

Article DOI: <https://doi.org/10.3201/eid3101.240151>

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Rickettsia sibirica mongolitimonae Infections in Spain and Case Review of the Literature

Appendix

Appendix Table 1. Detailed data about patients with *R. sibirica mongolitimonae* infections confirmed at the Center for Rickettsiosis and Arthropod-Borne Diseases (CRETAV) in Rioja, Spain, during 2007–2024

Case no. (ref)	Year	Bite/eschar location	No. eschars	Fever	Rash	Lymphangitis	Hospitalized	Available clinical samples	PCR+ sample	DNA amplicon size, bp*		IgG titers†, acute/convalescent
										<i>ompA</i>	<i>ompB</i>	
1 (1)	2007	Leg	None	Yes	No	No	No	Blood	Blood	486	382	Negative/negative
2 (2)	2011	Hip	1	Yes	Yes	No	Yes	Blood	Blood	486	381	Negative/1:512
3	2014	Forearm	1	Yes	Yes	Yes	Yes	Eschar swab	Eschar swab	503	359	No serum
4	2014	Groin	1	Yes	No	No	No	Eschar swab	Eschar swab	484	453	1:128/1:2,048
5 (3)	2016	Buttocks	1	Yes	No	No	Yes	Blood, eschar, eschar swab	Eschar, eschar swab	481	464	Negative/1:1,024
6	2017	Scalp	2	Yes	No	No	No	Blood, eschar swab	Blood, eschar swab	491	359	1:1,024/no serum
7	2017	Foot	1	Yes	No	Yes	Yes	Eschar swab	Eschar swab	491	382	Negative/no serum
8	2018	Forearm	1	Yes	No	No	No	Eschar swab	Eschar swab	515	464	No serum
9	2018	Shoulder	2	Yes	Yes	No	Yes	Eschar, eschar swab	Eschar, eschar swab	481	464	No serum
10	2019	Scapula/leg	2	Yes	No	No	No	Eschar swab	Eschar swab	484	453	No serum
11	2019	Leg	2	Yes	No	No	Yes	Eschar swab	Eschar swab	491	382	No serum
12	2020	Leg	2	Yes	Yes	Yes	Yes	Blood, eschar swab	Eschar swab	461	453	Negative/1:64
13 (4)	2020	Scrotum	1	Yes	Yes	No	Yes	Eschar	Eschar	491	464	No serum
14	2020	Scalp	1	Yes	Yes	Yes	No	Eschar swab	Eschar swab	486	452	Negative/no serum
15	2020	Ankle	1	Yes	Yes	Yes	Yes	Eschar swab	Eschar swab	491	464	No serum
16	2020	Thigh	1	Yes	Yes	No	No	Blood	Blood	486	382	Negative/no serum
17	2021	Thigh/hip	1	Yes	No	No	No	Eschar swab	Eschar swab	491	464	1:64/no serum
18	2021	Buttocks	1	Yes	Yes	Yes	Yes	Blood, eschar	Eschar	491	464	No serum
19	2021	Unknown	None	Yes	Yes	No	Yes	Blood	Blood	481	380	Negative/1:1,024
20	2021	Arm	2	Yes	Yes	No	Yes	Blood, eschar	Blood, eschar	481	464	No serum
21	2022	Hip	1	Yes	Yes	No	No	Blood, eschar, eschar swab	Eschar and eschar swab	491	382	No serum
22	2022	Face	1	Yes	No	No	No	Eschar swab	Eschar swab	491	382	No serum
23	2022	Arm	1	Yes	No	Yes	Yes	Eschar swab	Eschar swab	491	464	No serum
24	2023	Leg	1	Yes	No	Yes	Yes	Eschar swab	Eschar swab	491	464	No serum

Case no. (ref)	Year	Bite/eschar location	No. eschars	Fever	Rash	Lymphangitis	Hospitalized	Available clinical samples	PCR+ sample	DNA amplicon size, bp*		IgG titers†, acute/convalescent
										ompA	ompB	
25	2023	Abdomen/ groin	2	Yes	Yes	No	Yes	Eschar swab	Eschar swab	472	464	No serum
26	2023	Iliac fossa	1	Yes	No	No	Yes	Blood, eschar swab	Blood and eschar swab	481	464	Negative/1:1,024
27	2023	Abdomen	1	Yes	Yes	No	Yes	Eschar swab	Eschar swab	491	464	No serum
28	2023	Armpit	1	Yes	No	No	No	Tick	Tick	491	464	No serum
29	2024	Buttocks	1	Yes	No	No	No	Eschar swab	Eschar swab	491	459	Negative/no serum

*All PCR amplicons of *ompA* and *ompB* genes showed 100% identity with those of *Rickettsia sibirica mongolitimonae*. bp, base pairs; ref, reference; +, positive.
†IgG titers determined for acute and convalescent serum samples by using immunofluorescence assays.

Appendix Table 2. Epidemiologic, clinical, and microbiologic characteristics associated with patients infected with *Rickettsia sibirica mongolitimonae**

Case no.	Country	Year case occurred/publication	Patient age, y/sex	Tick bite reported	Other epidemiologic condition	Month†	Bite/eschar locations	No. eschars	Fever	Rash	Lymphangitis	PCR+ sample	Ref.
2	France	1998/2000	49/M	No	Gardener, living in rural area	May	Leg	1	Yes	No	Yes	Eschar	(6)
3	South Africa	2002/2004	34/M	No	Working in area with <i>Hyalomma truncatum</i>	September	Toe, foot	1	Yes	No	Yes	Eschar	(7)
4	France	2000–2004/2005	53/M	Yes	Gardening	May	Knee	1	Yes	Yes	No	Eschar	(8)
5	France	2000–2004/2005	40/F	Yes	Gardening	July	None	None	Yes	Yes	Yes	Serum	(8)
6	France	2000–2004/2005	59/M	Yes	Gardening	April	Back	1	Yes	Yes	No	Eschar	(8)
7	France	2000–2004/2005	21/F	No	Gardening	May	Heel	1	Yes	No	Yes	Serum	(8)
8	France	2000–2004/2005	70/M	No	Gardening, contact with birds	May	Forearm/ abdomen	2	Yes	Yes	No	Eschar	(8)
9	France	2000–2004/2005	55/M	No	Walk in Camargue National Park	June	Arm	1	Yes	Yes	Yes	Eschar	(8)
10	France, return from Algeria	2000–2004/2005	62/F	No	Travel to southern Algeria	April	Foot, hypochondrium	2	Yes	Yes	No	Eschar, serum	(8)
11	Crete	2002/2005	76/M	Yes, <i>H. anaticum excavatum</i>	Collecting olives	December	Scrotum	None	Yes	Yes	No	Blood, tick	(9)
12	Portugal	2004/2006	73/F	No	None	August	Toe	1	Yes	Yes	No	Blood culture	(10)
13	France	2005/2008	20/F	No	Walking	June	Face	1	Yes	Yes	No	Eschar	(11)
14	Portugal	2006/2008	44/M	No	Vacation	August	Forearm	1	Yes	Yes	Yes	Eschar	(12)
15	Spain	2007/2008	41/M	Yes, tick removed	Topographer	June	Leg	None	Yes	No	No	Blood	(1)
16	Spain	2007/2013	67/F	No	Gardening	July	Scalp	1	Yes	Yes	No	Eschar	(13)
17	Spain	2009/2013	32/M	No	Working at golf courses	September	Thigh	1	Yes	Yes	Yes	Eschar	(13)
18	Spain	2010/2013	33/M	No	Walking in rural area	April	Leg	1	Yes	No	Yes	Eschar	(13)

Case no.	Country	Year case occurred/publication	Patient age, y/sex	Tick bite reported	Other epidemiologic condition	Month†	Bite/eschar locations	No. eschars	Fever	Rash	Lymphangitis	PCR+ sample	Ref.
19	Spain	2011/2013	42/F	No	Walking in rural area	March	Shoulder	1	Yes	No	No	Eschar	(13)
20	Spain	2011/2013	40/F	Yes	Horseback riding	April	Neck	1	Yes	Yes	No	Eschar	(13)
21	Spain	2011/2013	75/F	No	Walking in rural area	July	Leg	1	Yes	Yes	Yes	Eschar	(13)
22	France	2009/2010	52/M	No	Trip to Egypt	September	Scapular area	1	Yes	No	No	Eschar	(14)
23	Spain	NA/2011	9/M	No	Rural environment	September /October	Scalp	1	Yes	No	No	Eschar	(15)
24	Spain	NA/2011	73/M	Yes	Working in vegetable patch	August	Back	1	Yes	Yes	No	Eschar	(16)
25	Spain	2011/2012	69/M	No	Vacation in rural area	September	Hip	1	Yes	Yes	No	Blood	(2)
26	France	2011/2013	73/M	No	Contact with animals	February	Armpit	1	Yes	Yes	No	NA	(17)
27	France	2011/2013	67/F	No	Contact with animals	April	Leg	1	Yes	No	Yes	NA	(17)
28	France	2011/2013	NA/M	No	Contact with animals	March	NA	1	Yes	NA	NA	NA	(17)
29	France	2012/2014	16/M	No	Fishing	May	Lower eyelid, forearm	2	Yes	No	No	Eschar swab	(18)
30–49	France	2010–2014/2016	Median age (±SD) 43 (±21) [IQR 2–70]; F, n = 8; M, n = 12	No, n = 14; Yes, n = 6	Tick bites or handling, n = 6; outdoor activities, n = 5; frequent contact with dogs, n = 8	April–June, n = 11; July–September, n = 8; October, n = 1	Lower limbs, n = 7; upper limbs, n = 4; trunk, n = 3; neck, n = 4	≥1, n = 20; Multiple, n = 3	Yes	Yes, n = 19; no, n = 1	Yes, n = 7; no, n = 13	Eschar swab, n = 13; skin biopsy, n = 10	(19)
50	France	2013/2015	61/M	Yes	Insect bite	June	Forearm	1	Yes	Yes	No	Eschar	(20)
51	North Greece	2013/2016	13/M	No	Holidays, walking to the woods	May	Upper chest,	1	Yes	Yes	Yes	None‡	(21)
52	Spain	2014/NP	12/M	No	None	May	Forearm	1	Yes	Yes	Yes	Eschar swab	NP
53	Spain	2014/NP	71/M	No	None	July	Groin	1	Yes	No	No	Eschar swab	NP
54	Spain	NA/2015	46/F	No	Dog with ticks	May	Scalp	1	Yes	Yes	No	Eschar	(22)
55	Spain	NA/2015	73/M	No	Rural environment and hunting	July	Abdomen	1	Yes	Yes	No	Eschar	(23)
56	Spain	NA/2015	25/M	Yes	Dog with ticks	July	Trunk	1	Yes	No	No	Eschar	(23)
57	Spain	2013–2014/2016	6/NA	NA	NA	NA	Scalp	1	Yes	Yes	No	Eschar	(24)
58	France, returned from Sri Lanka	2016/2017	30/F	Yes	Jungle	February	Flank	1	Yes	Yes	No	Eschar	(25)
59	Spain	2016/2017	39/M	No	Hunting	September	Buttocks	1	Yes	No	No	Eschar, eschar swab	(3)

Case no.	Country	Year case occurred/publication	Patient age, y/sex	Tick bite reported	Other epidemiologic condition	Month†	Bite/eschar locations	No. eschars	Fever	Rash	Lymphangitis	PCR+ sample	Ref.
60	Turkey	2016/2017	56/M	Yes, <i>H. marginatum</i> female	Farming	May	Umbilicus	1	Yes	Yes	No	Tick	(26)
61	France	2016/2018	42/F	No	Gardening	July	Abdominal	2	Yes	No	No	Eschar swab	(27)
62	Spain	2017/NP	76/F	No	Living with dogs	June	Scalp	2	Yes	No	No	Eschar swab, blood	NP
63	Spain	2017/NP	66/M	No	Hunting	September	Foot	1	Yes	No	Yes	Eschar swab	NP
64	Cameroon	NA/2017	54/F	No	Travel	May	Back	1	Yes	Yes	No	Eschar swab, eschar	(28)
65	Spain	2018/NP	39/M	No	Rural environment	August	Forearm	1	Yes	No	No	Eschar swab	NP
66	Spain	2018/NP	70/M	No	None	September	Shoulder	2	Yes	Yes	No	Eschar swab, eschar	NP
67	France	2018/2020	66/M	No	Living in rural area with animals	July	Ankle	1	Yes	Yes	Yes	Eschar swab	(29)
68	Spain	2019/NP	50/F	No	None	May	Leg/scapula	2	Yes	No	No	Eschar swab	NP
69	Spain	2019/NP	61/M	No	None	September	Leg	2	Yes	No	Yes	Eschar swab	NP
70	Spain	2020/NP	82/M	Yes	4 ticks attached	May	Leg	2	Yes	Yes	Yes	Eschar swab	NP
71	Spain	2019/2020	59/M	No	Rural area and contact with animals	April	Leg	1	Yes	No	Yes	Eschar	(30)
72	Spain	2020/2021	11/M	No	Walking with dog	July	Forearm	1	Yes	Yes	Yes	Eschar	(31)
73	Spain	2020/2021	5/M	Yes	Rural area and dog with ticks	June	Scrotum	1	Yes	Yes	No	Eschar	(4)
74	Spain	2020/NP	12/F	No	None	August	Scalp	1	Yes	Yes	Yes	Eschar swab	NP
75	Spain	2020/NP	75/M	No	None	September	Ankle	1	Yes	Yes	Yes	Eschar swab	NP
76	Spain	2020/NP	34/M	No	Hunting	June	Thigh	1	Yes	Yes	No	Blood	NP
77	Spain	2021/NP	34/M	Yes	Tick bite	April	Thigh/hip	1	Yes	No	No	Eschar swab	NP
78	Spain	2021/NP	70/M	No	None	June	Buttocks	1	Yes	Yes	Yes	Eschar	NP
79	Spain	2021/NP	66/M	Yes	Tick bite	June	Unknown	None	Yes	Yes	No	Blood	NP
80	Spain	2021/NP	74/M	No	None	June	Arm	2	Yes	Yes	No	Eschar, blood	NP
81	Spain	2022/NP	65/M	No	None	March	Hip	1	Yes	Yes	No	Eschar, eschar swab	NP

Case no.	Country	Year case occurred/publication	Patient age, y/sex	Tick bite reported	Other epidemiologic condition	Month†	Bite/eschar locations	No. eschars	Fever	Rash	Lymphangitis	PCR+ sample	Ref.
82	Spain	2022/NP	78/F	No	Rural environment	April	Face	1	Yes	No	No	Eschar swab	NP
83	Spain	2022/NP	52/M	No	Cat scratch	May	Arm	1	Yes	No	Yes	Eschar swab	NP
84	Spain	NA/2022	4/M	NA	NA	NA	Thigh	1	Yes	No	Yes	Eschar	(32)
85	Spain	NA/2022	6/M	No	None	NA	Scalp	2	Yes	No	No	Eschar	(33)
86	North Macedonia	2022/2022	60/F	<i>Hyalomma</i> sp.	Living in rural area	June	Armpit	1	Yes	Yes	No	Blood	(34)
87	Spain	2021/2023	29/M	Insect bite	Holidays in rural area	June	Forearm	1	Yes	No	Yes	Eschar	(35)
88	Spain	NA/2023	75/M	No	Living in rural area	NA	Neck	1	Yes	Yes	No	Eschar	(36)
89	Spain	2023/NP	57/M	Yes	Tick bite	May	Leg	1	Yes	No	Yes	Eschar swab	NP
90	Spain	2023/NP	74/M	Yes	Tick bite	July	Abdomen/groin	2	Yes	Yes	No	Eschar swab	NP
91	Spain	2023/NP	68/M	No	Vegetable patch	July	Iliac fossa	1	Yes	No	No	Eschar swab, blood	NP
92	Spain	2023/NP	69/F	No	Gardening	September	Abdomen	1	Yes	Yes	No	Eschar swab	NP
93	Spain	2023/NP	70/M	Yes, <i>R. pusillus</i>	Gardening	July	Armpit	1	Yes	No	No	Tick attached	NP
94	Spain	2024/NP	46/F	No	None	April	Buttocks	1	Yes	No	No	Eschar	NP

*Bold text indicates cases not previously published. Data are from patients with *R. sibirica mongolitimonae* infection diagnosed at the Center for Rickettsiosis and Arthropod-Borne Diseases in Rioja, Spain, during 2007–2024 and from literature published in PubMed during 1996–2024. NA, not available; NP, not published; Ref, reference; *R. pusillus*, *Rhipicephalus pusillus* tick; +, positive.

†Month patients were bitten or month of symptom onset.

‡Microbiologic diagnosis by seroconversion.

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