Table S1. Leg and head allometry in *Camponotus fellah.* To describe the relationship between mesosoma and leg length (ML-LL) and mesosoma length and head size (ML-HL/HW/HD), respectively, we used the allometric equation $y = a \times x^b$, with scaling factor *a* and exponent *b* and their respective 95%-confidence intervals (see Sommer and Wehner, 2012). Values are given for the allometric equation with y and x representing LL and ML, and HL/HW/MD and ML, respectively. R^2 is the coefficient of determination. Values were calculated for minors, medias, majors, and males (Fig. 2). Regarding ML and LL, b-values are near 1 within all worker subcastes, demonstrating nearly isometric scaling between leg and mesosoma lengths within subcastes. Across the worker caste *b*-values are slightly < 1, demonstrating negative allometric scaling (majors have relatively shorter legs), while values of subcastes are mainly > 1 (no significant differences from isometry due to large 95%-CI). Regarding mesosoma and head size, b-values are clearly > 1, demonstrating positive allometric scaling and underscoring the different head shape in majors. Medias show highest *b*-values, demonstrating the strongest increase in head size within the subcaste. Generally, longer legs and longer/wider heads are illustrated by higher values in scaling factor *a*, respectively (Sommer and Wehner, 2012). Data of males are included for an overview but cannot be compared to those of workers. Abbreviations: lengths of front (LL1), middle (LL2) and hind (LL3) legs; head length (HL), head width (HW), maximum eye distance (MD).

		a	b	R^2
minor worker (n=42)	LL1	1.710 (1.371; 2.131)	0.932 (0.756; 1.149)	0.567
	LL2	1.613 (1.228; 2.119)	1.048 (0.833; 1.318)	0.474
	LL3	2.177 (1.628; 2.910)	1.054 (0.827; 1.344)	0.411
media worker (n=39)	LL1	1.554 (1.278; 1.889)	1.017 (0.875; 1.181)	0.796
	LL2	1.745 (1.528; 1.993)	0.970 (0.871; 1.079)	0.896
	LL3	2.203 (1.849; 2.624)	1.030 (0.902; 1.176)	0.841
major worker (n=38)	LL1	1.156 (0.800; 1.671)	1.206 (0.982; 1.482)	0.624
	LL2	1.461 (1.125; 1.896)	1.076 (0.913; 1.267)	0.763
	LL3	1.917 (1.282; 2.867)	1.088 (0.848; 1.395)	0.448
worker caste (n=119)	LL1	1.632 (1.555; 1.713)	0.975 (0.938; 1.013)	0.956
	LL2	1.905 (1.827; 1.987)	0.899 (0.867; 0.932)	0.961
	LL3	2.701 (2.534; 2.850)	0.861 (0.822; 0.904)	0.931
male caste (n=11)	LL1	1.940 (1.146; 3.287)	0.856 (0.535; 1.369)	0.583
	LL2	1.884 (1.034; 3.431)	0.893 (0.537; 1.486)	0.504
	LL3	1.842 (1.047; 3.243)	1.025 (0.671; 1.566)	0.665
minor worker (n=42)	HL	0.461 (0.309; 0.685)	1.380 (1.071; 1.778)	0.357
	HW	0.235 (0.154; 0.358)	1.549 (1.220; 1.968)	0.429
	MD	0.181 (0.116; 0.281)	1.766 (1.417; 2.202)	0.518
media worker (n=39)	HL	0.117 (0.054; 0.235)	2.448 (1.918; 3.125)	0.453
	HW	0.076 (0.046; 0.126)	2.469 (2.105; 2.895)	0.769
	MD	0.116 (0.079; 0.170)	2.104 (1.825; 2.425)	0.816
major worker (n=38)	HL	0.196 (0.090; 0.425)	2.005 (1.546; 2.601)	0.395
	HW	0.089 (0.044; 0.184)	2.373 (1.937; 2.907)	0.634
	MD	0,153 (0,086; 0.272)	1.912 (1.561; 2.342)	0.635
worker caste (n=119)	HL	0.334 (0.290; 0.385)	1.645 (1.539; 1.759)	0.868
	HW	0.104 (0.091; 0.118)	2.263 (2.166; 2.364)	0.943
	MD	0.154 (0.139; 0.169)	1.900 (1.827; 1.976)	0.954
male caste (n=11)	HL	0.145 (0.046; 0.459)	1.855 (1.154; 2.980)	0.574
	HW	0.306 (0.152; 0.616)	1.062 (0.643; 1.753)	0.520
	MD	0.376 (0.207; 0.681)	1.004 (0.639; 1.579)	0.615

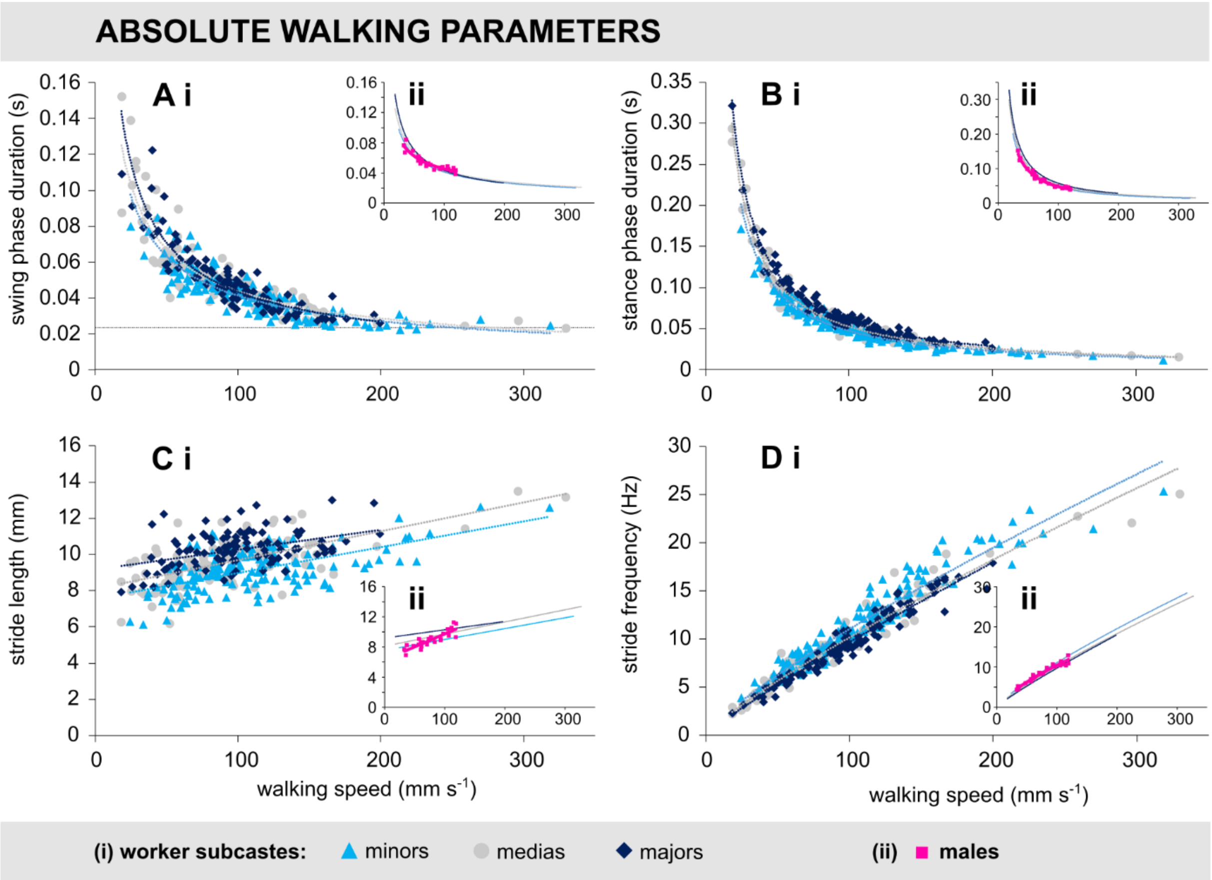
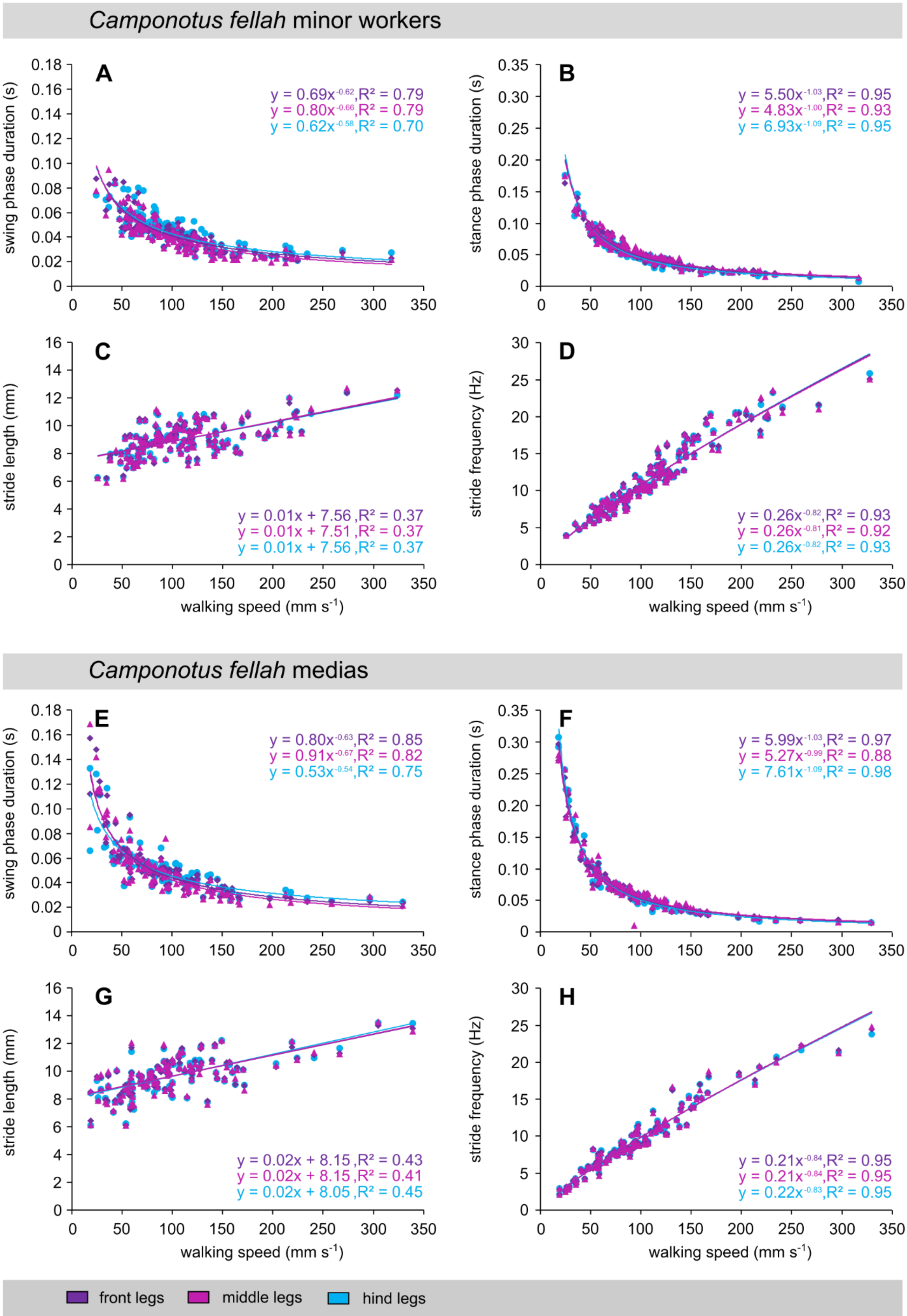


Fig. S1. Walking parameters. Most significant walking parameters in minors (light blue triangles), medias (grey circles), major workers (dark blue rectangles), and in males (pink squares) plotted as functions of absolute walking speed (mm s^{-1}). Each data point represents the mean value of the three leg pairs in a video sequence (minors: n=130, medias: n=93, majors: n=116; figure parts (i); males: n=25; figure parts (ii)). (**A**) Swing phase duration (power functions: minors: $y=0.71x^{-0.62}$, $R^2=0.78$, medias: $y=0.77x^{-0.62}$, $R^2=0.83$, majors: $y=1.14x^{-0.71}$, $R^2=0.85$, males: $y=0.39x^{-0.47}$, $R^2=0.87$); (**B**) Stance phase duration (power functions: minors: $y=5.65x^{-1.04}$, $R^2=0.95$, medias: $y=6.04x^{-1.03}$, $R^2=0.97$, majors: $y=6.44x^{-1.02}$, $R^2=0.97$, males: $y=4.62x^{-0.99}$, $R^2=0.97$); (**C**) Stride length (linear regressions: minors: $y=0.01x+7.55$, $R^2=0.37$, medias: $y=0.02x+8.12$, $R^2=0.40$, majors: $y=0.01x+9.17$, $R^2=0.17$, males: $y=0.03x+6.31$, $R^2=0.75$); (**D**) Stride frequency (power functions: minors: $y=0.26x^{0.82}$, $R^2=0.92$, medias: $y=0.21x^{0.84}$, $R^2=0.95$, majors: $y=0.16x^{0.89}$, $R^2=0.95$, males: $y=0.34x^{0.74}$, $R^2=0.95$). Walking parameters of all worker subcastes and males differed significantly from each other in each case concerning absolute and also relative walking speeds (test for correlation, $^*P<0.05$).


Camponotus fellah minor workers
A
y = 0.69x-0.62,R² = 0.79
y = 0.80x-0.66,R² = 0.79
y = 0.62x-0.58,R² = 0.70
swing phase duration (s)
B
y = 5.50x-1.03,R² = 0.95
y = 4.83x-1.00,R² = 0.93
y = 6.93x-1.09,R² = 0.95
stance phase duration (s)
C
y = 0.01x + 7.56 ,R² = 0.37
y = 0.01x + 7.51 ,R² = 0.37
y = 0.01x + 7.56 ,R² = 0.37
stride length (mm)
D
y = 0.26x-0.82,R² = 0.93
y = 0.26x-0.81,R² = 0.92
y = 0.26x-0.82,R² = 0.93
stride frequency (Hz)
walking speed (mm s-1)
Camponotus fellah medias
E
y = 0.80x-0.63,R² = 0.85
y = 0.91x-0.67,R² = 0.82
y = 0.53x-0.54,R² = 0.75
swing phase duration (s)
F
y = 5.99x-1.03,R² = 0.97
y = 5.27x-0.99,R² = 0.88
y = 7.61x-1.09,R² = 0.98
stance phase duration (s)
G
y = 0.02x + 8.15 ,R² = 0.43
y = 0.02x + 8.15 ,R² = 0.41
y = 0.02x + 8.05 ,R² = 0.45
stride length (mm)
H
y = 0.21x-0.84,R² = 0.95
y = 0.21x-0.84,R² = 0.95
y = 0.22x-0.83,R² = 0.95
stride frequency (Hz)
walking speed (mm s-1)
front legs
middle legs
hind legs

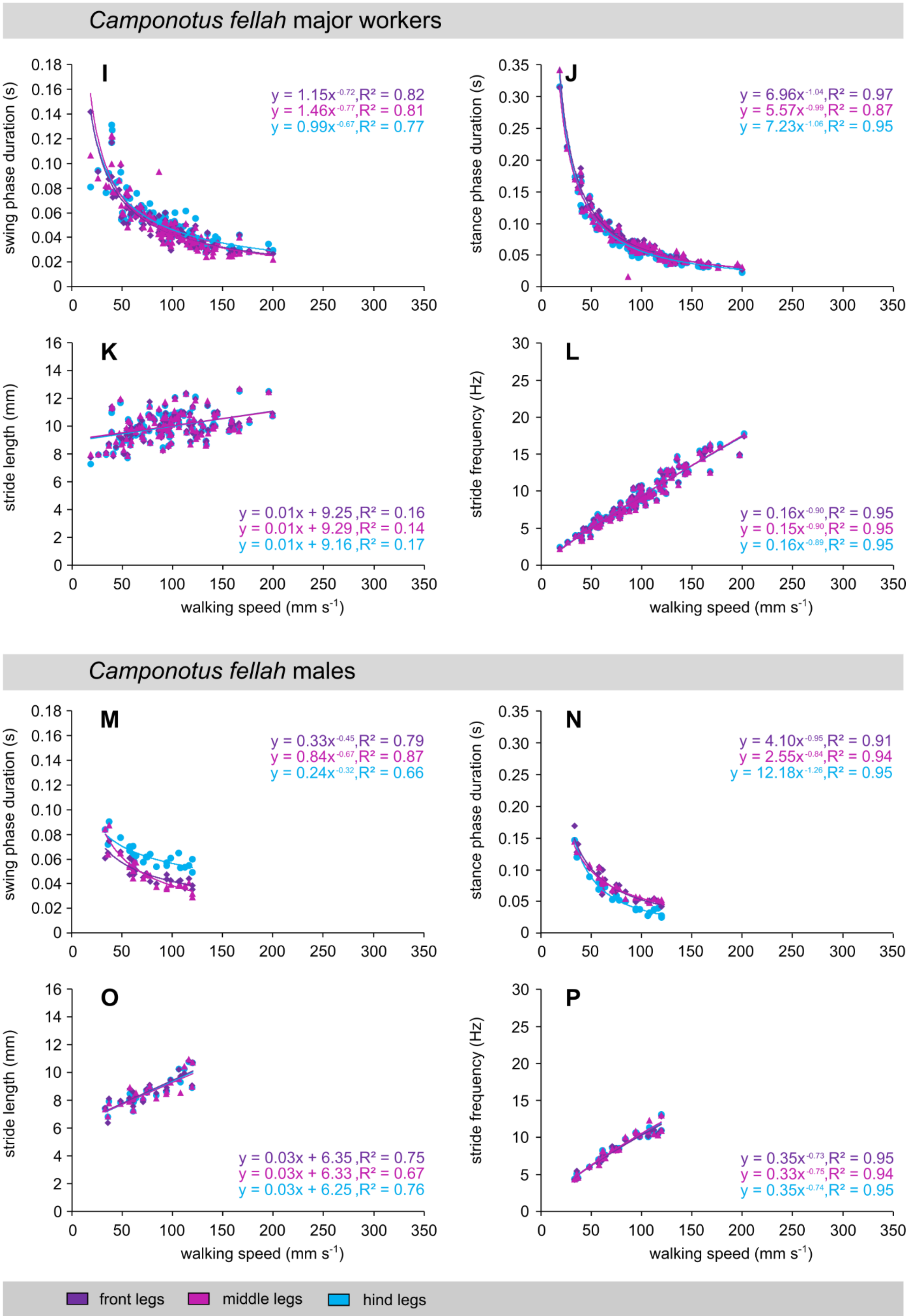

Camponotus fellah major workers
I
swing phase duration (s)
y = 1.15x-0.72,R² = 0.82
y = 1.46x-0.77,R² = 0.81
y = 0.99x-0.67,R² = 0.77
J
stance phase duration (s)
y = 6.96x-1.04,R² = 0.97
y = 5.57x-0.99,R² = 0.87
y = 7.23x-1.06,R² = 0.95
K
stride length (mm)
y = 0.01x + 9.25 ,R² = 0.16
y = 0.01x + 9.29 ,R² = 0.14
y = 0.01x + 9.16 ,R² = 0.17
walking speed (mm s-1)
L
stride frequency (Hz)
y = 0.16x-0.90,R² = 0.95
y = 0.15x-0.90,R² = 0.95
y = 0.16x-0.89,R² = 0.95
walking speed (mm s-1)
Camponotus fellah males
M
swing phase duration (s)
y = 0.33x-0.45,R² = 0.79
y = 0.84x-0.67,R² = 0.87
y = 0.24x-0.32,R² = 0.66
N
stance phase duration (s)
y = 4.10x-0.95,R² = 0.91
y = 2.55x-0.84,R² = 0.94
y = 12.18x-1.26,R² = 0.95
O
stride length (mm)
y = 0.03x + 6.35 ,R² = 0.75
y = 0.03x + 6.33 ,R² = 0.67
y = 0.03x + 6.25 ,R² = 0.76
walking speed (mm s-1)
P
stride frequency (Hz)
y = 0.35x-0.73,R² = 0.95
y = 0.33x-0.75,R² = 0.94
y = 0.35x-0.74,R² = 0.95
walking speed (mm s-1)
front legs
middle legs
hind legs

Fig. S2. Walking parameters - single leg pair analysis. (**A-P**) Values for the respective leg pairs (front legs (purple), middle legs (violet), hind legs (blue)) in relation to absolute walking speeds for minor workers, medias and major workers, and for males. (**A, E, I, M**) Swing phase duration; (**B, F, J, N**) Stance phase duration; (**C, G, K, O**) Stride length; (**D, H, L, P**) Stride frequency. Statistically significant differences between the three leg pairs of workers and males occurred for swing phase duration (test for correlation, *$P<0.05$) in all worker subcastes and males and for stance phase duration in minors, medias and males (test for correlation, *$P<0.05$). This characteristic had already been described for different desert ant species: middle legs perform the highest swing speeds and therefore spend less time in swing phase than do front and hind legs (see Wahl et al., 2015; Tross et al., 2021). Therefore, and for clarity reasons and due to the fact that all castes and also subcastes exhibited this characteristic, walking parameters were averaged for all six legs in the main analysis despite minor differences. Furthermore, striking differences occurred in swing and stance phase durations of males: hind legs spent less time in stance phase than front and middle legs (*$P<0.05$). This is due to their clearly shorter hind legs compared to the worker subcastes (see Fig. 2, Movie S1).

Tross, J., Wolf, H. and Pfeffer, S. E. (2021). Allometry in desert ant locomotion (*Cataglyphis albicans* and *Cataglyphis bicolor*) - does body size matter? *J. Exp. Biol.* **224**, doi: 10.1242/jeb.242842

Wahl, V., Pfeffer, S. E. and Wittlinger, M. (2015). Walking and running in the desert ant *Cataglyphis fortis*. *J. Comp. Physiol. A*. **201**, 645-656. doi:10.1007/s00359-015-0999-2

3. Phase analysis - duty factor

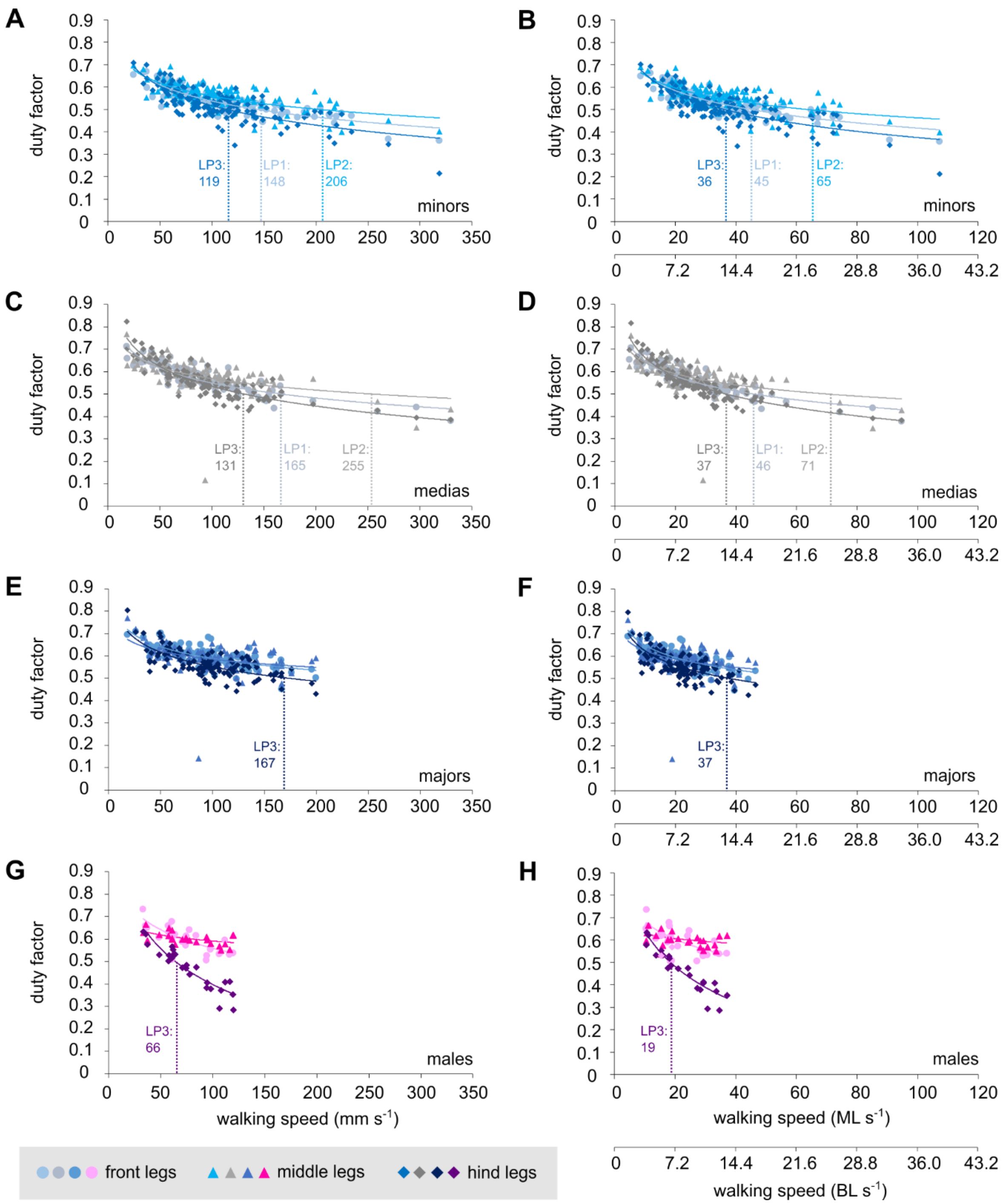
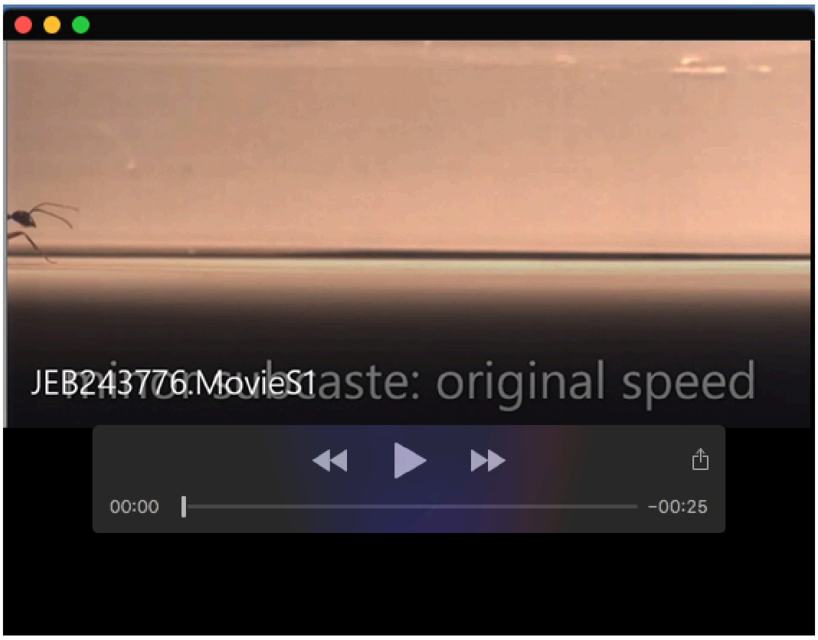


Fig. S3. Duty factor. Duty factor (ratio of stance phase to cycle period) plotted as function of **absolute** (left) and **relative** (right, mesosoma lengths per second (ML s^{-1}) and body lengths per second (BL s^{-1})) speed for the three leg pairs in the worker subcastes and in males. With increasing speed, duty factor decreased non-linearly for all three leg pairs in all castes and subcastes (logarithmic approximation). Minors changed from walking to running (duty factor for all leg pairs below 0.5) at the lowest absolute and relative speeds, followed by medias. In comparison, majors and males did not make the transition from walking to running in the observed speed range. The transition from walking to running is marked with dotted lines in each case and the respective speeds are given. Duty factor analysed for (**A**) minors and absolute, (**B**) relative speeds; (**C**) medias and absolute, (**D**) relative speeds; (**E**) majors and absolute, (**F**) relative speeds; (**G**) males and absolute, (**H**) relative speeds. Legend: front legs (leg pair 1, LP1): circles; middle legs (LP2): triangles; hind legs (LP3): rectangles.

4. Vertical movement of the COM and tarsus movement



Movie 1. Vertical movement of the centre of mass (COM) and the tarsi in *Camponotus fellah* workers and males. Sample high-speed videos in lateral view of minors, medias and major workers and of males in original speed and slow motion (x0.0625). All ants moved at an intermediate walking speed (minor caste: ~100 mm s^{-1}, media caste: ~75 mm s^{-1}, major caste: ~80 mm s^{-1}, male caste: ~90 mm s^{-1}).

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5. Momentary (frame-by-frame) inter-leg coordination patterns

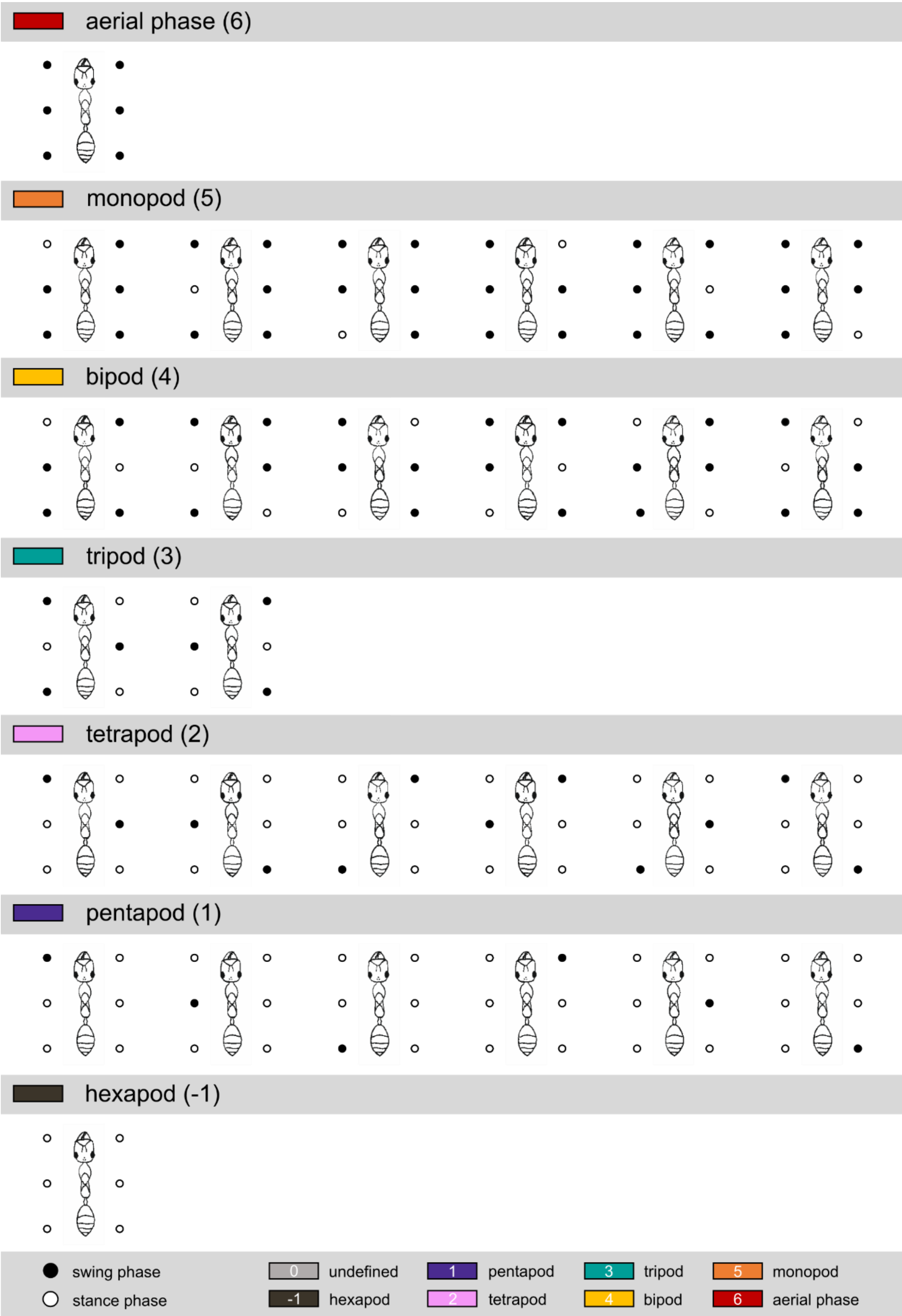

Fig. S4. Inter-leg coordination patterns. Every video frame was assigned a (momentary) leg coordination pattern (index number and colour), according to the combination of legs in swing and stance phase. If none of the described combinations was applicable, the frame was assigned 'undefined' (0, grey). Note that the coordination patterns are defined by a certain combination of specific legs in the air and on the ground and not just by the absolute number of legs in swing or stance phase.

6. Inter-leg coordination patterns - quantitative analysis (colour and number indices)

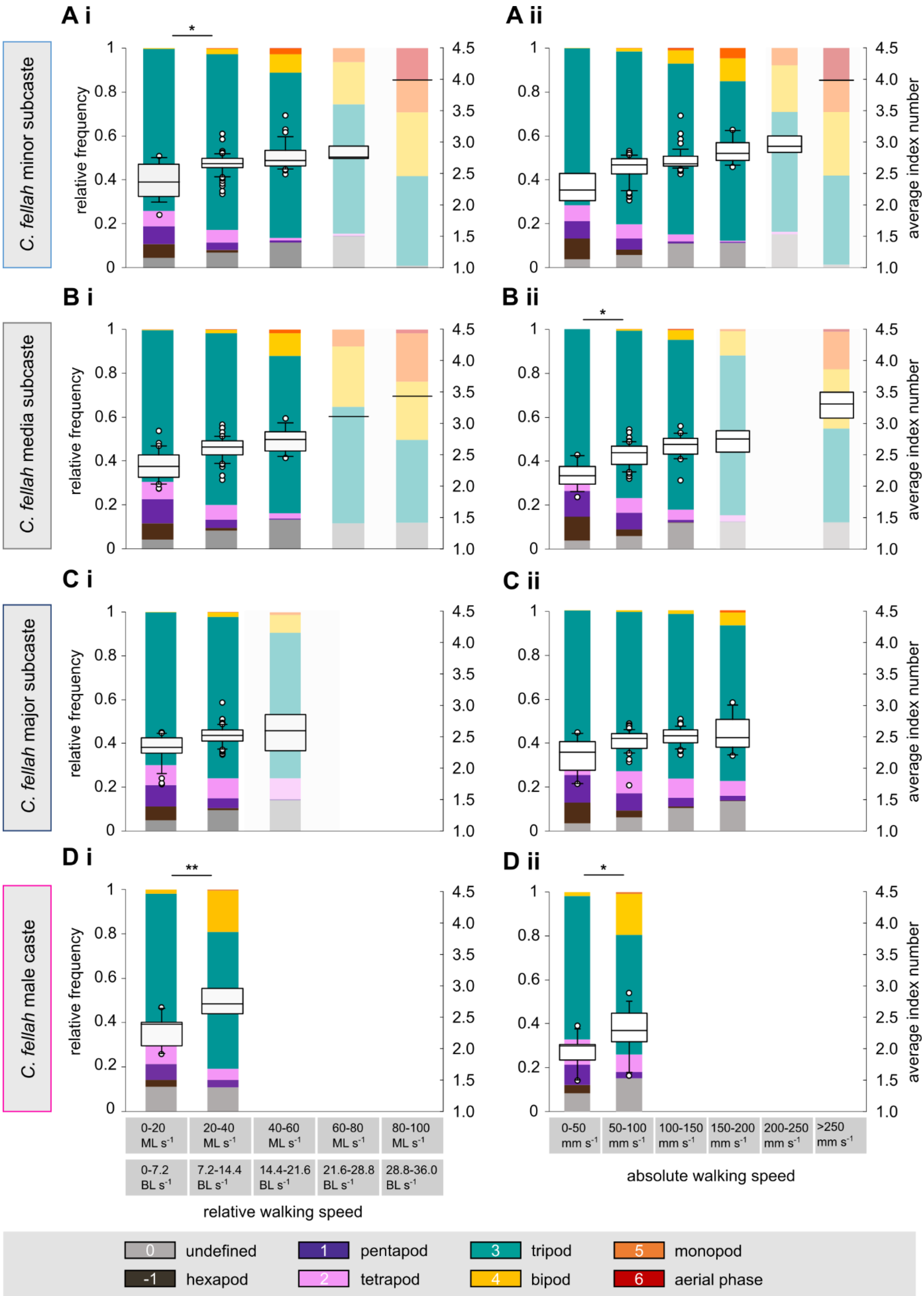

Fig. S5. Quantitative analysis of inter-leg coordination patterns. Analysis according to walking speed classes (relative speeds: 0-20 to 80-100 ML s^{-1}/ 0-7.2 to 28.8-36.0 BL s^{-1}, left (i), and absolute speeds: 0-50 to > 250 mm s^{-1}, right (ii)) for minors (**A**, n=129), medias (**B**, n=93), majors (**C**, n=99), and for males (**D**, n=30). Data are shown as relative frequency plots (colour index, left ordinate) and averaged index numbers (number index, right ordinate) for the respective walking speed bins. Each video frame was assigned an index number and a corresponding colour according to the leg coordination in that frame (see colour and number key at bottom of figure). For an exact definition of inter-leg coordination patterns see Fig. S4. No data were available for walking speeds > 40 ML s^{-1} in males and only n=3 majors, n=2 medias and n=5 minors reached relative walking speeds of > 40 ML s^{-1}, > 60 ML s^{-1} and > 60 ML s^{-1}, respectively (transparent columns, data not included in further comparisons, but illustrating trend). Regarding relative walking speeds, notable differences in leg coordination pattern distribution were observed in minors and medias at walking speeds > 60 ML s^{-1}. The consistent presence of tetrapod coordination in major workers and the comparably high bipod fraction in the 20-40 ML s^{-1} speed bin of males were notable. Statistically significant differences occurred between the 0-20 and 20-40 ML s^{-1} speed bins in minors (ANOVA on ranks, *P<0.05) and in males (t-test, ** P<0.01). When comparing number indices of minors, medias, majors and males for the above speed bins regarding relative speed, there were statistically significant differences for the 20-40 ML s^{-1} bins (ANOVA on ranks, ***P<0.001). Regarding absolute walking speeds, statistically significant differences occurred between the 0-50 and 50-100 mm s^{-1} speed bins in medias (ANOVA on ranks, *P<0.05) and males (t-test, *P<0.05).