Supporting Information to accompany:

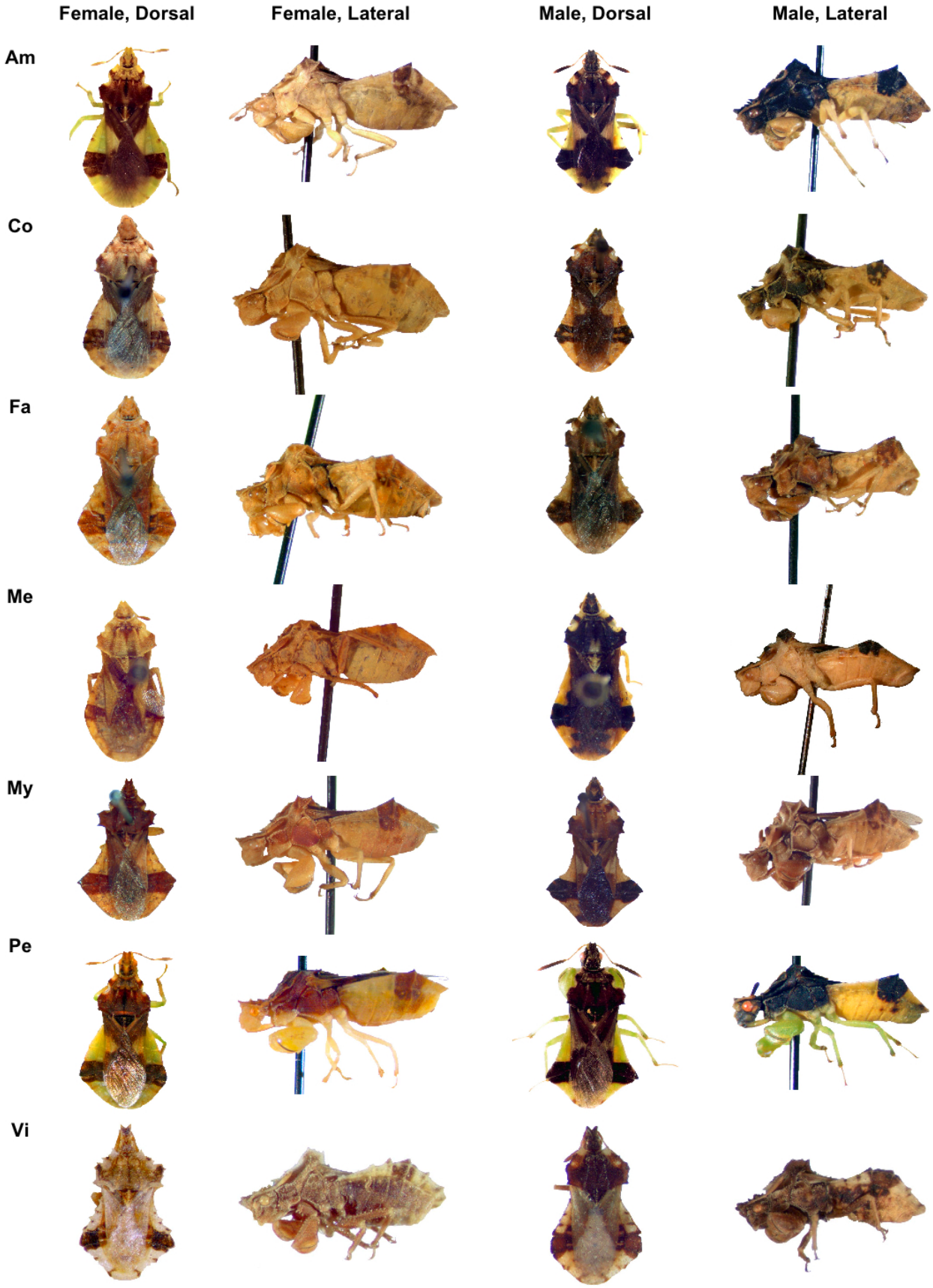
Punzalan, D and Rowe, L. Evolution of sexual dimorphism in phenotypic covariance structure in *Phymata*

S1. Background information on *Phymata* and specimens

Phymata americana americana Melin, *P. americana coloradensis*, Melin, *P. americana metcalfi* Evans are considered to be a complex of geographical subspecies (Melin 1930, Evans 1931; but see Kormilev 1962) but sometimes have been lumped with *P. pennsylvanica* (e.g. Evans 1931, Balduf 1941). Similarly, *P. f. fasciata* (synonymous with *P. wolfii* and *P. f. georgiensis,* following Froeschner, 1988) and its neighbour to the south, *P. f. mystica*, have been associated with each other due to confusion over nomenclature and likely misidentifications. We also included data for a species, *P. vicina vicina* Handlirsch, which is rarely collected despite a rather wide geographic distribution. All seven species are thought to share similar habits (e.g. terrestrial, anthophilous, generalist, sit-and-wait predators) though detailed studies of the ecology and life history is mostly restricted to a few of these (e.g. Balduf 1939, 1941; Dodson and Marshall 1984a, 1984b, McLain and Boromisa 1987, Yong 2003, 2005; Punzalan et al. 2008c, 2010).

Specimens used in the study came from the Canadian National Collection of Insects, Arachnids and Nematodes (Ottawa, Canada), American Museum of Natural History (New York, USA), University of Michigan Museum of Zoology (Ann Arbor, USA), Carnegie Museum of Natural History (Pittsburgh, USA), Smithsonian Museum of Natural History (Washington D.C., USA) and the Royal Ontario Museum (Toronto, Canada). Species identifications for *americana* and *pennsylvanica* were double-checked and, if necessary, determinations were made following the keys in Evans (1931) and Kormilev (1962). For the other 5 species, identifications were usually taken at face value, except for those (130) specimens originating from the Carnegie Museum of Natural History, for which specimens were identified or verified by DP.

S2. *Phymata* spp. sexual colour pattern dimorphism. Representative images illustrating colour pattern of *Phymata americana* (Am), *P. coloradensis* (Co), *P. fasciata* (Fa), *P. metcalfi* (Me), *P. mystica* (My), *P. pennsylvanica* (Pe) and *P. vicina* (Vi), when viewed from the dorsal and lateral aspects. Images are not to scale, nor standardized for colour. Also note that dorsal and lateral images are not necessarily for the same individual.


Female, Dorsal
Female, Lateral
Male, Dorsal
Male, Lateral
Am
Co
Fa
Me
My
Pe
Vi

S3. Detailed methods for image data collection and analysis.

Methodology for obtaining and analyzing images utilized Scion® Image (http://www.scioncorp.com) and follows Punzalan et al. (2008c) but was modified to accommodate preserved specimens, rather than live animals. Specimens were placed on a custom made stage with an adjustable (position) colour and length standard: four printed squares (hypotenuse 4.03mm) of black, 50%, gray 25% gray and white. These corresponded to average (adjusted) values of 261, 143, 92 and 60, respectively. Previous work has shown that the protocol has repeatabilities upwards approximately 0.90 (Punzalan et al. 2008c).

The standard also accommodated a unique specimen identification (numeric) label. The standard and specimen were aligned with the appropriate plane of focus for the corresponding photographs from dorsal and lateral aspects. Photography was conducted using a Nikon Coolpix™ 995 or 4500 digital camera with an LED ring light (Nikon SL-1). During analyses of photographs, each image was recalibrated according to the known values from the colour/length standards. MD and ML are measures of mean pixel value and were taken from a circular patch on the dorsal surface of the pronotum (between the left or right posterior lobe and longitudinal ridge) and on the mesopleuron, respectively. Identification labels as well as the date of photography accompany the specimens, which were returned to their museum/collection of origin.

S4. Phenotypic variance-covariance matrices (P) and corresponding jackknife standard errors (parentheses), estimated separately by sex and species (see Methods). Values have been multiplied by 10^4 to facilitate readability.

Species		Female			Male		
		PN	**MD**	**ML**	**PN**	**MD**	**ML**
americana	**PN**	39.44			41.68		
		(6.81)			(5.31)		
	MD	-6.96	166.50		-4.40	69.74	
		(7.39)	(24.64)		(5.97)	(12.05)	
	ML	-8.66	82.29	189.04	-14.23	94.31	296.34
		(9.40)	(19.19)	(33.77)	(9.99)	(17.32)	(41.61)
coloradensis	**PN**	41.12			42.11		
		(8.68)			(7.28)		
	MD	5.45	188.18		30.82	181.84	
		(11.91)	(28.87)		(11.61)	(38.68)	
	ML	9.47	89.22	193.34	62.95	140.77	545.46
		(9.31)	(24.97)	(40.06)	(19.79)	(40.47)	(93.78)
fasciata	**PN**	47.91			42.48		
		(12.06)			(10.07)		
	MD	15.76	160.24		21.66	181.12	
		(11.23)	(35.26)		(12.22)	(39.49)	
	ML	25.43	110.39	164.03	5.15	160.98	256.85
		(11.32)	(29.75)	(44.83)	(13.98)	(45.09)	(69.06)
metcalfi	**PN**	53.74			44.20		
		(12.82)			(6.10)		
	MD	8.80	347.12		13.11	134.95	
		(39.91)	(166.28)		(9.09)	(37.16)	
	ML	7.25	103.14	264.05	24.00	102.20	289.96
		(24.75)	(55.18)	(59.84)	(12.04)	(27.54)	(104.62)
mystica	**PN**	73.77			53.25		
		(13.31)			(9.89)		
	MD	15.80	334.38		28.94	308.59	
		(24.17)	(44.87)		(15.28)	(48.39)	
	ML	71.91	204.50	364.04	48.81	409.71	660.92
		(29.87)	(49.73)	(75.37)	(20.19)	(72.42)	(116.82)
pennsylvanica	**PN**	35.27			40.23		
		(5.38)			(5.36)		
	MD	-10.29	77.35		-1.17	103.30	
		(6.43)	(11.49)		(5.65)	(11.28)	
	ML	-15.11	67.06	128.56	13.24	109.20	185.06
		(8.31)	(14.41)	(23.79)	(7.58)	(13.01)	(18.31)

vicina	**PN**	30.59			61.86		
		(17.62)			(14.15)		
	MD	6.59	148.43		25.10	121.32	
		(18.47)	(66.63)		(16.62)	(32.14)	
	ML	9.06	119.05	195.25	18.66	138.67	285.74
		(23.37)	(71.09)	(79.56)	(21.24)	(29.97)	(46.50)

S5. Effects of sex, latitude and their interaction on trait expression. Results are from ANCOVA analyses for each trait, performed separately by species. Within species, degrees of freedom, in parentheses (numerator, denominator), were the same for each model effect and trait. Significant (at $\alpha = 0.05$) *P*-values are indicated with asterisks.

SPECIES (DF)/ EFFECT	PN			MD			ML		
	F	***P***		***F***	***P***		***F***	***P***	
americana (1,224)									
Sex	129.95	< 0.0001	*	386.09	<0.0001	*	407.58	<0.0001	*
Latitude	15.59	0.0001	*	15.96	<0.0001	*	0.01	0.9383	
Sex*Latitude	0.12	0.9074		12.25	0.0006	*	0.45	0.5028	
coloradensis (1,112)									
Sex	116.98	<0.0001	*	125.00	<0.0001	*	13.25	0.0004	*
Latitude	5.40	0.0291	*	3.51	0.0638		0.01	0.9049	
Sex*Latitude	1.03	0.3121		2.75	0.1002		<0.01	0.9429	
fasciata (1,77)									
Sex	59.72	<0.0001	*	15.18	0.0002	*	12.28	0.0008	*
Latitude	6.20	0.0149	*	5.27	0.0244	*	7.32	0.0084	*
Sex*Latitude	0.45	0.5030		0.10	0.7560		1.30	0.2577	
metcalfi (1,111)									
Sex	49.50	<0.0001	*	272.95	<0.0001	*	0.06	0.8019	
Latitude	1.93	0.1683		1.05	0.3088		2.21	0.1399	
Sex*Latitude	1.48	0.2262		2.72	0.1019		1.07	0.3031	
mystica (1,115)									
Sex	29.61	<0.0001	*	11.48	0.0010	*	27.66	<0.0001	*
Latitude	4.06	0.0462	*	0.06	0.8027		0.22	0.6378	
Sex*Latitude	5.16	0.0250	*	0.10	0.7578		0.08	0.7718	
pennsylvanica (1,252)									
Sex	271.56	<0.0001	*	76.43	<0.0001	*	131.19	<0.0001	*
Latitude	7.98	0.0051	*	0.48	0.4874		0.11	0.7446	
Sex*Latitude	0.96	0.3277		3.64	0.0576		3.07	0.0811	
vicina (1,53)									
Sex	0.66	0.4193		60.95	<0.0001	*	17.48	0.0001	*
Latitude	5.29	0.0254	*	0.89	0.3498		<0.01	0.9987	
Sex*Latitude	0.18	0.6699		1.60	0.2118		3.21	0.0788	

S6. Intraspecific latitudinal variation in trait expression. Depicted are bivariate scatterplots of pronotum width (PN, left column), mean dorsal darkness (MD, middle column) and mean lateral darkness (ML, right column) against latitude for female (open circles) and male (closed triangles) *americana* (Am), *coloradensis* (Co), *fasciata* (Fa), *metcalfi* (Me), *mystica* (My), *pennsylvanica* (Pe) and *vicina* (Vi). Species are arranged (top to bottom) in rows in order of decreasing average latitude. Dotted lines indicate ordinary least squares regression lines, peculiar to species and sex.

S7. Leading eigenvectors ($\mathbf{P}_{max}$) and percent variance explained for females (F) and males (M) of the seven *Phymata* spp. Species are listed in order of increasing average species latitude.

Species	Sex	% explained	PN	MD	ML
mystica	F	74.2	0.130	0.667	0.734
	M	91.4	0.064	0.549	0.834
fasciata	F	74.2	0.127	0.693	0.710
	M	80.2	0.051	0.622	0.782
coloradensis	F	66.4	0.044	0.696	0.717
	M	78.3	0.123	0.323	0.938
pennsylvanica	F	62.7	-0.128	0.562	0.817
	M	79.5	0.046	0.568	0.822
vicina	F	72.8	0.042	0.635	0.772
	M	78.4	0.093	0.496	0.863
americana	F	66.2	-0.050	0.656	0.753
	M	81.2	-0.051	0.340	0.939
metcalfi	F	62.7	0.031	0.828	0.560
	M	73.2	0.091	0.443	0.892

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