

## New ecological data on the rare *Entoloma cedretorum*

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**Key words:** *Entolomatales*, *Entoloma*, *E. cedretorum*. – Ecology, new record, rare species. – Mediterranean region.

**Abstract:** *Entoloma cedretorum*, a very rare *Leptonia*, is described and illustrated macro- and microscopically. It was reported in only three countries within the Mediterranean basin: France, Spain and Morocco. The new finding, probably the first one in Italy, improves the knowledge of its ecological requirements and geographical distribution.

**Zusammenfassung:** *Entoloma cedretorum*, eine sehr seltene *Leptonia*, wird makro- und mikroskopisch beschrieben und illustriert. Die Art ist im Mittelmeerraum bisher nur aus Frankreich, Marokko und Spanien bekannt. Der Neufund, möglicherweise der erste in Italien, erweitert die Kenntnis der ökologischen Bedürfnisse und der geographischen Verbreitung dieser Art.



Fig. 1. *Entoloma cedretorum* in situ. – Phot. N. RIGHETTO.

**Riassunto:** *Entoloma cedretorum*, *Leptonia* molto rara, viene descritta e illustrata macro- e microscopicamente. Nell'ambito del bacino del Mediterraneo la sua presenza è stata segnalata soltanto in Francia, Spagna e Marocco. Il nuovo ritrovamento, probabilmente il primo in Italia, espande la conoscenza sulle esigenze ecologiche e sulla distribuzione geografica della specie.

Being interested in the genus *Entoloma* we made field trips especially to the mountains of north-eastern Italy. Last October we came across an *Entoloma* species we had never seen before.

### Materials and methods

The photographs of the basidiomata were taken in the field. Fragments of fresh material for microscopical analysis were stained with Congo red (Titolchimica, Rovigo, Italy) or mounted directly in water, while dried material was previously hydrated in 5 % KOH. For light microscopical features 61 spores were measured and their parameters (Table 1) calculated, including the percentage of iso-, subiso- and heterodiametrical spores (Table 2). We followed the taxonomic arrangement of NOORDELOOS (1992, 2004). In order to characterise the degree and percentage of heterodiametry in more detail we widened slightly the traditional scheme of NOORDELOOS (1992) by dividing the Q-range in nine categories of heterodiametrical spores. Microphotographs were taken by a Nikon Coolpix 5400 digital camera and a Nikon Eclipse E-200 LM. Abbreviations of the authors of fungal names and acronyms of herbaria follow KIRK (2008) and HOLMGREN & HOLMGREN (1998).

**Table 1.** Basic spore parameters of *Entoloma cedretorum* (n = 61)

	Min	Max	Mean	SD	Median	Mode
Length	8.4	12	10	0.9	10	10
Width	6	8	7	0.4	6.7	6.7
Q (L/l)	1.3	1.8	1.4	0.1	1.5	1.5

**Table 2.** Percentage of isodiametrical, subisodiametrical, and heterodiametrical spores in *E. cedretorum*, comprising nine new categories of heterodiametrical spores named HDH1-HDH9, observed in one sample (n = 61)

Category	Abbreviation	Q-range	Percentage
Isodiametrical	ID	1.0-1.09	0%
Subisodiametrical	SID	1.1-1.19	0%
Heterodiametrical H1	HDH1	1.2-1.29	8%
Heterodiametrical H2	HDH2	1.3-1.39	26%
Heterodiametrical H3	HDH3	1.4-1.49	23%
Heterodiametrical H4	HDH4	1.5-1.59	35%
Heterodiametrical H5	HDH5	1.6-1.69	5%
Heterodiametrical H6	HDH6	1.7-1.79	3%
Heterodiametrical H7	HDH7	1.8-1.89	0%
Heterodiametrical H8	HDH8	1.9-1.99	0%
Heterodiametrical H9	HDH9	≥ 2.0	0%

### *Entoloma cedretorum* (ROMAGN. & RIOUSSET) NOORDEL. (Figs. 1-4)

#### Characters:

Pileus: 18-32 mm wide, obtuse conical to convex, uniformly violaceous blue, not hygrophanous, not translucently striate; surface woolly-flocculose, squamulose.

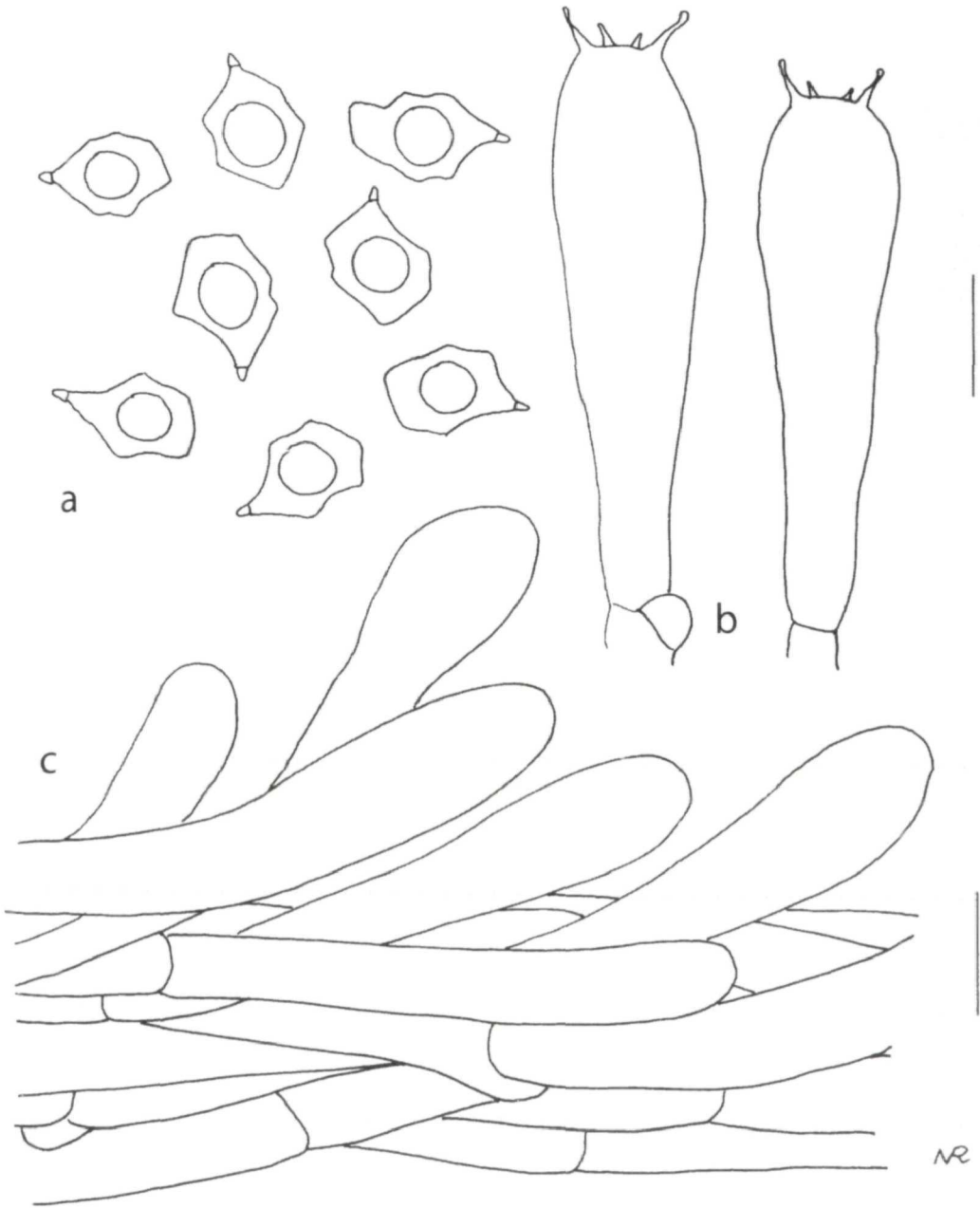


Fig. 2. *Entoloma cedretorum*. a spores, b basidia, c pileipellis. Upper bar: 10 µm. Lower bar: 20 µm.

Lamellae: moderately crowded, adnexed, up to 7 mm broad, white then pink with concolorous entire lamellar edge.

Stipe: 42-80 × 3-4 mm, cylindrical, straight, concolorous with the pileus, fibrillose-flocculose, woolly-tomentose; base provided with a white tomentum.

Context: blue greyish. Smell and taste indistinct.

Spore print: pinkish brown.

Spores: (8.4-)10 ± 0.9(-12) × (6-)7 ± 0.4(-8) µm, 5-6(-7) angled in side view. 100 % heterodiametrical.

Basidia: 27-45 × 7-12 µm, cylindrical to clavate, 4-spored, with clamp connections.

Cheilo- and pleurocystidia: absent.

Pileipellis: a transition between a cutis and a trichoderm or a true trichoderm of inflated hyphae 45-110 × 8-25 µm. Terminal hyphae usually cylindrical, slightly clavate or even tapering.

Clamp connections: present in all tissues.

**Habitat:** terricolous in a deciduous wood on calcareous soil at 1200 m s. m.

**Phenology:** October.

**Specimen examined: Italy:** Veneto, Vicenza, Cogollo del Cengio, terricolous under deciduous trees, 10. 10. 2007, leg. N. RIGHETTO (MCVE 18138).

## Observations

*Entoloma cedretorum* is characterised by its violaceous-blue basidiomata, white to pinkish lamellae with concolorous edge, fibrillose-flocculose to woolly stipe surface, absence of cystidia and presence of clamp connections.

*Entoloma lepidissimum* (SVRČEK) NOORDEL. and *E. coelestinum* (FR.) HESLER are close to *E. cedretorum*, but they have a smooth stipe and spores of different size and shape (NOORDELOOS 1992).

Remarkably, in Italy, which geographically can be considered a bridge across the northern and southern coasts of the Mediterranean Sea, the species studied was not reported as yet.

HAUSKNECHT (1991) prophetically wrote: "the species picked up either in middle Europe or in northern Africa are largely widespread and it makes sense to reckon that one day they will be found also in Mediterranean regions like Italy".

*Entoloma cedretorum* was found in southern France in stands of *Cedrus* spp. (ROMAGNESI 1976, TRIMBACH 1983), in evergreen forests of *Quercus ilex* L. subsp. *ballota* L. in Andalusia, southern Spain, (ORTEGA & al. 2000), on rotten wood of *Argania sideroxylon* ROEM. & SCHULT in Morocco (HAUSKNECHT 1991) and in woods of *Quercus ilex* and *Pinus* in Catalonia, Spain. (VAN-WAVEREN & al. 2007). Most *Cedrus* spp., except *C. deodara* (D. DON) G. DON, *Argania sideroxylon*, an endemic from the dry south-western zones of Morocco, and *Quercus ilex* are typical Mediterranean trees.

As a consequence it seems as if *E. cedretorum* would be strictly Mediterranean and thermophilic.

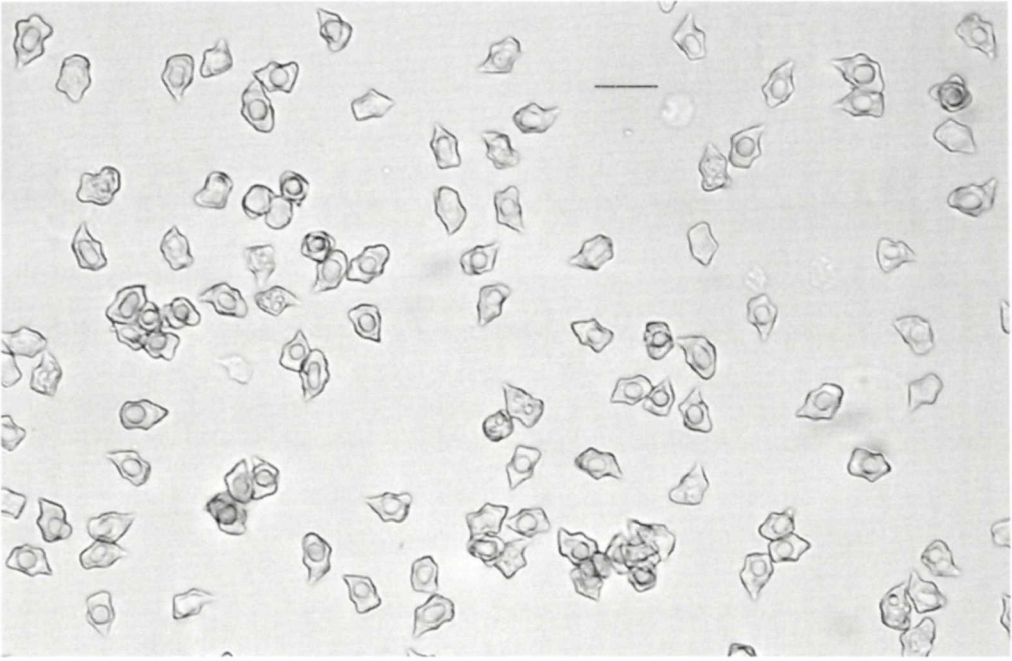


Fig. 3. Spores of *Entoloma cedretorum*. Bar: 13  $\mu\text{m}$ . – Phot. E. BATTISTIN.

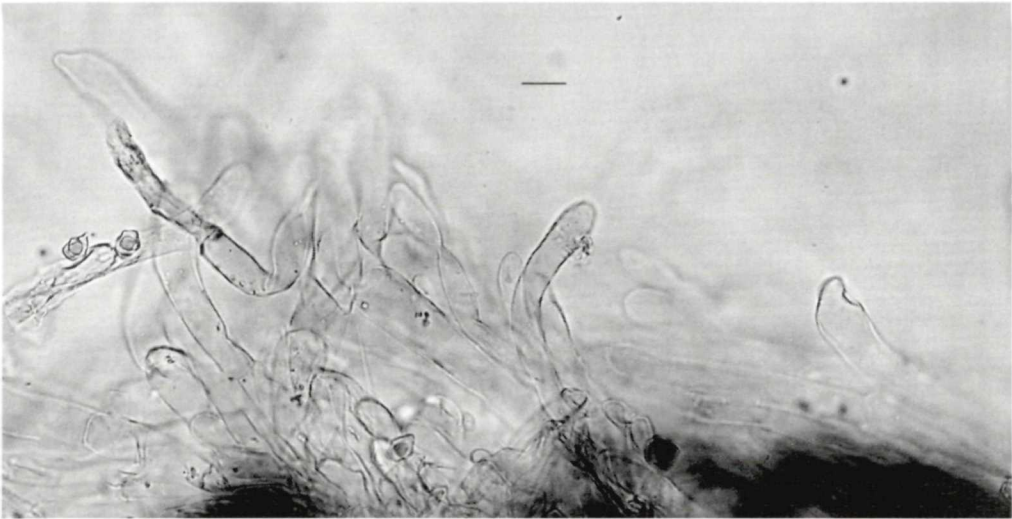


Fig. 4. Pileipellis of *Entoloma cedretorum*. Bar: 10  $\mu\text{m}$ . – Phot. E. BATTISTIN.

According to CAPPELLETTI (1976) two bioclimatic zones can be distinguished in Italy: the Middle European zone, comprising the Alps and the widest Italian lowland, the "Pianura Padana", and the Mediterranean zone, comprising the rest of the Italian peninsula as well as the islands, e.g., Sardinia and Sicily.

Occurrence of *E. cedretorum* in a mountain district of northern Italy at 1200 m s. m. under trees like *Acer pseudoplatanus* L., *Corylus avellana* L., *Tilia* spp., *Fagus sylvatica* L., *Fraxinus excelsior* L., and *Picea excelsa* Link in a prealpine region in the Middle European zone was surprising. It is also worth noting that it was found in October, when the mean temperature is low.

One may suppose that *E. cedretorum*, which hitherto was found only in the Mediterranean, will as a consequence of global warming appear in future more often also in alpine regions. This trend has already been shown in many plants and animals (EASTERLING & al. 2000, McLAUGHLIN & al. 2002, PARMESAN 1996, PARMESAN & al. 1999, THOMAS & LENNON 1999).

According to NOORDELOOS (1982), most temperate-boreal and alpine-arctic *Leptonia* species are typically saprotrophs. As a saprotroph *E. cedretorum* prefers organic substrates: needle litter (ROMAGNESI 1976), a thick layer of leaf litter (our collection), rotting wood (HAUSKNECHT 1991), and abundant organic substrate (VAN-WAVEREN & al. 2007).

In conclusion, our observations suggest that *E. cedretorum* is not or not any more strictly Mediterranean and the organic substratum, on which it depends as saprotrophic organism, plays a more important role for its occurrence than geography or phenology.

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