

Supplementary Information

Sexual dimorphism, allometry, and interspecific variation in the cranial morphology of seven *Meriones* species (Gerbillinae, Rodentia)

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Table S1 Museum voucher numbers of examined specimens.

Meriones libycus

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

326941, 326942, 326943, 326944, 326969, 326970, 326971, 326973, 328266, 328267, 328269, 369798, 369799, 369801, 369802, 369806, 369808, 369810, 369812, 369814, 369815, 369817, 369818, 369819, 369822, 369824, 369826, 369827, 369828, 369829, 369831, 369832, 369833, 369834, 354682, 326968, 328257, 328258, 328260, 328262, 328264, 328265, 354690, 354691, 354692, 354695, 341256, 341258, 341261, 341262, 341263, 341264, 341265, 341266, 341267, 328224, 328225, 328271, 328272, 328273, 328274, 328275, 329188, 329189, 329190, 329191, 354696, 354661, 350558, 350559, 350572, 354647, 354649, 354650, 354652, 354653, 354664, 354665.

British Museum of Natural History (London, UK)

40.259, 1983.314, 40.257, 25.4.3.43, 25.4.3.23, 10.3.12.4, 25.4.3.25, 5.7.2.3, 25.4.3.20, 47.383, 56.2.29.5, 19.12.10.3, 47.1412, 47.1414.

Type materials: *M. l. aquilo*, *M. l. gaetulus*, *M. l. cuscaudatus*, *M. schousboeii*, *M. s. edithae*, *M. s. evelynae*, *M. syrius*.

Zoological Museum of Ferdowsi University of Mashhad (Mashhad, Iran)

M564, M799, M810, M785, 322, 245, M-35, 1021, 30, 1499, 909, 1473, 1504, 303, 208, 474, 1470, 1468, M844, M571, 1506, 1471, 217, M-17, M-35, 157, M-3, 39, M-28, M-36, 205, 212, M-21, 174, M-29, 1469, 24, M-34, M-7, 518, M-37, 176, 563, M-1, 1482, 574, 461, 88, 9, M-572, M-579, M-12, M-808, 4, M-432, M343, 2, M-331, M-188, M-646, M-196, M-11, 850, 11, M-111, M-842, M-573, 7, M-175, M-548, 14, M-694, M-568, M-236, M-251, 840, 577, 106, M-3, M-12.

Musée National d'Histoire Naturelle (Paris, France)

1950.468, 1950.508, 1957.1330, 1957.1338, 1957.1339, 1958.89, 1958.91, 1958.330, 1958.331, 1958.336, 1958.341, 1958.342, 1958.343, 1958.344, 1958.345, 1958.346, 1958.347, 1958.351, 1958.352, 1958.750, 1957-334, 1957-335, 1957-332, 1957-336.

Royal Belgian Institute of Natural Sciences (Brussels, Belgium)

10186, 10190, 10189, 10187, 10348, 10322, 10192, 10078, 10137, 10283, 10184, 10497, 10185, 10188, 10318, 10319, 10082, 10282, 10194.

Meriones crassus

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

328235, 328236, 350507, 350508, 350509, 350479, 350481, 329156, 329157, 350468, 350470, 350471, 350472, 350475, 350476, 350477, 350478, 354739, 354741, 354743, 369465, 369466, 350500, 350501, 350503, 350505, 326904, 326905, 326906, 326910, 326911, 326914, 326915, 326916, 326918, 326919, 326920, 326921, 326922, 326923, 326924, 326926, 326928, 326931, 326932, 326935, 326937, 326940, 326947, 328228, 328230, 328231, 328232, 328233, 328245, 328246, 328248, 354732, 354733, 354734, 354735, 354736, 350484, 350487, 350488, 350489, 350490, 350491, 350492, 350493, 350494, 350196, 350497, 350498, 350512, 354710, 354711, 354712, 354713, 354714, 354715, 3564716, 354717, 354718, 354719, 354721, 354722, 354723, 354724, 354727, 354729, 354699, 354701, 354702, 354703, 354704, 354705, 354706, 354707, 354708, 354709, 328237, 328238, 328239, 328240, 328243, 329151, 329153, 329154, 329155, 354738, 369467, 369468, 369470, 369471, 369472, 369473, 369474, 369476, 369486, 369489, 369490, 369491, 369492, 369493, 369505, 369506, 369507, 322693, 322659, 322660, 322661, 322662, 322663, 322664, 322665, 322666, 322667, 322668, 322694, 322695, 282504, 282505, 282506, 282507, 282508, 282509, 282512, 282513, 283230, 283231, 321872, 321873, 321874, 401157, 401158, 401159, 401160, 401161, 401162,

401163, 401165, 401166, 401167, 401168, 401169, 401171, 401172, 401173, 401174, 401175, 401176, 401177, 401178, 401179, 401180, 401181.

Field Museum of Natural History (Chicago, USA)

103308, 103311, 103312, 103313, 103314, 103315, 103317, 103318, 103319, 103321, 103322, 103323, 97234, 97238, 97227, 97231, 97232, 97249, 97214, 97216, 97220, 97221, 97223, 97248, 111954, 111655, 153162, 153161, 179005, 179008, 87612, 87618.

British Museum of Natural History (London, UK)

19.7.7.2356, 19.7.7.2808, 47.508, 47.514, 47.510, 47.518, 47.509, 47.513, 95.350, 47.523, 47.529, 66.2584, 471537, 471535, 471538, 1979.2052, 1968.949, 1968.947, 1968948, 206814, 1957.10, 206813, 846146, 1023243, 51311, 196124, 196125, 54247, 23241.

Type materials: *M.c.pallidus*, *M. charon*, *M. ismahelis*, *M. pelerinus*, *M. c. tuareg*, *M. tripolius*,
CoType: *M.longifrons*,
LectoType: *M.longifrons*.

The Musée National d'Histoire Naturelle (Paris, France)

1997-403, 1957.1340, 1955.21, 1957.519, 1953.4230, 1957.1036, 1957.1039, 1957.1043, 1953.425, 1958.104, 1957.1042, 1957.1037, 1957.1038, 1991.1220, 1952.532, 1957-329, 1957-325, 1957-314, 1958-63, 1957-321, 1957-528, 1957-316, 1958-61, 1958-62, 1957-825, 1957-318, 1957-328, 1957-330, 1966-1054, 1957-823, 1957-311, 1957-315, 1957-309, 1957-307, 1957-312, 1957-320, 1958-6423, 1957-306, 1957-326, 1957-323, 1958-65, 1957-322, 1958-107, 1958-106, 1957-1354, 1995-1700.

Meriones tristrami

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

369843, 350513, 327435, 327436, 327437, 327438.

Field Museum of Natural History (Chicago, USA)

181370, 97383, 97384, 97385, 112123, 112124, 112125, 112126, 112115, 112116, 112122, 97379, 97381, 97386, 97387, 97389, 97390, 97391, 111952, 179029, 179030, 179031, 179032, 179034, 179035, 179036, 179037, 122288, 122289, 122290, 122295, 122297, 122300, 122306, 122303, 97383.

Musée National d'Histoire Naturelle (Paris, France)

1957-299, 1957-1371, 1957-1381, 1957-1373, 1957-1390, 1957-1380,

Meriones persicus

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

354661, 350558, 350559, 350572, 354647, 354649, 354650, 354652, 354653, 354664, 354665, 326875, 326876, 326877, 326879, 326880, 326881, 326882, 326884, 326885, 326886, 326887, 326890, 326892, 326894, 326895, 326896, 326897, 326898, 326903, 341248, 350560, 350562, 350563, 350564, 350565, 350566, 350568, 350570, 350571, 341249, 341251, 354654, 354655, 354656, 354657, 354658, 354659, 328336, 328337, 328338, 329181, 353657, 353658, 353659, 353660, 353684, 353695, 353696, 353697, 353698, 411090, 411091, 411093, 411094, 413607, 413608, 411087.

Field Museum of Natural History (Chicago, USA)

97295, 97290, 97314, 57896, 57899, 57289, 57290, 57295, 57298, 97300, 97303, 97304, 97305, 97309, 97313, 97314, 97342, 97343, 97347, 97349, 84508, 111801, 111940, 111944, 111945, 111951, 111953, 111964, 111998, 112003, 112034, 112035, 103500, 103503, 103505, 103507, 103508, 103397, 103398, 103399, 103402, 103403, 103404, 103405, 103485, 103486, 103487, 103523, 103524, 103525, 103526, 103527, 84464, 97358, 97360, 111968, 111982, 111986, 111989, 111992, 111979, 11980, 11982, 112021, 112023.

British Museum of Natural History (London, UK)

77.3052, 20.5.20.3, 20.2.9.21, 19.11.8.42, 19.11.7.72, 71.1581, 16.11.7.68, 19.11.7.71, 70.20.24, 70.20.23.

Zoological Museum of Ferdowsi University of Mashhad (Mashhad, Iran)

1399, 10, 14, 1396, 6, 1394, 28, 1395, 22, 24, 1397, 11, 27, 18, 8, 498, 135, 18, 333, 1392, 655, M-18, 566, 114, 320, 321, 315, M-15, 317, M-1111, M-1116, M-1113, M-1115, M-1110, M-110, 1571, M-1114, 1112, M560, 1398.

Musée National d'Histoire Naturelle (Paris, France)

1947.846, 1947.848, 1950.419, 1950.420, 1950.421, 1950.430, 1950.431, 1957.978, 1957.993, 1985.1628, 1991.241, 1957-290, 1957-203, 1957-257, 1957-200, 1957-221, 1957-285, 1957-245, 1957-215, 1957-226, 1957-234, 1957-273, 1957-186, 1957-983, 1957-209, 1957-272, 1957-210, 1957-283, 1957-229, 1957-223, 1957-246, 1957-227, 1957-231, 1957-232, 1957-190.

Royal Belgian Institute of Natural Sciences (Brussels, Belgium)

10498, 10369, 10072, 10363, 10051, 10427, 10365, 10034, 10043, 10370, 10038, 10425, 10026, 10366, 10041, 10039, 10361, 10368, 10025, 10042, 10044, 9884, 10377, 10364, 10379, 10032, 10074, 10064, 10373, 10031.

Meriones vinogradovi

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

354662, 354663.

Field Museum of Natural History (Chicago, USA)

97395, 97396, 97399, 97400, 97401, 97402, 97403, 97404, 97405, 97406, 97409, 97410, 97407, 97408.

Musée National d'Histoire Naturelle (Paris, France)

1950.459, 1950.468, 1950.476, 1950.477, 1950.478, 1950.481, 1953.426, 1957.522, 1958.265, 1985.1627, 1985.1630

Royal Belgian Institute of Natural Sciences (Brussels, Belgium)

10179, 10417, 9895, 10493, 9890, 9893, 10320, 9885, 9897, 9891, 10278, 10277, 10274, 10411, 9898, 9886, 9888, 10273, 10423, 10419, 9894, 10279.

Meriones meridianus

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

155056, 155057, 155059, 155061, 155064, 172526, 172527, 172528, 172571, 172576, 174998, 259528, 259529, 326872, 326873, 326874, 326908, 326909, 329161, 329162, 329164, 329165, 329166, 329168, 329169, 329170, 573110, 573118, 573119, 573120, 573121, 573122, 573123, 576210, 576211, 576212, 576205, 576206, 576207, 576208, 576209, 576210, 576211, 576212, 576213, 576214, 576216, 576217, 576218, 576219, 576220, 62149, 62150.

Field Museum of Natural History (Chicago, USA)

106654, 21911, 32729, 32730, 32731, 32732, 32734, 32737, 32739, 32741, 32742, 32743, 32744, 32746, 32747, 32749, 36134, 43426.

British Museum of Natural History (London, UK)

9.1.1.73, 9.1.1.83, 9.1.1.811, 9.1.1.85, 9.1.1.81, 9.1.1.76, 9.1.1.79, 9.1.1.69, 9.1.1.74, 9.1.1.71, 29.11.7.46, 89.11.7.47, 28.10.24.18, 14.5.10.88, 14.5.10.89, 14.5.10.92, 14.5.10.85, 14.5.10.86, 14.5.10.91, 114.5.10.91, 14.5.10.83, 14.5.10.84, 12.6.2.21, 12.6.2.22, 66.2091, 66.2092, 9.4.3.54, 9.4.3.50, 9.4.3.47, 9.4.3.49, 9.4.3.55, 9.4.3.52, 9.4.3.48.

Musée National d'Histoire Naturelle (Paris, France)

1957-1352, 1959-121, 1975-7, 1975-5, 1975-4, 1975-3.

Meriones hurrianae

Smithsonian Natural Museum of Natural History (Washington D.C. USA)

328339, 329183, 353682, 353683, 369161, 369162, 369163, 369164, 369165, 369166, 369510, 369518, 369519, 411108, 411110, 411111, 411113, 411115, 411116, 411117, 411118, 411119, 411120, 411121, 411122, 411124, 411126, 411127, 411128, 411129,

411130, 411131, 411132, 411134, 411135, 411136, 411137, 411138, 411139, 411140, 411141, 411142.

Field Museum of Natural History (Chicago, USA)

83071.

British Museum of Natural History (London, UK)

1911854, 74112118, 1911849, 1911851, 1911853, 763101.

Musée National d'Histoire Naturelle (Paris, France)

1328, 1329.

Table S2 Description of cranial landmarks used in this study. The descriptions are based on the terminology of Tong (1989) and Popesko et al. (2002). All landmarks were taken on the ventral view of the cranium, and the numbers of the landmarks correspond to the numbers that appear in Fig. 1.

	Description
1	rostral tip of internasal suture
2	most lateral junction point of incisive alveolus and body of premaxillary bone
3	most rostral point of incisive foramen
4	most caudal point of incisive foramen
5	most rostral point of palatine foramen
6	most caudal point of palatine foramen
7	most rostral point of premolar on alveolar process
8	most caudal point of third molar on border of alveolar process
9	most caudal point of median suture of palatine bone
10	most rostral point of foramen magnum
11	most lateral point of occipital condyle
12	most caudal point of acoustic tympanic bulla
13	rostral curvature point at level of the meatus
14	most caudal point of zygomatic process concavity formed by temporal bone
15	intersection between frontal squama, wing of presphenoid bone and wing of basisphenoid bone
16	most lateral point of zygomatic arch at maximum width of skull
17	rostral point of zygomatic plate
18	maximum curvature of zygomatic plate in infraorbital foramen
19	intersection of zygomatic arch and vertical line passing through most caudal point of third molar
20	intersection of the zygomatic plate and line connecting the landmarks 13 and 18

Figure S3 Morphospace represented by the first two principal components (of interspecific procrustes coordinates) occupied by each of the seven *Meriones* species (with both sexes pooled together). Symbols representing each species are indicated in the figure. The percentage of explained variance by each PC are also indicated in parentheses.

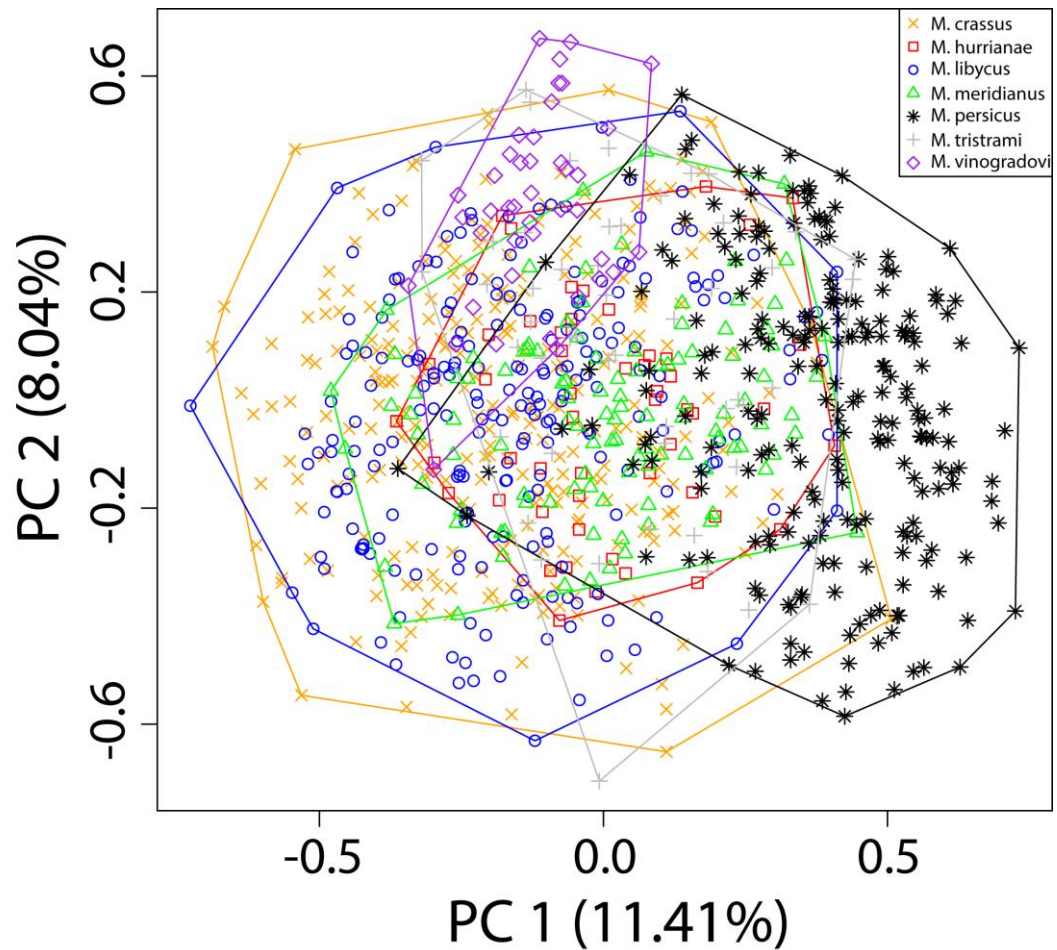


Figure S4 Differences in the log transformed centroid sizes among seven *Meriones* species when males and females were pooled together (based on the ventral cranial landmarks). Inner boxplot lines are median values, box margins are 25th and the 75th percentiles, whiskers are 5th and 95th percentiles, and points beyond the whiskers are outliers. Results of the ANOVA analyses are also shown.

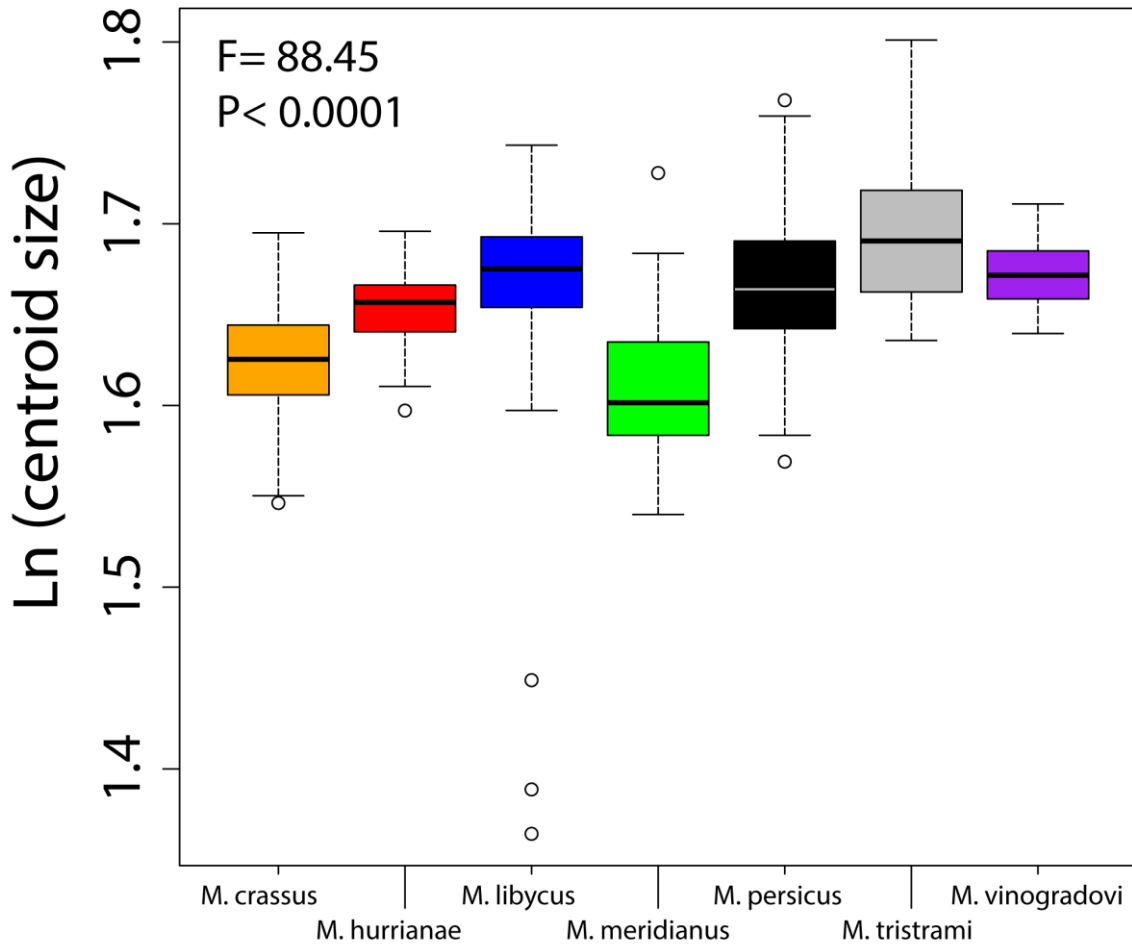


Figure S5 Scatterplot showing the outcome of a univariate linear regression of PC1 of cranial shape being regressed onto log centroid size for the seven *Meriones* species when males and females were pooled together. The statistical results of the univariate regressions for each species are also indicated on the plot following the species abbreviation. Separate best fit lines are shown for each species. The percentage of explained variance by PC1 is indicated in parentheses.

