

ENTOMOLOGY

Agonum tulliae sp. n. from the Sila National Park (Calabria, southern Italy) (Coleoptera: Carabidae: Platynini)

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Abstract

Agonum tulliae sp. n. is described from the Sila Massif upland in Calabria, Italy. This species is similar to *Agonum (Olisares) sexpunctatum* (Linné, 1758) as far as the external morphology is concerned, but it is easy to distinguish by the colour pattern, the shape of pronotum, and at best by the morphology of male genitalia. The study includes some remarks about the habitat and ecology of the new species. It lives only in the eastern part of the Sila massif and occupies the southernmost part of the distribution area of the *Agonum sexpunctatum* (Linné, 1758) complex in Italy.

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Introduction

The genus *Agonum* Bonelli, 1980 is particularly rich in species in the Holarctic Dominion, but it extends also on the Neotropical, Afrotropical and Oriental regions, and was defined as Laurasian taxon (Liebherr & Schmidt, 2004). Species identification is often difficult and requires mostly examination of the genitalia (Hürka, 1996). We found this *Agonum* species by hand-collecting in 2006 and with pitfall traps in 2007, and during a survey of the wetlands of the Sila National Park, in the frame of the Action Programme *Zone umide*, promoted by the Italian Ministry for the Environment and Protection of Territory and Sea (2012-2013). Both *Agonum sexpunctatum* (Linné, 1758) and the new species have been found when sampling carabid communities in transition bog mires, quaking mountain bogs, river banks and/or lake shores. *A. sexpunctatum* lives in the north-western part of the Sila upland, whereas the new species has been found only in the south-eastern portion.

Study area and habitats

The Sila upland (partially included in the territory of Sila National Park) forms a large, approximately rectangular plateau covering about 170,000 hectares at altitudes ranging from 1100 to 1800 m a.s.l. The area belongs to the oceanic temperate bioclimate, precipitations increase with altitude and the winters are cold, the yearly average temperatures vary between 12 and 6°C. A detailed description of the study area is available in Mazzei *et al.*, 2015.

An *Agonum* species inhabiting this area seems to be new for science; it was collected by pit-fall traps in transition mires and mountain quaking bogs included in two *Natura 2000* sites of Community Importance (SCI) of the EU Habitats Directive (92/43/EEC): *Colle del Telegrafo* (IT9330128) and *Torrente Soleo* (IT9330125), at an altitude of respectively 1540 and 1400 m a.s.l. The areas comprise a complex mosaic of habitats, e.g. watercourses with *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (*Natura 2000* habitat code: 3620). Moreover, *Nardus* (mat grass) pasture grasslands, (habitat 6230) and *Molinia* meadows are frequent on peaty or clayey silt-laden soils (*Molinion caeruleae*), sometimes mown late in the year, that correspond to a deteriorated stage of drained peat bogs (habitat 6410). Hydrophilous tall herb fringe communities are scattered between forest edges and standing water bodies (habitat 6430). The most abundant *Agonum* populations were found in *Sphagnum* rich transition mires and quaking bogs, peat-forming communities developed at the surface of oligotrophic to mesotrophic waters, covered by *Carex echinata*, *Juncus articulatus* and other hygrophilous plants (habitat 7140).

Materials and Methods

Agonum specimens have obtained by pitfall traps installed according to the survey design (Brandmayr *et al.*, 2005), rarely by hand collecting, and preserved in 60% alcohol or dried in entomological boxes. The description terms follows Lindroth (1974); carabid taxonomy and nomenclature follow the updated *Fauna Europaea*. Specimens have been examined using a Zeiss dissecting microscope (Carl Zeiss, Oberkochen, Germany). Photographs of adult material were made with a Zeiss Stemi SV11 Stereoscope, with a Canon Power-Shot G16 digital camera (Canon, Tokyo, Japan). Male genitalia figures have been elaborated with Adobe Photoshop software. Morphometric measurements were taken with a stereoscope Zeiss Stemi SV 11 Apo; images were treated with Matrox PC-VCR software (for Windows® 2000).

Abbreviations for morphometric parameters have reported in Table 1: BL=total body length, taken from the anterior margin of the labrum to the apex of the elytra, measured along the elytral suture; PW/PL=Ratio between pronotum width (PW) and pronotum length (PL), measured as distance from the basal to the anterior margin along the midline; Elytra length (EL) and elytra width (EW).

Comparison of the new species with *Agonum sexpunctatum* (Linne, 1758) is based on the description by Lindroth, 1974 and 16 specimens from various localities, 5♂ e 5♀ from Friuli-Venezia Giulia: Udine, Ampezzo, Lago della Maina; 1♂ - Udine, Carnic Alps, Pramollo, Traversata Carnica, m 1600; 1♂ - Calabria, Crotona, Cotronei, Lago Ampollino, m 1288; 2♀ and 2♂♂ - Calabria, Cosenza, Spezzano Piccolo, Macchia Sacra, m 1670. All the specimens examined in this study have deposited in the Department DiBEST (Biology, Ecology and Earth Science) of the University of Calabria (P. Brandmayr collection).

Results

Agonum tulliae sp. n.

HOLOTYPE: ♂, Italy, Calabria, Catanzaro Province, Taverna,

Tirivolo: Capitano. Sila National Park, Crocchio stream valley. 1560 m a.s.l. Site of Community Importance: *Colle del Telegrafo* SIC IT9330128. Hand collected 02.IX.2006 by A. Mazzei. The type is deposited in Brandmayr's collection at the DIBEST Department.

PARATYPES: 2♀♀, Italy, Calabria, Crotona, Mesoraca municipality, Mt. Femminamorta, Sila National Park, Soleo stream valley. 1400 m a.s.l.. Site of Community Importance: *Torrente Soleo* SIC IT9330125. Hand collected 01.VI.2009 by A. Mazzei. From the holotypus locality and Colle del Telegrafo SIC also: 1♀ collected 02.IX.2006; 1♀ collected. 24.X.2006; 5♂♂ and 3♀♀ hand collected 02.V.2007; 8♂♂ hand collected 02.VI.2007; 3♂♂ and 4♀♀ hand collected 26.VI.2007, all specimens collected by A. Mazzei. These paratypes are deposited in Brandmayr's collection.

OTHER MATERIAL EXAMINED: several specimens collected with pitfall-traps in 2007 during their entire activity season, from April to September, in the *Sphagnum* bog of Tirivolo in the Crocchio stream valley (see data in the notes on bionomy).

Locus typicus

Italy, Central Calabria, Sila National Park, Taverna municipality (Catanzaro Province), Tirivolo, Capitano, Crocchio stream valley. WGS84 UTM zone 33N 640242 E, 4329119 N, 1560 m SLM. Site of Community Importance: *Colle del Telegrafo* SIC IT9330128 (Figure 1).

Etymology

Tullia Zetto was an active zoologist and teacher of the Department of Ecology of the University of Calabria, who endeavoured for more than 20 years larval morphology and behaviour of carabids and other predatory beetles. She was born in Trieste 15.I.1949 and deceased in Cosenza 24.X.2010.

Diagnosis

A medium sized *Agonum* species with total length between 8.7-9.4 mm (holotype 9 mm), macropterous, pronotum and elytral color pattern similar to *Agonum sexpunctatum* (Linne 1758) (Figure 2). Head and pronotum from golden-coppery to green-red, elytra with



Figure 1. A) The Tirivolo mire in late summer. B) *Agonum tulliae* sp. n. individual walking on *Sphagnum* of the Tirivolo mire. Photo: A. Mazzei.

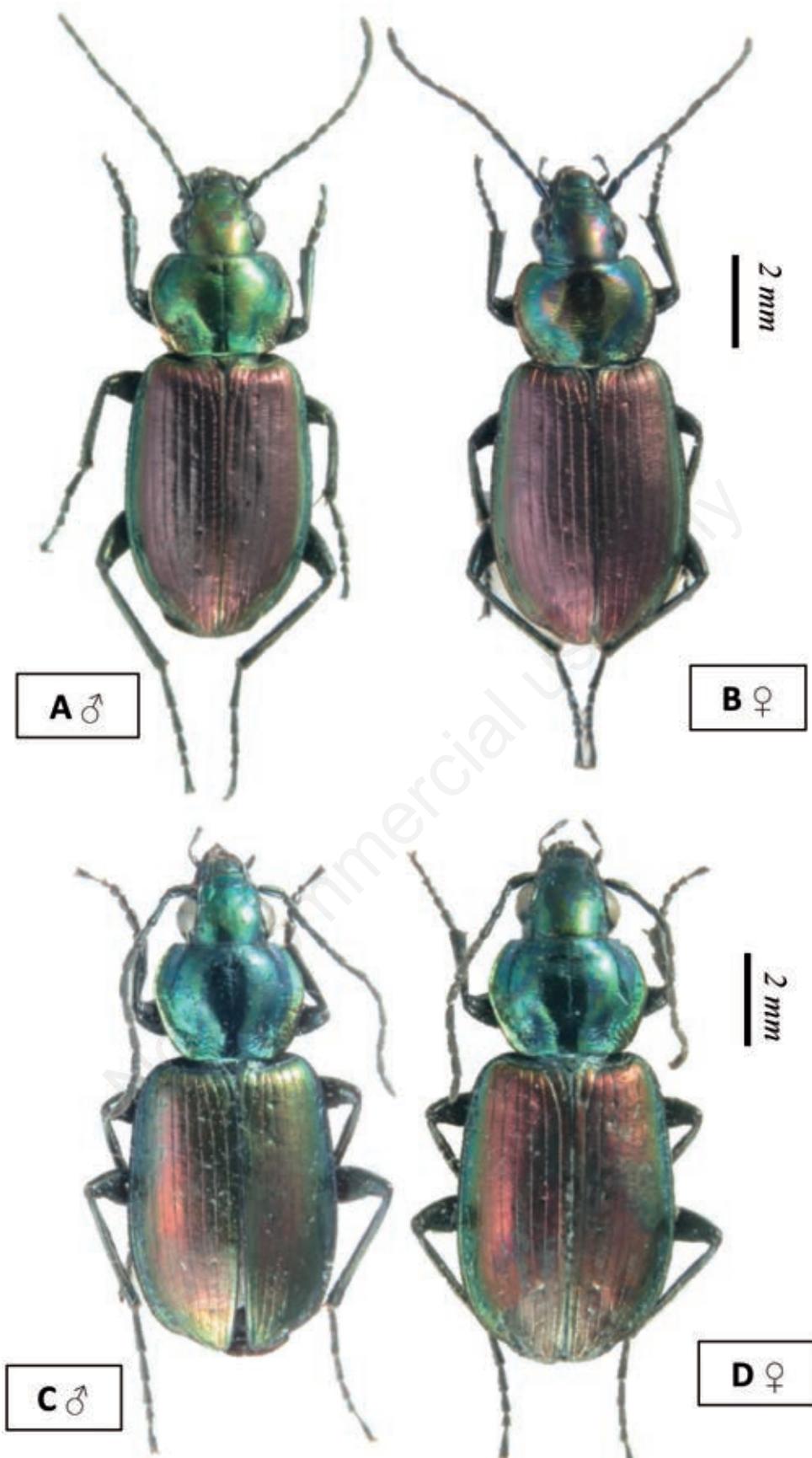


Figure 2. Habitus of *Agonum tulliae* sp. n. (A ♂ B ♀) and *Agonum sexpunctatum* L., (C ♂ D ♀). A ♂ - Calabria: Catanzaro, Taverna, Tirivolo, Capitano, Crocchio valley. B ♀ - Calabria: Crotone, Mesoraca, M. Femminamorta, Soleo valley. C ♂ - Friuli-Venezia Giulia: Udine, Ampezzo, Sauris, Lago della Maina. D ♀ - Friuli-Venezia Giulia: Udine, Ampezzo, Sauris, Lago della Maina.

slight metallic green shine, suture ad margins copper red. Pronotum normally with rounded sides and maximum width at middle, lateral margin progressively broadened backwards and confluent in the basal foveae. Aedeagus apex symmetrical (ostium side).

Description

A species is close to *Agonum sexpunctatum* (Linne 1758), that shares with it the same body size. Head and pronotum golden greenish, pronotum borders reddish golden, elytra with green border well defined and not trespassing the 8th interstria, head appendages and legs dark black but with slightly metallic femurs, basal antennomeres and palps. Male protarsi with three dilated tarsomeres covered by fine adhesive setae on ventral side. Eyes moderately protruding, front and other head surfaces smooth and shiny, as in *A. sex-*

punctatum. Pronotum with rounded sides, rarely sinuate towards basal angles, maximum width at middle, lateral groove normally slender at front angles and progressively broadening backwards to merge with the basal foveae. PL/PW varies between 0.7 in males and 0.8 in females (Table 1). Dorsal surface shiny, very often with small transversal corrugations. Elytra bright in males, matt and with isodimetric microsculpture in females, the third interval bears often seven trychobothria instead of six, at least on one side. Striae well impressed and finely punctate, punctuation more evident than in *A. sexpunctatum*. Hind wings around 1.6 times longer than elytra. Aedeagus laterally more arcuate at basis and less bent dorsally at apex (everted position), apex symmetrical with respect to aedeagus axis, easy to check from the ostium side (Figure 3). Internal sac small, pale and with no spines nor sclerified areas.

Table 1. Morphometry of *Agonum tulliae* n. sp. Mean values and ranges of variation have reported.

Sizes (mm)	BL	PL	PW	PL/PW	EL	EW	EL/EW
Holotype ♂	9.0	2.0	2.8	0.7	5.6	4.0	1.4
Paratype	9.2	2.1	2.9	0.7	5.7	4.0	1.4
Mean 10 ♂♂	8.7	1.9	2.6	0.8	5.1	3.5	1.5
Min	8.3	1.8	2.5	0.7	4.6	2.8	1.3
Max	9.0	2.0	2.9	0.8	5.3	3.9	1.9
Mean 10	9.4	2.1	2.9	0.7	5.7	4.1	1.4
Min	9.1	2.0	2.7	0.7	5.5	4.0	1.3
Max	10.0	2.2	3.1	0.8	6.0	4.3	1.4

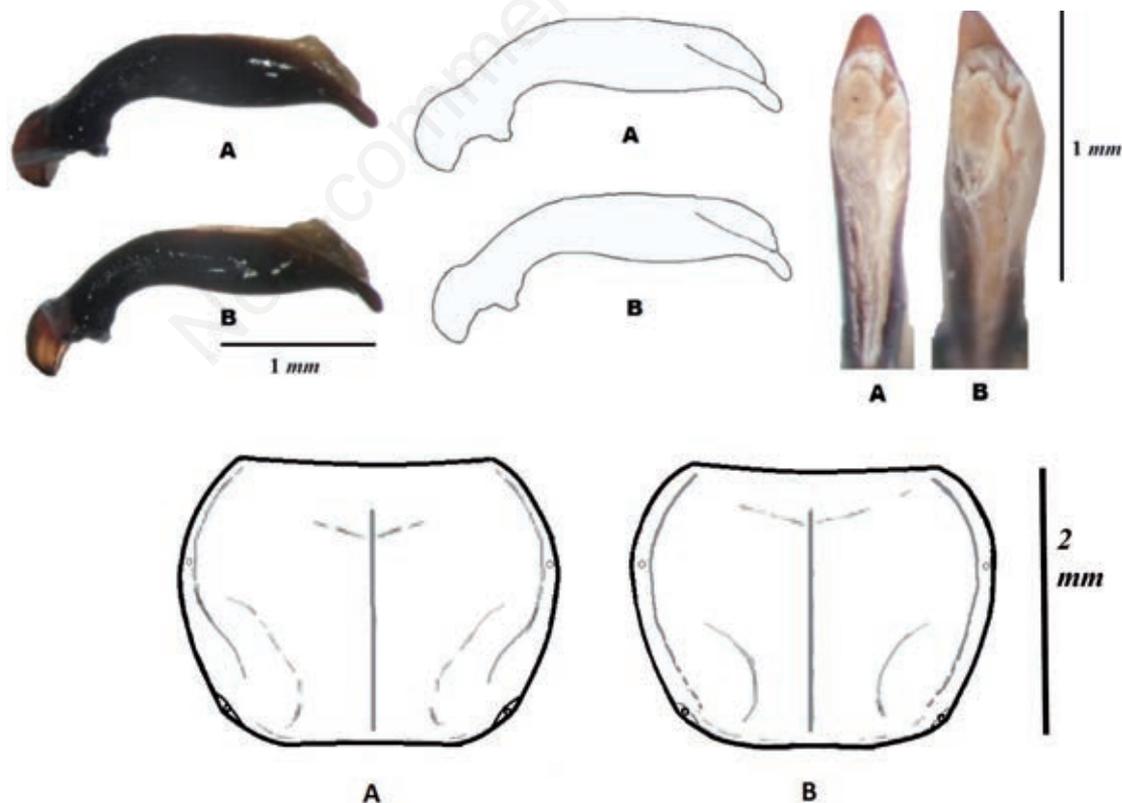


Figure 3. Male genitalia and pronotum of A) *Agonum tulliae* sp. n. paratypus, Calabria: Catanzaro, Taverna, Tirivolo, Crocchio valley, 02.IX.2006. B) *Agonum sexpunctatum* (Linne 1758), Friuli-Venezia Giulia: Tarvisio, Laghi di Fusine, 12.VIII.1969.

Bionomy and habitat

Agonum tulliae sp. n. is mainly an inhabitant of *Sphagnum* transition mires and perhaps of other types of river border vegetation of the south eastern part of the Sila upland, the so called "Sila Piccola". It could be more habitat restricted than *A. sexpunctatum*, because it has found so far at only two sites, at altitudes over 1400 m a.s.l. and yearly temperature average less than 10°C (climate data in Nicolaci *et al.*, 2014). Its reproduction rhythm is possibly be the same than that of *A. sexpunctatum*, with egg laying in spring and short larval development in summer, the new generation remains mostly inactive, as suggested by the captures with pitfall traps in the Tirivolo marshlands (11.V.2007 – 9 individuals, 02.VI.2007 – 29, 29.VI.2007 – 22, 27.VII.2007 – 1, 30.VIII.2007 – 1).

Taxonomic status and biogeographical remarks

Agonum tulliae sp. n. has been found in a small area of the south eastern Sila plateau (Figure 4), whereas *A. sexpunctatum* is found in a larger, north-western area of that plateau. The differences in morphology between the two forms are constant, and no intermediate or hybrid individuals have found so far, despite both

are full winged and probably able to disperse and settle in new habitats. Data on the Italian distribution of *A. sexpunctatum* (Magistretti, 1965; Pescarolo, 1990; Angelini, 1991; Casale *et al.*, 1993; Vigna Taglianti *et al.*, 1998; Allegro & Cersosimo, 2004; Negro *et al.*, 2009; Allegro & Correggia 2010; Colombetta, 2011; Gobbi *et al.*, 2013; Pilon *et al.*, 2013; Bisio *et al.*, 2015), show a remarkable disjunction between Northern Italian populations and the southern isolates. The water rich and cold Sila plateau seems to be the only Mediterranean mountain massif where *A. sexpunctatum* populations may have survived during the warmer interglacial phases. We hypothesize that *Agonum tulliae* sp. n. evolved probably from isolated populations of *A. sexpunctatum*. The new species is possibly a geographic relict living at the southern border of the Sila Plateau, an area with high conservation value. Limitations to range expansion could explained by the restricted climate preferences of both *Agonum* species. Another species of the same genus, *Agonum viridicupreum* (Goeze, 1777) seems to be less sensitive to climate and shows a continuous distribution at its southern fringe (Drees *et al.*, 2011). A similar distribution pattern of *A. sexpunctatum* and *A. viridicupreum* is found in the Iberian Peninsula (Serrano, 2013).

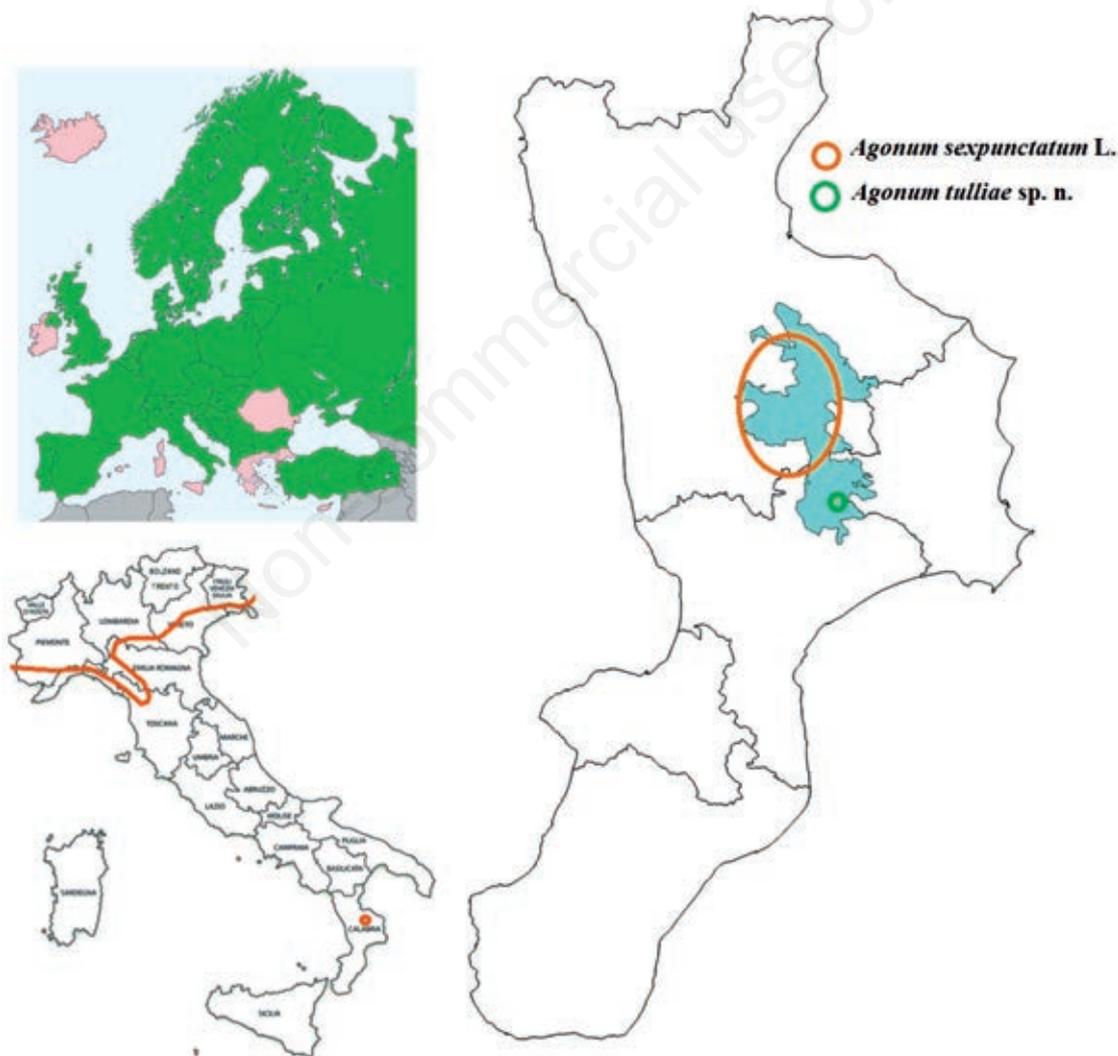


Figure 4. Left above: Distribution of *Agonum sexpunctatum* (Linne 1758) in Europe, from Fauna Europaea. Left below: Distribution of *Agonum sexpunctatum* (Linne 1758) in Italy. Right: Distribution of *Agonum sexpunctatum* (Linne 1758) and *Agonum tulliae* sp. n. in Calabria. The boundaries of the Sila National Park are reported.

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