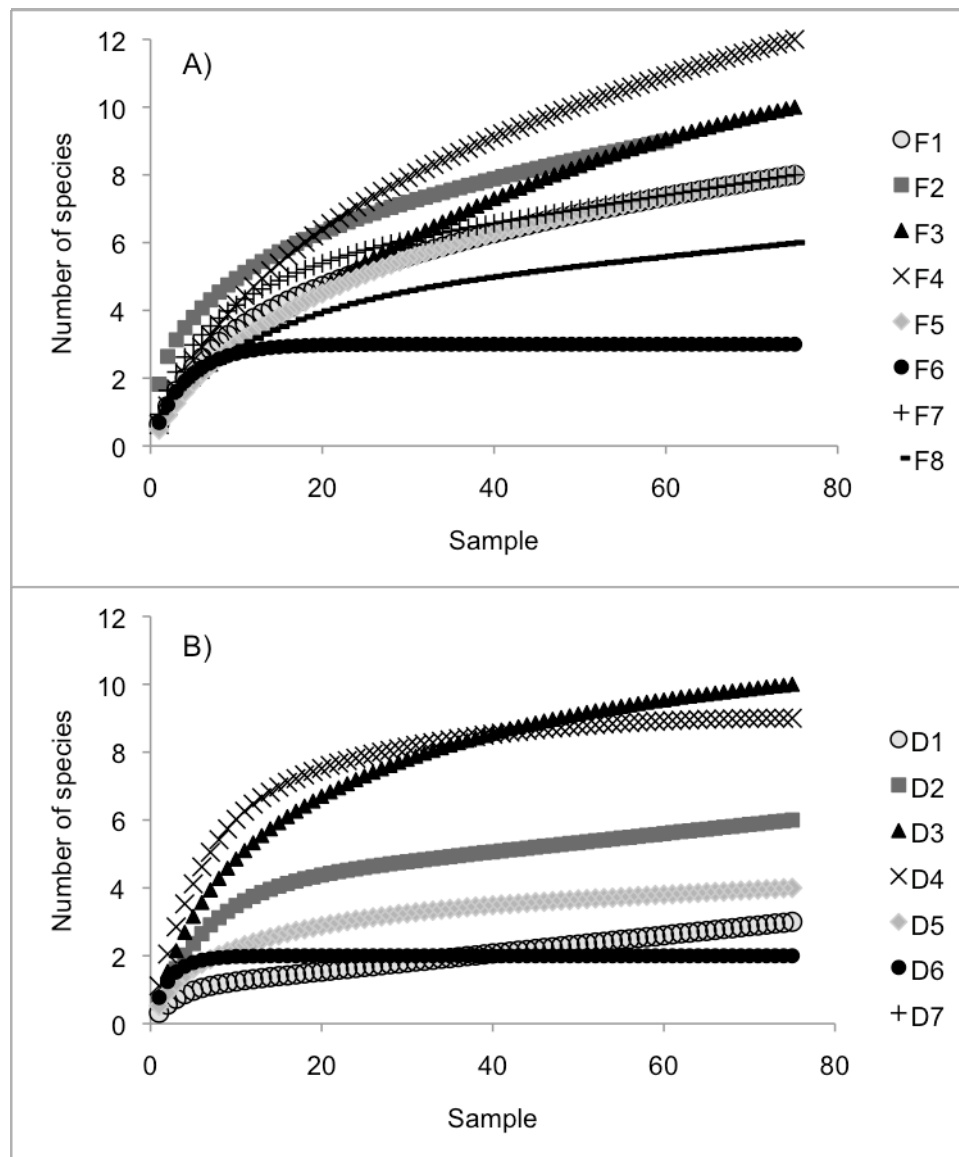
[illegible]

species	Functional	F1	F1	F2	F2	F3	F3	F4	F4	F5	F5	F6	F6	F7	F7	F8	F8	D1	D1	D2	D2	D3	D3	D4	D4	D5	D5	D6	D6	total
	group	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p	b	p
Formicinae																														
<i>Camponotus aethiops</i>	SC					h																								
<i>Camponotus cruentatus</i>	SC		4	20	66		3																						20	
<i>Camponotus herculeanus</i>	SC							7		5		13	6	8	3														33	
<i>Camponotus piceus</i>	SC	1				2	3																						3	
<i>Camponotus sylvaticus</i>	SC	2		4																									6	
<i>Camponotus vagus</i>	SC						3	1																					1	
<i>Formica</i> (combined)	CCS																	15				1				23		35		
<i>Formica fusca</i> (<i>fusca</i> gp.)	OPP							h		6										6		23	1	32	3				67	
<i>Formica pratensis</i> (<i>rufa</i> gp.)	CCS																				7								7	
<i>Formica foreli</i> (<i>exsecta</i> gp.)	CCS																				1								1	
<i>Formica rufa</i> (<i>rufa</i> gp.)	CCS																			2	1			52	14	59	23	64	35	177
<i>Formica cunicularia</i> (<i>fusca</i> gp.)	OPP							2																					2	
<i>Formica sanguinea</i> (<i>sanguinea</i> gp.)	CCS									11																			11	
<i>Formica lemani</i> (<i>fusca</i> gp.)	OPP													24	10	9	4												33	
<i>Formica aquilonia</i> (<i>rufa</i> gp.)	CCS															106	88												106	
<i>Formica truncorum</i> (<i>rufa</i> gp.)	CCS																				9		21	1					30	
<i>Lasius alienus</i>	CCS																			14	6	3		6					23	
<i>Lasius emarginatus</i>	CCS	37	39			2								1															40	
<i>Lasius flavus</i>	CRY																				h									
<i>Lasius fuliginosus</i>	CCS													31	62						8	28			2	3			41	
<i>Lasius niger</i>	CCS																	1			5	3							6	
<i>Plagiolepis pygmaea</i>	OPP	5	12	16		4																							25	
Total ants		58	98	138	178	20	98	58	30	41	14	48	53	85	77	129	95	37	36	63	36	117	46	201	31	73	49	105	78	1173
No. species		6	5	9	2	7	4	13	2*	7	1*	3	3	8	4*	6	3	3	1*	6	4*	11	4*	9	5*	4	3	2	2*	
Total no. species		8		9		9		13		7		3		8		6		3		6		11		9		4		2		40

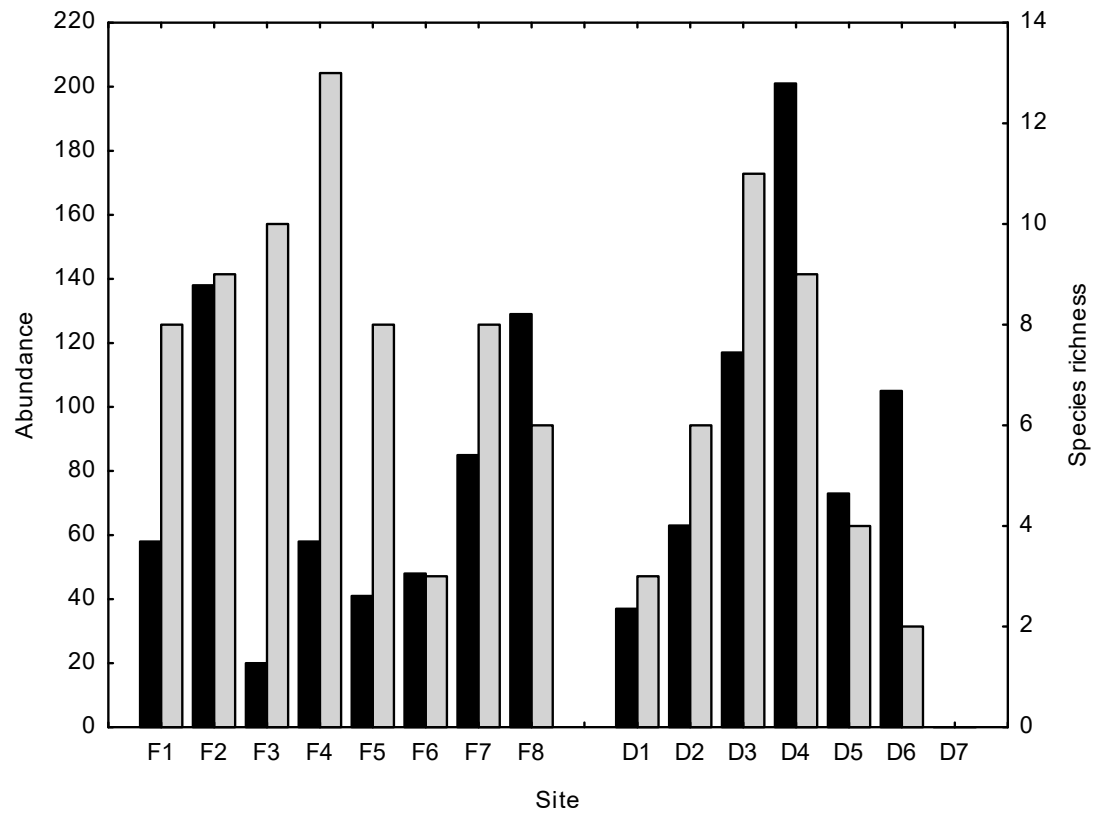
Supplementary Material S8. Species rank-abundance curves of ants quantified in pitfall traps (A-C) and at baits (D-F) at sites in France (A, B, D, E) and Denmark (C, F). ★ Indicates that the data are potentially for multiple *Myrmica* species. French sites separated for clarity.



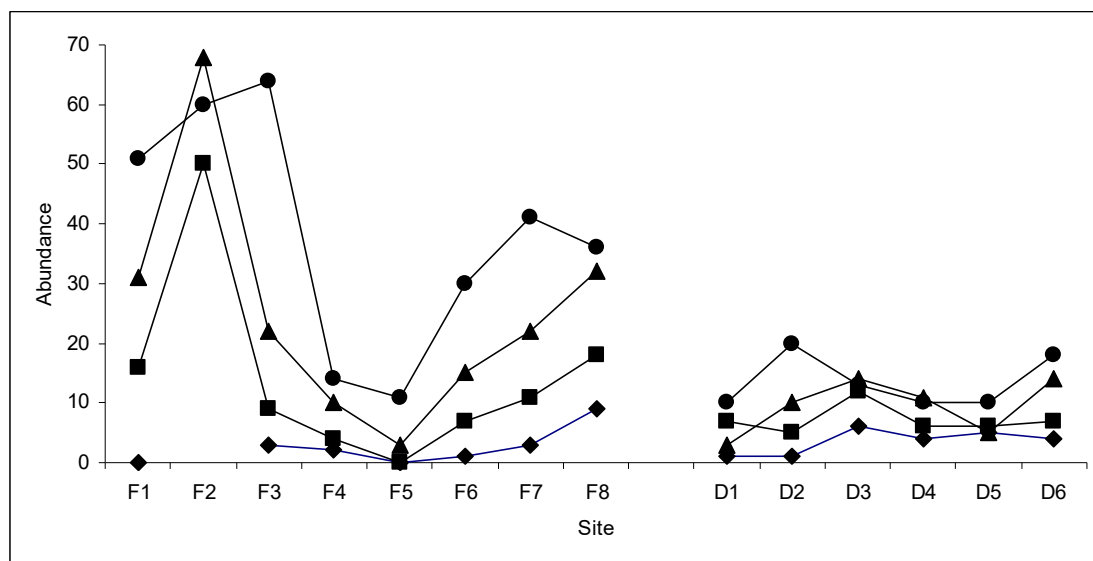
Supplementary Material S9. Rarefaction curves of species accumulation at each site in France (A) and Denmark (B) as found in 15 pitfall traps and at 15 baits assessed after 5, 15, 30 and 60 minutes. Note site F2 lacked the 15 minute bait assessment, so only 60 samples were analysed.



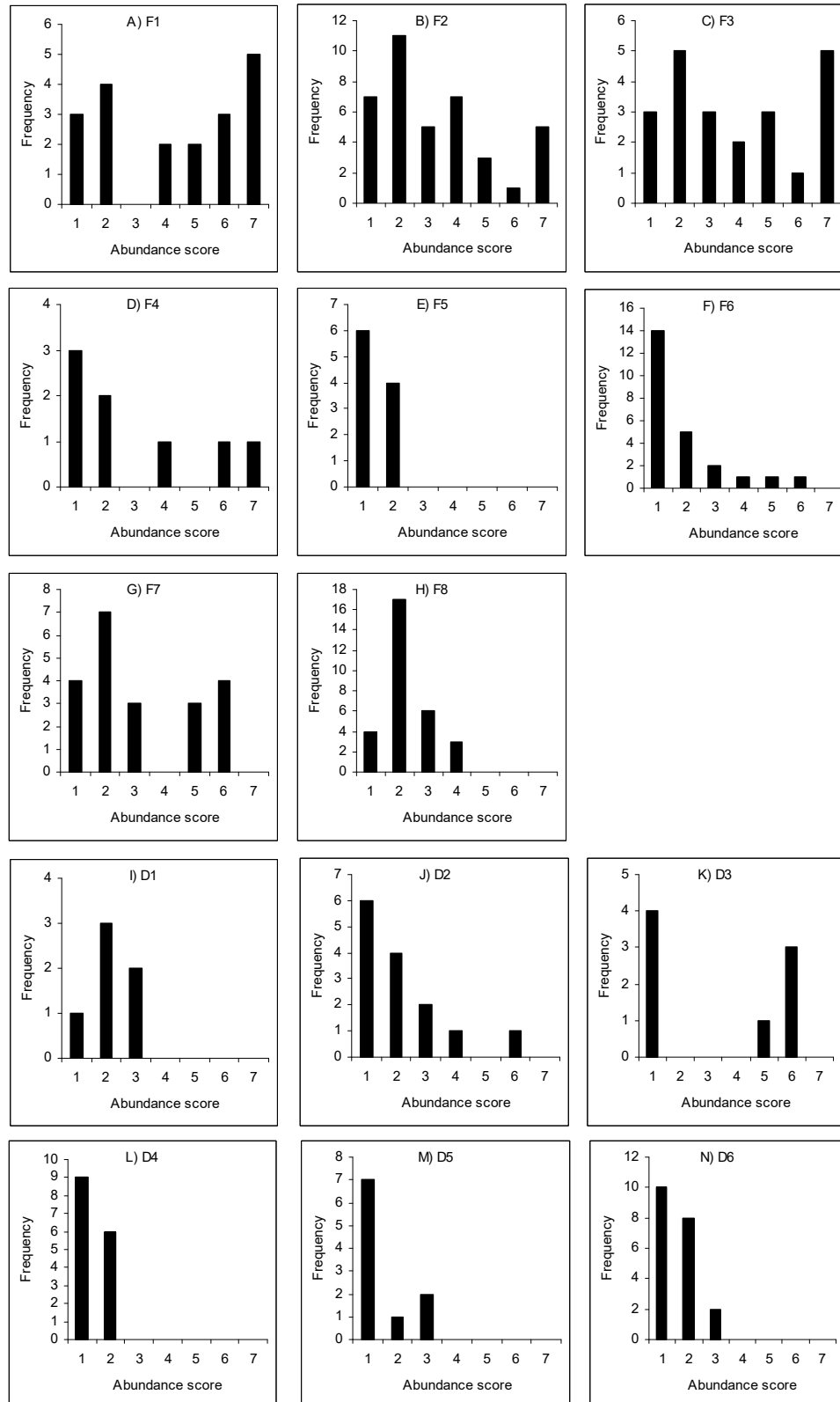
Supplementary Material S10. Ant abundance (pitfall trap catches only; black bars) and species richness (all records combined; grey bars) at sites along two bio-climatic gradients of increasing thermal stress in France (F1-F8) and Denmark (D1-D7).



Supplementary Material S11. Ant abundance at baits at each site along the two bioclimatic gradients in France (F1 – F8) and Denmark (D1 – D6) of increasing thermal stress for four observation times: 5 minutes (diamond); 15 minutes (square); 30 minutes (triangle); and 60 minutes (circle). If each of the fifteen baits at each site had more than one hundred ants of a given species, then this would give the maximum total abundance score of 105. Note, the 5-minute sample was not obtained at site F2, and no ants were recorded at site D7 so it is not shown here.



Supplementary Material S12. Frequency distributions of ant abundance scores at baits for each site along the vegetation gradients in France (A-H) and Denmark (I-N). Data are pooled across species. Only 30 min and 60 min observation periods are considered (i.e. giving time for species to locate and recruit foragers to baits).



Supplementary Material S13. Assignment of European ant genera to functional groups.

Functional group	European taxa
Dominant Dolichoderinae	<i>Liometopum</i> , <i>Tapinoma nigerrimum</i> group
Subordinate Camponotini	<i>Camponotus</i>
Hot-climate Specialists	<i>Cataglyphis</i> , <i>Goniomma</i> , <i>Messor</i> , <i>Oxyopomyrmex</i>
Cold-climate Specialists	<i>Dolichoderus</i> , <i>Lasius</i> (excluding <i>flavus</i> gp.), <i>Formica</i> (<i>sanguinea</i> , <i>rufa</i> & <i>exsecta</i> groups), <i>Leptothorax</i> , <i>Manica</i> , <i>Myrmecina</i> , <i>Prenolepis</i> , <i>Rossomyrmex</i> , <i>Stenamma</i> , <i>Strongylognathus</i> , <i>Temnothorax</i>
Tropical-climate Specialists	Nil
Cryptic Species	<i>Acropyga</i> , <i>Bothriomyrmex</i> , <i>Hypoponera</i> , <i>Lasius flavus</i> group, <i>Ponera</i> , <i>Solenopsis</i> (<i>Diplorhoptrum</i>), <i>Strumigenys</i>
Opportunists	<i>Alloformica</i> , <i>Aphaenogaster</i> , <i>Cardiocondyla</i> , <i>Formica</i> (<i>fusca</i> group & subgenus <i>Neoformica</i>), <i>Lepisiota</i> , <i>Myrmica</i> , <i>Plagiolepis</i> , <i>Proformica</i> , <i>Tapinoma</i> (excluding <i>nigerrimum</i> group), <i>Technomyrmex</i> , <i>Tetramorium</i>
Generalised Myrmicinae	<i>Crematogaster</i> , <i>Monomorium</i> , <i>Pheidole</i>
Specialist Predators	<i>Polyergus</i>