

Research articleSubmitted: January 15th, 2019 - Accepted: May 5th, 2019 - Published: May 31st, 2019**Geographical distribution and conservation status of the threatened saproxylic beetles *Rhysodes sulcatus* (Fabricius, 1787), *Clinidium canaliculatum* (O.G. Costa, 1839) and *Omoglymmius germari* (Ganglbauer, 1891) in Italy (Coleoptera: Rhysodidae)**Antonio MAZZEI^{1,*}, Paolo AUDISIO², Augusto VIGNA TAGLIANTI³, Pietro BRANDMAYR¹¹ Department of Biology, Ecology and Earth Science, University of Calabria, Cubo 4B - Ponte Bucci, 87036 Rende (CS), Italy
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Abstract

The distribution of the three Italian species of Rhysodidae was reviewed by re-examining published data, museum conserved and newly collected specimens. *Rhysodes sulcatus* chronogeonomy encloses a large majority of old findings and only two recently confirmed active populations are recorded after the year 2000. *Omoglymmius germari* shows a similar picture, with only one recent record (2018) in the Pollino National Park (Basilicata) but a small number of active populations after 2000. *Clinidium canaliculatum* populations are in a much better conservation status, with about 50 new sites detected after 2000 in the Sila National Park. Threats and research/monitoring needs have been discussed for each species and new IUCN status proposed for Italian populations: Critically Endangered (CR) for *Rhysodes* and *Omoglymmius*, Near Threatened (NT) for *Clinidium*.

Key words: IUCN, conservation status, EU Habitats Directive, chronogeonomy, biodiversity conservation.**Introduction**

The beetles of the family Rhysodidae are represented by more than 350 species worldwide, mainly distributed in tropical forests, where they live depending on the ameboid stages of Myxomycetes growing in dead wood (Bell 1998). They are placed within the suborder Adephaga as a separate, primitive, family by several authors, or, in more recent times, also as a part of Carabidae, as a subfamily, tribe or subtribe. In this work we follow the proposal by Makarov (2008), who places the Rhysodids as an independent family of Geoadephaga with a probable Archostematan ancestor, based on the similarity of larval morphologies.

As saproxylic components of the food web (Speight 1989) the Rhysodids follow the dynamics of tree aging and are involved in the processes of fungal decay of wood and nutrient recycling in natural ecosystems (Burakowski 1975; Alexander 2008). They are particularly affected by inappropriate forest management, habitat loss, and deterioration of forest quality. At European level only one species, *Rhysodes sulcatus* Fabricius, 1787, is listed in the annexes II and IV of Council Directive 92/43/EEC ("Habitats")

as well as by the Bern Convention (annex II), and is also listed in the IUCN red list of Threatened species (Nieto & Alexander 2010), classified as EN (Endangered) in the EU 27 and as DD (Data Deficient) for the whole continent.

Two other Rhysodid species are recorded from Italy, *Clinidium canaliculatum* (O. G. Costa, 1839) and *Omoglymmius germari* (Ganglbauer, 1891), both listed as VU (Vulnerable) (Italian populations: Carpaneto et al. 2015) and DD in Europe (Nieto & Alexander 2010). Despite the importance of Rhysodids for biodiversity conservation, data about their distribution in Italy are still fragmentary and often only based on old museum material; also more recent records are mostly found in grey literature rather than obtained during targeted research campaigns. This status of knowledge is even more inhomogeneous because of the cryptic way of life of the adults and especially of the larvae, and by the progressive rarefaction of old growth forests and of the wood necromass in managed ones.

This paper is an attempt to assess the distribution and preservation status of the Rhysodid beetle species across Italy, with the aim to facilitate research and monitoring in view of Natura 2000 reporting and future conservation measures.

Materials and methods

We focused on both recent and historical literature regarding the distribution of the three species, and examined several museum collections. Further data have been obtained by direct collecting in Southern Italy during monitoring surveys in the frame of the Natura 2000 IV Report to be due in the past March, 2019. For each species, records have been listed and georeferenced from North to South (In “Results” below and in Table 1). The geographic coordinates have been reported in the UTM system, WGS84; number of decimal places vary according to the accuracy of labels. In the case of historical records, the GPS coordinates are only approximate. In Table 1 the distribution data have been ordered on chronological basis: after 2000 (green); between 1970 and 2000 (yellow); before 1970 (grey). Acronyms of Italian provinces follow the official list available at <https://www.comunecitta.it/sigle-province-italiane>.

Collections examined are indicated by the abbreviations below:

MGE	Museo civico di Storia Naturale “G. Doria”, Genoa. Collections: A. Doderò, G. Binaghi.
MFI	Museo Zoologico “La Specola”, Florence.
MZUR	Museo di Zoologia dell’Università di Roma, Rome: Coll. M. Cerruti.
MCZR	Museo Civico di Zoologia di Roma. Collections: P. Luigioni, F. Rasetti, D. Vita.
MSNC	Museo di Storia Naturale della Calabria, University of Calabria, Sect. of Entomology. Collection: P. Brandmayr.
FA	Private collection: F. Angelini, Via Imperiali, 203 - 72021 Francavilla F. (Brindisi).
AVT	Private collection: A. Vigna Taglianti, at present preserved in MZUR.

Results

Rhysodes sulcatus (Fabricius, 1787)

Lombardia: (1) “Lombardia” (sic!, Luigioni 1929). **Emilia-Romagna:** (2) Sassofratino (FC), 12.IX.1982, 2 ex., lg. G. Sama (Cecchi & Bartolozzi 1997). Foreste Casentinesi (Sasso Fratino) (FC), 1988 (Fabbri 2003). National Park “Foreste Casentinesi”, Mount Falterona and Campigna, Foresta della Lama (FC), surroundings of the Forest Police Office, ~ 700 m, 1 ex., 11-13. V.2015 (Ceccolini & Norbiato 2015). **Toscana:** (3) Toscana (sic!, Luigioni 1929). **Lazio:** (4) Monti Cimini (VT) (Luigioni 1929). (5) Monte Fogliano (VT), 19.V.1910, lg. Luigioni (MCZR). (6) Monti Sabatini (RM/VT), IV.1896, lg. G. Doria (MGE). (7) Bassano Romano (VT), 3.V.1908 [lg. Luigioni?] (MGE); *ibidem*, 28.V.1908, lg. Luigioni (MCZR, MGE); *ibidem*, 12.VII.1908 [lg. Luigioni?] (MCZR); *ibidem*,

18.VII.1909, [lg. Luigioni?] (MCZR); *ibidem*, 1.VI.1913, lg. Luigioni (MCZR). (8) Oriolo Romano (VT), lg. A. Raffray (MZUR); *ibidem*, 12.VII.1913, lg. Luigioni (MCZR). **Abruzzo:** (9) Abruzzo National Park (AQ), Vallone Pesco di Lordo, m 1500, 1 ex., in a beech decaying trunk, 17.IX.1959 (Papini 1962). (10) Gran Sasso, Pietracamela (TE), Mt. Corvo, NE slope, Venacquaro Valley, Piana Grande, m 1220, 1 ♂, 10-20.V.2012, reared ex larva collected at 6.IX.2011 (Di Santo & Biscaccianti 2014). **Campania:** (11) Alburno Mt. (SA) (Luigioni 1929). **Puglia:** (12) Gargano, Foresta Umbra (FG), 15.V.1965, lg. Barajon (MGE). (13) Foresta Umbra (FG), Valle del Tesoro, 29.IV.1978, lg. Angelini (FA). **Basilicata:** (14) Vulture Mt. (PZ) (Luigioni 1929).

Omoglymmius germari (Ganglbauer, 1891)

Lazio: (1) Cimini Mts (VT) (Luigioni 1929). (2) Monte Fogliano (VT), 19.V.1910, lg. Luigioni (MCZR). (3) Bassano Romano (VT), 28.V.1908, lg. A. Falzoni (MGE); *ibidem*, 28.V.1908, lg. Luigioni (MCZR, MGE); *ibidem*, 31.V.1908, [lg. Luigioni?] (MGE); 12.VII.1908, [lg. Luigioni?] (MCZR); *ibidem*, 18.VII.1909, lg. Luigioni (MCZR, MGE, MZUR); *ibidem*, 1.VI.1913, lg. Luigioni (MCZR); *ibidem*, 20.VII.1913, lg. Luigioni (MCZR). (4) Oriolo Romano (VT), lg. A. Raffray (MZUR); *ibidem*, 7.XI.1909, [lg. Luigioni?] (MCZR). (5) Bosco di Manziana (RM), VI.1965, G. Gobbi (AVT). Rome, lg. Luigioni (MCZR - Coll. Rasetti), a doubtful locality, perhaps confused with “Bassano Sutri / 18.VII.1909”. Paludi Pontine (= Pontine marshlands) (LT): doubtful locality, based on an old specimen labeled “*Rhysodes / exaratus* Illig. / Roma / Paludi Pontine, lg. Prof. Targioni” (MFI). **Campania:** (6) Alburno Mt. (SA) (Luigioni 1929). **Puglia:** (7) Foresta Umbra, Gargano (FG) (Faggioli 1956). Mount Gargano (FG), Foresta Umbra, 28.V.1948, lg. G. Binaghi (MGE); *ibidem*, 15.V.1965, lg. Barajon (MGE); *ibidem*, 800 m, 3.V.1990, lg. Angelini (FA); *ibidem*, Particella Pavari, 12.IV.2002, lg. A. Vigna-Taglianti (AVT). **Basilicata:** (8) Vulture Mt. (PZ) (Luigioni 1929). (9) Viggiano (PZ), Nature Reserve “Abetina di Laurenzana”, 1270 m, 20.VII.1997, lg. Angelini, on beech (FA). (10) San Severino Lucano (PZ), Pollino National Park, Bosco Magnano, 800 m, 13.X.1996, lg. Angelini, on beech (FA). (11) Policoro Forest (MT), 1 ex., 18.V.1970, lg. De Marzo (Angelini & Montemurro 1986). (12) Terranova di Pollino (PZ), Spinazzeta silver fir Forest, 5 ex., 25/IV/2018, lg. Mazzei & Brandmayr (MSNC). **Calabria:** (13) Serra San Bruno (VV), 1878, lg. F. Baudi di Selve (MGE).

Clinidium (*Arctoclinidium*) *canaliculatum*

(O.G. Costa, 1839)

Toscana: in the general collection of the La Specola Museum of Florence (MFI) is conserved a ♂ specimen that probably belongs to a series collected in Calabria by Ca-

Table 1 – Summary of the historical and contemporary distribution of Italian Rhysodidae. Details on localities of each record in the list of the reported material (in Results above). Data ordered on chronological basis: after 2000 (green); between 1970 and 2000 (yellow); before 1970 (grey). In the column “Years” is reported the time interval of each record from present (2019). Geographic coordinates reported in the UTM system, WGS84.

Rhysodes sulcatus F.

	Regions	Date	Years	E_UTM	N_UTM
3	Emilia-Romagna	2015	4	727970	4856425
11	Abruzzo	2012	7	380611	4706141
2	Emilia-Romagna	1988	31	723169	4858606
14	Puglia	1978	41	585696	4631260
13	Puglia	1965	54	582471	4631025
10	Abruzzo	1959	60	396537	4626597
1	Lombardia	1929	90	566093	5036201
4	Toscana	1929	90	680975	4848875
5	Lazio	1929	90	267908	4692084
12	Campania	1929	90	524701	4488869
15	Basilicata	1929	90	553549	4533668
8	Lazio	1913	106	267775	4677757
9	Lazio	1913	106	265269	4671068
6	Lazio	1910	109	263782	4690791
7	Lazio	1896	123	272837	4671945

Omoglymmius germari G.

	Regions	Date	Years	E_UTM	N_UTM
12	Basilicata	2018	1	615204	4423701
9	Basilicata	1997	22	582713	4473733
10	Basilicata	1996	23	594665	4433177
11	Basilicata	1996	23	643011	4446536
7	Puglia	1990	29	582471	4631025
5	Lazio	1965	54	261626	4666823
1	Lazio	1929	90	267908	4692084
6	Campania	1929	90	524701	4488869
8	Basilicata	1929	90	553549	4533668
3	Lazio	1913	106	267775	4677757
2	Lazio	1910	109	263782	4690791
4	Lazio	1909	110	264474	4670817
13	Calabria	1878	141	613626	4268116

vanna, labeled “622. *Rhysodes / sulcatus* Fab. / M^e Amiata / [Mt. Amiata, Grosseto province], abetina [fir forest] del Pigel= / leto.”. In our opinion a wrong locality, due perhaps to a label exchange with a lost specimen of *Rhysodes*. *C. canaliculatum* is reported by Magrini & Vanni (2001: 102) from Tuscany in six localities in the provinces of Pistoia, Florence, Arezzo, Grosseto, but not from the Amiata Mount. Magrini (personal communication, 2008) informed us that the data in fact concern the distribution of *Platyderus canaliculatus* [= *neapolitanus*; Carabidae], being the entire page a misprint.

Campania: (1) Alburno Mt. (SA) (Luigioni 1929). **Basilicata:** (2) Viggianello (PZ), Colle dell’Impiso (Brandmayr & Zetto Brandmayr 1984). (3) Monte Sirino (PZ), Madonna del Brusco, 1300 m, 7.VIII.1969, lg. G. Gobbi & V. Vomero, “su faggio” [= on beech] (Gobbi 1973). Monte Sirino (PZ), 6.VIII.1969, lg. V. Vomero (AVT). (4)

Clinidium canaliculatum C.

	Regions	Date	Years	E_UTM	N_UTM
12	Basilicata	2018	1	615204	4423701
46	Calabria	2018	1	636687	4352123
32	Calabria	2015	4	638133	4361294
33	Calabria	2015	4	636468	4363920
34	Calabria	2015	4	634248	4361097
35	Calabria	2015	4	636745	4362210
53	Calabria	2015	4	642572	4324411
17	Calabria	2014	5	634085	4356396
20	Calabria	2014	5	628309	4356780
31	Calabria	2014	5	633983	4361105
36	Calabria	2014	5	638671	4362816
37	Calabria	2014	5	638412	4362808
38	Calabria	2014	5	637070	4363882
42	Calabria	2014	5	639377	4344647
43	Calabria	2014	5	640846	4354454
47	Calabria	2014	5	621091	4359326
48	Calabria	2014	5	642345	4332409
52	Calabria	2014	5	642072	4324008
19	Calabria	2009	10	636628	4361423
21	Calabria	2009	10	624025	4354748
22	Calabria	2009	10	634657	4358735
27	Calabria	2009	10	635407	4363660
28	Calabria	2009	10	634078	4360963
29	Calabria	2009	10	634485	4360319
30	Calabria	2009	10	639859	4359479
39	Calabria	2009	10	639625	4355815
40	Calabria	2009	10	640588	4349230
41	Calabria	2009	10	634416	4345526
45	Calabria	2009	10	631859	4350525
49	Calabria	2009	10	640777	4326898
50	Calabria	2009	10	637980	4327016
61	Sicilia	2004	15	475930	4198510
13	Calabria	2002	17	593438	4364692
58	Calabria	2002	17	574995	4228549
9	Basilicata	1998	21	581634	4473646
60	Sicilia	1993	26	503869	4201652
23	Calabria	1991	28	627451	4353165
44	Calabria	1991	28	629888	4346502
55	Calabria	1987	32	616287	4265988
11	Basilicata	1985	34	605863	4422805
2	Basilicata	1984	35	599041	4420574
24	Calabria	1979	40	636898	4361987
26	Calabria	1979	40	638725	4363396
10	Basilicata	1976	43	605247	4423020
8	Basilicata	1975	44	600161	4420527
56	Calabria	1972	47	612900	4262702
5	Basilicata	1971	48	595654	4417676
6	Basilicata	1971	48	596239	4418094
4	Basilicata	1970	49	603986	4425378
7	Basilicata	1970	49	600324	4419687
25	Calabria	1970	49	634802	4362091
3	Basilicata	1969	50	570039	4442430
14	Calabria	1953	66	624805	4349372
51	Calabria	1950	69	634731	4327000
15	Calabria	1939	80	620428	4355716
18	Calabria	1933	86	622764	4354628
1	Campania	1929	90	524701	4488869
16	Calabria	1920	99	621224	4356662
59	Sicilia	1906	113	412864	4160129
54	Calabria	1887	132	613878	4267890
57	Calabria	1880	139	574560	4234041

Pollino Mts (PZ), Cugno dell'Acero, 1500 m, VIII.1970 - 71, lg. G. Gobbi & V. Vomero, "su faggio e abete" [= on beech and fir] (Gobbi 1973). (5) Pollino Mts, Timpone di Viggianello (PZ) (Gobbi 1973). (6) Pollino Mts, Piani di Ruggio (PZ) (Gobbi 1973). (7) Pollino Mts, Colle Gaudolino (PZ), 1500-1600 m, VII-VIII. 1971, lg. Colonnelli, Sacco & Vomero, "su faggio" [on beech] (Gobbi 1973). Pollino Mts, Colle Gaudolino (PZ), 9.VIII.1970, V. Vomero (AVT); Pollino Mts, Colle Gaudolino (PZ), 10.VII.1971, lg. V. Vomero (AVT). (8) Pollino, Vaquarro (PZ), 1500 m, 12.VIII.1971, lg. Gobbi & Pinzari, "su abete" [on fir] (Gobbi 1973). Pollino, Vaquarro (PZ), 14.VIII.1975, lg. Carpaneto (AVT). (9) Laurenzana (PZ), 1100 m, 31.V.1998, lg. Angelini, "su abete" [on fir] (FA). (10) Pollino, Terranova di Pollino (PZ), Duglia, 1400 m, 22.VIII.1976, lg. Angelini, "su abete" [on fir] (FA). (11) Pollino, Pantano Grande (PZ), 1380 m, 17.VI.1985, lg. Angelini (FA). (12) Terranova di Pollino (PZ), Spinazzeta silver fir Forest, 6 ex., 25/IV/2018, lg. Mazzei & Brandmayr (MSNC).

Calabria: (13) San Benedetto Ullano (CS), Parco Naturale della Comunità Montana Media Valle Crati, 7 ♂♂, 5 ♀♀ 09.III.2002, lg. Mazzei & Brandmayr (MSNC). (14) Monte Botte Donato (CS), (ca. 1900 m), 15.VI.1953, lg. Barajon (MGE). (15) Monte Scuro (CS), 1600 m, 5.VII.1939, lg. Ceresa (MGE); 4/5.VII.1939, lg. Moltoni (Schatzmayr 1941: 66). (16) Fago del Soldato (CS), 1400 m, VII.1920, lg. Confalonieri (MGE). (17) Spezzano Piccolo (CS), I Pagani (Mazzei et al. 2018). (18) Spezzano della Sila (CS), Camigliatello Silano (CS), (1300 m), 4.VIII.1921, A. Fiori (MGE); *ibidem*, 11.X.1933, lg. Patrizi (MCZR). (19) Spezzano della Sila (CS), SIC Cozzo del Principe (Mazzei et al. 2011a). (20) Spezzano della Sila (CS), Valle Capra, (Mazzei et al. 2018). (21) Spezzano della Sila (CS), SIC Pineta di Camigliatello (CS) (Mazzei et al. 2011a). (22) Spezzano della Sila (CS), SIC Pineta del Cupone (Mazzei et al. 2018). (23) Spezzano della Sila (CS), Croce di Magara (Angelini 1991). (24) Longobucco (CS), Fossia, 1300-1400 m, 4.VIII.1921, lg. A. Fiori (MGE); *ibidem*, 13.VIII.1970, lg. Terzani (MZUF); *ibidem*, 1400 m, 10.VII.1977, lg. Montemurro, "su abete" [on fir] (MZUF); *ibidem*, 14.VII.1979, lg. Angelini (FA). (25) Longobucco (CS), San Giovanni Paliati, 1300-1500 m, 19.VIII.1970, lg. Terzani (MZUF). (26) Longobucco (CS), 1500 m, 15.VII.1979, lg. Angelini (FA). (27) Longobucco (CS), Nature Reserve Bosco di Gallopane, (28) Longobucco (CS), Nature Reserve of Golia Corvo, (29) Longobucco (CS), SIC Vallone Freddo, (30) Longobucco (CS), Mt. Pettinascura (all in Mazzei et al. 2011a). (31) Longobucco (CS), Vallone Cecita (Mazzei et al. 2017). (32) Longobucco (CS), Sbanditi, (33) Longobucco (CS), Cava dell'Orso, (34) Longobucco (CS), Vallone S. Michele, (35) Longobucco (CS), Vallone Fossia, (36) Longobucco (CS), Serra Vurga, (37) Longobucco (CS), Vallo di Casu, (38) Longobucco (CS), Colle del Lupo (all in Mazzei et al. 2018). (39) San Giovanni in Fiore (CS), SCI Arnocampo (Mazzei

et al. 2011a). (40) San Giovanni in Fiore (CS), SCI Juri Vetere Soprano (Mazzei et al. 2016). (41) San Giovanni in Fiore (CS), SCI Nocelleto, (Mazzei et al. 2011a). (42) San Giovanni in Fiore (CS), Macchione di Montenero, (43) San Giovanni in Fiore (CS), Fosso del Lupo (both in Mazzei et al. 2018). (44) San Giovanni in Fiore (CS), Lorica (Angelini 1991; Mazzei et al. 2018). (45) Serra Pedace (CS), SCI Pineta di Silvana Mansio (Mazzei et al. 2011a); *ibidem*, V.2012 lg. Brandmayr. (46) Serra Pedace (CS), Monteoliveto, (47) Celico (CS), Trefontane, (48) Mesoraca (KR), Macchia dell'Orso (all in Mazzei et al. 2018). (49) Taverna (CZ), Nature Reserve Coturelle – Piccione, (50) Taverna (CZ), SCI Pinete del Roncino (both in Mazzei et al. 2011a). (51) Taverna (CZ), Villaggio Mancuso, 1300 m, 15/23.V.1950, lg. Binaghi (MGE). (52) Magisano (CZ), Bosco Caritello – Viperaro, (53) Magisano (CS), Pineta Caritello – Viperaro (both in Mazzei 2018). (54) Serra San Bruno (VV), F. Baudi di Selve (MGE); *ibidem*, 25.VIII.1887 (MGE); *ibidem*, 1.IX.1887, lg. A. Fiori (MGE; MCZR). (55) Le Serre, Stilo Ferdinanda (RC), Bosco di Stilo, 1100 m, 27.VI.1987, lg. Angelini (FA). (56) Le Serre, Fabrizia (CZ), 950 m, 10.X.1972, lg. Espinosa (Espinosa 1978: 14). (57) Aspromonte, (date presumably 1880), lg. Cavanna (MZUF); *ibidem*, lg. Paganetti-Hummler (MCZR). (57) Sant'Eufemia d'Aspromonte (RC), lg. Paganetti-Hummler (MGE) (Biscaccianti et al. 2016). (58) Gambarie (RC), Cippo Garibaldi, 1220 m, 30.VI.1972, lg. Bartoli (MGE); *ibidem*, 27.V.97 lg. Bartoli & Dellacasa (MGE); *ibidem*, 26.IV.2002 lg. Angelini (FA). (59) Gambarie (RC), 1300 m, 31.V.1993, lg. Angelini (FA). **Sicilia:** (60) Sicilia, lg. Ghiliani (MGE); *ibidem*, lg. Böttcher, 1906 (MCZR). (61) Montalbano Elicona (ME), Bosco di Malabotta, 1100 m, "faggeta" [beech forest], 3.VI.1993, lg. Angelini (FA). (62) SCIs: Serra del Re (CT), Monte Soro (ME) and Biviere di Cesarò (ME) (Sabella et al. 2004). **Sardegna:** "Sard. / P.Reitter 86" (MGE, locality very likely incorrect).

Analysis of geographic distributions in Italy

Rhysodes sulcatus (Fig. 1)

The large amount of gathered data supports a first chronogeonomic analysis of the three *Rhysodids* in Italy. In Fig. 1 the known localities have been ordered based on collection time. The historical distribution (before 1970: Luigioni 1929; Papini 1962; Raffray (MZUR); M. Barajon (MGE)), indicates *Rhysodes sulcatus* only from Lombardy, Tuscany, Latium, Abruzzi, Campania, Apulia and Basilicata). During more than a century this species has been collected from 15 localities in seven Italian regions, but in the period 1970-2000 only in two ones: Emilia-Romagna and Apulia. After 2000 the findings also concentrate in only two regions: Emilia Romagna and Abruzzi. The general conservation status of *R. sulcatus* in Italy looks extremely precarious, and until now its presence was not confirmed at any of the historical sites. Scattered populations seem to

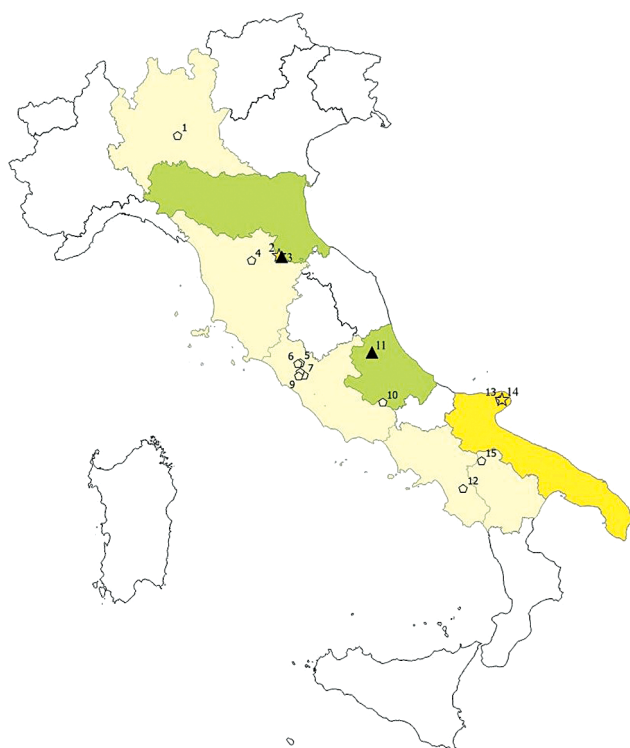


Fig. 1 – Historical and contemporary distribution of *Rhysodes sulcatus* in Italy. Recent records (after 2000) are represented by solid triangles; records 1970–2000 by stars; records before 1970 by pentagons. Light green: regions in which the species was collected only before 1970. Yellow: only records before 2000 available. Dark green: data after 2000.

survive only along the Apennine chain of Central Italy in some beech forest “sanctuaries” like the old growth forest of the Gran Sasso National Park (Di Santo & Biscaccianti 2014) or the “Foresta della Lama” in the National Park “Foreste Casentinesi” on the Romagna-side of the chain (Ceccolini & Norbiato 2015). Consequently, in Italy *R. sulcatus* remains at the moment an endangered species, it shows no signs of reprise and it is highly probable that several of the historical populations are extinct since long time. This Euro-Siberian beetle seems a little better conserved in France (Brustel & Gouix 2011), but on the whole its actual presence in Europe is noticeably rarefied in most recent times (Bussler et al. 2005; Vrezec 2007; Konvička & Čížek 2015; Šag et al. 2016). Speight (1989) documented the extinction of this rare beetle in western and middle Europe and proposed it as one of the most reliable indicators of forests of international importance.

Omoglymmius germari (Fig. 2)

Fig. 2 recapitulates the chronogeonomy of the species in Italy. During over 100 years the beetle has been recorded in 13 localities inside 5 Italian regions, but only one finding dates after the year 2000, in an ancient traditional silver fir forest of the Pollino National Park (Basilicata region). In the three decades 1970–2000 some more records

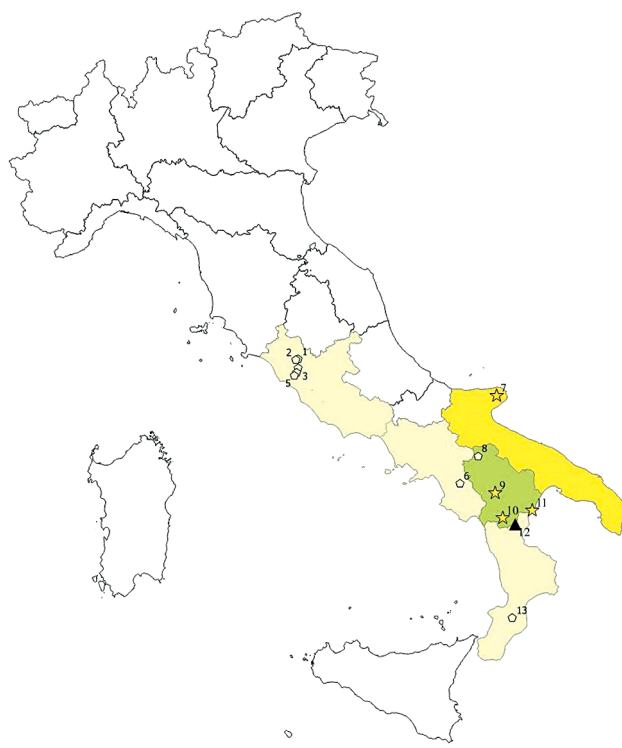


Fig. 2 – Historical and contemporary distribution of *Omoglymmius germari* in Italy. Symbols and colors as in Fig. 1.

are known from Basilicata and from Apulia, in the old forest of the Gargano promontory. In the remaining regions (Latium, Campania and Calabria) all findings date before 1970, in some cases they are over 100 years old. This beetle is distributed in Southeastern Europe, Anatolia, Caucasian countries, Azerbaijan, Iran (Northern Khorasan), and seems to be strongly declining or at least rarefied in several European countries (Konvička & Čížek 2015; Šag et al. 2016; Bekchiev 2010; Bussler et al. 2005). Apparently lacking in France (Brustel & Gouix 2011). Its ecological preferences also include flatland habitats around rivers and it was also recorded from poplar formations like the *Populus nigro-albae* (Šag et al. 2016). In the Pollino National Park it was collected in a centuries-old silver fir forest used by local inhabitants (of the village of Alessandria del Carretto) for a spring feast in which a maypole tree is erected (“Festa della Pita”).

Clinidium canaliculatum (Figs 3, 4)

This species exhibits a more restricted distribution, and its geographic range covers exclusively Southern Italy and Greece, from Sicily to Taygetos in Morea, and is considered among the vulnerable Mediterranean endemites (Garcia et al. 2018). In more than 100 years it has been recorded from 61 sites of four Italian regions. Recent findings are located in Sicily and especially in Calabria, in the years 1970–2000 also in Basilicata (Fig. 3). The only known record from Campania (Mt. Alburno) is very old and has not

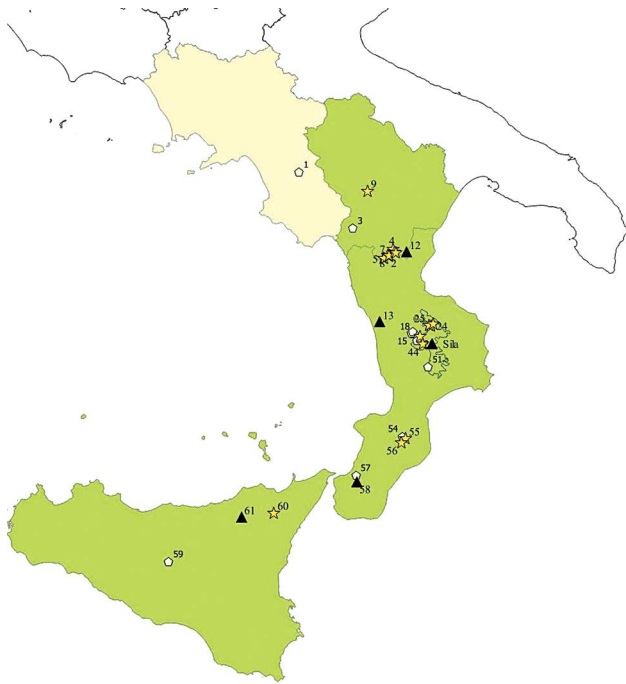


Fig. 3 – Historical and contemporary distribution of *Clinidium canaliculatum* in Italy. Symbols and colors as in Fig. 1.

reconfirmed since today. Fig. 4 represents the distribution of *C. canaliculatum* at smaller scale in the Sila National Park in central Calabria. Here the species was practically absent in the years before the last millennium end, probably because of precipitation scarcity. It reappeared in the years around 2010 after a long period of dryness and is now easy to find on decaying logs and snags of *Pinus nigra calabrica*. After a thorough ecological study of saproxylic beetles performed in the Sila forest landscape, Mazzei et al. (2018) proposed this species as “biodiversity indicator” of forest ecosystems with high conservation value. The biology of the beetle remains anyway poorly investigated.

Conclusions

The Rhysodids are poorly mobile and flightless beetles strictly bound to decaying wood where they feed on slime mold plasmodia (previously named Myxomycetes, now considered a phylum of the Protozoa, called Myxostelida). *Rhysodes* and especially *Omoglymmius* seem frequent on a wide variety of trees, and despite a larger distribution area in Europe, their conservation status in Italy is very unsatisfactory. The first species is considered a relic of primeval forests, very sensitive to disturbances to forest ecosystems, present throughout Europe in the past, now extinct in many European countries (Sienkiewicz 2017). Our assessment shows that the Italian populations of both species became extremely rarefied in the last decades, and their survival seems granted only in old growth forests

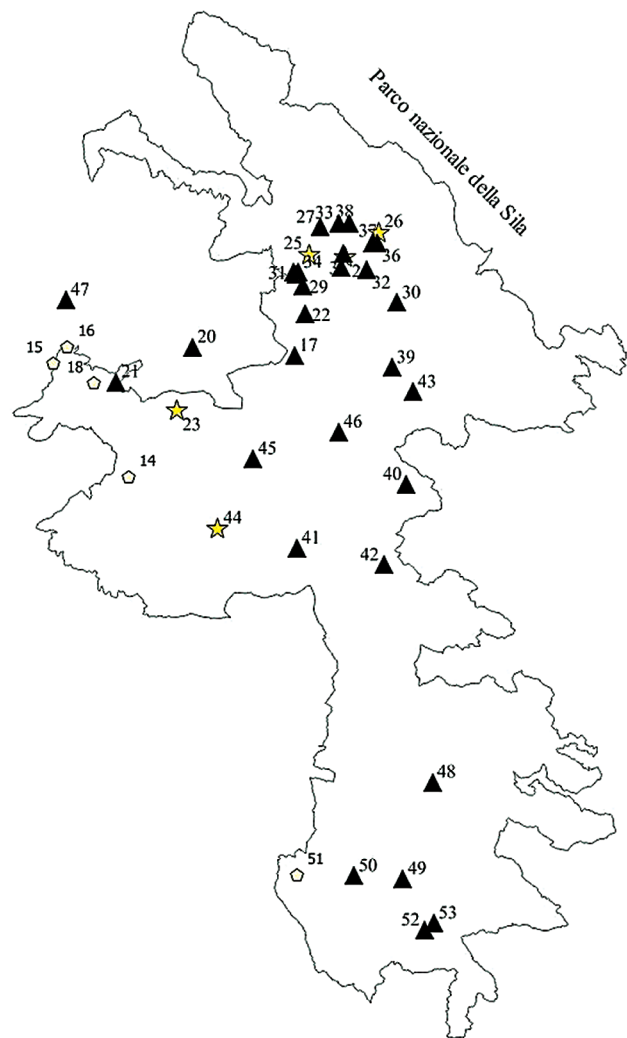


Fig. 4 – Historical and contemporary distribution of *Clinidium canaliculatum* in the Sila National Park. Recent records (after 2000) are represented by solid triangles; records between 1970–2000 by stars; records before 1970 by pentagons.

maintained since centuries and characterized by uninterrupted habitat continuity. The main threats are certainly the removal of large deadwood masses, especially logs, from humid forest sites, but we could not exclude an effect of the decreasing precipitations connected to the climate change. *Clinidium* on the contrary inhabits almost exclusively coniferous forests, mainly those with *Abies alba* and *Pinus nigra calabrica*, where it is frequently found aggregated in small groups under bark or inside the red-decaying wood. In our experience it strongly depends on wood humidity and this could explain the absence or rarity of the species during drought periods, as observed also for *Cucujus cinnaberinus* (Coleoptera Cucujidae) in the Sila National Park (Mazzei et al. 2011b). Nevertheless, the conservation status of this subendemic species seems by far less alarming, as indicated by the increasing population density and occurrence observed in the last ten years

in the Sila N. P. (Mazzei et al. 2018). In conclusion, the following conservation status of Rhysodids should be acknowledged for Italy:

***Rhysodes sulcatus* (Fabricius, 1787)**

International Law: protected by the European Habitats Directive (annex II of Council Directive 92/43/EEC)

Domestic Law: included in the IUCN red list as Data Deficient (DD), IUCN Red List of Threatened Species, Méndez et al. 2010; Endangered (EN) B2ab (iii), Red List of Italian Saproxyllic Beetles, Audisio et al. 2014. Endangered (EN), B2ab (iii), Carpaneto et al. 2015. Not Evaluated (NE), García et al. 2018.

New proposal for Italy: Critically Endangered (CR)

In order to determine the current distribution of *Rhysodes sulcatus* in Italy, inventories should be carried out covering old positions and sites where, according to current data, proper habitat conditions still exist.

***Omoglymmius germari* (Ganglbauer, 1891)**

Domestic Law: Species protection - strict protection (species that require active protection) IUCN. Threat Category IUCN: Data Deficient (DD), IUCN Red List of Threatened Species, Méndez et al. 2010; Vulnerable (VU), B2ab (iii) DD PR, Audisio et al. 2014. Not Evaluated (NE), García et al. 2018.

New proposal for Italy: Critically Endangered (CR)

Research recommendation: as for *R. sulcatus*.

***Clinidium canaliculatum* O.G. Costa, 1839**

Domestic Law: Species protection - strict protection (species that require active protection) IUCN. Threat Category IUCN: Vulnerable (VU) IUCN Red List of Threatened Species, Brustel et al. 2017; Vulnerable (VU), B2ab (iii) DD PR, Audisio et al. 2014; Vulnerable (VU), B2ab (ii,iii), endemic, García et al. 2018. Evaluated as indicator of forest ecosystems with high conservation value (Mazzei et al. 2018).

New proposal for Italy: Near Threatened (NT)

Research recommendation: periodic monitoring for the aims of the Natura 2000 network; careful visual census in older sites if proper habitat conditions still existing.

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