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 MAZZEI¹,*, Paolo AUDISIO², Augusto VIGNA TAGLIANTI³, Pietro BRANDMAYR¹

¹ Department of Biology, Ecology and Earth Science, University of Calabria, Cubo 4B - Ponte Bucci, 87036 Rende (CS), Italy
antonio.mazzei@unical.it; Pietro.brandmayr@unical.it

² Department of Biology and Biotechnologies “Charles Darwin”, Sapienza University of Rome - Via Alfonso Borelli 50, I-00161 Rome, Italy - paolo.audisio@uniroma1.it

³ Department of Biology and Biotechnologies “Charles Darwin”, Sapienza University of Rome, Zoological Museum - Piazzale V. Mas-simo 6, I-00161 Rome, Italy

* Corresponding author

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.comuniecitta.it/sigle-province-italiane.

Collections examined are indicated by the abbreviations below:

| Acronym | Location | Date | Collector |
|---------|----------|------|-----------|
| MGE     | Museo civico di Storia Naturale “G. Doria”, Genoa. Collections: A. Dodero, 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). Forste Casentinesi (Sasso Fratino (FC), 1988 (Fabbri 2003). National Park “Forste 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); 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 (MCZR); 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. Barjon (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 (MCZR); ibidem, 7XI.1909, [lg. Luigioni?] (MCZR). (5) Bosco di Manziana (RM), VI.1965, G. Bobbi (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. Barjon (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.VI.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), Spinazzetta 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-
Distribution of Italian Rhysodidae

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 |
|------------------|------|-------|-------|-------|
| Emilia-Romagna   | 2015 | 4     | 727970| 4856425|
| Abruzzo          | 2012 | 7     | 380611| 4706141|
| Emilia-Romagna   | 1988 | 31    | 723169| 4858606|
| Puglia           | 1978 | 41    | 585696| 4631260|
| Puglia           | 1965 | 54    | 582471| 4631025|
| Abruzzo          | 1959 | 60    | 396537| 4626597|
| Lombardia        | 1929 | 90    | 566093| 5036201|
| Toscana          | 1929 | 90    | 680975| 4848875|
| Lazio            | 1929 | 90    | 267908| 4692084|
| Campania         | 1929 | 90    | 524701| 4488689|
| Basilicata       | 1929 | 90    | 553549| 4533668|
| Lazio            | 1913 | 106   | 267775| 4677757|
| Lazio            | 1913 | 106   | 265269| 4671068|
| Lazio            | 1910 | 109   | 263782| 4690791|
| Lazio            | 1896 | 123   | 272837| 4671945|

### Omoglymmius germari G.

| Regions          | Date | Years | E_UTM | N_UTM |
|------------------|------|-------|-------|-------|
| Basilicata       | 2018 | 1     | 615204| 4423701|
| Basilicata       | 1997 | 22    | 582713| 4473733|
| Basilicata       | 1996 | 23    | 594665| 4433177|
| Basilicata       | 1996 | 23    | 643011| 4446536|
| Puglia           | 1990 | 29    | 582471| 4631025|
| Lazio            | 1965 | 54    | 261626| 4666823|
| Lazio            | 1929 | 90    | 267908| 4692084|
| Campania         | 1929 | 90    | 524701| 4488689|
| Basilicata       | 1929 | 90    | 553549| 4533668|
| Lazio            | 1913 | 106   | 267775| 4677757|
| Lazio            | 1910 | 109   | 263782| 4690791|
| Lazio            | 1909 | 110   | 264474| 4670817|
| Calabria         | 1878 | 141   | 613626| 4268116|

Vanna, labeled “622. Rhysodes / sulcatus Fab. / M. 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’Impio (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)
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. Colonelli, Sacco & Vomero, “su faggio” [on beech] (Gobbi 1973). 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), Duoglia, 1400 m, 22.VII.1976, lg. Angelini, “su abete” [on fir] (FA). (11) Pollino, Piantano 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 (MNSC). 

Calabria: (13) San Benedetto Ullano (CS), Parco Naturale della Comunità Montana Media Valle Crati, 7♂♂, 5♀♀ 09.03.2002, lg. Mazzei & Brandmayr (MNSC). (14) Monte Botte Donato (CS), (ca. 1900 m), 15.VI.1953, lg. Barajon (MGE). (15) Monte Scuro (CS), 1600 m, 5.VII.1939, lg. Ceresia (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.IV.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), Fossiata, 1300-1400 m, 4.IV.1921, lg. A. Fiori (MGE); ibidem, 13.XI.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), Sbadittii, (33) Longobucco (CS), Cava dell’Orso, (34) Longobucco (CS), Vallone S. Michele, (35) Longobucco (CS), Vallone Fossiata, (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 Nocelletto, (Mazzei et al. 2011a). (42) San Giovanni in Fiore (CS), Machione 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 Ferdinande (RC), Bosco di Stilo, 1100 m, 27.VI.1985, lg. Angelini (FA). (56) Le Serre, Fabrizia (CZ), 950 m, 10.X.1972, lg. Espinoso (Espinoso 1978: 14). (57) Aspromonte, (date presumably 1880), lg. Cavanna (MZUF); ibidem, lg. Paganetti-Hummler (MCZR). (58) Sant’Eufemia d’Aspromonte (ME), lg. Pollicino (ME); ibidem, 27.9.VII.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, 1986 lg. Böttcher, 1906 (MCZR). (61) Montalbano Eliano (ME), Bosco di Malabotta, 1100 m, “fiaggeta” [beech forest], 3.VI.1993, lg. Angelini (FA). (62) SCI: 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

Rhyssodes sulcatus (Fig. 1)

The large amount of gathered data supports a first chromo-geonomic 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, Tuscanny, 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
Distribution of Italian Rhysodidae

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 Populetum 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 Carrettio) 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

The beetle 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 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 & Norbìato 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
reconfirmed since today. Fig. 4 represents the distribution of \textit{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 \textit{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.

\section*{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). \textit{Rhysodes} and especially \textit{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 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. \textit{Clinidium} on the contrary inhabits almost exclusively coniferous forests, mainly those with \textit{Abies alba} and \textit{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 \textit{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 Saproxylic Beetles, Audisio et al. 2014. Endangered (EN), B2ab (iii), Carpaneto et al. 2015. Not Evaluated (NE), Garcia 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), Garcia 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 (iii), endemic, Garcia 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 exist.

Acknowledgements – The authors wish to thank the President, Mrs Prof. Sonia Ferrari, and the Director, Dr. Giuseppe Luzzi of the Sila National Park for financial help and research permissions gently granted along several years. They feel also grateful to the President and the Director of the Pollino National Park for research permissions received in the year 2018.

References

Alexander K.N.A. 2008. Tree biology and saproxylic Coleoptera: Issues of definitions and Conservation language. Revue d’écologie (la Terre et la Vie), 63: 1–5.

Angelini F. 1991. Coleotterofauna dell’altipiano della Sila (Calabria, Italia) (Coleoptera). Memorie della Società entomologica italiana, 70 (1): 171–254.

Angelini F., Montemurro F. 1986. Coleotterofauna del bosco di Policoro (Matera) (Coleoptera). Lavori della Società Italiana di Biogeografia, 10: 605–625.

Audisio P., Baviere C., Carpaneto G.M., Biscaccianti A.B., Battistoni A., Teofili C., Rondinini C. (Eds). 2014. Lista Rossa IUCN dei Coleotteri saprofilici Italiani. Comitato Italiano IUCN e Ministero dell’Ambiente e della Tutela del Territorio e del Mare, Roma, 132 pp.

Bekcherev R. 2010. New data for *Omoglymmius germari* (Ganglbauer, 1892) (Rhysodidae: Coleoptera) in Bulgaria. Zootiles, 11: 1-3. www.zootiles.bio.uni-plodiv.bg - ISSN 1313-9916

Bell R.T. 1998. Where do the Rhysodini belong? In: Ball, G. E., A. Casale and A Vigna Taglianti (Eds). Phylogeny and Classification of Caraboidae (Coleoptera: Adephaga). Proceedings of a Symposium (28 August, 1996, Florence, Italy) XX International Congress of Entomology. Atti, Museo regionale di Scienze naturale, Torino, pp. 261–272.

Biscaccianti A.B., Mani F., Castiglione E., Bonacci T., Siclari A., Pelle L., Bonsignore C.P. 2016. Coleotteri saprofilici e specie in Direttiva Habitat del Parco Nazionale dell’Aspromonte. Riassunti XI Convegno Nazionale sulla Biodiversità, Matera, 9-10 giugno 2016: 150.

Brandmayr P. & Zetto Brandmayr T. 1984. Le comunità a coleotteri geoadefagi di alcune faggete ed abetine appenniniche, dal Casentino al M. Pollino (Coleoptera, Carabidae, Rhysodidae). Lavori della Società Italiana di Biogeografia, 10: 685–699.

Brustel H., Gouix N. 2011. Coléoptères Rhysodidae en France: données complémentaires pour *Rhyodes sulcatus* (F., 1787) et incitation à la recherche d’*Omoglymmius (s. s.) germari* Ganglbauer, 1892. L’Entomologiste, 67(6): 321–325.

Brustel H., Audisio P., Micó Balaguer E., Otero J. 2017. *Clinidium canaliculatum*. The IUCN Red List of Threatened Species 2017: e.T165907A44189128. http://dx.doi.org/10.2305/IUCN.UK.2017-2. RLTS.T165907A44189128.en. Downloaded on 01 May 2019.

Burakowski B. 1975. Description of larva and pupa of *Rhysodes sulcatus* (F.) (Coleoptera, Rhysodidae) and notes on the biomics of this species. Annales zoologici, 32 (12): 271–287.

Bussler, H., Müller, J. Dorka, V. 2005. European Natural Heritage: the Saproxylic Beetles in the proposed Parc National Défiuelul Jiului. Analele ICAS, 48(1): 55–71.

Carpaneto G.M., Baviere C., Biscaccianti A.B., Brandmayr P., Neri F., Mason F., Battistoni A., Teofili C., Rondinini C., Fattorini S., Audisio P. 2015. A Red List of Italian Saproxylic Beetles: taxonomic overview, ecological features and conservation issues (Coleoptera). Fragmenta entomologica, 47 (2): 53–126.

Cecchi B., Bartolozzi L. 1997. I Coleotteri xilofagi e subcorticolici del Parco Nazionale delle Foreste Casentinesi, Monte Falterona e Campigna (Insecta Coleoptera). Bollettino della Società Entomologica Italiana, 70 (1): 171–254.

Cecceolini F., Norbiato M. 2015. Contributo alla conoscenza della coleotterofauna della “Foresta della Lama” nel Parco Nazionale del Gran Sasso e Monti della Laga (Appennino centrale) (Coleoptera Rhysodidae, Lucanidae, Cetoniidae, Cerambycidae). Bollettino della Società entomologica italiana, 146 (3): 99–110.

Fabbri R. 2003. Gli invertebrati dei suoli forestali: i Coleotteri Carabidi (Coleoptera Carabidae) del Parco Nazionale delle
Mazzei A., Brandmayr P. 2016. I coleotteri del Parco nazionale della Sila, serie “Parco”, Nr. 14. 190 pp. ISBN-13: 9788897750130.

Mazzei A., Gangale C., Laurito M., Luzzi G., Menguzzato G., Pizzolotto R., Scalise C., Uzunov D., Brandmayr P. 2017. I Coleotteri Carabidi (Coleoptera, Carabidae) come indicatori di passati interventi selvicolturali in foreste vetuste del Parco Nazionale della Sila (Calabria, Italia). Forest@ 14: 162–174.

Mazzei A., Bonacci T., Horák J., Brandmayr P. 2018. The role of topography, stand and habitat features for management and biodiversity of a prominent forest hotspot of the Mediterranean Basin: Saproxylic beetles as possible indicators. Forest Ecology and Management, 410: 66–75.

Méndez M., Dodelin J., Petrakis P., Schlaghamersky J., Nardi G. 2010. Rhysodes sulcatus. The IUCN Red List of Threatened Species, 2010: e.T157582A5100245.

Méndez M., Dodelin J., Petrakis P., Schlaghamersky J., Nardi G. 2010. Omoglymmius germari. The IUCN Red List of Threatened Species, 2010: e.T157680A5123710.

Nieto A., Alexander K.N.A. 2010. European Red List of Saproxylic Beetles. Luxembourg: Publications Office of the European Union.

Papini G. 1962. Reperti. Rhysodes sulcatus Fabr. (Col. Rhysodidae). Bollettino dell’Associazione Romana di Entomologia, 17 (2-3): 9.

Sabella G., Sparacio I. 2004. Il ruolo dei Parchi siciliani nella conservazione dei taxa di insetti di particolare interesse naturalistico (Insecta Coleoptera et Lepidoptera rhopalocera. - Il Naturalista siciliano, S. IV, 28 (1): 477–508.

Speight M.C.D. 1989. Saproxylic invertebrates and their conservation. Council of Europe. Nature and environment 42, 79 pp.

Šag M., Turić N., Vignjević G., Lauš B., Temunović M. 2016. The first record of the rare and threatened saproxylic coleop-tera, Cucujus cinnaberinus (Scopoli, 1763), Rhysodes sulcatus (Fabricius, 1787) and Omoglymmius germari (Ganglbauer, 1891) in Kopački Rit Nature Park. Natura Croatica, 25(2): 249–258. Doi: 10.20302/NC.2016.25.20.

Sienkiewicz P. 2017. Methodological guide for: Species of animals: 4026 Rhysodes sulcatus (Fabricius, 1787). Methodology of nature monitoring – Inspection of Environmental Protection. [Translated by LIDEX Sp. z o.o. - ul. Magiera 16/17, 01-873 Warszawa. Library of Environmental Monitoring]. http://siedliska.gios.gov.pl/images/pliki_pdf/publikacje/methodological_guides/4026-Rhysodes-sulcatus.pdf

Vrezec A. 2007. Status brazdarja (Rhysodes sulcatus) v Sloveniji (Coleoptera: Rhysodidae): dosedanje poznavanje in raziskovalne perspective. Acta Entomologica Slovenica, 15(1): 51–56.