

## Supplementary material

### **The unusual case of the widely distributed fiddler crab *Minuca rapax* (Smith, 1870) from the western Atlantic: an exemplary polytypic species**

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Supplement 1. The following intact preserved specimens were examined:

1) U.S. Museum of Natural History, Washington, DC, USA (USNM):

USNM 10370 (Louisiana), USNM 15057 (Alabama), USNM 18689 (Tampico), USNM 25033 (Texas), USNM 33031 (Texas), USNM 50690 (Rio de Janeiro), USNM 60838 (Dominican Republic), USNM 72131 (Texas), USNM 72132 (Texas), USNM 93084 (Cuba), USNM 95526 (Yucatan), USNM 96475 (Tamaulipas), USNM 121598 (holotype, *U. virens*), USNM 122205 (paratypes, *U. virens*), USNM 122765 (Texas), USNM 128129 (Louisiana), 128130 (Louisiana), USNM 138642 (Texas), USNM 138643 (Texas), USNM 138814 (Maranhão), USNM 138818 (Rio de Janeiro), USNM 138819 (Rio de Janeiro), USNM 138820 (Rio de Janeiro), USNM 138830 (Rio de Janeiro), USNM 138861 (Recife), USNM 180191 (Mississippi), USNM 180192 (Texas), USNM 180193 (Texas), USNM 180194 (Texas), USNM 180195 (Tamaulipas), USNM 180196 (Veracruz), USNM 180198 (Campeche), USNM 180199 (Yucatan), USNM 180200 (Yucatan), USNM 302846 (Texas), USNM 1081531 (Piauí), USNM 1081532 (Paiuí).

2) Naturalis Biodiversity Center, Leiden, Netherlands (RMNH):

RMNH 25144 (paratype *U. virens*), RMNH 25169 (Suriname), RMNH 25170 (Suriname), RMNH 25823 (Suriname), RMNH 25824 (Suriname), RMNH 25825 (Suriname), RMNH 26282 (Suriname), RMNH 26596 (Trinidad and Tobago), RMNH 31587 (Guyana), RMNH 32205 (St. Martin), RMNH 32206 (St. Martin), RMNH 33192 (Suriname), RMNH 35195 (Grand Cayman).

3) Zoological Museum, University of Sao Paulo, Sao Paulo, Brazil (MZUSP):

MZUSP 4217 (Rio de Janeiro), MZUSP 6221 (Maranhão), MZUSP 6222 (Maranhão), MZUSP 9367 (Rio de Janeiro), MZUSP 12311 (Pará), MZUSP 13262 (Paraíba), MZUSP 18606 (Piauí), MZUSP 18657 (Pará), MZUSP 21722 (Santa Catarina), MZUSP 22328 (Alagoas).

4) Zoological Collections of the Department of Life Science, National Chung Hsing University, Taichung, Taiwan (NCHUZOO):

NCHUZOOOL 13580 (Panama-west coast), NCHUZOOOL 13584 (Texas), NCHUZOOOL 13942 (Jamaica), NCHUZOOOL 13943 (British Virgin Islands), NCHUZOOOL 13944 (Panama-east coast), NCHUZOOOL 13946 (W. Florida), NCHUZOOOL 14908 (Rio de Janeiro), NCHUZOOOL 14909 (Espírito Santo).

5) Senckenberg Museum, Frankfurt am Main, Germany (SMF):

SMF 34741 (Ecuador)

6) Natural History Museum and Institute, Chiba, Japan (CBM)

CBM ZC11306 (Guadeloupe)

7) Zoological Reference Collection of the Lee Kong Chian Natural History Museum, Singapore:

ZRC 2009.0697 (Honduras), ZRC 2018.0162 (Venezuela).

Table S2. Collection data of female *Minuca rapax* used in geometric morphometric analysis. N = number of females. Salinity: O = oligohaline mOsm/kg < 300; M = mesohaline 300< mOsm/kg<600 mOsm/kg; E = euhaline 600< mOsm/kg< 1050; and H = hypersaline mOsm/kg> 1050. Soil: T = terrigenous and C = carbonate. DOC = date of collection. MX = Mexico, BE = Belize, BR = Brazil, USVI = US Virgin Islands, PR = Puerto Rico, JA = Jamaica. ●- northwestern Gulf of Mexico, X-peninsular Florida, □ - Caribbean and Yucatan, + - north Brazil, and \* - south Brazil

Latitude	Longitude	Symbol	Country	State	County	Locality	N	Substrate	Salinity	DOC
30.250	-88.067	●	USA	Alabama	Mobile	Dauphin Is.	10	T-sand mud	M	20 June 2002
30.392	-88.798	●	USA	Mississippi	Jackson	GCRL Beach	8	T-mud	M	2002/2006
29.265	-89.954	●	USA	Louisiana	Jefferson	State Park lagoon	18	T-mud	O	2002/2006
28.288	-82.723	X	USA	W-Florida	Pasco	Werner Salt Springs	12	T-mud	M	14 June 2003
27.837	-97.220	●	USA	Texas	San Patricio	Ingleside Cove	25	T-mud	H	8 July 2000
27.524	-82.645	X	USA	W-Florida	Manatee	Desoto Natnl. Mon.	5	C-mud	E	13 Jun 2003
27.477	-80.315	X	USA	E-Florida	St. Lucie	Ft. Pierce	1	C-sand	E	11 June 2003
27.169	-82.476	X	USA	W-Florida	Sarasota	Oscar Sherer Park	4	C-mud	O	13 June 2003
26.514	-80.055	X	USA	E-Florida	Palm Beach	Boynton Beach	5	C-mud sand	O	11 Jun 2003
26.075	-97.166	●	USA	Texas	Cameron	Brazos Santiago Pass	13	T-mud sand	M	Aug 1994
25.954	-97.150	●	USA	Texas	Cameron	Boca Chica, Rio Grande	2	T-mud	E	25 Aug 1976
25.927	-80.137	X	USA	E-Florida	Dade	Oleta SP mangroves	7	C-rocky mud	M	11 Jun 2003
25.138	-80.931	X	USA	E-Florida	Monroe	Flamingo	3	C-marl	O	12 Jun 2003
23.793	-97.804	●	MX	Tamaulipas		La Pesca	1	T-mud	H	1 Sep 1974

21.596	-88.146	□	MX	Yucatan	Rio Lagartos (□)	2	C-marl	E	5 Sep 1976
21.594	-88.162	□	MX	Yucatan	Boca del Lagartos (□)	1	C-marl	E	5 Sep 1976
21.275	-89.663	□	MX	Yucatan	Progress (□)	1	C- marl	E	4 Sep 1976
21.260	-89.700	□	MX	Yucatan	Nuo Progreso (□)	1	C-marl	E	4 Sep 1976
20.239	-96.784	●	MX	Veracruz	Casitas	1	T-sand	E	14 Sep 1976
19.462	-90.706	□	MX	Campeche	No. Champotón (□)	2	C-mud	M	1 Sep 1976
19.359	-90.671	□	MX	Campeche	Rio Champotón (□)	11	C-mud	M	1 Sep 1976
18.765	-91.524	□	MX	Campeche	Isla del Carmen (□)	17	C-sand mud	O	31 Aug 1976
18.422	-93.169	●	MX	Tabasco	Puerto Ceiba	12	T-mud	M	29 Aug 1976
18.357	-64.220	□	USVI	St. John	Princess Bay (□)	6	C-mud	E	13 May 2007
18.349	-64.681	□	USVI	St. John	Elk Bay (□)	2	C-mud	O	13 May 2007
18.346	-64.708	□	USVI	St. John	Coral Bay (□)	3	C-sand	H	13 May 2007
18.327	-64.799	□	USVI	St. John	Enighed Pond (□)	1	C-mud	E	13 May 2007
18.319	-64.865	□	USVI	St. Thomas	Compass Bay (□)	2	C-mud	H	13 May 2007
18.121	-67.180	□	PR	Cabo Rojo	Laguna Joyuda (□)	1	C-mud	E	26 Nov 2008
17.964	-76.854	□	JA	St. Catherine	Ft. Augusta (□)	9	C-sand mud	E	12 Dec 2005

17.952	-66.184	□	PR	Guayama	Puerto de Jobos	3	C-mud	E	25 Nov 2008
17.962	-66.931	□	PR	Guanica	Playa Santa	3	C-sand	M	25 Nov 2008
17.958	-76.866	□	JA	St. Catherine	Dawkins Lagoon	2	T-mud	E	12 Dec 2005
17.936	-67.192	□	PR	Cabo Rojo	Cabo Rojo, Jaguey	18	C-sand	H	26 Nov 2008
16.809	-88.255	□	BE	Stann Creek	Sittee River	4	T-humus mud	M	03 Jan 2006
16.892	-88.086	□	BE	Stann Creek	Tobacco Cay	4	C-sand	E	03 Jan 2006
02.147	-50.696	+	BR	Amapá	Amapá River	10	T-mud	M	1 Jul 2009
-03.775	-38.439	+	BR	Ceará	Coco River	24	C-sandy mud	O	6 Jun 2009
-07.810	-34.843	+	BR	Pernambuco	Itamaracá	20	C-mud	E	9 Jun 2009
-12.737	-38.604	*	BR	Bahía	Madre de Deus	20	T-mud sand	E	4 Aug 2009
-19.924	-40.180	*	BR	Espirito Santo	Santa Cruz River	23	T-sand mud	E	12 July 2009
-23.025	-43.563	*	BR	Rio de Janeiro	Bahia Guaratiba	18	T- mud	M	29 Aug 2009
-23.726	-45.420	*	BR	São Paulo	Enseada Beach	9	T- mud	O	6 June 2009
-25.854	-48.587	*	BR	Paraná	Bahia Guaratuba	20	T-mud sand	E	20 Sep 2009
-27.450	-48.526	*	BR	Santa Catarina	Reserva Daniela	<u>8</u>	T-humus mud	M	8 Oct 2009
					Total	372			

Table S3. Film sites for *Minuca rapax* courtship behavior in the western Gulf of Mexico. AM = morning hours, PM = afternoon hours. TX = Texas, MX = Mexico.

Site Name and Conditions	Latitude	Longitude	Crab	Waves	Average Duration	Typical N = Pauses	Average Delay
Matagorda Beach, Matagorda Co., TX, USA AM, 23 Jun 1974; 26° C	28.598288°	-95.979439°	1	3	2.68 ± 0.46	6	0.14 ± 0.07
			2	6	3.22 ± 1.02	4	0.16 ± 0.05
			3	4	4.21 ± 1.62	6	0.27 ± 0.16
UTMSI, Port Aransas, Nueces Co., TX, USA AM, 12 March 1976; 27°C	27.838373°	-97.052121°	1	13	3.50 ± 1.01	6	0.47 ± 0.34
			2	2	2.35 ± 0.24	4	0.88
			3	5	4.64 ± 2.00	6	0.52 ± 0.62
Park, Ingleside Cove, San Patricio Co., TX, USA AM, 10 Mar 1976; 24°C	27.837713°	-97.220111°	1	8	4.27 ± 1.42	5	0.80 ± 0.65
			2	4	5.24 ± 0.81	8	0.61 ± 0.52
			3	3	2.47 ± 0.41	3	0.30 ± 0.05
Brazos Santiago Pass, Cameron Co., TX, USA AM, 3 Mar 1976; 24° C	26.074072°	-97.165647°	1	2	1.82 ± 0.18	5	1.31
			2	7	4.53 ± 1.57	2	0.48 ± 0.48
			3	3	4.04 ± 0.56	3	0.56 ± 0.29
			4	2	8.96 ± 2.33	13	0.22
Lago Almagre, La Pesca, Tamaulipas, MX AM, 15 Mar 1976; 27° C	23.791678°	-97.801736°	1	4	4.43 ± 0.70	7	0.51 ± 0.35
			2	2	6.84 ± 1.18	13	0.84
			3	5	4.99 ± 1.25	6	0.68 ± 0.49

			4	6	$2.48 \pm 0.67$	4	$0.50 \pm 0.35$
Agua dulce, Rio Lagartos, Yucatan, MX	21.596461°	-88.145423°	1	5	$12.18 \pm 1.45$	20	$0.93 \pm 0.53$
PM, 5 September 1976; 28° C			2	4	$4.37 \pm 0.49$	6	$0.29 \pm 0.07$
			3	7	$7.64 \pm 1.38$	13	$0.59 \pm 0.27$
			4	3	$12.29 \pm 1.32$	22	$1.16 \pm 0.10$
			5	3	$9.65 \pm 1.09$	15	$1.18 \pm 0.31$
Rio Seco, Puerto Ceiba, Tabasco, MX	18.422280°	-93.169568°	1	6	$9.97 \pm 1.77$	17	$1.00 \pm 0.30$
AM, 29 August 1976; 29° C			2	5	$9.68 \pm 1.44$	16	$1.06 \pm 0.29$
			3	4	$10.34 \pm 1.22$	17	$1.17 \pm 0.28$
			4	3	$12.62 \pm 0.86$	23	$0.99 \pm 0.50$
			5	7	$11.29 \pm 1.53$	18	$1.15 \pm 0.16$



Table S4. Haplotypes of 16S rDNA and COI markers for specimens of *Minuca rapax* and *M. virens* from Americas, and the outgroups.

Species	Locality (and catalogue no. of UNI, unless indicated)	Sample size	Haplotype of 16S	Access. no.	Sample size	Haplotype of COI	Access. no.
<i>M. rapax</i>	USA: W Florida (2555); E Florida (62) Puerto Rico (2830; 2832) British Virgin Is. (NCHUZOOOL 13943) US Virgin Is. (1739) Venezuela (ZRC 2018.0162) Brazil: Amapá (B2699; B2700); Bahia (B976); Maranhão (B2857); Ceará (B2454); Pernambuco (B296)	13	Urp-1		13	Mrp-C1	
	USA: E Florida (1276; 1277)	2	Urp-1	LC388593	2	Mrp-C3	LC388603
	USA: E Florida (62)	1	Urp-1	LC388593	1	Mrp-C4	LC388604
	USA: W Florida (2595)	1	Urp-1	LC388593	1	Mrp-C5	LC388605
	USA: W Florida (2594)	1	Urp-1	LC388593	1	Mrp-C6	LC388606
	USA: W Florida (2554)	1	Urp-1	LC388593	1	Mrp-C7	LC388607
	USA: W Florida (472)	1	Urp-2	LC388594	1	Mrp-C8	LC388608
	USA: W Florida (472)	1	Urp-1	LC388593	0		
	USA: Alabama (3260)	1	Urp-1	LC388593	0		
	Mexico: Campeche (453)	1	Urp-3	LC388595	1	Mrp-C9	LC388609
	Mexico: Yucatan (478)	1	Urp-1	LC388593	1	Mrp-C10	LC388610
	Belize (58)	1	Urp-1	LC388593	1	Mrp-C11	LC388611
	Belize (59)	1	Urp-4	LC388596	1	Mrp-C12	LC388612
	Honduras (ZRC 2009.0697)	1	Urp-1	LC388593	1	Mrp-C13	LC388613
	Honduras (ZRC 2009.0697)	1	Urp-1	LC388593	1	Mrp-C14	LC388614
	Panama: Bocas del Toro (NCHUZOOOL 13944)	1	Urp-5	LC087928	1	Mrp-C15	LC087957
	Jamaica (3265)	1	Urp-1	LC388593	1	Mrp-C16	LC388615
	Jamaica (NCHUZOOOL 13942; 3263; 3264)	3	Urp-6	LC087926	3	Mrp-C1	LC087956
	Puerto Rico (2831)	0	—		1	Mrp-C17	LC388616
	British Virgin I. (NCHUZOOOL 13943)	1	Urp-1	LC388593	1	Mrp-C18	LC388617
	US Virgin Is. (1740)	1	Urp-1	LC388593	1	Mrp-C18	LC388617
	Guadeloupe (CBM ZC 11306)	1	Urp-1	LC388593	1	Mrp-C19	LC388618
	Brazil: Amapá (B2701); Ceará (B2455); Bahia (B978); Espírito Santo (B710; B711; NCHUZOOOL 14909); Rio de Janeiro (NCHUZOOOL 14908; B1182; B1206; B1207; B1208; B1289; B1291; B2117; B2155); São Paulo (B2591; B2592; B2593; B1977); Paraná (B1624; B1625; B1626); Santa Catarina (B1825; B1826)	24	Urp-1	LC388593	24	Mrp-C2	LC388619
	Brazil: Maranhão (B2855)	1	Urp-7	LC388597	1	Mrp-C20	LC388620
	Brazil: Maranhão (B2856)	1	Urp-1	LC388593	1	Mrp-C21	LC388621
	Brazil: Ceará (B2457)	1	Urp-1	LC388593	1	Mrp-C22	LC388623
	Brazil: Pernambuco (B297)	1	Urp-1	LC388593	1	Mrp-C23	LC388624
	Brazil: Pernambuco (B298)	1	Urp-8	LC388598	1	Mrp-C2	LC388619
	Brazil: Bahia (B977)	1	Urp-1	LC388593	1	Mrp-C24	LC388625
	Brazil: Espírito Santo (B709)	1	Urp-1	LC388593	1	Mrp-C25	LC388626
	Brazil: Espírito Santo (NCHUZOOOL 14909)	1	Urp-1	LC388593	1	Mrp-C26	LC388627
	Brazil: Rio de Janeiro (B1290)	1	Urp-9	LC388599	1	Mrp-C2	LC388619
Brazil: Rio de Janeiro (B2116)	1	Urp-10	LC388600	1	Mrp-C2	LC388619	
Brazil: Rio de Janeiro (B1181)	1	Urp-1	LC388593	1	Mrp-C27	LC388628	
Brazil: Rio de Janeiro (B1183)	1	Urp-6	LC087926	1	Mrp-C2	LC388619	
Brazil: Santa Catarina (B1827)	1	Urp-1	LC388593	1	Mrp-C28	LC388629	
total		73			72		
<i>M. virens</i>	USA: Texas (NCHUZOOOL 13584); W Florida (2546; NCHUZOOOL 13946) Mexico: Veracruz (3267)	4	Uvr-1	AB813665	4	Mvr-C1	AB813681
	USA: Texas (NCHUZOOOL 13584)	1	Uvr-2	LC087930	1	Mvr-C1	AB813681
	USA: W Florida (2547)	1	Uvr-3	LC388601	1	Mvr-C1	AB813681
	USA: W Florida (309)	1	Uvr-1	AB813665	1	Mvr-C2	LC388630
	USA: W Florida (310)	1	Uvr-1	AB813665	1	Mvr-C3	LC388631
	USA: Alabama (3261)	0			1	Mvr-C4	LC388632

	USA: Texas (628)	1	Uvr-2	LC087930	1	Mvr-C5	LC388633
	USA: Texas (13584)	1	Uvr-1	AB813665	1	Mvr-C6	LC388634
	Mexico: Tamaulipas (485)	1	Uvr-1	AB813665	1	Mvr-C7	LC388635
	total	11			12		
outgroups							
<i>M. herradurensis</i>	Panama: Diablo Heights mangroves (NCHUZOOL 13580)			AB813664			AB813680
<i>M. galapagensis</i>	Ecuador: Puerto Morro (SMF 34741)			LC150349			FN430705
<i>M. pugnax</i>	USA: Maryland (NCHUZOOL 13941)			LC388602			LC388636